

Annals of Theoretical Psychology 11

Kenneth R. Cabell  
Jaen Valsiner *Editors*

# The Catalyzing Mind

Beyond Models of Causality

# The Catalyzing Mind

# Annals of Theoretical Psychology

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Kenneth R. Cabell • Jaan Valsiner  
Editors

# The Catalyzing Mind

Beyond Models of Causality

 Springer

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# Annals of Theoretical Psychology: A Reintroduction

As professors and researchers of psychology, we are often asked, “What is Psychology?” We generally reply, “Psychology is the scientific study of behavior and mental processes.” This answer, very proper and direct, speaks to their inquiry, but it leaves room for discussion and debate. By definition, the scientific study, analysis, and understanding of human behavior explains its essential components, but it does not completely address the epistemology of the discipline—a point upon which few seem to agree. As argued by Smedslund (1991), psychology is becoming more and more “pseudoempirical,” and therefore, we believe that a theoretical focus needs to be re-introduced into the discussion of modern psychology.

The desire and necessity of reintroducing theory in psychology is not a new one, as one can see from the prior editions of *Annals of Theoretical Psychology*. From Joseph Royce’s initial work putting together Volume 1 of this series in 1984 to the most recent edition by van Geert, Mos, and Baker in 1995, a thoughtful and thorough exploration of the role of theory in psychology has taken place. Certainly, we regret the delay as the discipline has not stood still in the almost 20 years since that last volume. It is in this light that we enthusiastically reintroduce the *Annals of Theoretical Psychology* as an annual publication that will address the need for greater dialog across psychological perspectives, sub-disciplines, theorists, and methodologies. It is our intent that by driving reasoned dialog and constructive debate related to important topics in psychology, we will stimulate further inquiry of central, overlooked, or complex psychological principles.

Our goal in reviving the *Annals of Theoretical Psychology* is to expand and explore ontological, epistemological, and methodological debates (among others) and attempt to provide a forum for discussing what psychology is what is the focus of its study, and how one can study its phenomena. Furthermore, the revival of this series attempts to focus on constructing, from the aforementioned debates, exactly how to proceed with the development of theory and its applications. Despite various “crises in psychology” (Teo, 2005), to date the role of theory in psychology has not risen to the forefront in any appreciable manner.

The need for an annual publication on theoretical psychology at this time is significant. As an example, in the United States, psychology is a core science that has only grown in importance since its acceptance as an academic discipline. One need

only look to the daily news to see that many of the issues of today focus on the human dimension and the human condition. However, despite its growth as a core science, it has become fractured and highly specialized (an old problem identified by Vygotsky, as summarized by Hyman, 2012). The result is that each sub-discipline develops its own language and approach where the concepts can no longer operate to explain the entirety of the human experience, even though they seek to explain similar behavioral or mental processes.

In order to begin from common ground, the Oxford English dictionary defines theory as, “a supposition or a system of ideas intended to explain something, especially one based on general principles independent of the thing to be explained:—a set of principles on which the practice of an activity is based: a theory of education | [mass noun]: music theory.—an idea used to account for a situation or justify a course of action: my theory would be that the place has been seriously mismanaged.—(Mathematics) a collection of propositions to illustrate the principles of a subject” (Oxford University Press, 2010). From this set of definitions the role of theory in its application to psychology can be clearly seen.

It is in this light that we re-launch the *Annals of Theoretical Psychology*. Theoretical psychology, as we see it, is not limited to basic or applied science. Theoretical psychology is about the supposition or system of ideas that helps spark debate and move our discipline forward in a unified fashion. Additionally, through this debate, a more meaningful understanding will develop. More directly, theoretical psychology is about identifying problems or shortages in our shared understanding of the human experience and exploring how these gaps are addressed through science and the state of the art.

For example, arguably the most famous psychologist (or infamous depending on one’s perspective) in history is Sigmund Freud. His theories have been simultaneously contentious (e.g., Grünbaum, 1986) and useful for some as the roots of his theory are still employed by thousands of psychoanalytic therapists around the world. However, why do his theories work for some and not for others? Can we understand the basic science, application, and theoretical underpinnings so that development and growth can occur relative to this theory?

Likewise, incomplete representations of psychological phenomena and “principles” are not limited to the realm of personality theorists. Despite vast amounts of research, we still cannot completely explain basic yet abstract concepts such as memory, human agency, free will, leadership, confidence, love, or consciousness, let alone more challenging topics like promoting change, developing meaning, or structures and ways of knowing, just to name a few.

Numerous reasons may account for our general inability to examine key psychological principles in a complete manner. As noted by Stam (2004), functionalism and other more convenient demands may play a role. Likewise, various critiques of psychology highlight that the methods of scientific inquiry have become the focus of psychology rather than a direct examination of underlying theories and relevant data (Teo 2005; Bakan 1996). Ultimately, the “what” of psychology is lost in “how” it is investigated. These reasons generally prohibit meaningful dialog, but the *Annals of*

*Theoretical Psychology* will provide a forum for meaningful dialog across various disciplines.

The Annals of Theoretical Psychology will move the dialog forward by bringing together disparate communities and perspectives of psychologists. For example, representatives from cultural psychology, cognition, neuroscience, social psychology, theology, and various other disciplines will be invited to consider numerous topics within this series. Decidedly, these writings and debates will represent clear “works in progress.” The dialog and created environment will attempt to address historical challenges inherent in the science of psychological inquiry. This will help counteract the “science wars” highlighted by Driver-Linn (2003) related to scientific progress in her analysis of Thomas Kuhn. In short, through this series, we are not so bold to believe that the *Annals* will predict or create scientific revolutions. Instead, we hope to present a “pebble on the pile” that will gradually shift psychological research and discourse toward a normative dialog that actively considers theory, research, and application.

We believe that this first volume in 19 years picks up the debate where it was left off and begins to look at psychology through many lenses, in order to see the landscape and future of psychology through many focal points. Additionally, we believe that the dialog beginning in his volume will start to advance the discipline, science, and thought for future decades to come. Perhaps in those decades, the future of psychology and theory will lead our discipline toward a multidisciplinary approach. It is hoped that the future volumes will speak to that future.

Craig Gruber, Hroar Klempe  
Matthew Clark, Jaan Valsiner

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Kenneth R. Cabell

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**Part I**  
**Theoretical Considerations of Causality**  
**and Catalysis**

# Chapter 1

## Systematic Systemics: Causality, Catalysis, and Developmental Cybernetics

**Kenneth R. Cabell and Jaan Valsiner**

Traditionally the principle of unidirectional causal relationship has become so internalized in the thinking of the natural as well as human scientist that the notion of multilateral mutual simultaneous causal relationship was inhibited, repressed and did not occur in the scientific thinking, or when it occurred, it was discarded as unscientific, illogical or circular argument.—Maruyama 1960, p. 41

This book, *The Catalyzing Mind: Beyond Models of Causality*, began from our quest to achieve three goals for the discipline of psychology, and more specifically, as elaborated within a semiotic cultural psychology. Cultural psychology is a new “up and coming” (Cole 1996) research field of an interdisciplinary nature. Despite its recent emphasis in psychology, it is older than experimental psychology (beginning with Wilhelm Wundt and his opening of the first experimental psychology laboratory in 1879) dating back to the *Völkerpsychologie* tradition of the 1850s. The first professorship in the World that bore the name psychology was that of Moritz Lazarus in University of Berne, Switzerland, in 1860, with his *Lehrstuhl* in *Völkerpsychologie*. Unfortunately in the middle of social negotiations about how psychology “could be a science,” (Valsiner 2012) it was the experimental psychology tradition that expelled the study of complex cultural phenomena out of the realm of concerns of hardcore experimentalists who happily substituted the behavior of a white rat to stand in for the psyche of all human beings. The rat had no aesthetic attitudes towards the mazes he or she was forced “to run”, nor sophisticated ideas about investment of one’s behavioral capacities for the sake of future gains. The rat did not drink champagne, show herself in fashion shows, construct nuclear bombs or, paint the ceiling of the Sistine Chapel. Human beings did all of that—and much more. Their pilgrimage to arts, sciences, and geographic explorations were willful, complex, and often unrewarded—at least during their lifetimes.

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It is amidst the complexity of the human condition of meaningful future-oriented conduct (in opposition to the efforts to reduce psychology to the “study of behavior”) that the need arises for developing new models of conceptual and theoretical analysis. It is precisely this sentiment—the need for new models of theoretical and conceptual analyses of higher-order, complex, psychological phenomena—that lead us to formulate the following questions for authors to focus on in this volume:

1. Do causal models fit the complexity of phenomena studied in psychology? What are “causal” models? How are they defined? how are they used?
2. Are there other models—better models—that allow for understanding and explanation of complex phenomena in psychology?
3. Is it possible to use these other models to derive general laws of higher psychological functioning and behavior?

Before the authors of this volume begin to answer these questions from their own unique perspectives, we will lay the theoretical groundwork that we hope will “open the door” to a theoretical and empirical dialogue that might one day result in an answer for each of the questions mentioned above. This theoretical groundwork will include:

1. The concept and criteria of causality
2. The concept and criteria for the normal distribution
3. The concept and criteria of the second cybernetics
4. The concept and criteria of catalysis.

This theoretical groundwork for an alternative explanatory system for higher and complex mental and behavioral phenomena in psychology may bring about bigger questions—what is knowledge? What is science? What is psychology? What does the discipline of psychology study? What do various methods “tell us”? What counts as data? What is required for a psychological fact, law, or generalization? This is just a small sample of questions that this book begins to question, problematize and reconceptualize.

From our point of view, science is about generating a body of knowledge. Psychology, being a science, focuses on human experiences and the thoughts, feelings and behaviors that make these experiences meaningful. Putting these definitions together, the question becomes what kind of knowledge can result from focusing on lived experiences and their meaningful cultivation? The answer to this question is a focus on types—a focus on different types of (semiotic) mechanisms by which individual’s make their experiences meaningful. These types are classified according to their function and allow for explanatory laws to be built. Kurt Lewin—one of the key figures in the twentieth century psychology—emphasized such a focus on types back in the 1920s under the label of Conditional-Genetic Types (Lewin 1927). Lewin was far ahead of his times—focusing on the general and *conditional* nature of concrete psychological events. He laid the foundation for a new kind of science of psychology—neither behavioral nor mental, but one that looks for general laws of human conduct that are unique—conditionally bound to the present situation. He could have discovered the notion of catalysis back then in the 1920s—importing it

from chemistry where it was well recognized after Wilhelm Ostwald's Nobel Prize for it, in 1909. But he did not—it was physics rather than chemistry that fascinated Berlin Gestalt psychologists in the 1920s.

Before a version of scientific psychology—qualitative and conditional—is proposed, we must make explicit why the old axioms of a scientific psychology do not fit the goals of our research, while focusing on new axioms. This introduction, and the chapters to follow, try to do just that. Contrary to the focus on elementary psychological functions—be these behavioral or mental—we start from human psychological phenomena of highest complexity. Consider the following questions: How do we understand the sacredness of a religious experience? How do we explain the honor experienced when serving for one's country? Or defending the honor of a woman in a duel in the nineteenth century? What does it mean to experience *respect*, *duty*, or *obligation* and how does this operate within our everyday experiences?. All these—and many others of similar kind—are qualitative phenomena that cannot be “measured” in the habitual act of a psychologist “assigning numbers” to them. Quantification here loses the richness of these experiences. Statistics loses the heterogeneity of these experiences. Unidirectional linear causality loses the complexity of the experiences. The power of the complexity of human psychological phenomena that matters in everyday life forces psychology as science to re-think its methodological habits.

But how? Of course it is easy to deconstruct—show the faults in long-ingrained habits of—the modern practices of any discipline. We take no satisfaction in only problematizing the mismatch between phenomenon and the methods used to study them. There is an abundance of deconstruction and criticism of modern psychology, but not enough theoretical proposals to allow any one author, or the discipline as a whole, to move beyond the faults to a more constructive and developmentally sophisticated discipline. The goal of this book is constructive. What type of axioms would allow for psychology to maintain the richness, heterogeneity, and complexity of concrete experiences while still being able to make explanatory laws?

## **Beyond Models of Efficient Causality: A Focus on the Three Neglected Causes**

Much of the discussion regarding the qualitatively rich, heterogeneous, and complex phenomena and how we can better explain and understand them begins with the concept and criteria of causality. The history of causality takes us back to Aristotle. For Aristotle, there were four causes: (1) material cause, (2) formal cause, (3) efficient cause, and (4) final cause:

‘Cause’ means (1) that from which, as immanent material, a thing comes into being e.g. the bronze is the cause of the statue and the silver of the saucer, and so are the classes which include these. (2) The form or pattern, i.e. the definition of the essence, and the classes which include this (e.g. the ratio 2:1 and number in general are causes of the octave), and the parts included in the definition. (3) That from which the change or the resting change first begins; e.g. the adviser is a cause of the action, and the father a cause of the child, and in general the

make a cause of the thing made and the change-producing of the changing. (4) The end, i.e. that for the sake of which a thing is; e.g. health is the cause walking. (Aristotle, 2006, p. 46)

Often it is only Aristotle's third type of cause—efficient cause—that is used in psychological science. This is because the field's interest is only in prediction and explanation of "change". But change need not be the only focus of a science, and therefore efficient cause need not be the only type of cause used. We reinterpret these causes to ask the following questions:

1. How does a phenomenon emerge, develop, and disappear?
2. What form does a phenomenon take and why?
3. What is the system within which the phenomenon operates?
4. For what purpose, goal, or intention does a phenomenon function?

Abstracting from Aristotle's writings, these questions generally fit his notions of material, formal, efficient, and final causes. However, they are not meant to be strict interpretations, as it is our belief that in order to achieve progress in a discipline, one should always go beyond (i.e., develop, extend, build upon) the writing of others (not treat them as completed works that require the strictest adherence).

If we bring these general questions into the field of psychology, we can apply them to a subject of interest for the authors: trapping phenomena. Trapping phenomena are a type of psychological event in which the individual feels, thinks, or perceives himself/herself as stuck, caught, in a bind, etc. Take, for example, someone who feels trapped when passing a beggar in the main street of a city. They can give money to the beggar, even though they know that this beggar is tricking them or they cannot give money, and feel bad they did not help a poor, homeless, and troubled man. Either way, there seems to be a perceived negative consequence.

Psychology needs a new developmental focus. For material cause, "that from which a thing comes into being" is a developmental question. However, it is important to point out that "development" here is not tied to the notion of the developing person across the lifespan, but the general notion of development of a phenomenon. Therefore, it would not make sense to study how trapping phenomena develop as the person ages. Instead, what form, function, structures, processes, persons, events, conditions, etc allow for trapping phenomena to emerge? To understand the material cause of the trap, one must ask how a trap can emerge? How would a trap develop? How does an individual get out of a trap (i.e., how does the trap disappear)? This question is hard to know until we better understand the form of trapping phenomenon.

Formal cause is related to the form that a phenomenon takes and why it takes this form. This question has two subparts—its genotypic and phenotypic form. These words are used similar to their use in biology and are imported into psychology through the work of Kurt Lewin (1927) and his *conditional-genetic* types—as mentioned earlier. Each psychological phenomenon has a genotype—carefully defined "root" properties and ways of expressing these in specific contexts—and a phenotype—the manifested genotype in a certain condition, at a certain time, and in a certain space. Therefore, a genotype is analogous to the theoretical definition, while the phenotype is the various ways that definition can manifest itself. For example,



a beggar might not be the only place where one feels trapped. We can feel trapped when guilt-tripped by a friend, a parent, or a significant other. We can feel stuck or in a bind when confronted by conflicted social norms in another culture. Trapping phenomena adhere to a type, but manifest themselves in a variety of forms. The name, conditional-genetic, is directly related to these genotypic definitions, since the point of a conditional-genetic analysis is to uncover the conditional nature of genotypes. Said differently, conditional-genetic analysis studies how certain genotypes manifest their different phenotypic displays in various conditions. The primary focus is on conditions—which can generate results vastly different from one extreme to the other. To understand the differentiation between phenotype and genotype in terms of trapping phenomenon, we might say that given the example earlier, trapping phenomenon have the genotypic form of two (or more) contradictory, opposing, or ambivalent trajectories where both the contradictory trajectories are perceived to result in negative consequences. The phenotypic form in this case is the individuals who feel that they can either give money or not give money to the beggar (contradictory actions). If they give money, they feel they are likely being tricked and will lose money to someone who is maybe unworthy of it. If they do not give money, they will feel like a bad person for not helping out, which is a socially desirable trait. Both of these courses of actions have negatively perceived consequences.

Efficient causality is related to the systemic embeddedness of the phenomenon. What role are other factors playing in the phenomenon's operation? What various relationships does the phenomenon have to other phenomena, structures, processes, persons, events, conditions, etc.? Efficient causality is known for its focus on change. Typically, we view this change as variable A acting on variable B. Instead, if we think of it in systemic terms, then this change can be the result of a variety of interrelated and interlinked phenomena. Even if there is no "change", there might be some systemic reason for the buffering of or resistance of the effect. This buffering, inhibiting, resistance quality cannot be understood in linear causal terms (cause A leads to outcome B) but only in systemic terms (system of X-Y-Z leads to outcome B, under some, but not other circumstances). In the trapping example, there are factors such as social status (e.g., "beggar"), social norms, social values (e.g., helping), personal beliefs (e.g., don't want to get mugged), and various meanings that surround social acts and social objects (e.g., money, donating, giving, begging, etc). There is the place, the historical period, the social locations of both individual's involved, etc. Of course many will say in rebuttal that there are many infinite parts of the system involved. However, it is our belief that not all parts of a system are meaningful for the given situation. This distinction between meaningful and nonmeaningful parts of a system must be elaborated upon.

Lastly, final cause asks for what purpose, goal, or intention does a phenomenon function? This is important for psychology, since we are dealing with active participants, engaging in a world within which they act, think, and feel. Individuals are purposeful, they intend to act in certain ways, changing their current environment. Similarly, psychological phenomena, related to the individual's mind and coordinated with society, are also purposive, goal-oriented, and intentional. Why certain phenomenon function, is a key part in understanding the phenomenon. In terms of trapping phenomenon, for what purpose do we trap others? For what

purpose does the trapping phenomena exist? Why are people able to get trapped? These are very important questions to better understand trapping phenomena.

These four types of causality can only explain a phenomenon if they are explored together as a totality. Explanation and understanding of a phenomenon can only be understood by identifying how the phenomenon emerges, develops, and disappears, what forms it takes (genotypically and phenotypically), what function it serves, and the systemic relation between the phenomenon and other persons, processes, and conditions.

## **Beyond Unidirectional Causal Models: A Focus on Morphogenetic Causal Loop Models**

Aristotle unveiled various types of causality that might be mapped on to a phenomenon's development, form, systemic relation, and function. In this section, we can focus on efficient causality, or, in our terms, systemic relations. Models of causality for efficient causality have always been in terms of linear causal relations. But these are not the only types of causal relations. For example, other types of causal relations include:

1. *Nonreciprocal causal models*, in which causal relations may be either probabilistic or deterministic, but there are no causal loops; causal relations obey the transitive law.
2. *Independent-event models*, in which the most probable states of the universe or of an isolated system are states of random distribution or independent events, each having its own probability; nonindependent relations and nonrandom structures exist but are less probable, tending to decay into more random, unstructured, homogeneous states.
3. *Homeostatic causal-loop models*, in which causal relations may be probabilistic or deterministic and may form loops; structures and patterns of heterogeneity are maintained by homeostatic causal loops.
4. *Morphogenetic causal-loop models*, in which probabilistic or deterministic causal loops can increase heterogeneity, generate patterns of mutually beneficial relations among heterogeneous elements, and raise the level of sophistication of the system. (Maruyama 1980, p. 589–590)

Although historically psychology has been focusing somewhere between the first and second types of causality, it is our belief that psychology should focus on the fourth type of causality—morphogenetic causal loop models. In this type of model, a phenomenon is looked at in relation to the whole system. The main property of the system is its amplification of variability and the new forms of the system has mutually beneficial relationship with other elements.

## **Beyond Statistical Models: A Focus on Variability**

Although psychology is based within a positivist/post-positivist paradigm, and although it uses linear causal assumptions, many of the hypotheses produced are tested via statistics. However, the question becomes whether or not statistics, as a tool, is

adequate for explaining and understanding the complexity of higher-order mental and behavioral phenomena psychology. Authors who think that statistics is not an adequate tool for understanding and explaining psychological phenomena, often make the following type of argument:

The uncritical use of the assumption of normal distribution—the bell-shaped curve—dominated psychological and social sciences. But in this assumption, something important was overlooked. Researchers tended to forget or never learned how the bell-shaped curve had been mathematically derived and defined. The normal distribution occurs when both of the following conditions are satisfied: (1) the fluctuations are *random*; (2) They are *independent* of one another. But psychological and social events are neither random nor independent. Therefore it is illogical to assume a normal distribution. This is what most researchers forgot or never learned. (Maruyama 1999, p. 53)

There are two problems. The first is that the statistical use of the normal distribution is illogical since the theoretical criteria for its use is not met by psycho-social phenomena. The second is that using the normal distribution and statistics simplifies the complexity of phenomena, homogenizes them, and ignores the focus of real interest for psychologists—the variability of phenomena:

It is often assumed that variations occur in a Gaussian (normal) distribution around the mean. This assumption holds if the variations are due to random fluctuations or random errors, which are independent from one another. However, in many biological and social processes, heterogeneity is non-random and interrelated. Therefore, the distribution is often non-Gaussian (non-normal). Even in such cases, however, a normal distribution is often assumed in order to ‘simplify’ matters. This assumption enables the researcher to ignore the *nature* of variations; they become just a matter of degree, which can be measured in terms of standard deviation. They also become expected accidents and abnormalities which need no explanation and play no important role. What counts is the mean, which is the major trend, *the trend, the mainstream, the ‘real’*. (Maruyama 1980, p. 589)

It is precisely the variability that is interesting in psychology. The extremes of the distribution can tell us more about the underlying processes affiliated with a phenomenon than the mean can. After all, the mean is a hypothetical construct affiliated with “the average person” or “the average phenomena”—but what or who is this average? In the end, the mean is an index—it points to an area around which the majority of the individual persons and individual phenomena are located. Unfortunately, this seems to be associated with some other goal of psychology because if the goal of psychology is to better understand and explain the form, function, development, and systemic relations of phenomena, then we do not need to know the hypothetical average phenomenon, but instead concrete phenomena in all their variability. The importance of variability can be highlighted here:

Beneath the assumption of the normal distribution, there is another assumption: homogeneity is basic, necessary and desirable. Homogeneity has been often considered a source of peace and standardization was equated with efficiency. However, from ecology we learned that heterogeneity is basic, necessary and desirable. (Maruyama 1999, p. 55)

If we think seriously about the psychology of everyday life, we come to realize that no two thoughts, feelings, or actions are the same. They might be similar, but never the same. A focus on phenomena, in an ever-developing and ever-diversifying

psychological system that highlights a systemic point of view is that which does not adhere to the assumptions of statistical phenomena.

## **Beyond Homogeneity and Stasis: A Focus on Deviation-Amplifying Mutual Causal Processes**

The same genotype, with various manifested phenotypes, in all their variability, are the result of deviation-amplifying mutual causal processes. The second cybernetics, the focus of which is deviation-amplifying mutual causal processes, was introduced by Maruyama in 1963:

By focusing on the deviation-counteracting aspects of the mutual causal relationships however, the cyberneticians paid less attention to the systems in which the mutual causal effects are deviation-amplifying. Such systems are ubiquitous: accumulation of capital in industry, evolution of living organisms, the rise of cultures of various types, interpersonal processes that produce mental illness, international conflicts, and the processes that are loosely termed as “‘vicious circles’ and ‘compound interest’” in short, all processes of mutual causal relationships that amplify an insignificant or accidental initial kick, build up deviation and diverge from the initial condition. (Maruyama 1963, p. 164)

Mutual causal systems include “elements within a system [that] influence each other either simultaneously or alternately” (Maruyama 1963, p. 164). While differentiating between the two types of mutual causal systems, Maruyama writes the following, “the difference between the two types of systems is that the deviation-counteracting system has mutual negative feedback between the elements in it while the deviation-amplifying system has mutual positive feedbacks between the elements in it” (Maruyama 1963, p. 164). Often times, it is the assumption in experimental work that if we have similar conditions, we can produce similar effects. This way we can try to achieve replicability of our results. However, the implications of mutual causal systems—of both types—are that similar conditions can produce different effects. It all depends on the parts in the system, the initial kick, and what parts are deviation-amplifying versus deviation-counteracting. This revision of causality has been formulated as follows:

In the light of the deviation-amplifying mutual causal process, the law of causality is now revised to state that similar conditions may result in dissimilar products. It is important to note that this revision is made without the introduction of indeterminism and probabilism. (Maruyama 1963, p. 167)

Since this definition lacks indeterminism and probabilism, a definition of causality inclusive of these concepts has been formulated as follows:

A small initial deviation, which is within the range of high probability, may develop into a deviation which is very improbable within the framework of probabilistic unidirectional causality. (Maruyama 1963, p. 167)

With either definition of causality (with and without probabilism and indeterminism), causality in the psychological system must be systemic. It must include heterogeneous elements and processes related to each other in various ways, achieving greater and greater variability over time. This variability allows for the synthesis of novel thoughts, feelings, and behaviors.

## A Possible Synthesis and Solution: Catalysis

Semiotic Cultural Psychology is a discipline on the borders of psychology, semiotics, and cultural studies that focuses on how individuals make their experiences meaningful. Analytically, the discipline uses a semiotic perspective, using the notion of the sign as its analytical unit. The goal of a semiotic cultural psychology is to specify the semiotic mechanisms by which individuals make their experiences meaningful. In one theoretical attempt to extend the aims and scopes of semiotic cultural psychology, Cabell (2010) attempted twofold by: (1) differentiating the mechanisms (i.e., the types of signs) by which we make meaning and (2) focusing specifically on context-inclusive models of human psychological functioning. That paper intended to present an argument for a semiotic catalyst, which was functionally different from semiotic regulators (e.g., promoter signs or inhibitor signs). In this section we seek to clarify and extend the arguments from that paper in light of the other concepts described in this chapter.

Psychological functions are built upon mediating processes, where mediating processes are any processes that intervene between a cause and effect, a stimulus and response, or any two associated/contiguous phenomena. “Intervention” is defined as the act of inserting—between a cause and effect, stimulus and response, or two associated phenomena—a process that redefines, reformulates, and reconstructs the relation between a cause and effect, stimulus and response, or two associated phenomena in such a way that the mediator is necessarily involved between the two. Mediation is a general term for the intervention of a process between two things in a way that redefines the relationship between the two things, necessarily including the mediator. Therefore, it is fruitful for the discipline of semiotic cultural psychology to begin to theoretically and empirically define the *specific types of mediating processes*. Said differently, *it is the goal of the semiotic cultural psychologist to identify the way certain mediating processes change the relationship between cause and effect, stimulus and response, or two associated phenomena*.

A functional differentiation of mediating processes includes two types: semiotic regulators and semiotic catalyzers. Semiotic regulators have a direct impact on the effect, the response, or the resulting phenomenon. This direct impact can negate the effect, response, or resulting phenomenon, it can also continue to promote the effect, response, or resulting phenomenon, or it can change the qualities of the effect, response, or resulting phenomenon. Notice that a regulator does not intervene and have a direct impact by creating an entirely new effect, response, or resulting phenomenon. If this was the case, then regulators would just be causes, stimuli, or

phenomenon to which new effects, responses, or resulting phenomenon followed. Instead, regulators have the ability to nullify, promote, maintain, or hybridize (i.e., change parts of the descriptive qualities of) the current effect, response, or resulting phenomenon. They do not change the effect, response, or resulting phenomenon to something entirely new and different. To be sure this is clear, a search for types of mediating processes is a search for alterations or modifications in cause–effect, stimulus–response, or two phenomena’s relationships. If this alteration or modification was actually a change of the whole phenomenon, rather than changes in parts, we would be identifying new paths of causality.

Semiotic catalyzers are a noninvasive intervention (whereas regulators are invasive). They are the conditional or contextual support within which something occurs. Any cause and effect, stimulus and response, or two associated phenomena work in so much as they have the proper conditions to do so. They provide directional flavoring and support, aid, and enablement, and without them certain meditational processes (i.e., certain semiotic regulators) cannot operate.

Since the semiotic catalyzer is analogous to the meaning of a set of conditions, a context, or a situation, it is a concept that is meant to be systemic. The semiotic catalyzers systemic qualities have been charted out by Valsiner (2002) in the following way:

The process of synthesizing two separate substrates (a, b) into a new compound (ab) is made possible through the cyclical process of constructive aliasing of the compounds. A catalyst (c) temporarily binds the input substrates to itself. First a becomes linked with it—this results in an intermediate compound ca. Then b is added, arriving at intermediate compound cab (i.e. binding a and b into one whole). The catalyst then releases the newly created compound ab and re-creates itself (c), becoming thus ready for the new cycle of binding the input substrates. Without the binding role of the catalyst, the synthesis need not be possible (direct unmediated synthesis  $a + b \rightarrow ab$  cannot proceed). (2002, p. 254–255)

The concepts of historical importation into psychology (Chap. 3) and methodological implications (Valsiner 2007, p. 373) add an important level of theoretical clarity to the concept. For example, in its conception, semiotic catalysis was a systemic phenomenon, meant to allow for the analytic charting of systemic parts, relating to each other in a way that produced novelty and maintained the system as a whole. This allowed for a focus on the developmental nature of the phenomenon:

Development—of any biological, psychological, or social system—is regulated by its own transforming state. That state—constantly in a process of change—sets up the conditions under which it relates with selected aspects of the environment, making it possible for the latter to guide further development of the system itself. This autocatalytic function guarantees continuity of the system’s development—and sets the stage for guidance efforts upon its development from outside (allocatalytic processes). (Valsiner 2008)

It is important to note that the concept of semiotic catalysis is a process that highlights the systemic relations between parts, and specifies how the relationship of these parts construct, as a gestalt, the conditions necessary, but not by themselves sufficient, to bring about a qualitative transformation of a psychological phenomenon. Semiotic catalysis should highlight the systemic, transformative, developmental nature of

mediating process and the heterogeneous variety of outcomes that result (such as the enabling of certain semiotic regulators).

Although there have been developments identifying various semiotic regulators, there is still a lack of conceptual, strategic, and analytic clarity for semiotic catalyzing processes. Although a theoretical charting out of semiotic catalyzers has occurred in other places (Beckstead et al. 2009; Cabell 2011) this book began as a project to incorporate international and interdisciplinary perspectives to question, criticize, and comment on the concept of semiotic catalyzers with the hopes of extending, expanding, and developing the concept into a useful theoretical and empirical tool. It is our hope that from the groundwork of cybernetics and causality, that the concept of catalysis can have a rich and fruitful basis for development as a theoretical concept better suited to the model and explain everyday experiences and their meaningful cultivation.

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**Part II**  
**Historical and Conceptual Considerations**  
**of Causality and Catalysis**



## Chapter 2

# Breaking the Arrows of Causality: The Idea of Catalysis in its Making

Jaan Valsiner

Life ... becomes a chemical symphony based on the simple melodic line of water, and is worked out in relation to carbon, nitrogen, phosphorus, sulfur, iron, sodium, potassium, calcium, and traces of other elements, but the greatest of these components is the water. As in great musical masterpieces only the initiated can fully appreciate the achievement of the master, so here the initiated alone can only appreciate the versatility and the amazing chemical beauty of this creation. Viewed in this way water is the music, the carbon compounds and colloids are the instruments, *the catalysts of the various changes produced are the players*, and the whole is possible because the qualities of the energy fields that correspond to the air of the room in which the “orchestra” plays. Sometimes the “performance” goes awry, owing to anomalies in one or more of the above and we have pathology and even death. Who can say then whether the music, the instruments, the players, or the “energy field” is the most important in the “ensemble” known as life?

Witzemann 1943, p. 178 (added emphasis)

Immanuel Kant was brutal. His verdict about two parallel sciences—dealing with compounds of different kinds—was negative. Kant believed that psychology and chemistry, cannot become sciences since they cannot be mathematical. The godly role of mathematics haunted the secularizing sciences in the eighteenth century. Not mathematical—not science!

Looking back, we can see that Kant was half-right: psychology has proven unable to become science, as it has failed to reach generalizations of the level of abstraction, characteristic of mathematics. Despite—or maybe because—its dedication to statistics—and the General Linear Model—psychology remains pseudo-empirical (Smedslund 1997, 2009) and theory-phobic. One can observe recurrent unhappiness by psychologists with such sad state of affairs in their discipline. That takes the form of active denial (“we are science, after all!”) or equally active lament. Neither solves the problem.

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However, Kant was quite wrong in his characterization of the other science—chemistry—that according to him was also doomed to the fate of being nonscience. While being similar in their epistemological credos in Kant’s time (1780s), chemistry became a respectable science in the nineteenth century (1830s–1870s), while psychology became a hostage to the ideological war between *Naturwissenschaften* and *Geisteswissenschaften* (Valsiner 2012). How could chemistry do what psychology has failed to accomplish?

By trying to answer this question, I here admittedly position myself on the side of those chemists who considered history and philosophy of their discipline relevant (such as Humphrey Davy—Abbri 1994), and in clear opposition to the founders of contemporary chemistry who—Lavoisier and Berzelius in the lead—denied the value of history of science for progression of ideas toward the future. Here, I enter into the history of ideas in chemistry to find out which of the intellectual turns these ideas took in chemistry—and have failed to take in psychology—could be borrowed for the latter discipline. History matters—both for understanding the past and producing the future.

## What Went Right for Chemistry?

Many things did. Lavoisier’s *Traité élémentaire de chimie* (1789) set up the basic scientific revolution in the discipline that by early 1800s had escalated its empirical productivity by a manifold. But empirical proliferation does not guarantee breakthroughs in ideas. Fortunately, the philosophical intellectual context in chemistry—mostly dominated by promoters and opponents of German *Naturphilosophie*—provided a fertile ground for invention of corresponding abstractions. The basic concept of polarity and the presumption of the unitary phenomenon consisting of opposites which may be in tension—are all stable notions for chemistry that have roots in *Naturphilosophie*.

By the 1830s chemistry reached the stage of formalization of its language, and by 1870s—with the gradual acceptance of Mendeleev’s Periodicity Table—reached a solution to the “induction or deduction problem” of scientific inference in the form of *uniting* the inductive and deductive parts of science. Instead of conflict between empirically observed (and inductively generalized) practices of “empirical science” and that of “top-down” axiomatically driven (and hence always suspect to the discipline’s alchemical past), the post-Mendeleev’s chemistry was a new science of theoretically oriented and empirically tested knowledge of the potential transformations of known chemical compounds into new, not yet known, ones. Chemistry became the map of principles and of their possible combinations (Abbri 1994, p. 38). And such combinations take time—chemistry is a science where sequence of ongoing reactions, and their subcomponents, is taken as a primary target for investigation. An outcome of a chemical reaction can be explained only by unveiling the sequence of intermediate reaction chains that lead to such outcome.

In some ways, this focus maps on the developmental perspective in psychology—before the final act of a developmental innovation occurs, there exists a series of time-bound events that leads up to it. Yet, there is a difference—in chemistry each of these reactions constitutes a unity of binding and unbinding—the relationships between reagents are crucial for the arrival at the final product. In developmental psychology, however, where the notion of binding is not a theoretical core concept, such intermediate relationships are back-translated into essentialist “causes” and viewed as if they “have an effect” (rather than “bring the system to the outcome”). Psychology’s enslavement by the notion of causality is analyzed by Toomela (2013) in detail.

Thus, the main difference between chemistry and psychology is in the adoption of different models of causality. While psychology continues to search for linear causal ties along the lines of inductive generalization, using all the statistical inventions of the twentieth century (Gigerenzer et al. 1989), chemistry since 1830s has moved into the focus on catalytic processes, together with structural depictions of binding processes (Klein 2004). Psychology’s sticking to the search for linear causality has led it into conceptual stagnation over the twentieth century (Toomela 2012). While working hard to find causal “main effects” and “interaction effects” through the ANOVA-type thinking that turns methods into theories (Gigerenzer 1991), psychology has overlooked the alternative ways of thinking about causality. Chemistry’s move into the use of the notion of catalysis—from 1830s onward, and particularly after 1890—has created an alternative framework of thinking that maps onto the reality of binding and un-binding processes of chemicals.

There are also other linkages with various disciplines. Chemistry these days becomes united with biology. Contemporary biology operates with the centrality of catalytic functions—enzymatic processes—on and off membranes. The frontiers of biological science is in the functioning of dynamic structures. In contrast, psychology—emulating some image of physics—attempts to reconstruct its object through “measures” that supposedly reflect some underlying (essential) quality. Comparing with chemistry that has left the notion of “saltiness” of “salts” very far behind, psychology is involved in an alchemical kind of act.

My goal in this chapter is to give an overview of the history of the catalytic process in general—extrapolating from chemistry—in ways that could be productive in bringing the notion of catalysis to the epistemology of psychology. It is mildly ironic that in the twenty-first century one needs to translate between “sister” disciplines that have developed in almost opposite directions. Reasons for that can be found in the socio-moral implications of psychology (Dolby 1977). Knowledge of the mind (or soul) is by far more sensitive in social living than that of various chemicals. The goals are also different—establishing the stability of the mind, in contrast to the transformability of chemicals. Psychology has focused on analysis, while chemistry is a science of synthesis. The focus on making something—bombs or pharmaceuticals—is the opposite of making sense of the already happened ruptures of the souls. Yet, both predicaments are practical in their nature.

## Proving Immanuel Kant Wrong: How Chemistry Has Come to Be a Science

Each science has its ghost. If for psychology such ghost is mysticism, for chemistry it has been alchemy. Trying to break with the mystical explanations—moving from the “stone of wisdom” to contemporary explanations—has been a long way of development of chemistry as science (Ertl and Glonya 2003). The context of such distancing from alchemy in the nineteenth century was *Naturphilosophie* and the German Romantic tradition as a whole (Snelders 1970). Chemistry was in-between the Romanticism of new formations and the pragmatism of the direct look at substances—first of all in mineralogy. A discipline that collects and orders various minerals is certainly a next door neighbor to chemistry—yet one who might look at the acts of chemists with distrust. What a mineralogist has found and classified is for him final—but not for the chemist.

In the dialogue with mineralogy, chemistry fought the battle with the immediately observable—different observed structures of minerals overshadowed chemists’ efforts to find their common chemical underpinnings (Melhado 1980). Fighting both the poetic romanticism that kept alive traces of alchemy and the rugged direct perspectivism coming from mineralogy, chemistry synthesized the focus on different languages of explanation that would fit different purposes. Without bringing the conceptual house in order, chemistry and mineralogy were on a clash course in early 1800s. The situation between these disciplines was that of fight against chemistry “swallowing” mineralogy through its greater explanatory potentials. Yet, the immediately available (mineralogical) picture of substances seemed to tell a different story. The introduction of Eihlard Mitschernich’s principle of isomorphism in 1819 consolidated chemistry’s perspective.

The issue at stake then has a striking resemblance to the “competence versus performance” discussion in cognitive psychology since the 1960s. The “performance” of minerals—two similar (or different) looking specimens A and B, could be considered different (or similar) by chemists analyzing their chemical structure. If they looked similar but were claimed to be chemically different, or if they looked different but were claimed to be chemically similar—the mineralogists’ trust in chemistry was deeply challenged. As minerals come to our attention in a myriad of forms—tainted in appearance by all kinds of additives—the direct perception and classificatory habits of mineralogists was a serious obstacle for the acceptance of chemical explanation. One has only to remember that around the same time—the first half of the nineteenth century—biology went through a similar process of “going beyond the information given” with the outcome of adopting the Wallace–Darwin evolutionary theory.

Borders of different disciplines were actively maintained in the nineteenth century science. Chemistry was not united—the contrast between inorganic and organic branches of the discipline was a major domain of disputes in early nineteenth century. The arguments in general were about reductionism—could one reduce the complexity of organic compounds to its elementary constituents that were of inorganic kind? Furthermore—can one reduce the ways in which living organisms exist to the general

principle of organic chemistry<sup>1</sup>? In other terms—can life be reduced to nonlife, in sum? The fate of similar boundary negotiations continued between biology and physiology—is the biological functioning of organisms reducible to physiological principles? And, finally, can psychological phenomena be reduced to physiological or genetic elements?

Interestingly, similar borders were present between chemistry and physics, and between psychology and physiology—chemists resisted actively to the idea that chemical phenomena can be explained away in physical terms.

The importance of flexible moves between the immediate and the abstract are conceptual benefits for chemistry where they move toward increasing abstractness of concepts. This feature of chemical language use allows for quick movement between general—categorical but vague—and specifically precise—language uses.

## **A Key to Conceptual Solution: Accepting Polylingualism in Chemistry**

Scientific language in any discipline is central for negotiating its investigative orientation with the integration of knowledge and its accessibility to the nonscientific public. The various languages usable in chemistry became formulaic—chemistry moved away from the common sense through developing generalized formulae that are applicable across concrete contexts. However, such progress in chemistry was slow. It was by the 1870s when the formulated chemicals were organized into a system of specifiable knowledge (Mendeleev's table).

In contrast, in psychology, the issue of language has been poorly differentiated. Efforts were made either to reduce its scientific language to its common sense counterpart, or to move toward inductively based theories that mimic the logic of analysis of variance. Either way, psychology uses its selected method, such as factor analysis, as the basis for a theory (e.g., 5-factor theory of personality).

In contrast, chemistry has overcome its alchemical language uses in the seventeenth to nineteenth centuries (Crosland 1978, Vickers 1984). In ways very analogical to our modern day psychology's labeling of inductively discovered factors and then believing that the labels have a causal force<sup>2</sup>, the alchemists operated on the basis of analogies between celestial, material, and mystical meaning systems. Alchemy compressed layers of abstraction into a complex of meanings where the reactions performed in a laboratory could be explained by occult forces, analogies with planets, or at least by the sensorially available characteristics of the states of chemicals<sup>3</sup>.

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<sup>1</sup> The border between the chemical and biological worlds was at stake: "Nineteenth-century chemists submitted animal compounds to elementary analyses in their laboratories, while physiologists claimed that they could not understand the processes transpiring in living bodies because they dealt with dead matter" (Bensaude-Vincent 2003, p. 209).

<sup>2</sup> e.g., "my high introversion makes me to be shy in public".

<sup>3</sup> A particularly difficult mental puzzle for the alchemists was an apparent disappearance of such perceivable characteristics at different phases of alchemical experimentation. For example—if gold

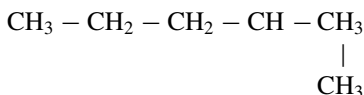
As a result of breaking free from its alchemical past, chemistry has incorporated a differentiated system of layers into its scientific language. Such differentiated picture of such language layers affords the discipline flexibility of presentation of ideas in relation to the desired audience. Such differentiated language domain allows for fitting the messages to the recipients as the common language meaning.

... survives in their synchrony in a different manner than is the case in natural languages. In natural languages diachrony manifest itself only through the etymology while in chemistry lay and semi-lay terms coexist today as clear synonyms with and to the functional and systematic names, and the choice of terms is determined by the efficacy rationale of the various communication situations pertaining to the field of chemistry (Mounin 1981, p. 218, added emphasis)

It is important to underscore the *functional flexibility* of the idea of this new way of language use in chemistry. Languages developed did not represent what the essence of the named substance is (e.g., in common sense: salt = “something salty”), but the presentation of the chemical for a particular way of reacting with other chemicals, to arrive in a new synthesis. From the generic notion salt, one cannot predict any potential to enter into reactions with others, but from a formulaic version one can chart out possible future connections with other reagents.

At the level of concrete terminology, there are at least four layers of names—for the same substances—used in the chemical nomenclature. The first one overlaps with those in the common language—terms like water or salt are used both in chemistry and everyday life. In chemistry one can encounter at least four layers of names for the chemicals talked about (Mestrallet Guerre 1980—referenced via Mounin 1981, pp. 217–218):

1. Lay terms that represent either a specialization of common sense terms (water, salt, ammoniac) or neologisms based on alchemic roots of chemistry (aqua forte, tincture of litmus). These names do not represent the actual chemical composition of the substance, and are arbitrary encoding of the objects. So, the term water has no implications about its composition of H–O–H.
2. Semi-lay terms that combine the root of a common sense word with a prefix or a suffix that connects to a paradigm (benzene, ethylene, propylene); nothing in the name gives information on the structure of the chemicals, yet their function as a category name can be elaborated in the terms of the components.
3. Functional names that specify major chemical function (phosphoric acid, benzoate of soda, silver chloride).
4. Names that describe the sum of the elements—rigorous and absolutely unambiguous reconstruction of the substance is possible—2-methyl pentane:




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turns into red crystals—has it vanished? Or is it merely disguised? Explanations for such transformations could be built on analogy with transmutation (of souls), or masking. The latter became demonstrated through reversal of the reaction—red crystals could turn back into gold (Crosland 1978, p. 38).

Through opting for multiple labels, chemistry keeps its creativity open through the flexibility of its language use—and by the interesting aspect of it: *the most concrete use of the language is simultaneously the most abstract*. The latter is the result of introduction of a new formulaic language to chemistry in the 1810s–1830s, largely thanks to Jöns Jakob Berzelius (Melhado and Frängsmyr 1992). That language brought hierarchical order to chemistry and thus allowed the discipline to emerge as one that unites structural and functional features of chemical transformations within the same formal system. That order also entailed the elaboration of the notion of causality—moving beyond the Aristotelian legacy—and to formulate principles of catalysis and (in biology) enzymatic functions.

## The Road to the Idea of Catalysis

As chemistry is a science of synthesis, the question of participation by various chemical reagents in the synthesis of the final product is the key conceptual issue in the science. Such participation may be direct, as in the case of reactants that directly bind to others, or indirect, that happen on the margins. The latter are necessary for the reactions to happen, but do not undergo change in themselves.

Such “contact action” of course does not mean that some miraculous impact of the presence of the given chemical is assumed. Rather, we can better talk of the surface of the indirect participant—a reaction taking place in the vicinity of platinum may involve the border of the metal, but not change its chemical nature. As such, the chemical both participates in the reaction (by peripheral contact) and does not do so (does not change its nature). The notion of catalysis—which could be called *causality without causes* (but by mere presence—or peripheral participation)—was a major intellectual invention of the nineteenth century. It comes from the intersection of chemistry and *Naturphilosophie*—the very idea of impact without causation fits into the holistic thought of the latter.

Johann Wolfgang Döbereiner (1780–1849) was a chemistry advisor to Johann Wolfgang Goethe, and—thanks to Goethe’s patronage—professor of chemistry, pharmacy and technology at University of Jena from 1810 until his death. While an experimenter and inventor of applied techniques first, he was interested in the philosophical issues due to his direct links with the romanticist in Jena. As a result, his look at the chemical processes was dynamic—making it possible to invent a lighting mechanism (later called *Döbereiner’s Lamp*—or *Döbereiner-Feuerzug*—Kauffmann 1999). This gadget—a lighter invented in 1823 and produced until 1880s—is built on the use of the platinum as the catalytic condition for spontaneous combustion by hydrogen. The practical device included the ideas that led Berzelius a decade later to the idea of catalysis, and has led to the use of catalytic converters in our contemporary automobile technology.

Döbereiner’s Lamp was a clever solution to producing fire through a chemical reaction (of sulfuric acid with zinc, releasing hydrogen as the first result). Döbereiner’s ingenious invention was to let the released hydrogen pass over platinum—letting the

oxygen from the air enter into mixing with the hydrogen and resulting in an intermediate product (*oxyhydrogen*) that burns and ends up as water (the binding of two gases into a liquid— $\text{H}_2\text{O}$ ).

Platinum as a metal that has “miraculous” effects on various chemical reactions was known already in the eighteenth century, but it was Döbereiner’s engineering genius that made its catalytic function visible in a newly created tool of functional value. His setting up the *mere presence* of a platinum plate to the *crucial phase* of the chemical reaction—release of hydrogen and mixing it with oxygen—caused the gas mixture to burn (hence the light) while turning into water. Without the presence of the platinum as a catalyst such reaction is not enabled, but platinum (as metal) does not participate in the chemical reaction sequence of producing water out of zinc and sulfuric acid (and oxygen from air).

The notion of catalysis was first introduced by Jöns Jacob Berzelius in 1835. In his capacity of inventing new terms, the notion of catalytic force (*katalytische Kraft*); the first effort was to classify the phenomenon into a category (catalysis). Yet, not much was done with the notion in terms of understanding of how it works, until Wilhelm Ostwald launched upon large-scale research and application efforts at the end of the nineteenth century.

**Catalysis as it Changes Reaction Speeds** It is not very surprising that the first exploration of the new notion of catalysis was dedicated to demonstrating how a chemical reaction could be sped up—or slowed down—by conditions that were not parts of the chemical reaction itself. Traces of that focus survive in the popular presentations of the concept to the present day<sup>4</sup>, while the complexity of ideas about catalysis have surpassed this first approach.

The various versions of impact of catalysts on the reaction rates were summarized by Mittasch (1938), here reproduced as Fig. 2.1. A regular one-time catalytic effect can be inhibitive (trajectory 2—Giftwirkung poisoning) or escalatory (trajectory 1—Aktivierung). The activation can be delayed by a catalyst (trajectory 4). Thus, in the outcomes of reactions, different time-dependent patterns can occur.

However, the notion—catalyst is not consumed in the reaction—does not necessarily mean that it does not—temporarily—bind itself with an intermediate state of the chemical by-products and become released from them by the end, not “losing” its nature or quantity. Thus, in a typical reaction where X and Y result in compound Z, the catalyst (C) can enter into—and exit from—the intermediate forms of the chemical reaction:

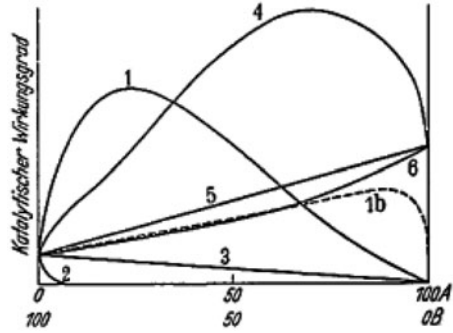



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<sup>4</sup> cf. Wikipedia explanation: “Catalysis is the change of rate of a chemical reaction due to the participation of a substance called catalyst. Unlike other reagents that participate in the chemical reaction, a catalyst is not consumed by the reaction itself.” The conceptual core notion that emerges here is participation—with (chemical reagents) or without (catalysts) being “consumed”. This definition has roots in the work of Berzelius and Ostwald, but becomes obscure at our time. The “not consumed” notion is better replaced by “renewed”.



**Fig. 2.1** Different quantitative impacts of catalysts on reaction rates. (Mittasch 1938, p. 25)



The catalyst C here binds itself to X, followed by the hybrid binding Y to itself, and then XY becoming Z while C is present. Subsequently, the Z is the result of the chemical reaction, while C becomes reproduced in quality and quantities it existed. Note that, here the catalyst does not remain an “outside condition” for the reaction process (like the first examples of platinum as catalyst were). Instead, the catalyst becomes temporarily functionally bound into the whole reaction at its intermediate stages.

To draw parallels with psychological processes—the entrance into the chemical reaction in the middle part of the construction of a new compound in chemistry has a parallel in the microgenetic processes of psychological kind where the structure of intermediate gestalts (Valsiner and van der Veer 2000; Chap. 7) involves psychological materials that disappear as the final percept or any other psychological phenomenon becomes assembled. However, psychology—in contrast with chemistry—has not often analyzed these intermediate steps, and the ways in which the final result is produced remains unexamined. While chemistry has turned the domain between Stimulus (S) and Response (R)— $S \rightarrow R$ —into a domain where the processes in between (i.e.,  $S \rightarrow (\text{set of intermediate transformations}) \rightarrow R$ ) are the focus of investigation, psychology has continued to look for formal relations<sup>5</sup> between S and R, avoiding the analysis of transitions.

In contrast, chemistry depends on the explanation of the “steps in-between”, and it is precisely here that the role of catalysts becomes central. Similarly to the development of *Aktualgenese* ideas in psychology, it is the specific conditions of the intermediate states of affairs that need catalytic lead-in toward the stable end product (Fig. 2.2). The sequence of reactions depends upon the appropriate catalysts acting in the sequence at appropriate time. This turns catalytic processes into time-space

<sup>5</sup> Usually representing these in terms of correlation coefficients or their derivatives. The hope is to reconstruct what happens in between through looking at the relations between S and R. Yet, as these relations are formal, they cannot re-construct the psychological process that is actually taking place.

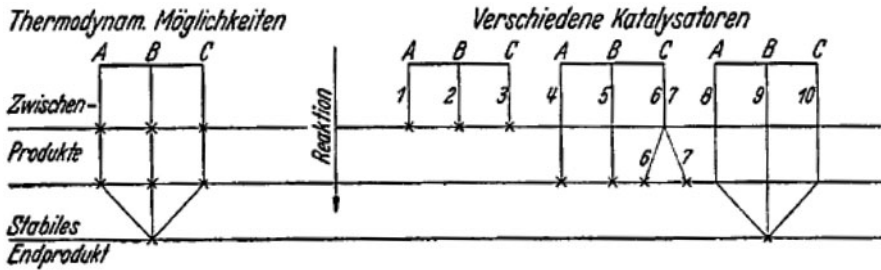
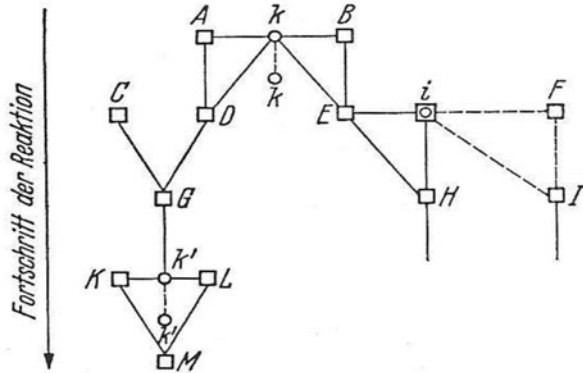


Fig. 2.2 The enabling role of catalysts in sequential reactions. (Mittasch 1938, p. 30)

Fig. 2.3 Catalytic conditions that create bifurcations. (Mittasch 1938, p. 70)



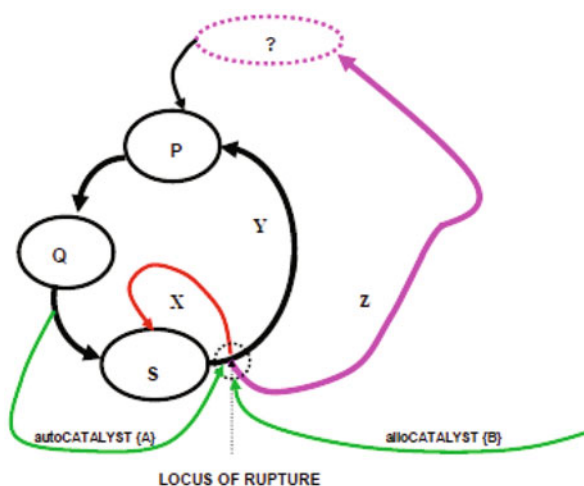
structures that can be described—and such description of the reaction sequence is the explanation of the outcome.

In Fig. 2.2, different sets of catalysts (1 . . . 10) lead the process of A-B-C to the end state of hybrid compound in a sequence; 1–7 prepare the intermediate products, but 8–10 are needed for the actual synthesis.

**Catalysis as it Creates a Bifurcation** Aside from unification—of the various intermediate compounds to a final one—catalysts can create the diversion of the chemical reactions into different trajectories. (Fig. 2.3).

In Fig. 2.3. it is the catalyst  $k$  for one part of the system (A- $k$ -B)—but it can also become a part of the reaction system (K- $k'$ -L-M). The scheme includes inductors ( $i$ ), with the result that the catalyzed system can both regulate the reproduction of the catalyst ( $k'$ ) and induce new outcomes of the process (F, I). The discourse about catalytic forces entails both “positive” (promoters) and “negative” substances that operate on the catalyst either by inhibiting the current catalyst (“inhibitors”) or by irreversible elimination of it (“catalyst poisons”). The story about the whole catalytic process is the narrative of mutual struggle between “positive” and “negative” catalytic forces as they regulate the time-dependent proceedings of the chemical reaction. The roots of this kind of systemic thinking in the traditions of *Naturphilosophie* are obvious.

**Fig. 2.4** Autocatalysis and allocatalysis in an open system



**The Conceptual Relevance of Autocatalysis** The notion of autocatalysis was introduced by Wilhelm Ostwald in 1890. The chemical process entails the synthesis of substance X at time T1 that would enter as a catalyst into the same reaction chain at T + N, acting in any role (promoter/inductor or inhibitor/poison)

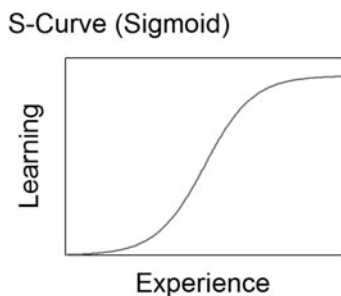
Wilhelm Ostwald was a prolific person. Not only was he the initiator of physical chemistry (receiving the Nobel Prize in 1909 for the catalysis applications), but also through his active propagation of the energetist notion that was supposed to unify all sciences, he had an impact upon psychology of his time as well.

As described in Fig. 2.4, the autocatalytic system is the key for all the three fates of the system—its collapse (trajectory X), self-maintenance (trajectory Y), and development into a new form (trajectory Z). The openness of the open systems depends on the relationships between auto- and allocatalytic processes in the system.

Autocatalysis is the basic process of the maintenance and development of open systems. The emergence of life out of inorganic components has been attributed to autocatalytic functions—which of course is the reasonable attribution in contrast to all the implications of attributing such emergence to any outside causation. Its characteristic form of the proceeding with the outcome production is the Sigmoid curve (Fig. 2.5). It indicates the feed-forward catalysis of the process—learning in this case—that speeds up the process in the intermediate stage, to be followed by the slowing down at the reaching of destination.

**An Organic Example of Autocatalysis: The “Tin Pest”** At 13 °C and lower, pure tin transforms from its silvery metallic form to nonmetallic “grey tin”. First that transformation is slow, but as the decomposing reaction catalyzes itself—the more of the “grey tin” is produced the more of it will be produced (until finally the tin decomposes into powder). What seems—at warm temperatures—a metallic object—can disintegrate at low temperatures in an escalatory way. By some interpretation,

**Fig. 2.5** The normal example of simple autocatalytic outcomes: the Sigmoid curve



Napoleon's soldiers fighting in the Russian winter conditions lost their buttons on their uniforms because those were made of tin .

**From Science to Practice** One could use the development of knowledge in chemistry as an example of autocatalytic process. Ever since Wilhelm Ostwald and Alwin Mittasch provided ideas of catalysis that granted profits to chemical manufacturers, the search for catalytic solutions to practical chemistry problems has been escalating. Such escalation often involved “trial-and-error” type of learning, leading to the need for new qualitative breakthroughs in theory.

Alwin Mittasch—a disciple of Wilhelm Ostwald who most diligently carried his ideas of catalysis further both theoretically and practically—joined the BASF company in 1904 to undertake the development of commercial synthesis of ammonia<sup>6</sup> (NH<sub>3</sub>) from atmospheric air through a catalysis process. The direction of efforts was clear—to find adequate catalysts that would increase the production of ammonia to the level that was commercially viable. In that effort, the applied researchers scanned huge variety of catalysts (2,500, in year 1912; Farber 1966, p. 165). This largely “blind” process—try what one can, maybe something works—resulted in local generalization of how one could succeed<sup>7</sup>. Together with solving engineering problems of the scale of the production plant, the effort succeeded—the factory near Ludwigshafen started production in 1913 (it closed in 1957). By the end of 1915 the BASF plant produced 150,000 t of ammonia (in comparison, by year 2012 the World's production of ammonia was 198 million tons). Catalytic functions are the main focus of our chemical industries.

**“The Partner of the Hormones is the Living Cell”<sup>8</sup>—Biological Catalysis** The organic world is different from the anorganic. Figure 2.3 leads us to the crucial notion of autocatalysis that is of importance in biological systems. Autocatalysis is a form of catalysis where the catalyzed system itself produces substance that acts—in another

<sup>6</sup> A colorless gas used widely in fertilizers and military ammunitions, as well as pharmacological industry.

<sup>7</sup> The key was to purify the catalytic activators, and use various catalysts to absorb hydrogen and nitrogen separately (Farber 1966, p. 163).

<sup>8</sup> Giersberg, cited via Mittasch 1938, p. 70.

location of the system—as a catalyst for the system (e.g.,  $k' \rightarrow k$  in Fig. 2.3, and A in Fig. 2.4)

**Enzymatic Catalysis** Enzymes—biological catalyzers—are molecules that regulate metabolic reactions in the biological organisms. Almost all biochemical reactions in a cell require the presence of catalysts. Enzymes determine which metabolic pathways can be taken in that cell. Enzymes are highly context-specific, and dependent on other small molecules—coenzymes—that are bound to the enzymes. Coenzymes transport chemicals from one enzyme to another (perhaps the most commonly known coenzyme is Acetyl-coenzyme-A in the Krebs cycle). Coenzymes are changed by their action.

An intricate example of the way in which enzymatic catalysis works could be taken from a further look at ammonia—how it would be met if encountered by humans (or other vertebrates) in contrast with aquatic animals (fish). For the latter—as they lack the specific enzymatic reaction to protect them from ammonia—even small concentrations of ammonia in the water turn out to be lethal. But—not so for humans! A specific pathway guarantees that ammonia cannot be built up in the bloodstream. A special enzyme—*carbamoyl phosphate synthetase*—transforms ammonia into carbamoyl phosphate, after which it is either directed further to turn into amino acids or urine. The cycle ends up re-producing the enzyme. The neutralization of the effect of ammonia for vertebrates is guaranteed here.

The enzyme action is thus a form of specific catalysis, and . . . it provides a definite, general solution for all the fundamental biological enigmas: the mysteries of the origin of living matter, of the source of variations, of the mechanisms of heredity and ontogeny, and of general organic regulation . . . Catalysis is essentially a determinative relationship, and the *enzyme theory of life*, as a general biological hypothesis, would claim that all intra-vital or “hereditary” determination is, in the last analysis, catalytic. (Troland 1917, p. 327)

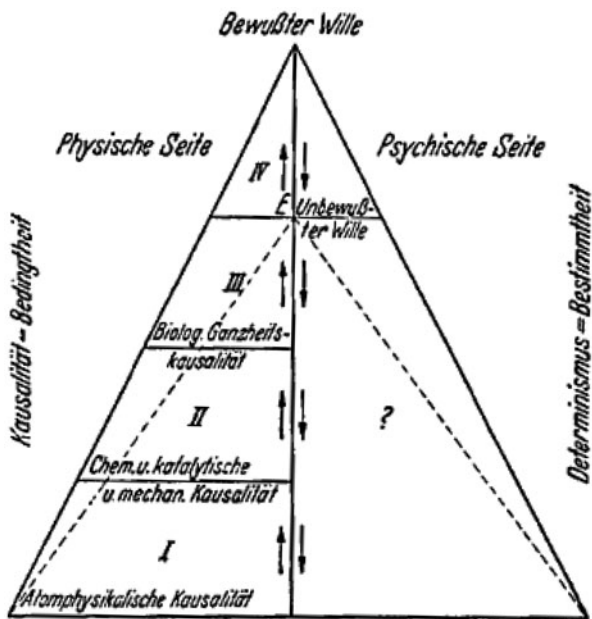
What enzymatic catalysis tells us—in psychology—is a story that makes our conceptual domains very complex, and almost completely eliminates the traditional uses of quantification in psychology. Instead of “measurements” of barely conceivable illusory psychological properties and claims of explaining small portions of “variance” we would be faced with dynamic structures of binding and un-binding processes within the phenomena of mental and affective kind. Implications of such change for psychology as science are enormous—yet realistic.

## From Chemistry to Psychology: Catalysis Within Hierarchical Orders

The catalytic paradigm in chemistry is of course not a simple solution for neighbouring fields. Working with catalytic models requires a number of elaborations (Kuznetsov 1966, p. 204):

1. Exact explanation of the border between catalytic and noncatalytic reactions
2. Explanation of the great distribution of catalytic reactions

**Fig. 2.6** Hierarchy of catalyzing processes. (Mittasch 1938, p. 116)



3. Differentiation of the processes of initiation and reactions by small additional composites.
4. More exact classification of catalysis than used currently.

The high variety of enzymes in the body and their narrow yet redundantly overlapping functions set the stage of even greater complexity for the psychological domains. Furthermore, they bring to psychology the focus on directedness (see Toomela 2013, on the paradoxes of the catalytic causality model).

Catalysts as directive agents in chemical reactions are akin to the organizers, inducers, and all other “directive” substances in the development of organisms. Such an analogy is helpful in the design of biological experiments, and it also points to unresolved problems. The integration of directive actions “is actually a mystery” (Farber 1966, p. 177)

The talk about organizers and inducers brings to chemical catalysis a parallel with embryonic development and the work of Hans Spemann in the field of epigenesis. Empirical evidence of organizers in embryonic development is known since 1924, from Spemann’s and Mangold’s classical study of creating twin salamanders by the way of tissue transplant (Sander and Faessler 2001).

Possible uses of catalytic terminologies in psychology need to deal with the levels of organization of the catalytic processes in the organism. Here—like in biology—the catalytic processes belong to a hierarchical order. It is of interest here to return to Alwin Mittasch’s scheme of hierarchical catalysis that includes the psychological counterpart of the biological one (Fig. 2.6)

While Mittasch—who after his retirement from BASF in 1933 turned directly to the study of philosophy of chemistry—manages to fill in the physical side of his hierarchical scheme (the left hand side of Fig. 2.6), the psychological “uncovered territory” (right hand side) is bare. He only indicated an analog of two levels of catalytic processes—chemical and biological—as counterpart to unconscious psychological processes. The final inclusion of the intentional action (*Bewusster Wille* on top) would guide psychologists to topics that were relevant in the late nineteenth century: intentionality, Gestalt nature of psychological functions, and their varied rates. Such complexity of the catalysis processes becomes the norm in the living systems that in addition to the complexity of inorganic compounds entail the capacities of movement, adaptation to changing conditions, and—in some cases—goals-directedness.

What has been accepted in chemistry and biology as the unquestionable basis for science—catalytic and enzymatic organization—is slowly beginning to enter into contemporary psychology. Catalytic ideas have found their place also in management science or organizations (Padgett and Powell 2012). Yet, old mindsets are hard to break and the illusory beauty of the General Linear Model keeps its dominance in psychology, leading to the theoretical “blind spot” of not noticing the nonlinear and noncausal nature of the psychological phenomena. Theoretical innovation of basic models—of causality and catalysis—needs to precede any empirical inquiry.

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# Chapter 3

## Cause and Catalyst: A Differentiation

Alaric Kohler

### The Need for Differentiation

This book suggests using the concept of *catalyst* and *catalysis* in human science. It intends to make *catalyst* a nomad concept (Darbellay 2012), moving from one scientific field to another. A nomad concept can be very fruitful and a classical example is Darwin's use of the concept of *selection* taken from animal breeding and horticulture into his theory about the origins of species. However, nomad concepts can also provoke confusion, because their transposition into a new domain always changes the meaning, from the slightest change to the most dramatic one, and sometimes there is not much left from the original use of the concept. To clarify this point, it is necessary to address the question of the similarity between *catalyst* in chemistry and *catalyst* in human sciences, as Cabell does in a former paper (Cabell 2011).

The previous paragraph raises the question of the differentiation of the concept of catalyst between different scientific fields. The corollary of this question is to consider the differentiation of the concept of catalyst with close or related concepts already existing in human sciences. As catalysis is a kind of relation of determination the central concept in the field is *causality*. Causality is therefore directly concerned, all the more since the introduction of the concept of catalyst in human sciences builds upon dissatisfaction with the notion of *cause*. The aim of this chapter is not only to examine causality in order to differentiate catalyst and cause, but also to inquire whether there is a lacuna in the meaning of causality that can be filled by introducing a nomad concept such as catalyst.

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## Plan of the Chapter

In order to differentiate catalyst from causality it is necessary to critically examine the various definitions of causality. The first step consists of looking at the various meanings taken by the concept of *cause* throughout the history of philosophy. As this is a far too complex matter for a single chapter, I will only discuss a few important landmarks in the long history of the various attempts to define causality. These landmarks are selected for being highly relevant for causality in human science, and for being *critical* moments in the history of ideas about causality, critical in the sense of what Kuhn calls a change of paradigm (Kuhn 1962). The various attempts to define causality will be organized in two routes leading in two different directions, and will be accompanied by a discussion of the epistemology of causality; i.e., the way we come to know about causality. Along with these two routes I will confront some aspects of causality developed through the history of philosophy to the results of empirical studies in psychology or in science education.

The development of causality through the history of ideas is not just similar to the development of the notion for an individual educated in the western culture. Nevertheless, there are interesting links between the cultural development of philosophy and the development of the notion of cause for an individual within the same culture, notably through the shared language. Those links and the variety of meanings given through the historical and individual development of the notion will allow us to consider causality as a semiotic tool, and discuss its usefulness: what causality is good at, and where it can lead to bias. For instance, social psychology has convincingly showed such examples of distortion of reality.

## A Transdisciplinary Approach

Considering both philosophical work on causality and the empirical studies about the acquisition of the same concept do not assume that one perspective nests the other; neither must the philosophical definition of causality be considered as the final point of the acquisition of the concept of causality, nor must the philosophical attempts to define causality be considered merely a step in the development of an individual mind. I will adopt a transdisciplinary approach to the notion of causality, in the sense that I propose to integrate both the philosophical and the developmental perspectives within a common theoretical framework that can stand across disciplinary perspectives. The chosen framework consists of considering causality as a semiotic tool.

Transdisciplinarity is a word introduced by Piaget (1972), referring to “a higher stage succeeding the stage of interdisciplinary relationships [. . .], which would not only cover interactions or reciprocities between specialized research projects, but would place these relationships within a total system without any firm boundaries between disciplines”. In order to avoid confusing transdisciplinarity with interdisciplinarity, these few words might be useful:

In contrast to interdisciplinarity, which tends to combine disciplines by transferring methods or ideas between them, transdisciplinarity tries to find coherence among phenomena at different levels of organization. In this sense, the meaning of trans is closer to the prefix meta, which denotes “beyond”. Disciplinary research has since been used to understand reality; transdisciplinarity then aims to identify common patterns across these disciplines, which appear unrelated under the current framework of scientific inquiry (. . .). The end of identifying these common patterns is a more coherent understanding of the world. (Acevedo-Rocha et al. 2010, p. 24)

In an inquiry about causality the “common patterns” could be the semiotic roles of the various meanings of causality developed through the history of ideas or observed in the individual development. It is understood within this approach that there is no need to choose one definition of causality as opposed to another, if various definitions fulfill various semiotic roles. For this reason, I think that neither do we have to consider the philosophical definition of causality as the endpoint of individual development, nor the individual development as an explanation for the philosophical definitions.

## A Few Historical Landmarks

### *Aristotle’s Four Types of Causes*

The earliest explicit discourse about causality takes us all the way back to Antiquity. The most known philosophical work in classical times is Aristotle’s distinction between four types of causes: the material cause, the efficient cause, the final cause, and the formal cause. Let us read Aristotle for the definitions of those four types:

“Cause” means: (a) in one sense, that as the result of whose presence something comes into being—e.g. the bronze of a statue and the silver of a cup, and the classes which contain these [i.e., the material cause]; (b) in another sense, the form or pattern; that is, the essential formula and the classes which contain it—e.g. the ratio 2:1 and number in general is the cause of the octave—and the parts of the formula [i.e., the formal cause]. (c) The source of the first beginning of change or rest; e.g. the man who plans is a cause, and the father is the cause of the child, and in general that which produces is the cause of that which is produced, and that which changes of that which is changed [i.e., the efficient cause]. (d) The same as “end”; i.e. the final cause; e.g., as the “end” of walking is health. For why does a man walk? “To be healthy,” we say, and by saying this we consider that we have supplied the cause [the final cause]. (e) All those means towards the end which arise at the instigation of something else, as, e.g. fat-reducing, purging, drugs and instruments are causes of health; for they all have the end as their object, although they differ from each other as being some instruments, others actions [i.e., necessary conditions]. (Aristotle 1989, *Metaphysics*, Book 5, Sect. 1013a)

In this passage, we are immediately confronted with the multiplicity of meaning that causality can take. However, this multiplicity is not problematic for Aristotle: One needs to find all the four types of cause in order to fully explain something. This is an important point, as we will see that the notion of cause has been less demanding later in history, in particular in the philosophical roots of empirical science laid in the seventeenth and eighteenth centuries, where philosophers were looking for one single type of cause.

From Aristotle's four types of causes, we can summarize the following four meanings of the word *cause*:

- A cause is something that makes something else (the effect) **exist**. It is not trivial that there is a cause for the existence of each thing and this idea would later be denied by Hume, for instance. For now, let us just remember this usage of the concept of cause.
- A cause is structural or functional, which means, if we accept taking the risk of an anachronism, that it corresponds to a mathematical **function**<sup>1</sup> that refers to a law. This type of cause also prefigures a systemic cause, which we will discuss further in the chapter.
- A cause is something that **produces** a change or rest, or the beginning of a process. This is probably the most common understanding of what causality is, and it is directly related to the question of the *causal powers*, which are capabilities of producing change, rest, or the beginning of a process.
- A cause is an end, an intention or an **aim**, or even the reason for an action. As Aristotle's examples show, this meaning seems to be used in particular in Human Sciences, in order to explain human behavior. However, in the Antique World it was assumed as a valid causal explanation for Nature (what we currently call physics) as well.

### *Causality for Empirical Science*

It would be unjust to think that nothing new about causality emerged from philosophy between Aristotle and the era of empirical science. However interesting, the philosophical work of the Middle Ages about causality is intertwined with the question of God's part in the causation of the world, which would bring us out of our topic. This is also true for many contemporary philosophers of the first empiricists: Descartes, whose *method* aims at proving the existence of God; Spinoza, with an original solution about the freedom of human being warranted by the constant creation of the World by the divine power; or the philosophy of the bishop Berkeley, trying to reintroduce an active divine role into empiricism. Besides those examples, the rise of empirical sciences with the notable figures of Galileo and Newton, and then empiricist philosophers such as Locke and Hume brings a turning point in the definition of causality. They define a *New Science* which must be empirical and therefore requires a secular and well-defined concept of causality. It is common place in philosophy to consider that Aristotle has laid the basis of the concept of causality later used in empirical science. However, Aristotle's explanation requiring all four types of cause is abandoned by the *New Science*. In short, the newly formed empirical science does not need to answer the question "why?" anymore, only the question "how?" (Grize 1982, p. 51). This is, however, only true for the official science and does not say

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<sup>1</sup> Of course, Aristotle did not have our modern mathematics, however the example given in his text is clearly pointing at what we would call today a *function*.

anything about the interest of the scientists themselves, as we now know that Newton, the prototypical figure of this New Science, was secretly very busy trying to answer the big “why?” about the world, God, The Bible, and prophecies (Verlet 1993), practising alchemy during his free time. Nevertheless, the official New Science just retained efficient causes, in terms of Aristotle’s causes, and rejected the other three causes as being unnecessary, or even suspicious. For instance, the final cause has been considered for a very long time as the prototypical non-scientific explanation, associated with the logical form of religious explanation.

### *Hume’s Causation*

Hume’s conception of causality interests our study for several reasons: Firstly, it constitutes a solid conception of causality for empirical sciences illustrative of the empiricist philosophers; secondly, within the lines of Hume’s writing, there are several interesting precursors of the more modern definitions of causality, such as statistical causality or systemic causality; thirdly, Hume introduces a radical change in perspective in his approach to causality. We will have a closer look at the last point, but let us first introduce the main ideas of Humean causation.

Hume’s conception of causality is a radical critique, still very influential today, of the classical reasoning about causes. He states that causality is a relation we do not know objectively. We can only suppose it’s existence, and to do so we will base our judgment on the observed relation between objects or events, which can be considered, after analysis, merely consisting of a relation of precedence, contiguity and repetition. Hence, the judgment following such an observation is always a subjective one. There is no possible objective knowledge about causality. Let us examine briefly how Hume defends this standpoint in the *Treatise of Human Nature*.

Hume examines three criteria on which we base our judgment that there is causation. The first criterion is contiguity:

The idea, then, of causation must be deriv’d from some relation among objects; and that relation we must now endeavour to discover. I find in the first place, that whatever objects are consider’d as causes or effects, are contiguous; and that nothing can operate in a time or place, which is ever so little remov’d from those of its existence. Tho’ distant objects may sometimes seem productive of each other, they are commonly found upon examination to be link’d by a chain of causes, which are contiguous among themselves, and to the distant objects; and when in any particular instance we cannot discover this connexion, we still presume it to exist. (Hume 1739, p. 62)

The second criterion is priority:

The second relation I shall observe as essential to causes and effects, is not so universally acknowledg’d, but is liable to some controversy. ’Tis that of priority of time in the cause before the effect. (Hume 1739, p. 62)

Hume continues by making an argument in favor of the condition of priority, which is, if a cause was exactly contemporary to the effect, and if there is another cause prior to it, only the latter will be considered as the real cause, and the contemporary one

would not be a cause at all, because it would either operate later, or we must consider the first cause as having a different effect which brings the unhappy consequence of breaking the chain of cause and effect, and leads, in Humean philosophy, to the annihilation of time. If the second criterion can be reconsidered today, Hume's arguments having lost much of its relevance since contemporary physics, it is not where the core of the critique lies. The interesting discussion is the one that follows those two rather common criteria and inquires about the *necessary connexion*, that must be added to get a satisfactory definition of causation. Indeed, it is not sufficient that two events follow each other contiguously to consider the first a cause and the second an effect.

Having thus discover'd or suppos'd the two relations of contiguity and succession to be essential to causes and effects, I find I am stopt short, and can proceed no farther in considering any single instance of cause and effect. Motion in one body is regarded upon impulse as the cause of motion in another. When we consider these objects with the utmost attention, we find only that the one body approaches the other; and that the motion of it precedes that of the other, but without any sensible interval. 'Tis in vain to rack ourselves with farther thought and reflexion upon this subject. (Hume 1739, p. 63)

Hume explains this point further in the following passages:

When we look about us towards external objects, and consider the operation of causes, we are never able, in a single instance, to discover any power or necessary connexion; any quality, which binds the effect to the cause, and renders the one an infallible consequence of the other. We only find, that the one does actually, in fact, follow the other. The impulse of one billiard-ball is attended with motion in the second. This is the whole that appears to the outward senses. The mind feels no sentiment or inward impression from this succession of objects: Consequently, there is not, in any single, particular instance of cause and effect, any thing which can suggest the idea of power or necessary connexion. (Hume 1777, p. 51) Shall we then rest contented with these two relations of contiguity and succession, as affording a complete idea of causation? By no means, an object may be contiguous and prior to another, without being consider'd as its cause. There is a necessary connexion to be taken into consideration; and that relation is of much greater importance, than any of the other two above-mention'd. (Hume 1739, p. 62)

To define the necessary connexion, Hume relies on experience. The rationalist principles such as “any effect has a cause” are rejected for being circular: a husband always has a wife, but it does not say anything about the fact that husband and wife actually exist. The same principle about the existence of an object, i.e. “whatever begins to exist, must have a cause of existence”, is considered at best uncertain because we cannot demonstrate that everything that comes to be has a cause. Convinced that the idea of necessary connexion comes from experience, Hume presents a theory of perception and knowledge that takes the reader from perceptions (“impressions on the senses”) to ideas, from ideas to beliefs, from beliefs to the cause of beliefs and to probabilities, and the role of habits and customs for the idea of causation. Nothing in the presented psychological investigation of Hume explains or justifies the inference of necessary connexion: neither the impressions on the sense, nor probabilities which are considered as “concealed causes”. He then starts his chapter *Of the Idea of Necessary Connexion*:

Having thus explain'd the manner, *in which we reason beyond our immediate impressions, and conclude that such particular causes must have such particular effects*; we must now return upon our footsteps to examine that question, which first occur'd to us, and which we dropt in our way, *viz. What is our idea of necessity, when we say that two objects are necessarily connected together.* (Hume 1739, p. 115)

Suppose two objects to be presented to us, of which the one is the cause and the other the effect; 'tis plain, that from the simple consideration of one, or both these objects we never shall perceive the tie, by which they are united, or be able certainly to pronounce, that there is a connexion betwixt them. 'Tis not, therefore, from any one instance, that we arrive at the idea of cause and effect, of a necessary connexion of power, of force, of energy, and of efficacy. Did we never see any but particular conjunctions of objects, entirely different from each other, we shou'd never be able to form any such ideas. But again; suppose we observe several instances, in which the same objects are always conjoin'd together, we immediately conceive a connexion betwixt them, and begin to draw an inference from one to another. This multiplicity of resembling instances, therefore, constitutes the very essence of power or connexion, and is the source, from which the idea of it arises. (Hume 1739, p. 119)

Hume points out that considering causality as a single instance—and most philosophical discussion so far even had a single cause with a single effect—is not equivalent to considering the repetition of causality. Hume considers that it is not sufficient for the analysis to consider only one cause operating once, even when imagining the same process adding up infinitely, because the meaning of the repetition is not taken into consideration. Hume introduces this point because he thinks that it is impossible to make the inference that there is causation based only on one instance of causation. Therefore, Hume bases his inquiry on many instances of causation and includes into the discussion the dimension of time and human memory: When we perceive contiguous events we also remember having seen them before (or not), and this memory matters. Only such a dynamic perspective considering multiple instances of causation, *constant conjunction* of causes and effects, he states, can lead to the idea of *necessary connexion* in the human mind.

### ***A Change of Paradigm***

From those last remarks it clearly appears that Hume's investigation on causality is *psychological*: he is interested in the way we *know* causality. This perspective consists of a change of paradigm in the domain of causality. Instead of considering the problem the way Aristotle and many philosophers after him did, that is starting from the fact that there is causality in the world and trying to define it from there, Hume turns the problem the other way round; he inquires about what we can know about causality from our experience of the world. Normally, a philosopher would consider his job defining causality in a way that corresponds to what causality is in reality. Hume considers that assuming causality in the world without analyzing how this knowledge comes to us through our senses, is not the right method. Instead, he investigates what our senses tell us about causality. Finding that we can only observe (and expect) regularities, Hume investigates how a mind—the one of a philosopher or any other—builds up the idea that causality exists in the world.

Here is a passage where Hume describes the shock his change of perspective can provoke in the reader, putting into words what could be the reaction of a doubtful reader:

What! the efficacy of causes lie in the determination of the mind! As if causes did not operate entirely independent of the mind, and wou'd not continue their operation, even tho' there was no mind existent to contemplate them, or reason concerning them. Thought may well depend on causes for its operation, but not causes on thought. This is to reverse the order of nature, and make that secondary, which is really primary. To every operation there is a power proportion'd; and this power must be plac'd on the body, that operates. If we remove the power from one cause, we must ascribe it to another: But to remove it from all causes, and bestow it on a being, that is no ways related to the cause or effect, but by perceiving them, is a gross absurdity, and contrary to the most certain principles of human reason. (Hume 1739, p. 122)

The counter position to Humean causation presented in the passage above is grounded on the idea of *causal powers*: if a cause causes an effect, it is because this cause has a causal power to do so, i.e., it has an inherent property to cause the effect. Hume tries to show that this vision of causality is only what we made ourselves believe, some sort of common sense that a more in-depth analysis allows to overcome. Hume thinks that the common belief about causal powers is just some sort of projection of the mind onto things, because all we can observe and know is the constant conjunction of events, from which we make the inference that some are causes and others are effects. This sort of projection will also be studied in empirical psychology, in terms of *attribution of causality*. A few results of the research on attribution will be discussed further in the chapter.

Thus, Hume refuses to consider that causal powers are real, because we cannot know them. His position is mainly grounded on two reasons: First, he assumes that we know everything we know from experience, as he commits to the principles of empiricism, and that we should not claim to know anything we cannot know from experience (as the rationalist does); second, he shows convincingly that we cannot know any sort of *necessary connexions* from experience, nor can we describe *in a specific way* causal powers such as *force*, *energy*, *agency*, and so on. From this very last point, we may find an alternative to Hume's skepticism about causality and causal powers. Hume states that the attempt to define specifically the various terms referring to causal powers has failed. Since Hume, many have engaged in the route of specifying those terms, and empirical sciences such as physics have brought many fruitful domain-specific theories and results. I will call this alternative to Humean skepticism about objective causality the route of "specifying causality," and several more recent paradigmatic definition of causality will be presented later in the chapter.

## ***After Hume***

If Hume's inquiry about causality brings a new meaning into the history of ideas, it also casts doubt on the possibility of ever finding a definition for objective causality, at least understood as a unique concept or as a necessary connexion between things



or events. In addition, Humean causation depends on another instantiation of the same event for being a causation: An undesirable consequence lies in the fact that any event unique in the history of the world could not be regarded as a cause of anything. However, considering that the idea of necessary connexion comes from the observation of regularity, the third criterion for causation does not mean that Hume thinks every cause must be first regularly observed before we make the inference of causation: Once the idea of causation is acquired, we can make inference from a single instance of cause. Hume immediately warns his reader that those inferences do not come without errors and bias. He points out the use of “unphilosophical probabilities”, i.e. the use of probabilities in a rather undefined manner, and states that this use is easily taking the layperson into errors and bias. Faithful to his psychological perspective, Hume actually points out an important problem about the use of causality in everyday life—including the one of scientists—which is that bias and errors can occur. We will prolong this discussion further in the chapter, with the empirical results of social psychology.

Hume’s answer, however, is not fully satisfying, because even if we accept the possibility of making inferences about causation based on a single instance of a constant conjunction—maybe erroneously—the criteria to judge whether something is the cause of something else still depends on observations and/or inferences that are external to the events considered. This state of affairs is not desirable for a scientist, who would like to be entitled to state that the event  $e1$  is the cause of the event  $e2$  without having to rely upon other causation between other events.

In order to step over this difficulty, a contemporary philosopher (Mackie 1965) has developed a more precise criterion for Humean causation. This criterion defines a cause as an “insufficient, but necessary part of an unnecessary but sufficient condition” for the considered effect to take place. Mackie gives the example of a short-circuit causing fire: The short-circuit is not sufficient for the house to catch fire, because inflammable material needs to be present nearby, but it is still a necessary part of a sufficient condition for the fire to occur in the house. However, this condition (a fire caused by a short-circuit) is not the only one that can set a house alight. Therefore, the condition itself is not necessary. The definition developed by Mackie has the merit to introduce a more detailed account of how causation combines various elements or events which can each have a different status concerning sufficiency and necessity. The introduction of the notion of condition is interesting for the definition of a catalyst, and we will discuss this point at the end of the chapter.

Philosophers dissatisfied with Humean causation, be it for the skepticism about necessity or about causal powers in the world or for the external and subjective criteria for establishing judgment of causality between events, have tried to build a more ambitious definition of causality which includes the common sense about causes as productive or as necessary. One remark must be made about the dissatisfaction with Hume’s account of causation: Being dissatisfied, if it is a good reason for searching for a better definition, does not however have the charge of an objection. Actually, most philosophers nowadays are still Humean (Esfeld 2006).

## ***Russell: Causality is not a Concept***

Russell considers that causality is a notion of common sense, and not a precise and scientific concept. He bases his position on the insurmountable effort to precisely define causality—which he considers to have failed—and on the fact that causality is not in use anymore in the most advanced sciences such as physics. His famous paper *On the notion of cause* is also a reaction to the philosophers' attitude at the time, considering that the philosophical definition of causality should establish the norms of science:

All philosophers, of every school, imagine that causation is one of the fundamental axioms or postulates of science, yet, oddly enough, in advanced sciences such as gravitational astronomy, the word “cause” never occurs. Dr James Ward, in his *Naturalism and Agnosticism*, makes this a ground of complaint against physics: the business of science, he apparently thinks, should be the discovery of causes, yet physics never even seeks them. To me it seems that philosophy ought not to assume such legislative functions, and that the reason why physics has ceased to look for causes is that, in fact, there are no such things. The law of causality, I believe, like much that passes muster among philosophers, is a relic of a bygone age, surviving, like the monarchy, only because it is erroneously supposed to do no harm. (Russell 1913, p. 1)

Russell continues his paper examining three definitions of the notions of *causality*, *cause*, and *cause and effect*, showing that there are inconsistent with each other, and that they all depend on a certain vagueness to be useful. One definition of cause is dismissed notably because it is psychological: This is of interest, as we have seen that Hume's perspective is psychological. For Russell, finding a definition of cause such as “whatever may be included is in the thought or perception of a process” is merely a reason to abandon that definition, because it means a *cause* does not really exist if we can only define it as what is in our mind.

Lets us follow the argument concerning the less problematic definition of causality discussed by Russell, i.e. “The necessary connection of events in the time-series.” Russell first provides an account of this law of causality in logical terms:

Given any event  $e_1$ , there is an event  $e_2$  and a time-interval  $\tau$  such that, whenever  $e_1$  occurs,  $e_2$  follows after an interval  $\tau$ . (Russell 1913, p. 4)

He later defines what an event is, and discusses the length of the time-interval:

An “event”, then, is a universal defined sufficiently widely to admit of many particular occurrences in time being instances of it.  
(...) However short we make the interval  $\tau$ , something may happen during this interval which prevents the expected result. (...) In order to be sure of the expected effect, we must know that there is nothing in the environment to interfere with it. But this means that the supposed cause is not, by itself, adequate to insure the effect. And as soon as we include the environment, the probability of repetition is diminished, until at last, when the whole environment is included, the probability of repetition becomes almost *nil*. (Russell 1913, p. 7–8)

Russell's critique here is aiming at any theory of causality based on the repetition of the relation between events, such as Humean causation. Nevertheless, if Russell is known for his proposal to abandon the concept of causality, it must be noted that he

does not fully consider causality useless as an idea, nor does he deny the intuition about regularities observed in the world, e.g., the constant conjunction of Hume. He considers causality useful, but only for the “infancy of a science”:

In spite of these difficulties, it must, of course, be admitted that many fairly dependable regularities of sequence occur in daily life. It is these regularities that have suggested the supposed law of causality. (. . .) I am far from denying that there may be such sequences which in fact never do fail. (. . .) I also do not deny that the observation of such regularities, even when they are not without exceptions, is useful in the infancy of a science: the observation that unsupported bodies in air usually fall was a stage on the way to the law of gravitation. What I deny is that science assumes the existence of invariable uniformities of sequence of this kind, or that it aims at discovering them. All such uniformities, as we saw, depend upon a certain vagueness in the definition of the “events”. That bodies fall is a vague qualitative statement; science wishes to know how fast they fall. This depends upon the shape of the bodies and the density of the air. (. . .) In short, every advance in a science takes us farther away from the crude uniformities which are first observed, into greater differentiation of antecedent and consequent, and into a continually wider circle of antecedents recognized as relevant.

The principle “same cause, same effect,” which philosophers imagine to be vital to science, is therefore utterly otiose. (Russell 1913, p. 8)

In this passage, Russell sets clearly a problem we have based our historical journey on: Causality has been defined at various levels of precision in philosophy, and it is not without consequences. For Russell, the attempt of philosophy to define causality is always grounded a certain vagueness.

As it appears in the passage quoted above, Russell does not deny ontological causality. Still, he considers that using the concept of causality becomes inappropriate when a science—or a learner I’d like to add—moves out of the vagueness of the notion of cause or causality. Russell briefly analyzes how causality has been a “fruitful source of fallacies” in the history of philosophy, stressing the following points:

- The analogy between human volition and the relation of cause and effect, which leads to a certain confusion, whether it is to assume volition in the world or a similar cause–effect relation between events and between our volition and own action. This point from Russell raises the following question: Can we combine into a single notion of causality both actions of an agent and actions of other powers such as energy and gravitation? Russell calls for a clear distinction between them.
- The resemblance between the cause and the effect which corresponds to an “unduly simplified law of causality” excluded the causal explanation that is more appropriate to contemporary physics, stating that it is a whole state of the universe at one point that is the “cause”<sup>2</sup>. To comment on this point, I would like to stress that the idea of the resemblance between cause and effect comes from the classical productive sense of causality, notably Aristotelian, where the change produced is considered having some quality in common with the cause. Within a nomological explanation such as what Russell has in mind, the classical understanding looks indeed oversimplified.

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<sup>2</sup> Or a whole state of a given system.

- The fact that the attempt to define causality in philosophy often relies on a sense of what is “intelligible” for the philosophers, or on what is “familiar to imagination”; yet, science often leads to unfamiliar results and requires to make sense precisely of what seems at first not intelligible at all. This point seems to only address the criteria of acceptance or refusal for a definition in philosophy; however it is an important issue.
- The idea that the cause compels or determines the effect in a way that the effect does not compel or determine the cause, grounds the asymmetry between cause and effect; Russell shows that this is illusory, as it does not resist the analysis with multiple causes or multiple effects, because the fact to consider an event multiple or single is a choice of how vague we describe this event; therefore the asymmetry between cause and effect results from our selection of cause and effects (more or less vague, multiple, . . .) and is not real but illusory. What Russell points out here, is that the delimitation of the cause(s) and effect(s) is a problem that philosophers have failed to address, and that this problem cannot easily be solved: It rather leads to the conclusion that the selection of cause(s) and effect(s) is totally arbitrary, which in turn questions the distinction between cause and effect and the whole notion of causality itself.
- The historically well documented resistance for causes that can operate when they have ceased to exist, or that can operate at distance, is considered by Russell as expressing a widely common prejudice, based on the analogy between the action of a volition (a person) and causality; For Russell, causes cannot operate, only volition does, and therefore there is no problem in saying “The night causes the day”. This last point is a corollary from the first and third point, bringing an illustration of the consequence of the denounced confusions.

From this list of what Russell considers fallacies, we have a preview of the complexity brought up through the attempt to define causality. For Russell, when a science progresses in defining the description of the relation between particular “events”—or should we rather say of a phenomenon cut into “events” vague and arbitrary—then causality leaves the ground to a *probable sequence*, a useful prediction in daily life and in the infancy of a science according to Russell, or to a *formula*, a *function* of which the example is in physics.

Certain differential equations can be found, which hold at every instant for every particle of the system, and which, given the configuration and velocities at one instant, or the configurations at two instants, render the configuration at any other earlier or later instant theoretically calculable. (. . .) This statement holds throughout physics, and not only in the special case of gravitation. But there is nothing that could be properly called “cause” and nothing that could be properly called “effect” in such a system. (Russell 1913, p. 14)

As I understand Russell’s position, it says that when we undertake the task of differentiating the concepts that Hume considered synonymous (energy, force, . . .), we have to move beyond causality itself, thought as a unique and unequivocal concept for making sense of all types of necessary connexions at work in the world. Indeed, in physics, the causal explanations are replaced by laws of conservation or constants ultimately based on measures.

Even if Russell refers to physics and the mathematical expression of a function, it should not be considered the only way. What Russell really has in mind is *a law within a given system*, as it appears in the passage below, where he specifies his idea of law into two categories, and defines what replaces causality in his view: Relatively or practically isolated systems.

In all science we have to distinguish two sorts of laws: first, those that are empirically verifiable but probably only approximate; secondly, those that are not verifiable, but may be exact. The law of gravitation, for example, in its applications to the solar system, is only empirically verifiable when it is assumed that matter outside the solar system may be ignored for such purposes; we believe this to be only approximately true, but we cannot empirically verify the law of universal gravitation which we believe to be exact. This point is very important in connection with what we may call “relatively isolated systems.” These may be defined as follows:

A system relatively isolated during a given period is one which, within some assignable margin of error, will behave in the same way throughout that period, however the rest of the universe may be constituted.

A system can be called “practically isolated” during a given period if, although there might be states of the rest of the universes which would produce more than the assigned margin of error, there is reason to believe that such states do not in fact occur.

(. . .) It will be observed that we cannot prove in advance that a system is isolated. (. . .) But it should be observed that isolated systems are only important as providing a possibility of discovering scientific laws; they have no theoretical importance in the finished structure of a science.

The case where one event A is said to “cause” another event B, which philosophers take as fundamental, is really only the most simplified instance of a practically isolated system. It may happen that, as a result of general scientific laws, whenever A occurs throughout a certain period, it is followed by B; in that case, A and B form a system which is practically isolated throughout that period. It is, however, to be regarded as a piece of good fortune if this occurs; it will always be due to special circumstances, and would not have been true if the rest of the universe had been different though subjects to the same laws. (Russell 1913, p. 16)

Selecting a cause event, an effect event (and maybe both at different scales, more or less vaguely, . . .) and trying to define the relation between them might be useful at the infancy of a science, but is soon replaced, according to Russell, by a different task: Isolating a system, defining laws valid within that system. This last task entails more description, definition, and model than the first: The system must be defined at least specifically enough to have boundaries, the law entails constants or other relations that must be described or modeled into a formula, including the definition of all elements included in the law, and maybe the specification of circumstances where the law is valid.

The catalysis in chemistry seems to be one of those circumstances that matters for the validity of a law. The law defines a certain reaction when two chemical elements are put in contact. The presence of a specific third element, a catalyst, constitutes a special circumstance that changes the parameters of the law of reaction; however it could be hindered by anything out of the practically or relatively isolated system.

## *Enough Landmarks for Two Routes*

We will stop accumulating landmarks here about causality throughout history of philosophy, as we have enough to set two routes taken by philosophers and scientists to continue the challenging task of defining causality after Hume. Hume's critique to the objectivity of causality cannot be easily dismissed. It is usually considered relevant among philosophers, at least when it comes to stress that we cannot have an objective content for the notion of necessity. This position is known in philosophy as the *Humean metaphysics*. However, the condition of the regularity of an event for establishing causality is problematic for many, who wish for another definition of causality.

Two alternatives to Humean metaphysics remain open:

1. Firstly, a common sense notion of causality, specified into various domain-specific meanings according to the phenomena under study, as Russell suggests;
2. Secondly, a definition of causality which does not include necessity, for instance a statistical causality.

In addition to those two routes, Hume raises the problem of the limits of our knowledge about causality, and the consequence of those limits on the work of defining causality. The position of Hume about the direct link between epistemology and ontology is not shared by all: Do we have to define what causality is from what we can know or from the way we know about causality, as Hume assumes, or on the contrary should we separate the epistemology and the ontological analysis of causality? I will discuss this problem in a further section.

### **First Route: Specifying Causality**

Hume addresses the question of how we can build the notion of power or efficacy, on which the notion of causation relies. He concludes that the idea of *necessary connexion* comes from regularity through time, observed thanks to our memory and the multiple instantiations of causes. He considers the reference to causal powers meaningless, because we are not able to define such powers:

Shou'd any one leave this instance, and pretend to define a cause, by saying it is something productive of another, 'tis evident he wou'd say nothing. For what does he mean by production? Can he give any definition of it, that will not be the same with that of causation? If he can; I desire it may be produc'd. If he cannot; he here runs in a circle, and gives a synonymous term instead of a definition. (Hume 1739, p. 62)

I begin with observing that the terms of efficacy, agency, power, force, energy, necessity, connexion, and productive quality, are all nearly synonymous; and therefore 'tis an absurdity to employ any of them in defining the rest. (Hume 1739, p. 119)

From the two passages above, it appears that Hume's position nevertheless leaves an alternative. There might be a hope for causal powers or more generally for an objective account of causation, through the endeavor that Hume challenges his readers with,

that is to specify causation in more precise terms, notable in physics. Indeed, Hume's problem of synonymy leaves an open door to an objective definition of causation, if we can ever define some of those concepts independently from each others. If it seemed impossible to Hume, nature sciences have built much knowledge since, and today it looks like a promising route. The concept of catalysis in chemistry is such a definition about a necessary connexion between a specific chemical element in the presence of particular reactants and the quantity of energy needed for the reaction to take place. It does not fall into the problem of synonymous terms raised by Hume, at least from the standpoint of my limited understanding of chemistry, because it relies on theories (notably the table of elements and thermodynamics) precise enough to lead to independent perceptions, i.e., measures.

### ***Counter-Factual***

Another attempt to save objective knowledge about causality after Hume's critique is the counter-factual definition of causality. A is a cause of B if and only if the following counter-factual proposition is true: if B would not have occurred, A would not have occurred. This counter-factual definition of causality has been developed by David Lewis notably (Esfeld 2006), who considers that there are "other possible worlds" besides ours, where for instance A would not occur while it does in our world. The concept of "possible worlds" brings specific difficulties, for instance the decision on whether A is a cause of B or not relies on a thought experiment of the kind "what would have happened if . . .", which makes the criteria subjective to the philosopher's mind, and highly unverifiable, especially in Human Sciences where the exact repetition of some research processes is impossible.

Counter-factual causality meets a difficulty that concerns the aim of this chapter, regarding the differentiation between cause and catalyst. This problem is called the preemption problem: if there is an event other than the cause event A that would cause the same effect B if A does not occur, A cannot be considered a cause according to the counter-factual definition, even if it is nevertheless the cause when A occurs. Additionally, counter-factual definition cannot distinguish between epiphenomena and causes.

In sum, if the counter-factual definition of causality seems to offer a simple and efficient criterion to decide what is a cause and what is not, a closer look at the application of this criteria leads to inextricable difficulties, and in addition does not address the fundamental problem raised by Hume, namely what are those connexions—if any—between cause and effect.

### ***Causal Powers***

A realist account of causality, built up to avoid the Humean metaphysics, consists of a revival of the idea of *causal powers*, built upon Locke's *primary qualities*, and Leibniz dynamical field theory according to which creatures as Humans and God are

mutually sharing causal powers. Causal powers rest on dispositional properties, while Humean metaphysics rest on categorical properties. It means that causal powers are considered *in the things*, inherent to the cause.

Let us consider first why the idea of causal powers has fallen in discredit through the history of philosophy. One first concern with the dispositional properties is that they can be abused in a way that brings the explanation into a tautology. This problem refers to the famous *virtus dormitiva* taken for a joke by Molière (*Le malade imaginaire*, act III), and aimed at turning Descartes' philosophy into ridicule: To the question "What is the cause or reason for the opium to make us sleep?" the scholar answers "The reason is that opium has the virtue of sleepiness". If I say "The mug is yellow, because it has the property of yellowness", I have provided no explanation whatsoever of the cause of the color of the mug, but only put into the discussion a superfluous property of which I have no proof of existence. Such reason or cause is of the kind of dispositional properties, and Hume calls them *occult qualities*.

However, there is more, as Kistler explains in this passage:

The logical empiricists of the beginning of the twentieth-century thus seem to put forward a new argument against dispositions. To the traditional accusation of epistemic obscurity, they add that of semantic indeterminacy: the meaning of predicates attributing dispositions is only partially determined, and the indeterminacy concerns precisely those circumstances in which the need for dispositions is the most pressing: where they do not manifest themselves. As a result, the conception of explanation in terms of nomic regularities promoted by the logical empiricists leaves no place for dispositions and causal powers. The predicates expressing lawful regularities must be categorical, for the simple reason that the meaning of the terms used in an explanation must at least be as clear as the meaning of the terms describing the phenomena to be explained. But descriptions of phenomena are always in categorical terms. (Kistler and Gnassounou 2007, p. 24)

Hence, nomological explanation such as laws or function within a system cannot have causal powers.

The contemporary theory of causal powers rests on dispositional properties as universal that can provide a causal power for being universal. Here is a summary of such a position:

Although many of the implications of the account I have advanced are radically at odds with Humean views about causality, it does enable us to slavage one of the central tenets of the Humean view, namely the claim that singular causal statements are "implicitly general". As I see it, the generality of causal propositions stems from the generality of properties, that is, from the fact that properties are universals, together with the fact which I began this essay by pointing out, namely that causal relations hold between particular events in virtue of the properties possessed by the constituent objects of those events, and the fact, which I have tried to establish in the paper, that the identity of a property is completely determined by its potential for contributing to the causal powers of the things that have it. If I assert that one event caused another, I imply that the constituent objects of the cause event had properties which always contribute in certain ways to the causal powers of the things that have them, and that the particular episode of causation at hand was an actualization of some of these potentialities. I may of course not know what the relevant properties of the cause event were; and if I do know this, I may know little about their causal potentialities. This is closely related to the now familiar point that in claiming to know the truth of a singular causal statement one is not committed to knowing the laws in virtue of which it holds. Moreover, a singular causal statement does not commit one to the claim that the instantiation of the relevant



properties in relevant similar circumstances always produces the effect that it did in the case at hand; for the laws governing these properties may be statistical, the powers to which the properties contribute may, accordingly, be statistical tendencies or propensities, and the causation may be non necessitating. Also, the claim that singular causal statements are implicitly general does not, as here interpreted, imply anything about how such statements are known—in particular, it does not imply the Humean view that causal relationships can only be discovered *via* the discovery of regularities or “constant conjunctions”. But where the present theory differs most radically from theories in the Humean tradition is in what it claims about the modality of the general propositions, the laws, that explain the truth of singular causal propositions; for whereas on the Humean view the truth of these propositions is contingent, on my view it is logically necessary. I thus find myself, in what I once would have regarded as reactionary company, defending the very sort of “necessary connection” account of causality which Hume is widely applauded for having refuted. (Shoemaker 1980, p. 133)

In sum, causal powers are thought of, *instead* of laws of nature, or nomological explanation. Indeed, causal powers being genuine and dispositional properties that are not merely predicates (Armstrong 1989 quoted by Ellis 2001), and being powers of processes, are “the truth makers of the law” (Ellis 2001, p. 112). Causal powers are also considered instead of systemic explanation, because laws are considered the mere addition of causal powers, and for tenants of the identity theory between qualities and properties, even the qualities of the whole are considered a mere “arrangement” built up from qualities of the part, explicitly denying the possibility of emergence<sup>3</sup> (Heil 2003, p. 114).

### *Causality As a Process*

An alternative to the necessary connexion vainly looked for by Hume, consists of considering causality as a process instead of a necessary connexion. Salmon (2002) agrees with Hume that there are no logical connexions, and thus no necessary connexions between causes and effects, but cannot resign to what he considers a consequence of Humean causation: That if there were no more humans to think of causation, causation would not exist anymore. In brief, Salmon tries to give a realistic account of causation, where causation is something existing independently from us (and that we can know). Salmon wants to show that *causal processes* are the causal connections Hume was looking for:

Hume’s characterization of causation involves a pair of events (or facts) *C* and *E*, the cause and effect in question, and some relation *R* holding between them. Most subsequent approaches have adopted the same pattern; the crucial question then concerns the nature of this causal relation *R*. I propose that we temporarily stop thinking about separate facts or events, and that we temporarily eliminate the terms “cause” and “effect”. Instead, I suggest that we begin with the notion of a process. We are all familiar with many examples of processes. For

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<sup>3</sup> In a footnote, the author states: “I do not think that the properties of wholes emerge in any sense that involve an addition of being to the properties of parts of a whole (suitably organized)”, without any argument supporting his belief.

instance, a moving material object is a process; in fact, so is a particle that is at rest in our particular frame of reference. A moving shadow is a process; so is a red dot that moves on a projector screen because of a laser pointer used by a lecturer. (Salmon 2002, p. 112–113)

The theory of causality as a process considers causation as the transmission of something. A painting transmits a certain configuration of the color spectrum under the appropriate light that allows me to interpret what I see. A ray of light transmits energy to a surface of matter. There are several variants about what is transmitted through a causal process: For Reichenbach, causal processes have the capacity to transmit marks; for Dowe or Kistler, causal processes transmit a conserved or physical quantity. For instance, Kistler (1999) proposes to define causality this way:

Two events  $c$  and  $e$  are linked as cause and effect if and only if there is at least one physical quantity  $P$ , submitted to a law of conservation, exemplified in  $c$  and  $e$ , and of which a determined quantity is transferred between  $c$  and  $e$ . (Kistler 1999, p. 17–18, translated by the author)

If this definition may satisfy a physicist, it has very little chances to be useful in other sciences. It seems that the theory of causation as causal processes chooses for a specification where physics is the main or only domain where the meaning of causality should be elaborated. Salmon concludes his chapter with an explicit statement of this aim:

The account that has emerged removes this concept [i.e. causality] from the field of metaphysics and transports it to physics. If this goal has actually been achieved, I count it as philosophical progress. (Salmon 2002, p. 131)

However, Salmon recognizes the reductionist flavor of this theory in respect to Human Science, more specifically to psychology:

I realize that the theory I am proposing has a highly reductionistic flavour. It seems to me that my account should hold in the natural sciences—including biology, but not quantum mechanics. I am not confident that it is suitable for psychology and the social sciences. (Salmon 2002, p. 131)

The account of causality as processes is an interesting endeavor, but the reductionism to one process—in physics—for all causality is of little use for Human Sciences: It is leading us to consider that there is only science about the material world, which is not acceptable in a general epistemology of science. Other versions of the theory of causality as a process may avoid this reductionism, such as the theory of Reichenbach, but require a more in-depth analysis that I can't present here. Let us inquire now—supposing we follow the reductionist route—if physics ends the debate and provides a final definition of causality.

### *Causality in Physics*

Physics has often been taken as the domain of reference for the definition of causality. In particular, physics remains silent about the veracity of Humean account of causation, even if both Humeans and philosophers supporting causal powers claim support from physics. Esfeld summarizes arguments for both sides:

All that our fundamental physical theories state are certain regularities in the distribution of physical properties. There is thus not more to causation than the Humean acknowledges (cf. for instance Loewer 2001, pp. 322–324, and Field 2003, Sect. 1). (. . .) The argument for admitting powers stems from our experience of agency and functional properties in general. If there are powers, there are powers all the way down to the domain of fundamental physics. (. . .) The argument for admitting powers thus is one of coherence: if we look for a coherent view of the world that includes everything, then we should acknowledge powers in order to do justice to functional properties and the experience of ourselves as acting beings. Hence, we cannot let our metaphysics be determined solely by the criterion of what may be the most parsimonious ontology for current physics. (Esfeld 2007, p. 214–215)

Nevertheless, physics is silent about which definition to give to causality (Esfeld 2006). What deserves attention here, is that in the attempt to move the definition of causality from philosophy to physics, and specify it with as many scientific explanations as there are causal processes, Salmon actually proposes to abandon the precise definition of cause and effect:

I do not think it is profitable to try to define such terms as “cause” and “effect” in any precise way. They are part of the common idiom; they are used quite loosely and are highly context dependent. Nevertheless, statements about cause-effect relations furnish valuable objective information about the world with respect to our wide range of purposes, interests, and background knowledge. (Salmon 2002, p. 128)

Salmon considers cause and effect as a kind of preliminary notion to what later becomes a more specified, domain-specific, scientific explanation. In that sense, he shares a position close to Russell, who proposed to abandon causality altogether as being vague and contradictory. Salmon still keeps the relation, but defines it broadly as a certain type of process, which transmits something. But even this definition is already too reductionist, and for any more precise definition, Salmon explicitly relies on physics or natural science explanation of each process singularly. It is, I believe, abandoning the idea of causality as a unique and well define concept, and is therefore taking the route of specification where causality remains a prescientific notion later replaced by the precise domain-specific description of a process (the real scientific concept), and of what this process transmits.

### ***Conclusion of the First Route***

Hence, from the transdisciplinary standpoint chosen for this chapter, I would like to conclude for this route that specifying causality leads either into a reductionism such as Kistler’s theory, that is when one single physical process is supposed to account for all causality, or to a great number of different and domain-specific concepts (energy, gravitation, entropy, agency, . . .). There are two alternatives for domain-specific concepts: Russell’s nomological explanation or describing either causal processes or dispositional properties in a way that they are not synonymous and can hardly fit within a single concept of *causality* anymore. Russell’s alternative consists of replacing the vague notion of *cause* by laws valid within a system, where the system as a whole only could be considered having any causality. On the contrary, the approach

of causal powers considers constant regularities, laws, and systemic causality as mere epiphenomena, reducible to dispositional properties of their parts, and therefore does not consider a system as a cause.

## Second Route: Statistical Causality

Necessity is hard to find in human sciences, and we might be less inclined to search for objective causes. Indeed, there is nothing like billiard ball shocking each other in the world of human action, neither can we use practically or relatively isolated systems in order to set laws or functions with a success equivalent to physics. This has led to an unending debate in Philosophy of Science, wherever human sciences should have the same types of explanation than physics. From this debate, I only retain the fact that many human scientists are not ready to work with causality in the sense of a necessary and sufficient relation, especially as a relation between one single cause and one single effect. For instance, would systemic causes be considered as necessary and sufficient? Some authors have taken this path, like the social determinism of Emile Durkheim, and have become controversial for this very reason. Often, social scientists prefer to remain below any precise definitions of causality, and/or adopt with little conceptualization the terms of *statistical causality*. Indeed, this is the second route for anyone who does not want to specify the meaning of causality as exact sciences do.

In a sense, statistical causality is just the methodical and systematic observation for regularity, for *constant conjunctions* that Hume considers the origin of our idea of cause. Hence, it is fully under Hume's critique for anyone looking for causal powers, meaning that there is no way through statistics to know objectively what are the *necessary connexions* or causal processes at stake. Scientific use of statistics is nevertheless coherent with a definition of causation inspired from Hume, and it is somehow assuming that we do not know—or even that we cannot know—causality at work in the world. All we can do is to make inferences about where causes could be, inferences based on constant conjunctions. Still, we can do this well through statistical methods, abundantly developed since Hume's broad statement about observing constant conjunctions.

Hence, statistical causality appears to be a solution in Human Sciences, because it does not judge the necessary and sufficient character of factors of influence and allows us to deal with multiple factors through probabilities without having to specify what causality actually is. It grounds scientific knowledge in numbers, allowing large data management and easier comparison. Despite its usefulness to discover factors of influence and maybe identify the most influential among them, statistical causality nevertheless has little to do with the empiricist definition of causality: It says nothing of the process of causality involved in the relation between variables, but merely allows us to state that there is a relation. In sum, statistical causality is the systematic measured observations of constant conjunctions (with all the possible bias mentioned by Hume), therefore leaving the objective cause itself unknown and being unable to

give explanation of the dynamics of the processes involved (Beckstead et al. 2009). Alternatively, and much more rarely (see for instance, the discussion of Lewin 1931), statistical causality can be understood as a functional relation in the sense defined in the first route which, according to Russell, cannot be considered as a cause, because only the whole system within which the function is valid may be considered as a cause.

In conclusion, we can therefore consider statistical causality as being a way to identify relations about which we have no objective knowledge to claim that they are causes-effect relations. Statistical causality does not help for defining causality, and is either a methodology to elaborate functional relations, statistical laws, or a way of abandoning causality in favor of a systemic approach, as Russell proposed.

## Epistemology of Causality

Now, having briefly examined two alternative routes in the endeavor to define objective causality after Hume's critical analysis, let us have a look at the "subjective" causality, I mean the way we come to have the idea of causality. The problem here is another question raised by Hume: Does the way we know about causality matter for defining objective causality?

Instead of defining the necessary connexion with domain-specific terms referring to powers, Hume grounds his definition on the origin of the idea of cause, keeping causation as a unique concept that should be defined for the ensemble of the various terms:

This multiplicity of resembling instances, therefore, constitutes the very essence of power or connexion, and is the source, from which the idea of it arises. (Hume 1739, p. 119)

Hume makes the origin of causation (from an epistemological perspective) a definition of causation (on an ontological perspective). In his empiricist philosophy, it is coherent because perception is the only origin of knowledge, but without the empiricist principles, it can look like a fallacy. Indeed, Hume commits to the principle that all knowledge comes from the senses, and therefore considers that *impressions* or *ideas* are causes and effects. In addition, the impression from which we have the idea of causation is considered the cause of the idea of causation, and shares some properties with its effect: We can then know the effect (the idea of causation) by knowing the cause (what made us have the idea of causation). This philosophy of knowing sounds dubious today. Still, if we can doubt Humean metaphysics, it is his perspective that I am interested in here.

Hume's investigations about causality leads him to conclude that we never directly observe causation itself, and therefore causation is in the mind, an idea of the *faculty of imagination*, in his eighteenth century English language. It is remarkable for the questions pursued in this chapter, that Hume considers causality as a product of imagination, because it lays the ground to an understanding of causality as a semiotic tool that helps us make sense of what we perceive. Hume opens the door to a radically

different perspective on causality, where it is not all about defining types of cause or progressing in describing what causation between the object is in reality, but it is about understanding how our mind—and our various languages—is able to access and come about the concept of causality. In this sense, the analysis of causation in his *Treatise of Human Nature* is rather an epistemological work, addressing the question of the possibility and limits of human knowledge and understanding, than a work of metaphysics.

### *Separating the Epistemology of Causality from the Ontological Causality*

Humean metaphysics has been rejected on the ground of the distinction between epistemological and ontological perspective on causality (von Wright 1971): Even if we agree with Hume that we know causality from the observation of constant conjunction, this epistemological thesis about the origin of our idea of causation does not state anything about the causation actually happening in the world, about the ontological causality. Von Wright, for instance, is Humean for the epistemology of causality but still believes that there is a causality operating in the world independently of human action.

Von Wright's distinction can be easily accepted as long as we do not commit into the challenging work of defining the ontological causality. When one starts defining ontological causality, Hume's problem becomes relevant again, and epistemology cannot be so easily left aside. Indeed, how can we pretend defining causal powers or other ontological causality if the only way we know such relations is not objective? Von Wright states that causality operates independently from us, but I would add, causality cannot be known and therefore defined independently from us, and that is where the epistemological analysis of Hume is still relevant.

In addition, it should at least appear from Russell's list of confusion about causality that epistemological issues are not entirely distinguishable from ontological ones: Philosophers working towards a definition for what causality ontologically is, are influenced by the epistemological issues such as the analogy with human action, or as what sounds familiar to the imagination.

In sum, I do not think that distinguishing between ontological and epistemological discussion of causation allows to draw a line of separation between the two: Epistemological issues are related to ontological ones, at least for the simple reason that the limits of our possibilities of knowing actually frame the ontological validity of our attempts to describe or explain causality<sup>4</sup>. Hume recognizes those limits:

I am, indeed, ready to allow, that there may be several qualities both in material and immaterial objects, with which we are utterly unacquainted; and if we please to call these power or efficacy, 'twill be of little consequence to the world. But when, instead of meaning these unknown qualities, we make the terms of power and efficacy signify something, of which

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<sup>4</sup> It is probably my activity as an educational researcher that grounds this reasoning.

we have a clear idea, and which is incompatible with those objects, to which we apply it, obscurity and error begin then to take place, and we are led astray by a false philosophy. This is the case, when we transfer the determination of the thought to external objects, and suppose any real intelligible connexion betwixt them; that being a quality, which can only belong to the mind that considers them. (Hume 1739, p. 122)

Said in other words, the necessary connexion is a “quality which can only belong to the mind” and therefore assuming such a connexion ontologically between objects is going across the limits of what we are able to know, and it is a “false philosophy” because in doing so, what we know as a quality of the mind is projected onto objects that are not minds. Still, Humean metaphysics does not pretend that causality does not ontologically exist, and science can build many hypotheses about it, of which some look sensible and effective ways for representing causal relations.

To summarize the turning introduced by Hume in the philosophical tradition, one could say that his perspective on causality opens the way to the psychological investigation of the epistemology of causality, an area of research focusing on its origin, usage, functionality, and also the cognitive bias related to it. It opens many interesting investigations about the way the concept of causality has been developed within culture and how it is built through individual cognitive development, and about the heuristic value and the relevance of the concept as a semiotic tool. Let us have a quick tour of those investigations.

### *From Hume to Genetic Epistemology*

Piaget has taken seriously Hume’s idea that the notion of causation comes from the observation of regularities, and decides to study this question empirically. Piaget has taken the following reasoning of Hume for his empirical research on epistemology:

Thus as the necessity, which makes two times two equal to four, or three angles of a triangle equal to two right ones, lies only in the act of the understanding, by which we consider and compare these ideas; in like manner the necessity or power, which unites causes and effects, lies in the determination of the mind to pass from the one to the other. The efficacy or energy of causes is neither plac’d in the causes themselves, nor in the deity, nor in the concurrence of these two principles; but belongs entirely to the soul, which considers the union of two or more objects in all past instances. ’Tis here that the real power of causes is plac’d, along with their connexion and necessity. (Hume 1739, p. 121)

His findings are coherent with Humean causation, but Piaget prefers not to abandon the idea of productive causation, of causal powers, even if he agrees that we have no direct perception of such powers. Piaget is not satisfied with Humean causation, because he thinks that Hume, when watching the billiard balls hitting each other, has simply “forgotten” to look at the cue and the player hitting the ball. For Piaget, it is being a player performing the action of hitting the ball that is responsible for our idea that some constant conjunctions are producing effects while others are not. Thus, Piaget wants to complement Hume’s explanation with the idea that causation does not come from the mere *observation* of effects following regularly compound causes,

but from the *action* regularly followed by effects. He considers nevertheless that the feeling of power or efficacy that we can get from our own action is not directly perceived, as holds Maine de Biran, but is a “perceptive pre-inference”, in other terms an interpretation occurring during the perception. In Piaget’s epistemology, i.e., the constructivism, the world is not just made of objects or events, but of *actions*, inextricable interactions between the subject and the object that transforms both of them, and perception is not considered as being the automatic impression of properties onto the mind, but is rather explicitly assumed as a judgment, including the risk of bias but also the expertise of an observer that is much more active than in Humean theory.

Research on the perception of causality (Michotte 1954; Andersson 1986, for instance) supports Hume’s analysis. This research notably shows that someone assumes causality when watching a figure on a screen, for instance a square, moving into one direction and stopping when it reaches another figure which, at the same time, starts moving into the same direction. Most subjects of those experiments on the perception of causality confirm “*seeing*” (more exactly *interpreting* while perceiving) that the movement of the first figure *causes* the movement of the second figure, despite the fact that figures on a screen cannot cause any movement at all (they are just light beams reflected on the surface of the screen, so to speak). To the contrary of Hume’s previous criteria, the perception of causality is even resistant to a certain distance between the two figures, contradicting the need for an exact contiguity between cause and effect, despite the fact that there is no visible intermediary object or anything suggesting matter between the two. According to the developmental psychologists (Rochat 2006), this attribution of causality based on perception of movement builds up between 2 and 8 months of age.

I think that these experiments on the perception of causality illustrate what Hume is expressing while saying “when we consider these objects with the utmost attention, we find only that the one body approaches the other”. In addition, we can consider that the situation is eventually the same for someone watching real objects as it is for the subject of an experiment watching a screen: Whether they are figures on the screen or real billiard balls, in both situations there are light beams reaching our eyes and interpreted by our mind. Piaget has built upon those results to elaborate his own definition of causality through the empirical work of his team on genetic epistemology:

In other words, causality is a set of operations (operations are required indeed as causality is cannot be directly observed but is always reconstructed inferentially) which are attributed to these objects, which means they are not only used by the subject but conceived as corresponding to the real actions of objects one onto others. (Piaget 1974, p. 12, translated by the author)

Piaget provides example of experiments with mobiles attached to the cot, staging what we would call today *abductive reasoning* of babies. The further development of causality, according to Piaget, consists for the infant of a decentration from her/his own action to actions between external objects, and later to the contextualization of the relation of causality within space and, eventually, time. Still, what is particularly interesting in Piaget’s genetic epistemology is that causal relations are not



different from logical-mathematical relations: They consist of the same relations, but attributed to the object of the external world. His theory points out the coevolution of those operations in terms of causality—applied to external objects—and in terms of mathematical or logical relation—applied to thoughts. Even if Piaget believed in an ontological causality, his theory seems to require nothing more than a Humean causality, once the passive observation of constant conjunction is replaced by the active interaction of the child with the world, giving to the child's own actions and operations the epistemological origin of the idea of causation.

### *From Russell to Science Education*

Piaget complements Hume's psychological explanation with his finding that the notion of causality builds up not only from constant conjunctions, but also from our own actions and our own efficiency while performing actions. If Piaget's theory explains our intuition for causal powers and supports Hume's statement that we cannot know objective causality, it does not necessarily mean that the concept of causality is useless. Causality is nevertheless central in Piaget's theory, and educators taking on Piaget such as Francis Halbwachs, insists on the important role causality can play in science education. Halbwachs, physicist and collaborator with Piaget in epistemology, responds to Russell's critique of causality in a article cosigned with educational scientists, showing that if causality can be considered unused in achieved physics it is nevertheless an important concept for learning physics.

Modern models in physics generally expel the notion of "cause" considered rightly as an anthropomorphic residue. Explanations in these models refer to conservation or evolution laws (thermodynamics), principle of optimization (conditions for a static integral) relations of interaction (electromagnetism) or more abstract structural relations resting on an axiomatic (relativity, quantum mechanics). The confusion pointed out earlier between physics teaching modernization and modern physics teaching brings a tendency to expel causal relations from teaching. It is certainly to such a preoccupation that the new forms of mechanics for secondary teaching respond, forms mainly based on conservation laws.

Now, psychologists' studies have shown the fundamental predominance of causal relations in children' and teenagers' answers. Causality, for Piaget, consists in projecting onto objects (in attributing to objects) the structure of operations that the child has build in his mind from the coordination of his actions. It is exact that this projection is anthropomorphic. However, it does not consists in attributing (magically) the capabilities of action belonging to the subject to objects, but only the operations structures formed from these capabilities of action; and as these operational structures are also the origin of all logico-mathematical thought, it is genetically through causality that logic and mathematics are put in relation with physics, i.e. that the subject becomes capable of forming operative models in physics.

Causal thinking not only constitutes an essential intermediary step—we could even say indispensable—in the building of models in physics, but we have seen evidence that causal explanation are the explanation par excellence until advanced stages in teenage development, which are satisfying for the child with the exclusion of all others. When we confront the child with a "structural" statement (for instance: the direction of the light is getting closer to the normal when the light penetrates from air into water) or with an experimental evidence (for instance: bodies sunk into water becomes lighter) they are not satisfied nor can they assimilate or handle with rigour the relation introduced, until we have replied to the "why?"

they immediately ask us (when they are put in conditions where they can express their spontaneous reactions, of course). (Halbwachs 1975, p. 26–27, translated by the author)

Put in other terms, Halbwachs's point in the passage above means that if causality (as a unified concept) can indeed be abandoned in achieved models of physics, and replaced by precise nomological or structural explanations, causality still remains indispensable for learning or elaborating such models. It is to say that causality may be ontologically poorly relevant<sup>5</sup>: It is nevertheless a useful semiotic tool, at least for learning and elaborating such models of physics.

It is worth noting the consistency between Halbwachs's position, grounded on genetic epistemology, physics, and science education, and Russell's idea that causality can be useful "in the infancy of a science". More specifically, we could consider causality useful for a domain or problem that has not yet reached the description of a system allowing for nomological explanation. As that might be the doom of Human Sciences, we can clearly see that Russell's critique is far from taking causality out of our toolbox for good. Indeed, we might not submit to the science the monologism of Russell, where Human Science should develop nomological explanation like in physics.

### ***Consequences of Genetic Epistemology on the Definition of Causality***

From the two routes we have set to travel further than Hume, two points emerge about this question. First, that the specification of causality into several independently defined concepts—examples are taken in physics mostly—lead to the abandon of the concept of causality *as a unequivocal unique concept*. However, if it is not merely replaced by a unique physical causal process that reduces all sciences to physics, it can be a promising route even for Human Science to specify causality into a larger set of domain-specific concepts, each defining one process with all necessary specificities of the object under study<sup>6</sup>. Second, there is nevertheless a causality *of the whole system of laws* that can sometimes be considered necessary and sufficient and called *systemic causality*, but in other cases nomological explanations would not be considered a causal explanations. Yet, a physical law is not a necessary connexion, neither a causal power: It is more or less general, valid within a certain domain of usage. The necessity is in the system of laws, not in the law:

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<sup>5</sup> At least if we consider achieved physics models as representing the physical world, which correspond to a certain epistemology of science. There is, however, another epistemology of science where models themselves do not represent anything, at least when achieved or constituted into "closed" formal systems (Grize 1982). In this second epistemology, it is the process of elaborating a model that ensures a certain fitting with the world.

<sup>6</sup> It is easy to imagine how different the study and description of a *process* will be in physics from educational sciences.

This is why physicists rarely speak of “causes” (this is a significant fact that has often been used wrongly as an argument against causality): they “observe” only laws, even if they immediately try to explain them causally and even if, as it seems to be the case, it often the search for a causal explanation that leads to discovering these laws.

This admitted, it is only easier (and this is not a paradox) to identify from where causality starts: since a system of laws acquires a necessary nature *as a system*. This precision is by the way obvious, because a law is never by itself necessary: it is more or less general, which is not similar. For having necessity a system is required, thus deduction is required and we agree with Meyerson on this, which is about the importance of deduction. (Bunge et al. 1971, p. 197, translated by the author)

Science education research shows that the learner moves from a simple causality, being able only to consider a single cause linked to a single effect, to a more complex causality involving either repetitions through time or multiple causes with a single effect, multiple effects from a single cause, and more elaborated relation between cooccurrence of causes such as interaction.

The development, from a simple causality to a complex causality, which is associated with a multifunctional approach, requires learning at the level of specific knowledge, reasoning and epistemology. (Tiberghien 2004, p. 99, translated by the author)

Based on science education research, I suggest considering causality as a *conceptual stepping stone* for learning complex *functions*<sup>7</sup>, which requires a systemic approach and is particularly difficult to master, even for scientists.

While using causality, however, the learner is very likely to create confusions such as the ones in Russell’s long list, leading to many misleading ideas about the nature of science (Driver et al. 1985) or to misunderstandings (Kohler 2014).

## Causality As a Concept Used in Science and in the Everyday Life

### *Cognitive Bias*

The everyday use of causal attribution is best documented by social psychology working on social cognition (Deschamps and Clémence 1990, for instance), of which there are some famous concepts displaying cognitive bias in the attribution of causality, such as the *cognitive dissonance* (Festinger 1957), the *Pygmalion effect* (Rosenthal and Jacobson 1968), and the *fundamental attribution error* (Ross 1977). Research in social psychology is most relevant to our concern about the use and the usefulness of the notion of cause. The attribution of causality in this domain is sometimes considered as an attribution of responsibility: If one considers that John is the cause of the bad teamwork, it is also a way of saying that he is “responsible” for the team’s bad performance. Everyday use of causal attributions stresses the link between causality and responsibility, but this link exists since the notion of cause first appeared. In old

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<sup>7</sup> Function in the mathematics meanings, formalized within a closed system, or as of a functional explanation in Human Science that is most often not relevant to formalize with an equation.

Greek, the word *αἴτια* means both “cause” and “accusation, reproach”<sup>8</sup>, indicating the original legal and moral value of the idea of cause, and possibly also the use as an attribution directly aiming at someone. There are other languages where the same proximity can be observed. Considering that the epistemological origin of the idea of causality comes from the experience of our own action—which includes great number of actions taking place in and about the social realm—causality is therefore at first applied to our own actions but also very soon to other people’s actions and to people themselves (through the *implicit theory of personality*, for instance). Viewed under this light, the conceptual proximity between causality and legal or moral responsibility is nothing but surprising.

Hence, instead of considering the causal attribution in social cognition as a secondary use of a more global understanding of the world that would be “naturally” causal—and not a very happy use, since it is full of bias—we could consider the social cognition as a primary domain of practice of causal attributions, from which causality becomes progressively differentiated from a social responsibility. Following this thread of thought, when we are looking for causes in the world, or trying to define causality, we would be intuitively trying to put our hands on a discrete portion of the world (of the kind that we vaguely call “event”, or maybe a process or a property of something) that is *responsible* for the effect we are interested in, and to which we can attribute a causal role, to which we can attribute the responsibility of our state of affair. This could explain some of the dissatisfaction with Humean metaphysics, for instance, that it does not only say nothing about responsibility, but even worse: Humean causation sends the responsibility back to the individual who operates the attribution.

Causality is not just about causal powers being out there, in the space, or not. It is also about social power, responsibility, accusation, and judgment. Let us remember, as a last illustration of those important implications, the notion of *scapegoat* (Frazer 1922; Poliakov 1980): When something happens that is much out of control, be it because it is too complex or simply because it is one of those things we have to deal with, powerless, such as natural catastrophes, human being nevertheless most often prefers to point out an innocent “cause” be it a person, in order to symbolically regain the lost control, even if that entails heavy punishment for the designated victim.

### ***A Pitfall for Scientists***

Bias in causal attribution not only occurs in everyday life context, but also in science. However, the nature of the problem of attribution is quite different for the scientist: If we can have good hope that explicit methodology and reasoning should prevent most common bias, scientists are confronted with a bias related to their expertise. It is the same bias that makes it so difficult for an adult to understand a child’s world: As an adult, we naturally take for granted what we know about the world when making

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<sup>8</sup> A. Bailly (1901). *Abrégé du dictionnaire Grec-Français*. Paris: Hachette.

inferences, yet the whole problem of teaching is precisely that some of what we take for granted has not been acquired, or at least is significantly different from the adult's beliefs. The risk, when it comes to causality, is therefore to project one or the other of the numerous expert definitions of causality built throughout the history of philosophy onto the human agent under study. Social psychology has been among those sciences which projected the formal scientific method—here the research of a scientifically defined causality while analyzing the world—on the layperson's psychological functioning, in order to explain it. Heider (1958) for instance, considered human subjects as naïve statisticians, practising inferences like a scientist searching for correlations and causes. Many other examples can be found, for example in the various models of decision making, attributing to the layperson a calculating behavior that has more to do with the expert vision of Artificial Intelligence than with the perspective of a layperson taking a decision in a real situation, as Gigerenzer and Todd (1999) have since demonstrated, or in some developmental psychology assuming a hypothetical mechanism of systematic analysis of regularities of events in the surrounding world, projecting an expert statistical approach to knowledge onto infants or children. My point here is not to make a list of the authors falling into such bias, but only to give a few examples among many possible to clearly indicate what I mean by the risk of attribution of an expert understanding of causality—whichever one—to the subject under study in the practice of human science.

Even if all those approaches are somehow following the Humean concept of causality and share some good sense, there is a fundamental difference between Hume argument and the projection of scientific method on everyone's psychological functioning. Hume demonstrated with his arguments that causality cannot be directly perceived, and therefore we ground our notion of causality—whatever this one is—on the observation of regularities. However, when a scientist who has developed a very specific and quite advanced definition of causality for his research work, assumes that this specific notion of causality grounds the cognitive functioning in general (whether it is about adults analyzing the social world, people taking decision, or very young children discovering their environment), this scientist is somehow returning Hume's reasoning back to front. Instead of demonstrating (or trying to) that we can ground a philosophical or scientific work about causality on observations or experiments (with the help of inference, the work of *imagination* in Hume's terms), such a scientist assumes the layperson to make use of a philosophically or scientifically defined concept of cause while observing their environment.

In conclusion, if I agree that there is an inferential activity of a layperson or even of a very young child, leading from observation to a sense of causality, as Hume first described it, I nevertheless consider that this sense of causality is not theoretically developed and therefore does not resemble the scientist's concept of causality. There are two reasons for this position: First, the understanding of causality developed in different fields of research varies considerably from one to another. It is not by chance that many social psychologists imagine the layperson using a statistical causality, as the social psychology researchers themselves use this specific notion of causality, while the cognitive scientists would rather imagine a subject building an intuitive model made of boxes and arrows for taking decision, just like the expert models

built in their academic field. Second, as we have seen throughout a few historical landmarks, the various specific meanings of causality have been developed through a long time span, and with the contribution of much hard work. It is still expected that we will find new meanings encapsulated in the sense of causality, and this book itself is very likely a step towards this development yet to come. Therefore, attributing such precision of thought that is required for a conscious, formal, well-defined understanding of causality to anyone—including small children—seems very likely a cognitive bias rather than a finding.

## Explanation in Sciences

Considering causality in depth raises the question of what a scientific explanation is. If a physicist succeeds in building a law giving account of the observations, is he really satisfied with it or does he also need a causal explanation to fulfill the need for explanation? This question is too complex for a short answer, or maybe even for any answer at all. There is nevertheless one interesting point to stress, which can be considered as knowledge in the matter, coming both from history and philosophy of science (Latour 1984, for instance), and empirical work in sociology of science (Latour and Woolgar 1979, for instance), and sociocultural psychology in education (Kovalainen and Kumpulainen 2007, for instance): What counts as an explanation depends on the current state of research in a given scientific community. Applied to our example in physics, the elaboration of a law—the nomological explanation—might come as the achievement of a long process and replace previous causal explanations by relating them within a global system, and at the same time raise new questions—formulated in terms of causality—about a domain yet out of reach for thought, which can themselves be integrated into a more general system as laws, suppressing the causal form and so on. Still, for many, the nomological explanation is not the right thing to pursue in Human Science, a position that can be supported by a causality specific to the actions of living organism of the higher order—to agency—of a fundamentally different kind than the causality at stake in physics, specified for instance in concepts such as energy, gravitational forces, and entropy. Even if we accept the possibility to reduce living organisms in their physical component (the material cause, would say Aristotle), the description at a much higher level of organization—at the level of a living system or even of a society—has little to do with what we can state of the physical particles, and therefore can require specific concepts for explanation. It requires types of *causes* different from what physics needs.

## Causality as a Semiotic Tool

### *Semiotic Roles*

From the transdisciplinary perspective set for this chapter around the concept of semiotic tool (Van der Veer and Valsiner 1994), we can stress the usefulness of Humean causality as a semiotic tool for empirical research in psychology about the early development, while Russell's proposal of leaving the notion of cause for the infancy of a science echoes with the development of the knowledge, from the standpoint of an individual learner or of a whole domain of knowledge. Indeed, learners as well as scientists exploring a new problem seem to first look for causal explanations before being able to reach a more systemic and complex understanding, including functions. From this perspective, it appears that the various definitions of causality are not (only) competitors for truth, but also fulfill various semiotic roles in terms of the aim of the elaboration of knowledge.

Even if it is a rather optimistic perspective on the diversity of positions about causality, it should not be understood as if *any* definition or work about causality is good for something. However, I believe that much confusion comes from using the various meanings of causality as if there was only one that is true or to be found accurate, and therefore they are all considered as competing synonyms occupying the same space in the body of knowledge, forced to play the same semiotic role. With this attitude of mind, there is no need to cautiously distinguish between the various meanings of causality and the use of one or another is more or less randomly chosen or given through intellectual traditions, sometimes with very little relevance, rather than being the result of a cautious choice. One confusion of this sort is stressed by Halbwachs in a passage quoted above: Taking Russell's suggestion to drop causality in science for eliminating causality from the school books is confusing the semiotic roles: If causality is not used in a specific achieved domain of knowledge, it is still useful for learning this same knowledge. Of course, this problem also concerns the layperson using causality in the everyday life, which makes it even more difficult for scientists to avoid this pitfall.

Taking altogether the way young children and, later, adults elaborate a notion of causality, the daily use of causal attribution in social cognition and in many other domains, it appears clearly that causality is not only the tool of philosophers or scientists. A consequence of this statement is that the definitions of causality naturally tend to answer different aims, socially and culturally embedded, or in other terms they are elaborated and/or used for various purposes, which I called *semiotic roles*. To embrace the wide picture we have briefly outlined through this chapter, we have referred to all those various forms of causality and yet bring them together through the fact they all are, on their way, a shared semiotic tool: a culturally and socially constructed sign, that allows humans to make sense of the perceived reality, dialogue about it with others, and even deal with serious matters as the share of power and the juridical responsibility. The transdisciplinary perspective brings all those different notions of causality next to each other, because it places the various notions

and usage on the same level, without any normative selection referring to a more adequate philosophical definition of causality. In addition, it allows distinguishing the various meanings and their accuracy for various semiotic roles or aims in the building of knowledge. Whatever causality *is* in reality—it might not even exist as Russell suggested—it is nevertheless a tool helping us to think, share our thoughts, and interact successfully with the perceived world. And this is what we want it to be. So far so good. Now that we have all this diversity laid on the table, so to speak, we can seriously consider what causality as a semiotic tool allows us to do and what the concept of catalysis can bring.

### *The Importance of Vagueness*

The vagueness of the concept of causality, or causation, does not only rest on the various historical accounts about what is exactly the connexion (a necessary connexion, a constant conjunction, . . .), but also as Russell showed on the concept of event, and even more subtly on what will be selected as one cause or as one effect, selection that can operate at various scale. From the first attempt of Aristotle to use a more precise vocabulary, distinguishing four types of causes, we have reached today a vast body of philosophical definitions which relations one with another meets great difficulty. For instance, expressing scientific knowledge in terms of material, formal, efficient, and final causes would not make sense anymore, as the whole vision of the world has changed too much. If the notion of causality has nevertheless traversed history, it is very likely thanks to the vagueness that always accompanied it. Let us sum up once more the main variant in which the terms of cause and causality have been accepted.

A single cause can be considered necessary and sufficient to produce a specific effect. Without the idea of production, causation can be considered with Hume as the mere constant conjunction between a cause (antecedent) and an effect (subsequent). Causality can also be considered a general term, a common notion for processes or powers which need to be specified in every domain of knowledge and for each specific relation between those phenomena than we would generally call causes and effects.

Little has been said in this chapter about the multiple or complex causality. Still, interaction and combination of causes is an important aspect of the ambiguity of the notion of cause. The way the combination of causes is conceptualized brings out philosophical debate about emergence and more generally the relation between parts and whole, which are in turn vague notions themselves. Deliberately avoiding a long discussion of those matters, I will limit this point to the presentation of three broad variants to approach complex causes:

*First,*

there is the analytical tradition that reduces complex or multiple causality to the mere sum or computation of single causes, such as the multifactorial approach in statistics, which assumes that the weight of each cause can be quantified and deals with the complexity through this quantification.



*Second,*

complex causality can be approached with something like Mackie's account (presented earlier), which is to consider several causes each insufficient but all necessary for the effect to take place; notions such as a "trigger" used in medical research would fit well in this variant.

*Third,*

there is the systemic approach, including laws of physics, ecosystems in biology, some multilevel retro-actions in Artificial Intelligence, and many other examples where causality is systemic, in the sense that picking up singular causes in the system does not make sense anymore: Causes are considered efficient in such a system only *relationally* to the other causes and ultimately to the whole system.

## Catalysis As a New Semiotic Tool

If the main part of this chapter is devoted to present causality as a semiotic tool, I now examine causality and catalysis side-by-side, both as semiotic tools. Are they overlapping signs? Is catalysis needed as a new tool in Human Sciences, and if yes, what does it bring that causality lacks?

There are two ways to support the need to introduce the new concept of catalysis. First, it is to consider that the diversity of the notion of causality is problematic, and a scientist needs different names for the different definitions and usage of the vague, and somehow confused, notion of causality. It would be to introduce catalysis as a part of what is commonly—and quite messily—understood as *causality*. Second, it is to give catalysis a semiotic role that causality lacks, besides all that it does. I will come back on those alternatives after a closer look on what catalysis is not, and what it could be.

### *What Catalyst is Not*

To make sure catalysis does not inherit the confusion in which causality often (or ever) remains, it might be useful to add to our attempt to define catalysis in the previous section with what we know catalysis is not.

Semiotic catalysis is neither a standby condition of necessary causes nor a physical process of transmission of quantity, specifically not of a quantity of energy like in the chemical catalysis. Semiotic catalysis is definitely not a necessary connexion, and neither is it a Humean regularity. This last point finds support in Russell's analysis of the vagueness of the notion of "event". Russell shows that more you include the environment into the event, less is there repetition of the same event. As I understand catalysis, it must include environment as much as possible, because any substance (or meaning for semiotic catalysis) could possibly change the outcome. Therefore, with the semiotic catalysis we are probably close to consider only unique events, as "events" take a clinical case-like definition that includes the whole semiotic environment. Humean regularities, or any statistical causality, would be groundless for conceptualizing what happens within those complex unique practically isolated systems.

## ***What Catalyst Could Be***

A catalyst could be one of several Humean causes, as they are defined by Mackie<sup>9</sup>, each insufficient but all necessary for setting the condition that is itself sufficient but unnecessary for the effect to take place. However, this option would lose the domain-specific meaning that catalysis gained through a precise description of one particular causal process in chemistry.

On the other hand, catalysis could be used as a concept of *trigger* with a causality of powers: The catalyst would work as a condition that eases, helps, or enables the trigger of causal powers. But what would be the causal powers in semiotics? As far as I can see, this is a doubtful option.

More seriously, catalyst can participate of a systemic causality, in a specific role that still needs to be more specified: What is the part of the reactants and the part of the catalyst in the process?

## ***Elements of Definition***

We are now equipped to consider contributing to a definition of catalysis. In the previous publications about catalyst (Beckstead et al. 2009; Cabell 2010, 2011), it is stated that catalyst is a necessary but not sufficient condition to *aid*, *help*, or even to *enable* the production of novel meanings or the regulation of meanings. Cabell also specifies that catalyst is not a cause as such. After our journey through the various historical and conceptual definition of causality, we are now able to react to this comment in a precise way.

When Cabell states that a catalyst is not a cause, I understand two general statements: First, it is not a cause in the sense that it is not necessary and sufficient for producing (enabling and so on) the effect; second, it is not a cause in the sense that it is a condition. The authors developing the concept of catalysis insist on the contextual, the background nature of catalysis, as opposed to a foreground causality that stands out of the expected usual course of things. This weight on the contextual aspect—and maybe the whole idea of introducing catalysis—comes from the deliberate aim to have a concept for explanation that is not cutting out parts out of the complexity of the real world:

Thus the notion of catalysis can be employed to understand how repeated *and* unique events occur without reducing the complexity of life to more elemental parts. (Beckstead et al. 2009, p. 73)

As I understand it from a philosophical perspective, this is a way to take seriously Russell's critique, moving away from the infancy of psychology to define functional relations that step over causality. Or, as I also used those terms, it is to consider a systemic causality. It is a way to move from the notion of cause, doomed to be vague

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<sup>9</sup> See 2.5.

or ambiguous, to the concept of a system. Catalysis can be understood as part of a system, as Cabell clearly states:

This emphasis on the relationships between parts in both biochemical autocatalysis and cultural semiosis suggest that both processes must necessarily take place within a system, even if that system only contains two semiotic structures (in cultural semiosis) or three molecules (in autocatalysis). (Cabell 2011, p. 6)

The statement made here, I believe, is equally valid for any type of catalysis. Now, we have seen earlier that for a system causality as such is not to be found in the relationship between parts of the system anymore. If there is causality in a system, the system as a whole is the only eligible cause. The relationships within the system are nomological, whatever the kind of function (support, enabling . . .) they can be described with, all causally dependent on the whole system.

Hence, we can double the statement that catalysis is not a cause with the fact that catalysis is necessarily contained in a system. However, there is more to be said about the system. It is, at least in chemistry, a practically isolated system, and when it fails to be<sup>10</sup>, the catalysis does not happen as expected. The system of the catalysis in chemistry can be isolated because catalysis is one of those domain-specific specified causality that can be precisely defined within the discipline—and therefore allow for dropping the notion of causality—in such a way that some philosophers are ready to bet that this is a clue of causal powers, or at least that there is a causal process taking place. Without going back to the philosophical question, this perspective nevertheless obliges us to look further into the description of the practically isolated system in which we find the concept of catalysis. Indeed, a domain-specific specified causality is not easily transported into another discipline: If we only grab the concept—as a nomad concept—and leave the description of the system behind, I think that the nomad concept will suffer from vagueness and ambiguity.

In chemistry, the system containing catalysis, considered broadly, entails at least:

- A chemical reaction, which is the domain-specific, specified causal process.
- An energy barrier or threshold that needs to be reached for the reaction to take place.
- Two reactants or more, which will be merged together at the end of the process.
- An intermediate reaction or reactant, that only exists temporarily.
- A catalyst, which will not be merged with the reactants at the end of the process, but is a reactant for the intermediate reaction to take place.

This list is probably not perfect, and would require the help of experts in chemistry for assessment. Anyway, the semiotic catalysis does not need to stick completely to what catalysis is in chemistry. My point here is to stress that even if catalysis takes a slightly different meaning in psychology, if it remains a concept specifying a process within a practically isolated system like it does in chemistry, the semiotic catalysis needs a description of that system, understood as a semiotic system or anything else that would correspond to what the chemical reaction is in chemistry.

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<sup>10</sup> Is it the case of the poison mentioned by Cabell?

To progress in the definition of the system, it is necessary to understand what the semiotic role of the concept of semiotic catalysis is. Cabell reports two examples: First, there is the “generalized feeling of war” functioning as catalyst of a new categorization (a transformation of meaning) of old friends into enemies; second there is fashion, “which appears, interferes in the dynamics of the basic culture, only then to disappear without trace” (Cabell 2011, p. 10). From those examples, the correspondent to the chemical reaction within the semiotic system is a transformation or creation of meaning. Semiotic catalysis would be considered “semiotic” in that it is catalysis about semiosis, about creation and transformation of meaning. Should the disappearance of the catalyst, like in the second example, be a condition for considering that there is a semiotic catalysis? If yes, the “generalized feeling of war” of the first example must be disappearing too, if it is a catalyst, or be replaced for instance with a feeling of danger or anything different that emerges after the neighbors become enemies<sup>11</sup>.

Another point needs clarification: At which scale do we consider this process? For chemistry, the scale at which the chemical reaction takes place is unequivocal: The change transforms the molecules. For semiotic catalysis, is it the creation or transformation of meaning at the scale of a sign as suggested by the reference to Peirce (Cabell 2011, p. 6) or at a much broader scale including the regulation of great numbers of signs and meanings as suggested by the examples above?

Finally, the question of the nature of the action of the catalyst must be addressed. How is the catalyst thought of? Certainly not as a causal power. To state that it is an *insufficient but necessary condition* remains too weak: If I apply the idea to chemistry to make my point clearer, during a chemical reaction the various containers used are also insufficient but necessary conditions, but we might not want to call them catalysts. A possible answer is to say that the containers are not included in the relatively isolated system. In this case, we once again need a precise description of what would be a semiotic system in which a semiotic catalysis may take place. Another possible way to respond to this question is to find an idea in semiosis corresponding to the chemical energy threshold, in a way that also allows in psychology a precise definition of a domain-specific process such as, for chemistry, “lowering the energy barrier.” Moreover, if we refuse to define more accurately the semiotic catalysis in analogy with chemistry, it is to consider catalysis more broadly, as playing the role of a “middle man” or *mediation*, and would require a definition such as defining a specific type of *mediation*.

## Conclusion

We have seen two options for introducing catalysis: First, as a specification of causality and second, as a complementary concept to causality that plays a semiotic role causality fails to.

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<sup>11</sup> Of course, only a look back on the data collected for this example would give the answer.

## *A Specific Causality*

Specifying the vague notion of cause (or condition) by introducing the concept of semiotic catalysis contributes to move out of the “infancy of a science,” and can convincingly take two lines of development: Firstly, catalysis can be part of a semiotic system, itself causally determinant or not; secondly, it can be described as a domain specific process within semiotics. The first option requires providing a clearer account of the system in which a catalyst plays a role. The second requires to specify the process—the equivalent of the chemical reaction—for which a catalyst plays a role, the scale at which the process takes place, and the part that a catalyst takes in the process.

## *A Different Semiotic Role*

If the concept of semiotic catalysis is introduced as a notion complementary to causality, it means catalysis is playing a different semiotic role that causality or other available concepts lack. Such a role must be defined. A way to work on semiotic roles is to elaborate the notions of “conditions” and “constraints” used for defining the specificity of a semiotic catalyst in reference to the conditions it offers to the transformation of meaning or in reference to putting down or lowering constraints relevant for meaning transformation. An example of such constraints could be the tendency of a human being to avoid contradiction with oneself. A catalyst would release the constricting power of this rule of self-consistency. The example with the “general feeling of war” allowing to become the enemy of our previous friends would work well with this suggestion: the catalyst—the general feeling of war—allow an exception to the constraint imposed by the principle of self-consistency. The data about cognitive dissonance could be reinterpreted this way. For a candidate of semiotic role, I have suggested the idea of the unusual and punctual suspension of a constraint, such as rules or norms. Yet, I am sure there are other good candidates, but they shall be found in the way the concept of catalyst is usefully put into practice in empirical research.

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# Chapter 4

## Catalysis, Functional Explanations and Functionalism in Psychology

Sven Hroar Klempe

The term “catalysis” must be regarded as a foreign term in psychology. Just recently, it has been introduced as a term describing constraining factors in human behaviour (Beckstead et al. 2009). The motivation is primarily to emphasize the conditional aspects of a process in which there are some constraining factors that are hard to specify (Cabell 2011). In this sense, catalysis connotes descriptive adequacy in the sense that the term communicates some changes without specifying exactly what the cause would be. Yet, catalysis has a very specific meaning in chemistry, where the catalyst provides a mechanism to “increase in the rate of a chemical reaction induced by material unchanged chemically at the end of the reaction” (<http://www.merriam-webster.com/dictionary/catalysis?show=0&t=1343969737>). This definition tells us that the catalyst is a material or an environment that influences a chemical reaction of which the catalyst is not to be regarded as a part. Accordingly, the catalyst stands unchanged after the reaction, and the reaction could have happened anyway, but not with the same intensity. According to this definition, a catalyst cannot explain the reaction, and it is not to be regarded as a necessary part of the chemical reaction. The reaction is dependent on the two or more chemical substances that interact, whereas the catalyst represents a foreign entity that has impact, but is not included, and in this sense stands outside the chemical reaction.

To what extent a catalyst may have explanatory power in the process touches on some intriguing questions embedded in the theory of science. In this respect, there may be drawn a continuous line from a nontheoretical description placed at one end, with causality given by necessity placed at the other. In between, we have all nuances and combinations of descriptions and explanations in which the explanatory factors belong to at least three different categories: (1) completely independent, (2) dependent with sufficient reasons or (3) dependent given by necessity. Sometimes we explain the rainy weather with the fact that we forgot to carry an umbrella. Although everyone knows that there are no connections between those factors, we sometimes accept the lack of an umbrella as an explanation for rainy weather. Murphy’s Law,

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which says that anything that can go wrong, will go wrong, is another example of the first category. All statistics with significant results are accepted on the basis of being just a sufficient reason and count as examples of the second category. Although most of us do not see any bad consequences for our health by drinking a glass or two of wine per week, many would say rather the opposite that the average alcohol consumption in a population corresponding to two glasses of wine a week is statistically regarded as a heavy burden for the average state of health, and it counts as a sufficient reason for modesty among everyone. As an example of what we would attribute as a necessary dependent, a drunken driver that steers a car directly into the face of a cliff is, by necessity, regarded as the cause for the incident if no other obvious explanations are to be found.

The role of density functional theory (Kohn 1998) in physics and chemistry may pinpoint these examples. This theory “is principally a theory of an atomic or molecular ground state” (Parr and Yang 1995, p. 702), which aims at modelling the electronic structure and nuclear position in which many and different bodies and materials are involved. Yet, in chemistry, this theory is applied as an explanatory model for the role of the catalyst (Parr and Yang 1995; see also Davison and Sulston 2006). In one respect, the atomic and molecular ground state of the catalyst has an impact on the chemical reaction. Thus, the density functional theory may have a kind of explanatory power in the sense that the atomic and molecular ground state may predict the metal’s catalytic impact on a specified chemical reaction. Yet, on the other hand, we are still talking about a catalyst, which stands outside and is in itself left untouched by the chemical process. This implies that the catalyst has impact, and can partly be regarded as a cause for the *intensity* of the chemical reaction, but not for the chemical reaction itself, which occurs between the materials that actually do go through a chemical transformation and end up being something different from what they were before the reaction. As long as the catalyst does not go through the same kind of transformation and is not affected by the chemical reaction, it is relevant to talk about “function” instead of “cause” when it comes to the role of a catalyst, which the name—density *functional* theory—also explicitly indicates. In the beginning, therefore, functional explanation could loosely and broadly be sketched as a situation in which the effect alone is regarded as the cause. The metal applied as a catalyst is defined as a catalyst solely because of the effect it has, and the metal itself is not necessarily an object for further investigations.

## Functions in Mathematics

Catalysis, therefore, is highly related to functional explanations, and in this respect, the problem and potentiality of the process of catalysis may be regarded as transferable to several fields in which functions have been focused on. Even in mathematics, functions play an important and almost inevitable role. Here, function is very much understood in terms of two or more variables associated with each other in a more or less strict sense. A directory may serve as an example: a given name ( $x$ ) is assigned



to a certain number ( $y$ ), which implies that a directory consists of the two sets A (names) and B (telephone numbers) related to each other in terms of an assignment ( $f$ ). In this sense, a telephone number is given as a function of  $x$ , which is mathematically expressed by the symbols:  $f(x)$ . Thus, a function in mathematics does not imply any necessary relationship between the two sets. They are, strictly speaking, rather independently assigned to each other by rules that are conventionally given or defined more or less ad hoc. A function indicates a not very strict or rather unnecessary connection between some data and the outcome derived from them. This is also why probability is mathematically expressed by a function of the data ( $x$ ):  $P(x)$ ; the likely outcome from the given data is rather suggested than given by necessity.

## Functions in Biology

In Darwinistic biology, on the other hand, function is rather conversely understood. The process of natural selection is regarded as decisive and given by necessity because it includes and presupposes cause and effect. Although Darwin refers to functionality in an organism, he does not present an extensive definition of functional explanations in biology (Darwin 1859). The core aspect of functional explanation in biology is primarily related to natural selection (Darwin 1859; Elster 1979). Consequently, the only source of innovations and changes is provided by randomly given mutations. This implies that genetic dispositions are regarded as the only cause for development and that causality goes just in one direction, i.e. from the parents to the offspring. Thus, the function does not count as the cause for a certain capacity in the organism, but rather as a mechanism for selection. The function of the achieved capacity is tested against the environment, which determines if the acquired capacity gives the organism “the best chance of surviving” (Darwin 1859, Chap. 4, p. 1). There are primarily two reasons for why a cat is good at seeing in the dark: a mutation caused this at a certain stage in its development and this capacity made it easier for the cat to catch food and therefore to survive. Neither of these factors can be regarded as functional explanations but rather as outcomes of causes and effects. One cause is the mutation and the other is the capacity to see in the dark. This capacity has a specified cause and is therefore given by necessity, and the function or the effect of the capacity is to be regarded as an inevitably determining factor for the organism’s ability to survive.

## Functions in Psychology

The Darwinian perspective on development and causality was adopted by psychology quite early. As William James refers to Darwin in his famous paper on emotions from 1884: “The labours of Darwin and his successors are only just beginning to reveal the universal parasitism of each special creature upon other special things, and the

way in which each creature brings signature of its special relations stamped on its nervous system with it upon the scene” (James 1884, p. 190 f.). Ten years later, John Dewey aimed to combine the James–Lange theory of emotion with Darwin’s principles: “In the following pages I propose, assuming Darwin’s principles as to the explanation of emotional attitudes, and the James-Lange theory of the nature of emotion, to bring these two into some organic connection with each other” (Dewey 1894, p. 553). Functional explanations in psychology are therefore highly associated with William James and American psychology. Yet, there are a lot of questions to pose in this respect. As we have seen so far, if functional explanations shall be subsumed under one paramount definition, it must be very vague and broad because an abundance of varieties that may even contradict each other have to be included. The complicating factor is, of course, to what extent a function is to be regarded as a sufficient or necessary condition to be a reason, or if a function can be regarded as a reason at all. There is inevitably a teleological aspect of a function, and teleological explanations have been hard to justify during the last centuries. Another complicating factor is the philosophical background of William James, which is tightly connected to the American pragmatism. As Charles Sanders Peirce formulated the pragmatic thesis, scientific understanding is primarily related to the conceivable effects, which implies that the understanding of causality is dependent on our conception of the matter (Peirce 1878/1986). This philosophy is probably not so easy to combine with Darwinism as long as it includes strong causality as a prerequisite, and Peirce does not exactly embrace Darwin (Peirce 1878/1986).

Catalysis in psychology must also be assessed on this background. In a chemical reaction, catalysis has a function in the sense that it has demonstrable effect on the reaction, but it is not a part of the chemical reaction itself. In this respect, a catalyst has a function and is explained in terms of its function. Moreover, it must be regarded as a sufficient reason for moderating the reaction, but it is definitely not a necessary reason for the reaction. Thus, when the term “catalysis” is transformed into psychology, it has to be regarded in these perspectives. The connecting point is, first of all, the extensive use of functional explanations in both sciences. Yet, the crucial issue is that functional explanations in psychology may refer to very different forms of explanations. On the one hand it is referred to Darwinism in which function forms a certain type of necessary condition, yet in chemistry, on the other hand, function is rather applied as a sufficient condition for increasing the chemical reaction. However, it may be that when the term “function” is applied in psychology, it satisfies neither necessary nor sufficient conditions for an explanation. If this third alternative is correct, is it then possible to talk about an explanation at all?

This is exactly the question this chapter aims to pursue. First of all, we have to go deeper into the nature of functional explanations. Then, we have to investigate the relationship between necessary and sufficient conditions and reasons. However, “conditions” are used here in a logical sense and refer to the relationships between statements, whereas “reasons” are related to empirical matters. When we talk about a bachelor, an unmarried man counts as a necessary condition for the concept; however, to find a man that is actually unmarried is a necessary reason for having found a bachelor. This chapter primarily deals with explanations, which include empirical

matters, and hence, it will rather be referred to “reasons” than “conditions” because the latter requires obvious logical necessity. Therefore, the criteria for sufficient reason have to be specified, which is probably not only the most challenging but also a crucial issue in this investigation. On this background, we are hopefully able to present a nuanced but specified variety of functional explanations. On this background, there will be a need for a discussion about functionalism in psychology on the basis of a nuanced taxonomy of functional explanations. This discussion will hopefully sort out distinctions between the different appearances of functionalism in psychology. Admittedly, if we find appearances of functional aspects that may count as a sufficient reason in psychology, these examples would be sufficient to conclude that the term “catalysis” may be meaningful in psychology as well.

## Functional Explanations

In a discussion about explanations, Aristotle’s four different causes: (1) matter, (2) form, (3) effect and (4) final are inevitable. Yet, these four types of causes discussed in his book *Physics* are not the only aspects he is introducing when it comes to explanations. To explain a phenomenon is regarded as one of the main duties of a philosopher, so in this sense, all his books aim at explaining the issues they are discussing. Nevertheless, the four causes he is mentioning in *Physics* demonstrate to a great extent his understanding of the variety of explanations that may exist and that the causes can not only be systematized in a rational way but also challenge our modern understanding. All those three aspects concerning variety, irrationality and modern perspectives on explanations are important to take into account in a discussion about explanations, and not least when we read Aristotle’s four types of explanations:

In one sense, then, (1) that out of which a thing comes to be and which persists, is called “cause”, e.g. the bronze of the statue, the silver of the bowl, and the genera of which the bronze and the silver are species.

In another sense (2) the form or the archetype, i.e. the statement of the essence, and its genera, are called “causes” (e.g. of the octave the relation of 2:1, and generally number), and the parts in the definition.

Again (3) the primary source of the change or coming to rest; e.g. the man who gave advice is a cause, the father is cause of the child, and generally what makes of what is made and what causes change of what is changed.

Again (4) in the sense of an end or “that for the sake of which” a thing is done, e.g. health is the cause of walking about (“Why is he walking about?” we say. “To be healthy”, and, having said that, we think we have assigned the cause). The same is true also of all the intermediate steps which are brought about through the action of something else as means towards the end, e.g. reduction of flesh, purging, drugs, or surgical instruments are means towards health. All these things are “for the sake of” the end, though they differ from one another in that some are activities, others instruments. (Aristotle 1990a, Book II, part 3)

This perhaps exhausts the number of ways in which the term “cause” is used.

There are no references to functional explanations in this summary. On the other hand, there are two forms of explanations that rather challenge the modern mind. This is the second and the fourth. We can accept number one because from a logical

point of view, we will admit that the material counts as a necessary condition for making something and that the quality of what we have made is highly dependent on the material it is made of. This is also true when it comes to the third explanation. According to the modern way of thinking, this is even the ideal type of cause, and probably the only acceptable as well. What we have problems with accepting are the form and finality as causes. The former is hard to accept because it mirrors a kind of platonic world in which the ideal type of everything already exists, and the latter because it presupposes a sort of purpose behind every event in the world.

Aristotle does not mention “functions” or “functional explanations” in the presentation above. However, in *Metaphysics*, he brings the term “function” in his explanation of the four causes. “The same thing may have all the kinds of causes, e.g. the moving cause of a house is the art or the builder, the final cause is the function it fulfils, the matter is earth and stones, and the form is the definition” (Aristotle 1990b, Book III, part 1). Aristotle associates finality or the teleological cause with function. Thus, the term “function” is in this example directly related to the builder of the house and his ideas about it because of the function it is supposed to have. There is a big overlap between the way Aristotle introduces the term “function” and the intentions the craftsman may have by building the house. This is probably also the reason why we very often find an unspecified use of functional explanations in psychology, in which intentional causes also may be included (de Jong 2003). This understanding of functional explanation rather contradicts the biological use of it, which assumes a blind and unintended mutational process as a prerequisite.

This confusion can also be regarded from the perspective that the conditions for Aristotle talking about causation and causality are very different from our comprehension today. This is what Heidegger is focusing on in his discussion about “The question concerning technology” (Heidegger 1977): “For centuries philosophy has taught there are four causes: (1) the *causa materialis*, the material, the matter out of which, a silver chalice is made; (2) the *causa formalis*, the form, the shape into which the material enters; (3) the *causa finalis*, the end, for example the sacrificial rite in relation to which the chalice required is determined as to its form and matter; (4) the *causa efficiens*, which brings about the effect that is the finished, actual chalice, in this instance, the silversmith” (Heidegger 1977, p. 6.). Heidegger is questioning our understanding of the term “cause”, which is not a Greek but a Latin word. According to Heidegger, the term used by Aristotle is “aition”, “that to which something else is indebted” (Heidegger 1977, p. 7). Here, Heidegger applies the German term “Schuld” and “verschulden”, which may be associated with “cause”, but rather means “to be responsible” for something or even “guilty”. Heidegger’s point is that our modern one-sided emphasize on *causa efficiens* as a mechanical and blind cause does not correspond to the Aristotelian understanding. If we take a new look at how Aristotle formulated this cause in his *Physics*, Heidegger is right. The one who has given an advice, or is the father of the child, is rather the one to be blamed (or maybe rather priced) than to be regarded as a unintended cause for the outcome.

Heidegger has a certain agenda for this discussion. Yet, the agenda is ambiguous. On the one hand, he is the one to praise modernity in terms of the age that has “introduced subjectivism and individualism” (Heidegger 1977, p. 128). Yet, according to

Heidegger, the original Greek term for subjectivity, “*hypokeimenon*”, has nothing to do with the self-centred I, but rather means: “Man becomes that being upon which all that is, is grounded as regards the manner of its Being and its truth. Man becomes the relational centre of that which is as such” (Heidegger 1977, p. 128). This is the basis for his philosophy and the ontology he develops in his main thesis *Being and Time* from 1927, and highlights first of all subjectivity and existence, and in this sense, it is an acceptance of subjectivity as a salient trait of modernity. Yet, on the other hand, modernity is also characterized by another aspect in the sense that “no age before this one has produced a comparable objectivism” (Heidegger 1977, p. 128). Although he admits that this tension between subjectivism and objectivism must be taken into account in a discussion about modernity, his investigation of the role of technology in modernity indicates something else. His discussion about the four causes of Aristotle reveals this. He wants to emphasize that *causa efficiens* is not to be understood as an objective or neutral cause, but rather as a subjective form of explanation. This is a distinction that can be illustrated by the phi phenomenon. If we have two lights placed at a certain distance from each other and they are alternately turned on and off in a certain tempo, the light is experienced as one source moving back and forth, whereas the two lights are in reality standing still. The cause is attributed to one or two sources of light. Heidegger would say that the two-light source attribution is also a subjective form of explanation.

This critique of modern science is important, but it also demonstrates a problem in Heidegger’s philosophy. Although he acknowledges that objectivism is a characteristic of modernity, he has problems with accepting it because according to him, subjectivity is to be regarded as the only basis for a modern ontology. The same can be traced in the writings of another critical scholar, namely the Wittgensteinian Stephen Toulmin, who emphasizes that modernity is characterized by a transition from particularity to universality (Toulmin 1992). Both critics are important, yet they do not take into account how to place the modern need for accuracy and strict reasoning, to which the praise of a more mechanistic understanding of *causa efficiens* in science is an example. It is exactly in this intersection between objectivism and subjectivism or rather between strict and loose reasoning functional explanations are of interest. They include both perspectives, almost at the same time. Thus, the challenge is first of all to sort out when functional explanations can be said to be what.

## Defining “Functional Explanations”

There are several attempts at defining functional explanations. Fodor’s contributions in psychology in the late 1960s may be of interest in this context. He aims at meeting some analytical requests, but at the same time, opens up for alternatives to behaviourism and identity theories of mind. He ends up with a sort of functionalism along with Donald Davidson and Hillary Putnam. In his article about functional explanations (Fodor 1968), he presents the concept “phase one theory”, which refers to “the first phase of psychological explanation” (Fodor 1968, p. 233). These “theories characterize the internal states of organisms only in respect of the way they function in the production of behaviour” (Fodor 1968, p. 233). These types of explanations

“are not causal explanations” (Fodor 1968, p. 233) and “they give no information whatsoever about the mechanisms underlying these [internal] states” (Fodor 1968, p. 233). This type of explanation may be quite diverse and not very strict. In this sense, the explanations may correspond with an indefinite number of hypotheses. However, there is at least one criterion from which the explanation can be refuted, namely when the explanation contradicts known facts, specifically in neurology, he says. In this respect, “it is sufficient to disconfirm a functional account of the behaviour of an organism to show that its nervous system is incapable of assuming states manifesting the functional characteristics that account requires” (Fodor 1968, p. 235).

The latter quotation is interesting for several reasons. First of all, Fodor wants to bring in some constraining factors that can discern functional explanations from a type of “anything goes” theories. Yet, he admits that the demarcation criterion he presents is highly disputable, and therefore he acknowledges that the criterion is probably too strong, or maybe even wrong. A moderated version could therefore be that if the explanation contradicts common sense, either among ordinary people or scholars, the explanation has to be rejected. This implies anyway that there must exist some criteria based on which some explanations can be refuted, and as far as these criteria exist, each one of them will count as a sufficient reason for refuting the explanation. This is not the same as saying that the theory is falsifiable in a logical sense. The refutation can for example be based on a common sense decision made by a certain group of stakeholders. However, this decision could also be derived from obvious facts. Although both criteria may count as sufficient reasons for refuting the theory, they have different statuses from a logical point of view. In the first case, the refutation could, for example, be based on good conscience—what a group regards as reasonable or not. This type of refutation could be a consequence of some practical, religious or even juridical reasons. These can all be compelling, but not for logical reasons. Thus, from a logical point of view, a refutation on this background is not given by necessity. A refutation derived from obvious facts on the other hand is given by necessity for logical reasons (Hempel 1966):

$H_0$ : Catalysts do not have any effect on the disproportionation of hydrogen peroxide to water and oxygen;

As the evidence shows: Added manganese dioxide makes that hydrogen peroxide reacts rapidly;

$H_0$  is not true.

In other words, in the case of catalysis, the catalyst counts more as a sufficient reason given by necessity, compared with a refutation based on some sort of agreements. The aspect of necessity is, in other words, rather related to a question about degrees than a question about either–or. The reason is that the hypothesis ( $H_0$ ) and the observed situation are two incomparable spheres given by thinking and sensation, respectively. This points at the problem with both falsification and verification, specifically that the general hypothesis and the particular observation will never coincide, and a hypothesis can neither be completely confirmed nor completely refuted. The traditional argument against falsification, which says that there is an infinite amount of hypotheses that can be related to and therefore explain an event can also be applied to confirmations. If one hypothesis is rejected or confirmed, there are

still an infinite number of hypotheses left because infinity minus one, or even minus thousands, still equals infinity. The hypothesis that is not falsified is not necessarily more correct than the other that is falsified. However, when it comes to statements belonging to each one of the two spheres, they are comparable individually. One fact may contradict the other, and because of the principle of contradiction, we have to choose one or the other. The same is true for theories as long as they contradict; then we have to make a choice. The same is also true when different theories are both confirmed. The rule is often that we choose the simplest one, which is solely a pragmatic criterion. Thus, this choice can be made on different bases, and the point here is that we experience an explanation as more or less likely owing to its level of necessity, but sometimes a low level of necessity is sufficient for accepting the explanation. This is what happens when we choose the simplest theory or when Murphy's Law is applied, for example.

Fodor's presentation of functional explanations demonstrates the same fact, specifically that explanations may be of a great variety and represent different degrees of likeliness. According to him, they are understood very widely, and he does not make any distinction between different types either. Thus, functional explanations are close to a category that may be labelled as "anything goes". There may exist some constraining factors that can narrow this down, and if so, these may serve as sufficient reasons for refutation. Yet, the reasons Fodor presents are not given by necessity, but rather given by common sense based on certain beliefs or values. In this respect, Fodor's presentation of functional explanations has not made us wiser when it comes to functional explanations given by necessity. This is probably why some rather refer to "functional analysis" than "functional explanations". According to Cummins, functional analysis is "the application of property analysis to dispositions/capacities" (Cummins 1983, p. 28), which in science implies the following: "to ascribe a function to something is to ascribe a capacity to it that is singled out by its role in an analysis of some capacity of a containing system" (Cummins 1983, p. 28). In other words, nothing is given by necessity in a functional analysis. The researcher has to define the role of a capacity owing to an unspecified context. In this respect, functional analysis is referring to a quite loose understanding of the effect as an explanation of the cause. Yet, this type of explanation is not only characterising Fodor's discussion of functional explanations but also seems to be a proper understanding of "functionalism" in general: an unspecified direction of causality in which both the effect may explain the cause and the cause may explain the effect.

### *A Strict Understanding of Functional Explanations*

As a reaction to the "anything goes" discourses, especially in a Marxist-influenced rhetorical style in social sciences in the 1960s and 1970s, Jon Elster tried to sort out what is and what is not acceptable to present as scientific explanations in general (Elster 1994). Yet, this study on Marxism is highly related to some other publications of the same author. This includes also a study in Norwegian, in which he presents how the three sciences—physics, biology and social sciences—are characterized by

three different types of explanations (Elster 1979). In physics, causality in terms of a necessary relationship between cause and effect is regarded as an inevitable sort of explanation. Biology is characterized by functional explanations, whereas social sciences are characterized by intentional explanations based on the theory of rational choices. The point and conclusion of his study is that a functional explanation has to be defined in a strict sense, which reduces its area of application to biology, and the only acceptable forms of explanations in social sciences are different sorts of intentional explanations. His conclusion, in other words, is that functional explanations must be rejected in social sciences (Elster 1979). Yet, this presupposes an exact and clear distinction between intentional and functional explanations.

“Intentional explanation cites the intended consequences of behaviour in order to account for it. Functional explanation cites the actual consequences” (Elster 1994, p. 27). This quotation may serve as a definition of the overall difference between the two types of explanations. Yet, a full understanding of functional explanation requires an elaboration. Elster suggests five aspects that characterize a functional explanation (Elster 1979). (1) We are first of all focusing on the effect of “something”, and not about the cause. This “something” could be a substance, an organism, a capacity, a certain pattern of behaviour or an institution. (2) The effect or consequences of “something” are beneficial for the same “something”. (3) The effect or consequences are accidental in the sense that those who are responsible for this “something” do not consciously intend to end up with them. (4) Those that are responsible for the effect and consequences of “something” have not acknowledged or realized the beneficial consequences. (5) The effect and consequences maintain this “something” by means of a causal feedback through those who are responsible for this “something”, but still do not realize the beneficial consequences of it.

Thus, the most outstanding characteristic of a functional explanation is the fact that it is blind. There are no connections between the intentions the agents may have and the outcome. It is solely the unacknowledged beneficial consequences that provide the existence, and not any sort of intentions. For example, it is not sufficient to say that an institution was established on the basis of a certain purpose, whereas it functioned in an almost opposite way. Foucault’s analysis of reforms of punishments may count as an example (Foucault 1977). Although the presented argument for making reforms was based on the purpose of increasing the prisoners’ dignity, the result was rather that the punishment became more effective; hence, it was not the dignity aspect that sustained the new forms of punishment, but rather their efficiency. To compare this with the 5-point scheme presented above, the explanation Foucault presents for the reforms in punishment would be as follows: (1) The unintended effect of the reforms in punishment is stronger discipline. (2) Stronger discipline is beneficial for the government. (3) The argument presented for the reforms is to make punishment more human. (4) The government will not admit that the reforms make the punishment more efficient. (5) The efficiency of punishment is the actual reason for continuing to make reforms. Yet, in such cases, there are still agents that actually do have these intentions. They want to fortify the punishment rather than make it human. In those cases, there are some agents that are very well aware of the consequences. On this background, Elster states that in social sciences criteria 4



and 5, namely unacknowledged consequences combined with feedback effects from the consequences, are never satisfied at the same time. This is a strong statement, but it sounds reasonable in terms of the fact that the criterion for an explanation is that *explanans* (the explanation) must be able to explain *explanandum* (the event that shall be explained) with necessity. This criterion combined with the fact that human beings are characterized by having intentions and the capacity of analyzing a situation, makes it hard to say that unacknowledged effects alone are able to explain institutions made of human beings.

On this background, there are three different explanations that can be combined with a sort of necessity. First, we have mechanical or efficient causality, which primarily dominates physics and natural sciences, but is also applied in social sciences and humanities. Second, we have functional explanations that primarily can be justified in biology in terms of natural selection. Yet, we have seen that functional explanation can be applied in chemistry when it comes to the role of catalysis. Still, the catalyst represents a blind effect, which has a certain feedback on the chemical reaction. However, both in biology and chemistry, the functional aspects represent a sort of constraining environment that forces the causal process in a certain direction. Third, we have intentional explanations, which are given by necessity in social sciences and humanities. Although causal explanations are valid in those sciences, functional explanations seem to be hard to accept without ending up with intentional or mechanical factors. Anyway, there are some constraining factors that determine the situation in social sciences and humanities as well, but these rather determine the individual choices, which bring in the intentional aspects again.

Nevertheless, there are no reasons to reject functional explanations. Although there are some overlaps with mechanical and intentional explanations, one or the other type of functional explanation is hard to get rid of and therefore seems to stand on its own feet. So far this investigation tells us that the definition we started with, namely that functional explanation is characterized by regarding the effect as the cause, seems to be valid still. Yet, the effect has to be understood in a way that includes finality. This is the way Aristotle understood functionality and he connected it with teleological explanations. To regard the effect as the cause is to put the cart before the horse, and to regard finality as a cause is to assume an unidentified purpose. Neither sounds very rational nor scientific, but in that sense, they are in the same category as Murphy's Law, which make connections that are impossible to trace. Yet, this is exactly the meaning of "function" in functional mathematics. The tag number, the car and the owner have nothing in common, except sharing a common destiny of being brought together, but in this respect, they are inseparable. On the other hand, a functional explanation can refer to a very strict understanding of the development of the species, and help us to trace the origin of each one of them. The same is the case for the catalyst in chemistry. In other words, the term "functional explanation" can refer to a great variety of forms of explanations, but they still have in common the emphasis on effect. So far it is hard to put them into more specified categories, but this stands left to investigate and hopefully achieve something by pursuing necessary and sufficient reasons as constraining factors.

## Necessary and Sufficient Reasons

When the philosopher and physicist Stephen Toulmin should enquire explanations in science, he ended up talking about understanding instead (Toulmin 1963). “Explanation” represents something decisive, whereas “understanding” rather may refer to a kind of familiarity with something, without specifying how rich and deep the understanding actually is. Thus, there is a continuous scale of gradual transference from obvious acceptable explanations to obvious tentative and hardly acceptable forms of understanding. It is in this respect that we are talking about explanations given by necessity or sufficiency, or neither of them. Although it is hard to find the criteria on which different sorts of explanations are based, especially because “necessity” is a logical term and “explanation” an empirical, we have an intuitive understanding of what is given by necessity, although it is mixed up with some degree of uncertainty.

It is basically the same with necessary and sufficient reasons. On the one hand, both types of conditions may be understood strict and logical. Thus, the sufficient condition can also be defined in terms of:

If A, then B.

That A is a sufficient condition for B implies that if A occurs, B will also occur, but if B occurs, A will not necessarily occur (Næss 1971). A necessary condition may similarly be defined in terms of:

If B, then A.

That A is a necessary condition for B implies that if B occurs, A will also occur (Næss 1971).

However, we have in addition an everyday use of both types of reasons, which is very different. In regard to sufficient reasons for accepting something, we will admit many types of persuasive arguments. They do not even have to be logical, but rather emotional. One example would be “because you deserve it”, you just have to buy it. Especially when the persuasive effect is dependent on emotions, there will be no strict distinctions between what is given by necessity and what is not. As long as one is obsessed by a certain thought, this thought is from a subjective point of view as if it is given by necessity. This is the car buyer syndrome: one starts with thinking about a reasonable car, but after having visited the car dealer the third time, one is obsessed with a certain standard, which is normally high above the starting point, and the final decision of buying exactly this car is almost given by necessity.

## *Schopenhauer*

In this respect, every decision is based on a certain reason, which is regarded by someone to be sufficient to say that it is both reasonable and meaningful. This is very much the foundation for the philosopher Arthur Schopenhauer to build a complete philosophy on the principle of sufficient reason. In his terms, this principle is formulated quite simply as “Nothing is without a reason for its being” (Schopenhauer 1903, p. 5). Although Schopenhauer has been accused for not being a very

reliable philosopher, his method for investigating this principle is highly relevant in this context. As the foundation of his method, he applied what he calls “the law of homogeneity and the law of specification” (Schopenhauer 1903, p. 1). These two laws, or rather strategies we may say, imply that it is important to highlight and specify distinctions between phenomena. However, this does not stand in opposition to the fact that the phenomena are to be regarded as related to each other in a certain way, like in nature, where exemplars are collected “into species, species into genera, and so on” (Schopenhauer 1903, p. 1). These two laws, which more or less guide the intellectual activity, make the discussion sensitive to distinctions and connections at the same time. Yet, the principle of sufficient reason is a principle that emphasizes the latter, namely connections, but opens up for the former, namely distinctions.

The four reasons Schopenhauer ended up with, specifically “becoming”, “knowing”, “being” and “willing”, could have been relevant in this context, but not at this stage of the discussion. The same is true when it comes to both Leibniz’s and Wolff’s use of the principle of sufficient reason. When it comes to these three philosophers, they are applying the principle as a basis for their ontology, although Wolff admits that there is a psychological need for bringing in a sufficient reason to explain a certain act or behaviour (Wolff 2005, § 70 ff.). In other words, the principle of sufficient reason is regarded as an overall principle that provides (1) logical inferences, (2) explanations in natural sciences, (3) explanations in humanities and (4) a general understanding of something. Accordingly, keeping in mind Schopenhauer’s method by regarding this in terms of the laws of homogeneity and specificity, we may find out if there are any distinctions and concurrences here.

On this background, we may conclude that there are at least three different types of reasons. The first one is (1) *necessary reasons*, out of which the most obvious appearances are connected to causality in physics, specifically theoretical physics. Gravity is theoretically regarded as a necessary condition for the fact that the apple will fall to the ground if the stem detaches from the branch. The second and third would be the two different types of sufficient reasons. One is (2) *sufficient reason given by necessity*. This is best exemplified by the catalyst’s role in a chemical reaction. The catalyst is neither a necessary nor a sufficient condition for having a chemical reaction, but it is sufficient for enforcing and intensifying the reaction. The catalyst is a sufficient reason by necessity because it *always* enforces and intensifies the chemical reaction by its presence, but as there may be other metals or aspects (like temperature, certain wave frequencies in the air or in the water etc.) that can provide the same catalytic effect, it is not a necessary condition. The last type of reason is just (3) *sufficient reason*, which is an open principle, whose purpose is to provide an understanding of a situation or an event based on the statement that “Nothing is without a reason for its being”. All these three types of reasons share some similarities in the sense that they define the conditions for our understanding and consequently belong to a common category. In this respect, the law of homogeneity covers them. Yet, on the other hand, they are in principle quite different and operate on different levels of precisions, which make them also to be covered by the law of specificity (Table 4.1).

**Table 4.1** Characteristics of reasons

Types of condition for reason	Characteristics
Necessary	If A is a necessary reason for B, then if B occurs, A will always occur
Sufficient by necessity	If A is a sufficient reason by necessity for B, then if A occurs B will always occur
Sufficient without necessity	If A is a sufficient reason without necessity for B, then if B occurs, there must exist at least one A that may count as a reason for B

**Table 4.2** Characteristics of explanation

No.	Type of explanation	Characteristics
1	Causal (mechanical)	A specified event that determines a specified outcome
2	Functional	A specified effect that determines a specified but general specie, property or capacity by means of specified genetic and environmental causes
3	Intentional	A specified purpose that determines a specified outcome
4	Catalysis	An unspecified effect on a process that includes causal explanations
5	Functionalism	An unspecified direction of cause and effect
6	Understanding	An unspecified connection between some specified events

## Relationship Between Explanations and Necessary and Sufficient Reasons

When Toulmin talked about understanding instead of explanations (Toulmin 1963), the conclusion must primarily be understood in terms of “the law of homogeneity”. In the effort of achieving a paramount and adequate understanding of explanations, the common ground for all sorts of explanations must be the need of obtaining a sort of connection between phenomena, and this sort of making meaning by placing something in a context in a looser or stricter way is probably what characterizes our use of the term “understanding”. Thus, understanding does not contradict “the law of specificity”, which helps us make some distinctions between different sorts of explanations. In this respect, it is not necessary to bring in all the different types of explanations, but just summarize some of those that seem to be valid in the modern science of today and relevant for this discussion. Accordingly, there seem to be six main categories of explanations that are at stake here: (1) causal explanations, (2) functional explanations, (3) intentional explanations, (4) catalysis, (5) functionalism and (6) understanding. Hence, we do not have to include all the three other types of explanations Aristotle referred to, the four types from Schopenhauer (1903) or other types of explanations, but they are not excluded either (Table 4.2).

We see now that the six types of explanations represent six different levels of specificity and that they can be divided into two subgroups. The first three are more specific than the last three. The first three refer to a specific connection between cause and effect. The three latter forms are rather unspecific when it comes to the

relationship between cause and effect. This is a crucial distinction because a common sense understanding of a scientific explanation is that the connection between cause and effect is to be specified. However, what this investigation has demonstrated so far is that catalysis is a type of explanation in natural science that operates with an unspecific connection between cause and effect. Yet, this is not sensational in natural science. As long as theoretical complementarity is applied, like when light is understood both as a sort of wave and a sort of particle at the same time, the understanding of light as such is still an open question. However, this is no problem in practice. We can still find out the distances to stars by treating the light as waves, and we can analyse the light's energy by treating it as if it consists of particles. In this respect, there are unspecified connections between cause and effect, but we accept this as the understanding of light anyway. This is why all the six types have to be included as scientific explanations.

If we now compare the six different types of explanations with the three different types of reasons, we may hopefully end up with an increased specification of the explanations. This will tell us the explanations' level of precision as well. Although a (1) causal explanation is not as applicable as we would like it to be, there is no doubt that it represents the strictest type of understanding with a high level of precision in those cases where it occurs. This type of explanation satisfies both necessary reasons and sufficient reasons given by necessity. Gravity is both a necessary and a sufficient reason for the fact that the apple will fall to the ground if the stem is detached from the branch: without gravity, the apple will not fall.

When it comes to (2) functional explanations it is not that easy to put it into a proper category. Yet we have already made a distinction between functional explanations and functionalism. This implies that functional explanations have to be reserved to how it is applied in biology in terms of natural selection. Because of the presentation given in this chapter, causality forms the basis also in functional explanations in the sense that mutations represent the cause for why a certain organism has obtained beneficial properties. These properties may also not be beneficial for the organism, and if so, the organism will become extinct. In this sense, a functional explanation presupposes blindness in the sense that it is not the end that explains the survival of a species, but a random occurrence of a mutation combined with a randomly given environment. This blindness presupposes, of course, an abundance of individuals, which is certainly the situation for some species, but not necessarily for all. For this reason, Fodor and Piattelli-Palmarini (2011) accuse Darwinism for committing an intentional fallacy by stating, "evolution is a process *in which creatures are selected for their adaptive traits*" (p. xvii) on the basis that "evolution is a process in which *creatures with adaptive traits are selected*" (Fodor and Piattelli-Palmarini 2011, p. xvii). In other words, the fact that some species by necessity have developed beneficial characteristics by means of random mutations and natural selection does not imply that all species by necessity have developed beneficial characteristics solely by random mutations and natural selection. There may be several other explanations, and the condition, specifically the necessary abundance of individuals, may not have existed. In this sense, the causality in functional explanations is not to be regarded as a necessary condition given by necessity in all cases but still appears as a sufficient reason given by necessity in those situations in which it is reasonable to be applied.

It is quite common in psychology to include (3) intentional explanation as a part of (2) functional explanations. However, with the specification of functional explanations presented here, this integration will be impossible. They rather contradict each other in several ways, and especially in regard to the role of intentions. Functional explanations are characterized by blindness, which is completely excluding any type of intended plans, whereas intentions form the core characteristics of intentional explanations. The intentions or purposes even have to be explicit. Immanuel Kant has already characterized “unconscious intentions” as a contradiction in terms, which is also emphasized by Elster (1979). This signalizes that intentional explanations are to be regarded as given by a sort of necessity, or at least that necessity is a sort of ideal and realistic achievement. The reason is that social phenomena are hard to explain unless one is able to trace a certain intention or purpose behind their occurrences. As long as purposes are traceable in records, social phenomena are easy to explain. Yet, the problem is that the great amount of intentions and purposes have very often never been articulated or recorded. They have rather remained within the inventor’s minds. Especially if there is a group standing behind a social phenomenon or an institution, which very often is the case as well, it is certainly difficult to trace the type of intention that forms a sort of necessary condition for its existence. Especially in history, the phenomenon to be explained may have changed and therefore may have appeared as something else because new decision makers with new intentions would have come in and made the changes. Although we may refer to the same institution, building or social phenomenon, it could have been one thing originally and something else later on. This has caused Elster to distinguish between different sorts of intentional explanations by introducing the terms “subintentional causality” and “supraintentional causality”. The former includes individuals’ wishful thinking, reduction of cognitive dissonance, biases and unrelated motivation and the latter refers to an aggregated cluster of notions and motivations, which make the intentions rather diffuse (Elster 1994). In this respect, intentional explanations are touching the whole spectrum of conditional factors in psychology. Intentional explanations do include aspects of necessity in the sense that an act presupposes a purpose, and this purpose is a necessary reason for the act. Yet, when the act is performed as a result of an order, it is not this person’s intentions that are followed, but another’s, who may even be unidentified. The fact that the order is given is sufficient, but not a necessary reason for the act that is performed. Thus, intentional explanations may gradually move over to serve as sufficient reasons, and even to the looser versions, especially if the forcing condition for an act is an unidentifiable person or even undetectable circumstances. There is at least one more or less certain intention behind a social phenomenon or an institution, and this is sufficient to achieve an explanation. Sometimes this can be so strong and well articulated in the records that we may talk about causality in terms of being a necessary reason. This was the situation when parliamentarism was introduced in Norway in 1884 for example. This historical change required that someone agitate for parliamentarism, and the politician Johan Sverdrup did so. He was also nicknamed “The father of Parliamentarism in Norway”, which tells us that he was the reason for this political change. Yet, he was not a sufficient reason by necessity because this change of

political system had to be approved by King Oscar II, and he was rather reluctant to this reform. In this sense, the king could have been a sufficient reason by necessity, but Johan Sverdrup's resistance caused him to not be one. Several individuals and the whole Norwegian population contributed to force the king to approve, and in this sense, almost each individual within the Norwegian borderlines contributed to this, but we do not have any records telling us what each one of them actually contributed. The whole Norwegian population therefore represented a sort of reason for why the king was forced, but it is more diffuse. Therefore, the pressure from the whole Norwegian population was sufficient to make a change, but it is hard to specify exactly how there should be a connection between each individual's opinion and the king's decision. In other words, by being nicknamed "The father of Parliamentarism in Norway", Johan Sverdrup was regarded as a sufficient reason without being the only reason for the political change. In this sense, he was an important factor, and probably the most important factor along with a lot of other unspecified factors, like the people's will for example. Because of all the other factors, but Sverdrup as the most specific, Sverdrup could be regarded as a sufficient reason, but not in a strict sense and therefore without logical necessity.

Some similar aspects are also recognizable when we talk about (4) catalysis. According to the density functional theory, the catalyst's impact on the chemical reaction may be explainable. What is recognizable is the fact that the catalyst is a third and not so definable part in the chemical process. In this sense, the catalyst counts as a sufficient reason for making the reaction stronger and more efficient. The certain metal applied is not necessary but rather sufficient because there may be other metals or even other factors that will trigger the same type of reaction. The same could be said about the process of decision-making in the earlier example from Norwegian history, namely that a certain individual takes the decision, but there would be a lot of other factors that have influenced upon it. In this respect, the individual would be the direct cause to the decision made, but very often it would have been triggered by a lot of different factors, like colleagues, as well as quite peripheral factors like a certain mood or whatever. Yet, these factors would represent a great variety and are quite unpredictable in the sense that it would be impossible to decide which of those two factors that actually set off the certain decision on exactly that day. Hence, the psychological situation is analogous to the chemical situation in some respects, but not in all. The difference is of course that it is hard to decide which factor that appeared as the compelling force triggered the very decision. The reason is that the factors involved are human beings, and each one of them has a free will that can go in different directions. The same is true for the decision-maker as well, of course. One may narrow down the environment, but the unpredictability will still be there because the individuals have free wills, which make the situation very different from a chemical process.

On this background, catalysis may refer to two separable situations. One is in chemistry, in which a specified metal or circumstance has a demonstrable impact on a certain chemical reaction. In this situation, the catalyst counts as a sufficient reason for making the chemical reaction stronger and more efficient. It is also predictable in the sense that by bringing in this metal or factor, the chemical reaction will always be

intensified. The other situation may also appear in chemistry in the sense that there may be different catalysts and factors that can trigger a specified chemical reaction, which does not appear without the catalysts. In this situation, we do not know exactly the causal sequences in the sense that the catalysts seem to represent a type of cause, although they are untouched at the end of the chemical process. In this sense, the catalyst can rather be regarded as a constraining factor in which the causal sequences are highly unclear, but still count as an explanation for the efficiency of the process. This is a situation that can be comparable with a psychological situation, like in decision-making as mentioned. However, these two situations are still discernible in the sense that the first situation indicates that the catalyst is a sufficient reason given by necessity, whereas the other is a sufficient reason not given by necessity.

What is called (5) functionalism is of a very different type of explanation. We actually do not know very much about the causal sequences, and if we are able to trace some, there must certainly be many others as well. Thus, the only thing we can deal with is the effect and not the cause itself. As may be obvious, these represent a group of explanations that are neither logically nor intellectually fully satisfying. We nonetheless accept them as a type of sufficient reason, but not in a logical way. In this context, the term “sufficient reason given by necessity” is reserved for a situation in which the reason is given as if it is by logical necessity: A by necessity always implies B, but B does not by necessity always imply A. So when the reason is not given by necessity, we are not dealing with reasons as result of logical inferences, but rather with reasons as a psychological need, so to speak. This is the need for making meaning out of an situation and this is what Ernst Cassirer calls “mythical thinking”, which “has a free selection of causes at its disposal” (Cassirer 1955, p. 46). Yet, according to Cassirer, this does not contradict the “empirical thinking”, which makes “an unequivocal relation between *specific* ‘causes’ and *specific* ‘effects’” (Cassirer 1955, p. 46) in the sense that empirical thinking also is a sort of mythical thinking: “Thus taken abstractly, both the mythical and the scientific explanations of the world are dominated by the same kinds of relation: unity and multiplicity, coexistence, contiguity and succession” (Cassirer 1955, p. 60). However, thinking in causes and effects is different from a pure mythical thinking, and they represent different aspects in our understanding of the world. It is also a requirement to make distinctions between different forms of understanding the world, to exactly obtain different sorts of meaning. On this basis, it is meaningful to make a clear distinction between (2) functional explanations and (5) functionalism. Yet, owing to the two laws of specificity and homogeneity, they neither exclude each other nor appear as identical. They have different forms in the sense that the mechanical cause and effect is more closely related to the logical notion of necessity, whereas the latter has a free selection of causes at its disposal and is detached from any logical criteria of necessity.

On this background, it is interesting to quickly again bring in the retrospective look at some aspects of the appearance of functionalism and functional explanations in the history of psychology. So far, functional explanations are narrowed down and are to be defined in terms of natural selection as it is presented in Darwinism. Thus, the conclusion in this chapter is to make a distinction between functionalism and Darwinism. If we go back to the one that is regarded as the founder of functionalism in psychology, namely James Rowland Angell, we will see that he did not make any distinctions between functionalism and Darwinism: “functional psychology [...]



has been increasingly in evidence since Spencer wrote his *Psychology* and Darwin his *Origin of Species*" (Angell 1907, p. 62). By referring to the *Origin of Species*, he is referring to the mechanism of natural selection and specifically functional explanations. Yet, this is not specified, like it is not in James' 1884 article on emotions either. On the one hand, James also talks about Darwin as the one who has presented a universal understanding of development (James 1884, p. 190 f.), but on the other hand, he is also referring to Darwin's work on emotions (James 1884, p. 190; Darwin 2009). Those two works of Darwin must be said to be different in the sense that the latter does not discuss natural selection, but rather focus on bodily forms of expressions as a basis for explaining emotions. This is the aspect John Dewey was pursuing when he aimed at bringing "Darwin's principles as to the explanation of emotional attitudes, and the James-Lange theory of the nature of emotion [...] into some organic connection with each other" 10 years later (Dewey 1894, p. 553). This connection is more or less fulfilled in Dewey's discharge theory of emotions, which tells us something about the relationship between functionalism and functional explanations. "My proposition at this point is that the phenomena referred to the principle of direct nervous discharge (the response to an idiopathic stimulus) are cases of the failure of habitual teleological machinery, through some disturbance in one or more of the adjusted members of the habit" (Dewey 1894, p. 560). In other words, the inhibition in achieving intended goal is producing emotions, which are expressed in a bodily reaction. This includes, by necessity, some teleological aspects. Yet, the teleology in this situation is to be defined in terms of certain intentions. In other words, functionalism in this situation does not include efficient causes, like we found in functional explanations, but rather intentional causes.

In this retrospective perspective also behaviourism is interesting in the sense that especially B.F. Skinner referred quite frequently to Darwin (Skinner 1976). Fodor and Piattelli-Palmarini (2011) make a great point out of the coincidences between Darwinism and the theory of operant conditioning: "In fact the two theories are virtually identical: they propose essentially the same mechanisms to compute essentially similar functions under essentially identical constraints" (p. 3). They continue: "both are about how traits in a population change over time in response to environmental variables" (p. 5). They both also deny mental causes, and in this respect "Darwin was right [...] but] Skinner was wrong" (p. 13). It is in this respect Fodor and Piattelli-Palmarini can state that Skinner commits an intentional (with an "s") fallacy. Skinner presupposes a separation of behaviour and intentions and regards them as independent entities, whereas they are in fact two sides of the same coin and cannot be separated at all. When it comes to behaviour, it is completely dependent on intentions, and in this respect, it is explained by mental causes. Fodor and Piattelli-Palmarini endeavour to persuade the reader that Darwin also committed the same fallacy. Yet, the argument is not as strong and persuasive, although their arguments make sense because the theory of natural selection presupposes an abundance of individuals to create favourable mutations, and it is not very likely that they can be traced back to the development of higher primates. This does not logically exclude the possibility of natural selection as an explanation for the existence of these species though.

## Conclusions

The aim of this chapter was to investigate to what extent catalysis can serve as an explanatory term in psychology. The conclusion is that catalysis in chemistry has to be regarded as something different from catalysis in psychology. Yet, the term can also be used in psychology, but if so, it refers to something else than what is referred to in chemistry. The difference is based on a nuanced understanding of sufficient reasons, which is used in two different meanings in the literature. On the one hand there is a logical understanding of sufficient reason, which implies that by sufficiency a specified reason is given by necessity. On this background, one may say that catalysis in chemistry forms a sufficient condition for enhancing the chemical reaction, whereas catalysis in psychology rather counts as a sufficient reason without any compelling factors given by necessity. In this respect, there are no clear differences between the use of catalysis and functionalism in psychology.

Several philosophers have applied sufficient reason in a not so strict meaning to have a criterion for meaningful explanations. One of them is Schopenhauer. His law of specificity was applied to make distinctions between the explanations and the criteria applied to specify them. The distinction between sufficient reason and sufficient condition is one of them. Similarly, the law of homogeneity was also applied, not only for saying that there is a connection between sufficient reason and sufficient condition but also to make a connection between the different explanations. Thus, there is a continuous line between the explanations and their reasons, which also results in overlaps between them. Therefore, catalysis in psychology must be understood in this perspective, which makes that it may appear as a metaphor as well as that it adequately explains influences circumstances and situations may have on individuals or a group of people.

This is a sort of connection, which was also traced between functionalism and functional explanations. Functionalism was brought in because the process of catalysis is normally explained in terms of the functions of the catalyst. Yet, it was demonstrated that functionalism could be distinguished from functional explanations in biology and intentional explanations in social sciences and humanities. The latter two forms of explanations are more strict and specified in the sense that it is possible to trace and pursue the parts in a series of causes. This is not the case in functionalism, which is rather a way to make meaning out of something that is not characterized by an explicit and traceable causal sequence, and therefore is very close to a general understanding. Hence, when catalysis is applied in psychology, it is primarily used in the latter meaning, which is a situation where there are some constraining factors, but where the causal sequence is impossible to specify. On this background, we have dealt with six different forms of explanations and evaluated them in terms of “sufficient reason”, “sufficient reason given by necessity” and “necessary reason”. This can be illustrated in a table in which the X will show which forms of explanations are satisfying which criteria (Table 4.3).

The brackets signify that the explanation just partly satisfies the criterion of being a necessary reason. This emphasizes the problems with putting these terms into such strict categories as the table represent. Because the terms are rather empirical

**Table 4.3** Criteria different forms of explanations

	Sufficient reason	Sufficient reason by necessity	Necessary reason
Efficient cause		X	X
Functional explanations		X	(X)
Intentional cause	X	X	(X)
Catalysis	X	X	
Functionalism	X		
Understanding	(X)		

than theoretical, there are no strict boundaries between the categories. They are to be regarded as stations on a continuous line, which is continuous because of the law of homogeneity, but the stages are also possible to discern because of the law of specificity. In this sense, the table does not take into account the law of homogeneity, but rather emphasizes the law of specificity. On this background, there are some similarities between the different sorts of explanations, and also between catalysis applied in chemistry and psychology; however, these similarities do not exclude or contradict emphasising the distinctions as well. In other words, there is no problem to apply all the six types of explanations, but one has to be aware of the fact that they are different and represent different levels of precision.

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**Part III**  
**Biosemiotik Considerations of Cause and**  
**Catalysis**

## Chapter 5

# Semiotic Scaffolding: A Biosemiotic Link Between Sema and Soma

Jesper Hoffmeyer

The scientific understanding of the body, as developed in the medical and biological sciences, has never distanced itself from its basis in Cartesian sensory mechanics, the belief that the world reaches us through the mechanical (physicochemical) workings of the sensory system. And yet, the problem of how mechanical processes could possibly transform themselves to thoughts and ideas has never been decently answered, although metaphorical talk of “programming” or “information processing” may have created the illusion that the tools for a solution were now at hand. To get out of this impasse, we shall have to challenge the basic premise for these ideas; the belief in sensory mechanics as an exhaustive explanation for how the outer world enters our mind; instead of *sensory mechanics* we shall have to take *sensory semiotics* as the point of departure in the life sciences. The world around us reaches us through sign processes, semiosis, i.e., our lives do not play out in a mechanical body but in a semiotic body. Biosemiotics, the sign-theoretic or semiotic approach to the study of life and evolution is based on the understanding that biochemical processes are organized in obedience to a semiotic logic (Sebeok and Umiker-Sebeok 1991; Hoffmeyer 1996, 2008a). Molecular structures are not just chemical entities; they are also potential sign vehicles mediating communicative activity between cells, tissues, and organs of our body or between bodies.

This semiotic reframing of our fundamental ideas of life and organic evolution has obvious consequences for our understanding of that peculiar species of animals to which the authors as well as the readers of this book belong. One important consequence is that the human genome cannot be considered a “master plan” or controller of human development. As will be shown in this chapter, the genome is better understood as a semiotically controlled scaffolding system. However, as a scaffolding system, the genome is only the most basic form; multiple semiotic scaffoldings of a more and more overriding range are built on the top of the genetic scaffolding system, and most important in the context of cultural psychology, semiotic scaffolding systems painlessly bridges the mind–body gap, being in their function as controllers,

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essentially somatic and social, in one and the same process. The three instances or events brought together in a sign process, the sign vehicle (e.g., smoke), the object (e.g., fire), and the interpretant (e.g., fear), may—and most often do—belong to different hierarchical levels, as when a certain taste of crumbs of a madeleine cake dissolved in a cup of tea releases a strong emotional bodily memory in a person of long forgotten childhood Sunday mornings. Here, a certain combination of taste-provoking molecules constitutes the sign vehicle. The forgotten Sunday mornings is the object to which the sign vehicle refers, and the interpretant is the sudden feeling that Marcel Proust in his famous novel expresses in these words: “And at once the vicissitudes of life had become indifferent to me, its disasters innocuous, its brevity illusory—this new sensation having had on me the effect which love has of filling me with a precious essence; or rather this essence was not in me it was me. . . .” (Proust 1913–1927).

This, of course is a perfect example of what Jaan Valsiner called semiotic catalysis: the sign process here acts as a catalyst for the production of an unexpected insight, that might not otherwise have come to mind, an insight, furthermore, that has no intrinsic relation to the sign vehicle itself, the mixture of molecules releasing its production (Valsiner 2000; Kull this volume). As we shall see, this explanatory principle may be generalized to cover processes at cultural levels.

Needless to say, a semiotic understanding of life processes runs counter to deep ontological intuitions not only in the scientific society but also in the humanities. Before we can proceed with the biosemiotic analysis, it may be necessary to consider the legitimacy of these intuitions.

## **The Taboo Against Final Causality**

When the toddler rises to her feet from under the table and bumps her head into the tabletop, she learns that it hurts because of something she herself did. You cannot bump into hard, heavy things, such as tabletops without hurting yourself. The child spontaneously and inwardly comes to know the workings of that causality which David Hume saw as a purely psychological phenomenon and Immanuel Kant understood as an a priori category of reason. Neither Hume nor Kant related causality to the simple bodily experience from which our conception of causality necessarily originates. The concept of “force” is ultimately a biological concept rooted in bodily movements, and the effects that flow from the use of force are experienced as caused by the force we have to spend in order to surmount the resistance that nature (or other people) raises against our actions. When we ascribe the mutual pulling of the celestial bodies to the workings of a gravitational force, we are therefore in effect projecting our bodily experiences onto the world at large. Thus, we provide the nonliving nature with a kind of bodily dynamics, which science, paradoxically, subsequently has used to “prove” that living nature basically is nothing but dead nature, DNA molecules, particles in motion.

We know about the world because we are in constant interaction with it, not just because our sense apparatus picks up signals from it, and this simple fact has far-reaching implications for the everlasting standstill between science on the one hand and transcendental philosophy or phenomenology on the other hand. The fact that we can project our bodily experienced causality into the world at large and derive trustworthy and nonfalsified understanding from it allows us to abductively reach the strong hypothesis that the world is in a deep sense of the same kind as is life. One important implication of this is that natural science cannot uphold its ingrained taboo against final causation, another—perhaps even more important—is that the claim of transcendental philosophy or phenomenology for a distinction between observable *phenomena* and indefinable *noumina*, becomes seriously weakened: if causality is basically rooted in bodily experience the idea of the thing-in-itself (das Ding-an-Sich) loses much of its substance (see later).

Ever since Francis Bacon's days science has considered it a "deadly sin" to explain the workings of nature in anthropomorphic terms: "... human understanding is like an uneven mirror receiving rays from things and merging its own nature with the nature of things, which thus distorts and corrupts it" wrote Bacon in the *Novum Organum* (Bacon 2000/1620, p. 41). The truth of this warning notwithstanding, it should be noticed that while a taboo against anthropomorphism in science was both rational and legitimate in Francis Bacon's own time, when humans were still thought to be the direct creations of God, it obviously became absurd from the moment Darwinism was accepted. According to a Darwinian understanding, humans were themselves products of nature and the very existence of human mental life, and the purposes implied thereby, would thus be in downright contradiction to the taboo against anthropomorphism and final causation in natural science. That some philosophers and scientists have felt it necessary to adopt the position of so-called eliminativism, the belief that mental life is an illusory or meaningless concept, speaks volumes of how deeply the taboo against final causation is rooted in the scientific ontology. Apart from the absurdity of denying the reality of human mental life, eliminativism itself ends up in absurdities; the pursuit of knowledge is a purposeful activity, and yet eliminativism could hardly exist without it.

Had scientists and philosophers been open to Charles Sanders Peirce's semiotic and evolutionary philosophy, this discussion might have come to follow other tracks. According to Peirce, the problem of final causation in scientific explanations is essentially rooted in the absence of a clear distinction in the Cartesian tradition between two things that should never be confounded: the concept of *purposive, consciously conceived end causes* which in a strict sense has validity only in the human world and a *general principle of final causation*: "It is a widespread error to think that a *final cause* is necessarily a *purpose*. A purpose is merely that *form* of final cause which is most familiar to experience" said Peirce (Peirce 1931–1958, Vol. 1, p. 211; italics added), or in other words, "purpose is the *conscious* modification of final causation" (Peirce 1931–1958, Vol. 7, § 366; italics added). *Psychological* end causes, such as the distinct purposes I might have in writing this text, are in Peirce's thinking just a special subcategory of the much broader category of final causes, and these, according to Peirce, are at play in any sort of goal-oriented activity in nature,



as well as in culture. A final cause is simply the general form of any process that tends toward an end state (a finale).

An example of a natural law that embraces this form of a final causation is the 2nd law of thermodynamics, often called the “entropy law”. This law does not stipulate how exactly entropy is going to increase, but it does stipulates that every change taking place in our universe must necessarily imply a global increase in entropy (although locally entropy may often be decreased—by being exported to the environment—which is the trick that keeps living systems alive). We are so used to thinking in the reductionist scheme of classical physics that it perhaps feels odd to ascribe causality to a principle like the entropy law, and yet in a modern understanding it is exactly the irreversibility described by this law, which accounts for the perpetual energy transformations that cause not only the organic life on Earth but also the whole universe to evolve. In his recent book, “Incomplete nature”, the American anthropologist and neurobiologist Terrence Deacon outlines a possible path that may have led from a prebiotic world, governed by thermodynamic lawfulness, to the appearance of systems exhibiting, what he calls *teleodynamic* properties, i.e., systems in which causal processes have been ordered so as to exhibit “consequence-organized features”<sup>1</sup> (Deacon 2012a). Through computer simulation he has managed to construct a model that does in fact develop to perform as a teleodynamic system. If Deacon is right, it must be concluded *that life and final causation is—at least potentially—inherent in the fundamental physics of our universe* and rather than tabooing final causation right away we should make a distinction between acceptable and nonacceptable kinds of final causation.

When the tornado Sandy caused major destructions in New Jersey and New York, it was obviously not because Sandy “wanted” to take revenge on the poor New Yorkers or otherwise spoil their life. Likewise, when a monarch butterfly in October sets out on its migratory flight down from New York State to Mexico it is not due to any specific wish the butterfly might nourish. And yet, while an explanation in terms of finality may be appropriate to the butterfly’s behavior, it is impermissible for the tornado. The difference is that the butterfly is a living system and as such it exhibits what Deacon calls *entional* properties. By the term “entional” Deacon refers to “phenomena that are intrinsically incomplete in the sense of being in relationship to, constituted by, or organized to achieve something non-intrinsic. This includes function, information, meaning, reference, representation, agency, purpose, sentience and value” (Deacon 2012a, p. 549). The migration of the butterfly is presumably more or less directly caused by information in the sense of its genetic setup that causes specific metabolic changes in response to certain particular conditions in its environment.

One of the few general trends that can be ascribed to organic evolution is the tendency towards the production of species exhibiting more and more semiotic competence or freedom in the sense of “increased capacity for responding to a variety

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<sup>1</sup> By teleodynamics Deacon means “a form of dynamic organization exhibiting end-directedness and consequence-organized features that is constituted by the co-creation, complementary constraint, and reciprocal synergy of two or more strongly coupled morphodynamic [self-organizing] processes” (p. 552).

of signs through the formation of (locally) ‘meaningful’ interpretants” (Hoffmeyer 2010, p. 196; Hoffmeyer [in print](#)). *Semiotic freedom* can be seen as one among other survival strategies in the evolutionary game, and as such it would obviously have been best suited to life forms of free moving animals, because of the need in such species for coping with fast spatial variations. While a diffuse nervous system already is present in the cnidarians (jellyfish, sea anemones, corals etc.) the first archaic brains appear some 550 million years ago in early bilateral animals such as flatworms. In much more advanced invertebrates like insects and octopuses, we already find very well developed brains, but it is in the vertebrate line and especially in the warm-blooded (and therefore much more active) mammals and birds, that we find species possessing the most highly developed semiotic freedom. The important point here is that ententional phenomena, as defined by Deacon, form a graded series relative to the complexity or sophistication of the ententional mechanisms that the different species have at their disposal. Thus, while conscious organisms have probably been around on Earth for some 200 million years it is only in our species—and thus only for the last 200,000 years—that linguistic intelligence has been present. Explanations in terms of final causes are therefore level dependent with human beings being probably alone in having distinct well-articulated purposes, mammals and birds alone in exhibiting consciously based choices of action, animals alone in having sufficient brain capacity for individually learned behavior patterns. All nonanimal species probably have very low or no capacity at all for individually initiated problem-solving strategies being, in this respect, nearly fully dependent on their genetic predispositions. Therefore, explanations in terms of final causation are only permissible when applied at the proper level relative to the kind of finality imposed.

## The Stream of Bodily Semiosis

The fact that causality is rooted in bodily experiences and arises as a result of our own intentionality, and the understanding that such intentionality does not inherently contradict the basic physical lawfulness of our universe, shows us a way out of that “insurmountable” split between the world of unknowable and indefinable *noumena* and the world of knowable *pheno(u)mena* from which transcendental philosophy takes its point of departure. Kant claimed that “because the receptivity or capacity of the subject to be affected by objects necessarily antecedes all intuitions of these objects, it is easily understood how the form of all phenomena can be given in the mind previous to all actual perceptions, therefore *a priori*, and how it, as pure intuition, in which all objects must be determined, can contain principles of the relations of these objects prior to all experience” (Kant 2003/1787, p. 76). But, as we have seen, there is nothing *a priori* about our understanding of causality, and there is no good reason to believe that there is anything *a priori* about our understanding of space and time, for our understanding is basically coined in our bodily intentionality, in our semiotic interaction with the world in space and time.

With our fingers, arms, legs, etc. and through the means of thought and imagination, we expose the things before us to our curiosity and volition. If a Kantian would claim that the pencil on the table in front of me cannot in principle be known, I must answer that I can surely manipulate it and feel its form, hardness, temperature, and so on, and by doing so, I establish the missing loop in the sensory-cognitive scheme; I do not just sense the pencil mechanically, for my knowing the pencil does not start in the retina, and it does not end up in the brain, rather it flows back and forth through an indefinite number of loops where the pencil is integrated into the movements of my fingers and thus into a world of immediate as well as memorized bodily experiences and back again to neuronal circuits in the brain forming a continuous and branched set of loops. My interaction with the pencil is historical and semiotic, not mechanical. As the philosopher of science Tyrone Cashman has put it “what assures us that our images are in fact *about* the object in the world is that our sensory images track the changes in the world that the hands initiate. What assures us that our constructed concepts of what the world is like are truly *about* the world is both the way the concepts guide action, and the way that, through this ability, they can be falsified by the results of manipulation in experiment” (Cashman 2008, pp. 56–57).

The teleodynamics exhibited by living systems places cognition solidly in the stream of bodily semiotics, and phenomenology and science is challenged in symmetrical ways by this new understanding. The taboo against final causality (science) and the rejection of the possibility to know the “thing in itself” (phenomenology) are interconnected errors reflecting a general failure to recognize the fundamentally semiotic nature of life and cognition.

What is needed is an ontology of *semiotic realism*. The activities of living creatures are always end-directed; they all depend on a capacity to anticipate dangers and to anticipate where and when resources of different kinds might be accessible. To achieve this organisms produce internal “models” of significant parts of their surroundings, or *Umwelts* to use the expression the Estonian-German biologist Jakob von Uexküll introduced (Kull 2001). Although the *Umwelts* of animals may seem extremely limited in both spatial and temporal variety, when compared to our own human *Umwelts*, they nevertheless usually serve them well in making life-saving choices of action. Even a bacterium that chooses to swim right instead of left, because thousands of molecular receptors sitting in its cell membrane tells it that this is where most nutrient molecules are likely to be found, is in fact making a kind of anticipation. While it swims along, the bacterium continuously measures the number of hits between its own receptor molecules and the nutrient molecules in the medium, and as long as the number of hits per second is increasing it will proceed forward in the same direction. Should the frequency of hits start decreasing, the bacterium will eventually stop moving forward and instead start tumbling around, which then in time may bring it to move forward in a new and perhaps more favorable direction. It seems very likely that this molecular recognition mechanism is the earliest precursor of all processes of cognition in the life-sphere. One might perhaps object to calling it cognition at all, but rather than quarrelling on definitorial questions, we should recognize that no matter what we call it, this mechanism is indeed a kind of

categorization—as pointed out by Frederik Stjernfelt (Stjernfelt 1992). The semiotic character of the process lies in the fact that unlike nonliving processes, the categorization of substances in molecular recognition, already realizes a split between object and property. Molecular recognition may *fail*—for instance if the bacterium erroneously categorizes synthetic sweetener molecules as sugar molecules—leading the organism to irrelevant or even poisonous substances; and such failure, we should add, becomes objectively measured through its consequences for survival.

A hardliner phenomenologist might object to the notion that the choice of a bacterium should bear any relationship to genuine human interpretational processes, pointing to the fact that the biochemical mechanism, which produce such bacterial choices, are by and large well known, and that under the given conditions, the bacterium could not have made the particular choice it made. The choice then, was compulsory—not free. Against this objection, I have two comments. First, one should observe, that our hardliner-phenomenologist owes us to show that human choices are mechanistically based on radically different, causally more free kinds of processes. I actually think this might be done at a scientific basis, even though, basically, human cognitive processes also in the end depend on processes inside cells that are biochemically quite well known. The difference, however, resides in the fact that human cognition is a result of 100 billions of interacting cells in the brain, while the bacterium, such as we know it from the lab, is entirely on its own.

This brings us to my second comment. Our hardline-phenomenologist should be aware that bacteria in the real world—as opposed to the lab—are never alone. Both temporally and spatially, they take part in a global community of bacteria even crisscrossing species boundaries. Microbiologist Soren Sonea dubbed this a “global organism” (Sonea 1991), and we all encounter the phenomenon in the form of bacterial resistance to antibiotics. The internal communication in the world of bacteria proceeds via the exchange of genetic material, and no matter which substance we invent in the fight against bacterial infections there will always, somewhere on the globe, exist a bacterium possessing some genetic material that may be used by bacteria to fight this particular poison. Due to communicative processes inside the global organism, such genes will sooner or later arrive in the human population and produce resistance among the pathogens. The global organism, if not the single bacterium, is capable of sizing up the situation and produce an adequate response, which is pretty much what interpretation and choice is about. All organisms on Earth are descendants from symbiotic conglomerates of bacterial cells that in the course of evolution have evolved to become animal cells, plant cells, or fungal cells, and it seems most parsimonious to see bacterial communicative behavior as a predecessor for human mental life rather than to assume mental life to have sprung into being by an, as yet, unknown independent mechanism in a later state of evolution.

A hardliner-biologist, on the other hand, might claim that terms such as semiosis and interpretation are confusing and superfluous since the concept of information is all we need; the bacterium simply receives information from the medium telling it where to find the nutrients, he might claim. But in saying so, he would in fact commit a category error, for information is not a substance and neither is it energy. So what does it mean, that the bacterium “receives” information? The concept “information” has

been used in many different ways, but a reasonable understanding of the concept in this context would be that information is a measure for *a deviation from expectations*. So what the biologist should have said would be, rather, that the input from the medium combined with the bacterium's own swimming movements has caused an alteration in its "state of expectation". He could not of course have said this, though, for such a statement would conflict with the taboo against final causation; and in a way, he would be right, for expectations are loaded with human psychological implications which represent a kind of finality that does not belong to bacterial life. There is no need to introduce psychological language here, suffice it to use the much more parsimonious semiotic language; the bacterium does not receive anything, it actively searches the area (swimming), and eventually alters its course by interpreting relevant signs, which in this case are the measured changes in concentration of nutrient molecules. Any number of other chemical changes may take place in the medium and yet remain "unknown" to the bacterium, as long as they do not belong in its recognized Umwelt. The bacterium, in other words, actively selects those, and only those, events in the milieu that are meaningful to it. Information, as generally understood in biology, is much too poor a concept for describing the process involved.

## Sensory Semiotics

The little girl looks at the red strawberry and thinks "goody!". She does this, of course, because she has earlier tried to eat a strawberry like this and enjoyed it. But we will have to start our analysis somewhere, so why not right here, at this moment, when she sees this red strawberry? The reflected light from the strawberry reaches her through the eye's lens and is projected upon the retina where 130 million photoreceptors (rods and cones) are ready to catch the light signals and send them to local ganglia in the outer layer of the eye. A significant amount of processing of the visual signals takes place already at this local level and a condensed version is successively transmitted to the brain via the optic nerve. Part of the further processing is taken care of by a small almond shaped area in the limbic system called the amygdala that plays a decisive role in the appraisal or biasing of the visual inputs. The amygdala receives and sends signals directly from and to the visual system, reacting to visual stimuli without the involvement of consciousness (Siegel 1999, p. 133). Processes such as these may be involved in the strange sense of belief with which we sometimes unconsciously evaluate our experiences.

In this description, we have moved a long way from the traditional sensory mechanical scheme. And yet, terms such as "signals" and "processing" keep us inside a fairly mechanistic frame of thought. Are these "signals" to be conceived of as unambiguous "packets" of some "informational stuff"—whatever that would be? And is the processing anything else than the kind of algorithmic symbol manipulation that computers can do so easily for us? As long as these questions are not answered, it remains difficult to understand how a signaling activity—no matter how complex—could possibly end up as an experience of desire in the mind of a small girl. We are

here confronting the so-called *hard problem* of consciousness (Chalmers 1996), and I shall not pretend that a semiotic understanding will give us any easy solution to it. However, while an explanation in terms of mechanistic or informational models leaves us with a downright impossible problem, the semiotic model points us to emphasize relational phenomena that, in principle, are independent of the substantiality of the related entities, and this opens new channels of explanation.

A sign process is a triadic relation whereby something called the “sign vehicle” (the sound of an ambulance for instance) is referring someone to an “object” (the need for stepping on the breaks) through the formation in the body and mind of a mediating process called an “interpretant”. It is important to notice here that the interpretant is a relational *process* inside the interpreter (be it a human or some other receptive system), a process whereby the perceived sign vehicle becomes related to the object, in such a way that it somehow mimics the sign vehicle’s own relation to that same object. Thus, the interpretant formed in the body and mind of a human person hearing the specific warning sound of an approaching ambulance is the process whereby this person becomes aware of the need for stepping on the break. A semiotic understanding of mental processes therefore does not require us to commit the usual error of misplaced concreteness; sign processes are never rooted in particular entities or processes, but are always just “snapshots” of the fluent open-ended relational dynamics of entities and processes. Furthermore, sign processes easily cross gaps between hierarchical levels. Thus, the social implications which may derive from one and the same mechanical process inside a person’s ears is fully dependent on what goes on inside that particular person. The sound of an ambulance may for instance cause a traffic accident as a friend of mine told me had happened to her when she, a minute after she had seen her 8-year-old daughter from the car’s window walking peacefully along the sidewalk of a busy street, heard the sound of an approaching ambulance and, irrationally frightened, bumped into another car parked along the street. In semiotics, there is no such thing as a compulsory link between cause and effect. A given sound may be judged insignificant, or it may release a pressing of the break, or it may even cause you to bump into another car.

A detailed semiotic analysis of the girl’s “goody!” experience would include an enumeration of the long chain or web of sign processes in which the interpretant in one process is acting as a sign vehicle provoking the formation of a new interpretant at the next more comprehensive level. In the course of the process, the whole scale of contextual relations are drawn into the process, comprising not only the now-and-here (impulses from other senses) but also memorized material (the girl’s former experiences with this category of visual impressions), and all of it must continuously be calibrated according to new visual, olfactory, auditory, or touch inputs that she might receive, and also according to her own motoric interaction with the objects of her field of vision (even if she does not move, small involuntary movements of the eye’s focus, saccades, nevertheless continuously need to be integrated). Both cognitive and motoric activity becomes initiated through this chain of interpretants produced at more and more overriding levels (exclamations like goody!, or reaching out for the strawberry). Our sensing must be considered one open-ended loop of interactions between memory, sensory impulses, and motoric activity.

Since an interpretant is always formed as a context sensitive response to an event (e.g., an electrochemical change of a cellular membrane), the interpretant is never a given once and for all but always a result of the specific history that the involved entity (e.g., a nerve cell) has gone through, so that former experiences will come to influence the interpretative process already at the earliest stages (ganglia in the eye). The sign process, in other words does not cause the response in the traditional sense of efficient causation, rather as pointed out by Vasiner and Cabell, it catalyses it or, as I have suggested, what we might here talk about *semiotic causation* : “bringing about things under the guidance of interpretation in a local contexts.” (Hoffmeyer 2008b, p. 37)

## Experienced Worlds

Now, one might ask the \$1 billion question: at what point in the semiotic process should we talk of genuine experiences? To attempt an answer to this question, let us make a side trip to the animal world and pose the question: does a chimpanzee experience its world? Knowing well enough that neither a “yes” nor a “no” to this question can be decisively proved (as long as chimpanzees do not speak), it seems very unlikely that the answer should be a “no.” First, because chimpanzees are so much like ourselves that it seems illogical to think that they should be deprived of that dimension of life which undoubtedly is the most important dimension of our own human life, our experienced life. Second, because there are now numerous well-studied examples of behaviors in chimpanzees that skilled ethologists do not shy away from likening to well-known human behaviors such as showing empathy, morality, or cheating (Bekoff and Pierce 2009). It is not easy to imagine someone cheating on you if this someone, does not have the faintest experience of your existence.

If we step further back along the evolutionary path and consider fish, reptiles, birds, and mammals we can actually point out a graded series of growing cognitive competence (Hoffmeyer and Stjernfelt *in press*; Hoffmeyer *in print*), and logically it becomes rather impossible to point out a definitive step before which there is no sentience, but after which sentience is present. In general, the rather gradual character of evolutionary change logically points us to a “more-or-less” view rather than an “either-or” view (either the animal has an experienced world, or it has not). Since the experiential world is multidimensional, this more-or-less must of course also be understood in a multidimensional sense. Thus, even in fish we find behaviors that seem to imply a kind of social intelligence that would be hard to explain in the total absence of sentience.

Let us take a look at the sophisticated relation between cleaner fish and their clients as discussed in Hoffmeyer and Stjernfelt (*in press*). Cleaner fish get their livelihood by eating and thus removing parasites from other fish called clients. In addition to the parasites, the cleaner also likes to eat the more nutritious body mucus of their clients which, understandably, maddens the client fish which may visibly “jolt” and dart off when cleaners bite them. A trade-off situation then develops

between cleaners and clients in which the clients attempt to avoid cleaners that have previously cheated upon them or—more remarkably perhaps—which have been observed cheating on other clients (Bshary et al. 2002). Full-time cleaners such as the cleaner wrasse *Labroides dimidiatus* may have about 2,300 interactions per day with clients belonging to over 100 different species (Grutter 1996). Bshary et al. lists a number of behaviors found in cleaners and clients that may be likened to behaviors more usually observed in primates: categorization, cheating, punishment, manipulation through tactile stimulation, and so-called altruism. Thus, cleaners can categorize their 100-or-so client species into types that may be cheated and types that are not so prone to cheating. Clients, on the other hand, may “punish” (inflict expenses upon) the cleaners, which would seem to imply an amount of individual recognition (probably by scent).

Rather than concluding for or against fish having experiences or sentience, I think our fast growing knowledge of the surprisingly sophisticated cognitive capabilities of fish and animals in general points us to abandon the idea of sentience as a unitary phenomenon. There are many kinds of sentience, and our own human kind of sentience is just one example in a multigraded series. A snake for instance has probably no idea whatsoever of the prey animal it is chasing, instead it has different modalities such as things to be searched for, things to be stroked, and things for swallowing (Sjölander 1995).

As a consequence, we must understand the establishment of experiences, such as the “goody!” with which we began this discussion, not as residing in some finished or final state of mind but as an emergent glimpse of recognition followed by a stream of new glimpses in a continuous flow embedded in the processes whereby the girl interprets her world, i.e., in the flow of semiosis. Our experiences (and those of animals) are always embedded in an emotional state of some kind and without operating with a directionality of one’s life, that is, without implying final causation, sentience simply becomes incomprehensible. There will always be a reason behind sorrow, sadness, worry, joy, happiness, fear, anger, etc., and this reason—which does not itself need to be conscious and probably most often is not—locates the experience in the temporal directionality of our organismic strive (to use the term, that Darwin himself used in Darwin 1972/1859, p. 71).

If we think of an emotion as a subjective reaction to a salient event, characterized by physiological, experiential, and overt behavioral change (Siegel 1999, p. 123), we might perhaps think of the origin of experiential life as rather narrowly connected to the (evolutionary) origin of emotional life. Needless to say, the taboo against anthropomorphism has made the ascription of emotions to “brute” animals a risky affair<sup>2</sup>. Here, we must take care to distinguish between emotions and feelings although such a distinction is in no way easy or simple. Primary emotions are spontaneous bodily

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<sup>2</sup> As is often the case, Darwin himself had a clearer voice. In *The Descent of Man* he writes quite explicitly: “The fact that the lower animals are excited by the same emotions as ourselves is so well established, that it will not be necessary to weary the reader with many details. Terror acts in the same manner on them as on us, causing the muscles to tremble, the heart to palpitate, the sphincters to be relaxed, and the hair to stand on end” (Darwin 1981/1871, Chap. 3).



reactions such as sadness, anger, fear, surprise, or joy that come to us without interference of consciousness, and which are accompanied by well-defined physiological patterns that are also to some extent measurably present in animals seemingly exhibiting similar emotional reactions. Young birds, for example, that duck their heads in the nest when a hawk is passing over the nest are experiencing the same hormonal response as we see with fear in humans. Feelings, on the other hand are emotions that are consciously dealt with to produce context dependent nuances. What complicates the matter, of course, is that feelings often produce further secondary emotional responses that then trigger off secondary feelings in an infinite temporal loop of interaction between our cognitive life and our emotional life. As evidence for emotional response patterns in mammals and birds is fast growing in these years (see Bekoff and Pierce 2009 for a survey), it seems increasingly farfetched to claim that emotions are not present in species with lower cognitive capacity. Again, we should adopt a “more-or-less” view rather than an “either-or” view.

Let me suggest that we see semiosis, emotion, and experiential life as a graded series where semiosis is a fundamental characteristic of life as such—life without semiosis is unthinkable; emotions are a somewhat less fundamental property but most likely some preliminary kind of emotion must be at play in every multicellular organisms where a fast coordination of body parts is necessary in response to danger, or food, etc., since such coordination would presuppose a capacity for producing an instantaneously propagated “emotional” wave throughout the body<sup>3</sup>; genuine experiences, on the other hand, probably only occur in species possessing a central nervous system. The important point in the present context is that semiosis, emotion, and experiences are not thought to be essentially different categories, but rather to be a succession of more and more sophisticated elaborations of the same basic theme of teleodynamic existence. Considered in this way, the shift in perspective from sensory mechanics to sensory semiotics as the basis for perception opens up new fascinating agendas for studying the body–mind interplay.

## Semiotic Scaffolding

In the biosemiotic perspective, the genome is not seen as a master plan for the organism, the way traditional biology sees it. The fact that, say, a snail genome will lead to the appearance of a snail-type living system and a wolf genome will lead to the appearance of a wolf-type living system, has implanted the conception in the minds of biologists that the genome *controls* the ontogenetic process. But this metaphor of “control” is far too strong. Genes are not control-units but *semiotic modulators*—they frame the biosemiotic integrations inside the body. In fact, the functional role of the genome very much is to act as a highly sophisticated digitalized inventory control

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<sup>3</sup> One might perhaps think of this as a sudden “wake-up” glimpse, a little like when the pocket calculator is switched on (although we do not claim any emotional component in the pocket calculator).

system, a system that not only contains the specifications necessary to produce all the body's protein and RNA molecules but also a number of switches and locks by which an agent may access the archives. Thus, if a given enzyme is needed in a tissue, cells will turn on the switch that opens the particular lock normally keeping the coding region of the responsible gene from being transcribed. When enough of the enzyme has been produced, the switch is turned off again. So, if a given enzyme is needed, say a peptidase, the cell will click down the menu for enzymes, pick the submenu for peptidases and select a suitable one among the different kinds of peptidases on offer, depending on the kind of tissue and/or the concrete situation. The cellular machinery will then start off the process of operating the switches and keys corresponding to this particular gene (RNA splicing and other modifications included).

The most important factor that has been turned around in the semiotic description of the process relative to more traditional informational descriptions is that agency here resides with the cell, the tissue, or the organism, not with the genetic system—not at the level of a macromolecule (DNA)<sup>4</sup>. Harvard geneticist Richard Lewontin expressed clearly why this is necessary, when he stated that: “genes do nothing in themselves” (Lewontin 1992)<sup>5</sup> (it follows that Richard Dawkins' much famed concept of “selfish genes” is outright nonsense). Language use in modern biology is profused with hidden *homunculi* (to use Terrence Deacon's expression (Deacon 2007, 2012a)<sup>6</sup>, and biosemiotics is needed precisely in order “to make explicit those assumptions imported into biology by such unanalyzed teleological concepts as function, adaptation, information, code, signal, cue, etc., and to provide a theoretical grounding for these concepts” (Kull et al. 2009).

But the genome is only the most basic level in the web of semiotic scaffolding mechanism that controls the cooperation between the estimated 100 trillion cells that make up a human body. Each of these cells are ultimately autonomous units that in their whole construction are tuned to follow internal schemes towards proliferation. Yet, “mysteriously”, all these cells manage to cooperate in life-long functional patterns or else we get ill. The “mystery” is hidden in the infinitude of semiotic interactions linking cells, tissues, and organs together into stable functional modules. Throughout evolution, new scaffoldings have been built on top of those already operative. Evolution is primarily about the establishment of successful semiotic scaffolding devices and genetic mutations are just elementary tools in this process that may often not rely on modifications at the genetic level at all. The genome, thus is only half the story, the other half being the *semiome*, the entirety of semiotic tool

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<sup>4</sup> That anyone could imagine DNA molecules to possess agency is a total mystery to me.

<sup>5</sup> It often takes more than a dozen of different protein molecules to (1) unwind the threads of the double helix, (2) fix the position of the gene in the correct spatial position relative to other, more or less distant, locations on the DNA string, (3) attach the polymerase enzyme at the right location, (4) initiate the transcription, and (5) stop the process at the right place and time.

<sup>6</sup> “a homunculus argument as one in which *an ententional property is presumed to be “explained” by postulating the possession of a faculty, disposition or module that produces it, and in which this property is not also fully understood in terms of non-ententional processes and relationships*” (emphasis Deacon's; p. 64).

sets available to the species: the means by which the organisms of a species may extract significant content from their surroundings and engage in intra- or interspecific communicative behavior. The semiome defines the scope of the organism's cognitive and communicative activity (Hoffmeyer [in print](#)).

The human semiome is different from that of other animals mainly in being deeply embedded in linguistic practices. Most often, the difference between human cognition and animal cognition has been explained by reference to our supposed higher general intelligence. Following the work of Terrence Deacon (Deacon [2012b](#)) we shall instead base our discussion on the peculiarities of the human linguistic semiome. As Deacon tells us: "Language is dependent on a widely dispersed constellation of cortical systems, each of which can be found in other primate brains, but evolved for very different functions" ([2012b](#), p. 34). In the terminology of the present chapter, part of what happened in human evolution was an unprecedented loosening of the genetic scaffoldings stabilizing the cognitive roles of a range of modules in our brain. The adaptation to language required our brains to become essentially dedifferentiated allowing cognitive functions to be scaffolded through symbolic communication rather than by genetic predetermination.

## **Semiotic Scaffolding of Cultural Evolution**

Whole new kinds of semiotic scaffolding mechanisms thus became available in our species. While all species on Earth possess some capacity for iconic and indexical referencing only language, i.e., symbolic referencing, makes recursive messages available, thereby opening for an infinitude of complex meanings to be thought out and socially shared. The invention of social semiotic scaffolding mechanisms such as dance and art, written language, city life, military organizations, cathedrals, the printing press, fast moving transportation systems, radio, telephone, movies, TV, personal computers and mobile phones, the internet, etc. has gradually offered new generations, stronger and stronger (in the sense of productivity, spatial and temporal range, efficiency, and precision) semiotic scaffolding structures, implying that deeper and deeper meaning contents can be grasped and shared up through human history. Each new jump to higher level semiotic scaffolding systems tends to homogenize cultural performances at the lower level while opening up for new complexity and expressivity at the higher level.

There is no determinism in any of this. Different cultural systems may proceed along these steps in many different ways, or they may be captured in "time-pockets" to the extent that they are not themselves open to newer and stronger semiotic scaffolding mechanisms. From the perspective of cultural psychology an essential question will be to understand how people develop culturally specific ways to cope with the semiotic scaffolding devices available to them. The concept of catalysis (Cabell [2009](#), [2011](#)) seems to point out a fruitful way to an understanding of such processes. To take an example, while the exposure of the youth to social media like Twitter and YouTube was an obvious extension of the technological potentialities built into mobile phones,

nobody did foresee the use of these new media to catalyze the series of mass protests in North African and Mediterranean nations that came to be known as the Arabic Spring. The catalyst in this case was not the phone as such or the social media but the grasping by huge population groups of a new semiotic scaffolding mechanism allowing for fast and anonymous spreading of knowledge and documentation.

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# Chapter 6

## Catalysis and Scaffolding in Semiosis

Kalevi Kull

The aim of this chapter is to find the place for the concepts of semiotic catalysis and semiotic scaffolding in the conceptual system of general semiotics. Following Kenneth Cabell (2012), we find it reasonable to distinguish between four partly overlapping—as if Borgesian—types of catalysis: chemical catalysis (if the catalyst reduces the activation energy of the chemical reaction), enzymatic catalysis (if the catalyst is enzyme), autocatalysis (if the process is intensifying itself), and semiotic catalysis (if the catalyst is a sign process).

We start from the question on the semiotic aspects, as these appear in enzymatic catalysis close to the lower semiotic threshold.

### Enzymes with Semiotic Features: Where Chemistry Turns into Something Else

Enzymes seem to be, at least to those molecular biologists and biophysicists who are building their models, just molecules, complex molecules that behave like other molecules do, only being more complex. However, the features that they have may make them objects that need to be considered as something quite principally different.

Medical chemistry, already since Paracelsus in the sixteenth century, has attempted to identify the characteristics called *signaturen*, e.g., in plants, which can be related to the power of healing (for instance, Leonhardt Thurneysser in Berlin, and Giambattista della Porta in Naples) (Jahn 1998, p. 214). In 1850s, Louis Pasteur argued that fermentation represents the *sign* or *signature* of life (Morange 2000, p. 11). Nowadays, the biological ferments are called enzymes.

The term ‘enzyme’ was coined in 1878 by Wilhelm Kühne, a biologist of Heidelberg, editor-in-chief of “*Zeitschrift für Biologie*,” a teacher and colleague of Jakob von Uexküll. According to Kühne, an enzyme is “something that occurs that exerts

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this or that activity, which is considered to belong to the class called fermentative.” Contemporary definitions of the term are often no less cautious: “enzymes are the biological catalysts that specifically catalyze chemical reactions in living cells” (Kendrew and Lawrence 1994, p. 325).

What is the reason to be cautious? In what sense are the enzymes not just chemical molecules like any other?

In case of inorganic and simple organic molecules, the structure of the molecule determines the reactions that the molecule can enter. Accordingly, the nomenclature of these molecules corresponds to their structure. If we know the structure, we can identify the name, and all the features are thus connectable with the particular structure.

In case of enzymes, the situation is radically different. The reactions that can be catalyzed by an enzyme molecule are not determined by its primary or secondary structure. The tertiary structure (spatial structure) of the enzyme molecule can say something about the substrate it can catalyze, but the tertiary structure is greatly a result of the local environment of this big molecule, and not just determined by its primary and secondary structures; additionally, an enzyme may consist of several large molecules, which constitutes its quaternary structure. And what the enzyme does may depend very much on the actual place where it happens to be located in the cell. As a result, the structure of an enzyme has no direct bearing on the function of the “molecule”. This is particularly true for the primary structure as stored (in a premature version) in the sequences of DNA—in genes.

The nomenclature of enzymes also differs from the usual chemical nomenclature. The names are given according to the function, and not according to the structure of the enzyme. For instance, the enzyme called ribulose-biphosphate-carboxylase-oxydase, abbreviated as Rubisco, is the one that can catalyze the reaction between ribulose-biphosphate and  $\text{CO}_2$ .

The story becomes even more fascinating by the finding that Rubisco—the enzyme which every plant leaf has—is different in every plant species, or even in most plant genets. Like any other enzyme, it has many forms. Thus, the name Rubisco denotes simultaneously billions of molecules of different structure; and there is no way to say how many different structures belong to Rubisco. And if anybody will have a molecule with a new structure, there will be, in principle, no way to identify it as Rubisco, other than to put it into a plant cell and look whether it will catalyze the reaction Rubisco usually does. And if it does not work in the tested plant cell, it may still work in some other plant species of the present or past or future. The task to describe all possible structures of a particular enzyme seems to be unsolvable—at least due to combinatorial complexity. Walter Elsasser (1998, p. 49 ff.) has called this type of features of living systems the *immensity*. The case is obviously even more fundamental—this problem is nonalgorithmic (Kauffman 2012, p. 37).

Thus, contrary to the names of usual molecules, the names of enzymes denote their function and not at all their structure. Despite the many functions to be found in a cell, the number of these functions is very small in comparison to the number of different structures via which these functions can be carried out.

If there would not be any enzymatic activity in an organism, the chemical compounds would not react. Enzymes mediate almost all chemical reactions in living organisms. The reactions they carry out are such which almost do not perform spontaneously. Without enzymes, the dead organisms would not decay, and no ecological cycles would be possible.

In order to understand the origin of the enzymatic network that participates in all biological reactions, it is important to know that the functional specificity of enzymes is not absolute. Despite that their names usually refer to one single function, and despite that most of the enzymes in a cell actually provide just the catalysis of one particular reaction, all enzymes are potentially *polyfunctional*. They can also catalyze a range of other reactions, although with much lower efficiency, or such reactions are excluded because there are no other appropriate substrates available at the location in the cell where the enzyme in question happens to be situated.

From an evolutionary point of view, and slightly simplifying the story, one can say that enzymes have appeared as stochastic sequences of aminoacids; some of them happened to catalyze some reactions. In a closed cell, most of the reaction chains are closed, i.e., cyclic. Due to this, feedback effects appear. For instance, when a product is in excess, it may inhibit the production of enzyme molecules involved in its own synthesis, and vice versa, when the product is in deficit, more corresponding enzyme molecules are produced. Thus, the cell itself may have selected which molecules to take into use and which ones to be “forgotten” for the evolutionary story.

What was said earlier about enzymes holds true for most of the proteins of a cell. In addition to the enzymes which catalyze the metabolic reactions (enzymes *sensu stricto*), there is a large number of different regulatory proteins, transcription factors, transport proteins, protein receptors, etc. Also, there are RNA-compounds which function very much like enzymes, and which are also classified according to their function; these are tRNAs and ribozymes.

Enzymes make regular bonds between certain sites of nucleic acids and the reaction they catalyze. Note that there does not exist any chemical or physical reason why a particular site (a particular primary sequence) of DNA has to be connected to certain particular biochemical reaction in the cell. Indeed, this relation made via enzyme is *arbitrary*. This is arbitrary as any other code relation. The life of a cell looks very much as the action of catalysts—the enzymes and alike.

## Why Catalysis Seems Important: Catalytic Closure and Autocatalysis

Almost no organic processes can proceed without an involvement of some living being. Nearly all organic compounds that form the bodies of organisms are chemically inert in the physicochemical conditions of biosphere. For a dead body, for any dead cell, the only way to become decomposed (at an ecologically reasonable time scale) is by the help of enzymes, via organic catalysis. But there are no enzymes in a natural ecosystem besides those produced by living organisms.



Thus, if there would be no life, the element cycling would stop. In this sense, life is catalytically closed (see also Kauffman 2012, p. 35). Life requires life. Life is its own mediator.

Taking into account Sebeok's thesis—that life process *is* semiosis (see Kull et al. 2008, p. 43; Kull 2012b), we could reformulate it as: *semiosis is the general catalyst*.

There are (at least) three corollaries to the same rule:

- a. *Omne vivum ex vivo*—life is always from life (Redi's rule; this is true only after the origin of life, of course); a general formulation of this rule sounds *omne signum ex signum*—each sign is from a sign (see Kotov and Kull 2011); it is this same aspect of closure that Juri Lotman (2005/1984) sees as the basis for semiosphere;
- b. Semiosis involves scaffolding and is dependent on scaffolding (Hoffmeyer 2007; see Kull 2012a);
- c. Semiotic systems are relational systems (signs are never alone)—or, any semiotic system is dependent on catalytic relation between signs.

The general statement—a rule of life—states that semiosis is dependent on catalysts that are themselves produced by semiosis. Thus, it turns out to be possible to specify the general rule that *semiosis is the general catalyst*, since the catalyst as a temporal product of semiosis can be separated from semiosis and manipulated independently.

The specific catalysts have been an obligatory component of life since its origin (Cavalier-Smith 1987). These catalysts—enzymes and ribozymes—are exclusive products of living cells themselves. The network of enzymes—proteome—is both responsible for the gene expression pattern and the presentation of this pattern.

For life itself, as well as for semiosis, of course, catalysis is necessary but not sufficient, neither autocatalysis nor enzymatic catalysis, nor these together. The condition for semiosis is code plurality—the coexistence of several incompatible codes. Code-relation is certainly different from nonsemiotic catalytic relation. However, in case of semiotic catalysis, we may presume that relation between the semiotic catalyst and the relation catalyzed by it is a code-relation.

## Why the Concept of Semiotic Catalysis

The term *catalysis* is sometimes used in the area of social sciences, cultural relations, and linguistics, particularly in respect to the processes of learning (e.g., Thonhauser 2008; Thibault 2011). Occasionally, the term has also been applied in semiotic context (e.g., in Hjelmslev 1953, and following him in Barthes 1968, p. 70, 1970). The term *semiotic catalysis* became quite frequently used in the writings of Jaan Valsiner and his colleagues in recent decade (e.g., Valsiner 2000; Cabell 2012; Josephs 2003, pp. xii–xiv; Beckstead et al. 2009). Remarkably, in most of these cases, it is not just a metaphoric usage of this term. This is rather a result of applying a quite general definition of catalysis—the definition that includes the nondirect participation of the catalyst in the process, and the enhancement of the process attacked by the catalyst.

Jaan Valsiner first speaks about the role of catalysis in the context of typology of causality in psychological processes (Valsiner 2000, p. 74 f.). He also makes a reference to Kurt Lewin (1927) who uses the term *konditional-genetische Bestimmungen* (Lewin 1927, p. 397). Cabell and Valsiner (2011) make an excellent review of the concept of catalysis aiming its application in psychology (and possibly in semiotics).

There seem to be couple of particular reasons why the concept of catalysis looks promising for Valsiner and his coauthors. They pay attention mainly to the following features of catalysis:

- a. Different type of causality, nondirect causality; Valsiner (2000, p. 75) states: “Since developmental models cannot be context-free, notions of direct causality are not sufficient for the study of development. Let us call context-bound causality models examples of *catalyzed causality*. *Catalysed* here is a term to refer to conditions that need to be present for a particular causal linkage to occur, and the absence of which does not allow the causal process to lead to an outcome. [...] The notion of catalysed causality retains the relevant context-dependency of developmental phenomena. [...] Models of catalyzed causality are usable in sciences that deal with living systems.”
- b. Regulatory aspect, a regulatory function of catalysis (see, e.g., Beckstead et al. 2009, p. 75 f.); signs as catalyzers can both inhibit and activate (Mattos and Chaves 2012);
- c. Contextual aspect; catalysts are the means via which the context works;
- d. Mediative aspect; as in sign processes, catalysts can mediate processes;
- e. Qualitative mode; catalytic relations are seen as relations that allows to build a model on purely qualitative basis.

Some more aspects are described in a recent review by Cabell (2012).

Chemical catalysis just changes the speed of existing processes. In case of the crucial phenomena of semiotic catalysis, the reaction rate is not really important. Instead, as for almost all bioorganic reactions, the presence of an enzyme is required in order to have any reaction at all. In case of enzymatic catalysis, the primary aspect is therefore not energetic but informational. Thus, the role of semiotic catalysis is primarily qualitative.<sup>1</sup>

## Semiotic Scaffolding<sup>2</sup>

Jaan Valsiner has mentioned that “scaffolding—a narrow concept used largely after Jerome Bruner and others since 1970s—is a version of catalysis (catalyzing child development through setting up support conditions at relevant moments of relating with environment). In their uses of scaffolding, the clarity of catalysis (enabling but not determining) has never been quite clear, given the quasi-Vygotskian orthodoxy of “human being is social”. With that, scaffolding can easily become a form of *social*

<sup>1</sup> Cf. the concept of *enablement* in Kauffman 2012.

<sup>2</sup> This chapter repeats material from Kull 2012a.

determination. But it need not . . . in any case the catalytic story there is not clear, not exemplified.”<sup>3</sup>

Indeed, *scaffolding* is a concept already used in Lev Vygotsky’s works, later developed by Jerome Bruner (Vygotsky 1986/1934; Wood et al. 1976; see also Foley 1994), Andy Clark, and others. For instance, Clark (2008) speaks about language as scaffolding. Wimsatt and Griesemer (2007) provides an approach to culture from developmental biology, using the concept of scaffolding.

Semiotic scaffolding has been one of central concepts and themes in Jesper Hoffmeyer’s work, particularly in his writings after 2005 (Hoffmeyer 2007, 2013). For instance, he writes: “The genome is not controlling ontogeny, it scaffolds it (just as books do not determine culture, but they certainly scaffold it)” (Hoffmeyer 2013); “The network of semiotic interactions by which individual cells, organisms, populations, or ecological units are controlling their activities can [. . .] be seen as scaffolding devices assuring that an organism’s activities become tuned to that organism’s needs” (Hoffmeyer 2007, p. 154).

Jesper Hoffmeyer’s role here has been (1) to observe that scaffolding in this sense is always a semiotic scaffolding, and (2) to demonstrate that semiotic scaffolding is at work in all levels of semiosis, from the origin of life forward. This entails something very important and fundamental for the whole of semiotic theory.

The way Hoffmeyer describes semiotic scaffolding is in terms of its instructional bearing; he generalizes this important concept, and illustrates it with many examples. However, to specify the definition of semiotic scaffolding, stating more clearly its relationship to semiosis and code, would give us a central concept for general semiotics.

It is possible, and fruitful, to develop Hoffmeyer’s formulations and to conclude that semiotic scaffolding is a general result and function of semiosis. Semiosis as an active meaning-seeking-making process results often with the building of some relatively static or even quite solid structures that somehow embed in themselves the findings of that active searching-event of semiosis. The resulting structure is a scaffolding. It canalizes further behavior. It is the frame for habits.

Scaffolding is the building for the development of codes; thus it looks almost like a code—a code, too, being always a product of semiosis. What differs between code and scaffolding is their functionality. Codes can be described just as correspondences, whereas scaffolding always has a helping-supporting task or function. Habit, as a product of semiosis, is always, to a certain extent, instructional. Semiosis is a learning process that produces scaffolding that forms habits that results in codes.

Scaffolding, thus, being a product of semiosis, and semiosis being a process that takes place in an indeterminate situation of incompatibility that life permanently creates and carries on, is a relational semistable setting. Scaffolding can be reproducible, but this is not its universal feature. Thus, the role of the genome is secondary here (Hoffmeyer and Kull 2003, pp. 262–263).

Scaffolding is a reduction of degrees of freedom (as noted by Wood et al. 1976, p. 98, and as early as Bernstein 1967), a constraint—and this is how scaffolding works, the reason it is useful.

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<sup>3</sup> Jaan Valsiner’s letter to the author from Dec. 30, 2012. See also Valsiner 2005.

Thus, we may think of semiosis as a process that results in building scaffolding for further semiosis. Semiosis itself may be seen as collaborative learning: the process whereby at least two codes that are mutually incompatible meet and interact.

Semiotic scaffolding is thus so universal a feature of semiotic structures that we cannot even imagine a sign relation without it. Scaffolding is the way to keep and canalize communicational processes.

Hoffmeyer generalizes the notion so that we can think of the whole of an organism's body as a scaffolding. The body is scaffolding. Scaffolding is what results from learning. Semiosis produces scaffolding that support semiosis.

Now, turning back to the semiotic catalysis, it occurs, that catalysts in living systems—in organisms and cultures—are just special kinds of scaffolds. This seems to contradict Valsiner's remark above, saying that scaffolding is a kind of catalysis. Let us try to resolve this problem.

In case of semiotic catalysis, the catalyst has to be a sign. A scaffold, produced by semiosis, may be a sign, but there are also scaffolds that influence on an organism or culture or any other semiotic system without being themselves signs, i.e., by nonsemiotic means. Like a chemical catalyst—which may not be a semiotic catalyst—may change the speed of some metabolic pathway.

## General Semiotic Framework: An Account of Semiosis

Something is a sign due to its capacity to carry multiple meanings. A sign is essentially plural, or polysemic (Kull 2011). This is the feature that distinguishes signs from nonsigns—because, strictly speaking, there cannot be strictly monosemic signs. At that, meanings are qualitative by their very nature. This means that meanings are incommensurable and irreducible to each other—or, in a more general formulation, they are incompatible; although, they can be related to each other—any sign is such a relation.

Semiotic process or semiosis is a decision-making between different coexisting meanings. Meanings are given via code relations. Thus, semiosis is a process of finding solution in a controversial situation, in a situation of incompatible codes. Semiosis is the search that appears due to the unpredictability (or, a piece of freedom) that results from an incompatibility situation.

Semiosis as a process of search is also meaning-making, it establishes meanings. In order to find a way between the incompatible codes, semiosis uses earlier signs. This can be called semiotic regulation, or semiotic catalysis. Semiosis, simultaneously, has two tendencies:

- a. Singularization; it reduces the number of meanings, increasing the dominance of its one meaning over the others, making signs more rigid, evolving habits (as C. S. Peirce would formulate), and
- b. Diversification; it introduces new distinctions, creating new codes, thus creating the means to distinguish between more meanings.

Both of these tendencies are often called *learning*.

In its extreme, a sign may become very rigid, which means that the plurality of meanings has decreased and can ultimately collapse into a single meaning. Then the process becomes automatic (mechanical) and semiosis itself disappears. Thus, the meaning disappears, because meaning, strictly speaking, can never truly be single—meaning is always multiple. A monosemic sign is sometimes called signal, which is not a true sign. However, when meaning is gone, the relation built by semiosis, as built-in into a material structure—a code relation—may still be there.

Semiosis designs and produces new structures. Semiosis produces new codes—the correspondences that cannot be deduced from general physicochemical laws, because these codes are local and historical, these are combinations from an immense number of possibilities that come about only due to life. Built environment, rigid structures of organism's body, tools, and machines—these are all examples of products of semiosis. These are artifacts that are made by life, the structures that cannot even appear otherwise than being created by life. These include codes that may stay there for a while even without any semiosis involved. These can function on scaffolding further semiosis.

Meaning appears only due to a contact between code relations. A contact between (incompatible) codes which activates semiosis, requires a living system. This is because semiosis assumes a mechanism of learning, i.e., a mechanism that can create new codes (therefore to restore and to reproduce), which is just a feature of living systems.

The *incompatibility* as a fundamental precondition for semiosis is a phenomenon that appears exclusively in semiotic systems and due to code-plurality. Two codes are two codes if their simultaneous application would lead to logical incompatibility (controversy being a special language-bound case of it). Such phenomena do not exist—cannot exist—outside of the life-bound systems, because only these can create codes. The incompatibility situation itself is the source of indeterminacy, the source of freedom.

Sign is a multiple code relation. There are different types of signs as dependent on the type of relation created, which is dependent on the type of the mechanism of learning involved. It seems reasonable to distinguish between four major types of relations, and accordingly of signs, and of the mechanisms of learning that are responsible for the formation of particular type of relation:

- a. Relation of recognition—iconic signs;
- b. Relation of association—indexical signs;
- c. Relation of imitation—emonic signs;
- d. Relation of convention—symbolic signs.

From these, (a), which is obviously based on trial-and-error learning, and (b), which is possible due to associative learning or conditioning, are common in all nonhuman animals; (c) is connected with social learning (also with empathy and emotions) and can be found in many vertebrates; (d) is mainly connected with language capacity, i.e., with humans.

Since semiotic catalysis is catalysis via signs, i.e., via a relation, it can lead in each case to one of these four types; or, other way around, sign relations themselves are

of qualitative catalytic type, which means that this classification can also be a classification of catalytic relations. However, we foresee here a rich field of distinctions possible.

Although, when applying this simple division, semiotic catalysis can be one of these types: iconic, indexical, emonic, or symbolic. In our human conscious situation, we notice mainly the latter two—emonic and symbolic. The first two—iconic and indexical relations—are truly biological and nonconscious, thus usually not included into the descriptions of cultural semiotics but playing a large role in biosemiotic models.<sup>4</sup>

## Some Implications

If semiotic systems are products of sign processes, the semiosphere being the stream of semiosis, the sign flow web, and the interaction between sign processes also taking place via sign processes, then a major problem to understand the changes in the sign flow is to understand how a sign process can influence other sign process. According to Jaan Valsiner's deep statement, signs influence other signs mainly by catalysis.

From the semiotic point of view, the expression *semiotic catalysis* in its broad sense just states that *semiosis is carried on by signs*. Signs are (semiotic) catalysts for semiosis.

Sign relations themselves are of qualitative catalytic type. It can be hypothesized that signs influence something else only like catalysts—i.e., not directly, but via enablement, either as promoters or as inhibitors (or rather as connectors).

Semiotic catalysis is different from chemical catalysis—semiotic catalysis is a qualitative relation, whereas chemical catalysis concerns the quantitative aspects (reaction rates).

Semiotic catalysis and chemical catalysis may cooccur, they may appear as complementary aspects of the same process, but they may also occur independently. For instance, the chemical catalysis that occurred on Earth before the origin of life did not involve semiotic catalysis, because there was no agency that could make a qualitative distinction. On the other hand, a solution of logical controversy in a human dialogue with the help of a textbook as a catalyst could be an example of a purely semiotic catalysis, in which, the chemical catalysis is irrelevant. An enzyme in a signal transduction pathway of a cellular membrane, however, can be an example where one and the same catalyst is simultaneously a chemical catalyst and a semiotic catalyst.

Semiotic dynamics can be seen as streams of semioses, either in an organism, in ecosystem, or in culture, i.e., in all forms of mind. Semiotic catalysis is the process that changes the stream, whereas semiotic scaffolding stabilizes it—still both being products of semiosis itself.

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<sup>4</sup> Note that what has usually been called “iconic” in the earlier cultural semiotic discourse is “emonic” according to the terminology used here.

Usage of the concept of catalysis in humanities and social sciences, including in linguistics and psychology, seems to be at least temporarily useful on the way towards a proper semiotic conceptual apparatus. Catalysis seems to have a catalytic effect to semiotics.

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**Part IV**  
**Systemic and Contextual Considerations of**  
**Catalysis**

## Chapter 7

# A Systemic Approach to Cultural Diffusion and Reconstruction

Brady Wagoner

The present chapter explores the conditions and processes through which culture is reconstructed and diffused within and between social groups. The approach explored here differs from the majority of contemporary approaches to cultural transmission (e.g. memetics) in that it (a) focuses on an investigation of the complex dynamics of concrete single cases, (b) aims to explore the transformation of culture rather than simply predicting the likelihood of transmission, (c) highlights individual and group agency in this process, as well as (d) the history, traditions and norms particular to different social groups. To sketch out this holistic approach, I revisit the ideas of early diffusionist anthropology, in particular, the framework developed by Frederic Bartlett in his unjustly neglected book *Psychology and Primitive Culture*. In his framework, culture is conceptualized as heterogeneous, systemic and changing patterns of activity mediated by both individual and group processes. Furthermore, any society must be conceptualized in time, existing in a state of tension between stability and change, conservation and construction. A major catalyst for change is 'culture contact', whereby new cultural elements are introduced into a social group from outside, simulating constructive efforts to integrate them into its ways of life.

As with the study of cultural dynamics itself, to understand early diffusionist ideas, they must be placed in historical and social context. Thus, this chapter begins by providing some background in Cambridge anthropology between 1890 and 1912. It was in dialogue with this background that Bartlett developed his own diffusionist approach in psychology. The chapter proceeds to outline Bartlett's framework for exploring cultural dynamics, according to which the investigator should focus on the systemic conditions that shape individual and group responses; these conditions include a whole individual, belonging to a particular social group and acting in a particular social and material environment. This framework is then applied to the study of cultural contact (where groups are in intimate contact with one another) and cultural borrowing (where foreign cultural elements are carried by single individuals

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to a receipt group). The results of these intercultural contacts will depend on a number of factors, including the symmetry of relationship between the groups concerned and the social organization particular to them. Finally, a discussion is made of how this framework can be extended so as to apply it to contemporary society.

## Cultural Evolution on the Way to Diffusion

The cultural evolutionary approach, the predecessor of diffusionism, dominated anthropological thinking from the nineteenth through the first decade of the twentieth century. This approach aimed to map cultural differences onto a single line of cultural development that progressed in stages from simple to complex culture, culminating in European scientific culture. The collective project of anthropology scholars was to describe the different stages of humanity's cultural evolution. For example, in his *The Golden Bough* (1890), the Cambridge philologist James Frazer (1854–1941) described in great detail similarities in magic and religion in widely diverse 'primitive cultures' around the world, so as to chart societies' evolution from magic through religion to science. Two years earlier, Oxford anthropologist Edward Burnett Tylor (1832–1917) had put forward a statistical method to chart out the stages of cultural evolution from information provided by missionaries and colonial officials. He found advancement from polygamy to monogamy, matrilineal to patrilineal descent, nomadic life to permanent settlement, homogeneity to class hierarchy and role differentiation, and polytheism to monotheism. When a cultural item did not fit the stage at which the society had reached, Tylor argued that it was a 'survival' from an early stage. Moreover, when information was missing about a society, he argued that the anthropologist could justifiably fill in the gaps with knowledge of other societies at the same stage of development. This was possible because each stage constituted holistic cultural 'complex' and all societies progressed in the same direction through uniform stages, though at different rates.

The evolutionary scheme was upheld by the assumption of 'psychic unity': confronted with similar problems, all minds respond in a similar way. Accordingly, elements of culture were to be explained through individual psychological causes. For example, Frazer (1890) traces society's initiation ceremonies back to the individual's instinctual desire for food. Society was here understood in terms of the psychology of the individual writ large. Individual development was a process of socialization that recapitulated the cultural history of humanity up to the stage the group had reached, at which point individuals members of the group further advanced its culture. As such, the cultural evolutionists emphasized the everyday inventiveness of humans, rather than the spread of cultural innovations from a particular society as the diffusionists would do. Similarities of culture in different societies were understood to be the result of 'independent invention', though they also acknowledged that diffusion of culture might happen between societies at the same evolutionary stage. Most of the time, however, progress in a society is achieved through the accumulation of small innovations made by individuals every day. This scheme was

similar to the small modifications that constituted biological evolution in Darwin's influential theory, although the two theories differed in that the cultural evolutionary scheme was overtly teleological.

The cultural evolutionists' theories were developed primarily from reports made by missionaries and colonial officials. The notion of 'fieldwork' that we are familiar with today had not yet been developed. Frazer explicitly defended the division of labour between those who collect the data and the 'armchair' academic who used it to construct theory. He was himself the prototype of this model, having hardly ventured out of England and certainly not to do fieldwork. In fact, Frazer played an important role in convincing Alfred Cort Haddon (1885–1940) to collect ethnographic data (which Frazer's theorizing depended on) during a trip to the Torres Straight to investigate marine biology. Frazer argued that whereas the marine life would be around for generations, the culture of the Torres Straight islanders would soon disappear as a result of European intervention in the region. Haddon followed Frazer's advice and soon after became fully engaged with anthropological research. His books, *The Decorative Art of British New Guinea: A study of Papuan Ethnography* (1894) and *Evolution in Art: As Illustrated by the Life Histories of Designs* (1895; Haddon 1895), present a wealth of indigenous art, which is organized by classificatory modes analogous to biologists' investigation of the distribution and evolution of different species (Roldán 1992). Beyond this, Haddon argued from a cultural evolutionary framework that there was a teleological progression in art from figurative representations of natural objects to geometrical and conventionalized patterns.

In 1898, Haddon organized a large Cambridge expedition to the Torres Straight in order to collect a breadth of data on its people and their culture. In the interdisciplinary team of experts he assembled, Haddon stressed the importance of psychologists. The Cambridge polymath W. H. R. Rivers originally declined to participate but on hearing that his two best students, C. S. Myers and W. McDougall, had been recruited he changed his mind. These three were initially trained in medicine but had interests in psychology (Rivers was considered a leading experimental psychologist at the time for his work on vision and would go on to contribute to a number of other areas, while Myers and McDougall would later become distinguished in organizational and social psychology, respectively). They were to handle the psychological component of the expedition, which aimed to experimentally test the then current European belief in the superior sensory capacities of 'uncivilized' peoples (and by implication, lower intelligence), a belief fashioned from circumstantial missionary reports of native's incredible perceptual feats. This was to be the first rigorous cross-cultural study ever conducted. Responsibilities for investigating each of the special senses were distributed between them: Rivers studied vision, Myers studied audition, smell and taste, and McDougall studied touch and weight discrimination.

The results of these experiments were somewhat mixed. McDougall found differences in tactile acuity using the 'two point test', whereby two pin points are applied to the skin and moved further apart until the subject experiences them as two points. However, there were intermediate qualities between one and two points, such as 'dumbbell'- or 'line'-shaped sensations. This would explain the variation within The Torres Straight islands estimates, and their on-average superior performance could

be explained by their interpretation of the experiment as a competitive task, which was different from European's understanding of the task instructions. In contrast to McDougall, Myers found that the Torres Straight islanders, in comparison to Europeans, had inferior auditory acuity. This was probably the result of their habit of pearl diving. However, it did not seem to interfere with their everyday use of audition. Finally, Rivers found differences in visual acuity but was clear that these differences were too slight to confirm the belief in the natives' extraordinary sensory capacities. With regard to colour perception, he found that the islanders were generally more sensitive to red and less to blue than Europeans, but were otherwise capable of similar colour discriminations. This finding was important in that it provided evidence against the notion that the limited colour vocabulary of 'primitives' was indicative of an inability to discriminate colours and thus helped to theoretically differentiate biology from culture.

Rivers also tested the natives' susceptibility to visual illusions. It was thought that 'primitives' would either be easily fooled by such illusions as a result of their inferior intellect, or not fooled at all due to their attention to sensory details. In fact, the islanders turned out to be less susceptible to the Müller-Lyer illusion and more susceptible to the horizontal-vertical illusion. Clearly, these were two different 'sets' of illusions. Much later, this difference would be explained by perceptual training to meet the demands of particular environments: those living in 'carpeted' environments (with tables, chairs and all kinds of corners) are susceptible to the Müller-Lyer illusion, while those spending time outdoors with long-vistas (e.g. at sea) are susceptible to the horizontal-vertical illusion (see Segall et al. 1966).

### ***Rivers' Diffusionism***

Rivers greatly enjoyed his time doing research in Torres Straight and afterwards devoted himself to the emerging discipline of anthropology through further fieldwork in Melanesia, Egypt, Australia and southwest India. Within the course of his investigations, he came to increasingly question the assumptions of cultural evolution. In 1911, he gave a lecture to the anthropology section of *The British Association for the Advancement of Science* explaining his 'conversion' to a diffusionist perspective. The diffusionist approach had itself migrated to England from Germany, where it was first developed by Ratzel, Graebner and Schmidt. This approach saw a group's culture as being result of contact between different cultural groups rather than an independent evolution. For instance, a society's transition from figurative to geometric decorative art designs would be explained through the history of contact with another group that had a convention of more geometric artistic designs, rather than by an evolutionary tendency as Haddon had done.

The diffusionists argued that a group's history of cultural contacts provides a better guide to how a culture had developed than a uniform evolutionary norm. The cultural evolutionary approach often led to erroneous conclusions about a group's cultural history. For example, it said that a group believing in *mana* (an impersonal

supernatural force) was at the most primitive stage and would progress in the next stage to animism. Rivers (1911) points out that in some Melanesian groups he had worked with, it was likely that the earlier religion was animistic and that this was replaced when the natives came into contact with a group believing in *mana*. What cultural evolutionists considered to be the more primitive form of religion had in fact been imported from outside replacing what they considered to be the more advanced cultural form. Furthermore, elements of a group's culture may also internally devolve if they lose their functional significance: Rivers (1912) shows how different South Pacific groups lost the art of making canoes, pottery or the bow and arrow.

Rivers also argued that cultures were not as unitary as the evolutionists made them out to be. Multiple different cultural beliefs and practices could coexist in the same society. For instance, in Melanesian society, Rivers (1914) found several different customs of disposing of the dead, which for him illustrated a history of diverse cultural contacts. Even more, some cultural forms only arise out of the interaction between two groups—that is, they did not exist in either group before their meeting and interchange. Following psychoanalytic theory, Rivers said that groups developed cultural forms that were 'compromise formations' bringing together two different and often conflicting cultural practices in a new cultural form. A society's culture must then be seen as the result of a 'blending' of different peoples. The question for him becomes what are the factors involved in the transmission and transformation of culture between peoples.

One important conceptual move was to see culture as having different levels, from social structure at the 'deepest' level to material culture at the 'shallowest' level, and language occupying a middle position between the two. Material culture could be easily changed when one group recognized a superior element of culture in the other—the quick adoption of European firearms by 'primitive' people is a good example of this. This kind of cultural change requires only a few migrants carrying the cultural item with them. By contrast, social structure—including marriage customs, kinship patterns and group 'sentiments'—has a far more deep-seated character and changes only with the intimate blending of two peoples or the most profound political changes. As such, 'it is with social structure that we must begin the attempt to analyze culture and to ascertain how far community of culture is due to the blending of peoples, how far to the transmission through mere contact or transient settlement' (Rivers 1911, p. 395).

This emphasis on social structure in Rivers' theory was itself influenced by contact with the ideas of Durkheim and his sociological school. This influence helped Rivers to make a departure from the individualist psychology of cultural evolutionism. Durkheim argued that out of group interaction emerged social forms that were irreducible to individual processes within the group. He made the analogue with the properties of H<sub>2</sub>O: hydrogen and oxygen are flammable on their own but put together as a molecule they can put out a fire. Just as properties found at the molecular level cannot be predicted from the atomic level, so too properties of groups cannot be predicted from the individuals in them. These group properties (such as customs, values and traditions—in short 'collective representations') exert a determinate influence on the thought and behaviour of individuals in the group. While recognizing

the importance and autonomy of ‘social facts’, Rivers (1916) would not separate sociology and psychology as sharply as Durkheim; instead, he saw the two fields as developing a number of connections and mutually enriching one another.

Rivers also retained a more psychological perspective in his belief that individuals would regress to more primitive levels of functioning under certain environmental conditions. The physiological basis for this was demonstrated in well-known experiment by Rivers and Head (1908): Rivers severed a nerve in Head’s arm and over a period of 5 years detailed the return of sensation to it. They found that first a holistic all-or-nothing sensitivity returned (i.e. *protopathic sensibility*), which registered blunt pressure on the skin but was completely insensitive to stimulation with cotton wool, to pricking with a pin, and to all degrees of heat and cold. Later, localized sensitivity (i.e. *epicritic sensibility*) returned and suppressed the influence of the former. Following the neurologist Hughling Jackson, they thought the former was evolutionarily a more primitive response. Likewise, on the Torres Straight expedition, Rivers had recognized that the islanders’ performance on a task was worse when they were fatigued or during certain times of day. These studies and others led him to emphatically reject the more radical Durkheimian position of Lévy-Bruhl, who claimed that the thought processes of ‘primitives’ were entirely different from Europeans (see following text).<sup>1</sup> Individuals from any culture could regress to more primitive functioning under certain environmental conditions, such as fatigue or in the extreme case of war.

### ***Bartlett’s Social Psychological Approach***

Bartlett’s approach follows Rivers in charting a middle way between different theoretical positions on the creation of culture and the mentality of ‘primitives’. On one side, he rejects the cultural evolutionary explanation of culture as originating in the minds of individuals, à la Fraser. On the other, he accepts Durkheim and his school’s stress on the importance of social factors without, as they did, asserting that individual psychological processes had a negligible influence in the shaping and sharing of culture. Moreover, Bartlett sees both similarities and differences between ‘primitive’ and ‘advanced’ peoples. According to him, all people have certain fundamental instinctual tendencies, which are universal components of mind. However, these fundamental tendencies operate interdependently with one another and with group norms in individuals’ action and experience. Thus, mental and cultural diversity of humankind is to be explained by how these tendencies are combined and put in relation to different environments. The basic unit of analysis in this scheme becomes the active individual embedded within a social and physical environment:

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<sup>1</sup> He also rejected the functionalist argument that culture was always beneficial for the society concerned. As a psychiatrist who treated ‘shell-shocked’ soldiers, he knew that extreme conditions such as war clearly lead to pathological functioning.

The individual who is considered in psychological theory, in fact, is never an individual pure and simple. The statements made about him always have reference to a particular set of conditions. The individual with whom we deal may be the individual-in-the-laboratory, or—and in social psychology this is always the case—the individual-in-a-given-social-group. (Bartlett 1923, p. 11)

The job of the psychologist is then to explore the conditions under which certain responses occur. The conditions set up by the social group to which the individual is a member are always present and of central importance. In stressing social conditions, Bartlett was attempting to avoid the pitfalls of the cultural evolutionary approach, which explained culture by speculating about its origin in purely individual psychological processes. For example, the folk story had been explained as the outcome of an individual's contemplation of nature or 'like the dream, springs from one or two deep-seated individual needs, or desires, or wishes' (p. 58). Both Fraser and psychoanalysis adopted this form of explanation. These explanations fail firstly because it is normally impossible to discover the absolute origin of a folk story and secondly because they ignore inescapable social influences. For a folk story to be transmitted or maintained within a 'primitive' community, it must be performed to an audience. The storyteller must make an appeal to their interests and ways of thinking in order to retain and bolster his own prestige. This dynamic facilitates conservation of the story when it is retold within a particular community. However, when a folk story spreads from one community to another, it is usually transformed in order to appeal to new audiences. Bartlett uses Boas' (1901) work on Native American folk tales to illustrate how the 'same' story morphs into different forms as a function of the community to which it enters. He shows how the story's characters, their relations to one another and the moral conveyed change from one community to the next. In all this, we find that 'it is not the institution that is derived from the story but the story from the institution' (Bartlett 1923, p. 61).

Even outside the direct presence of the social group, the individual is unconsciously influenced by his or her group's 'cultural patterns' or 'conventions'. Bartlett gives the example of the Dahomey artist, who is convinced that he is creating a new design. In fact, the artist is following a number of conventions, such as the need to put a kink in each curve, rather than making them smooth, and for the figure to possess a certain harmony of outline and balance of parts, which are characteristic to the social group he belongs (p. 12). Thus, we cannot fall prey to thinking of individual experience and action in pre-social terms, outside the traditions of his or her social group:

It is only if we interpret individual to mean pre-social that we can take psychology to be prehistoric. The truth is that there are some individual responses which simply do not occur outside a social group. To look for these outside such a group is to court failure, and leads inevitably to speculation and guess-work. (pp. 12–13)

The notion of the 'social' used here is markedly different from contemporary psychology's use, which tends to focus exclusively on interactions between individuals, ignoring the broader social–historical context. By contrast, social scientists up to the early decades of the twentieth century defined the 'social' as the norms, values and



traditions specific to different social groups; properties that could not be reduced to the individuals in the group (Greenwood 2003). All groups have conventions that are in many cases unique to them. Scientists can use a group's conventions as legitimate starting points in their analysis without having to explain them in themselves, as cultural evolutionists had done.<sup>2</sup> The methodology for such an approach becomes the 'intensive study' of particular social groups and their mentalities. Bartlett (1923) argues that general theory should be developed from the careful analysis of concrete single cases rather than simply in the abstract. He also practices what he preaches: *Psychology and Primitive Culture* is replete with extensive discussions of 'primitive' cultures from the North America, Africa and Southeast Asia, demonstrating Bartlett's wide reading in anthropology. These studies are worked with in their complex uniqueness in order to generate principles for describing and explaining cultural dynamics at a general level.<sup>3</sup>

### *From Instincts to Tendencies*

In order to explore the interdependence of individual and group influences on the creation and diffusion of culture, Bartlett conceptualizes the individual as a dynamic system of 'tendencies', which are continuously being reorganized in relation to different contexts and material. By tendency, he means,

an active prompting towards a given mode of response—whether cognitive, affective, or expressed in definite bodily movement—which arises when an individual is brought into touch with a situation and attends to it. The tendency must have material to work upon, there must be some definite situation apprehended; while for its part the material must be met by a tendency if it is to provoke a response. (Bartlett 1923, pp. 273–274)

The notion of tendency implies a dynamic relation between an individual and his or her environment, similar to what other theorists have called a 'transactive' approach. Bartlett's 'tendency' was an extension of McDougall's 'instinct', discussed in his *An Introduction to Social Psychology* (1908), which for many years was the most widely read source on the subject, especially in England. Inspired by Darwin's evolutionary theory, McDougall made 'instincts' the central ingredients of his psychology. For him, instincts were innately determined 'psychophysical dispositions', which provide the drive behind the human mind's 'purposive' character. They should not be understood in terms of a rigid behaviour sequence, but rather flexible patterns taking shape in particular environments. Through the instincts, he aimed to give 'motivation' (the active part of the mind) its rightful place in the discipline of psychology.

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<sup>2</sup> Compare Wittgenstein's (1958) comments on the nature of customs: 'If I have exhausted the justifications, I have reached bedrock and my spade is turned. Then I am inclined to say: "This is simply what I do."'

<sup>3</sup> In this respect, Bartlett's approach is in step with idiographic principles of theory building (see Salvatore and Valsiner 2010).

Bartlett was sympathetic to McDougall's approach but criticized him for his focus on creating an exhaustive list of instincts rather than emphasizing how they combine in individual and group behaviour. Bartlett is content to work with an incomplete set of instincts in his analysis of culture and only adds others when it becomes necessary. He extends McDougall's 'instincts' to create a typology of 'tendencies', which includes:

(a) instinctive tendencies, (b) other tendencies, also innate, but particular to the individual himself; (c) derived or constructed tendencies which, in the course of experience, are built up on the basis of (a) and (b). In the last class perhaps the most important of all are the tendencies to reaction which an individual absorbs or takes over directly from his social group. (Bartlett 1927, p. 198)

Bartlett called the first group 'fundamental' tendencies, because they provide the foundation on which the other tendencies are constructed. The fundamental tendencies are innate and shared by all human beings. Examples are flight, repulsion, curiosity, pugnacity, construction, suggestibility, imitation, feeding, parental and gregarious instincts. Some fundamental tendencies are immediately social, requiring a group for their expression (e.g. suggestibility), while others are not. Two different classes of the fundamental tendencies are particularly important to Bartlett's approach and will require more detailed explication.

First, 'the social relationship tendencies' include *dominance*, *submissiveness* and *primitive comradeship*. When there is asymmetry of power and status in a social relationship, the higher-status individual or group takes on the *dominance* or *assertive* tendency, while the lower-status actor takes on the *submissive* tendency. The *dominant* actor has influence through command and by making an impression on the other rather than being an expression of their way of thinking. In contrast, *primitive comradeship* is expressed in symmetrical social relationships. Here, influence moves freely from both parties without force from either. Elsewhere, Bartlett calls this tendency 'friendship' and 'persuasiveness'. This group of tendencies is distinctly social in that they require a group for their expression. They are present in the relations between groups, between individuals in a group, and in an individual's relation to his or her group (e.g. a leader).

A second class of important fundamental tendencies includes *conservation* and *construction*. 'The conserving tendency provides a basis for the continuance of institutions, just as . . . constructiveness gives us a basis for the formation of institutions' (p. 42). These tendencies are interesting in that they suggest situating individuals and groups dynamically in time. Stability is maintained through *conservation* that is oriented to the past, while change is brought about through *construction* which is oriented to the future. *Conservation* is supported by a 'tendency of preferring the familiar to the unfamiliar' (p. 41).<sup>4</sup> At a group level it is upheld by collective 'sentiments' towards established group symbols, such as religious objects, titles, uniforms, etc. By contrast, the *construction* tendency looks forward and is responsible for the

<sup>4</sup> This phrase is taken over directly from McDougall (1908). In *Remembering*, Bartlett changes it to the more active 'making the unfamiliar familiar'. The revised phrase in turn becomes central to Moscovici's theory of social representations.

creation of new cultural forms and social organization.<sup>5</sup> In short, conservation and construction are the dynamic mechanisms of stability and change.

The last class is the derived tendencies, of which I will only mention a subset that ‘the individual takes over directly from his social group’. These bring into Bartlett’s framework the inescapable influence of group conventions. Bartlett says, ‘[These tendencies] cluster about a group’s established institutions and act directly as determining factors of individual social behavior’ (p. 29). He calls them the ‘group difference tendencies’ to make an analogue with ‘individual difference tendencies’—groups, like individuals, have different mentalities. In *Remembering*, Bartlett re-names them ‘the group’s preferred persistent tendencies’. It is important to note that he does not see these tendencies as necessarily opposed to biological tendencies, but rather as constructed from them. At the same time, he is emphatic that they are not reducible to individual processes.

The typology of tendencies is useful for analytic purposes but it is important to keep in mind that the tendencies always operate together as a dynamic system. For example, if fear is called into play in a social setting in which the prevailing tendency is primitive comradeship, it is likely to lead to panic, group disintegration or stampede. By contrast, if the social relationship tendency is that of dominance ‘the constructive [tendency] is likely to be immediately aroused, and therefore definite social mechanisms of persecution and cruelty, hardening into social institutions will appear’ (p. 39). These examples describe the hierarchical organization of different tendencies<sup>6</sup>, but there may also be conflict between them—for example, between the tendencies of curiosity and fear, comradeship and dominance, or conservation and construction, to name a few. When the antagonism among tendencies is strong the opposing tendencies will have their expression limited to a particular sphere of activity or a recognized period of time. Social limitations on the expression of sexual or violent impulses in certain contexts are obvious examples of this. On the other hand, weak antagonism between tendencies tends to lead to their integration in new cultural forms, sometimes called ‘compromise formations’ (see previous text). For instance, friendly discussion between people with different points of view is highly conducive to the construction of new ideas. Lastly, tendencies can mutually reinforce one another in positive feedback loop without becoming integrated into a new form.

## *Group Organization*

Characteristic groups and institutions grow up within the spheres of activity to which specific tendencies are limited within a society. These groups function to maintain

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<sup>5</sup> The concept of construction would later become central to Bartlett’s (1932) theory of remembering, in which memories are not merely registers of the past but are constructed in order to meet current demands (see Wagoner, 2014).

<sup>6</sup> Bartlett’s idea of the hierarchical organization of tendencies has parallels with Valsiner’s (2007) notion of regulation through semiotic hierarchies.

the tendencies in question and guide their expression. Bartlett's (1925a) definition of a group puts tendencies at its core:

A group is any collection of people organized by some common appetite, instinctive or emotional tendency, need, interest, sentiment, or ideal. The essential character is the organization, and one of the best general ways of differentiating one group from another is by reference to the different typical organizing tendencies that are at work. (p. 347)

This definition includes broad social groupings, often referred to as 'cultures' or 'societies', as well as differentiations within these, which he tends to refer to as 'special groups'. In both cases, a group is more than a haphazard collection of people; it is an *organization* of people around a particular tendency or set of tendencies. These tendencies constitute the group's *psychological* possessions.<sup>7</sup> These in turn create an interpretive background through which meaning can be given to its 'cultural elements' (e.g. objects, ceremonies, dances, decorative designs and all kinds of institutions). The particular set of tendencies that differentiate a group from others and the group's cultural elements together constitute its culture.

Bartlett (1925a) distinguishes between three types of social groups: *instinct*, *sentiment* and *ideal*. These types form a developmental sequence from which the new emerges out of the old, and the old continues to abide together in the new. At the most basic level, is the *instinct* group, such as the food-seeking group for satisfying hunger, the war group to express pugnacity or the religious group, which Bartlett believed is commonly linked with fear. Leaders emerge within the *instinct* group, whom most express the tendency in question. For example, the climbers on an expedition to Mt. Everest quickly found themselves in a certain hierarchy based on motivation and ability in that activity. At the next level is the *sentiment* group. Sentiments are complex and organized sets of emotions. In their social guise, they cluster around group institutions and play a key role in creating group solidarity, an idea that had earlier been articulated by Durkheim (1912). They also help to retain stability through time:

Even if the group changes its membership, the institutions are maintained, and, being both interesting and persistent, they regularly become the center of sentiments. But sentiments are always turned chiefly toward the past . . . They draw their strength from history. They depend on persisting features in group organization, and are apt to be the stronger, the more peculiar and clearly differentiated the group's special functions are. They help to stabilize all kinds of devices—uniforms, hidden formulae, catchwords, flags, symbols of every sort—for maintaining the past. Feelings are mental parasites. They must attach themselves to something, and preserve that to which they attach themselves with as little change as possible. Thus in a world which is in general ceaselessly moving, they constantly weaken their own hosts. The sentiment-governed individual and the sentiment-organized group both lose in adaptability what they seem to gain in inner cohesion. (Bartlett 1925a, p. 362)

Out of the sentiment group a third type of group can develop, called the *ideal* group. This group is practical and intellectual in its workings, though it retains a basis in feeling. Bartlett saw an example of this type in expert scientific groups and the League

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<sup>7</sup> Bartlett (1937, 1943) argued that a group's psychological possessions can best be brought to light with psychological methods, such as his method of serial reproduction.

of Nations (renamed The United Nations). Unlike the *sentiment* group, which looks to the past, the *ideal* group is oriented primarily to the future. In other words, it is more *constructive* than *conservative*. 'The sentiment maintains what has been and is, the ideal seeks to determine what will be. Nearly all vigorous and effective groups within the modern nation are mainly ideal groups; all nation groups are at present mainly sentiment groups' (p. 365).

The *sentiment* and *ideal* groups also differ in the type of leadership they support. The leader in the *sentiment* group garners his or her prestige through the *institution*. This is done with the use of institutional symbols, such as uniforms, titles, badges and modes of address, which elicit group sentiment. These leaders have difficulty deviating from the traditional requirements of their role and thus lack flexibility. By contrast, the leader of the *ideal* group acquires his or her position as a result of his or her practical insight and ability to weave different factions into a common pattern. In short, they are of the *constructive* and *comradeship* type.

Every group in a society develops its own institutions, which express and maintain the tendencies that differentiate it from other groups. The group receives a certain 'reputation' and 'prestige' within the broader community that are passed on to its members. Thus, we need to consider the relations between groups. A reputation means that certain abilities and qualities immediately spring to mind when persons of that group are seen. This in turn makes members of the group more likely to display and exaggerate the abilities and qualities in question, such that they become *conventionalized* attributes of the group. Leaders within the group tend to most strongly display these attributes. A feedback loop emerges between the expectation of the community and display by its members, especially the leader. Such a stabilized social organization will be resistant to change. Even if the broader community tries to drive the group's tendency out of social life altogether, the group's tendencies will simply go underground and only come to the surface again in moments of crisis, as can be seen in sudden religious revivals and outbursts of persecution. In the next section, we will consider what happens when two cultures come into contact and how these group dynamics shape the result.

### ***Diffusion by Contact and Borrowing***

Bartlett's primary interest was to explore the changes that ensue when two cultures come into contact with one another. Contact was for him the greatest stimulus of change, particularly when the groups concerned have radically different forms of social organization. He outlines three different kinds of contact, each of which set up distinct conditions for cultural diffusion: *contact*, *borrowing* and *intercommunication*. *Contact* involves the migration of whole groups across long distances, carrying their cultural possessions with them, to settle in a new environment, where they have a considerable influence on the culture of the indigenous group. This generally leads to the blending of two formerly distinct groups. In the case of *borrowing*, individuals travel from their home, where they become acquainted with the culture of another

group, and on returning home bring with them foreign cultural elements, which they often try to introduce into the life of their home community. Finally, *intercommunication* involves two neighbouring groups that are in regular contact with one another, assuring the steady flow of culture between them. It thus occupies an intermediate position between *contact* and *borrowing*. Bartlett does not elaborate on it.

Diffusion of culture by *contact* takes different directions depending on a number of factors, such as the social relationship tendency of the group (e.g. being inclined to peace or war), the groups' numerical proportions, differences in physical and cultural endowments (i.e. whether one group is perceived to have a superior culture), and the proportion of the sexes. The most important of these are the social relationship tendencies. When the two groups share an attitude of *primitive comradeship*, the result is likely to be the blending of culture. Knowledge gained of the other's culture will tend to lead to its adoption. In Rivers' (1914) work, he described how Melanesian society had incorporated a number of different ways of disposing of the dead through the various waves of contact with other people. By contrast, *dominance* of one group tends to lead to the displacement of the other.

There are, however, different types of dominance that need to be differentiated. The most extreme form of dominance is due to force of numbers leading to the extermination of the other. A more psychological form of dominance is when one group is perceived to have the more superior culture, in which case the other group will readily adopt it. However, the adoption tends to happen at the surface level of culture (i.e. material culture, ceremony and designs) and not to the deeper level of social organization and the interpretation of these different elements, which will be resistant to change. Moreover, this adoption will be selective; it will depend on the particular tendencies in operation in the group, which are expressed as the group's distinctive 'cultural patterns'. These patterns grow and adapt to incorporate the new: 'It is because the group is selectively conservative that it is also plastic' (Bartlett 1923, pp. 151–152). Thus, the group retains stability through its flexibility.

Finally, one group might force the other to relinquish its culture to be replaced by the culture of the dominant group, which the other does not see as superior. This has generally happened with European efforts to convert 'primitive' groups to Christianity. In this process, the primitive's culture does not altogether disappear, but is driven underground or the old is retained by becoming the backdrop upon which the new cultural material (e.g. Christianity) is superimposed. For example,

Years after the Spaniards had conquered New Granada . . . when the native Indians were all accounted Christian, and had taken over the religious paraphernalia of their conquerors, secret Indian shrines were sometimes found. In one of these was discovered, offered to the 'overthrown' idols, the cap of a Franciscan friar, a rosary, a priest's biretta, and a Spanish book of religious precepts. The new material had been assimilated, but its predominant, though hidden significance preserved the past. (Bartlett 1925b, p. 5)

This processes lead to the formation of symbols. Symbols are different from signs in that they have double or multiple meanings (Bartlett 1924). They carry both a 'face' and an underlying 'hidden' value. The latter is generally characterized by sentiment, which helps to give symbols whatever stability they possess. In the previous quotation

‘the cap of a Franciscan friar, a rosary, a priest’s biretta, and a Spanish book of religious precepts’ stand for the hidden value of old religious beliefs.

Diffusion by *borrowing* takes a different route. Here, an individual travels to another group and assimilates elements of that culture on the basis of his or her particular personality. The personality of the individual borrower is itself the result of a combination of different tendencies, including those taken over directly from the social group to which the individual belongs. Diffusion by borrowing is more influenced by individual psychological processes than diffusion by contact. It is personality that determines which aspects of the foreign culture are lifted out and brought back to the individual’s own group, as well as how the individual borrower relates with their home group once they have returned to it. When the individual tries to introduce the new element of culture to his or her group, a new ‘special group’ will typically develop around the new item. This group then often comes into conflict with the wider group as it attempts to extend its sphere of influence. Bartlett gives the following example:

John Rave, a member of the Winnebago group, was a man of strong religious bias. Travelling eastwards from his home he came into touch with a new religious cult centering about the eating of the drug peyote. He took over many of the new practices, and returned to his home, where he introduced them amongst his friends. Subsequently the cult spread widely throughout the community, with Rave as a ceremonial leader. Outwardly novel, the cult represented in the main the persistence of the old. A fire mound was used. It was called Mount Sinai; it took the place of the old sacred mound of the Buffalo Dance. The Bible was introduced. On the face of it the Bible was new, and carried the prestige of a higher civilisation. In actual fact it was treated exactly as any item of the old Winnebago ceremonial regalia had been treated. Rave’s religious interest had been attracted by the new customs; his strong conservatism had placed them in close relation to the old practices. And his interpretations then became current owing to his position in the community. (Bartlett 1924, pp. 281–282)

Rave’s personal interest in ceremony was the mechanism that ‘lifted’ the peyote out of the foreign group and brought it back to his home group. In his home community, Rave formed a special group around the peyote. Conflict with the community started when Rave wanted to expand the borders of the peyote cult. The expansion of the group required increasing its prestige within the wider community, which involved incorporating old cultural patterns into it and thus leading to the formation of symbols. For example, the fire mound took the face value of ‘Mount Sinai’ and the hidden value of the old sacred mound of the Buffalo Dance. When the community rejected the new cult, Rave became more hostile to the old traditions, which paved the way for a more aggressive innovator named Hensley, who introduced the bible into the cult. The growth of the cult into a new cultural pattern was not planned by any single individual; rather it involved the unconscious weaving together of a number of scattered influences. Bartlett (1923, 1928, 1932) calls this complex process ‘social construction’ or ‘social constructiveness’, which we will return to later.

## *Some Principles of Cultural Change*

Bartlett outlines a number of general principles that hold when cultural elements diffuse from one social group to another. First, elements of culture tend to travel much more quickly than their significance and thus while the elements themselves come from outside a group their interpretation typically grows up from within. Second, for a new element of culture to diffuse in community it must be attached to existing tendencies already found there. These tendencies will likely be different from the community from which the cultural element originated. Third, material culture tends to be adopted as a whole, while ceremonial culture is split up into separate pieces. Fourth, special social groups tend to grow up around new elements of culture (e.g. the peyote cult). Fifth, a group will develop its culture in such a way as to increase its prestige within the wider community and as such is constantly being influenced by the wider community. Sixth, diffusion involves processes of *elaboration* and *simplification*—these had earlier been discussed by Haddon (1894) and are particularly important to Bartlett's argument.

*Elaboration* refers to the increasing complexity of culture. This can occur through the repetition of certain patterns, and by conscious or unconscious inventions. Ornamental designs are good illustrations of this principle at work, often incorporating patterns of a foreign group into those of the home group. The opposing but complementary process of *simplification* refers to the disappearance of details through their absorption into a more dominant detail, as has generally happened with the evolution of alphabets.<sup>8</sup> The best condition for *elaboration* is where a special group has a position of moderate dominance within the community and close working relationship with it. *Simplification* tends to occur through either isolation or popularization. The former typically happens with ceremonial culture and the latter with material culture. In decorative arts, for example, expansion of the group with new members creates conditions for unskilled and careless coping of designs. Isolation may occur when the group secures a position of dominance in the community and makes little effort to widen its influence within the community.

In *Remembering*, Bartlett returns again to the issue of the general principles of cultural transformation in diffusion and provides an altered list of the processes involved, namely *assimilation*, *simplification*, *retention of apparently unimportant elements* and *social constructiveness*. The first three in the list are primarily conservative processes. *Assimilation* refers to the part played by the existing cultural background of the group concerned. Any new cultural element must be linked to the cultural patterns of the recipient group if it is to be adopted. In this process, the new element is transformed to fit the group's cultural patterns while the patterns themselves flexibly adapt to the new content. Earlier we saw how the natives of New Granada assimilated Christian objects to their old religious beliefs. Bartlett's (1932) description of *simplification* remains the same as in his earlier discussion of it. He

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<sup>8</sup> The exception to this is ancient Egyptian hieroglyphs, which were highly ritualized and changed little over thousands of years.



notes again that a process of *elaboration* often precedes and works in consort with it. Changes seen in decorative art and alphabetic script through time are prototypical examples. *Retention of apparently unimportant elements* was frequently found in Bartlett's (1932) own experimental results. These retentions tended to exert a decisive influence on the direction of change the material underwent. Again, close parallels can be made with the diffusion of decorative art described by Haddon (1894).

Perhaps the most interesting in the list is the process of *social constructiveness*, which we have already encountered in the discussion of diffusion by borrowing. This points to the fact that groups not only have a past but also a *prospect* (i.e. a future orientation). Culture is transformed not only in the direction of already existing cultural patterns but 'also positively *in the direction along which the group happens to be developing*' (Bartlett 1932, p. 275). The general outcome is usually the welding together of cultural elements from diverse sources into a new cultural form or social organization. This is what happened with the peyote cult described above, and is how Bartlett (1925a) characterized *ideal* groups, which become particularly important in modern society (see following text). Bartlett (1932) even characterizes sports teams as socially constructive in their creative and dynamic response to new challenges in the game. The concept of *social constructiveness* thus synthesizes diffusionism's focus on spread of culture and cultural evolution's focus on the progressive growth of culture from within (see Bartlett 1928).

### ***From Primitive to Modern Culture***

Although Bartlett advances his argument through examples of primitive culture, he thought his framework could also be used to study modern culture, though with certain modifications. Thus, at the end of *Psychology and Primitive Culture* he attempted to describe the relation between primitive and modern culture. Bartlett wanted to avoid the radical separation of primitive and modern mentality famously described by Lévy-Bruhl. Lévy-Bruhl argued that in contrast to the modern mentality, primitive thought is characterized as pre-logical, emotional, mystical and self-contradictory. Primitives do not sharply distinguish themselves from other objects, but rather emotionally *participate* with them.<sup>9</sup> He famously described how members of a Brazilian Borono tribe claimed to be simultaneously a type of parrot and human being. From a modern point of view, they were committing the logical error of contradiction. However, this does not mean that we should think of primitive mentality as inferior to modern. Following Durkheim and contra Fraser's notion of 'psychic unity', Lévy-Bruhl argued that both primitive and modern mentalities are distinctly *social* forms of thinking, irreducible to individual psychological processes. Each mentality has its own internal standards of thought and thus it is illegitimate for the modern anthropologist to privilege their own standards in the evaluation of primitive culture.

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<sup>9</sup> Piaget (1930) characterized the mentality of children in the same way.

Bartlett accepts Lévy-Bruhl's Durkheimian argument for the need to include social causes in one's analysis but is critical of his way of doing this. Firstly, Bartlett (1923, p. 289) comments, 'the error . . . is not that the primitive or abnormal are wrongly observed, but that the modern and normal are hardly observed at all.' He goes on to say that Lévy-Bruhl compares the primitive to the scientific expert or philosopher rather than the everyday thinking of modern people. Secondly, primitive societies contain a variety of different thought styles, which change in relation to the topic (e.g. death, war, food, art). In other words, the same tendencies found in primitive society can also be discovered in the modern society, though not necessarily in the same contexts and in relation to the same material. The notion of causality illustrates this point: "Causal links" says Lévy-Bruhl, "which for us are the very essence of nature, the foundation of its reality and stability, have no interest" for the primitive man: he is swayed by a "kind of *a priori* over which experience exerts no influence" (quoted in Bartlett 1923, p. 289). Examples of establishing links and not establishing links in a causal chain can be found in both the thinking of primitives and modern people. The range of thinking styles found in both cultures makes the sharp distinction between them untenable. As such, Bartlett argues that the basic processes of thought are the same for both primitives and moderns but that their differing life conditions lead to the greater influence of certain tendencies:

There are . . . two great differences between primitive and modern mental life. First the contents dealt with are different, and secondly the tendencies which deal with them are differently arranged. We, at our level, are perhaps less closely dominated by immediate vital needs, for the means of which these are to be secured have become to a large extent a part of the regular organisation of society . . . we less readily yield ourselves to the sway of freely associated images, more often try to use some formulation which claims general and objective validity. But when the savage thinks, he thinks as we do. When we follow the flight of images our progress has the same characteristics as his. (Bartlett 1927, p. 202)

Instead of a sharp qualitative difference between primitive and modern culture, Bartlett argues for a quantitative one. In his words, 'we come from complexity [in primitive society] to yet greater complexity [in modern society]' (Bartlett 1923, p. 256). The increase in complexity is due mainly to two factors: 'the multiplication and division of specific groups, together with immense improvements in the mechanisms of inter-communication' (p. 256). As mentioned in the previous quotation, the differentiation of groups and their functions frees the individual from the need to focus on securing basic vital needs. Both the differentiation of groups and improvements in the means of communication between groups place the individual within a number of different groups which are in effective contact with one another. For the different groups to which the individual belongs the same element has different meanings, any of which can be pursued by the individual. This gives the individual a more independent status, increasing the possibilities of thought and behaviour. Likewise, cultural material can be easily lifted out of one group and brought into another. These processes are already found in primitive groups but are further accelerated in modern society, creating new conditions for the free movement of thought, social constructiveness and greater individual independence.

Bartlett also mentions the ascendancy of a particular kind of leader in the modern world, which he calls ‘representative man’. This leader stands in for his group in the negotiation with other representative men over policy that affects all their groups. Representative men are necessary in modern society because of the ever larger social groups that must be coordinated. The representative man tends to be of a diplomatic type, who ‘expresses his group rather than impresses it’ (p. 261). He is generally of the *comradeship* rather than *dominant* type in his relation with other representative men and members of the group he represents. Any decision or contract arrived at by the group of representatives is binding for all the groups to which they stand. Often a group breaks these contracts leading to accusations of deceit and immorality by others, but this outcome can also be explained from a social psychological perspective. Bartlett (1923) points out that ‘the behaviour of the representative man in the group which concludes the bargain, and his behaviour in the group which has elected him, are conditioned by different sets of factors’ (p. 260). The traditions regulating the group of representational men are not the same traditions regulating his behaviour with regard to his own group, and being of the *comradeship* type, he is highly swayed by both influences.

### ***Modern Culture and Political Propaganda***

Bartlett continued to be actively interested in problems surrounding the contact of cultures throughout his life, though social and cultural aspects of his work took an increasingly more subordinate position after *Psychology and Primitive Culture*. Over his career, technology improved rapidly, providing conditions for wider and faster intercommunication between groups. Individuals could more easily travel to distant parts of the world and cultural elements moved even faster through radio, film and television. ‘The development of swift and easy forms of locomotion, the rise of a popular Press, the invention and universal use of the cinema, of wireless and of television, mean that no group can live to itself’ (Bartlett 1940, p. 3). These forces greatly accelerate diffusion, particularly diffusion by *borrowing*, where cultural elements are ‘lifted’ out of one society and dropped into another. As we have already seen, while these cultural elements come from outside a group, their interpretation grows up from within.<sup>10</sup> Bartlett’s discussion of these broad social changes, however, remained more suggestions to follow up than fully worked out analyses. The one exception to this is his book *Political Propaganda*, published in 1940 shortly after the start of the Second World War.<sup>11</sup> It offers an illustrative example of how

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<sup>10</sup> This insight has important implications for and parallels with contemporary theories of globalization. Robertson (1992), for example, argues that we need to simultaneously consider ‘localization’ alongside ‘globalization’. He combines the two processes in his invention of the term ‘glocalization’.

<sup>11</sup> Late in his career, Bartlett did publish a number of other articles and speeches on different aspects of modern cultural diffusion—e.g. national and international social groupings (Bartlett 1947a, 1947b), globalized culture (Bartlett 1955), and the cinema (Bartlett 1960).

Bartlett applied his approach to modern society as well as an interesting reflection on propaganda which at that moment was becoming a major political tool.

Bartlett's (1940) social psychological approach to propaganda is noteworthy in that it gives equal weight to both intelligence and emotion. He is critical of the assumption that modern mind is simply governed by intelligence as well as the assumption that the public is primitive, inferior, prone to forgetfulness and ruled by emotions. The former position was widespread when he published *Psychology and Primitive Culture* and was his point of critique there. By 1940, the latter position had become ascendant and would be the primary focus of criticism in *Political Propaganda*. Bartlett develops his argument against Hitler and Goebbels' belief that the masses were unintelligent and should be controlled by a *dominating* elite—the word 'mass' itself comes from the metaphor of a potter shaping an inert piece of matter. Bartlett points out that if the German public has these qualities it is only because the ruling political party keeps them in this state through censorship, coercion and by requiring uniformity of opinion. This contrasts sharply with democratic propaganda, a point I will elaborate further.

The book begins with an exploration of the emergence of propaganda, which Bartlett (1940) traces to advances in mass media and education:

The rapid development of effective contact between groups in contemporary society means that no important political, economic or other cultural change can take place anywhere which will not swiftly be treated as affecting the destinies of distant groups. The rise of popular education means that any major political, economic or other cultural change must be explained, or justified, to an ever-increasing number of people. These two movements together provide the setting and the fundamental conditions which have led to a terrible outburst of political propaganda. (Bartlett 1940, p. 4)

With regards to education, Bartlett describes the efforts made by the Bolsheviks to make the largely illiterate masses literate so that they would be in a position to replace old habits with new ones deemed correct by the Communist party. These efforts, however, resulted in stimulating intellectual curiosity beyond the Party ideology, as Bartlett's theory of groups would predict. Thus, in the interests of retaining uniformity of opinion, totalitarian regimes combine education with strict censorship, dramatic persecution and many forms of repression. Ultimately, Russia began to prefer more visual propaganda, such as film, picture posters and art, which according to Bartlett (1932) are less likely to stimulate analysis and critical distance than words. Italian and German Fascists developed similar tactics for totalitarian education, rewriting schoolbooks, controlling the press and pitching their message to the lowest intellectual level. These efforts were particularly systematic in Germany.

In any social organization, the propagandist must pitch his or her message so that it connects up with the public's already existing tendencies if their efforts are to be successful, although education might be put in the service of creating new tendencies. There will always be certain aspects of a group's beliefs that are highly resistant to change while others are more open to it—Bartlett (1943, 1946) called these the 'hard' and 'soft' features of culture, respectively. A thorough understanding of the particular culture background of the audience is needed to identify where propaganda can be successful. This makes it much easier to create propaganda for the home group

than a foreign group as currents in the culture can be much more easily ‘intuited’ in the former case. Even in the home group the message will often be transformed in the process of communication. An extreme case of this is where the propagandist spreads rumours within a population (i.e. ‘a whisper campaign’). The problem with this is that while rumours are easy to start, they are difficult to control; they readily transform in their transmission, often in surprising directions, as Bartlett’s (1932) serial reproduction experiments themselves show. In the end, they may have the opposite effect to the one intended by the propagandist.

In addition to whisper campaigns, Bartlett analyzes a number of different methods used by the propagandist in order to shape public opinion. Some of these are of general utility when used in a certain way but nevertheless come with limitations. For example, humour can be successfully used if the propagandist is sufficiently acquainted with currents within the culture of his audience. For it to be effective the message must be pitched just beyond what has already become a routine joke, so as not bore or offend the receiver. Another frequently successful method is the use of statistics. Even though the assumptions made about them are usually wrong, the use of statistics succeeds because numbers operate as symbols that have the aura of scientific fact. Symbols of all kinds can be highly potent in that their hidden value produces effects without the person ever becoming fully aware. For instance, the Italian Fascists put images of a club, fist or, particularly, square jaw next to verbal content to convey authority. There are other methods of propaganda, however, that often completely fail because of their assumption that the public is of low intelligence and forgetful. For example, lying and distortion generally only produces the desired effect in the short term, as it is likely to be called out by counter-propaganda, destroying propagandist’s group credibility in the future. Other methods that pitch to the lowest intelligence, such as constant repetition and avoiding argument in preference for simple declarations, run the risk of boring their audience, so that they pay little attention to the message.

Bartlett argues that democratic propaganda operates with a different set of principles than totalitarian regimes: It allows for dissenting views, avoids the lie and focuses on long-term rather than short-term effects. Moreover, rather than keeping the public’s intelligence at a low level and trying to get the bulk of people to accept wide generalizations without criticism, democratic propaganda allows for the free interplay of different points of view, so as to stimulate intelligence and independent thought—Bartlett (1923) had earlier described this in relation to modern culture (as already discussed). Bartlett finds parallels between democratic propaganda and modern advertising, in that, in both, multiple different messages are available and thus the sender must *persuade* the receiver. In short, while the democratic propagandist tends to be of the *persuasive* type, the totalitarian propagandist is *dominant* in relation to a *submissive* audience. Bartlett clearly favoured democratic forms of propaganda and even rather optimistically believed in the power words ‘to settle difficulties that arise when interdependent larger groups come into contact’ (Bartlett 1947a, p. 36).

## Conclusion: A Conditional Analysis of Culture

This chapter has used Bartlett's framework to explore the systemic causes of cultural diffusion, maintenance, change and invention. In this concluding section, I will highlight how this framework is guided by the principles of conditional analysis (see, e.g. Beckstead et al. 2009). The different factors Bartlett identifies that condition the direction of cultural diffusion do not directly 'cause' cultural elements to be incorporated or ignored, transformed or maintained; rather they 'set the stage' for these processes to occur. These factors cannot thus be treated as mere variables that somehow 'interact'; instead, the researcher must consider how they operate as a system through the analysis of concrete and contextualized single cases as they change through time (i.e. diachronically). Thus, Bartlett confronts us with a wealth of ethnographic studies that illustrate particular processes of diffusion and analyses them with a flexible theoretical apparatus that looks at the *relations* between different tendencies and the material in which they work on. This framework necessitates attending to individual and group processes, which dynamically relate with a particular environment. The unit of analysis is an active individual embedded within an environment that is both physical and social.

The social part highlights a number of important conditions of the transmission and transformation of culture: the forms of relationship (i.e. *dominance*, *submissiveness* and *primitive comradeship*), which operate between individuals, between the individual and the group, and between groups. These work in concert with a group's 'cultural patterns' or 'conventions', which always stand in a dynamic tension between past and future, stability and change, *conservation* (the flexible maintenance of the old) and *construction* (the creation of the new). Primitive groups tend towards conservation but conditions can quickly change such that construction takes the lead. Although these different factors may appear rather simple from the outset, their dynamics quickly become complex when applied to single cases. Primitive groups are not homogeneous, but differentiated into 'special groups', which become custodians of certain tendencies and material culture. Special groups develop certain relations with the wider community that in turn creates particular conditions for the growth of culture. For example, a group's relative *dominance* and regular contact with the wider community 'sets the stage' for the *elaboration* of culture, whereas isolation or popularization creates conditions for *simplification*. Individual acts of *elaboration* or *simplification* are not, however, 'caused' by these social conditions, but rather work *through* them.

There are also complex dynamics between one community and another. Contact with new groups and the introduction of new cultural elements can transform a group's whole culture. This is because cultural elements do not stand alone but form a relational whole. Diffusion between communities takes the route of *contact* or *borrowing*, each of which sets different conditions. *Borrowing* depends more on the personality of the individual, who brings a foreign cultural element into the community and is its promoter, while *contact* depends more on broader societal factors. *Contact* creates conditions for the blending of culture when the communities

are in a relation of *primitive comradeship* and displacement when one is *dominant* and the other *submissive*. One can see how a number of factors come into play simultaneously and work as a complex whole in preparing the ground for different processes of diffusion and reconstruction—whether cultural elements are accepted or rejected, assimilated as a package or individually, how they are combined with the old and/or used to construct genuinely new cultural forms.

The processes of diffusion found in modern societies are not fundamentally different from ‘primitive’ societies, but do set up different conditions as a function of their differentiation into many special groups and their technologies of transport and communication, which allow for ever wider and faster diffusion (these technologies and education themselves create conditions for the widespread use of propaganda in modern societies). Furthermore, belonging to and communicating with a number of different social groups are necessary conditions for the individual to be able to follow different trains of thought, which promote individual autonomy and social constructiveness (i.e. the emergence of genuinely new cultural forms that bring together multiple influences). Totalitarian societies try to stifle this development through censorship, coercion and repression. This certainly creates adverse conditions for intellectual and cultural growth, but as leaders of a one-party system know well, they cannot completely suppress the formation of new ideas and culture. Instead, repression tends to create conditions for them to simply go underground and only resurface during times of social upheaval, as Bartlett (1923) himself stressed. The Arab Spring and the protests that have followed all over the world, confirm his point. The diffusion of a single idea like ‘revolution’ can have dramatic effects, not just on the transformation of individual nations, but the world as a whole.

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## Chapter 8

# Catalysis and Morphogenesis: The Contextual Semiotic Configuration of Form, Function, and Fields of Experience

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The possibility to use the notion of catalysis to develop a semiotic cultural psychology is important. However, this task is not easy since the transposition of a concept from one discipline to another is not easy. We believe it is essential that the complexity of the human being is preserved and understood as a subject in relation to and developing within the socio-cultural world.

The concept of catalysis used in chemistry and in biology refers to the conditions necessary but not sufficient—by means of a catalyst—to help in two different ways: (1) the production of chemical substances which could not be produced without the presence of catalyst and (2) the change in the reaction rate that could not take place without the presence of the catalyst (Valsiner 2007; Cabell 2011; Cabell 2010).

The catalyst has the same abstract function in both disciplines—functioning as a “helper” in the reaction process. The way in which the catalyst helps in the reaction process is by activation. In psychology, the catalyst or the catalytic agent activates other mediating functions required for the reaction process. In chemistry the help comes from providing resources (energy) that activate the reaction. Although the outcomes of the catalytic process in both disciplines are similar, they slightly differ. In psychology, catalysis enables production of novel meanings and enables the regulation of other meanings. In chemistry, catalysis aids in producing novel chemical substances and aids in changing the rate of reaction. (Cabell 2011, p. 3)

The semiotic proposal within the cultural psychology of Valsiner considers a psychological catalyst, or a semiotic catalyzer, conceptualized as a special meaning

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(*a point-like sign, a field-like sign, or a hypergeneralized sign*<sup>1</sup>) in which the psychological system provides the conditions necessary to enable the production and regulation of other meanings in the stream of consciousness of the person.

A catalyst enables the production of new meanings through the activation of other mediation mechanisms and regulation mechanisms within the system (e.g., promotion and inhibition) (Valsiner 2007; Cabell 2011).

The innovative importance of this concept is that researchers can renounce the old concept of linear causality and the use of cause–effect that has dominated psychology throughout the epistemology of modern science.

Catalysis is a concept that introduces the researcher to the systemic and circular causality toward a complex vision of the dynamic interaction between organism and environment.

The “before” and “after” of a phenomenon are no longer “states” with different ontological status but are modalities of same phenomenon that are interconnected with hierarchical levels of different extension and generalization. This enables research of a phenomena in a different way than what is typically performed. A psychological phenomenon is always embedded in a process taking place over time and in an ecological setting.

How can the semiotic catalytic perspective preserve and help understand the system of subjectivity? How is a semiotic catalyst able to create conditions that favor the development of psychological processes that occur over time, but without the ability to determine imperatively the direction of the trend?

Similarly, another question that also demands discussion, is “what,” “how,” and “when” a semiotic catalyst such as semiotic agent becomes active. If we believe that a semiotic catalyst predisposes the appropriate conditions for the implementation of a process then we feel the need to ask ourselves what predisposes the necessary conditions to activate the working of the catalyst.

Autocatalysis (Deacon and Sherman 2008; Kauffman 1995; Lotman 2000; Valsiner 2007; Cabell 2011) is a phenomenon based on processes of recursivity and self-regeneration. Autocatalysis requires at least three parts (two catalysts and one molecule) that react in a way that is mutually generating. The catalytic process is assumed to be the original transition from inorganic material to the organic world allowing for the initial conditions of the emergence of life. However, the

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<sup>1</sup> *Point-like signs* are static and stable conceptions/representations of something. The most common example of a point-like sign is a word. [...] Therefore, we can identify the presence of a catalyst in the form of a point-like sign by a particular word that provides the conditions necessary for regulated change (Cabell 2010, p. 28). [...] *Field-like signs* are mental conceptions/representations structured in space and time and represent through the embeddedness of something in relationship to its (spatio–temporal) environment. For example, the notion of “identity” can be viewed not as an entity (“I am X”) but as a field-like sign through which catalytic processes can take place (Cabell 2010, p. 30). [...] *Hypergeneralized signs* allow for symbolic generalization and symbolic linkages with the indefinite and undefinable. They provide a representation of the totality of life experiences in a form that is overwhelmingly undefinable, and yet actively operating (and many times regulating) in the psychological functions of the individual (Cabell 2010, p. 31, emphasis added).

same autocatalytic process is enough to understand the emergence, development, and disappearance of psychological phenomena.

The operation of meaning-making in minds and in societies requires the catalytic concept that focuses psychological research and analysis on appropriation and synthesis in domains such as: the formation of complex structures (the problem of becoming), the identification of trajectories along which moves the development of complex structures (the problem of the future states of evolution), the definition of an evolving system as a whole (the problem of the relations between parts of the system and its totality; Bertuglia and Vaio 2011), and the relationship between the system and its wider context.

In this work, we intend to reflect on the psychological phenomena of *emotions*, an affective processes that enables the configuration of the intra/intersubjective field of meaning making processes in everyday experiences.

## The Complexity of a Simple Experience

When we reflect on human experience, we generally come to understand it in two different ways. On one hand, we understand that the daily experience of each person is just a process of response to variety of stimuli that come from various environmental sources. On the other hand, we understand that experience unfolds as an internal flow of intrasubjective consciousness.

These two perspectives lack the ability to fully understand all the complexity of action and thought in human experience.

The human being in one case is seen as an agent of response to stimuli already present and given in the outside world; in the other case, the human being is fully taken by a determination and imposition of himself in the world, in the modification of the world through the externalization of his imperious inward flow of experience.

Obviously, we have used hyperbolic examples of the perspectives to make more evident the implicit assumptions in alternative paradigms of psychological research and theory. Although both views offer a their own form of complexity, this complexity is shown mainly as abundance of external stimuli acting simultaneously or as an irrational, chaotic “feeling” of the person unable to be reduced to the laws of rationality and logic.

But what happens when we are no longer satisfied with the reductionist perspective adopted for the definition and observation of psychological phenomena? What happens when our paradigmatic eye is insufficiency and inadequacy for our complex phenomena?

The invitation to write in this volume allows us to reflect on catalysis through an interdisciplinary but critical perspective among different disciplinary fields is exactly the “sign” of a clear to think about the psychological processes of meaning.

The human being is a complex system composed of infinite potential and relational networks within complex systems that are increasingly large (defined by historical and cultural trajectories). The dynamics and the development over time

of the subjectivity of a person requests that the complexity, the potential, and the vastness of its relational links are integrated and interacting with each other and that can be achieved in concrete terms.

We believe that the way to relate the complexity of the human being with the world's complexity is through emotion. We use the catalytic metaphor—as a reconceptualization of chemical catalysis (Cabell 2011)—to expose our idea of how emotion is a process of creating a context that activates various semiotic processes of meaning making and predispositions to act. This process of contextualization is an affective way of constructing, weaving, and maintaining relationships with other people in the world of becoming. Such affective processes catalyze—active—semiotic fields in order to create lived experience, intersubjectivity, and cultural ground.

## Building a Context

We define emotion as a primary psychophysical experience activated by stimuli of context, and also as the main component of the human relationship with the environment which generates the elaboration of emotional symbolization of events (Carli and Paniccia 2003; Salvatore and Zittoun 2011; Salvatore and Freda 2011; Freda and De Luca Picione 2012).

Emotion is not only an effect or a reaction to stimuli but also a process of immediate orientation of one's actions. Emotion, therefore, does not concern the evaluation of a single, discrete object or event but is rather a “field of experience” and guides the process of interpretation and meaning making (Salvatore and Freda 2011). Emotions acts as a catalytic process that ensures the conditions of semiosis and facticity of being-in-the world.

The debate on the role of emotions in human life is ancient and unresolved due to the irreconcilability of physicalist, neurophysiological, cognitivist, phenomenological, psychoanalytic, etc. positions. Although generally the term “emotion” is understood as a conscious experience and a recognition of affective states (Valsiner 2001), in this work we use this term in reference to its Latin etymology of *ex-movere* namely “to push out,” “to move toward,” meaning to refer to emotion as a process of construction of a context, as a condition in which it is possible exert an action and a process of meaning making. We prefer the use of the term “emotion” to that of “affect” just to focus on the aspect of catalytic predisposition for every semiotic process, although we are aware that this could cause confusion and ambiguity for the turbulent history of this term in several disciplines. However, the lack of a definitive agreement and a constant evolution in time of the meaning of this term is a clear sign of how it continues to arouse the interest of scientists, scholars, theologians, philosophers, psychologists, and thinkers, precisely because it is an essential constituent dimension of the action and thought of the human being.<sup>2</sup>

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<sup>2</sup> Here, we avoid entering in the debate about whether the emotion is inherent in every living being.

Emotions as a relational modality sets up a framework for the delimitation of effective and concrete dimensions of experience. In this sense, we believe that the emotions are a local and contextual process that construct a hermeneutic frame of meaning within which it is possible to experience. Obviously, such a definition creates more problems than it solves, so it needs to be discussed thoroughly.

## Emotion and Perception as Two Different Semiotic Processes

Emotion is a prereflexive process (Salvatore and Zittoun 2011), which creates the conditions for the realization of semiosis. Each experience always has an unconscious emotional matrix<sup>3</sup> (Fornari 1976, 1983; Matte Blanco 1975) directed towards symbolopoietic making. This unconscious emotional matrix is not an intrasubjective and individual dimension but is a semiotic process of construction of a relational field informed by specific and contingent characteristics. A subject enters into a relationship with the world and with the others through the creation of a context that provides and organizes the meaning of their experiences. The creation of a context is the possibility of being able to define what is relevant and therefore it functions as a hypergeneralized frame (Valsiner 2007) in which it is possible to realize semiotic processes.

The creation of a context is a process of defining a *semiotic function of pertinentization* realized through a continuous and recursive process of delimitation and growth of the complexity of relationships. The term “pertinence” comes from the Latin “pertinentem” (“to belong,” “to relate,” “to concern”) and is formed by the prefix “per” and the verb “tenere” (“to hold,” “to contain,” “to possess”). The semiotic function of pertinentization acts as reduction and definition of a domain of trajectories and possibilities to establish relationships and connections between the signs (Salvatore, *in press*).

The definition of “semiotic function of pertinentization” occurs through the interaction of processes of *symmetrization* and *asymmetrization*. These semiotic processes, in the theorization of Matte Blanco (1975), are the basis of emotional and perceptive modality in the human being. The former works through relations of symmetry and generalization,<sup>4</sup> which tends to blur the differences between the signs

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<sup>3</sup> The use of the term “unconscious” in this work is not in reference to representations that are repressed and relegated in some alleged “region of the psyche.” The term “unconscious” refers to a specific modality of semiosis according to the principles of condensation, displacement, absence of the concepts of space and time, lack of denial (Freud 1915) whose extensive study by Matte Blanco have made possible to draw the principles of symmetry and generalization (Matte Blanco 1975, 1989) of affective semiosis (Carli and Paniccia 2003; Salvatore and Zittoun 2011, Salvatore and Freda 2011, De Luca Picione and Freda 2012). In this way, the unconscious is not a region of a reified psychic system but is a modality of a specific process of meaning of the experiences that Freud called “primary process” (no temporal relationship of before and after, no denial, lack of distinction between reality internal and external reality; Freud 1900, 1911, 1915).

<sup>4</sup> According Matte Blanco, the ways of working of unconscious are the “principle of generalization” and the “principle of symmetry.” The former states that the unconscious system treats an individual

and produce homogeneity between the parts of a given relation. Such a process of *affective semiosis* transforms relations of contiguity between the signs in relations of identity and comes to confuse the part with the whole (Matte Blanco 1975; Salvatore and Freda 2011; Zittoun and Salvatore 2011; De Luca Picione and Freda 2012).

The process of asymmetrization instead deals with specific perceptive activity. It works by identifying differences. It operates according to the principles of Aristotelian logic system (the principle of identity, the principle of non-contradiction, the principle of the excluded third; Matte Blanco 1975). The logic and semantic relations sustain rational thought in whom the position of the terms of any relation are not changeable and cannot be inverted without affecting the truth value of the proposition (Matte Blanco 1975; Salvatore and Freda 2011; Salvatore and Zittoun 2011).

The two psychological modalities (emotional and perceptual) are never absolute but always interdependent and mutually interacting at different levels of proportion. The processes of categorization, generalization, and abstraction are the result of collaboration and fusion of these two semiotic processes.

The reciprocal influence of perceptual and emotional processes allows the construction of the subjective context in which it is possible to act, to symbolize experiences, to interact with others. In fact, through the symmetrization and asymmetrization of signs, e can identify a semiotic field in which it is possible to establish relations with the world and at the same time to allow a compromise between continuity and discontinuity of experiences.

Let's give an example. A glass is an object that can have an almost unlimited set of functions but its precise use is defined by the creation of a contextual semiotic field in which the glass is made usable. The use of glass as a tool to drink, or to water the plants on the windowsill, or as a container for pens on the desk, or stored in the cupboard as remembrance of a gift to mark a special occasion, etc. is defined by a process of specific relations between a subject and an environment that results in a contextual frame of action and symbolization. This contextual frame is the delimitation of a specific set of possibilities that guides the actions and thoughts of a person and is achieved through the organization of a temporary semiotic hierarchy with different levels of generalization and abstraction (Valsiner 2001, 2006, 2007; Branco and Valsiner 2009; Cabell and Valsiner 2011).

The glass is made a specific object-sign (for drinking, to water, to contain, to remember, etc.) through a process of *semiotic pertinentization* that the subject realizes acting moment by moment in his context. The glass has a number of potential uses, virtually endless, but it shows itself only under a specific use defined by a subjective dynamic of contextualization which is created by the symbolopoietic emotional work.

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thing (person, object, concept) as if it were a member or element of a set of class which contains other members; it treats this set or class as a subclass of a more general class, and this more general class as a subclass or subset of a still more general class, and so on. The latter states that unconscious system treats the converse of any relation as identical with the relation. In other terms, it treats asymmetrical relations as if they were symmetrical. From this, some consequences can be deducible. When the principle of symmetry is applied the (proper) part is necessarily identical to the whole. When the principle of symmetry is applied, all members of a set or of a class are treated as identical to one another and to the whole set or class (Matte Blanco 1975).

The glass is presented in a particular perspective—that is, *pertinence*—depending on the semiotic field defined by perceptual and emotional matrix. To use the glass as a tool for drinking or for any other purpose is never a relation exclusively functional but is always a subjective process emotionally experienced and that occurs within a field of activation with several levels (in a multitude of possibilities: use for pleasure; gesture of seduction and sexual desire; action with haste and urgency, need, anxiety or illness; cheers of celebration together with other people; drinking in a saddened loneliness due to a betrayal; drinking of consolation for a failure or a loss, etc.).

The specific use of an object is achieved through a semiotic process of meaning that is realized in the present through a process of reduction of complexity (reduction of the infinite relational networks potentially activable) and at the same time a process of increasing of complexity (the use of a sign in time requires that the network of semiotic relations continues recursively to settle and reconfigure the mediation between the subject and the world). This paradox of presence at the same time of decreasing and increasing of complexity is the primary guarantee of the possibility to perform an action, to think a thought, to move in irreversible time.

In this sense, we believe that the context (emotionally and perceptually organized) performs a catalytic function because it is created by a “function of semiotic pertinentization” that defines in a given moment what is important and what is not.

When we say that the catalytic process is a process of reduction of semiotic complexity and at the same time a process of increasing of semiotic complexity, we mean that the psychological catalyst is made possible by emotional and perceptual modalities of a subject that relates to the world by defining the relational possibilities and at the same time by creating a domain for the exercise of freedom and innovation within the contextual domain.<sup>5</sup> Catalysis—made possible by a function of semiotic pertinentization—creates the necessary conditions but not sufficient by itself for action and thought.

In this regard, we want to point out, however, that the same function of pertinence is able to work differently depending on the preponderance of modality of symmetrization or modality of asymmetrization. In fact, if the semiotic symmetrization of relations (namely a higher state of emotional arousal) is bigger, then the power of the catalytic function will be stronger to “drive” toward certain actions, behaviors, and evaluations.

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<sup>5</sup> By catalysis, we mean a process that “brings together” the becoming of the context and of the subject. What we are defining psychological catalysis is rather the creation of a field of semiotic space–time continuity realized through corporeity (namely, the possibility of a percipient and affective body) of the subject. Von Uexküll (1926) defines that every reality is a subjective phenomenon. In this sense, the psychological catalysis can be understood as a process of construction of an *umwelt*. Through catalysis, the environment is transformed in a relevant and salient context for the perceptual/operational structure of the subject (Freda and De Luca Picione [in press](#)).

## Morphogenetic Field of Semiosis

According to the idea that we are pursuing, emotions (as a semiotic relational process) working as catalytic process creates a field of meaning that makes semiosis possible. The catalytic function of emotion regulates the relationship over time between subject and environment realizing a process of semiotic pertinentization and contextual framing within which the psychological processes can be realized.

Our argument is that catalysis enables and configure a *morphogenetic field of semiosis* (De Luca Picione and Freda [in press](#)) in which there is an active contextual “function of semiotic pertinentization.” That is the first emerging result for the construction and functioning of the temporary semiotic hierarchies<sup>6</sup> that guide the relationship between the subject and its environment (Valsiner [2001](#), [2006](#), [2007](#); Cabell [2011](#); Branco and Valsiner [2009](#)).

The semiotic morphogenetic field is the “semiotic space” that works as a catalytic ground for the emergence of a new form. In our thinking, *form* does not mean a figure with a demarcation of its borders permanently over time, but we mean the plastic configuration and dynamic relationships that moment by moment are made salient.

A form is the emergence within a field of activation; a form is namely the possibility of concretizing of a series of multilayers of relationships (Margherita [2012](#)) that act simultaneously. The form is a dialectical process enabled by semiotic mediation between different temporal relations (continuous and discontinuous) and spatial relations (background/foreground, in/out, part/whole).

Andrade ([2002](#)) provides some interesting reflections on the epistemological and theoretical conceptualization introduced by the use of form as a dynamic expression of the “indissoluble semiosis of processes and structures.”

*Form* indicates that structures are dynamic, processional, transient or produced in a morphogenetic process and responsible for semiotic agency inasmuch they are the seat of local interactions. Thus, I define *form* as the process that gives rise to the establishment, transfer and conservation of a specific set of non-random interactions. Thence, *form* generates functions that materialize in a specific space-temporal arrangement of parts, of whatever nature, required to maintain a coherent performance. (Andrade [2002](#), p. 63)

Our approach to the development of the concept of catalysis as a process of emotional and perceptual relation of a subject leads us to conclude that the catalyst works as a morphogenetic process where the form is a contextual organization that changes

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<sup>6</sup> Processes of semiotic self-regulation operate through temporary hierarchies of signs (Valsiner [2001](#)). Generalized and hypergeneralized feelings, as well as differentiated emotions—all encoded as signs—operate as parts of such hierarchy. Signs operate upon signs, and become regulators with respect to one another. The multifunctional nature of signs guarantees the emergence of flexible hierarchical systems of semiotic regulation. The move of a sign into a regulator’s role creates the minimal case of a hierarchical dynamic system of semiotic regulators—a superior sign regulates its underlying process. The hierarchy of semiotic regulation is dynamic—a constructed regulator can immediately be superseded by another level of hierarchical semiotic regulation. [...] The regulation by signs includes—recursively—constraining (enabling) the generation of a superordinate organizer from the field of possible signs. We may encounter potentially ever increasing and ever generalizing growth of the semiotic regulatory system (Cabell Valsiner [2011](#), p. 101).



over time. The form is given by the relation between the systemic complexity of the subject and the systemic ecological complexity. The form is namely a dialectic and tension-filled organization that cannot be reduced to the precise definition of the boundary of a figure. The form is a dynamic, flexible, temporary “space,” which tries to repeat itself (because once it has emerged—through the interconnection of processes of symmetrization and asymmetrization—it exerts an attraction, constitutes a memory, performs a recursive process of the general organization of the processes of development in the field).

The form is the relational process of subjectivity that is configured moment by moment through the dialectic between the figure and the background. Thinking in terms of form also means emphasizing the importance of the relationship between the whole and its parts. In fact, the psychological processes are not made up of single parts (single ideas, single representations, single remembrances, single associations, single meanings, single behaviors) but are complex organizations in which what can be isolated as a single part is a phenomenological dimension that only makes *sense* in wider developmental trajectories (De Luca Picione and Freda 2012).

## **The Relationship Between the Parts and the Whole in a Morphogenetic Field of Semiosis**

The psychological processes of meaning making are oriented by wider frames of meaning (that is, with a wider generalization and temporality; Freda et al. [in press](#)) that guide their development (namely realizing trajectories of meaning that organize and predispose single meanings; De Luca Picione and Freda 2012). But we must not assume that the process of meaning is governed and determined only by more general and abstract dimensions (personal values, ideals, shared social representations, religion, political ideologies, etc.) because this assumption leads us to deny the value of contextual emotional experience in organizing relations, meanings, and actions.

We believe that it is interesting to think about the meaning-making process as a form, namely as contextual organization and emerging dynamics within a semiotic morphogenetic field activated by a function of pertinence. The morphogenetic field must not be considered as a two-dimensional plane but as a topological space in which they are interconnected different levels forming each other’s morphogenetic fields.

Let us remember that the emotions in the conceptualization of Matte Blanco (1975) are “bags of symmetry,” namely, semiotic sets separated from each other (in terms of asymmetry) but with internal symmetry (homogeneity between all parts). This complexity leads to temporary and variable semiotic structures with the possibility of homogenizing point-like signs, field-like signs and hypergeneralized signs, confusing the part with the whole. The processes of symbolization, categorization, and dynamic hierarchization of experience are made possible by the joint work of asymmetrical and symmetrical processes.

Such an interaction—in terms of semiotics—avoids the excessive homogenization undifferentiation, fragmentation and excessive diversification. The interconnection of these two processes is essential for the implications they carry. In fact, a person lives his or her experiences realizing processes of meaning making along trajectories of both continuity and discontinuity. From the points of view of symmetry and asymmetry, the continuity and the discontinuity assume meanings of different temporal scope.

Semiotic emotional modality (affective semiosis) is realized as a symmetrization of meaning when you are living the experience—many and several signs can stand for the same thing, and different things can be symbolized as homogeneous within the same set.

This leads us to think that the start-up of a process of transformation of semiotic systems is a *momentary synchronization* between the different levels and their parts. We believe that this synchronization takes place through a “process of semiotic pertinentization” coordinating synchronously different levels of generalization (definition of which is given by the contingent interplay of symmetrization/homogenization and asymmetrization/diversification) from the most concrete levels to the most abstract and general ones. In this way, a function of contextual semiotic pertinentization (defined by emotional and perceptual lived modalities) reduces the complexity to act and to mean in the present, but it is also able to maintain the multipotentiality about the future and reorganize the past meanings. If the catalytic process was made only by symmetrization, we would have an immediate reduction toward a relation of identity between all the signs and there would be a temporal collapse hindering every form of development. The catalytic process—by defining a function of semiotic pertinence—defines not only the setting of the symmetrization but also of asymmetrization.

The catalytic process correlates the parts of the system between them and provides the conditions for a process of transformation to occur. The catalyst—as preparation of contextual conditions necessary for the development of processes of meaning—provides the hypergeneralized coordinates of sense defining a semiotic context. Only in a semiotic context, it is possible to mediate between symmetrization and asymmetrization through the morphogenetic direction of semiotic pertinentization function.

Catalysis is a process that acts by activating a phenomenal field. This is exactly the central point to be able to think of a meaning-making process as a form of experience that emerges from a morphogenetic field of semiotics. The semiotic morphogenetic field is not assumed as a linear plane but as a hypertopological space that reconfigures every time in variable ways, both in its wholeness and relations between its parts—depending on its specific contextual activation.

## Development over Time of the Morphogenetic Field

A specific semiotic level of meaning can realize processes of innovation and transformation (within the specific range of freedom and constraints of that level—namely its degree of opening and closing) because a higher hierarchical level ensures the

continuity conditions and maintains the phenomenal domain. Let's consider the possibility of continuity and discontinuity of the person's life made possible by being part of a family/group/community/society. Likewise, we can assume a similar point of view to consider an organ within a body, a cell within an organ, etc.

A part cannot exist without being part of a whole. Each level of semiotic action has its own specific domain of freedom which is ensured by the stability and continuity offered by the upper levels that have a temporality of development generally wider, more extended and slower (from an asymmetric point of view).

In this sense, we have not only a causality that goes from top to bottom and that determines the behavior of the parts of the underlying layers, but also a lower level that through its domain of freedom can achieve innovations influencing the other level.

Once introduced into a certain level of the meaning-making process, an innovation that has taken on a certain level of stability (that is, has set up a new form) causes a change in the hierarchy semiotics. That is, creating the semiotic condition extends the novelty at higher levels through generalization. This occurs when a subject is capable of signifying a specific experience (through a symbolopoietic process of redundancy and circularity of reflexivity and emotionality).

The introduction of a novelty is always a phenomenon of rupture of a semiotic continuity and as such it generates a cascading effect between all levels. The temporary nature of a semiotic hierarchy (Valsiner 2001, 2007; Freda et al. [in press](#)) that supports the development of a process of meaning of experiences is the effect of a causal circularity that is realized through movement upward and downward.

However, the two movements are not indifferent and homogeneous. In fact, the introduction of a novelty to a specific level acts along two different directions: (1) the novelty acts on the higher levels of meaning through a new generalization which arranges the renegotiation of the continuity and the discontinuity, and (2) instead, the novelty acts on the lower levels generating new information that directs processes of more concrete and specific meanings. So we have a chain reaction that makes generalizations as a synthesis of new continuity and simultaneously novelties that break the present continuity generating discontinuities. Such processuality ensures that the boundaries between levels are not defined, established, and clear but are "areas" of translation of meanings (Lotman 2005).

We have not understood causality as a *deus ex machina*, that is, a transcendent mind that teleologically organizes the future, nor a strong causal principle of etiological law that determines the behavior of the parts of the lower hierarchical levels. There is an ecological and systemic circularity but this circularity is not linear and is not indifferently bidirectional. The recursive causal processes in both directions (upward and downward) ensure the continuity conditions (through new synthesis) and the conditions for the introduction of discontinuous novelties (generating ruptures).

In extreme synthesis, we can say that the catalysis of the morphogenetic field of semiosis occurs through a function of pertinentization on each semiotic level. In this case, we must not think, however, the isomorphism is a simplistic and trivial repetition of a pattern over time and across different levels, but it is a "process of translation"

of the function of pertinentization between the different levels of generalization of the process of meaning making.

The Lotman's idea of semiosphere (2005) provides us with an endless source of ideas, observations, and interesting topics.

The semiotic border is represented by the sum of bilingual translatable “filters”, passing through which the text is translated into another language (or languages), situated *outside* the given semiosphere. The levels of the semiosphere comprise an inter-connected group of semiospheres, each of them being simultaneously both participant in the dialogue (as part of the semiosphere) and the space of dialogue (the semiosphere as a whole). [. . .] The border retains the idea of a buffer mechanism, a unique unit of translation, transforming information. [. . .] The translation of information through these borders, a game between different structures and sub-structures; the continuous semiotic “invasions” to one or other structure in the “other territory” gives birth to meaning, generating new information. The internal diversity of the semiosphere implies its integrity. Parts enter the whole not as mechanistic details, but as organs in organisms. [. . .] Relative to the whole, located at other levels in the structural hierarchy, they [the parts] reveal an isomorphic quality. Thus, they are, simultaneously, the whole and its likeness. [. . .] The mechanism of isomorphism is constructed in a different way. Since, here, we don't have in mind a simple act of transfer, but rather an *exchange*, between participants there must be not only a relationship that is similar, but also one that exhibits a specific difference. A simple condition for this form of semiosis could be outlined as follows: substructures participating in the act of semiosis must not be isomorphic to each other, but separately isomorphic to a third element operating at a higher level of the system which they seek to enter. [. . .] The presence of two similar but simultaneously different partners in communication is one of the most important, but not the only, conditions in which dialogic systems originate. Dialogue includes within itself a reciprocity and mutuality in the exchange of information. But for this, it is necessary that the time of transference be superseded by the time of reception (Newson 1978: 33). And this implies discreteness—the possibility of interrupting the transmission of information. The possibility of giving information in portions appears to be a general law of dialogic systems. (Lotman 2005, pp. 205, 211, 215–216)

In order to achieve an isomorphism between parts, hypergeneralized relationships are required. These hypergeneralizations provide a “super-systemic” level of continuity without hindering the possibility of phenomenal diversity and specific processes at the “intrasystemic” level. That is, we observe the intricacies of symmetry and asymmetry. The interaction between the different semiotic modalities (emotional/symmetrizing and perceptual/differentiating) are built up over time through generalizations of meanings that are tested moment to moment by experience through a semiotic function of contextual pertinence.

The isomorphism is made possible from hypergeneralized fields that activate the genetic process of concrete phenomena. Isomorphism in this sense does not mean exact repetition of a pattern in different levels, but the specific “transduction” for each level of general information. A morphogenetic field of semiosis activated by the catalytic process performs a process of recursive translation that puts the system in a state of coordinating the parts with each other (within a same phenomenal level) and between the parts and the whole system, generating continuity as well as discontinuity (innovations or the end of the process of meaning). Through a reconfiguring process of the semiotic relations, catalysis works on borders and boundaries.

## Morphogenesis and Reification

The morphogenetic field acts in psychological terms as a process of catalytic activation, continually realizing a *process of reification*.

We mean that the morphogenetic field of semiosis works as a process of “mental hypostatization” (Salvatore and Zittoun 2011) in which signs are generated through the act of predicating them. The experience becomes understandable for the subject not as interconnection system of countless relationships between himself and the world but as a discrete intentional object for consciousness (referring to the intentionality of consciousness—Brentano 1874; Husserl 1900; Searle 1983).

In this sense, the function of semiotic pertinentization works as an unconscious relational matrix. In the process of reification, only some aspects become thinkable, that is to say that only some relational characteristics assume positions in the foreground while the background is not perceived—despite it has made possible the conditions for the semiotic process. These relational characteristics lose their dynamic and transformative value and assume a value of taken-for-granted entity in the psychological processes of meaning and relationships with others.

This is a further issue of reduction and growth of the complexity of processes of meaning making. The whole semiotic hierarchy in fact is not thinkable and cannot be object of thought since there are prereflective levels (for example the ones of bodily and affective activation or the ones of hypergeneralization of meanings).

Neuman (2003, 2009, 2010) defines reification as the objectification of the life experience, after it is filtered and simplified. Reification is the turning of a complex life experience into a stable, and relatively simple object.

We must not think that reification is a process of impoverishment of human experience (although in some cases it reduces the reflective possibilities of human thinking), in fact it allows to act, to think, to relate, since the reification is the result of mediation between semiotic processes of *pleromatization* (nonlinearity, semiotic abundance, semiotic richness, comprehensive relationship of the figure and the background) and *schematization* (linearity, order, finiteness, definition of a point-like sign, reduction of complexity in the direction of specific goals; Valsiner 2006, 2008).

Reification—acting as a hypostatized form of a morphogenetic field—exerts a power of attraction. That is, the semiotic contextual organization becomes point-like sign which can realize a catalytic effect recursively. A reified sign in fact starts up a *polarization of the field*. This means that it immediately defines what is similar and what is not.

In this sense, the semiotic polarization of the field produced by a point-like sign is a subset of the process of semiotic pertinentization of a morphogenetic field. The effect of recursive polarization of the field is closely related to the process of emotional symmetrization.

## Conclusion

In this work, we discussed the catalytic process as a semiotic process of transformation of the field. This is the precondition that allows the realization of semiotic processes of signification and action (*semiotic function of pertinentization*). Catalysis is a process that acts in temporal terms (mediating between continuity and discontinuity) and spatial terms (the relationship between the parts and the whole, and between the inside and the outside). Catalysis in psychological terms is understood as a process of contextual pertinentization triggered by emotional/perceptual relationship of a subject with his relational environment.

According to the perspective taken in this chapter, we have defined emotion as a psychophysical process of semiotic activation (symbolopoiesis) and organization of relations according to specific operating modalities (symmetry and generalization), believing that it always works in interaction with the perceptual processes (aimed at identification of differences and asymmetries).

Catalysis, in our view, creates a contextual activation of a “morphogenetic field of semiosis,” which regulates the relationship between the parts and the whole (between the signs and their organization) and the development over time of the process of meaning making (in terms of continuity and discontinuity/rupture).

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**Part V**  
**Developmental Considerations of Catalysis**



## Chapter 9

# Exploring the Role of Catalyzing Agents in the Transition to Adulthood: A Longitudinal Case Study with Brazilian Youth

Elsa de Mattos and Antônio Marcos Chaves

Young people's transition to adulthood is one of the most critical moments in the life course, when several psychosocial transformations simultaneously pervade the relationship of the person and their cultural context. As young people develop, they start to navigate new spheres of experience that can bring significant ruptures to their sense of self-continuity (Zittoun 2011, 2012a). For instance, a sense of self-discontinuity can emerge when young people enter the world of work and start to question what they are able to do (their knowledge and skills), their position in relation to others in the new contexts as well as their identity and the meaning of their actions.

The notion of youth transitions that we are going to elaborate here comes from ideas developed in the field of *cultural psychology* (Valsiner 1997, 2007; Zittoun 2006a, b, 2007, 2012a) and *Dialogical Self Theory* (Hermans 2001; Hermans and Kempen 1995; Hermans and Hermans-Jensen 2003; Hermans and Hermans-Konopka 2010). The aim is to go beyond traditional approaches to the phenomenon of "transition" as a linear sequence of events organizing individual pathways. These approaches usually emphasize young people's movements *between* institutions and formal settings (i.e., from school to work, or from university to the labor market) or from one *social role* to another (i.e., adolescent-adult, student-worker). However, instead of privileging an outcome view of transitions, in this chapter we will advance a more systemic and dialogical perspective of youth transitions, focusing on transition *processes* (instead of outcomes) and on the occurrence of *simultaneous ruptures* in a young person's life (Camarano 2006; Sato 2006; Zittoun 2012a). We will also stress the centrality of *semiotic mediation* and the relevance of adopting *a new perspective of causality* (i.e., *catalytic causality*) in psychology in order to understand human transition experiences, and the different ways in which individuals configure their

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own “*selves*” through positioning and repositioning along the life course (Hermans and Hermans-Konopka 2010; Valsiner 2008; Zittoun 2007, 2008, 2012a).

Although youth transitions have traditionally been associated with institutional and structural markers of development, emphasizing the sequencing of events leading to young people’s entrance into the adult world (Elder 1998; Camarano, 2006), recent studies of transition phenomena focus on the *processes* rather than on *outcomes* (Carugati 2004; Valsiner 2008; Zittoun 2006a, 2012a). Developmental transitions therefore are regarded as multifaceted and mediated by the production of signs, involving *catalytic cycles of innovations*, that allows for a qualitative reorganization of human experience (Cabell 2010; Beckstead et al. 2009; Zittoun 2012a) and of the self-system (Cunha et al. 2012; Hermans and Hermans-Konopka 2010). Such a perspective highlights the processes of semiotic mediation through which both the young people and the culture they inhabit are mutually constituted.

In this chapter, we want to elaborate on a *dialogical semiotic approach to youth transitions as a process of self-regulation that occurs through catalytic cycles of innovation within a specific time frame, involving the search for integration across life spheres as well as across time, mediated by dialogical relations with significant others acting as catalyzing agents*. This chapter has three sections. The first section, “A Semiotic-Dialogical Approach to Youth Transitions” draws on the perspectives of *cultural psychology* and *dialogical self-theory* to highlight a new understanding of youth developmental transitions, focusing on the role of *catalytic cycles of innovation* and more specifically of *catalytic agents* in the production of self-regulation. “The Role of Catalyzing Agents in Youth Transitions” presents a case example that illustrates how a young woman—throughout a developmental time frame that goes from 16 to 23 years of age—negotiates significant meanings of herself and her world and performs a new relevant synthesis in her self-system. “The Dynamics of the Self-in-Motion” demonstrates and elaborates on the dynamics underlying the processes of self-regulation leading to new life trajectory.

## A Semiotic-Dialogical Approach to Youth Transitions

As suggested by Valsiner (2004), *semiotic mediation* is the process that allows human beings to synthesize new meanings, both in the reflexive (i.e., through generalizations from the meaning of words) and affective domains. In this perspective, human development involves constant creation of innovation, through one’s capacity to question *what is*, to imagine a possible future to be (*as if*), and to continuously project oneself in that imaginary meaning field to orient one’s life trajectory (Abbey and Valsiner 2004). This movement characterizes the emergence of developmental novelty, in a dynamic tension between literal and imagined dimensions. The *self* is regarded as an autocatalytic and autoregulative system that orients the individual towards the future, while allowing for and restricting the emergence of new meanings, exerting flexible control over self-positions that the individual assumes at every moment (Valsiner 2002).

Along these lines, *semiotic mediation* can be seen as the *process of construction of meanings* that is at the core of “human” experience of the world (Abbey 2012; Valsiner 2008, 2012; Zittoun 2012a). In their relationship with the world, people are constantly creating meanings ahead of time about themselves and the world through the use of *signs* (Valsiner 2007). Therefore, meaning-making can be regarded as process through which a person internalizes *signs* that are available in the collective culture, recreating them from one’s own personal experience, and then externalizing them (Zittoun 2006a, 2012a). In this process, the person creates (or develops) a “*psychological*” or “*subjective*” domain of experiencing the world that organizes person–environment relationships (Zittoun 2012b).

Developmental processes—such as youth transitions—take place through changes occurring simultaneously at multiple levels of experience. The person is situated in a particular historical and social context, constantly negotiating a set of values, beliefs, and meanings, which create certain limitations but simultaneously offer certain possibilities for one’s development (Valsiner 2008). These elements circumscribe and channel opportunities as well as limits in people’s life trajectories, directing them to certain paths that are possible in their particular social–historical time and setting. Elements being channelized, however, are not static, they are not just “resources” that are there to be selected, “collected” or used. They are in a permanent transformation and present themselves to the person in dynamic or agentic ways, through person–other interactions in everyday life.

A young developing person is in constant interchange with the environment, and with social others present everywhere, continuously creating and recreating mechanisms of regulation of person–other relations. Semiotic mediation is the process by which such regulation takes place. As people create new meanings—i.e., signs—to regulate their experiences in the world, they produce a personal culture that directs their developmental trajectory (Valsiner 2000). Semiotic mediation operates through emergence of novel forms—i.e., through *catalytic cycles of production of innovation* (Valsiner 2006, 2008). Recent theoretical conceptions suggest that *semiotic mediation* is a general term that encompasses several different processes that can be understood using a general scheme of systemic causality similar to the process of *catalytic synthesis*. Along these lines, semiotic mediation may take the form of a *cycle of production of innovation* much the same way as a new component is synthesized in a *chemical cycle of catalysis*. (Cabell 2010; Beckstead et al. 2009; Valsiner 2004, 2008).

Catalyzing processes facilitate the emergence of specific *signs* in the self-system that may act as *promoters* or *inhibitors* of development (Beckstead et al. 2009; Mattos and Chaves 2013; Mattos 2013; Valsiner 2008; Valsiner and Cabell 2012). The *promoting* regulatory function is particularly relevant for facing future needs and meaningful adaptation of the person to ever-new life circumstances. Signs are conceived of as promoters of generalized meanings that emerge as fields loaded with affection, and work at a higher level in relation to the flow of everyday experience facilitating the creation of meanings in anticipation to the actual experience, and preparing the person to face the unforeseeable (Valsiner 2004). Moreover, promoter signs are able to act at a higher level than the ambivalent relations between personal

meanings that constitute the self-system of the person at any given time, operating changes in these relations (Valsiner 2004). However, further theoretical explorations are still needed to clarify the role of catalytic processes in the synthesis of promoter signs that may regulate youth transitions.

Much of current theoretical discussions about the role of catalysis in promoting self-regulatory processes point to a *set of conditions* or to an *atmosphere* that *indirectly* aids, supports, and enables other psychological mechanisms and functions to operate. Catalytic models may indeed be capable of showing the dynamic interactions of individuals, conditions, contexts, and catalytic agents. Yet the role of catalytic agents in this process needs more clarification.

## The Role of Catalyzing Agents in Youth Transitions

A dialogical approach can be useful in clarifying the *agentic* role of social others—acting as *catalyzing agents*—who facilitate the emergence of regulatory processes capable of promoting youth transitions. The *Dialogical Self Theory* was elaborated by Hermans (2001; Salgado and Gonçalves 2007; Hermans and Hermans-Jensen 2003; Salgado and Hermans 2005; Hermans 2001, 2002) to highlight a dynamic and multivocal movement of the construction and reconstruction of meaning inside the self-system. Unlike a *unified static entity* or an *internal essence* of the subject to be *revealed* through language exchanges, the *self* maintains its unity through dialogue, and is produced as plural and polyphonic through communication interactions (Hermans 2001, 2002). Therefore, the *dialogical self* is seen as multifaceted and complex, endowed with multiple voices and different positions that coexist and hold different perspectives about the world (Hermans 2001; Salgado and Gonçalves 2007; Ribeiro and Gonçalves 2010).

The notion of the *dialogical self* suggests variability within the *self*. The *self* is social—i.e., is populated by *alterities*—and emerges through relational encounters with multiple *others* in different spheres of experience. Dialogical encounters with multiple “others” become progressively internalized in the form of I-positions. The *self* is, therefore, a “space” (or as Hermans suggests, a “landscape”) composed by relations among I-positions, which are more than mere *social roles* (socially expected roles). They also refer to *reflexive meanings* and *affective states* (Hermans 2001). Therefore, a specific I-position is an emerging structure in a meaning-field of possible/alternative I-positions. The notion of the *dialogical self* emphasizes the fluidity of voices in a field of self relations (Hermans and Hermans-Konopka 2010). As a dynamic multiplicity, the self is permeated by tensions between voices that coexist and move along with changes that occur simultaneously in the diverse spheres of experience that the person navigates (Cunha et al. 2012; Cunha and Gonçalves 2009; Salgado and Gonçalves 2007; Salgado and Hermans 2005).

An interesting approach has been put forth by Zittoun (2006a, 2007, 2012a) in the recent years. The author suggests that a developing individual, actively participates in one’s own process of development, selecting and using *symbolic resources*, by

appropriating *signs* that are available in the collective culture, as well as recreating them from personal experience. *Transition* processes are triggered by *ruptures* or discontinuities that occur when people face situations that question what they take for granted, their existing operating meaning-fields or *semiotic sets* (Zittoun et al. 2012). Therefore, as argued by Zittoun, a semiotic dynamic is created to help the person overcome ruptures and reduce uncertainty when one negotiates, modifies, and transforms cultural and shared meanings in a personal way, creating new semiotic sets which organize and (re)structure one's personal culture. However, although Zittoun and colleagues advance important concepts related to youth transitions, their emphasis rely on young people's *selection* and *use* of symbolic resources and youth participation in different spheres of experience, but do not explicitly reveal the dynamics of self-regulation over time and the role of catalyzing agents in this process.

Along these lines, we want to propose here, the idea that social others are equally relevant in youth transition processes, not only because they function as "resources" but also because they may operate as *catalyzing agents* for self-transformation. Our idea is that in contemporary urban cities, as young developing people increasingly become participants in diversified spheres of experience (i.e., family, school, work, religious groups, and eventually youth collective groups), their interactions with social others substantially increase, and may contribute to an intensification of their sharing of specific activities and cultural values, beliefs and meanings. Therefore, *significant others may temporarily act as direct catalyzing agents in transition processes—facilitating new synthesis in youths' self-configurations*. Under these circumstances, significant others have a dynamic role and can be regarded as *temporary embodiments of the catalytic function that take on the catalytic function and enable a specific direction for change*. They do not merely act as "resources" for youth transitions, they actively "catalyze" such transitions.

In this chapter, we expect to contribute to the current theoretical discussions about youth transitions specifically by exploring the role of *catalyzing agents* in this process. Although semiotic catalysis can be generally regarded as a *set of conditions* or an *atmosphere* that *indirectly* aids, supports, and enables other psychological mechanisms and functions to operate (Cabell 2011), I will advance the idea that *significant others may temporarily act as direct catalyzing agents in the life of youth—facilitating the emergence of promoter signs capable of operating a new synthesis in their self-configurations*. By acting as *temporary embodiments of the catalytic function, significant others may enable a specific direction for change*. As catalytic processes come into play, catalytic agents may facilitate the emergence of *promoter signs*, and may anticipate the *result* of their regulatory functions in the self-system by "showing" this desired result in advance to the young person, before it actually occurs. The person, then, is able to foresee what one might become in the future, anticipating one's own "jump" from past to future in the present moment. In this movement, an individual regulates one's own development by building promoter signs that may operate as meaning bridges between past and future experiences, projecting oneself into the future, and orienting further actions towards change and reconfiguration.

Therefore, we believe that the processes supported by catalyzing agents may foster the building of *as-if* I-positions or alternative I-positions that orient the young person's actions towards the future. The role of catalyzing agents facilitates the emergence of promoter signs that provide an integration of personal culture *between different spheres of experience* and *between past and future dimensions of experience*. Such a conception may contribute to a dynamic understanding of youth transition processes, helping to uncover the dynamics of the self-in-motion, the emergence of the developing subject, integrating simultaneously diachronic as well as synchronic self-perspectives.

## The Dynamics of the Self-in-Motion

Following this line of reasoning, we suggest that youth transitions involve the dynamics of the self-in-motion, a process of self-positioning and repositioning in which people seek to overcome emerging ruptures as they participate in increasingly diverse spheres of life presented by their social and historical context. Ruptures bring tensions between I-positions and involve reconfigurations in the self-system. Therefore, youth transitions imply a movement of searching for self-continuity after changes. It involves *scaffolding* within the dialogical self. *Scaffolding* is a specific form of guidance that leads to *semiotic regulation* and *temporal reorganization* of the self-system. In youth transitions significant others may act as catalyzing agents that introduce multivocality and help increase dialogicality in the self-system. *Dialogical encounters with significant others located in diverse spheres of life become progressively internalized, guiding as well as legitimizing the emergence of promoter signs that orient youth developmental movement in a certain direction.*

The whole process may be seen through the lens of catalytic cycles where innovations are synthesized. Catalyzing processes create emerging differentiation (Cabell 2010) at bifurcation points in the developmental trajectory. Through catalyzing processes, specific *signs* can emerge in the landscape of the self and may act as *promoters* or *inhibitors* of development (Valsiner and Cabell 2012; Mattos and Chaves 2013; Mattos and Chaves, *in press*). As we have developed elsewhere, when a young person faces discontinuity in one's self-system, promoter signs will allow to distance oneself from the here-and-now experience, and build meaning-bridges between past and future, and/or between different spheres of experience, promoting self-continuity across time and space (Mattos and Chaves 2013; Mattos and Chaves, *in press*).

Dynamic transformations occurring after young people face ruptures in their self-system imply (re)configurations of relations between I-positions. After a young person faces a rupture, (for example, when one enters the world of work), dominant I-positions may not respond to the changes emerging in one's spheres of experience and new positions and meanings have to be created to face new situations. In extreme ambivalent situations, for instance, inhibitor signs may emerge and block further catalytic synthesis, bringing rigidity to the self-system (Mattos and Chaves 2013).

In this chapter, we will focus on a case study, mapping the *emerging tensions between I-positions* and *showing how these tensions evolve over time*, because we believe that an ideographic view is the best methodological approach to reveal the dialogical tensions and the dynamics of the self-in-motion as well as *scaffolding* within the dialogical self. We suggest that young people's positionings and repositionings are activated through *external* as well as *internal* (self-reflective) *scaffolding*, and that the role of catalyzing agents is crucial in these processes fostering the emergence of new I-positions—or better—of *promoter self-positions*. Our aim is to show how self-regulation processes are activated and contribute to the emergence of novelty and to the shaping of alternative developmental trajectories. We seek to elaborate on how young people are constructing and negotiating their *self-in-motion*, transforming their *self-configurations* while shaping their future, making the mechanisms through which catalytic cycles of production of meaning take place explicit, and highlighting the role played by catalyzing agents in this process.

## Case Example

The study presented here was designed as a longitudinal qualitative study of multiple cases (Stake 2006). It was structured in three rounds of in-depth interviews with six afro-descendant youths who participated in a youth apprenticeship program developed by an NGO (nongovernmental organization) in the city of Salvador, Bahia, Brazil. During the first round of data collection, the youths were 18–19 years old; in the second round they were 20–21, and in the third round, 22–23. We will report the case of Jane and focus on her experiences between 15 and 23 years of age. Interviews took place at the NGO headquarters and lasted about two hours. Data were digitally recorded and subsequently transcribed. Main themes explored during the interviews were: significant changes and challenges experienced, work experience and family relations, and educational experiences. At the end of each interview the participant completed an activity of timeline construction. Other forms of data collection involved the follow up of updates in Jane's profile on the social website, *Orkut* (created and managed by Google) for about eight months between the second and the third interview.

The present analysis focuses primarily on youth relations in the dimensions of family and work—because these are significant spheres of experience established by literature among Brazilian youth at this age range (Dayrell 2010; Sarti 2004). The case exemplifies *the dialogical semiotic approach to youth transitions*, emphasizing the dynamics of the *self-in-motion*, i.e., *self-configuration* and *reconfiguration* over time, exploring the person's negotiations of new self-positions among different spheres of experience and across time, highlighting the role of significant others (e.g., Jane's coworker and supervisor Helena, and Jane's grandmother) as catalyzing agents of changes in Jane's system of values and identity. Following the presentation of the case, we will articulate the analysis with theoretical perspectives.

## Jane

Jane is an afro-descendant young woman who lives with her parents and sister in a poor neighborhood in the city. Her father is an auto mechanic and her mother is a housekeeper. In the following presentation we will highlight the role of two significant others (her work supervisor Helena, and her grandmother), acting as catalyzing agents of transformations in Jane's self-system

**First Interview:** "I won't be able to do it all". In the first interview, Jane told us about the ruptures her family was going through after her father was severely injured in a work accident and had to stop working for a while. During this time her family went through a lot of financial hardship, because her father stopped earning and could not get a pension from the government. Jane was 16 years old when she searched for a way to contribute to support her family. She sought the apprentice program at an NGO, and started working at the library of a private university. She thought this was a turning point in her life, because the survival of her family depended almost exclusively on her earnings and on the help provided by her grandmother (who owned the house in which they were living).

When she started to work, she felt "people [coworkers] made a 'distinction' because [she] was an apprentice. They didn't treat [her] as a real employee at the company". When someone from outside asked who she was, her supervisor always said that she was a "young apprentice." She did not like the way she was treated, which made her feel uneasy and uncomfortable. However, soon Jane met Helena, who worked for the human resources department of the university and built a strong mentor-like relationship with her. Helena was frequently contacted by Jane to help solve problems and clarify doubts. Jane explained that Helena "trusted [her] more than she trusted her own self," as Helena always encouraged Jane to perform new tasks and try new things. However, in spite of Helena's support, Jane regarded herself as insecure and overly worried about everything. But Helena repeatedly tried to remind Jane of her capacity to accomplish new things. With the passage of time, Jane started to feel more confident and began to "value things [she] was doing," and learned "to commit" to what she was doing. When her contract as an apprentice expired (at the age of 18), she was hired by the university to work at the administration office. She said that she "learned what responsibility means," and explained that she understood responsibility as the capacity "to commit to something that [she was] doing, to know that what [she was] doing was something important, something that was making [her] grow, that will influence [her] future."

With her transition to the world of work, Jane could now "help [her family] with everything," particularly paying for their expenses, providing needed financial support. She formally became her family's main provider, as she "was the only person at home with regular earnings." During her first year of work, however, Jane used to give all the money she earned (around US\$ 200 per month) to her mother. Jane said she did so because her mother "knew better what to do with it," and she could manage the money better than Jane herself.



Regarding her dreams for the future, Jane remained dependent on the significant other's perspectives, dreaming her mother's dreams. She told us that she wanted "to fulfill [her] mother's dream to have a house of her own". As her family was living in a house lent by her grandmother, Jane wanted to earn money to buy a house for her mother.

**Second Interview:** "I can't think much about the future, I can only think about now." When Jane was 21, she told us about another relevant change in her life, her transition to a new job function: working at the university's administration office. As Jane started to perform more complex tasks, she took on more responsibilities. Progressively, she gained more self-confidence and became "one of the people with more responsibilities in her work department". She said she was feeling more competent and started to "know [she] was doing a good job," and became better adapted to work. She recognized that Helena had played a big part in her transformation, but at the time of this second interview, Helena had left the company, and Jane was working under the supervision of Joana, who also acted as mentor, encouraging Jane and giving her support in her job activities. But, Jane said she had become more independent of adult influence, "acted with more freedom," and started to "do things by [her]self," not relying so much on "adult's advice and opinion." She stopped doing what "adults told her to do." She said that her situation at work had reversed, because she had started to give advice to her less experienced colleagues. She became a sort of mentor to them, much the same way Helena had been to her. Jane told us that "people began looking for [her] help to solve their problems," and she started to feel "not only responsible for herself but also for others."

Although Jane's life changes at this time were marked by *gaining more responsibility at work*, the *kind of responsibility* she was taking at the job did not immediately transfer to the family sphere. In her family life, Jane felt "desperate and swamped in financial debts". By the time of Jane's 20<sup>th</sup> birthday, another significant rupture happened in her family—her mother got very sick, and Jane had to manage her family money and home expenses—tasks her mother used to do. This process, however, was very complicated because Jane's family was again relying almost exclusively on her earnings to survive. Her father could not work but wasn't receiving a government pension. Jane began to have money problems, and accrued debts from her credit cards. She said she "had to manage everything in [her] life, and this was a lot of work", demanding a lot of effort. As money debts started to pop up, she felt it was a "big challenge" to live on her earnings.

During this difficult time, Jane started to grow closer to her grandmother, a powerful woman that seemed to be the central figure in the family life. Her grandmother was a "mother-in-saint,"<sup>1</sup> a priestess of the Brazilian African-oriented religion called *Candomblé*. Jane started to visit her grandmother's temple often and to take part

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<sup>1</sup> A "mother-in-saint" is a priestess of the Brazilian Afro religion, "Candomblé." The word comes from the title "Ialorixá" in African language, where "Iyá" means mother and "Orixá" means a deity or ancestral spirit. The *mother-in-saint* run temples are where several rituals and cult practices take place throughout the year (Matory, 2005).

in the religious rituals. She told us she was being “initiated” into the religion by her grandmother, learning religious principles and values, and performing tasks in the preparation of rituals, such as cooking and cleaning the temple. She regarded this proximity to the *Candomblé* religion as “something [she] inherited from [her] grandmother.” She also revealed that, some time ago, she started to have dreams and forebodings that she “didn’t know the meaning,” of. Then, her grandmother told Jane that, according to the assumptions of their religion, these dreams could be seen as a “calling from the Saint”, implying that one of the divinities of *Candomblé* wanted to be praised and honored by Jane, and that she had “inherited” this “task” from her grandmother, who used to do the same.

As Jane explained, it was necessary for her to be initiated by her grandmother in the *Candomblé* religion in order to understand what was happening to herself and to praise the saints according to the rituals. Jane pointed out that her grandmother “already knew [Jane] had inherited this [task] from her,” because “it was a family thing.” But in the past, her grandmother had not wanted any family member to get involved with the religion, because she said it “demands a lot of responsibility.” As an initiate, Jane would have “to take responsibility not only for herself but also for others,” as her grandmother herself had.

Jane explained that her incursions into *Candomblé* caused some conflicts with her mother, who did not want Jane to “take on that kind of responsibility.” However, Jane talked to her father, and he said he had nothing against her participation. Jane’s father told her: “Do you really want this? If you want it, you can go.” Then she decided: “I want it, then I’ll go.” And since then, her mother was increasingly accepting of the idea of her involvement with *Candomblé*.

Regarding her relationship with the educational sphere of experience, Jane finished high school and tried to enter the university. She took the exams to get accepted into a public university three times (each time, for a different course: psychology, library, and communication), but failed. She reported that she “didn’t feel prepared,” because she “couldn’t think much about the future, [she] could only think about the [here-and-] now.” Working was her priority.

**Third Interview:** “I can take charge of my own life now”. At the third interview, Jane had just turned 22 years old. She said that a significant change in her life this time was the fact that she “*became more responsible*,” and had “learned to organize [her] finances.” She was dealing with her finances more competently: she paid off all her debts, cut up her credit cards, and paid for everything in cash. She started to account for her expenses, taking notes on everything she was paying for, and to limit her expenses, buying only what she really needed. She learned to control herself, and began “to do everything the right way.”

Talking about other changes in her life, she also said she had become more able to control her impulsivity towards others. She learned to deal better with other people, to listen to what they had to say. She had learned to let go when people said things that she did not like to hear. Sometime earlier, she had been aggressive and explosive, giving unreflective responses to other people’s commentaries, as if she could not

control what she was going to say. But now she was calmer and “didn’t want to enter in a dispute with others for small things.” She gained more control over attitudes and behavior.

These changes significantly affected Jane’s relationship with her mother. She thought they could deal better with each others’ differences, as her mother became better able to acknowledge Jane’s “own space,” to understand that she had to “have a space for [her]self.” Jane reflected that, some time before, her mother always wanted Jane to agree with her opinions. But now, her mother became more able to listen to and respect Jane’s thoughts and opinions. They were in less disagreement with each other, because Jane was better able to let go when her mother wanted to take a stand or to argue with her. And, as Jane did not want to get in disputes for small things any more, she could “let [her] mother discover for [herself] what might be right or wrong” (thus, Jane talked here in a reverse position—as-if referring to a child).

She said she was now taking care of her mother’s money. She had opened a sort of a savings account for her mother, and every month she deposited some amount of money in this account, and gave her mother some more to spend on herself. Therefore, regarding management of family money, their positions had reversed. Reflecting on the advantages of saving money, Jane said she thought “some people make plans to buy something with that money”—projecting herself into the future—“because some people are not able to save money, and spend their money as soon as they need something”—as she used to do in the past. And she thought this could be a good way for her mother to save the money to make home improvements she had wanted for a very long time.

Jane said she felt like an adult at the time of this interview, because she could “assume her life for [her]self;” she could “say what [she] wants, what [she] can and cannot do” because she was “responsible for [her]self”. Jane reflected that this was a “difficult [task] to achieve” because there were several people that influenced her life—such as her mother—and who used to tell her what to do, and she usually accepted whatever was told, but now she felt “liberated.” She could act based on her own decisions, and if something went wrong, she could “take the responsibility for her mistakes.” Therefore, Jane thought she could “take charge of [her] own life,” as she was “not only responsible for [her]self, but also for others.” Talking about what she considered an adult to be, Jane reflected that being an adult involved “taking responsibility for others, helping others,” and feeling that “not only does your own life depend on you, but other people’s lives can also depend on you.”

During the third interview, Jane also reported changes in her educational experience. She passed a very difficult exam to enter a public university and will study pedagogy (education). She said she had “felt prepared [for the exam]” because this time she had studied more. Now she can make plans for her future, and wants to continue studying and working at the same company for some time. She will arrange her work shift at the company in order to fit her university schedule, as she had gained more stability in her job. She said she now felt that she has “plans for [her own] life, only for [herself]” and that she wanted “to have a place of [her] own.” She told us that now she could dream about the future and she was “seeking to be happy” (see Table 9.1).

**Table 9.1** Synthesis of emerging ruptures and tensions between I-positions in Jane's self-system

Emerging ruptures	Spheres of experience	Main tensions between I-positions and overcoming strategies	Description
1st interview: father's work accident and beginning to work	Work	Apprentice X, unskilled-youth (mutual in-feeding)	Conflicting discourses: accepting youth apprentices X disqualifying them
	Family	Dependent-daughter X provider	Ambivalence between: being taken care of by parents and supported by them and X becoming the only household provider
2nd interview: escalation of ruptures, changing job functions; mother's sickness; appearance of debts; academic under-achievement; embodied symptoms	Work	Responsible worker (I-competent) X, irresponsible money manager (I-incompetent/I-in-debt), emerging promoter sign: "Initiated" (capable of weaving a sense of responsibility across different spheres of experience)	Dialogical encounters with Helena are initially circumvented by Jane's lack of trust in herself. Progressive internalization of Helena's voice (I-as-responsible-employee). Tensions emerge in the family as Jane's mother gets sick. Jane has to assume financial control of home expenses, but debts with credit cards start to appear and she feels desperate and swamped. Emergence of a promoter sign ("initiated") in the sphere of religion (Candomblé) which begins an integration of different spheres (I-Initiated)
3rd interview: religious engagement; changes in relationship with mother; passed public university exams; job stability	Family Religion Integration across different spheres of experience, religion + family + education + work	A meta-position: initiated (in Candomblé); integrates: responsible worker + responsible student + responsible money manager/provider + I-responsible (person)	The meta-position I-initiated acts a promoter sign, knitting a "sense of responsibility" across time (past-future) and space (different spheres of experience), guiding Jane's actions and decisions in the direction of future goals. Jane gains more stability at work, studies and passes the public university exam. Her relationship with her mother changes—she has more autonomy regarding her mother's opinions and takes care of her mother's money (reverse positions)

## Analysis

Jane's trajectory shows how self-regulation emerges in a process of dialogical *scaffolding* among different spheres of experience, leading not only to positioning and repositionings within the self-system but also to transformations in meanings and value's system—and more specifically in the meaning of *responsibility as a central value in Jane's self-system*. Her case highlights the dialogical tensions and the dynamic movements of the self-in-motion, across time and among different spheres of Jane's life. It shows how *external* and *internal scaffolding* are built upon dialogical exchanges with significant others present in central spheres of experience, acting as catalyzing agents of change.

The first interview (that took place when Jane was 18 years old) captured *self* dynamics when there was a significant rupture in Jane's life as a result of her father's work accident. Family life was at that time the *central sphere* of Jane's life experience, around which her self-system was organized. As her family experienced that rupture and faced financial hardship, Jane and her family were put in a situation of great *vulnerability*, and she sought the apprentice program as a way of helping support herself and her family. Jane's dominant I-position—*dependent daughter*—emerges out of her dialogical exchanges in her family, especially with her mother. This I-position creates a meaning-field that reflects how Jane experienced the family as a sphere of close proximity and bonds among people, where everyone cares for others and worries about others' wellbeing. In this sense, the *dependent daughter* I-position voices how Jane counted on her family for help and support in times of need, and that parents should act as supporters of children's needs as well as the reverse, children should support their parents in times of necessity. It also reflects a value system of an adolescent/young woman conforming to the opinions and orientations of her parents. Her *mother* and *grandmother* are dominant figures in her family life as well as in her personal life. In Jane's nuclear family, her *mother* is the one who guides the opinions and actions of her father, her sister, as well as herself. As Jane explains:

My mother's decisions are those of my father as well. She is the one who has the final word. If she says something, my father always goes with her [opinion]. He works and is the [family] provider, he does everything, but the salary is hers [to spend]. Therefore if she says 'go,' everybody has to go with her. [. . .] If she has a thought, she expects [me and my sister] to conform to this thought.

In the broader family—and even among members of the broader community—it is her *grandmother* (her father's mother) who is the central figure, who holds the family together and mediates conflicts among family members, as everybody remains in close proximity to her and to her activities as a *mother-in-saint*, the priestess of *Candomblé*. Every weekend the whole family gets together at her grandmother's place, and if there is a conflict among family members, it is always her grandmother who is called upon to solve the dispute.

Therefore, at the initial phase of our investigation, Jane's interest and worries are significantly influenced by—and even tied to—the needs and interests of her family, as she also makes clear when she says that *her dreams are the dreams of her mother*, implying that she could not have dreams of her own.

## Emerging Tensions in the Work Sphere and Their Overcoming

As Jane enters the world of work, new tensions emerge in her self-system. She is confronted by opposing discourses prevailing there. She recalls the voice of the librarian (her supervisor), who identifies Jane as a “young apprentice”, and makes her feel uncomfortable or even excluded from the “scene” of her work environment. The librarian seems to voice dominant discourses about young people in the Brazilian collective work culture: the *discourse of disqualification of “youth.”* Through this discourse, youth are regarded as less experienced and somehow incapable or lacking the necessary abilities to fit in the work environment or perform required complex tasks and responsibilities. Therefore, Jane feels challenged and devalued as “young” and “different” from older, more experienced colleagues.

Jane’s initial experience in the work sphere also reveals tensions between *acceptance*—prevailing in her family sphere—and *rejection*—that she faces as a new apprentice confronted with a context where everybody else’s job function is already determined and structured. The opposing I-positions that emerge out of these dialogical encounters with others in the workplace are: *Apprentice X unskilled(devalued)-youth*. The ambivalences between these self-positions reflect Jane’s struggle to fit in, to find a place in the work environment and to be recognized and accepted there. But the emerging feelings of “disqualification” (resulting from the combination of *unskilled* and *devalued*), of incompetence, and insecurity find echo and are amplified by the state of vulnerability of her family, and seem to take over and dominate the landscape of positions in her self-system.

Dealing with these ambivalences, Jane developed a strong mentor-like relationship with Helena, who brought an *alternative voice* to the landscape of her self-system, a voice of *confidence*, of *trust* in Jane’s *competence* to perform successfully at work. However, in the beginning, this alternative voice was always circumvented by Jane’s feeling of incompetence and insecurity, in a *mutual-in-feeding* strategy (Valsiner 2002). Every time Helena highlighted her trust in Jane’s competence, Jane reaffirmed her feeling of incompetence and inability, as if resisting change and trying to maintain the dominant negative view of herself.

In time, however, Jane started to internalize Helena’s voice in her self-system, and a new *promoter position* (Hermans and Hermans-Konopka 2010) emerges in the work sphere—the Responsible-Worker. Jane was capable of distancing herself from the stream of contradictory discourses and experiences. She acknowledged her own ability to perform new functions and to take on new work *responsibilities*, recognizing the difference between the way she used to be in the past and the new way she started to become. Slowly, Jane developed a sense of belonging to the work environment, and put into a new perspective the conflict between her old negative voice and Helena’s more positive alternative voice. Therefore, the new a *promoter position* of *responsible worker* emerges through dialogical encounters and recognition of a *significant other* present in her workplace, and through internalization of external voices, especially Helena’s. Using her relational resources, Jane began to build bridges with the alternative voice, by expanding self-meanings expressed by positions such as I-confident, I-competent, and I-trustful.

Yet a decisive turning point was the recognition she gained through her dialogical encounters with Helena—who trusted her, and demonstrated more confidence in Jane than she could have for herself. Helena’s *anticipated recognition* of Jane’s qualities provided the *catalytic condition* Jane needed to start reconfiguring herself as someone capable of performing new job functions successfully. Only after Helena’s recognition—and more specifically, *only after being* “imaginatively” *put by Helena into a more powerful position*—could Jane position her own self that way. She could voice these meanings for herself and feel empowered. Reflecting on these transformations, Jane told us she learned to be more confident, but “still [felt] a little insecure, sometimes,” indicating that the new emerging position as *responsible worker* was not yet fully consolidated.

In the family sphere, however, Jane was still operating mostly from the position of *dependent daughter*. Although a new position was emerging in her family sphere as well—the position of *provider*—this new I-position remained *latent*. Jane recognized that she was the “only person contributing to her family expenses”, but contradictorily she gave all the money to her mother to manage, because she regarded her mother was more capable of doing that than she herself was. Therefore, the *provider* position seemed *dissociated* from the stream of Jane’s experience within her family, remaining as a *latent* or *hidden* I-position, subsumed in a self-system where the *dependent daughter* was dominant.

Jane’s decisions regarding her future were postponed or suspended by her shared living experience, where the present was the best possible choice, due to the constraints existing in her immediate context. In this constraining environment, Jane was mostly caught in the here-and-now meaning field of life experience, and could not project herself much into the future.

### ***Growing Tensions between Relevant Self-Positions***

*Promoter positions*, however, do not immediately transfer or expand across different spheres of experience. In the second interview, Jane’s promoter position as *responsible worker* seemed much more consolidated, helping to promote her healthy adaptation to the work environment. Jane expressed her satisfaction with her accomplishments on the job, changing functions and gaining progressively more recognition as well as *responsibilities* from superiors. She proudly said she was “one of the persons with more responsibilities in her sector.” She still had a mentor-like relationship with her new supervisor Joana, but she felt more confident and secure, and could solve work problems by herself, without relying so much on support from others.

However, new ruptures and tensions emerged in Jane’s family life. Once more, her father stopped receiving his pension covering his injury, and her mother fell ill. Therefore, Jane had to assume the management of her family’s money, a task usually performed by her mother. The latent *provider* position was forced into the foreground of her self-system by the reversal of roles with her mother. Then, there was

a significant dispute between two powerful opposing positions to dominate the family sphere: *dependent daughter X provider*, one reflecting her old *self* configuration and the other, a new alternative position.

At this time, however, debts with credit cards started to appear, and Jane felt desperate and swamped. The new *responsibilities* she held at work did not seem to transfer to her family life. Jane felt that “it took too much work to manage her life”. By using the word “work” to refer to the ambivalences emerging in the family sphere, Jane was possibly trying to integrate within the psychological space two significant spheres of her life experience (work and family). She might be *trying to find a sign to mediate or to integrate her work experience* (now characterized by *responsibility* and the ability to perform) *and her family experience* (characterized by her *irresponsible* use of credit cards and inability to manage financial expenses). However, as she could not yet find a meaning bridge to integrate these two spheres, and as they seem to remain dissociated from each other, the tension grew and found expression through *body symptoms*, such as hives (*urticaria*), and *foreboding dreams* that made her feel terrified.

Therefore, although Jane gained significant foothold in the workplace, there was a growing tension between different spheres of her life experience. Despite the new-found prominence of her work life, the central sphere continued to be her family, and ambivalences between I-positions that dominate the two spheres became more relevant. Specifically, there was a growing tension between the *responsible worker* position—which dominates the landscape in the work sphere—and the *irresponsible money manager* position—that begins to dominate family life. With ambivalence growing out of different spheres of her life experience, Jane tried a *new meaning loop* as a way to reach for self continuity.

### ***Enabling Integration between Different Spheres of Experience***

By the time she began experiencing these ambivalences between *responsible worker X irresponsible money manager*, Jane also developed a very close bond to her grandmother. Jane’s grandmother was a “*mother-of-saint*”, and Jane started to visit her temple more often, participating in some of the rituals taking place there. When she talked about her grandmother, Jane emphasized that she “helped and took care of a lot of people, not only the members of her family, but also any people that sought her help.” She said she very much admired her grandmother’s commitment to helping others. However, as Jane explained, her grandmother had never wanted—until that moment—the direct involvement of her relatives in *Candomblé*, because this religion required the person “to take on many responsibilities”, and “it was not something you could enter and leave when you want.” Jane’s explanations seemed to imply that, in order to become a member of *Candomblé*, a person had to fully commit to *long-term spiritual responsibilities* (especially the responsibility to *help others*).

But the grandmother’s attitude towards Jane herself was different, because Jane was being “initiated” to become a member in her temple. The grandmother told



Jane that she had “inherited” some of her qualities as a religious woman. When she learned about Jane’s symptoms—especially about her *foreboding dreams*, of which Jane herself did not know the meaning, the grandmother told Jane that they were due to a “calling from the Saint.” In the religious tradition of *Candomblé*, when one of the divinities “calls” a person, it means that she is supposed to praise the divinity by adhering to the religious practices. The fact that the Saints were calling Jane, then, implied that she had to be “initiated” into the religion in order to start making offerings to the Saint and performing related rituals as a way to respond to that “calling.” Interpreted by her grandmother, the “calling from the Saint” had a powerful effect on Jane, who felt compelled to be “initiated” and to start taking on some of the *responsibilities* associated with *Candomblé*—to take responsibility for the *spiritual wellbeing* of others—even against her mother’s wishes.

From a *dialogical-semiotic approach to the self*, it is possible to understand the intricate interplay among Jane’s I-positions that emerge by these exchanges. To overcome *ambivalences between different spheres of experience*, Jane tries a *new meaning loop*. She gets closer to a powerful significant other: her grandmother—the central figure in her primary sphere of experience (i.e., family life). Her grandmother then took the role of a catalytic agent for change. It is by the *anticipated recognition* and *acknowledgement* coming from her grandmother—who interprets her symptoms, and gives meaning to something that Jane *herself* does not know the meaning—that a *new promoter position* can emerge and come to the foreground of Jane’s self-system, beginning to *integrate* different spheres of Jane’s life. The grandmother’s proximity and her interpretation of the meaning of Jane’s symptoms function as a condition for new transformations in Jane’s self-system. Much in the same way that Helena had done in the work sphere, Jane’s grandmother *recognized* Jane’s potential to *become* someone in the future that at that moment she was not yet, guiding the emergence of a *new promoter position* in Jane’s self-system.

The *promoter position* as *initiated* emerges in these dialogical relations, and knits together the positions of *responsible worker* and *provider*, by giving a new *amplified* meaning to the “*responsibilities*” Jane has to assume in the different spheres of her life. The position *initiated* carries a sense of *spiritual responsibility* that emerges as a powerful way to interweave different senses of responsibility across Jane’s life. On the one hand, Jane could redefine the sense of *personal responsibility* she has built in the work sphere, through dialogical exchanges with Helena, and that made Jane capable of assuming new work functions, and even to start helping co-workers with their tasks. On the other hand, she could also redefine her *interpersonal responsibilities* in the family sphere and become responsible “not only for herself, but also for others,” that is, for her parents and for her sister, by becoming more organized with expenses, reversing roles, and assuming responsibilities that originally belonged to her mother, and even taking care of her mother’s money by creating a savings account for her.

Therefore, what happened through this *new meaning loop* was the development of her capacity of self-regulation by the emergence of a *promoter sign* that functioned as a *meaning bridge* across different spheres of experience. After the emergence of a powerful *promoter position* that emerges in the *religious sphere* of experience,

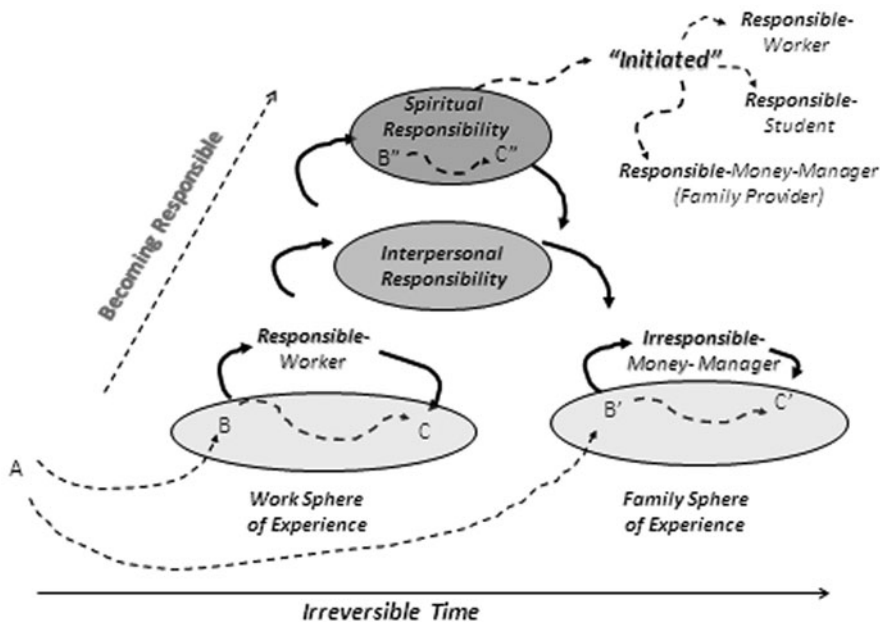


Fig. 9.1 The growth of self-regulation through hierarchical use of signs

previous *limited* senses of *responsibility* expanded to a broad—*spiritual*—meaning of responsibility. This *new hypergeneralized sense of responsibility* was capable of bringing continuity to Jane’s self-system across space (diverse spheres of experience) and across time (past-present-future).

As illustrated by Fig. 9.1, Jane’s initial self version (A) enters the work sphere and starts a dialogical relation with Helena (B), who recognized Jane’s competence in successfully performing her work tasks in advance (even before Jane could recognise that herself). Jane began to internalize Helena’s voice, and developed a *promoter position* as *responsible worker* (C). After some time, confronting her mother’s sickness in the family sphere, and through dialogical relations with her sick mother (B’), Jane positioned herself as *irresponsible money manager* (C’). The two positions of *responsible worker* and *irresponsible money manager* were powerful signs that dominated the landscape of dialogical relations in the main spheres of Jane’s life—family and work. However, there was a growing tension between these two dominant positions, because they referred to contradictory forms of dealing with *responsibility* (i.e., *contradictory semiotic sets*).

Seeking to overcome ambivalence, Jane reached for a new meaning loop by increasing her participation in the religious sphere and getting closer to the powerful figure of her grandmother (B’'), who offered an *anticipated view of Jane in the future*—by projecting her into *something that she not yet was, but could become*—because she has *inherited* the spiritual qualities of her grandmother. Then, dialogical

relations with the grandmother lead to the development of another *promoter position—initiated* (C’), characterized by an amplified or expanded perspective on responsibility: *spiritual responsibility*. This new *promoter position* acted as a powerful self-regulatory sign that *integrated* different spheres of Jane’s life (work, family, religion), and provided *continuity* across time (past–present–future), since it emerged as a sort of “inherited” quality passed through generations.

### ***Reconfiguration of the Self-System Across Space and Time***

The *meaning loop* taking place across different *spheres* and *levels* of experience brought Jane’s self-system to a reconfiguration in time and space. The intervention of the powerful *promoter position initiated*—emerging in the religious sphere—was able to knit together partial and/or limited meanings of *responsibility* that emerged in specific spheres of Jane’s life, providing a continuity of self across different contexts. Jane was able to put all kinds of limited responsibilities into perspective and expanded her responsibility into different life domains (i.e., work, family, education, and religion).

A new sense of religious responsibility and engagement came together with changes in Jane’s relationship with her mother, and brought changes in her academic life as well, as she studied and passed a very difficult exam to study at a public university. In her job, she also gained more stability, expanding and consolidating her previous job functions. At the work sphere, Jane had internalized the voices of competence, confidence and organization (expressed initially by Helena), and felt responsible not only for herself but also for coworkers. She acted as a mentor, an adviser, to her colleagues. Jane revealed that she no longer relied so much on the approval of others to make decisions. She felt free of other people’s influence, and believed she was “able to take charge of [her] own life.”

At home, she has taken on responsibility and acted effectively to manage the money that she earned at work. She has paid off all her debts and cut up all her credit cards. She paid cash for her expenses, and gave a little money to her mother every month. There was sort of a reverse in positions, because Jane was able to take care of herself and of others as well, consolidating and expanding *interpersonal responsibility* into the family sphere (which she had already accomplished in the work life). Her relationship with her mother also changed, because her mother has begun to listen to and respect her daughter’s opinions.

This movement demonstrates that Jane was creating new meanings for herself. By the time of the third interview, when she was 23 years old, she had reconfigured her self-system after the *meaning-loops* bridging different spheres of experience. She had forged a new identity, negotiated among several I-positions in the landscape of multiple voices. The voice that emerged as dominant was *responsible*, expressing an integrated and integrative perspective of herself, irradiating its influence to different dimensions of her life, and allowing for the overcoming of challenges across different contexts and time dimensions. With the qualities “inherited” from her grandmother

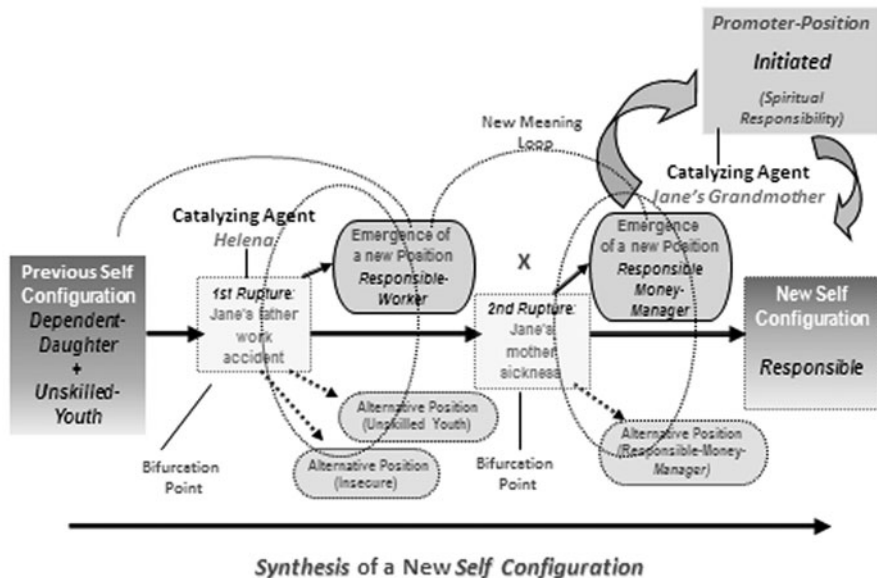


Fig. 9.2 Emerging differentiation generating Jane’s life trajectory

(her spirituality), Jane could reposition herself in the present moment as well as towards the future, which became populated by *alternative ways of being* (she has become a university student, began to have dreams of her own, and was “seeking to be happy”).

As illustrated by Fig. 9.2, Jane could forge a life trajectory that had a certain direction, as a result of emerging differentiation at bifurcation points.

As we can see in Fig. 9.2, emerging differentiation at specific bifurcation points of a young person’s life trajectory (1st and 2nd rupture) can be seen as *meaning-loops* that bring out new *promoter positions* to operate in the self-system. Triggered by dialogical relations with significant others who acted as catalyzing agents (i.e., Helena and Jane’s grandmother), these *promoter positions* became prominent in the landscape of different spheres of life. However, emerging differentiation may bring in new tensions, because development is not a peaceful, tautological movement. Development occurs through *catalytic cycles of innovation* that are capable of *interweaving various spheres of experience* as well as *time perspectives*. In Jane’s case, initial meanings and positions built in the work sphere were amplified and knitted ambivalent meanings and positions from other spheres of experience. Jane’s initial perspectives of being—her initial self-version that was operating at the time of the first interview—were reconfigured to a new time perspective that included both her *inherited past* (the spiritual qualities she “inherited” from her grandmother) and her *future to come*, as possible “becomings,” possible “comings-into-being” or alternative ways of being—that include professional life as well as spiritual life.

This movement of internal *scaffolding* within the dialogical self, begins with exchanges with significant others acting as *catalyzing agents* and not only as *resources* for the self. These dynamics take place simultaneously *between different spheres of experience*, and *between different levels of experience* (i.e., from more concrete meanings—constructed in everyday fields of experience—towards more abstracted and hypergeneralized meanings). Jane’s recurrent *meaning-loops* show that, in order to overcome ambivalences she had to search for signs at a higher level of generalization, such as “interpersonal responsibility” and “spiritual responsibility”. Overcoming uncertainty emerges through building meaning bridges as Jane reaches for *hypergeneralized signs* to act as promoters of her development, integrating multiple spheres of experience, designing a new life trajectory.

The active role of *catalyzing agents* was crucial in Jane’s transformations. Catalyzing agents such as Helena and Jane’s grandmother facilitated the emergence of a new synthesis in Jane’s self-configurations, as they enabled the emergence of *promoter* self-positions. We suggest that these significant others can be regarded as *temporary embodiments of the catalytic function*, as they embody, in interactions taking place at specific windows of time, the contextual conditions that may organize higher levels of experience. These significant others, therefore, may *take on the catalytic function and enable a specific direction for change*, anticipating certain types of recognition the person may get in the future. Specifically, only after Helena’s and her grandmother’s recognition and acknowledgement of alternative positions—only after being “imaginatively” put by these women into a more powerful position—could Jane position her own *self* that way, voice these meanings for herself, and feel empowered.

This analysis, therefore, illustrated how *catalyzing agents* may operate between the *micro-* as well as *mesogenetic* levels of a young person’s development, fostering the emergence of *promoter* self-positions, helping to create meaning bridges between past and future (projected) positions, and validating these new meanings in a broader context, giving a social framework to personal events happening in a life trajectory. Along these lines, we suggest that *catalyzing agents* might play an active role in transition to adulthood, especially when youth undergo processes of rupture transition in their developmental pathways, affording social recognition of young people’s new emergent meanings, and helping youth become more resourceful and empowered.

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# Chapter 10

## Catalysts and Regulators of Psychological Change in the Context of Immigration Ruptures

Irini Kadianaki and Tania Zittoun

In this chapter our aim is to show how the concept of catalysis, as taken from chemistry, can be used to understand psychological experiences and specifically how individuals cope with situations of psychological ruptures in their lives, such as that of immigrating.

Moving and living to a country other than one's own brings individuals into contact with different meanings about the social world they inhabit and about themselves, and changes their habitual ways of relating with other people. Immigrants often encounter stigmatizing meanings with regards to their identities (ethnic, migrant), which they strive to negotiate (Deaux 2006; Timotijevic and Breakwell 2000; Verkuyten 2005). As they deal with these meanings about themselves they engage in redefinition of their identity (Chrysochoou 2004) and in self-transformation (Gillespie et al. 2012; Kadianaki 2013). The change of the sociocultural environment often demands acquisition of cognitive and social skills and redefinition of cultural ethics and routines as well (Knafo and Schwartz 2001; Kwak 2010).

In this chapter we will examine how people experience the ruptures of immigrating and how they sustain themselves psychologically to deal with these ruptures. How can the concept of catalysis be relevant to our examination then? As we will demonstrate, a catalytic framework enables the understanding of both the conditions that bring change and support the emergence of new psychological phenomena as those induced by psychological ruptures.

Catalysis, as understood in chemistry, is a process that provides the conditions necessary for a chemical reaction to occur; it sets the conditions for a qualitative change to occur in an organism, a system (Cabell 2011). Witzemann (1943, p. 179) defines a catalyst in chemistry as an “extraneous substance that somehow causes

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a reaction to take place that would not take place in the same way or to the same extent in its absence in finite terms, and which is usually not permanently changed in the events in which it takes such a part". Catalysis thus describes those conditions that support, constrain or direct reactions to take place, through the activation of regulators, namely, promoters or inhibitors, leading to certain chemical outcomes.

In transferring the concept into psychology, Cabell (2010) has talked about semiotic catalysts and regulators, relating thus the concept to semiotic mediation: the idea that "human existence is organized by socially constructed and personally internalized semiotic means-signs of different kinds" (Valsiner 1998, p. 234). We build on the concepts of catalysts and regulators and connect them, as the following section will show, to the notions of rupture and symbolic resources used to understand psychological transitions and development (Zittoun 2006). Studying the uses of symbolic resources intends, precisely, to examine processes by which meaning-making is facilitated, accelerated and oriented thanks to peoples' uses of complex semiotic mediators in forms of regulators (Cabell 2011; Zittoun et al. 2003). Here, we go further in the analysis of ruptures and uses of symbolic resources as catalytic processes. Doing so, we hope to enrich both the understanding of catalytic processes and the study of uses of symbolic resources.

As we will argue, a catalytic framework provides a contextualized and systemic understanding of the conditions under which psychological phenomena occur and the processes (and not solely the outcomes) of qualitative change of the psychological system, which in our case, are induced by immigration.

## **Ruptures and Semiotic Elements as Catalysts, Symbolic Resources as Regulators**

In this project a rupture is conceptualized as a perceived change, a breach in the continuity of the individual's life course, which invites a renegotiation of taken-for-granted meanings and routine situations. A rupture triggers a period of transition, during which the person finds himself in a process of uncertainty and imbalance that needs to be reorganized and dealt with (Zittoun et al. 2003; Zittoun 2004, 2006).

Ruptures can emerge from different types of change in the lives of individuals (Zittoun 2006): from large-scale changes in the social context for a person (e.g. war), changes of and within the immediate environment of the person (e.g. immigration; new family member), changes in the relationship of a person with other people (e.g. divorce) or with objects (e.g. fear of flying), and intrapersonal changes (e.g. identity changes). Ruptures caused by different types of change can be interconnected: for example, the event of a war is likely to trigger intrapersonal ruptures. Ruptures can also be differentiated by their time extension (i.e. sudden, slow and recurrent) and their different degrees of generality in affecting the individual experience (i.e. whole affective experience, isolated aspects of experience). In this project we will discuss the rupturing experiences caused by immigration.

Events experienced as ruptures are, thus, synonymous to the destruction of existing meanings, of ways of defining oneself, and of acting, until they are treated as meaningful. As a consequence, ruptures are followed by periods of transition, which can involve: (1) a redefinition and repositioning of the self, for example, in the case of immigration, the movement to a new social milieu confronts people with new social others who perceive them in different ways than their home communities; (2) the mobilisation of social, practical, and theoretical skills to permit new ways of conduct, for example, moving to a new country invites new language skills and actions, which will permit people to deal with the non-habitual demands of everyday life; and (3) construction with symbolic elaboration of events, experiences, emotions to allow self-continuity and consistency (Zittoun 2006). Thus ruptures invite the activation of mechanisms that will regulate psychological processes of transition. Consequently, we suggest that ruptures introduce new meanings in the system constituted by the person and the immediate spheres of experience; it is the introduction of such meaning which might induce the destruction of the sense a person previously conferred to a situation. Hence, a situation of war introduces new meaning—about the importance of enrolling, sacrificing one’s life for one’s nation, the beauty of battles—in people’s environment, which in turn can disrupt the sense people were conferring to their daily lives. In that sense, experienced ruptures can be seen as catalysts.

“When ruptures occur, and meaning systems “bottom-out”, some process must be activated in order to start re-building and re-producing the meaning system. It is the semiotic catalyzers function to activate re-producing and synthesizing mechanisms to rebuild the meaning system. The catalyst, then, coordinates the mechanisms in the system to re-frame the mind and re-build its meaningful system” (Cabell 2011, p. 10).

Drawing on chemistry, Cabell (2010, p. 27) differentiates two types of semiotic mediators: semiotic catalysts and semiotic regulators. Semiotic catalysts are processes induced by a rupture, which “provide the directional flavoring that support—but do not act directly on—the enablement or disablement of ongoing psychological processes (. . .) and providing the support for the direct and active operation and employment of semiotic regulators (and other mediating devices)”. Semiotic regulators are “intra-mental devices that are actively and directly used on the ongoing psychological processes” or “extra-mental devices that are actively and directly used to cultivate the personal-cultural or the collective-cultural field” (Cabell 2010, p. 37).

We will be focusing here on these extra-mental devices that can act as semiotic regulators. These can be cultural elements such as a song, a movie, a book, which are abundant in the lives of individuals. Provided that people have the mastery of some of the semiotic systems and conventions by which these objects are built, they can experience them: they can read fiction, dance traditional dances or enjoy listening to a song. When these experiences acquire a particular, personal sense, these can be seen as becoming symbolic—they touch the person—the person “resonates” with the character, is “moved” by the melody, is “transported” by the colors of a painting, etc. Finally, when the person is using the cultural elements or some of its semiotic components in relationship to something else, with a form of intentionality—a novel

to remember a place, a song to regulate one's mood, a thought about visiting some place—then, he uses it as a *symbolic resource* (Zittoun 2006).

We can thus distinguish different degrees of mediation offered by cultural elements: as semiotic elements, they allow the person to experience a general meaning that is socially shared—e.g. the 2012 James Bond movie by Mendes is constructed on a plot showing the fidelity and bravery of the special agent to his country, supported by a choice of colors, certain type of music etc.; as symbolic resources, they actually resonate with specific aspects of a person's experience—e.g. one can be moved by James Bond's fight to recover his physical strength after an accident—and can guide and transform that personal experience.

Consequently, we first propose that cultural elements, together with their associated social representations and values, e.g. "James Bond always wins against all odds", can act as semiotic mediators, and can be considered as another form of catalyst. They can, as ruptures do, introduce meanings into the psychological system. Second, we suggest that symbolic resources can be used as semiotic regulators to facilitate the process of dealing with the rupture by mediating the relationship of individuals with: (1) one's self and inner feelings; (2) social others by creating, understanding, and transforming social relationships; and (3) social reality by facilitating understanding of the social world and positioning of the self in it. Resources can provide time orientation (allowing for self-continuity between past and future) and also mediate at different levels of the experience of an individual: from immediate embodied perceptions to a higher level of commitments and ideologies (Valsiner 2001, 2003) as our case study will show. We discuss how this aspect of multidimensionality of the function of semiotic regulators contributes to the development of the concept of catalysis when used to theorize psychological phenomena as opposed to chemical phenomena.

Thus, as occasions for development, the processes triggered by people's experienced rupture and their subsequent uses of symbolic resources can be seen as a catalytic process: A rupture creates conditions for change as a first form of catalyst, cultural elements create the condition for certain directions of change as second form of catalyst, and symbolic resources function as regulators in the elaboration of the new meaning.

Through our analysis we first suggest that a catalytic framework can enrich our understanding of the emergence of ruptures through theorizing the antagonistic relations of meanings introduced into the psychological system. Second, we explain how new meanings found or synthesized in symbolic resources/regulators are built in opposition to the meanings introduced by ruptures/catalysts. Finally, we suggest that our approach contributes to the catalytic framework by adding to its conceptualization, the ideas of mediators comprising complexes of different types of signs (hypergeneralized, field like, point like), and by showing the transformative qualities of semiotic mediators in discussing the ways in which regulators may become catalysts for further change.

To illustrate our approach we will use the case of Sabar, a 34-year-old Kurd from Turkey, who arrived in Greece in 1994 as a political refugee.

## Context and Methods of Research

Sabar's case study uses the data of a research project conducted by Irimi Kadianaki (IK) between August 2007 and April 2008 in Athens, Greece. The project investigated the experiences of 32 immigrants living in Greece for the past 2–30 years, coming from a variety of countries (South American and African countries, Turkey, Iran, and Albania). Specifically, part of the project aimed at understanding the immigrants' use of cultural elements as symbolic resources for coping with the psychological demands of relocation (Kadianaki 2010). The methodological approach was qualitative, involving interviews, focus groups and ethnographic observation in three immigrant communities.

We have chosen a case study to illustrate the theoretical concepts proposed in the previous section. A case study offers extended knowledge about the particularities of an individual's life story (Yin 2003) and in this case, it can permit an in-depth understanding of experiences of immigration, the catalytic meanings introduced by the context, and the regulatory processes involved in coping with the ruptures (Kadianaki *in press*).

Sabar's case was chosen because of the amount of material gathered by IK about his case through repeated interviews and meetings at informal gatherings. This information permits increased familiarity and in-depth analysis. Sabar is also an eloquent and highly reflexive individual, a fact that has facilitated the analysis presented here. Interviews with Sabar were conducted in Greek. Analysis of the material was conducted in the original language and the data used from the presentations were translated in English for presentations purposes. Transcription conventions can be found in the footnote below<sup>1</sup>.

## The Case Study: Sabar's Life Story

Sabar, 33 years old when IK met him in 2006, arrived in Greece in 1994, fleeing illegally from Turkey after being persecuted by the police. Since childhood, Sabar's life was formed by the rupture of being a Kurd in Turkey: a member of a persecuted minority. From his childhood memories, he remembered the intrusive and aggressive presence of soldiers in his house, destroying personal belongings and food supplies. He described school memories of having to conform to an imposed Turkish ethnic identity. Sabar grew up realising that he belonged to an oppressed and unrecognised minority as opposed to the dominant majority. During his university studies in Turkey,

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<sup>1</sup> Transcription conventions: *IK* indicates the first author and interviewer. *S* stands for the initial of Sabar, the pseudonym of the participant. “( )” indicates information about paraverbal, nonverbal behavior. (*inaudible*) indicates phrases or words that could not be heard in the audio file. “[ ]” indicates an addition from the author for explanation purposes. “!” indicates raised voice/shouting or generally added emphasis by the speaker in the discourse. “{ . . . }” indicates missing text, usually irrelevant to the analysis. ‘ ’ indicates an idiomatic phrase used, usually in another language or a switch in language by the participant.

he decided to get politically active in unions and organisations that promoted Kurdish culture and organised the “Kurdish struggle”, as he named it.

Sabar presented his political activism as an inevitable outcome of his everyday experiences, the violent suppression of his Kurdish identity, and the torture against his fellow Kurdish nationals. He presented collective action as a defence mechanism to the rupture of being a Kurd. However, the government followed his actions and soon he was persecuted. In the face of expected violence and imprisonment towards those involved in the Kurdish affair, Sabar managed to flee to Greece, while his companions were put in prison for 12 years.

Thus, Sabar’s arrival to Greece was a result of a chain of ruptures that began long before his flight: for him, being a Kurd meant living the life of intrusion, violation of human rights, and violent suppression of identity, language, and culture. At his arrival, Sabar had to stay in a refugee camp, where he lived in what he described as dehumanising conditions. During this time, which he perceived as analogous to being imprisoned in Turkey, he felt that his political ideas which led him to flee were foregrounded, as he was in a situation similar to that of the immigrants who fled for economic reasons.

One of the rupturing experiences that Sabar reports in his life in Greece relates to the disillusion he felt with the Greek state. His representations prior to arrival were formed based on an image of a democratic ancient Greece and on a long history of war that Greece shared with Turks, which, in his mind, implied a friendly attitude towards the Kurdish struggle. In other words, he expected to live in a democratic country where he could freely express his political ideals. Certain events,<sup>2</sup> however, made him realize that Greece was not the place he had imagined. The Greek state was seen to have betrayed the ideas of Kurdish refugees, and after these events, changed its attitude by closing its borders to the incoming Kurdish refugees. The suspicion Sabar had perceived about the Greek state and society affected him personally in terms of acquiring asylum, a process which lasted 6 years and involved many instances of being treated as an inferior by the authorities. Even when formal recognition as a political refugee was acquired, this was not accompanied by any actual benefits, for example, language education or assistance in finding employment.

Sabar has been politically active since his arrival in Greece. Soon after his arrival he became an active member of the Greek-Kurdish Friendship Union, an organization with the aim of informing the Greek public about the Kurdish affair and also connecting Kurdish refugees through a cultural centre, providing help with practical matters. Sabar presented his involvement in this union as a continuation of his collective political actions in Kurdistan. He felt he contributed to the conservation of the Kurdish culture and the protection the human rights of displaced people.

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<sup>2</sup> In 1999, Abdullah Öcalan, the leader of the Kurdish Workers Party (PKK) in Turkey was persecuted by the Turkish police with the charge of being a terrorist. Öcalan ran away from Turkey and found refuge in Kenya, hiding at the Greek embassy. After leaving the Greek embassy, he was arrested by Kenyan police. He was then handed over to Turkish security agents and was imprisoned in February 1999. It was widely believed that the Greek government gave him away to the Kenyan and then Turkish authorities. As expected, this event affected the ways in which Kurdish political refugees perceived the Greek state and thought they were perceived by the Greek state and nation.

Having left his university studies incomplete for agricultural practice due to prosecution in Turkey, Sabar decided to study politics in Greece. He was motivated, as he explained, by his need to become knowledgeable on political matters and understand the dynamics of the Kurdish affair. It was, as he described it, a period of disappointment with the Kurdish fight going international (breakup of Kurdish parties, organizations weakened in Greece) and a period of suspicion towards the Kurds in Greece, as mentioned above. His political activism was going through a crisis and his university studies facilitated new meaning-making and orientation.

Sabar has now been staying in Greece for 18 years. Despite being granted asylum in Greece, he has thought of leaving for another European country many times but has not so far realized it.

Thus, for Sabar, being a Kurd has been causing an ongoing series of ruptures in his life, of which the main three appear to be: (1) being discriminated as a Kurd in Turkey, which questioned his identity as citizen and disrupted the daily meaning of his life; (2) having the experience of migrating to Greece and being turned into a refugee, which again questioned his identity, possible actions, and projects (i.e. feeling the suspicion and rejection from the Greek state, feeling that the Kurdish fight cannot be sustained), and (3) realizing that Greece was not what he had expected and that threatened his system of representations. These ruptures are semiotic catalysts that introduced new meanings in Sabar's psychological system which opposed Sabar's existing meaning system. Through a series of events, they deployed the catalytic generalized meaning of "being a Kurd minority", which had different meanings in different contexts that Sabar found himself in. Thus, connecting to the theory, we suggest that a catalyst takes the form of a rupture when opposing meanings permeate the meaning system of the individual and call for change and redefinition of self, which is achieved through diverse means. We will focus on the means he used in the Greek context, where his change was enabled by his use and creation of semiotic regulators.

## **Sabar's Semiotic Catalysts and Regulators to Cope with Rupture**

In this section we will present the semiotic catalysts that provide Sabar with meanings, which lead him to use already existing semiotic regulators or create new ones to respond to the ruptures explained above. The semiotic catalysts or so to speak, semiotic environments that are presented here refer to meanings and qualities contained in music, film, and a website. These are different from catalysts described as ruptures above. They are particular songs and films and a website used to rebuild the meaning system, to provide Sabar with time orientation and to mediate his experiences at different levels. So the meanings contained do not, as in rupture-catalysts, oppose to the meanings of Sabar's psychological system. They are used to overcome the meanings of the rupture-catalyst. As it will become evident subsequently, the meanings presented in these extra-mental devices in the form of artifacts are largely political.

## *Using Music and Film as Semiotic Regulators*

Regarding his favorite music, Sabar explained that he connected Kurdish music to his personal memories. As he explained: “Kurdish music is very strong because it succeeds in reflecting the everyday life of Kurdish people directly, and you experience this immediacy”. He referred to a song that described in its lyrics a massacre of Kurds and noted:

Sabar: “When you listen to it, it is very direct, like you are watching it as it happens. That’s why I think that music is not far from reality. It helps you realize better some things, because there is the emotional part in it. At some point, music also functioned like propaganda, like a political vehicle”.

With regards to music that he listened when he arrived to Greece, he explained:

Sabar: When I came [to Greece] I bought, I ordered from abroad as well and I downloaded from the internet and I have almost all the Kurdish songs.

IK: Is there any time of the day particularly that you want to listen to something specific?

Sabar: Yes, when I work at home or read, I put on quality Kurdish music or classical. But I am a melancholic person, meaning that we come from a certain entity and we have certain roots that we cannot forget. And when I have problems, I try not to avoid them, on the contrary I try to face them, I will put on some melancholic music (pause) I like that and it keeps me alive with the past and with the fight.

Sabar listens to his favorite music and reads when he is at home. The Kurdish or classical music creates a general feeling of melancholy and connection to his roots. It orients Sabar’s experiences in some general way; it functions as a semiotic mediator, a catalyst. Then, more precisely, the music is used as symbolic resource in troubling times and as such, functions as a semiotic regulator that draws thematically on the meanings of the war and the Kurdish fight. It is music that either through its direct embodied instrumental effect or through its explicit narration describes a social reality that Sabar connects to. Sabar’s understanding of the Kurdish struggle was influenced directly by music when the Kurdish affair was still politically amorphous, as he noted. The semiotic quality of music thus, not only mediates his understanding of the *social reality* of war and struggle but also positions him in this fight as a politically active Kurd. These can be described as *semiotic* (i.e. providing understanding) and *performative* (i.e. enabling positioning) uses of symbolic regulators (Zittoun 2006) with regards to the social reality of the individual. Music also regulates Sabar’s *intra-psychological domain*: It responds to his emotional needs to face his problems and connects to his feelings of melancholy. Music thus assists emotional needs and also a self-understanding of who he is and how he deals with his problems.

Another function of music as a semiotic regulator is that it provides Sabar with *time orientation*: Through this music, he is not only connected to his past but also keeps his past struggles alive in his present. Finally, semiotic mediation enabled by these regulators can refer to different levels of generality, different levels of semiotic hierarchy within a person’s experience (Valsiner 2001; Zittoun 2006). For Sabar,

music relates to an *immediate embodied perception (1st level)* relating to emotions and experiences of the here and now, usually undefined and fuzzy (e.g. feeling melancholic). Music also enables Sabar to label his feelings and identify his state of mind, according to which, he decides how to act (e.g. stay connected with Kurdish affairs), he plans his *local conduct (2nd level)*. Finally, music facilitates the formation of *stable categories or self-categories or rule (3rd level)*. Sabar comes to see himself as a politically active Kurd: as a person with a past in the Kurdish struggle.

With regard to the forms that catalysts take when introducing meanings into the psychological system, Cabell (2010) recognized three forms: point-like, field-like, and hypergeneralized. Point-like catalysts can take the form of a representation of a particular concrete thing and can be, for example, a particular word. In Sabar's case, a point-like catalyst is a word or a sentence contained in the lyrics of the song describing a massacre. Field-like catalysts "are mental conceptions/representations structured in space and time and represent through the embeddedness of something its relationship to its (spatio-temporal) environment (Cabell 2010, p. 30)", as for example, the concept of identity. In Sabar's case, a field-like catalyst takes the form of a generalized melancholic feeling emerging from the melody. Finally, hypergeneralized signs permit a "symbolic generalization", a description of a life-experience on the whole, such as the concept of faith (Cabell 2010, p. 31). This happens when Sabar connects to ideas of the Kurdish fight through the music. All forms of signs are present in the music Sabar listens to, synthesizing in combination the catalyzing meanings.

IK continued the discussion by asking Sabar about films he liked and considered personal:

Sabar: I can say that one of the films that influenced me very much was "Braveheart".

It is about the fight of the Scottish, and when I saw it, it was like I placed on one side the Turkish and on the other the Kurdish, it was like it was talking about us. You can see the colonialist perception. How the colonialists behave. It shows of course the contradictions within the front and how the colonialists can take advantage of these. But the fight of the Scottish nation reminded me of the fight of the Kurdish, I mean the images of war, betrayal, heroism are universal and we experience them ourselves.

Sabar's film interests also draw on the wider semiotic theme of politics. "Braveheart" is his favorite film, which he used symbolically: He places the Kurds and the Turks in the place of the Scottish and the English and explains the colonialist attitude and the dynamics within the Kurdish front through the movie. As he says, war, heroism, and betrayal are all notions that the movie deals with and thus, connect to his personal experience of the Kurdish fight. Thus, as with music, film mediates Sabar's relationship with the social reality semiotically (i.e. understanding the Kurdish struggle) and performatively (i.e. positioning self as a fighting Kurd).

The film also seems to regulate higher levels of semiotic mediation: through its meanings, Sabar forms *higher level principles and commitments (4th level)*, namely, more crystallized political ideas and principles about the way the world functions.



Interpreting Sabar's contact with catalysts and his use of regulators, we can make the following observations. First, artifacts do not introduce meaning through singular forms of signs, but they do so in complex arrangements of signs. Music and film are complex sign syntheses which contain all forms of point, field and hypergeneralized signs that in combination introduce meanings: A hypergeneralized sign introduces meanings in the movie about "war, betrayal and heroism" in international relations; a melody introduces feelings of melancholy through its tune, as a field-like sign, and the lyrics, as a point-like sign talk about the Kurdish massacre. Second, Sabar's regulators are used to respond to meanings introduced by catalysts described above as ruptures. They are regulators containing meanings about the Kurdish reality and the fight and give meaning about the position of the fight in the wider arena of international relations. Thus, Sabar's artefacts used to build meaning are responding to meanings introduced and disrupted by the rupture catalysts.

In describing his life, Sabar mentioned living in a constant displacement, living in Greece but thinking and feeling like being in Kurdistan. This displacement is central throughout his life: He lives in Turkey but is a part of a minority; he lives in Greece but is an active member of another nation. Music and film are semiotic catalysts which are used as semiotic regulators induced by the semiotic conditions of the ruptures of constant displacement: They are used to bring the past into the present, to understand the social reality of the fight of the oppressed, and the struggle for freedom and autonomy and to position himself within this reality as a politically active Kurd who has fought and continues to fight for the rights of his nation.

### *Creating a Semiotic Regulator: a Political Website*

In 2005, Sabar decided to create a website together with other Kurdish political refugees who lived abroad. He presented the website as an online newspaper written in four languages, Greek, English, Turkish, and Kurdish that had to do with topics such as "democratization, the Kurdish affair, human rights and academic matters". He explained:

Sabar: In 2005, when we started (pause) our new site, there was a bunch of people that we said [. . .] we are abroad I mean, eh not because we have this mission at a diplomatic level, not that we are diplomats, but de facto, whether you want it or not, things make you to (pause) to function as a diplomat { . . . } the reason why we created [the website] in 4 languages and in Greek and English was to inform our friends or the world, about what's happening in Kurdistan, but the thing is that, eh, we might be abroad, but eh but eh, our thought, our face (pause) is turned to our country, so { . . . } we might be abroad, disconnected from our countries, and basically we are here as a result of this war, the thing is that for us, we want to save the historical values and the cultural heritage of our countries { . . . } so if we can preserve or even develop the Kurdish language and our culture, it is of primary importance for us and this is another dimension of the fight {IK:

yes, I understand, yes, yes, yes }with this sense, so (pause) confronting ferocity, barbarity and nationalism that has been imposed by the enemy, or anyway, the Turkish, the Arab and etc { . . . } so we were saying that despite the fact that they have destructed our skeleton into four states, realistically, they have destructed they have divided in 4 states, but we while we use this new technology, we can unite at another level, you see what I mean? {IK: yes, I see it has a symbolic character} yes, right, it has a symbolic character, so (pause) our hopes and our visions eh can unite in eh (pause) at the end of the telephone line through fiber optics let's say, of the cable, at the other end of the cable our hopes can unite, our fight anyway.

Sabar noted that all the columnists that take part were, but no longer are, active members of political organizations and are educated, thus, characterizing the website as an intellectual community, producing high-class writings. They also represent a variety of opinions, in terms of their political and ideological orientations, but what unites them is the fact that they “try to save and to raise the morals of our nation”. For Sabar, this objective was fulfilled: “65 % of the visits to the site are from Kurdistan of Turkey and then Iran, Iraq, Syria and then Europe”.

Sabar recognized that the continuation of resistance and the fight towards the Turks through the Internet was a technological war—a modern dimension of an older conflict and struggle, and he explained how it functioned for him personally:

Sabar: It is that, until now they were trying to subordinate us with the guns and their bombs and they are trying now to subordinate us, anyway, they can't but this conflict is continued now at this technological level { . . . } this dimension of technology with regards to internet, there are no fixed positions of power. It might be that today they “drop” our site, but from this loss we learn better and the next day we create something technologically even better that they can't drop { . . . } and this knowledge that we acquire as we correct our mistakes, maybe we will be in a position that they will feel threatened because we know, we learn a lot of things with technology and they feel threatened

IK: { . . . } do you feel that at a personal level you continue a fight with other means, you, personally?

Sabar: Sure, Sure, because you are not detached from your fight, with other means you continue your fight, but with this, you can imagine, psychologically what it can create for a person who is away from his country. Basically, it makes you relax, to feel that you do something {IK: yes, I understand} you mobilize something, a positive ambience, you raise the morals of the nation.

Therefore, it has become clear that this website is perceived to have a threefold function: (1) to provide information about the Kurdish issue in Greece and abroad; (2) to preserve the Kurdish values and culture and safeguard Kurdish language and (3) to sustain the fight towards the Turks, both by maintaining Kurdish national identity and morals and by reversing the power and threatening the Turks through acquiring technologically advanced knowledge. All these are interlinked objectives carried out by Sabar and other like-minded refugees who, as he says are positioned “de facto”

as diplomats. Being abroad because of conflict and war they now see themselves as representatives of their nations, responsible for its preservation and continuation.

Through this website, Sabar maintains a time orientation: he connects to his past and sustains the fight into his present, which makes him feel relaxed. He sees this fight continuing into the future, in a transformed way through technological means. The website has various functions that regulate different levels of his experience: his *immediate embodied perception (1st level)*, by making him feel relaxed and his *local conduct (2nd level)*, by regulating his everyday actions (e.g. producing writings, updating the material). Through the website, he also forms *stable categories or self-categories (3rd level)* by recognizing himself as a “diplomat” or a fighter. Finally, *higher level principles and commitments (4th level)* are formed in terms of political ideals with regard to his nation and the fight.

Further, the website is used by Sabar in ways that it regulates his relationship with his *inner feelings and his self-understanding*: He feels he is connected to his Kurdish identity and that he continues to fight for his nation’s rights. It also regulates his *relationships with others* (i.e. his fellow fighters/diplomats, the enemy/Turks) and his *understanding and positioning of the social reality*: what needs to be made with regards to his nation and the fight and what his position with this realm is. Thus, Sabar, drawing on cultural and political semiotic material, which acts as a catalyst, creates a website that sustains him psychologically through the rupture.

Sabar has aided the creation of a new cultural element, which remains highly transformable—a website is in that sense a “ductile symbolic resource”: it is a malleable resource, or a resource that can be created or completes itself as it is used (Greco and Zittoun [in press](#)). This creation is also a self-generated semiotic regulator, a website which can respond to the catalyzing meanings of being a political refugee. Also, as a new cultural element released into the social world, it can itself turn into a catalyst for Sabar or for other users who visit it. Sabar, while interacting with his own creation may come to realize new things about himself as a person, about the social world and about his relationships with other people. Further, for others who are reading this website, the meanings contained may act as catalysts for change in diverse domains of their psychological reality. We will discuss these issues further in the following section.

## Conclusion

The catalytic analysis outlined here contributes to a conditional systemic understanding of psychological phenomena, as that advocated by Kurt Lewin (1935, 1936) and developed recently in the introduction of a catalytic framework in psychology (Beckstead et al. 2009). According to this approach, in order to understand human behavior one needs to understand the environment in which it happens and the conditions under which it emerges. Through this approach, following the legacy of Lewin, we pay tribute to both the uniqueness of human experience and to the construction of basic knowledge. The former is achieved by a case-study analysis highlighting the

complexities and uniqueness of Sabar's individual experience. The latter is achieved by demonstrating the catalytic process under which phenomena unfold, leading to theory construction and development. In other words, our approach contributes to a development of a general epistemological and methodological approach that does not lead to a reduction of psychological knowledge in terms of isolated variables, but highlights the complexity and dynamicity of psychological phenomena (Beckstead et al. 2009).

Following Cabell's proposition (2010), we have examined catalytic processes in a period of a life course during which a person went through a series of ruptures. Here, we wish to highlight the possible contributions of this analysis both for the theorization of catalytic processes, and for the understanding of uses of symbolic resources.

First, catalytic processes have been so far studied through their smaller units—as point-like, field-like or hypergeneralized signs (Cabell 2010). Introducing the perspective developed in the study of symbolic resources invites one to see complex cultural artifacts as made out of complex arrangements of signs: for example, many words, images, melodies, and so on, combined in unique fashions. Thus, it extends our understanding to the function of elements that are formed by all three types of signs. Different parts of a cultural object, different semiotic qualities of that object, synthesize in combination particular meanings that may support meaning construction for individuals, as we previously explained. For example, the music Sabar listens to is formed by a melancholic melody/tune, which takes the form of a field like sign and lyrics that introduce, in the form of point-like signs, meanings about the hardships and struggles of the Kurdish people. These semiotic qualities forming the cultural element are making up a complex sign system, the parts of which interactively produce meanings.

Further, our analysis suggests that catalytic processes conceptualized within a semiotic domain can lead to dynamic and generative transformations. In the case study analyzed here, we suggested that regulators used to respond to meanings introduced by catalysts (i.e. as ruptures) can themselves act as catalysts. People create new cultural forms and externalize them into a semiotic language, which can be conserved and transmitted to others: they can write poems or create choreographies (Kadianaki *in press*). Here, Sabar, following a rupture, created a website out of cultural-political material relating to the Kurdish issue. Celia, an immigrant from Colombia (whose case study is described in Kadianaki *in press*) created poems about her country or about immigration, which she read aloud in her ethnic association. These cultural forms acted as regulators for their creators, but they can also act as catalysts for the same people or for others. Sabar externalized to the world, a website with meanings which can be catalyzing for other people (e.g. introduce meanings about the Kurdish struggle). Similarly, Celia externalized proud national feelings about Colombia, and described the loneliness of immigration, meanings that may have acted as catalysts for her audience. However, they may have acted as catalysts for their creators as well: both Sabar and Celia may come to realize new aspects

about themselves, others or the social world through their own creations. The creation of a cultural element brings to the creator a form of reflexivity: a third person perspective (Martin and Gillespie 2010), which can act as a catalyst upon the self (e.g. realizing oneself is an immigrant or a representative of his/her country). Thus the transference of a catalytic framework into the realm of semiotic mediation can contribute to the theorization of the generativity of psychological change processes and of the conditions for the production of novel semiotic forms.

These ideas resonate with ideas related to autocatalysis (Cabell 2011). Autocatalysis describes processes of mutual generativity of a system “hypothetically, all that would be needed is, at the very least, three molecules that react in a way to mutually generate each other” to observe autocatalysis (Cabell 2011, p. 5). In the case described here, Sabar meets the catalyst that is “war against the Kurds” (let us consider it molecule 1), creates the regulator that is website (molecule 2), which in turn leads to a new catalyst, namely, meanings about “preservation of the Kurdish culture” and “sustenance of Kurdish fight” (consider it molecule 3). Hence there is an autocatalytic process in the sense that the meaning generates meaning here. It is not, strictly speaking, that the new meaning corresponds to the initial state as in some chemical reactions. However, it should be noted that the meaning-field “sustenance of Kurdish fight” or “preservation of Kurdish culture” is not so far semantically from “war against the Kurds”. Hence, autocatalytic processes help us understand the creation of novel phenomena, novel cultural forms, such as the ones described here. In these new forms, as Lotman (2000) argues, we can always trace other semiotic forms that existed prior to them and triggered their creation.

In addition, using the concept of catalysis to study psychological systems leads, unlike in chemistry, to more complex outcomes. Rather than leading to the production of one product (i.e. a chemical substance), semiotic regulators can produce different outcomes at different levels of the experience (different levels of mediation as shown in Sabar’s case), in different time levels (time orientation towards past, present and future) and with regards to different realms (self-other-social world) of the individual experience. Our chapter thus contributes to the psychology of catalytic process by inviting to consider the mutual dependency of interrelated semiotic regulations when using symbolic resources, and to consider the complexity of the semiotic outputs of these processes.

A catalytic framework, on the other hand, has enriched our understanding of ruptures and uses of symbolic resources by leading to the theorization of the antagonistic relation between different meanings embedded within catalysts and between catalysts and regulators and by suggesting a multilevel (i.e. onto, micro, sociogenetic) study of psychological phenomena.

Using a catalytic framework, we have highlighted the antagonistic relation between different meanings in the psychological realm of the individual, which lead to a rupture. For example, Sabar experienced a rupture when he realized he was an unwanted Kurdish refugee in Greece, seen with suspicion by the Greek state. These meanings were introduced into his psychological reality and disrupted the ways he wanted to see himself as a fighter for the wellbeing for his persecuted nation. Thus,

ruptures are new meanings that act antagonistically to the existing meanings that the individual has taken for granted. Since individuals come into contact with meanings antagonistic to their habitual ones, we can suggest that a rupture occurs when these opposing meanings permeate the meaning systems of individuals.

To deal with these, we have focused here on strategies that involve the use of cultural elements. Elsewhere, we discussed the ways in which individuals cope with an encounter with threatening introduction of meanings by focusing on the semantic level of their discourse (Gillespie et al. 2012; Kadianaki 2013), thus providing another view of how meanings introduce catalyzing meanings and set the conditions necessary for the employment of semantic structures as regulators.

Further, in this chapter we have suggested that semiotic elements are catalysts setting the grounds for symbolic resources to be used. Thus an antagonistic relationship also exists between rupture catalysts and semiotic catalysts (i.e. as cultural elements) or regulators (i.e. as symbolic resources). For example, Sabar's website contains meanings that are employed to deal with the rupture of not being able to sustain the Kurdish fight. Sabar uses the website to build up the identity of a diplomat and a fighter. In other words, it is the meanings about the loss of the Kurdish fight internationally (i.e. a rupture) that Sabar perceives are "battling" with meanings about the sustenance of the Kurdish fight through new technological means (i.e. website used as resource). Thus, efforts to rebuild meaning should be understood within a context of alternative, often contradictory, meanings (Gillespie 2008; Billig 1987).

A catalytic framework enables understanding of the antagonistic conditions that individuals find themselves into and the ways that they manage to cope with them. In this chapter, by focusing on semiotic regulators in the form of cultural elements, we examined the ontogenetic level of experience, namely, the "relatively stable meaning structures that guide the person within one's life course" (Valsiner 2007, p. 302). In Gillespie et al. (2012), by focusing on semantic structures used in the discourse of individuals to deal with threatening alterity, we examined the microgenetic level of experience, i.e. the ongoing flow of thought and talk. We suggest that a catalytic framework can be used to study the sociogenetic level of experience as well, that is, the "visible transindividual patterns of meaning which are not available in the analysis of a single individual" (Gillespie 2004: 85). Typically, sociogenetic processes take place when individual actions and meaning-making participate in the creation of new cultural elements, which will then durably transform the semiosphere and guide collective action. Here, when Sabar participates in the creation of a webpage for other people who are in the same situation as he is, he provides them with "visible transindividual patterns of meaning". From a catalytic perspective, individual catalysis generates collective catalytic dynamics.

A three-level examination can provide a holistic understanding of the conditions under which psychological experiences unfold and the processes through which they are constantly and actively negotiated and reconstructed within the individual, between individuals and at a social level.

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**Part VI**  
**Applying the Concept of Catalysis to**  
**Everyday Life**

# Chapter 11

## Fostering National Identity, Hindering Historical Understanding

Cesar Lopez, Mario Carretero and Maria Rodriguez-Moneo

History education has been traditionally considered a fundamental tool for instilling moral values and developing identities (Barton and Levstik 2008; Carretero 2011; Grever and Stuurman 2007; Lopez and Carretero 2012). A traditional claim for knowing about the past has been its use for understanding the present. In that sense, knowing about people in the past is supposed to help us to know about ourselves and our own identities. It is not surprising that history has been used in many nations to foster national identity in the citizens (Smith 1991; VanSledright 2008).

In fact, the origin of history as a modern discipline is closely linked to the origin of nation-states in the nineteenth century (Hobsbawm 1997). As schooling became generalized in the nineteenth century, each nation found the subject of history a convenient tool for teaching national values and developing loyalties in the students. Thus, the goals of history education were more focused on developing emotional and identity issues than on understanding the past (Carretero 2011; Foster 2012). Thus, the past was nationalized, and each nation developed its own history. This nationalization of the past can still be noticed nowadays (Crawford and Foster 2007; Foster and Crawford 2006). In any library devoted to history it is absolutely common to find titles such as “History of U.S.”, “History of England”, “History of Germany” and of practically any existing nation. These national histories usually content an official national narrative that narrates the history of the nation since its origin—which most of times is lost in time (Balibar 1991). These narratives revisit the past in a biased way trying to portray a positive view of the nation and sometimes relying more on myths and legends than in historiographical analysis (Berger and Lorenz 2010; VanSledright 2008).

The objective of these national narratives was more on legitimizing the political order of the current nation than on understanding the past. Thus, critical interpretations of the past were usually sacrificed for the sake of national objectives. As

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renowned Renan's (1882) sentence noticed: "Forgetfulness, and I would even say historical error, are essential in the creation of a nation". Although each nation has its particularities, some common features can be noticed for these national narratives in different nations (Carretero and Bermúdez 2012):

The nation and nationals are established as the main subject of the narrative. Thus, a narrative of a conflict between a national "we" against a foreign "they" is constructed. These concepts of nation and national identity are displayed as timeless entities and applied to every period of history. Conflicts over the national territory constitute one of the narrative's main themes. In these conflicts nationals' atemporal ownership and legitimacy over the territory is reinforced. Finally, the actions of the national group are always judged morally positively in contrast to foreign actions.

Many times these national narratives reflect an ethnocentric vision of the past (Dragonas and Frangoudaki 2001). They are filled with values and moral aspects looking for a positive image of the own nation. But regarding their lack of historiographical rigor, these national narratives have become unquestionable truths that are hardly revised and contested in school (Alridge 2006; Barton and Levstik 2004). Thus, usually the students have access to these romantic and essentialist narratives and not to any other challenging narrative.

The key role that the nation plays in the field of history makes us wondering what kind of representations and understandings about the past the students are developing (Carretero et al. 2012). In other words, we are interested in analyzing the conditions—in and out of schools—in which people learn about the past and the kind of representations that are facilitated by those conditions.

History textbooks have been traditionally considered a central tool through which students get access to the official national narratives. As Foster (2012) indicates:

School history textbooks in many nations across the world typically are shaped by two characteristics. First, they are often overtly nationalistic. Second, they commonly adopt an official, single, "best story" narrative style (p. 49).

The role of history textbooks is so important that in many countries the "fights about the curriculum" and about which history textbooks are to use have become "cultural and social wars" (Evans 2004). As a matter of fact, in many countries history textbooks are strongly controlled and supervised by the Ministry of Education that ultimately decides over the content to be taught (Janmaat 2002; Symcox and Wilschut 2009; Van der Leeuw-Roord 2004). Finally just a few textbooks are approved to be used throughout the country. Then it is frequent that the changes in the government lead to—sometimes—dramatic changes in the historical content to be taught.

Many studies have pointed out how in many nations, history textbooks are filled with national narratives that denied the student a critical understanding of the past, showing just a biased narrative focused in the nation and in national heroes. These biased views about the past are even more salient when different national narratives about the same historical event are compared. For example, Carretero et al. (2002) in a study on the so called "Discovery" of America pointed out the opposite narratives used by Spanish and Mexican history textbooks to depict the same historical event. Crawford and Foster (2007) reached to similar conclusions by analyzing history

textbooks from China, France, Germany, Japan, the USA, and the UK about the Second World War. Each nation built a nationalized narrative that selects which stories are to be told and how, in order to defend the own nation's image.

Although history textbooks are a main tool through which people come to know about their nation's past and develop ideas about their national identity, it is certainly not the only way. In everyday life people encounter themselves with their nations through many different ways. National flags on the buildings, sport games between nations, national memorials, national celebrations, and even streets' names filled with references to national figures, remind us that we are part of a nation. These practices became so natural and so routine in our lives that most times we are unaware that they are there. But the main goal of these practices is to celebrate the nation, and most of the times they do it in an implicit way. This phenomenon constitutes what Michael Billig has called *Banal Nationalism* (1995). Billig notices how although nationalism is usually associated with early practices from the nineteenth and twentieth centuries, nowadays the nation is still celebrated and considered a natural feature of our societies. Thus, it is difficult to think of a person who lacks national identity, as if it was a natural feature.

Not all these national social practices have to do with knowing the nation's past, but many of them do. Films about national past (Wineburg et al. 2001), historical novels, national history museums (Asensio and Pol 2012; González de Oleaga 2012), monuments (Valsiner 2012), and national anniversaries are mechanisms through which people encounter with their nation's past as much as through school history textbooks. The main problem is that most of these practices as already noted regarding history textbooks depict the nation as a timeless, static, and natural entity. The past and the present are linked and mixed in a national way. That is, the nation remains as a static, main character of history. Even historical events prior to the origin of the nation itself are nationalized. Thus, it is common to talk about terms such as "Prehistory of France", "Roman times in Spain," and to talk about people in the Middle Ages as if they already had a national identity. This Banal Nationalism that can be found in and out of school, reinforces the idea that the nation and national identities are natural and eternal realities. In doing so, they are mechanisms through which we link ourselves with people in the past, since we are supposed to share commons features, namely our nation and our national identity.

Thus, through different mechanisms people are offered stories and narratives that shared certain characteristics regarding their own nation and their national identity. At this point we think it is interesting to introduce the notion of *schematic narrative templates* proposed by James Wertsch (2004). The notion of schematic narrative templates focuses on generalized functions that characterize a broad range of specific narratives. Thus, several specific narratives may share certain features that fit under a more general schematic narrative. These schematic narratives are schematic in the sense that they concern abstract, generalized functions. As pointed out in classical psychological work by Bartlett (1935), people bring tendencies with them into the situation they have to deal with. These tendencies are thought in terms of "schemes" that guide the subject to understand and act in a specific situation. These schemes are usually used in a "completely unreflective, unanalytical, and unwitting manner".

Furthermore, Wertsch noted that schematic narrative templates are thought as similar as to implicit theories (Ross 1989), in that they encompass rarely discussed, but strongly held beliefs. It is worth noticing that these schematic narrative templates constitute tools of mediation constructed in a social context and shared by the members of a social group, and as such they could vary between those groups.

Applying Wertsch's notion of schematic narratives templates to the field of history, it could be thought that national narratives constitute schematic narrative templates in which different specific historical narratives are embedded. Thus, these national narratives are constructed within a social context and reinforced in an explicit and implicit manner. In the case of history, these national narratives are also a source for national identity. As in a picture family book, people are told to revisit these narratives in order to seek for their own identity. Some studies have analyzed the characteristic of these general national narratives in different countries (Barton 2001, 2012). Werstch exemplifies this kind of meta-narrative in what he called "triumph-over-alien-forces" narrative for the Russian history (Werstch 2004). This narrative serves as a scheme to describe different events in Russian history as Mongol invasion in the thirteenth century, the Swedish invasion in the eighteenth century, Napoleon's invasion, and Hitler's invasion during the Second World War. Barton and Levstik (2004) note that schematic narratives of "looking for freedom" and "progress" give structure to many historical narratives in the history of the USA.

Although schemes could be useful for subjects to interpret, understand, and behave in different situations and contexts, there are several difficulties when it comes to use national narratives to understand the past (Barton and Levstik 2004; Carretero and Lopez 2010b). First, national narratives present just one voice of the past, one vision, and one narrative. This narrative is thought as reflecting the past as it was. There is no room for alternative narratives, where other characters or other stories different than those regarding the nation are taken into account. Second, through these national narratives historical knowledge is simplified to the knowledge found in that narrative. Historical knowledge becomes fixed and static. There is no possible process of reinterpretation, confrontation, or inquiry about the past. Third, history is seen as a logical chain of events whose logical consequence is the nation. Finally, the main paradox, and maybe the most important problem of national narratives, is that most current historians agree to set the origin of nations never before the eighteenth century. That is, most modern historians understand nations or national identities as modern social constructions that emerged in the age of nationalism during the modern era (Anderson 1983; Connor 2004; Hobsbawm 1997; Ichijo and Uzelac 2005). Thus, from a modern historiographical point of view, talking of nations before the modern era has no historiographical sense. In contrast, many national narratives consist precisely in tracing the origin of the nation from the most remote past to the present.

Therefore, there is a tension between how history and the national phenomena are represented in traditional national narratives and current historiographical approaches. While traditional history has been based on romantic characteristics linked with the development of national identity and the celebration of nation, current disciplinary approaches are focused on the analysis and development of historical thinking

(Lee 2004; Seixas 2004; Voss and Wiley 2006; Wineburg 2001). One of the objectives of current disciplinary approaches is precisely to de-nationalize history (Hansen 2012) in order to achieve a more critical and less biased understanding of the past allowing different narratives to be taken into account. However, as Foster (2012) indicates, “nations that use their education systems to promote feelings of pride unity and common heritage have no reason to encourage multiple narratives or competing evidence” (p. 53).

Given the relevance of the national phenomena in the field of history and the presence of the romantic and nationalized approaches that can be found in and out school, we thought relevant to analyze empirically what types of representations are produced by students when they face historical contents. That is, taking into account the conditions in which students learn about national history, we are interested in analyzing what type of representations about the nation are enabled by these conditions. We are also interested in identifying which elements could be considered as catalysts for the development of particular representations. In doing so, we are exploring the relation established between schematic narrative templates that circulate between members of the nations—not only through schooling and history textbooks, but also through what Billig (1995) calls *banal nationalism*—and the particular narratives that students develop.

## Students' Understanding of National History

We carried out two different studies with Spanish college students about historical events (Lopez et al. 2013a; b). The first study (Lopez et al. 2013a) was planned to analyze students' representations about their own nation using a key historical event from “Spanish” history, the so-called “Spanish Reconquest”. The Reconquest refers to a period in which the Spanish nation did not exist yet. It began in 718 and ended in 1492 with the expulsion of Muslims from the Iberian Peninsula. However, this process was reinterpreted through romantic historiography and became a key national narrative based on the loss of Spain to the Muslims and its subsequent recovery. Spanish national identity has been built upon this national narrative and the “Reconquest” is considered as the foundational event of the Spanish nation (Ríos Saloma 2005). It is worth noticing that the very idea of the Reconquest is an “invented” concept (Hobsbawm and Ranger 1983). The very term “Reconquest” was elaborated in the nineteenth century—that is, almost four centuries after the historical events—to give legitimacy to the Spanish nation that was being constructed in that century (Ríos Saloma 2005). The so-called Reconquest constitutes a national narrative built around several conditions. First, the territory of the Iberian Peninsula belonged almost entirely to a single political entity called Spain before the arrival of the Muslims. Logically, that entity was inhabited by Spaniards. Second, the Spaniards, at least in some significant numbers, fled when invaded by the Muslims and hid in small northern territories of the Iberian Peninsula. Finally, Spaniards toiled legitimately for over 800 years to regain their lost territory. Although the Reconquest has traditionally

constituted the only narrative for analyzing that historical period, from current historiographical approaches the conditions upon which that narrative is built—basically grounded in the pre-existence of the Spanish nation—are strictly false.

However, most students interviewed in this study built a romantic narrative when explaining the historical events. Most students spontaneously apply national adjectives to the territory and the people that inhabited the Iberian Peninsula at that time—excluding the Muslims who were not categorized as Spaniards. Thus, for most of them, the Spanish nation already existed at that time. A relevant result is how most of the students judged the actions carried out by different groups. The Muslim conquests were seen as illegitimate while the “Spanish” conquests were seen as logical and legitimate. The following quote shows an excerpt exemplifying these representations.

[And whom do you think that territory belonged to?] It is true that at that moment it was dominated by the Arabs, but it was still Spaniards'. (. . .) Even though it had been taken by force, but sooner or later they had to expel the Arabs. (. . .) [The conquests you have drawn here (making reference to later Christian conquests in the year 1212), do you think they were legitimate?]) Conquests in the opposite way, to throw them out? Well, they seem to me more legitimate. Yes, a bit more legitimate, because they are kind of recovering what was taken from them. Let's see, wars are not right, but I do think it could be slightly justified. Recovering their territory and customs and whatever they were not allowed to do by the Arabs. (Sara, 22 years old).

As can be noted, the legitimacy is grounded in a previous ownership of the territory by the Spaniards, and therefore the idea of Spaniards “recovering” the territory appears as a logical consequence. Nearly 80 % of the participants built a narrative using spontaneously the main idea of “Reconquering”. It is worth noticing how half of the participants explicitly linked their identity with the protagonists of the “Reconquest” by using pronouns such as “we” or “our”.

Thus, the traditional romantic and nationalized narrative of the “Reconquest” seems to constitute a *master narrative* on which students rely to give sense to that historical period. Their representations on the Spanish nation seem to better fit in an atemporal, static, and natural category than in a modern and socially constructed one. This nationalization of the historical events carried out spontaneously by the students along with their biased moral judgments denies a complex and critical understanding of the process.

In order to examine the role of students' national identity on their representation about national historical contents, a second study was carried out with Spanish college students, this time using a historical content about a foreign nation (Lopez et al. b). In this case, the historical content used was the so-called “Ottoman occupation of Greece”—which encompass from the thirteenth century to the nineteenth century—and the process of Greek independence afterwards.

As already noted, many nations share a national narrative based on the dispute over the national territory, defending and legitimizing the natural right of the nation over it. That is the case of how traditional romantic historiography interpreted the “Ottoman occupation of Greece” (Antoniou and Soysal 2005). Thus, both historical contents, the “Spanish Reconquest” and the “Ottoman occupation of Greece”, share some key

elements that give form to each national narrative. These are fundamentally related with the pre-existence of both nations. Thus, the territory is legitimately bound to the nation and the nationals. On each national historiography the actions carried out by the supposed nationals against the “other” are always positively judged.

In the study, Spanish participants were provided with historical maps from three different periods. First, the “Byzantine period”, which precedes the “Ottoman occupation of Greece”. Second, the “Ottoman occupation of Greece”, and finally “the period of Greek independence and expansion” (nineteenth and twentieth centuries). For each period, the participants had to answer questions regarding the inhabitants of the Balkan Peninsula in each period and the conquests made by different groups in each period. The results show how most participants defend a romantic and essentialist conception of Greek national identity, even though it is a detached identity since all participants were Spaniards. That is, for most of them, Greek national identity is something that has been unaltered from ancient times and somehow transmitted through generations until today. For these students, the people who inhabited the Balkan Peninsula in Byzantine times—and even in ancient times—and the people who got Greece independence in the twentieth century share the same national identity. The following shows a quote from Maria’s interview reflecting this romantic idea.

[How long could the feeling of belonging to the Greek nation have been present?] I think since always. (...) If we forget history ... there has always been a feeling of saying “I belong to Greece”, to ancient Greece (...). And then came a moment in which you say, “From here on!” One or the other spreads the word; (...) they created that feeling until they say, “we have been invaded by the Romans, the Byzantines, the Ottomans; now is our moment.” Now in the 19th and 20th centuries, (...) is when they say, “now is the time for us to rebel and become independent as Greeks” (Maria, 21 years old).

On the contrary, when it came to interpret the legitimacy of the territory in dispute and judge the actions from different groups (Greeks and Ottomans), most students took a more critical position. That is, most of them did not legitimate the actions of one group over the other. Although few participants built a romantic narrative biased towards the Greeks, defending their atemporal right to own the Balkan Peninsula, most of participants did not take part for any of the groups. In doing so, they took into account that both groups, Greeks and Ottomans could be equally right to own the land since no one had an atemporal right over it. Thus, most participants understood the territory as a dynamic and changeable element and not as a static one.

Thus, it is worth noticing that most of Spanish participants did not build a “we” versus “they” narrative, as participants from the previous study about the “Reconquest” did. Participants did not refer to any group using pronouns such as “we” or “us”. In analyzing the “Ottoman occupation of Greece”, most participants took into account at least both sides of the conflict—that of Greek and also Ottoman—in order to try to understand what happened. That is, they did not defend just one biased possible interpretation of the period, but acknowledged that each group had their own one.



## Catalysis Applied to Students' Historical Understanding

In analyzing both studies together, the first about the own nation and the second using a different nation than the own, results show relevant information about students' understanding of national contents. In the case of the own nation, conditions seem to enable a predominant romantic understanding of the national past. There are many elements that could facilitate this romantic and ahistorical interpretation: History textbooks, historical novels, national museums, political discourses, patriotic celebrations and anniversaries, films, etc. Given this situation, we think it is not possible to establish a linear and unidirectional cause-relation for each of the components in order to determinate their influence on students' historical understanding. We think it is necessary to think of contextual factors as a dynamic system and that is where the concepts such of catalysis and catalysts (Beckstead et al. 2009; Cabell 2011) can help us to better understand these social phenomena. The mentioned components constitute conditions that reinforce a schematic narrative template featuring the nation as a naturalized concept. As we noted earlier in this chapter, these socially constructed national narratives are available for citizens to consume in many nations across the world (Ballantyne 2005; Barton and Levstik 2004; Barton and McCully 2005; Carretero and Lopez 2010a). National identity could be considered as a catalyst that along with those schematic narratives enables a romantic understanding. When Spanish students deal with a historical content other than "Spanish" their historical interpretations leave room for a critical understanding.

At this point we think it is relevant to rethink on how the concept of catalyst can contribute to the process of conceptual change. The process of conceptual change has been one of the most relevant contributions from the psychological field to the educational one (Posner et al. 1982; Vosniadou 2013). It aims to explain and understand how students change their conceptions from common sense to scientific conceptions. Many studies, mostly carried out within experimental sciences, have been developed in order to understand this process, the main question being: how to produce this conceptual change? Although the question remains mostly unanswered, some mechanisms have been tested in order to *cause* the conceptual change, such as the use of conflicting data or analogies. The two studies presented in this chapter shed some light on how the concept of catalyst can contribute to better understand the process of conceptual change, especially in the social sciences. Applying this concept means that we should stop emphasizing what *cause* the conceptual change in terms of "A" causes "B". Instead, it would be interesting to address this process in terms of the conditions that reinforce a common sense conception, for instance a romantic conception of nation, and which conditions could enable more scientific or critical ones. Our studies point out how schematic national narratives and national identity strengthen the presence of romantic conceptions, while breaking the identity link between the student, and the historical content could be thought as a catalyst in order to enable a conceptual change towards a more critical historical understanding.

It is important to take into account that dealing with content from another nation, it is not sufficient to guarantee a disciplinary understanding. Thus, as pointed out,

most Spanish participants still held a romantic understanding regarding Greek national identity, as if it was a natural concept instead of a social and constructed one. However, facing students with different historical narratives and historical contents from different nations could help them to understand that every nation builds its own narrative. That is, students could think about history as a process of constant interpretation, construction, and reconstruction in a dialog between past and present interpreters (Leinhardt et al. 1994), and not as an only and true narrative that contains the “History”.

We would not like to end this chapter without acknowledging that the relations established between national narratives, national identity, and historical understanding are dynamic and contextualized. The two studies presented in this chapter do not aim to be generalized to every historical event or nation. That is, Spanish students’ understanding of another national history could be different if the other nation considered was for instance, a neighbor nation such as France or Portugal. Also, the relations between national narratives, national identity, and students’ historical understanding could be changed depending on the context in which the student is. For instance, interpreting historical events about the “Reconquest” could be very different if the student is involved in a group discussion with Muslim students. In that case, the presence of the other could be interpreted as a catalyst for developing a different narrative of the historical event. However, we think that studies such as those presented here allow us to better understand this complex and dynamic system which we thought central in order to foster a better historical understanding in our students.

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# Chapter 12

## Beyond the Self and the Environment: The Psychological Horizon

Luca Tateo

Human beings always come under the horizon's spell. The word horizon derives from the ancient Greek "horizōn kyklos", meaning "separating circle", from the verb "horizō", "to divide", "to separate", and that from the noun "oros", "boundary, landmark" (Liddell and Scott 1925). The horizon is an epiphenomenon emerging from a peculiar combination between the spherical shape of our earth land and the organizational principles of human spatial perception and orientation. The horizon's metaphor has been often used in literature, natural sciences, and philosophy as a catalyzer of the human aspiration to the Unknown. The horizon is the edge of the interaction between human-centered awareness and the infinite realm of nonhuman phenomena, underlying "the separation of resident, or organic, from transient, or objective" (MacDougall 1903, p. 145). In this chapter, I will try to develop the idea of psychological horizon, understood as one of the semiotic elements characterizing the relationship between the self and the environment. The psychological horizon is one of the catalytic factors enabling psychological events. Drawing from Kurt Lewin's field theory, I describe the features of the psychological horizon as a semiotic device and its role in the process of meaning construction.

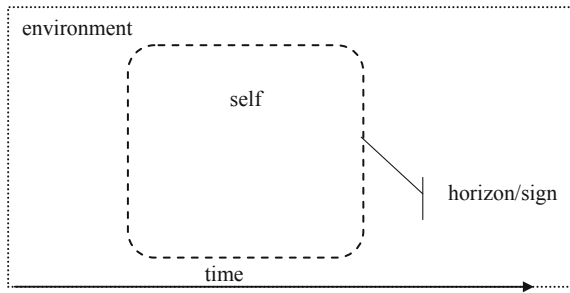
What lies beyond the horizon is not yet in the condition of perceived reality, thus unable to interact with our senses or orientate our action. Through the idea of psychological horizon this reality-not-yet-to-be comes into our life, playing a role in setting up our goals through the imaginative power (Danesi 1995). An example of this psychological role is a short lyric by the Romantic poet Giacomo Leopardi (1798–1837), titled "The Infinite":

1. Always to me beloved was this lonely hillside
2. And the hedgerow creeping over and always hiding
3. The distances, the horizon's furthest reaches.
4. But as I sit and gaze, there is an endless
5. Space still beyond, there is a more than mortal
6. Silence spread out to the last depth of peace,
7. Which in my thought I shape until my heart

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**Fig. 12.1** The role of horizon/sign



8. Scarcely can hide a fear. And as the wind
9. Comes through the copses sighing to my ears,
10. The infinite silence and the passing voice
11. I must compare: remembering the seasons,
12. Quiet in dead eternity, and the present,
13. Living and sounding still. And into this
14. Immensity my thought sinks ever drowning,
15. And it is sweet to shipwreck in such a sea. (Leopardi 1950, p. 924)

In lines 3–5 the poet has sketched the relationship between the perceptual horizon and the triggering of an imaginative, as well as reflexive process. The image of horizon is evoked by the perceptual limitation to the gaze (“the horizon’s furthest reaches”) in a poetic representation of Herbst (1976) co-genetic logic. In fact, the horizon in Leopardi’s lyrics is not the physical constraint to gaze, but rather the co-generation of constraint and sign (Fig. 12.1), leading to the emergence of several new psychological events: representations and imagination (line 7: “in my thought I shape”); memory (line 11: “I must compare: remembering the seasons”); and emotions (line 15: “it is sweet to shipwreck in such a sea”). The lyric thus synthetically expresses the idea that an act of semiotization and segmentation calls to life the psychological objects of our experience, that is every individual, material object, or sign that plays a role in the psyche. The “hedgerow” at line 2 becomes a sign, namely a horizon/sign, establishing a segmentation between the self and the environment, thus triggering the coming into life space of both the self and the environment as objects of experience (Fig. 12.1).

Another example of horizon/sign in everyday life is the word “now”, that introduces segmentation in the field of experience. It co-creates different objects by placing time into the public sphere, through acts of measurement and semiotization (Heidegger 2010; James 1950). This segmentation and semiotization generates the common sense knowledge about time as an infinite sequence of “nows” in the construction of temporality and its meaning. Horizon/signs can be generated at different levels of abstraction and reality, and they can be either material or immaterial objects (Fig. 12.2).

In the examples of Fig. 12.2, a sign is produced that establishes a segmentation of space, triggering a re-organization of the relationship between the self and the



**Fig. 12.2** Real and unreal, material and immaterial horizon/signs

environment. In the case of the painted wall, the sign is working on the physical border of the field, creating an immaterial and quite unreal horizon, modifying and widening the field itself. In the case of the ruins, a material object included into the perceptual field is used as a sign to segment the space, establishing a difference between the self and the environment. In both cases, the horizon/sign co-generates new objects in the field that produce new meaning to the psychological experience, like in the case of the “hedgerow”.

The semiotic process of naming the horizon establishes a meaningful differentiation between the observer and the environment, adding a value to the new co-generated elements. The idea of horizon as semiotic differentiation of elements, rather than just perceptual psycho-physiological process—thought rooted in perceptual activity—was already well known by poets and novelists but largely ignored by psychologists (MacDougall 1903). Whether you start from an empiricist—objective is permanent and subjective is transient—or rationalist—subjective is permanent and objective is transient—perspective, there is something pre-existing, the relationship between the self and the environment, that owns the right to inform the relationship between what is and what is not the subject. Gadamer’s hermeneutic perspective tries to solve this problem by the idea of “fusion of horizons” (Gadamer 1997). This moves the problem from the relationship between the subject and the environment to the process of intersubjectivity. The horizon is still related to subject as the “the range of vision that includes everything that can be seen from a particular vantage point” (Gadamer 1997, p. 302). Everyone has his own subjective horizon, and the question becomes how to overcome the individual points of view of historically affected consciousness, as far as “working out of the hermeneutical situation means the achievement of the right horizon of inquiry for the questions evoked by the encounter

with tradition (Gadamer 1997, p. 302). Also in this case, the hermeneutic process is possible only if something to be interpreted preexists the intersubjective fusion of horizons. In other words, every approach to the notion of horizon presupposes the existence of something before and apart from the subjective experience.

Summing up, we have at least three different accepted meanings of the word “horizon”: (a) the boundary of physical environment that can be perceived by individual senses; (b) the particular subjective perspective from which the environment is perceived; (c) the established boundary between the observer and the environment. In all cases, the notion of subject is the origin, the focal point of the horizon, also implying that the horizon line moves with the person<sup>1</sup>. It is worth noticing that the space within the range of horizon is not empty but populated by people and objects. It is thus reasonable to imagine that even the space beyond the horizon shall be populated as well. This simple assumption makes possible a wide range of inferences that are not strictly related to our direct experience of the phenomenal world. Rather than being a simple constraint to the psychological processes, the emergence of a horizon becomes a potential condition of such processes—like in Leopardi’s lyric—that provides meaning to the individual’s life space. In this view, the idea of horizon starts to look like an example of catalytic process. The horizon is produced as a sign that plays the role of semiotic catalyst promoting and guiding the emergence of new psychological phenomena. The horizon/sign is the valued and positive side of the coin, with respect to time perspective and boundaries. But before, it is worthy to clarify the co-genetic relationship between the self and the environment presented in Fig. 12.1, through the concept of meaningful life space in relationship with the horizon, drawing from Kurt Lewin’s topological psychology.

## The Meaningful Life Space in Lewin’s Topological Psychology

The idea of Kurt Lewin’s topological psychology is that human life space—or psychological field—is a multidimensional space “in which locomotion or structural change take place” (Lewin 1997, p. 201), populated by several meaningful objects, each one with its own specific value or charge. The psychological field is an ordered and abstract spatial construct, representing the relationships between psychological phenomena (Brown 1936). Through this abstract representation, it is possible to describe the psychological structure of the person and the behaviors carried out to reach a specific goal. With respect to the individual goal, any action, represented as a locomotion from an initial region to a different one, acquires a direction (Brown 1936). For the same reason, every object included into the field has a positive or negative value, whether it represents a possible pathway toward the achievement of the goal or a barrier to such an achievement. These opposing charges generate a field of forces which makes tension, rather than balance, the most important characteristic

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<sup>1</sup> I am grateful to Pina Marsico, University of Salerno (Italy), who gave me this insightful hint during a private conversation.



of life space (Lewin 1935, 1936, 1997). Actually, the basic epistemological principle of field theory is that “any behaviour or any other change in a psychological field depends only upon the psychological field *at that time*” (Lewin 1997, p. 201, original italic). This claim apparently narrows the elements of the psychological life to the here and now, misleading to the conclusion that field theory is a situationistic and behaviorist approach. Lewin’s idea was that elements outside the field as well as the concrete situations of the field in a previous time are not relevant in understanding the psychological processes at stake unless they are brought somehow into the field *at that time*. Objects of experience are included into the life space through a semiotic process of meaning making, that is bringing something into the field of forces and providing it with charge. This is basically an act of segmentation and semiotization of the relationship between the self and the environment. The objects included into the field of forces are also provided with a level of reality that depends upon their relationship with our needs and expectations (Lewin 1935, 1997). Semiotization is thus the process that co-generates all the elements outside and inside the field, as well as the real and unreal, and finally links the present with past and future situations. In this respect, the true meaning of “*at that time*” in field theory is that “the psychological field which exists at a given time contains also the views of that individual about his future and past. The individual sees not only his present situation; he has certain expectations, wishes, fears, daydreams for his future. His views about his own past and that of the rest of the physical and social world are often incorrect but nevertheless constitute, in his life space, the ‘reality-level’ of the past. In addition, a wish-level in regard to the past can frequently be observed. The discrepancy between the structure of this wish- or irreality-level of the psychological past and the reality-level plays an important role in the phenomenon of guilt. The structure of the psychological future is closely related, for instance, to hope and planning” (Lewin 1997, p. 207).

Lewin’s idea of development is based on a general genetic process implying the progressive elaboration by the individual of the life space meaning through differentiation. The child experiences an environment which is boundless, made of objects and persons that are somehow part of his own individuality.

[T]he newborn cannot distinguish between himself and his environment; slowly certain areas, for instance, those connected with eating, take on specific character, become more and more differentiated; the parts of his own body become differentiated from each other and from the rest of the world; social relations develop and become differentiated; needs, emotions, language go through a similar process of differentiation (Lewin 1942, p. 226).

This life space is also timeless, in the sense that the child lives in present time. It is besides magically real, in the sense that the boundary between real and unreal is fuzzily defined.

The young child does not distinguish clearly between fantasy and reality. To a great extent wishes and fears affect his judgment. As an individual becomes mature and gains “self-control”, he more clearly separates his wishes from his expectations: his life space differentiates into a “level of reality” and various “levels of irreality”, such as fantasy and dream (Lewin 1997, p. 81).

According to Lewin (1935, 1942), the boundaries of self are fuzzy unless a progressive differentiation between the self and the environment is dynamically established, through the experience of needs' satisfaction, constraints, others' guidance and frustration.

In the psychological life-sphere in addition to the plane of reality there usually exist various *levels of unreality*. Unreality (the plane of dreams, of so-called imagination, of gesture) is roughly characterized by the fact that in it one can do as he pleases. Dynamically there is a lack of firm barriers and a large degree of mobility. And the boundaries between the ego and the environment are also fluid (Lewin 1935, p. 145).

Differentiation occurs when objects in life space acquire their own symbolic meaning. Thus, an environment understood by the child as an extension of the body becomes a meaningful life space populated by objects charged with a symbolic value. Operating in the environment changes not only the individual state in the contingent present, but also all his reactions in future situations (Lewin 1935).

This influence of the present situation upon future possibilities of conduct, which is particularly significant to development as a process considerably extended in time, is due not only to the child's acquisition of certain intellectual experiences but, above all, to the fact that his whole person is changed in certain specific ways (Lewin 1935, p. 111).

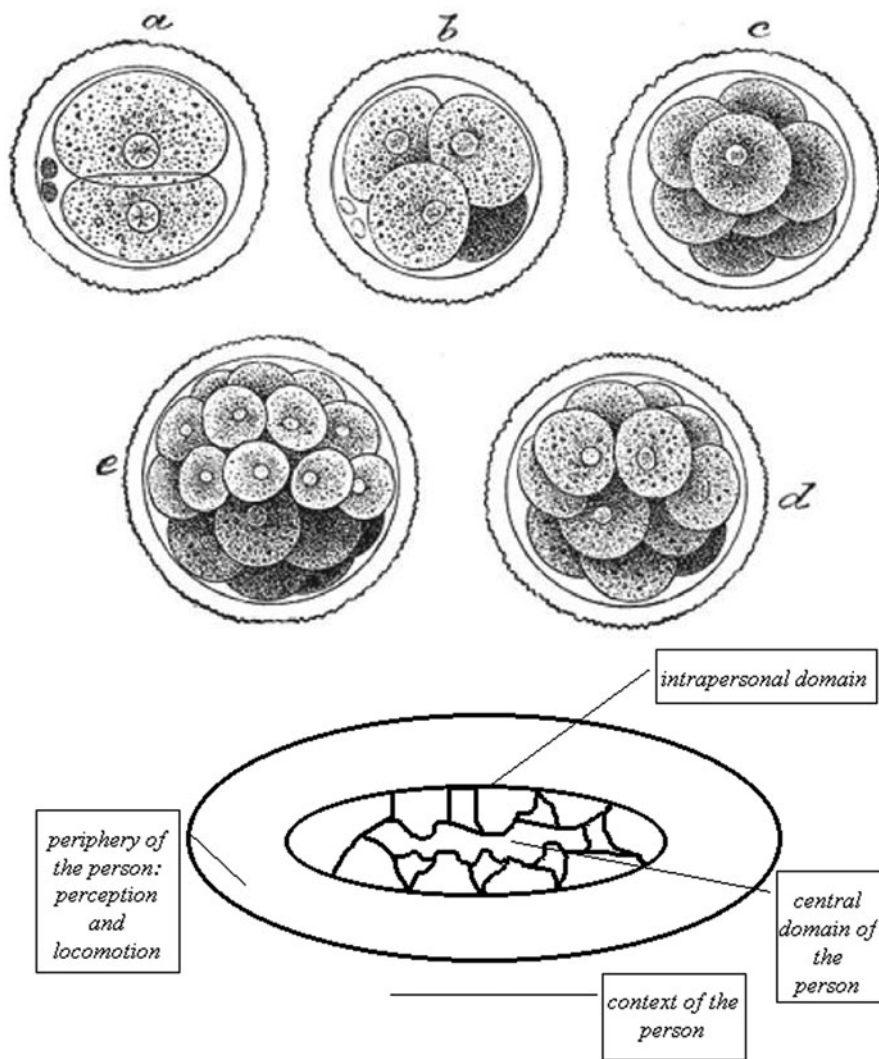
Like in the process of cellular division, the psychological space of the individual becomes more and more populated by meaningful objects and segmented by sets of internal and external barriers (Fig. 12.3).

The life space then becomes more articulated and different regions emerge, separated by more or less sharp barriers (Lewin 1938). This process also implies the creation of relationships between the different objects and regions. New needs, problems and solutions arise. The process of differentiation is concurrent with the process of establishing new connections between regions.

New connections or separations, differentiations or dedifferentiation of psychological areas have taken place. The "meaning" of an event in psychology may be said to be known if its psychological position and its psychological direction are determined (Lewin 1942, p. 229).

Differentiation, boundaries and new symbolic meanings make possible the circular relation between the self and the environment. In particular, "one may distinguish three main dimensions of extension. One deals with the scope and the differentiation of that area which for the individual has the character of the present reality. The second deals with increasing differentiation in the reality-irreality dimension. The third deals with the extending psychological time dimension" (Lewin 1997, p. 260). During the development, the twofold process of differentiating field structure and establishing functional connections between regions affects the construction of temporality. According to Lewin (1942, 1997) the time span of the individual enlarges during development, as well as the capability to include a larger amount of past events into the field and to extend the planning into the future.

The totality of the individual's views of his psychological future and his psychological past existing at a given time can be called "time perspective" (Lewin 1942, p. 230).



**Fig. 12.3** The process of cellular division and the topological representation of person's structure. (Lewin 1969, p. 185)

Time perspective also starts with meaning and boundaries. The development of time perspective triggers a change in the field structure allowing the projection toward the future.

Lewin (1942, 1997) describes several types of barriers surrounding the child's life acting "as a *bounding zone* of an inner sphere" (Lewin 1935, p. 130, original italic), as well as the internal segmentation of the life space in sub-regions with different values. The nature of these barriers could either be material or symbolic, physically coercive

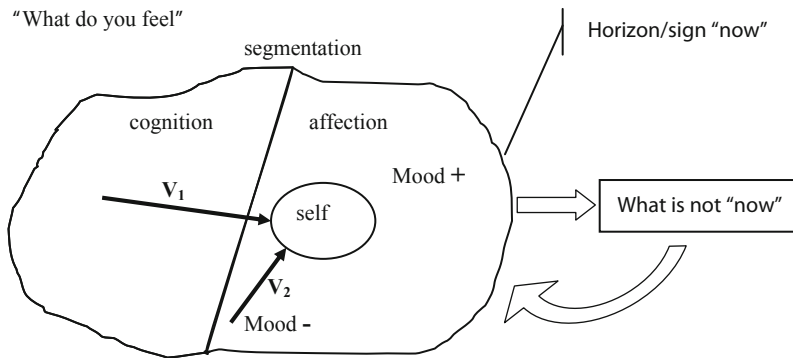


Fig. 12.4 The role of horizon/sign “now”

or internalized by the individual through customs or guilt. The internal regions of the field can be characterized by more or less “*sharply determined boundaries of these regions*” (Lewin 1997, p. 19, original italic). In any case, boundaries are part of the situation and play a role in determining the psychological value of all the objects in life space, as well as the value of the objects beyond these barriers. The other relevant feature of the boundary is to be always related to the future of the action to be taken. In fact, the value of an object as regards to the outer and inner boundaries of the life space is determined by the future-oriented goals. It makes no sense to worry about any constraint of an action already accomplished or a goal already achieved in the past. The past experience with boundaries becomes relevant and meaningful when entering the field, after a semiotic act that makes it still topical, to such an extent that past becomes a new kind of boundary in the field at that time. According to Simmel (2007a), the boundary is the interface between the social structure’s content and the individual’s participation to joint activities. Thus, boundaries are at the same time the product of social constraint and the *conditio sine qua non* of social interactions.

Each border is a psychological, or more precisely, a sociological occurrence. But through its investment as a line in space this reciprocal relationship achieves clarity and security through its positive and negative aspects (Simmel 2007a, p. 53).

For any event to become a psychological object within the field a semiotic process must take place. A sign is thus produced, co-generating a segmentation, a value, and a boundary. These three dimensions build the relationship between the self and the environment. In this respect, relationship and action are synonyms: a psychology of action is a psychology of relationship. As far as action is always oriented toward the future time, it is a relationship to the future. Nevertheless, it is inscribed in an experienced pattern of relationships with the other elements of the field. An utterance like “What do you feel?” is an example of such kind of act (Fig. 12.4).

Describing the situation through topological representation, after the sign “what do you feel?” is produced, it brings into the field a new psychological object—my mood or affective state—and at the same time co-generates a segmentation—mood or state as discrete entities in time, affection with respect to cognition, etc.—with its

related boundaries and its psychological value—desirable or not, positive or negative. This situation triggers a tension between forces in the field, represented by the vectors  $V_1$  and  $V_2$ , leading to a locomotion of the self toward a desired affective state of positive valence. In this respect, according to Lewin's description, "the actual occurrence is conditioned by the present structure of the environment" (1935, p. 117). When a horizon/sign is introduced like in the utterance: "What do you feel, now", a further boundary is generated and something becomes topical which is not totally within the field. The sign "now" projects the relationship beyond the boundaries of the life space. Something that is "not now" appears that is not actually present nor semiotized as a psychological object. Nevertheless, "what is not now" starts exerting an influence on the field, modifying, for instance, the charge of the objects within the life space at that moment. The affective state—for instance feeling a painful waiting—that has a strong negative charge could lose part of its relative value, by the appraisal that, *mutatis mutandis*, it could be more tolerable with respect to something yet to come. I argue that in this example the horizon/sign "now" works like a catalyst, as far as it provides the conditions to construct new psychological phenomena and regulates the existing field (Cabell 2010).

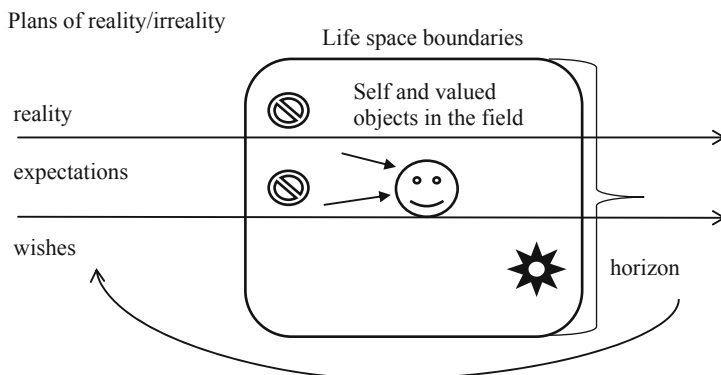
## The Psychological Horizon as a Catalyst

I shall now be ready to define the characteristics of psychological horizons and describe how time perspective and life space boundaries are the symbolic horizons that guide individual goal-oriented action. In this sense, the objects within life space acquire a part of their value in relation to these horizons. The word "horizon" is frequently used in social sciences and humanities, and loaded with innumerable meanings. For instance, an archaeological horizon is a widely disseminated level of common artifacts over a geographic area, distinguishing the levels of an archaeological sequence (Anthony 2007). In economics, a planning horizon is the length of time an individual plans ahead or the length of time companies can plan into the future with validity (Richter 2008). In artificial intelligence, the horizon effect occurs because a computational device is able to explore only a definite number of possible alternative states or positions down the choices' tree, for instance some ply in a chess game's tree. Thus, there is a possibility that the computer will make a move after five turns that is detrimental, but the detrimental effect is not visible because the error could happen at lower depth after eight turns. When a significant change exists just beyond the horizon of the search depth, the computer falls victim to the horizon effect (Russell and Norvig 2003). In all the earlier mentioned uses of the word "horizon" both spatial and temporal dimensions are involved, meaning that the portion of reality beyond a given boundary of experience is not accessible, notwithstanding the horizon exerts a certain role of reference in the experience itself. In other words, "horizon" is a synonym of "boundary".

In psychological processes, the boundary is instead always related to the future time of the action, understood as establishing new relationships in relation to future-oriented goals. Unlike the concept of visual horizon surrounding the observer all around, the psychological horizon is only oriented toward the future. “Field theory insists that that the derivation of behavior from the past is not less metaphysical, because past events do not exist now and therefore cannot have effect now. The effect of the past on behavior can be only an indirect one; the past psychological field is one of the “origins” of the present field and this in turn affects behavior” (Lewin 1938, p. 218). This is because the past, once semiotized, enters the field as psychological object provided with relative value, and the current situation is the place where tensions between forces generate the action, that is realizing relationships for “creating meaning ahead of the time” (Valsiner 2007, p. 58). Thus, all the boundaries of life space are related to the future, to such an extent that a boundary behind us is no longer an issue in the action/relationship-oriented psychological life. That is why the “horizon” is the valued and positive side of the coin, with respect to time perspective and boundary. It is a sign that enables some elements outside the life space to be semiotized, and prepare them to enter the field. Besides, the objects within the psychological field acquire value in relation to the semiotic horizon: the relationship between wishes and expectations, the imaginative anticipation, the appraisal of what is happening, the value of the objects and the polarity of forces in the field, the tenacity to pursue our goals, the moral and material price we are willing to pay, etc. (Lewin 1997). The “horizon” then becomes both the touchstone—even because is used retrospectively to evaluate past—and the engine for development. A similar kind of meaning construction is the idea of “fate” in Simmel’s view:

First of all, this concept requires a subject that, on its own and independently of any “event”, contains or represents a sense of something [Sinn], an inner tendency, a demand. Beside this inward sense of the subject, to which it is genetically unrelated, certain events emerge and take their course while nevertheless advancing and retarding it, disrupting its progress or binding together what has been removed, accentuating individual points or judging it as a whole. In this way, with reference to the subject, merely causal events take on a meaning [einen Sinn], a kind of retrospective teleology, as it were. That is, they are transformed into fates. Insofar as these fates, whose origin is entirely accidental with respect to the inwardly and generally determined course of our lives, attain a specific relationship to this course, a vital adaptation cannot be separated from what we call fate, although such an adaptation would have a negative and destructive significance, a connotation of “predestination”. Nevertheless, this sense of predestination only indicates an essentially superficial reflex of the concept of fate. In the first instance, it expresses the ability of the human being to adapt: certain elements are integrated into its life as defining occurrences that take an objective path without diverging from it, so to speak, and assume a meaning—a positive or negative sense of purpose—from the subjectivity of this life, while conversely these occurrences define this same life with respect to its direction and doom [Verhängnis]. As life relates tangentially to the course of the world, the activity and passivity of life have turned the concept of fate into a fact (Simmel 2007b, p. 80).

“Fate” can be considered a horizon/sign to the extent that it enables some events that are external to the field to become valued psychological objects to be put in relationship with the self. Even more relevant, the sign “fate” operates by creating the conditions for the future goal-oriented actions to be guided, and the future signs

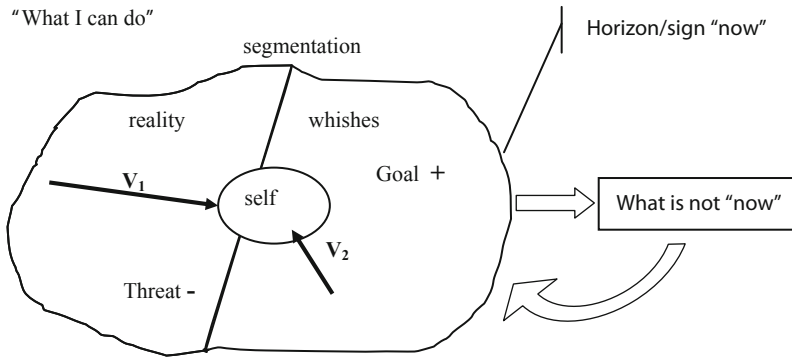


**Fig. 12.5** Horizon and plans of reality/irreality

to be interpreted, toward a “direction and doom” outside the borders of the life space at that time, like can happen with the sign “faith” for believers (Cabell 2010).

As far as the individual progressively learns the difference between the plans of reality/irreality, he develops the capability of articulating the different levels with respect to his goals (Lewin 1997). The apparent two dimensional life space reveals itself to be a multidimensional field of forces, in which what is not possible at the level of reality can be at the same time plausible or desirable at the level of expectations or imaginable at the level of wishes. Also in this case the horizon/sign works as a catalyst, enabling the different levels to interact (Fig. 12.5).

In a certain sense, human beings are doomed to develop, that is they are always headed toward a range of possible futures among which just one will be actualized. But, according to the idea of exquisitely future-oriented action, it seems that human beings are also doomed to never learn from their mistakes. It means that the past experience plays a role as far as it becomes a topical psychological object in the field at that time. Thus, its status of something that has already existed but no longer exists on the plan of reality does not affect its role in the field of forces, unless it becomes a new sign. What determines the value of the objects and the direction of the vectors in the field is the tension at that moment, and the whole system is finally guided by the individual goals. It is the case of regressive behavior that Lewin (1997) explains in terms of field theory. Regression is not related to the past experience, rather to the fact that a person can encounter a barrier that cannot be overcome in the field, while trying to reach a goal “corresponding to a need which is characteristic of a certain level of maturity” (Lewin 1997, p. 234). Thus, the person can turn to a different region of the field, corresponding to a less mature level, because this action “seems to promise at least some satisfaction to the need” (Lewin 1997, p. 234). In a multidimensional space, the tension can be represented also at different levels of reality/irreality, and the vectors can make for a level to another. Wishes and expectations can exert a force on the self, as well as desirable or unpleasant objects on the plan of reality. Barriers can be multidimensional as well. The person can encounter a barrier to overcome a region that exists between the plane of wishes and that of expectations or reality. Also



**Fig. 12.6** Horizon/sign and levels of reality/irreality

in this case, what lies beyond the boundaries of the field has some relationship with the life space, and the psychological horizon plays a role in determining the situation at that time, when a horizon/sign is produced. Figure 12.6 presents an example using the horizon/sign “now” in a different way.

For the sake of simplicity, the example shows a situation in which only one desired goal “+” exists on the plan of wishes. A sign “what can I do” is produced triggering the situation of the self subjected to opposing vectors. A segmentation occurs and a barrier emerges between the plan of reality and wishes of the field, with a real psychological object in the field threatening the achievement of the goal (i.e., possible blame to the realization of a sexual fantasy) and generating tension by the opposing force represented by vector  $V_2$ . When the horizon/sign “now” is produced, it modifies the situation, even if the condition outside the field “what is not now” has not yet been semiotized. For instance, the barrier between the plan of reality and wishes becomes more permeable, leading to the expectation that what is not achievable at present time could be possible in a future time. Also in this case, the horizon/sign “now” works like a catalyst, as far as it provides the conditions to construct new psychological phenomena modifying the existing field and the relationship between the different plans of reality/irreality.

A different example of horizon/sign production can be found in the work of the Italian–Argentine painter, sculptor, and theorist Lucio Fontana (1899–1968). He is considered the founder of the “Spatialism” movement in modern art. In the mid-1950s, he developed a particular technique called “slashes”, consisting of covering canvases with layers of thick oil monochrome paint and using a cutter to create great fissures in their surface (Fig. 12.7).

The aim of this kind of work is to draw viewer’s attention to the surface of the canvases as a conventional boundary, both underlining and breaking the two-dimensionality in order to reveal the space behind the picture. The slash thus produces a horizon/sign, whose function is to establish a relationship between the observer, the canvas boundary, and what is beyond it, understood as a new unknown, disquieting, and presemiotic sense of depth. In the case of Fontana’s slashes, it becomes



**Fig. 12.7** The artist Lucio Fontana at work. (Photograph of Lucio Fontana by Ugo Mulas. The use of this low-resolution image for critical commentary and research purposes qualifies as fair use under United States copyright law. Retrieved 2013 March, 7 from [http://upload.wikimedia.org/wikipedia/en/b/bd/Photograph\\_of\\_Lucio\\_Fontana\\_by\\_Ugo\\_Mulas.jpg](http://upload.wikimedia.org/wikipedia/en/b/bd/Photograph_of_Lucio_Fontana_by_Ugo_Mulas.jpg), available under the Creative Commons Attribution-ShareAlike License from Wikipedia®, a registered trademark of the Wikimedia Foundation, Inc., a non-profit organization)



more evident due to the fact that this process is possible because of the social context in which the psychological field is embedded. In fact, the production of the horizon/sign is related to the social norms and constraints guiding the activity of painting and watching a work of art. The catalytic function of Fontana's slashes consists of the modification of the perceptual field—the background of the canvas becomes an internal, rather than external, barrier—the breaking of social rules of art, and the regulation of viewer's psychological processes—attention, imagination, etc.—in order to trigger new psychological phenomena, by establishing a relationship between the psychological objects within the field and what is not painting. The space beyond the canvas then starts to exert his presemiotic and mysterious power upon the observer's life space.

## Conclusions

The idea of focusing on psychological processes and the conditions that cultivate them, goes beyond the concept of context for psychological processes, as well as the idea of horizon goes beyond the idea of life space. In this chapter, I attempt to read again the topological theory through the lens of the cultural semiotic approach

(Valsiner 2007). First, I discuss the idea that any object of experience is included in the field of forces when it becomes a sign, thus becoming a psychological object provided with value. Then I argue that there are some kind of signs, the horizon/signs, that set the conditions for what is outside the life space—that is what is presemiotic—to interact with the self and the psychological environment and to guide the expansion of the life space, modifying the field of forces. The function of the horizon/sign is to catalyze the relationships between the self and the psychological objects in the field towards a future-oriented direction. Besides, the horizon/sign acts upon the boundaries of the life space, by valuing the outer side of the boundary itself. The horizon/sign also produces the conditions of tension in which every sign is produced. When the self is subject to vectors producing a tension in field, one of the possible actions is trying to go out of the field (Lewin 1935). This option is more or less feasible depending upon the sharpness and permeability of the borders. When a horizon/sign is produced, like in the example of the sign “now”, it modifies the nature of the external boundaries, introducing a “not now” that is possible even if not yet fully semiotized. The life space, as a landscape of individual psychological experience, “stands as an objective, self-contained construct that nevertheless retains an interconnectedness, though one hard to express, with the whole soul, the full vitality of its creator, sustained and still perceptibly permeated by it” (Simmel 2007c, p. 22). The semiotic activity of socially guided psychological life generates segmentations, boundaries, and values oriented toward an unknown future. In other words, every production of signs is both an act of creation of psychological objects and of delimitation of a portion of reality.

This condition came into its own in modernity and assumed the leading role in the processes of culturalization. Underlying the plurality of relationships that interconnect individuals, groups, and social formations, there is a pervading dualism confronting us: the individual entity strives towards wholeness, while its place within the larger whole only accords it the role of a part (Simmel 2007c, p. 22).

This generates a sense of disquieting which is splendidly expressed in lines 4 and 5 of Leopardi’s lyric: “But as I sit and gaze, there is an endless/Space still beyond”.

The psychological horizon *is the infinite realm of possibilities ahead of time yet to be semiotized, thus still partially socially unbounded*, that is necessary as a reference point to the person’s widening of life space. The horizon/sign *is the specific sign that, once produced, establishes the conditions for the psychological horizon to participate in the production of new psychological phenomena through the co-regulation* of psychological processes. This process is also related to the temporality experience and to motivation, to such an extent that “whether or not an activity is disgraceful or unpleasant depends to a high degree on its psychological “meaning”, that is, on the larger unit of events of which this action forms a part. In the role of a patient, for example, the individual permits as “treatment” by the doctor what would otherwise be vigorously resisted because of bodily pain or social unpleasantness” (Lewin 1997, p. 82). This is a well-known phenomenon, for instance, in the treatment of addictions, where the problem of substance abusers’ psychological horizon affects both the persistence of drug use despite severe consequences and the success of treatments (Petry et al. 1998). If the idea of the horizon/sign is well-founded, then

the process of its production and the different types of horizon/signs could be studied in order to better understand their role in catalyzing the new psychological objects and the phenomena they trigger. Besides, a therapeutic use of horizon/signs aimed at fostering a reconstruction of the field could be imagined. Another potentially relevant field of application of the idea of horizon/signs is how they play a role in development and education. In fact, if the horizon/sign works as a catalyst for the change of the life space, investigating these signs in developmental processes could make us understand the fundamental human condition of seeking “the horizon’s furthest reaches”.

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# Chapter 13

## Man's Search for Extra-Ordinary Answers in Life: Silence as a Catalyst for Crisis-Solving

Olga V. Lehmann O.

*I have always loved the desert. One sits down on a desert sand dune, sees nothing, hears nothing. Yet through the silence something throbs, and gleams.*

The Little Prince—Antoine de Saint-Exupéry

Both the process of catalysis and the concept of a catalyst have been recently imported from biology, chemistry, and philosophy as a methodological and conceptual tool for cultural psychology and the establishment of a psychology of conditions. This theoretical and methodological tool opens a path for multiple contributions of research that enable an understanding of sense-making and decision-making processes (Cabell 2010, 2011a). In chemistry, catalysis is known as the process that increases the reaction rate of chemical synthesis. A catalyst is not only the reactant but also the product of the reaction because it is restored at the end of the process of synthesis (Fechete et al. 2012). Thus, these abstract qualities can be imported in to psychology so that catalysis can be understood as a coordination process of meanings in our everyday experience. This coordination of meaning provides conditions that enable the production or regulation of novel meanings by means of activating, directing, and deactivating existing semiotic mechanisms in the psychological system (Cabell 2011a, b). The catalyst modifies the qualities of the reaction of signs within the psycho-semiotic system, making it possible for semiotic regulators to construct or deconstruct meanings. Catalysts work in hypergeneralized, field like and point like signs (Cabell 2010), and the qualitative imprint of their reaction can be studied in everyday life. The cultural dynamics of catalytic processes in the psychological system

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of the self can change personal cultural trajectories (Cabell 2011a), which highlight its importance in times of crisis as a way out. The catalytic process involved here requires making sense of uncertainty through decisions that change cultural and personal trajectories producing perceived welfare<sup>1</sup>.

From the most conventional routine to the most memorable day in our life, both silence and language are means for sense-making of experience and existence. Furthermore, the dialectics of what is said, what is silent, and what is silenced involves a crucial tension in the ways we cope with uncertainty (Lehmann forthcoming, a). Everyday life is about making decisions in order to cope with personal, social, societal, and existential tasks that often make us feel as if we are “in crisis”. Think, for instance, about times when you might have asked yourself/others if you should get married, invest your savings in the stock exchange, or live abroad. The transcendence of such crises may vary from person to person, depending on the value he/she attributes to the decision to make—influenced by personality traits and developmental goals—in relation to the anticipation of future outcomes for their life project.

When facing such dilemmas, we often try to do the “right” thing and, in some situations we would rather not make such decisions, so we won’t be able to assume responsibility in the case of a negative outcome. The awareness of such inner dilemmas and decisions requires silence to emerge (Hermans and Hermans–Konopka 2010). During this crisis-solving process, popular advice that people receive and/or give come from proverbs, such as psalms, koans, or quotes from famous philosophers, singers, writers, or movie characters. For instance, in the famous claims from Pascal or Saint-Exupéry, the importance of following our heart in order to gather the truth of our longings is commonly referenced. Alternatively, the act of “listening to the heart”, as well as other references to popular sayings, proverbs, and the like involve silent settings such as sacred mountains, deserts, temples, and so forth. In this sense, silence catalyzes the dialogic property of affective resonance. This includes inner voices (i.e., heart’s voice versus rational voice, mother’s voice versus wife’s voice, god’s voice versus man’s voice, etc.), external voices (i.e., a family member, a priest, a friend, a peer, etc.) and environmental tools that can become messages (i.e., objects, advertisements, landscapes, etc.).

When trying to describe, analyze, understand, and comprehend human experience, we often look at words and discourse. Language has been the predominant tool for studying human experience in western culture; even if it became relevant during the twentieth century (Classen 1999). The predominance of words and discourse as a way to understand experience is a Greek and Jewish inheritance that permeated Christian culture (Steiner 1982) and became reinforced in scientific

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<sup>1</sup> With decisions that promote welfare, I intend those ones that maintain and/or increase the perceived quality of life. Furthermore, here quality of life is understood as: “‘individuals’ perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns”. It is a broad ranging concept incorporating in a complex way the persons’ physical health, psychological state, level of independence, social relationships, personal beliefs and their relationships to salient features of the environment (World Health Organization 1998, p. 3).

inquiry. It was around the time of the Enlightenment where the visual character of human phenomena gained more importance than other senses (Rosenfeld 2011).

The semiotic processes involved in the fields of language have never truly captured feelings and emotions in human life (Matte Blanco 1998). However, the boundaries of the linguistic world do not inhibit us from comprehension of affective phenomena, which is also a main objective of cultural semiotic psychology (Valsiner 2007). Sometimes, self-comprehension of affective experiences necessitates moving in between language and silence (Lehmann forthcoming, b). Furthermore:

(. . .) the dynamicity of silence in ordinary and extraordinary experiences is meant to become a field in human studies. The dialectics of presence–absence of signs goes beyond words. We cannot forget that resonance and vibration are corporal experiences, which are not just about hearing, but predominately about feeling and evoking aromas, images, rhythms, flavors, and textures of experience. (Lehmann 2012, p. 470).

That way, even if developing models for the study of silence based phenomena cannot constitute the answer for the comprehension of affective life, they are promising and integrative starting paths. In this chapter, I attempt to highlight the catalytic function of silence in everyday life, describing its role when people are trying to make sense of experience and existence by means of making decisions. With this purpose, I will first clarify what I intend by crises, then go in-depth with silence based phenomena highlighting the resolution of dilemmas enabled by different kinds of catalytic silences.

## Crisis-Solving Processes: Decisions to Cope with Uncertainty

From the etymologic point of view a “crisis” involves the dialectic relationship concerning the decision of how to cope with a seemingly unsolvable event (Cigoli and Scabini 2006). Psychological crises occur when sudden (i.e., an earthquake) or expected (i.e., impending finitude) changes menace the self, one’s identity, and/or the existence of one’s social positions. In their theoretical model of family relationships,<sup>2</sup> Cigoli & Scabini (2006) point out important characteristics of crises, based on assumptions from the anthropologic work of Bateson and Turner, which I adapt by linking with other conceptual frameworks:

- (a) *Crises are relational.* They involve a social other that from a dialogical self framework might be internal or external social positions (Hermans 2001).
- (b) *Crises are the basis of cultural rituals.* Every relationship involves a rite of passage formed from crisis and resolved from action guidelines (Cigoli and Scabini 2006) directly related to values.
- (c) *Crises can lead to constructive transformation or destruction of the self* (Cigoli & Scabini 2006). Given the dynamic quality of the self, changes to resolve crises that are chosen can be prejudicial for the constitution of the self, or promote its development.
- (d) *Crises are developmental.* Here, it is necessary to highlight the work of Erik Erikson (1968) who describes eight stages of development from infancy to late adulthood, each one

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<sup>2</sup> The Relational Symbolic Model created by Vittorio Cigoli and Eugenia Scabini uses the family therapy as a therapeutic genre, the systemic approach as a clinical paradigm and the Systems Theory as an epistemological tool (Cigoli 2006).

involving a crisis of two dialectic forces in order to enable the emergence of virtues by means of transforming the self.

(e) *Crises are historical*. That is, there are repeated crises through our family history and the history of our relationships, and an unconscious tendency to repeat these patterns. Otherwise, as Frankl (1994) highlights, every epoch entails a crisis, being the crisis of this time the existential vacuum.

As long as uncertainty is inherent to development, both the past and the future influence any present decision-making process (Abbey and Valsiner 2005). This uncertainty is subject to logical, illogical, and dialogical ways to make sense of experience (Josephs and Valsiner 1999) and therefore often result in crises. Furthermore, the complexity and multidimensionality of the mind that construct cultural processes such as linguistics, theoretical and empirical systems, and music (Klempe In Press, a) provide more room for the production of crises in the microgenetic and macrogenetic structure and functioning of affective arenas of everyday life (Lehmann forthcoming, a). Thus, crisis and contradiction describe the relationship of silence and feelings and the subsequent tension in the crisis-solving process where silence feelings and language are interwoven.

When dealing with crises, we can use and create cultural rituals as we move towards resolving these crises. An example of this could be the visit to graves after the death of a beloved person that Josephs (1998) mentions, because:

Rather than being characterized by rationality or logic, this process implies the transcendence of the world ‘as-if’ by the future-oriented ‘as-if-could-be’, in which both the person and the world as-is, as well as the person’s constructed past, are transformed. From an ontogenetic developmental perspective, it is argued that *this as-if mode of approaching and making sense of the world is not inferior or immature, but is rather an important characteristic of human development across all age groups*. (Josephs 1998, p. 180, *emphasis added*).

Think of similar “as-if” experiences such as supernatural apparitions (e.g., Something like a light came to me) where crises between observation and belief or between the real and unreal are often situated. It is not my attempt to discuss which crises are “real” crises, nor whether supernatural apparitions exists or not, but to make evident that phenomena have crucial—and even unexplored—roles as catalysts for sensemaking to cope with crisis. Consequently, such a topic is necessary for cultural psychologists to focus on.

## **Silence, Silences and Silencing: Dialogues Beholding and Beyond Language**

The academic interest in silences and their enabling of certain psychological spaces of meaning is not new. For instance, Abadjieff (2011) formulates different silences such as contemplative silences, silence during conversations, and silent settings in the environment. The first ones involve a person in front of nature or within the sacred (e.g., archetypical references to mountains, deserts, or meditation). Secondly, during conversations one could find: (a) silences that promote something to germinate;

(b) silences that reaffirm the power of words allowing them to be heard; (c) silence as promoters of encountering one's self essence; (d) aggressive silences, that paralyze others; (e) accusative silences, that do not support others' words; (f) hidden silences, that allow the person not to feel committed with the topic in course; (g) awaiting silences, that allow the person to choose a precise moment to talk; (h) caring silences, that quiet faults and imperfections of an "other", accepting him/here as he/she is; (i) silences that should be kept, as the ones concerning intimacy; (j) imposed silences, like the ones that emerge when someone is not available to talk with; and (k) protective silences, like when victims of violence stay quiet in order to protect themselves. Lastly the author mentions silent settings in the city such as libraries, streets at night, temples, hospitals, and houses. Abadjieff (2011) mentions in brief these different types of silence, without giving further explanations about their implications and functioning in everyday life.

In a more systematized way, Levitt (2001) found seven types of silence—here understood as a pause—in clients during psychotherapy that occurs when the need to focus on a psychological process is so powerful that the person requires being speechless. These types of silence correspond to three higher categories: productive, neutral, and obstructive silences. Silence is meant to be productive when it promotes reflection, expression, or emotional processing. Neutral silences are associated with mnemonic and associational issues. Silence is considered obstructive when it is threatening (disengaged), and when it comes from a disturbing reaction attributed to the therapist (interactional). With other perspectives of silence Stone et al. (2012) describe mnemonic silences—here understood as that which is unsaid during a conversation—in accordance with its intentionality and covertness (hiding the memory instead of overtly expressing it). Authors refer to mnemonic silence as the failure or refusal to express a memory during a conversation that in other situations would be remembered or expressed. The consequences of mnemonic silences depend on other subtypes of silence. Four types of silence are described in the paper: (a) when one remembers covertly and refuses to remember overtly; (b) when one refuses to remember overtly and suppresses covert remembering; (c) when one fails to remember overtly while remembering covertly; (d) when one fails to remember overtly and covertly.

Aforementioned approaches to silence share the same implications for interactions and relationships among individuals in diverse social settings. Acknowledging such implications of silence in the dialogical nature of the self<sup>3</sup>, Hermans & Hermans-Konopka (2010), state that decision-making involves conflict, criticism, agreement, and/or consultancy of different relationships between people and within the self (e.g., self-conflict, self-criticism, self-agreement, self-consultancy). There exists a particular interest in consultancy because:

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<sup>3</sup> For the Dialogical Self Theory "the self does not have existence separate from society but is part of the society (. . .) Society, from this side, is not 'surrounding' the self, influencing it as an external 'determinant', but there is a society of selves; that is, the self is in society and functions as an intrinsic part of it" (Hermans and Gieser 2011, p. 2).



when we are confronted with a difficult problem or when we pose a puzzling question to ourselves, we are sometimes not able to give an immediate answer and need time to consult ourselves. Self-consultancy is also typical of situations in which we have to take a decision that has important implications for our future and/or that of significant others. (Hermans and Hermans–Konopka 2010, p. 125).

In this case, awareness of the answer to give, requires a *preparing silence*, which needs a receptive attitude from other positions involved in the dialogue; this process involves hierarchies and power relationships (Hermans and Hermans–Konopka 2010).

Thus, with an emphasis on the experience of silence, the authors argue that the positioning of the 'I' is associated with three mystical states described by Robert Forman: (a) *unitive*, sense of communion with a wider external environment; (b) *dualistic*, the experience of awareness within an expansive silence and consciousness of the world; and (c) *pure consciousness*, inner silence involving absence of sensations and thoughts (Hermans and Hermans–Konopka 2010). Thus, in the emotional experience of silence, there are different degrees of involvement of attention and perception of boundaries that allow or block the simultaneous-polyphonic experiencing (Lehmann forthcoming, b).

Altogether, gathering possible structures of silence is just the beginning of research geared towards the comprehension of its functions in everyday psychological life. In the masterpiece of Bruneau and Ishii (1988) three aspects sum up all the conceptualizations of silence described above. The authors make a theoretical distinction between *silence*, *silences*, and *silencing* that becomes crucial for further conceptualizations of silence based phenomena, sharing the structure of concepts with Orlandi (1995). *Silence* is described as a present-now timeless experience associated to the individual which is often perceived as spiritual–mystical, solitudinal, unconscious, expanded, and acausal (Bruneau and Ishii 1988; Orlandi 1995). *Silences* are past–future oriented timefull experiences, often perceived as secular–profane, social, conscious, contracted, and relatively causal. Furthermore, *silencing* is considered a persuasive act in reference to the ones who silence and the ones who are silenced in social, societal, and political arenas (Bruneau and Ishii 1988; Orlandi 1995). Some precisions of terms are to be made in order to give an accurate understanding of silence based phenomena. Here, while silences are linked to what remains quiet—even if it could be said—silence concerns the untellable and involves a search of detachment from language. This is the case of poetic instants, where a hyper-generalized level of affect is experienced, facing the ambiguous boundaries of mystic and aesthetic experienced values (Lehmann forthcoming, b).

Secondly, the authors, one North American and the other Japanese, acknowledge the variance of the affective resonance of silence within cultural settings. Both in eastern and western cultures, silence is associated with some depth levels of consciousness, such as mystical experience, trances, and relative unconsciousness (Bruneau and Ishii 1988). Yet, it is stylized differently depending of diverse cultural, philosophical, and theological traditions (Bruneau and Ishii 1988). Furthermore:

... Since silence is not valued and therefore not tolerated socially in American (and many European) societies, the function of speech is in the avoidance of silence, generally, as well as in

the filling of silences during the transference of messages. Contrary to the American practice, silence and silences in Japanese society are generally considered to be positively meaningful and socio-culturally accepted to a much higher degree. (Bruneau and Ishii 1988, p. 25)

In fact, both west and east share the transcendence of silence from language, such as in the case of Zen and trapist Monks. While these experiences of silence are associated with mystical experience in general, it is paradoxical that in the predominant western culture, silence is something to avoid and for eastern cultures silence is something to embrace (Steiner 1982).

Silence is neither the opposite of speech nor an absence; on the contrary, silence and language are interdependent (Bruneau and Ishii 1988). Thus, language represents just a part of our everyday experiences (Wittgenstein 1922/2005). Furthermore, Bruneau and Ishii (1988) consider that:

... Silences are surfaces of deeper levels of silence. Silences are like interconnected rivers and lakes; but silence is like the sea to which they connect. While analogy is not a popular form of definition to Western scientists locked rigidly into a world of predictable becoming, it is nevertheless, a common way of explaining for great numbers of peoples throughout the planet. (pp. 4–5)

Very important facts emerge from the analogy above. By one hand, it highlights the straight link between the boundaries of language, silence, and poetry. According to Octavio Paz (1990), giving birth to a poem is to feel desperate with the powerless words and encountering the omnipotence of silence, by means of “listening” to the real voice of things (Paz 1990) and, that way, “Silence, in the field of senses, also holds the incapability of language to express the whole immersion of human experience” (Lehmann 2012, p. 469). Poetic interpretations of silence are needed in order to understand its significance in people's stories (Mazzei 2003).

On the other hand, it recognizes the interdependence of silence and silences. That is, socially promoted silences in a temple or in a museum can themselves make the apparition of silence possible as a contemplative act in the silent prayers to God, or in front of a work of art. Both silence and silences have a cultural mediation and emerge in Social Demand Settings [SDS]; that is, human made structures that constitute the social boundaries of the topic of talks and have three zones: the Zone of “Possible Talking” [ZPT], the Zone of “Promoted Talking” [ZPrT], and the Zone of “Taboo of Talking” [ZTT] (Valsiner 2000). These zones guide communication processes using semiotic mediators (Valsiner 2003). If you consider the zones of possible talk promoted talk, and taboo talk, it is easy to situate the presence of silence, silences, and silencing on them. Furthermore, one could also adapt such constructs to the existence of a Zone of “Possible Silentness” [ZPS]; a Zone of “Promoted Silentness” [ZPrS]; and a Zone of “Taboo of Silentness” [ZTS]. Indeed, the ZPrS and the ZTS are inside the ZPS, and the emergence of silence based phenomena from taboo topics needs to pass through ZPrS, these being interconnected.

Given the polysemy of silence related issues in literature and their dialogical quality, I consider here Silence Based Phenomena as the field involving silence, silences, and silencing settings that serve as a source of catalytic processes. Thus, Silence Based Phenomena can be studied as voluntary/involuntary silencing of inner

voices and noises and/or silencing external noises and voices that work as: (a) a source of hearing with varying degrees of involvement of awareness of the borders of inner and external experience; (b) a source of saying with varying degrees of involvement of awareness of the borders of inner and external experience; (c) the ambivalent sense of not saying and not listening but saying and listening everything at the same time, immersed in the timeless perception of communion between inner/outer borders (Lehmann forthcoming, a).

As an illustration, a brief description of the case study of a health professional that works in a palliative care practice is presented (Lehmann and Saita, In Press). CR is an Italian anesthesiologist who is in charge of pain management of advanced cancer patients in a hospital of northern Italy. She had also studied psychosomatic therapy for reasons she describes as personal, and affirms that she is very interested in transcendence, but does not practice any religion. Working in a hospital, silences inhabit the space in different zones. The place itself is a ZPS because there are zones where talking is allowed, as for instance cafeterias, but some others are ZPrS where noise is regulated by different signs (i.e., posters), such as waiting rooms, bedrooms, intensive care wards, and so on. The ZTS involve settings where taboo topics emerge, such as when communicating difficult issues concerning diagnosis and prognosis of illness, and/or topics related to death and dying.

CR has the custom of smoking while passing through the a garden that connects the parking lot with the entrance of the hospital. She is used to walking through the trees and plants of the garden while having a cigarette, which makes her feel relaxed and as if she is getting rid of the tensions from work and home. The silentness she has in this ZPrS was about allowing a releasing voice to emerge in order to make sense of her memories and anticipations of future to come (i.e., giving bad news to patients, difficulties in communicating with colleagues). CR's search for tranquility is a common process in the ordinary life of human beings, and tranquility itself is an attempt to face the unavoidable uncertainty of life. CR does not only work with persons that have cancer, but also suffered breast cancer which, in fact, increases the possibilities of suffering from lung cancer. We cannot avoid making difficult decisions. We move in the world through axiological categories: we are always giving value to the meanings we construct, and thus decision-making is a value-oriented processes (Lehmann forthcoming, b). Even if CR recognizes the smoking is a risky behavior, it becomes an ambiguous sign in her personal life because the relief of tension produced by these silences in the garden helps her give support to her patients in the hospital, despite her own difficulties facing mortality salience (Lehmann and Saita, In Press). Silences in her daily walk catalyze the crisis-solving process regulating stress and increase of perceived well-being—but immerses her in a new crisis: thinking about the effects of tobacco in her health and the dissonance it creates in her personal life. The ambivalence of signs in an individual's life trajectory are dilemmatic by nature, and the more a person questions both sides of the coin, the more they are aware of the uncertain directions of each decision.

Uncertainty and ambivalence are the foundations of meaning making. In our everyday life we face the dilemma of decision-making, and the impossibility to know how it will turn out (Valsiner 2003). It is precisely for coping with this ambivalence

that we establish solutions through imagination (Zittoun et al. 2012) and develop inner/outer monologues or dialogues with different positions of the self/others (Hermans 2001) where some answers are constructed. But how do such activities allow for the emergence of solutions in times of crisis? Cultural Psychology studies the intersection of dilemmas and the role of affective phenomena in decision-making and sense-making processes from the perspective of semiotic-cultural psychology (Valsiner 2007). In this order of ideas, it is our challenge to comprehend the affective phenomena by means of the explication of both the silent and affective vibrations of our ambiguous and ambivalent experiences (Lehmann 2012).

One example of the catalytic property of affective and Silence Based Phenomena is a curious event in the biography of the Jewish psychiatrist, philosopher, and neurologist Viktor Emil Frankl that he then shares in his memories (Frankl 2003). In fact, Cabell (2010) previously analyzed other issues of his biography where faith is considered a catalyst for making sense of unavoidable suffering related to his experience in the concentration camps. In 1942, with a brilliant scientific career in development, professor Frankl was strongly considering leaving Vienna and emigrating to the United States in order to be saved from the Second World War. On other hand, his family was not able to travel with him. One night, trying to find out what he should do, he went for a walk and entered in the catholic cathedral of Vienna, where there was an organ concert. He decided to sit down and consider what to do in a silent prayer, realizing that a message from God would be required in order to help him. Back at home, he found a stone on the radio. His father said he had picked it up from the ruins of the biggest synagogue of Vienna, and he interpreted this as the message he was supposed to receive. That stone had a golden Hebrew letter engraved on it, saying, *honor your mother and father*. He remained in Austria and he became a prisoner until 1945. With exception of his sister, all his family died in the concentration camps (Frankl 2003).

Certainly, religious temples are considered silent places where, music, chants, litanies, and prayers are not noise, but promoters of the silence and silences needed to get in contact with god(s). As Bruneau and Ishii (1988) describe the relationship of silences and silence, both silent settings and silent practices catalyze the silence that Viktor Frankl was seeking for. This silence was a catalyst for making sense of Frankl's dilemma and eventually providing the conditions necessary for solving the crisis by deciding to stay in Vienna and go to the concentration camps with his family. Theoretically, Frankl's crisis was not because he was Jewish, or because of the war, but because of two values that were no longer allowed to coexist under the current contextual conditions: his professional development and success, and his family.

Another important issue that can be understood from Frankl's lived experience is that of intuition, which has been recognized by some psychological theories as a trait of personality (Jung 1966). Personality traits have a social and cultural guidance (Valsiner 1998). A clear example of this fact that also serves to illustrate the catalytic function of silence-based phenomena is the comparison made by Bruenau and Ishii (1988) about eastern and western cultures. In many social interactions, the authors say, eastern people appear to be silent, that is, they do attempt to fill pauses during conversations with noise or talk, as North Americans are noted for doing.

This is due to some cultural characteristics, such as the non-verbal and intuitive communication skills of people from countries as Japan, where speakers deepen on the communicative setting of interactions, economizing messages, a fact that has been also associated with empathetic abilities. In this context, one could hypothesize that, more than talk, silence catalyzes sense-making of communicative practices. But Silence Based Phenomena are also present in inner dialogues of different positions of the self. For instance, Hermans–Konopka (2011) proposes that even if the self is constantly in interaction and dialogue with its positions, there's also a process of depositioning, that is, a thought free disidentification of any position. Furthermore, clients that experience this kind of silence, often when they are caught up by intense emotions perceive themselves less judgmental with their experience to take decisions.(Hermans–Konopka 2011).

## Conclusion

In a world of uncertainty, both affect and Silence Based Phenomena serve to make sense of experience and dialogue with inner and outer voices during the course of life. Yet, the study of silentness involves its comprehension as a point-like, field-like, and hypergeneralized-like sign, and given this abstract quality, it is often narrowed, giving more importance to the role of language in everyday life. The boundaries of language, tested in science focus cultural scholars on the extra-ordinary significance of Silence Based Phenomena and their affective resonance, which also requires a movement towards integration of science and the arts. For instance, music itself is composed by silences, and makes use of silences to promote different emotive arousals (Lehmann forthcoming, a).

The significance of silence, silences and silencing can be studied from its semiotic quality—as in the case of semiotics of silence (Kurzon 1997), but its catalytic role on sensemaking opens the path to the theoretical comprehension of affect, which transcends language, and also needs development of integrative theories; scholars interested in communication should pay more attention to the cultural values and interpretations that could arise from them during interaction (Bruneau and Ishii 1988; Orlandi 1995) and dialogue, because both language and silence have an infinite resonance in the sense-making and decision-making processes, and studies of the cultural-semiotic organization of human life should integrate these nuances that promote value-grasping in life by means of realizing priorities (Lehmann forthcoming b).

Silence as a masterpiece of everyday mysteries has a catalytic property on our sense-making process, by means of enabling or disabling the value-grasping of our meanings in life. This fact highlights the importance of axiological theories that could widen our comprehension of the affective charge of semiotic meanings, as well as of the boundaries of semiotics to explain the meaning-making process. But, it is also crucial for us to focus on personality traits and its cultural guidance, as long as they are conditions for the rates of reactions of our settings of significance.

Furthermore, the development of Silence Based Phenomena theories are crucial for the comprehension of how people solve crises in everyday life, and why do people face same/different crises putting in dialogue inner and outer positions of the self towards life course.

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# Chapter 14

## Semiotic Catalysts' Activators: An Early Semiotic Mediation in the Construction of Personal Syntheses

Márcio S. da Silva

The mind is at every stage a theater of simultaneous possibilities. Consciousness consists in the comparison of these with each other, the selection of some, and the suppression of the rest by the reinforcing and inhibiting agency of attention (James 1890/1918, p. 288).

In its ongoing endeavor to approach psychological processes as systemic and mediated transformations, cultural psychology of semiotic orientation has furthered discussions on the production of particular outcomes (syntheses) under enabling conditions (catalysts). Central to this notion of psychological catalysis (Beckstead et al. 2009, p. 73) is the idea of semiotic catalysts as signs which provide the conditions for regulated personal syntheses to occur (Cabell 2010, p. 27), being catalysts themselves activated one step before the activation or inhibition of semiotic regulators (SRs). That is to say, catalyst activators can be conceived as signs that prompt any semiotic mediator to function as a necessary condition for a given semiotic regulation to happen.

This chapter aims at contributing to the discussions about the extension of the notion of catalysis to the realm of psychological investigation from the perspective of a semiotic cultural psychology and its systemic catalyzed causality model (Valsiner 2000). Thus, by considering semiotic catalysts as those “conditions that need to be present for a particular causal linkage to occur, and the absence of which does not allow the causal process to lead to an outcome” (Valsiner 2000, p. 75), this chapter aims precisely at exploring how some signs provide support for another sign to function as a semiotic catalyst. Thus, we expect to expand our understanding of the functioning of semiotic catalysts as contextual conditions for the semiotic regulation of ongoing psychological processes, by addressing the mechanisms involved in the very construction of such provision of conditions itself.

The first part of the chapter approaches three interrelated topics: a brief discussion on causation in psychology; a presentation of key aspects of both chemical catalysis and the systemic catalyzed causality model; and finally, the depiction of catalysts

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as directing and directed agents, which is presented along with the argument for extending the notion of catalyst activators from chemistry to psychology.

In the subsequent section, the main idea of “semiotic catalyst activators” is defined, the main processes through which it takes place are depicted, and its relevance for the academic field of interest is highlighted. An empirically derived example of catalyst activation within a narrated life episode is then provided. At the end of the chapter, the significance of the storied dimension of catalytic cycles and the centrality of the active human agent in their depiction are considered in the section that precedes the concluding part of the chapter.

## From Causation to Regulation Through Catalysis in a Semiotic Cultural Psychology

The above mentioned systemic catalyzed causality model is embedded in a broader discussion related to the ways in which certain frames of reference conceive causal relations (Valsiner 2000). The very notion of causation in psychology has set the stage for discussions about divergences in the way it is thought of in other fields compared to that of psychological science. As Wolman (1971) points out:

Psychologists may marvel at the sophisticated discussions of the philosophers of the physical sciences regarding physical causation, but there is not much to be learned from these discussions, and human behavior cannot be interpreted in the light of discontinuity of quanta nor by Reichenbach’s principle of indeterminacy. The discussion of causality in psychology must be discussed within the framework of psychology. It was, indeed, a *coupe de grâce* to liberate physics from antropomorphism, but psychology deals with human beings and it cannot help but being antropomorphic (p. 882).

In his call for a “psychology-based philosophy of psychological science,” opposed to a physical science-based epistemology, Wolman (1971) approaches the issue of causality in psychology, favoring the notion of a context-dependent causality that fits into psychological phenomena. However, schematic ways of depicting contextually driven causality models in psychology not only still require a broader acknowledgment, but also face challenges such as the one related to the suggestion of necessary causality out of correlational findings between variables (Wolman 1971; Sugihara et al. 2012). Furthermore, the predominance of the principle of separability, according to which a causal factor is unique to a given independent variable, leads to the study of complex systems as if they were subject to be treated as linear systems whose pieces can be understood one at a time instead of as a whole, as pointed out by Sugihara et al. (2012).

In that sense, the very terminology “causality” (or causation) must be questioned, in the search for alternative representations of changes in human psychological mechanisms over time, such as “systemic catalyzed regulation” (see the regulatory role played by emotional catalysts in Beckstead et al. 2009).

## The Relevance of the “Condition Oriented” Characteristic of Catalysis to Psychology

In the realm of cultural psychology of semiotic orientation, the notion of synthesis through catalysis makes it possible to emphasize the semiotically mediated nature and systemic complexity of psychological outcomes (Valsiner 2000, 2002). With its roots in the nineteenth century, mainly with the contributions of Berzelius, the notion of catalysis entails hierarchical relations between catalyst and substrate elements of a dynamic system over time, with sequences of events leading to certain outcomes in a given way:

*De la force catalytique.* Certains corps exercent, par le simple contact, une telle influence sur d'autres corps, qu'il en résulte une action chimique: des combinaisons sont détruites ou de nouvelles combinaisons prennent naissance, et tout cela s'effectue sans que le corps qui produit tous ces changements soit altéré. . . . L'action de cette force est plus générale, et en même temps plus mystérieuse, dans les opérations de la chimie organique, surtout dans les corps vivants. . . . Nous avons donné à la cause de ces phénomènes le nom *de force catalytique* (Berzelius 1849, p. 111).

[*Regarding the catalytic force.* Certain corps exert, through a mere contact, such an influence upon other corps, that it results in a chemical action: a combination is destroyed or new combinations appear and all of that takes place without the alteration of those corps which produce those changes. . . . The action of that force is more general and, at the same time, more mysterious than the operations of organic chemistry, mainly in what concerns to living organisms. . . . We have called the causes of those phenomena *catalytic force*] (Berzelius 1849, pp. 110–111).

That mysterious aspect of the catalytic process became clearer in 1894, when Ostwald described the acceleration of chemical reactions promoted by catalysts (Van Nostrand's Scientific Encyclopedia 2008). One of the most relevant features of such a process for psychological inquiry is the emphasis on the relevance of certain elements that are considered as necessary conditions for a certain systemic causal linkage to occur in a certain way, as it has been referred to in a semiotic cultural psychology. It is precisely that “condition-oriented” characteristic of catalysis through the abstracted function of catalysts that has been brought into the field of cultural psychology of semiotic orientation (Valsiner 2000, 2002).

Another noteworthy aspect mentioned by Berzelius (1849), for the purposes of the ideas discussed here, is the outcome of the catalytic process: the appearance of new combinations of elements or of differentiated elements out of the destruction of existing combinations. Even though these elements obviously correspond to chemical substances in the specific context of chemistry, their regulated arrangement and rearrangement after being “acted upon” is the general aspect of interest here. In a semiotic cultural psychology, for instance, some of these syntheses or “new composite whole[s]” (Valsiner 2002, p. 255) may take the form of new meanings, new I-positions in the self-system and new forms of relations between such I-positions (Valsiner 2002; Valsiner and Cabell 2012, p. 88).

Those catalyzed outcomes, i.e., possibilities that were turned into actualities, ultimately emerge through the mediation of signs, which function as semiotic catalysts

upon SRs (promoter and inhibitor signs) (Cabell 2010, 2011a, b). Thus, semiotic catalysts change the relations between elements of one's psychological system at a given moment (Beckstead et al. 2009), creating optimum conditions for one's construction of personal syntheses in his or her meaningful encounters with the world. SRs, in their turn, can be of two kinds: intra-mental, directly used on ongoing psychological processes which mediates one's acting in the world (for example, an affective sign of mercy) and extra-mental devices which are used to "cultivate the personal-cultural or collective-cultural field" (Cabell 2010, p. 27), such as a novel or a film.

Such a way of approaching psychological phenomena sets the constructive human mind as a pivotal agent in the emergence of psychological syntheses. By doing so, the proposed model attempts to avoid suggesting necessary causation through correlation or depicting subjective syntheses as the result of the action of something else's exclusive feature, as it appears in Ganger causality (Sugihara et al. (2012). The notion of systemic catalyzed causality has been creatively approached and advanced through different aspects and it is doubtless that the concept of semiotic catalysts requires special attention from researchers in a semiotic cultural psychology due to its centrality in catalytic processes.

## **Beyond Reimorphism: The Personal Storied Nature of Semiotic Catalysts**

By dealing primarily with human beings, psychologists must resist the reimorphism in the adaptation of concepts and ideas from other sciences, as it is pointed out by Wolman (1984). It is notorious that, with regard to the chemical catalytic reaction, for instance, the catalysts' most emphasized role is their promoting of the acceleration of reactions. Also, the "mere contact" between catalysts and reactants mentioned by Berzelius (1849) can be contrasted to the embeddedness of constructed semiotic tools in one's personal story in the psychological realm. In that sense, the reconceptualization of catalysis in a semiotic cultural psychology has been carefully reflected upon and furthered, as it can be seen in Cabell's reflections upon the autocatalysis phenomenon in a semiotic cultural psychology and upon a psychology of conditions (2011a, b), and Mattos's formulation of the notion of catalytic agent (2013).

Aiming at contributing to that reconceptualizing endeavor, one of the aspects that revolve around the role played by catalysts in chemistry is discussed here, namely that of "catalyst carrier or promoter." From its description as it appears in chemistry, its possible reconceptualization in cultural psychology will be discussed, under the label of "semiotic catalyst activator," with its personal storied nature being kept in mind.

**Catalysts: directing and directed agents** In chemistry, catalysts can both increase the rate of a reaction and direct its transformation towards one outcome in preference to another (Mellor 1937). In that sense, the role played by catalysts is broadened in two dimensions: promotion of speed as well as of specificity of the resulting products.

For instance, the vapor of formic acid ( $\text{HCOOH}$ ) can be decomposed either into (a) hydrogen and carbon dioxide ( $\text{H}_2 + \text{CO}_2$ ) or (b) water and carbon monoxide ( $\text{H}_2\text{O} + \text{CO}$ ), depending on the catalyst over which it passes: In the first case, the catalyst is zinc oxide ( $\text{ZnO}$ ) and, in the second, it is titanic oxide ( $\text{TiO}_2$ ; Mellor 1937). This example deals with the catalysts' "directional effects" (Farber 1966) in their orchestration of the reactions.

However, catalysts themselves are also subject to the action of inhibitors (poisoning agents) and carriers (promoters). The former are foreign substances which damage catalysts' functioning by binding to their active sites in competition with the reactants (Van Nostrand's Scientific Encyclopedia 2008); the latter are materials which enhance catalysts' activity, increase their surface area, reduce their tendency to sinter by heat or prevent inhibitor agents from poisoning the catalysts (McGraw Hill Dictionary of Chemistry 2003; Academy Press Dictionary, 1992; Mellor 1937, p. 154). The oxidation of carbon monoxide is an example of two of these functions of carriers (Mellor 1937, p. 154): the catalyst "manganese oxide": (a) favors the oxidation of "carbon monoxide," but (b) can be deactivated by "alkali." However, (c) as the catalyst is combined with the carrier "cupric oxide," the poisoning alkali is prevented from interacting with the catalyst which, in addition, has its activity enhanced by its carrier.

The relevant aspect in this reaction is the shifting in the ways the directive role is played by the elements that are possibly involved in the production of the outcome. In the first case, that role is played mostly by the catalyst; in the second one, by the poisoning substance and, in the third, by the compound "catalyst + activator." As Mittasch (1936, as cited in Farber 1966) highlights, a catalyst "acts and submits to action, is free and conditioned, determines and is subject to being determined" (p. 174)—from such considerations, he detaches his reflections from the idea of catalysis in chemistry towards an increasingly abstract discussion on the issue of freedom and determinism (Farber 1966, p. 174).

In a generalized way, the previous depiction of catalysts' functioning can be broadly formulated as follows: A given necessary condition for an outcome to exist can either be the main directive agent in a systemic process or can have its own activity specifically constrained, i.e., reduced, enhanced, inhibited, or activated, by other adjacent elements.

By making such a statement, we slightly move away from the realm of atoms, molecules, and things alike, towards more generalized ideas concerning those elements in their mutual interactions and, ultimately, "wondering" about mechanisms that do not specifically (or strictly) refer to chemical elements. Such elaboration has to do with the constructive importing of abstracted ideas from one scientific area into another, aiming at reconceptualizing them in the new context with the subsequent emergence of new understandings of that new context.

If the aforementioned formulation of the catalysts' activity in generalized terms does make sense, the next step to be taken here is to further the notion of catalytic causality model in semiotic cultural psychology, mainly in what concerns to the concept of semiotic catalyst. We shift our attention, then, to the process of activation of semiotic catalysts in the construction of personal synthesis by outlining the main

features of “semiotic catalysts activators” and their functioning together with a given semiotic mediator in the semiotic catalytic cycle.

## Semiotic Catalyst Activators

Semiotic catalysts activators (SCAs) are signs which “distinctively support” other signs to function as providers of the necessary conditions for a given semiotic regulation to occur; in other words, they support a given sign to turn into a semiotic catalyst. They are constructed and cultivated out of persons’ meaningful encounters with their world, solely past encounters involving “specific dimensions of their lives” within which the ultimate outcome of a certain semiotic regulation is highly relevant.

Thus, this notion of SCA directly addresses the following question: “What leads a sign to function as a catalyst?” The main argument here is that signs are brought into the psychological system as catalysts through the person’s “articulating” of other supportive meanings, named here as activators, “along with” crucial features of a given situation. These crucial or relevant features are always judged as such by the person involved in the situation according to his or her most prominent needs, will, interests, and intentions.

For instance, the act of informing the police about someone else (X) consists of an outcome that is likely to be promoted by signs whose situational organization is synthesized by a catalyst (e.g., “fear”). However, the catalytic function of such an “emotional-semiotic mediator” (ESM; Beckstead et al. 2009) “fear” is taken on at a given circumstance due to the conjunction of semiotic activators with it: previously existing meanings related to the central issue at stake (e.g., “X” is life-threatening; “X” is unintelligible; “X” is obscure, etc.), conjoined with a situational and critical novel phenomenon or some of its features (the confirmation of a suspicion or the revealing of a secret, for example).

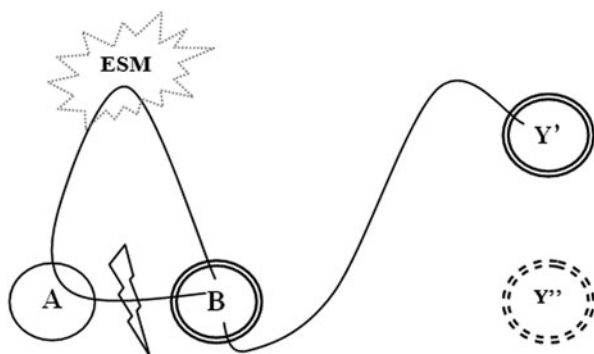
In spite of such ESM “fear” may have emerged at similar circumstances in the past, playing the role of a SR, the situational organization of meanings favors the mediator “to be turned into” a catalyst. In other words, signs are “semiotically supported” towards a catalytic role, i.e., they “acquire” such a status—they do not simply enter one’s psychological system “being” catalysts in themselves.

Figures 14.1 and 14.2 depict the same ESM “fear of being hurt” playing the roles of a SR and a semiotic catalyst respectively in two hypothetical conflicting episodes. The letters A and B represent two people involved in the episodes, which are represented by the “lightning,” from person B’s perspective. In Fig. 14.1, the black line represents the immediate emergence and mediation of the ESM which promotes the outcome indicated by one extreme (Y’, which could be, for instance, “threatening the opponent back” or “killing the opponent”) out of a set of possibilities ranging as far as Y” (calling the police).<sup>1</sup>

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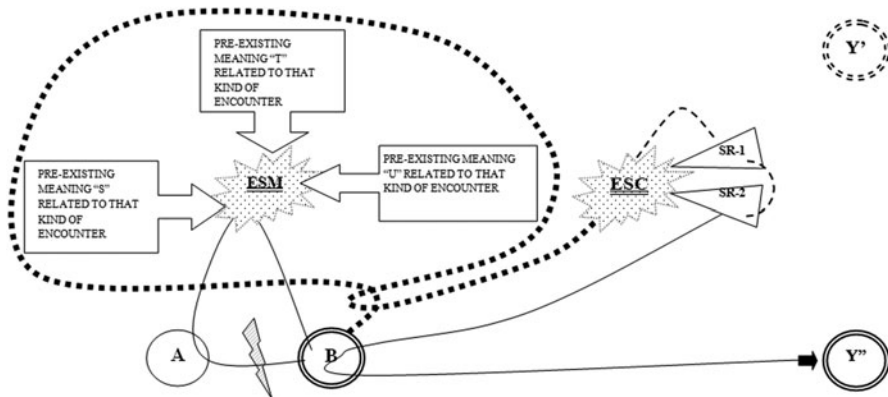
<sup>1</sup> See Valsiner (2004), on semiotic mediation at different levels of generalized abstractions.

**Fig. 14.1** An emotional-semiotic mediator (ESM) functioning as a semiotic regulator in a hypothetical conflicting interpersonal situation

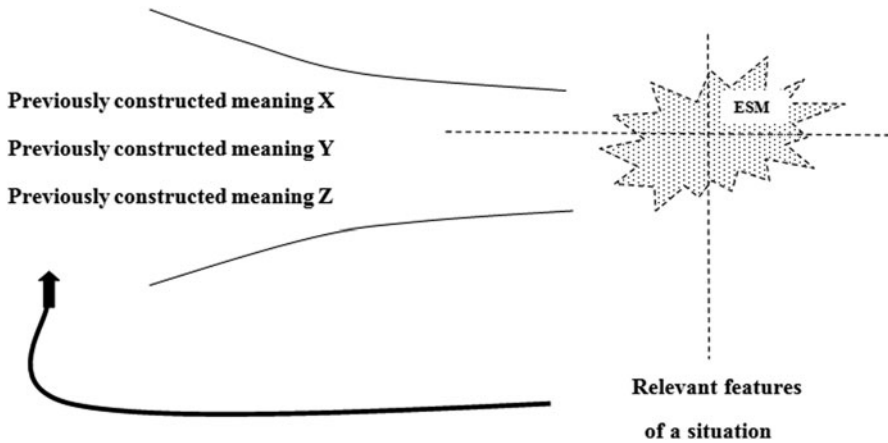


Despite the inherent semiotic complexity of any human context of interaction, the intention here is to highlight a direct ESM towards a triggered reaction (an outcome) in a specific interaction. This kind of mediation is characterized by the presence of signs with low levels of generalized abstraction (Valsiner 2004, p. 15). It resembles the widely known neuroscientific account on “fight-or-flight response” the main neural substrates of which are subcortical regions such as the hypothalamus, amygdale, and hippocampus. These structures mediate the arousal of affective states which, in turn, mediate outcomes with minimal or no interference of reasoning processes (i.e., without frontal cortical processing) in perceived threatening situations.

In the activated catalytic cycle (Fig. 14.2), two aspects are added to the mediation depicted in Fig. 14.1: Relevant distinctive features, represented by the hachure in the lighting, are noticed in this new conflicting encounter and previously constructed signs related to this kind of encounter are brought into the system due to those perceived distinctive features (thick dotted line)—these two elements integrate the complex named here as “catalyst activators”.



**Fig. 14.2** An emotional-semiotic mediator (ESM) turning into a semiotic catalyst through the support of catalyst activators in a critical event



**Fig. 14.3** Cultivated meanings are channeled into the meaning-making system, leading an emotional-semiotic mediator (ESM) to turn into an activated semiotic catalyst

The emerging semiotic mediator is thus provided with new contours of affective and value-laden meanings, becoming a catalyst by enabling the actualization of one of the future possibilities through the orchestration of promoter signs (thinner dotted line). Still referring to the hypothetical situation previously considered, the outcome “Y” (calling the police) is promoted by the synthesized linkage of SRs such as “protect myself” (SR1) and “protect my family” (SR2).

In the depiction of the catalyst activation process (Fig. 14.2), it is assumed that signs pervasively emerge out of humans’ encounters with their worlds as well as that binding semiotic emergences unfold over time. In the hypothetical example provided here, the ESM “fear of being hurt” is considered as the main emergence next to which binding representations of crucial features of that specific encounter with the world emerge: One might notice, after some time, that his or her opponent is using drugs this time, differently from the other times. Out of the complex flow of sensations, thoughts, and affects experienced by the person, previously constructed signs related to that crucial feature (for instance, “drugs users are life-threatening;” “people involved in the world of drugs threaten their enemies’ relatives”) are thus, brought into the system, setting the semiotic mediator in motion towards a catalyst role.

In sum, placed at the intersection between current perceptions and present functioning of previously constructed signs (Fig. 14.3), a given ESM is activated towards playing the role of a catalyst as: (a) relevant features of a situation, from one’s perspective, are brought to the foreground of one’s lived experience leading to (b) the channeling of personally cultivated meanings related to those highlighted features into the affective field.

The ESM has some of its characteristics transformed then: from “fear” to “extreme fear;” from “being hurt” to “being killed;” from “me” to “me and my family.” The mediator, thus, is intensified and extended in such a way that it prompts the entering

of other related signs into the system (self-protection; protection of loved ones) under its regulatory role—in other words, the ESM turns into an emotional semiotic catalyst.

## **The Activation of a Semiotic Catalyst Towards the Decision to Report on One's Own Son to the Police**

The notion of semiotic catalyst activators was derived from the analysis of narrative interviews performed by one participant who has taken part in a broader study on processes of integration of a violent loss of a child into bereaved mothers' sense of self.<sup>2</sup> In this section, some aspects of the study are presented and one episode of the participant's narrative is analyzed so as to illustrate the ideas previously discussed in this chapter.

## **Railroad Slums—The State, Criminality, and Personal Trajectories by All Saints' Bay**

The study which this case integrates is an empirical investigation carried out in a financially poor urban area named *Plataforma*, in Salvador city, Bahia, Brazil (see Fig. 14.4). This area is located in a macro region named *Subúrbio Ferroviário* (Railroad Slums, in an approximate translation into English) which is composed of 22 neighborhoods inhabited by around 600,000 people (Fundação Gregório de Matos 2012).

The history of the region has the construction of Afrânio Peixoto Avenue in 1970 as one of its landmarks. Before that, the region was inhabited mainly by fishermen villagers and, occasionally, by vacationers. After the construction of the avenue, people from different parts of the city and the countryside moved in, without any urban planning and governmental support. It is noteworthy that the absence of governmental assistance has prevailed over decades, largely contributing to the emergence of two relevant social phenomena: first, an insufficient (in some cases, inexistent) availability of crucial public services such as schools, public security, health services, sanitation, sports centers, libraries, cultural centers, parks, etc.; and second, the strengthening of influence of religious institutions (mostly Catholicism, Pentecostalism, and Candomblé) and criminal drug-dealers' groups over the region (Reis 2010; Santos 2010).

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<sup>2</sup> Neimeyer's theoretical formulations about meaning reconstruction in bereavement conditions (Neimeyer 1999; Neimeyer et al. 2002) is the main theoretical framework on which the broader study is based, in what concerns to bereavement issues. However, it has been omitted here due to my specific interest in catalyst activators in this chapter.





**Fig. 14.4** An urbanized area in Subúrbio Ferroviário, Salvador, Bahia, Brazil. (From Reis 2010, p. 95)

Despite the oversimplification of this depiction, one of its highly relevant aspects is the high rate of criminal practices which tend to stain whole families' trajectories in many ways, from children's and young people's entry into criminal groups (at the age of ten, or even before that) to the killing of young people and its severe consequences, mainly to bereaved parents and close relatives (Santos 2010).

According to official statistics (Secretaria de Segurança Pública do Estado da Bahia 2012), an average of 140 people are victims of homicide per month in Salvador, and most of these crimes happen in poor and peripheral urban areas such as *Subúrbio Ferroviário*.

### **Collecting, Co-Constructing, and Analyzing Narrated Personal Trajectories**

Through the mediation of a researcher who also lives in *Subúrbio Ferroviário*, four women were invited to participate in individual sessions of narrative interviews. After being provided with details about the aims, procedures, and ethical features of the study as well as having formally accepted to participate in the study and providing the researcher with sociodemographic information, the participants were invited to tell the researcher their personal stories related to their experiences as mothers, mainly as mothers of deceased children due to homicide.

The first interview was organized according to the narrative model proposed by Jovchelovitch and Bauer (2002). In the subsequent interviews, episodes considered meaningful by the researcher, i.e., episodes in which participants tried to integrate the loss into their personal stories were discussed further, mainly through specific and theoretically driven questions. One more meeting included the discussion of the organization of the data by the researcher at the beginning of the data analysis and, in the last meeting, a feedback was provided to the participants by the researcher.

An episodic-content analysis of the transcribed interviews was carried out, based on the categorical-content model proposed by Lieblich et al. (1998): (I) Selection of episodes—relevant episodes were highlighted and set apart, originating a set of subtexts, each one corresponding to a specific episode; (II) Identification of relations between events—passages of the episodes referring to specific events were highlighted and put in relation to one another, according to their role in the system (a whole given episode). This organization of the data was shared and discussed with the participant, generating more data to be analyzed; (III) Construction of visual and theoretical depictions of relations—such depictions of the system were constructed upon the previous step, with a focus on the process through which the main outcome of the episode was reached; (IV) Conceptual discussion—mechanisms identified in the analysis were discussed taking into consideration what has been developed regarding the concepts of interest of this study, aiming at contributing with advancements in that specific aspect in the field of semiotic cultural psychology.

A narrative episode (Freitag 2010), as a unit of analysis, is defined as:

- A set of interrelated events, located in time and space as well as in a certain temporal sequence. Information about these elements does not have to be “exact”: one may remember a relevant episode which happened either on a specific date or on one day in high school; events may have happened “somewhere” around place “X” and the main outcome of a series of events may open a self-narrative.
- The events tend to be performed by a group of participants, even though they can also involve just one participant;
- The set of events has a specifiable beginning and an end, occurring under an overall theme;
- Its level of generality is established by the narrator: from those of our everyday lives (a meeting at work, a class, etc.) to those related to broader contexts (a historical event, a natural disaster, etc.), being the borders of those levels of generality defined within a continuum by the speaker;
- It is interconnected with other parts of the whole narrative, but it also has a level of independence from them. Its relative independence from other episodes is rather arbitrary and it is defined according to the speaker’s perspective;
- It plays a role in relation to other parts of the whole narrative (e.g., emphasizing an aspect of an argument, concluding an idea, giving an example, suggesting what should be valued, etc.).

### Rebeca<sup>3</sup>—Three Violent Losses over a Strong Person’s Trajectory

Rebeca is a 41-year-old cleaning worker at a public department in Salvador, Bahia, who went to school up to the fifth grade in junior high school. According to her self-narrative, she grew up under very poor socioeconomic conditions but, in spite of that, she used to be very well-cared by her mother.

The first turning point in her trajectory happened when she got pregnant at the age of 15. For her, she says that was when childhood was left behind. “Walter,” her first son, would be born in the following year and would be killed 18 years later.

In the following 7 years, she lived with her husband who is depicted as violent and reckless towards her and their sons. Rebeca finds her husband’s behavior as a relevant contributor for their sons to become so revolted against them and to enter into the world of drugs. During that period, she gave birth to four other children, including “Leo,” when she was 22 years old. In that same year, she got divorced.

At the age of 23, she started living with her second husband and “Ali” was born. In the following year, she reconciled with her former husband and had her seventh child, getting divorced some time later on.

When she was 33 years old (2003), Walter was killed at the age of 18, as mentioned before. Seven years later (2010), Ali and Leo (17 and 18 years old respectively then) were killed in different situations in the same year.

Since Rebeca always needed to leave home for working, she says she was unable to take care of her sons appropriately and that may have contributed, in a certain way, to their entry into the world of drugs and crimes too, according to her. Nevertheless, she also evaluates herself positively, as a strong person, for having been a very strict mother and a hard-working person—a “mother and a father at the same time,” according to her.

**Informing the police about her own son, Walter, as a personal synthesis** The episode analyzed in this section was narrated by Rebeca in the second interview, at the point when she was required to tell the researcher about her relationship with Walter during his adolescence as well as their plans for his future back then. It starts with her coming back home from work and it ends with Walter’s arrest. The main theme of the episode, according to the participant, is her decision to inform the police about her son.

According to the participant, Walter revolted against his own family due to the suffering inflicted upon him by his father, who used to go home drunk at the end of the day and beat him. At the age of 9 years, Walter left home to live with some acquaintances and, around the age of 14 or 15, he was already using and dealing drugs.

After emphasizing the conflicting relationship between her and her sons, she was required to mention any specific event as an example. Rebeca, then, mentioned one of their conflicts, as it follows:

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<sup>3</sup> All personal names presented here are fictitious.

Once, when he [Walter] was already a grown up and involved with drugs, he grabbed a pressure cooker lid and threatened me with a beating . . . We had an intense argument . . . I got really angry at him and I told him: "Listen, if you throw that at me, I will kill you!". I said that, I used that expression because sons do not beat their mothers, right? And he grabbed that lid to throw at me. . . . He did not throw the lid at me because I faced him down! I really did! I faced him down and he did nothing then. . . . I told him I'd kill him! I told him: "Look! Do not touch me! If you throw this lid at me, I'll kill you! . . . I did not mean it! Of course I am not courageous enough to kill anybody, right? That was just the way I found to express myself . . . I don't know . . . At that moment . . . I don't know . . .

After the passage above, Rebeca went on narrating about the way her mother used to overprotect her (Rebeca's) sons every time they made a mistake, as she (Rebeca's mother) had done during that episode involving the lid. In the sequence, the participant mentioned Walter's revolt against people in general, due to his long-lasting suffering: *I could see it by his facial expressions . . . And he was aggressive . . . So, you notice when your child is revolted, right?* That was the exact point in the interview in which the researcher decided to approach the issue of Walter's entering into the world of drugs. During the subsequent 2 min and 49 s, the participant narrated the events which led her to inform the police about her own son, resulting in his arrest:

Listen: I have always been a very watchful mother and I had never seen him smoking marijuana or using any other kind of drugs. But I started to notice those strangers going to my house to talk to him! Then I started to link things and when I would ask him whether all that had anything to do with drugs he would always deny that! But I am not one of those mothers who are always pretending they do not see their sons' mistakes.

The subsequent events which integrate this episode are organized in Table 14.1 according to their role in the system in which the catalyzed outcome "informing the police on Walter" emerged. Key passages of the episode are italicized:

Considering the existing model of systemic catalyzed causality model, two new elements are inserted into the system: a critical event and the activating system (composed by some situational features perceived as highly relevant and previously constructed meanings related to those features which are brought into the system). It is relevant to note that, in the local media, there is an intense broadcasting of news related to violence in the Railroad Slums.

Including those new elements into the catalytic system favors the consideration of the personal synthesis ("I decided to inform on him") as an outcome that has a personal-historical dimension in specific ways. The previously constructed meanings "drug-dealers as life-threatening to their enemies' families" and "drug world as an unknown reality" were "channeled" into the system through the situatedness of Rebeca's personal experience, i.e., her initial witnessing of Walter's aggressive behavior followed by the confirmation of a suspicion. It is assumed here that contextually constrained affective states arose from the very moment Rebeca met her "extremely upset" son as she was arriving from work.

What can be seen here is a personal infusing of meanings into the affective field in such a way that the latter turns into an emotional-semiotic complex which, from then on, reorients both Rebeca's meaning system and her relation with the world. Regulator signs ("self-protection;" "protection of the other"), which mediate Rebeca's

**Table 14.1** Main elements involved in Rebeca’s personal synthesis of informing the police on her own son

Element of the catalytic cycle	Elements of the catalytic cycle in Rebeca’s case	Excerpts
Critical event	Witnessing Walter’s outburst	One day . . . when I came back home from work, he was extremely upset
Highlighted relevant features of “this” specific situation	Presence of drugs at home	<i>I did not know that he [Walter] had been selling drugs. . . . He had hidden some drugs somewhere in our house</i>
	Confirmation of the suspicion that Walter was involved with drugs	He could not find the drugs, I did not know where drugs were and he got very aggressive and wanted to destroy everything at home!
Catalyst activators	Representation of drug dealers on the news	As I used to listen to the news on the radio . . . <i>They [drug dealers] usually go to their enemies’ houses and kill their whole family and . . .</i>
	Lack of knowledge about the world of drugs Walter was getting into	I knew nothing about that world he was getting into, the kinds of people he had been dealing with!
Semiotic catalyst	<i>Fear</i> of being killed (as well as afraid for Walter himself and their relatives)	<i>I got afraid that someone could go into our house and kill me, my mother, and my sister, who were living with us at that time</i>
Semiotic regulator	Protection (herself, Walter himself, and their family)	I did it <i>for his own sake!</i> I told him that was the way I found to <i>protect him and our family as well</i>
Outcome	Informing the police	I went to the police station; I went there and informed the police officers. <i>I decided to inform on him</i> and, then, he was arrested

action outcome, are brought into the meaning system, being differentially related to participants in the episode: Rebeca, Walter himself, and their family (Rebeca’s mother and sister). In the core of this process, a human agent semiotically acts upon those environmental factors by which she is also affected.

### The Relevance of Persons and Their Stories to Further Our Understanding of Semiotic Catalysis

Two contributions which can be derived from the notion of catalyst activators to that of catalysis in a semiotic cultural psychology are: first, the inclusion of some aspects of the history of a given catalytic cycle in its own depiction and, second, the centrality of the active human agent in the catalytic cycle.

The very notion of catalysis is a kind of methodological expansion when psychological syntheses are being dealt with: There is no longer one element (with a certain exclusive characteristic) causing the emergence of something else. Instead,

there are some elements being oriented in a specific way under the influence of one or more necessary conditions. By zooming in on the visual depiction of the catalytic cycle, we can see that those conditions are “necessary” due to their “becoming so,” instead of due to their “essentially being so”: they can be either “one out of a range of conditions” for a certain synthesis to occur (depending on the contribution of contextual and preexisting elements for them to become catalysts) or they can become the catalyst for a range of psychological syntheses to take place. That is what has been referred to as the personal historicity of semiotic catalysts through catalyst activation in this chapter.

Consider a given psychological outcome that may emerge out of the catalytic influence of any of a wide range of elements from  $X_1$  to  $X_n$ . What will mostly define which one will function as a catalyst is not their intrinsic properties, as it is very likely to be true in chemistry. Instead, features of specific events meaningfully related to other existing elements will promote the assumption of a catalytic role by element  $X_5$ , for instance, instead of any other element within that range.

On the other hand, if we take the example of the practice of graffiti on walls in a context of protest, we can think of such context as a catalytic agent (Beckstead et al. 2009). Furthering our analysis, we can also think of specific features of the context that are brought to the forefront of one's perceptual field, triggering the influx of meanings into one's meaning system. Once linked to those “newcomers,” the meanings of the protest can catalyze the action outcome of drawing graffiti instead of destroying monuments or hurting people, which can be easily catalyzed during public demonstrations as well.

The rather obvious centrality of the active human agent in psychological catalysis is intrinsically linked to the reflections above concerning the historicity of the catalytic cycle. Despite the variation in the degree at which people “deliberately control” the construction of their personal syntheses, catalyst functioning is closely linked to some dimensions of people's personal stories: from sensations to perceptions, from bodily affective states to shared representations of them, from simple categories to highly elaborated moral values and other complex meaning fields made possible by (and contributors to) our reasoning skills. Human beings represent their worlds through signs and create the possibilities for those signs to play certain roles, such as a catalytic one.

Hence, when visiting a friend, if someone ( $X$ ) notices that his or her friend ( $Y$ ) has just started to yawn and to look at the clock and, right after that, “ $X$ ” decides to leave his or her friend's home, an observer will reasonably argue that the set of the host's behaviors was a catalyst for the outcome (leaving  $Y$ 's house) to emerge. However, if the visitor were, for instance, “ $X$ 's” 20-year-old low-functioning autistic son, who was left by “ $X$ ” in “ $Y$ 's” house for some hours, there would be no catalytic function in “ $Y$ 's” behavior per se due to the fact that “ $X$ 's” son would probably have difficulties in interpreting and representing “ $Y$ 's” behavior the same way “ $X$ ” would have done.

Over a century ago, James (1890/1950) argued that “thought tends to Personal Form” (p. 225). Aside the discussion about what James meant with the term

“thought,”<sup>4</sup> he emphasized the personified nature of the human mental procession, out of which no thoughts can be found (despite the abundance of artifacts in the world which are human constructions, it could be added). States of consciousness, thus, are “found in personal consciousnesses, minds, selves, concrete particular I’s and you’s.” (James 1890/1950, p. 226). This relevance of the human agent in the study of psychological processes has reappeared in different contexts of psychological science over the years, as in the contrast between anthropomorphism and reimorphism discussed by Wolman (1971); more recently, in a cultural psychology of semiotic orientation, the “semiotic reflexive construction” (Valsiner 2002, p. 252) is an appropriate example of this kind: a specific point in space (here) exists in the flow of time (now) and is perceived and reflected upon by an agent (I), such system being a starting point for an “expansion of different perspectives” (p. 252).

As it can be seen, the emphasis on the personal dimension of the catalyst functioning aims at justifying the theoretical notion of semiotic catalyst activators which, as relevant contextual elements, are expected to be considered in the importing of the abstract notion of catalysis from chemistry to psychology.

## **Conclusion: Semiotic Mediators Turn into Catalysts Through Contextual Activation**

The approach to the generalized notion of catalytic processes has furthered the systemic view on the issue of causation in a semiotic cultural psychology, mainly in three aspects: the conditions without which a certain outcome is not likely to occur (the catalysts), the other elements which are present in the system in a given circumstance which the catalysts bind with (corresponding to the substrates in chemistry), and the catalyzed outcome or synthesis. This chapter deals with the first of these three elements, the semiotic catalysts, by claiming that they are mediators which are initially activated by means of some processes: first, through one’s emphasis on specific features of a given situation, closely followed by one’s canalization of previously existing signs, which are meaningfully related to those features, into the situation. Those canalized signs bind with an initial affective-semiotic field which had emerged since the beginning of that person’s immersion in the situation, favoring the taking on of a catalytic role by a certain affective-semiotic mediator.

One issue related to the activation of catalysts which can be further investigated is the possible stability that some meanings may acquire in one’s meaning system and their consequent tendency to function as catalysts in diverse occasions over time, rather independently from activators. Complementarily, the existence of “semiotic catalyst inhibitors” can also be considered, and one hint of this process could be seen in Rebeca’s bringing the emotional-semiotic catalyst “fear of police officers’ violent actions” into more recent conflicting interactions between her and one of her

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<sup>4</sup> In sum, thoughts were considered by James (1890/1950, p. 186) as states of consciousness which suggest the omnipresence of references to objects “other than the mental state itself.”

sons, who has also been involved with drugs. So, the generalized feeling “fear of drug dealers’ violent actions” is a relatively stable and cultivated semiotic catalyst in Rebeca’s meaning system, since it is the condition which indirectly leads her to occasionally consider calling the police again when one of her sons gets aggressive; but, on the other hand, that same catalyst is usually inhibited by a stronger sign (fear of police officers’ violent actions), as she herself stated.

Extending a generalized idea regarding a process such as the chemical catalysis into the realm of human psychological phenomena poses us the challenge of building bridges that can justify such extension, as it has happened in previous initiatives (see Farber 1966, p. 173). Some of these bridges have already begun to be built in a semiotic cultural psychology (Valsiner 2000; Beckstead et al. 2009; Cabell 2010, 2011a, b): the origins and historical development of the concept; depiction of its main characteristics; abstraction of some of its characteristics and its contextualized application in the new academic field.

One justifiable way through which the notion of catalysis can be extended into the psychological science domain is that of metaphor, that is, “a cross-domain mapping in the conceptual system” (Lakoff 1998, p. 203). It implies that one domain of experience is understood in terms of a different domain (Lakoff 1998), through an established set of correspondences (mapping) between elements of both domains. In what concerns to a semiotic cultural psychology, such mapping allows us to reflect upon the systemic and semiotically mediated emergence of psychological outcomes using the knowledge available regarding chemical catalytic processes. Chemistry itself, for instance, uses the metaphorical expression “poisoning” to refer to the inhibition of a catalyst’s functioning by a substance other than the substrates involved in a catalytic compound.

What comes next, then, is the task to justify our ideas about systemic catalyzed causality model in a semiotic cultural psychology within its own rationale and beyond the initial correspondences established between this model and chemical catalysis—and that is what the notion of catalyst activators is intended to contribute with.

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**Part VII**  
**Conceptual Critiques of Cause and**  
**Catalysis**

# Chapter 15

## A Structural Systemic Theory of Causality and Catalysis

Aaro Toomela

This book intends to explore the basic concept of catalysis in philosophy, chemistry, and psychology, with the aim of developing the concept further in (cultural) psychology. This aim implies that the concept is, in principle, useful and the only question is how to use it most efficiently for advancing psychology as a science. In the context of modern mainstream psychology (see Toomela [in press-c](#), for the definition of ‘mainstream psychology’), indeed, any step further from linear cause–effect theory of causality is a significant advancement; yet it does not follow that the concept in the proposed form should be used.

### Why the Notion of Causality Matters?

Though science aims to explain and understand, not all kinds of explanations can be considered scientific. For instance, it is hard for many Christians to understand how God created the world, both in six days and instantaneously—both versions are suggested in the Book of Genesis. These two views may seem absolutely contradictory to anybody with reasonably developed intellect. Yet the brightest minds have proposed brilliant solutions to this contradiction. Among many wonderful ideas derived from discussing the time of creation, we find, for example, a suggestion by St. Augustine, according to whom, “God finished all his works in six days *because* six is a perfect number.” It was also made clear by others that “The creation of things is *explained* by the number of six, the parts of which, one, two, and three, assume the form of a triangle” (White 1896, p. 7, my emphasis; see also many other explanations for this contradiction *ibid.*). Here we find not only an explanation as to why it took exactly six days to create the universe but also a causal explanation as to why it took six and not any other number of days. Indeed, as the number six assumes the form of a

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triangle; obviously it took six days to create the universe, and, as a triangle is one, the creation was also instantaneous. This causal explanation, however, would not be considered scientific today, at least by scientists. Thus, we can conclude that even though all scientific knowledge is knowledge, not all knowledge is scientific.

So far I have written only a few lines and already introduced confusion that needs to be cleared up: I use the terms ‘explanation,’ ‘science,’ ‘scientific,’ and ‘causality’ as if it is clear what these terms mean; yet this is not the case. Next, I will discuss why causality matters for science.

### *Scientific Explanation and Causality*

Detailed discussion regarding the essence of scientific explanation and understanding goes beyond the scope of this chapter. I will give only a brief outline of the issue here (see Toomela 1996, 2009, 2010a, e, 2012, *in press-a* for more details). Shortly following Aristotle (e.g., 1941d), scientific knowledge could be defined as knowledge of causes. In mainstream psychology today, the issue seems to be solved—everybody seems to know what ‘cause’ and ‘causality’ mean. It seems to be universally accepted that causality refers to linear cause–effect relationships. Therefore, the whole science of psychology should also be concerned with discovering ‘causes,’ i.e., events that make ‘effects’ happen.

Understanding causality as a chain of cause–effect relationships, however, becomes questionable when it turns out that many other theories of causality exist. In this case a metatheory is needed to justify why this and not some other theory of causality has been chosen. In order to proceed, I provide one alternative (though there are several more). I have called this theory of causality structural–systemic (e.g., Toomela 2010e, 2012), to distinguish it from systems theories that are not structural and structural theories that are not systemic. According to structural–systemic view, followed by many continental European psychologists before World War II, three individually necessary, but only collectively sufficient aspects of causality must be distinguished. A studied thing or phenomenon is understood, i.e., explained causally, when, first, its constituent parts or elements are identified. Second, specific relationships between these parts are described and, third, qualities of the whole that emerge during the synthesis of parts are discovered. Structural–systemic causality requires methodologically, fourth, a developmental approach to the scientific study. This is because qualities of elements change when they are synthesized into an emergent whole; therefore, the identification of elements is possible only before synthesis takes place. On the other hand, it must also be demonstrated that the hypothetical elements truly belong to the studied whole. Thus, the actual process of synthesis—development—must be studied.

An example of this kind of explanation was repeatedly described by Gestalt psychologists as well as by cultural–historical psychologists, originally Vygotsky. The example is that of water. Koffka, for instance (see also Vygotsky 1926, 1983 for usage of the same example), discussed this example in the following way:

Let us take the simplest example we can find: water is explained by atomic theory as a compound of two elements, hydrogen and oxygen, in such a way that it consists of molecules, each of which is composed of three atoms, two of hydrogen and one of oxygen. [...] This sounds like a straight molecular theory, but it is not anything of the kind. For H, H<sub>2</sub>, and H<sub>2</sub>O have all different properties which cannot be derived by *adding* properties of H's and O's. [...] In the simple water molecule, what a complexity and what a difference of structure from the H and the O atoms! It is wrong to say that this system consists of two hydrogen atoms and one oxygen atom. For where are they to be found in it (Koffka 1935, p. 57)?

I am going to elaborate on this example to demonstrate all four principles of structural–systemic causality. First, there is the question of elements; we know that a molecule of water is composed of—but does not ‘consist,’ as we learned from Koffka—the elements hydrogen and oxygen. Among other qualities, one element burns and the other is a necessary component of chemical burning.

Second, these elements can be combined into different wholes. Chemical bonds can be established between these two elements. For instance, we can get water, H<sub>2</sub>O, but can also get many other substances, such as hydrogen peroxide, H<sub>2</sub>O<sub>2</sub>, or hydrogen superoxide, H<sub>2</sub>O<sub>4</sub>. All of these compounds are distinguished by the number of same elements, hydrogen and oxygen, as well as the kinds of relationships between these elements: H–O–H, H–O–O–H, and H–O–O–O–O–H, respectively. Furthermore, we can get oxyhydrogen by just mixing the two gases hydrogen and oxygen; in oxyhydrogen, the relationships between the elements are those of physical proximity without chemical bonds between them. Usually we would have a mix of two kinds of molecules, H<sub>2</sub> and O<sub>2</sub>, or H–H and O = O, where the bonds are formed between the atoms of hydrogen and atoms of oxygen, respectively, but not between H and O.

Third, all of these compounds as wholes are characterized with remarkably different properties: water can be used for extinguishing fire, whereas oxyhydrogen is highly explosive. Hydrogen peroxide and hydrogen superoxide are also distinguished by many properties from other compounds as well as from each other. Hydrogen superoxide, for example, can exist only at very low temperatures (Marshall and Rutledge 1959). On the other hand, the wholes also have properties that do not characterize the individual elements. Water can be used for extinguishing fire, whereas hydrogen burns and oxygen is necessary for burning. Thus, properties of elements change when included in an emergent whole. Additionally, the properties of a whole depend not only on its constituent elements but also on the specific relationships between the elements.

Finally, in order to demonstrate that water is, indeed, composed of hydrogen and oxygen, it is necessary to demonstrate that a molecule of water breaks up into hydrogen and oxygen; this can be done with the electrolysis of water, for example. On the other hand, it is also necessary to demonstrate that a molecule of water emerges via the synthesis of hydrogen and oxygen; among other ways, this can be done by heating a mix of two gases, H<sub>2</sub> and O<sub>2</sub>, until the hydrogen burns, i.e., the bonds between hydrogen and oxygen atoms emerge.

## *Glimpse into the History of Causality Theories*

So far we have seen that there is more than one theory of causality and, for some reason, one of them—that of the cause–effect chain—has been accepted almost universally by psychologists today. There should be reasons as to why this particular choice was made. Today, there is practically no discussion on the nature of scientific knowledge in psychology. Therefore, we need to look back into history with the aim of discovering when and why the choice among causality theories was made. I think it is necessary to go far into the past to find answers to these questions.

Causes and causality were mentioned and discussed to some degree by several philosophers of antiquity. The most advanced theory of causality was proposed by Aristotle, who distinguished four kinds of causes; now referred to as material cause, formal cause, efficient cause, and final cause, respectively (see, e.g., Aristotle 1941a). Material cause is a description of what a thing is made of, formal cause is the statement of essence of a thing as a whole, efficient cause is a description of the source of a change, and final cause is a reason or that for the sake of which a thing is.

This view is very similar, though not identical, with the structural–systemic causality theory. Particularly, material cause for Aristotle was not just the material from which something was made; it was also explicitly defined as parts. Formal cause, in turn, was that of the whole and synthesis. So, what we do not find there is the idea of specific relationships only.

It is also important to take into account that *efficient cause* as part of the more complex theory does not have the same meaning as it does when taken as the only kind of cause. Today, it is understood that cause is some event that precedes an effect and makes the effect happen; therefore, it has temporal characteristics and ontological consequences. Cause in this simplified theory is, in other words, something occurring *earlier* than effects and is also the beginning of the consequence, a reason why the result emerges. In the Aristotelian account, however, efficient cause is *not* the beginning of the result; according to Aristotle, all four kinds of causes are beginnings simultaneously:

[...] all causes are beginnings. [...] ‘Cause’ means (1) that from which, as immanent material, a thing comes into being, [...] (2) The form or pattern, i.e., the definition of the essence [...] (3) That from which the change or the resting from change first begins; [...] (4) The end, i.e., that for the sake of which a thing is; e.g., health is the cause of walking (Aristotle 1941a, p. 752, Bk. V, 1013a).

Indeed, no “effect” would emerge if there were no parts, no material from which the effect was made. There must be something already existing that changes when the efficient cause is added. In that sense, thus, efficient cause loses both of its characteristics—it is not the only kind of cause that precedes the effect, and it is not the sole kind of cause that has ontological consequences. A new thing or phenomenon emerges when all four kinds of causes act simultaneously; their effect, thus, is systemic, i.e., a process of emergence is possible only if individually necessary kinds of causes are also collectively present.

Today, however, ‘efficient cause’ is the kind of cause that is considered, by the majority, to be the theory of causality without other kinds of causes necessary. In some point in history, thus, the Aristotelian complex theory of causality was replaced with only part of it, that of efficient causality, which became an all-inclusive theory. Why was a more complex theory of causality abandoned and when? Today, efficient causality is almost universally accepted as the theory of causality. Perhaps there are very good theoretical arguments for this choice—a choice that may otherwise look ridiculous because an elaborate set of established principles has been replaced with one principle that does not cover all aspects of the earlier, complex theory.

Metatheories that reject all kinds of causes but efficient cause, can be found, indeed. There are two philosophers, Descartes and Hume, who can be “blamed” for abandoning Aristotelian thinking. Both of them suggested that only efficient causality should be considered as the theory of causality. It is especially interesting to understand, why only efficient causality? Descartes seems not to give explicit reasons for this idea, but if we take his works as a whole, we find that he had no other choice. Namely, a large part of Cartesian philosophy is to give proof to the existence of God—the background was not whether there is any doubt about God’s existence, for Descartes, there was none; the background was to logically prove to nonbelievers that God does exist.

Causality was also discussed in this context by Descartes. For Descartes, God was “infinite, eternal, immutable, omniscient, omnipotent” (Descartes 1985, p. 128). God was also the first (efficient) cause “of everything that exists or can exist in the world” (Descartes 1985, p. 143). If God is the cause of everything and is also all-powerful, then, logically, there can be no other kinds of causes. For other causes are constraints, they put limits on what can happen in principle and what cannot. Not everything can be built from the same material; therefore, material cause is a constraint. It follows that the same form, formal cause, cannot be achieved in an unlimited number of ways. Thus, formal cause is also a constraint. As to final cause, it may seem to fit with the notion of God, which was also mentioned by Descartes, but the problem is that for Aristotle final cause was a far more complex concept. According to him (cf. Aristotle 1941a, c), only some things are for the sake of something, and from these only some are in accordance with deliberate intention. In other cases final cause emerges from the ‘nature’ of things, and ‘nature’ means the matter and the form. Hence, final cause is in many cases actually a retrospective concept, which means that there is only one way a particular form from specific material came into existence. Finally, there is also a kind of final cause, in the case of which the thing in question has in itself, by nature, a source of becoming or changing. So a seed, for example, is a thing that becomes, determined by final cause as its essence, something else, a plant. Thus, final cause is also a constraint, and God, being all-powerful, cannot be constrained in any way. Therefore, there is only one kind of cause, that is efficient cause. Hume, in turn, followed a very different path (cf. Hume 1999, esp. pp. 101–115). He, in principle, did not deny that other causes can be operative. Yet he assumed that humans are not able to discover any other kind of cause because they are not capable of knowing the world beyond the appearance of things, and other kinds of causes are not apparent.

Therefore, it is possible to know only connections among ideas that emerge on the basis of observed associations between events.

Despite extensive literature searches, I have not been able to find any other justification for limiting causality theory to efficient causality. I also think that science today cannot accept the idea that there are no constraints on the world (this would exclude all principles, laws, and regularities). It also cannot accept the idea that the world beyond appearances is unknowable in principle. It follows that constraining causality theory to efficient cause alone is not justified by scientific principles and should be discarded.

Structural–systemic causality, which developed on the basis of the Aristotelian account, in turn, is free from unscientific theological limitations or assumptions about limits of the human mind that were reasonable a few centuries ago but turned out to be erroneous with the development of the sciences. Structural–systemic epistemology is also nothing new in psychology; it was a grounding principle for many powerful theories more than a century ago. As I have discussed elsewhere (see references above), there are many reasons to agree with Wilhelm Wundt, who suggested that scientific explanation in psychology should contain descriptions of attributes of psychical causality, which are discovered by studying psychical elements, psychical compounds, interconnections of psychical compounds, and psychical developments (Wundt 1897). Knowing the elements, their compounds, and the process of the emergence of novel wholes, the causes of studied phenomena are scientifically explained:

There is only *one* kind of causal explanation in psychology, and that is the derivation of more complex psychical processes from simpler ones (Wundt 1897, p. 24).

This quotation should not be taken out of context from where it was originally written. Wundt did not mean that more complex cause–effect relationships derived from studies of many simpler cause–effect chains would be causal explanations. For ‘complex,’ in this regard, refers to organization, the synthesis of elements that comprise the whole. Thus, causal explanation for Wundt was understanding how novel wholes emerge in the synthesis of elements. Altogether, there seem to be reasons to revise the current dominant theory of causality and go beyond oversimplified efficient causality. One such development is proposed by the introduction of systemic and catalytic causalities into psychology.

## Catalytic Causality in Psychology

Linear, or efficient, causality is the most primitive view on causal relationships. This model assumes that there are unitary entities, called causes, which necessarily and unconditionally lead to outcomes or effects. This model does not correspond to the context dependent and complex phenomenon studied in psychology, the (human) mind. In order to go beyond the limitations of efficient causality, Valsiner (2000) proposed using another theory of causality in psychology. He added to linear causality theory a systemic causality theory, according to which any outcome is a result



of mutually interdependent relationships between the parts of the causal system. Specific outcomes emerge only when all the necessary causes in systematic interaction act together. Furthermore, in order to introduce context into theories, especially theories of development, Valsiner suggested introducing the notion of catalytic or catalyzed causality. ‘Catalyzed’ refers to the contextual conditions that need to be present for a particular causal linkage to occur. In the absence of these conditions, the causal processes cannot lead to an outcome. At first glance, catalytic causality may look similar to structural–systemic causality. These two views, as I am going to show below, differ in several important aspects, however.

In his later work, Valsiner elaborated the model further (Valsiner 2007). He showed that the idea of systemic causality leads inevitably to hierarchically different levels of generality so that the causal cycle can work between adjacent levels. In systemic catalytic causal processes, new, hierarchically higher levels of forms emerge in the synthesis of elements. Together with the possibility of relationships between hierarchically different levels of causal processes, the causal chains will not remain unidirectional. In linear primitive models of causality only ‘upward’ causality is discovered; in this way it is expected to explain more complex hierarchically higher-order forms with lower-level causal entities. Multilevel causal system view, however, also entails the idea of ‘downward’ causality where lower-level entities are causally affected by higher-level forms (see on ‘downward causation’ also Andersen et al. 2000).

### **Catalytic Causality Theory (CCT) vs. Structural–Systemic Causality Theory (SSCT)**

So far three theories of causality have been described, efficient causality, structural–systemic, and systemic–catalytic. Even though there are other options, I will not discuss the others, which are neither more elaborate nor more popular. Also, I think that there is no need to further discuss whether the efficient causality theory should be taken seriously. The reasons for accepting it are irrelevant for science and reliance on it as the theory of scientific explanation leads to oversimplification and loss of even the possibility of explaining studied things and phenomena. The next question—the question to be answered in this chapter—is understanding which of the two remaining theories are more promising as an epistemological ground for scientific understanding—not only in psychology but in all sciences—and explanation.

No doubt, there are similarities between the two theories. Both assume that more than one kind of cause needs to be identified for full understanding of the studied thing. Next, both distinguish hierarchical levels of development. Further, in both theories the term ‘system’ is used. Yet there are also fundamental differences between the theories. These differences are not easy to discover because the language used to describe the theories overlaps more than their actual content. It is because the same terms—‘system,’ in the first place—do not consistently refer to the same idea. Next, I am going to show that CCT, even though it represents a significant advancement

when compared to the efficient causality theory, is not sufficiently elaborated and does not allow us to make all the theoretically important distinctions that follow from SSCT.

### *What is ‘System’?*

First, fundamental differences emerge when the notion of ‘system’ is analyzed in the theories. In SSCT, ‘system’ is a structure, i.e., organized whole, that is composed of (developmentally) distinguishable (but never separable) parts or elements in specific relationships. In the synthesis of elements, a whole emerges, which has properties that do not characterize the parts before they are synthesized. In the same process of synthesis, properties of elements also change; some properties of the emergent whole become properties of the parts simultaneously.

I have used a clumsy term, ‘structural–systemic,’ because there is more than one theory of what ‘system’ means. Relatively well-known today is, for example, dynamic systems theory (DST). This theory is in several principal ways different from SSCT (see for more details, Toomela 2009). First, DST studies processes and often explicitly denies the existence of, to some degree, stable structures underlying them. Second, as a rule, DST is applied by encoding the observations of studied processes into numerical variables. These variables are then analyzed as if they represent the elements of the system—whose structural nature is denied. In the process of encoding observations into numerical variables, however, the essential characteristics of the studied structures are irreversibly lost (see on the epistemological problems related to numerical variables, Toomela 2008). Third, DST studies non-linear changes without realizing that truly hierarchical changes are not only non-linear but also non-continuous; entirely novel qualities emerge in synthetic processes. Discontinuity is excluded in DST. In addition, DST is characterized by many vague terms, such as attractor, self-organization, and even the basic notion of ‘process’ is used in ambiguous ways. In DST, processes can ‘cause’ other processes, but process is essentially a change in a system that unfolds in time, and “unfolding in time” cannot cause anything.

‘System’ is also not unequivocally a structure of the thing or phenomenon in the General Systems Theory compiled by Bertalanffy (von Bertalanffy 1968). Bertalanffy believed that systems theory in its advanced form is a mathematical theory; he suggested, for example, that systems problems are “problems of interrelations of a great number of “variables” (von Bertalanffy 1968, p. xx). No mathematical theory, however, can be a comprehensive theory of any real structure of a thing because mathematics studies associations but not discontinuous qualitative changes in the world (see more on the limits of mathematical theories, Toomela 2010d).

The definition of the term ‘system’ is not unequivocally clear in CCT. In some places it may appear that understanding the ‘system’ is similar in CCT and SSCT. For example, in CCT it has been stated: “The system cannot be studied unless the aggregate of the qualitative whole is observed as a system—as interrelated parts

functioning in relation to one another” (Beckstead et al. 2009, p. 71). Thus, in a system there seems to be parts, their relationships, and the whole. Yet it is not a system in the SSCT sense. The differences are related to conceptualization of the three basic notions of systems theory—‘whole,’ ‘part,’ and ‘relationship’—that are understood differently in CCT and SSCT.

*Notion of ‘whole’ in the CCT* When talking about the whole, the authors are talking about an *aggregate*, which is usually defined as a collection of items that are gathered together to form a total *quantity*! In SSCT, instead of ‘aggregate,’ ‘organization’ would be used to refer to interrelated parts with the qualitatively novel whole emerging in the process of synthesis. Even though all theoretical principles are reflected in the ways language is specifically used, one unfortunate term does not necessarily indicate the whole essence of the theory. However, there are many other expressions that indicate the same—‘system’ in CCT is not a structure of distinguishable parts in specific relationships, rather it seems to be something vaguely defined. In some places, indeed, we find that the phenomena should be understood as qualitative wholes (Beckstead et al. 2009, p. 73). The meaning of ‘whole’ becomes unclear when we learn (see next section for details) that a system is in a context. This context is not a set of other systems that have the potential to interact with the particular whole but context is, rather, some ‘condition,’ ‘mediator,’ or ‘catalyst.’ None of them has been understood as a system or whole by itself in CCT.

For SSCT, in turn, all wholes, all systems or structures, are embedded into higher-order wholes. ‘Context,’ for example, means other systems can potentially interact with the particular distinguished system being studied. In that sense, thing-in-context becomes a higher-order whole with novel qualities that do not characterize the particular whole in some other context.

*Notion of ‘part’ in the CCT* The notion of ‘part’ or ‘element’ is also quite ambiguously defined in CCT. In some places we find that “parts and their relationships to each other as well as to the whole [...] cannot be treated as separate *variables*” (Beckstead et al. 2009, p. 71, my emphasis). In other places it is not variables but some *systemic conditions*, under which something occurs (e.g., Beckstead et al. 2009, p. 72). Other terms are added to that: “[...] the catalytic model—showing the dynamic interaction of *individuals, conditions, contexts, and catalytic agents* [...]” (Beckstead et al. 2009, p. 78). To these terms, other notions, such as *regulator* and *mediator* (Cabell 2010), should be added.

Altogether, it seems that in CCT some whole might be a system but this whole interacts with conditions, contexts, catalysts, regulators, mediators, and maybe with something else as well. So there are systems and there are factors (I have no better name for all these other notions taken together) that interact with systems. Perhaps it is possible to identify what a factor is, but I think it is not clear at all how exactly this or that factor leads to the change of a system.

This problem does not emerge in SSCT. For SSCT there are only structures that are distinguished from other structures; the universe as a whole is a structure that is composed of hierarchically lower-level substructures of different complexity. CCT tries to identify factors that contribute to the change of a particular whole. I do not see

any reason why the same notions that define a structure—parts and relationships—should not be used for explaining change and development. In SSCT, any structure as a whole can change only in two ways; either the relationships between the elements change (as in the case of burning oxyhydrogen), or a new element is synthesized into a structure (an atom of oxygen is synthesized with the molecule of hydrogen). In both cases we need “context”: oxyhydrogen will not change into water unless the process is ignited by an amount of energy introduced into the system (essentially it means that if properties of the elements of oxyhydrogen change, their energy-level will be different so that the molecules of oxygen and hydrogen can be broken in order to synthesize their atoms into water), and atoms of hydrogen must be in the “context” of oxygen for the synthesis of water to be possible.

Altogether, thus, there are only structures at hierarchically different levels of distinction. All the different terms, ‘individual,’ ‘condition,’ context,’ ‘catalyst,’ ‘regulator,’ and ‘mediator,’ refer to the same thing—these are the elements of a higher-order system where the ‘individual’ belongs. This ‘individual’ interacts with its environment, which is just a set of other structures that may become elements in the individual and some other subsystem of the environment higher order system. Below I will address more details and distinctions related to this issue, in the section on catalytic causality.

*Notion of ‘relationship’ in CCT* It is acknowledged in CCT that a system as a whole is different depending on the relationships between the parts: “Two systems with the same parts —A, B, C—but different relationship of the parts will yield different results” (Beckstead et al. 2009, p. 73). Superficially it may seem that the same idea relies under the notion of ‘relationship’ in both CCT and SSCT; yet this is not the case. Every theoretical notion is fully defined in the context of the theory it belongs to. The same notion in different theories is also different because the whole where it belongs to is different. The same applies in the case of ‘relationship.’ In CCT, relationship applies to relationships between parts of a system. Yet parts and system as a whole are not defined similarly, as we have seen in previous sections. Thus, ‘relationship’ also has different meanings. In SSCT, relationships emerge in a distinguished system as a whole as well as between the system and its context, which is a set of other systems. It is not clear at all, however, what ‘relationship’ means when CCT notions of conditions, contexts, catalysts, etc., are used. If there are no conceptual differences between the relationships between parts and between a system and context, condition, etc., then it is not clear what these other notions mean. But if the relationship with context is conceptually different from the relationship with catalyst or with mediator then it is not clear any more what ‘relationship’ means.

Parenthetically, it must be mentioned here that I am *not* suggesting that there is only one kind of relationship between elements in SSCT. On the contrary, there are infinitely many kinds of relationships possible. Relationships between atoms, chemical bonds, are not the same as relationships between words or between two human beings. The problem with CCT is that with confusing terminology of parts of a system and contexts, conditions, etc., principally the same kind of relationship can be treated theoretically as if it were different depending on whether we call a part

of a system a part, a condition, or whatever else. How so? In hierarchical systems, i.e., in all systems, a part at one level is a whole system at another level of analysis. Thus, what is ‘context’ at one level is ‘another part’ of a more complex system at another level of analysis. Therefore, what we describe as ‘relationship between parts’ at one level of analysis becomes something different, such as a relationship with a condition, for example, at another level of analysis; though it is the same relationship. This confusion does not emerge in SSCT.

### *Downward Causality*

Another questionable concept in CCT is the idea of downward causality. This notion is reflected in statements, such as, “phenomena are qualitatively organized by the whole system” (Beckstead et al. 2009, p. 72) or, “the emergence of higher levels of generalized signs becomes causative in relation to lower levels” (Valsiner 2007, p. 376). So there are two directions of causality, “upward” and “downward.” This distinction opens up the possibility for a lot of confusion. In the first place, it creates tension between a whole, “up,” and its parts, “down,” as if these two can be separated. Also, it becomes unclear in which sense these two forms of causality can be distinguished. For instance, are they simultaneous in time or do they have effects in different times? The distinction of the two forces is attributing “earlier” to upward causality and “later” to “downward” causality. This is because parts exist before the whole but an emergent whole—which “becomes [sic] causative in relation to lower levels”—cannot have its effect before it has emerged. If “downward” causality has its effect after the whole has emerged, then something very strange must be acknowledged—there must be a period of time when elements already become parts of a higher-order whole, but do not form the whole yet because to be in a whole means that they are affected by the whole. Otherwise we would have to say that the whole can be separated from its parts so that the whole, as efficient cause, can affect its parts. This possibility, obviously, would be rejected by CCT.

Hence, there is a contradiction in CCT, and, at the same time, there is hidden an important principle that is fully accepted in SSCT. As I mentioned already above, it is not only the qualitatively novel whole that emerges in the process of the synthesis of elements; the qualities of the elements also change in this process of emergence. Thus, SSCT rejects the idea that there is a direction in the relationship from parts to whole and from whole to parts. Rather, parts change qualitatively during the process of the emergence of the whole; changes in the qualities of parts and the emergence of a whole with new qualities are just different aspects of the very same process. Both changes are also simultaneous. One important notion must be defined in order to explicate this aspect of SSCT in sufficient detail. I am going to discuss this definition in more detail as important consequences follow from it.

## *Detour: Definition of Quality*

In human and social sciences the term ‘quality’ is used abundantly. Yet there seems to be no clear definition of what ‘quality’ means. In common language ‘quality’ is related to ‘good’ or some other value. In psychology ‘quality’ or ‘qualitative’ is often used as the opposite of ‘quantity’ or ‘quantitative.’ So “qualitatively different” becomes “different,” but not in quantity. In this use, the notion is not only circular but also misleading, because quantity and quality are not necessarily opposites. At least since Hegel’s analysis of the notions of quality and quantity, it is questionable whether these notions can be opposed at all (cf. Hegel 1969, esp. Sect. 3: Measure). There are too many phenomena in the world where increases or decreases in quantity are accompanied by change in quality. Even more, I would say that there is no quantitative change possible without concordant qualitative change and vice versa.

Over the history of philosophy, quality has been defined in numerous ways (see for a long list of different definitions, Chambers 1728). While not all definitions fit a theory of systems, ‘quality’ is an essential notion for all systems theories where it is recognized that qualitatively novel wholes emerge in the synthesis of elements (non-continuous accounts, especially mathematical, are implicitly nonqualitative even if, superficially, qualities are mentioned theoretically). Thus, we can constrain the choice of definitions to that which is defined in terms of systems theory. Following principles formulated in continental-European psychology, especially in Gestalt school and cultural–historical school, among others, I have suggested for more than a decade, that it is structural–systemic theory, which should be preferred over other systems theories. Therefore, the definition of quality I propose is defined in terms of SSCT.

The definition follows quite naturally from the basic notions of SSCT. There we have elements, relationships, and wholes, or hierarchical syntheses of elements, which are different from elements, so we need a term that determines what this difference means. Next, we observe that all processes of emergence of higher-order wholes are related to relationships. In the emergence of a whole, certain relationships are formed between the elements, and in the destruction of a whole, relationships are broken. Furthermore, every element is constrained in the process of synthesis; a relationship that has been established cannot be established again before breaking it. (Here it might seem that I am suggesting something self-evident. It might be so, but it is not self-evident that the question—can the same element establish unlimited number of relationships?—needs to be asked. All developments in science begin with discovering new questions; answers are much easier to find than questions worth asking.)

Thus, what actually changes in the emergence of a whole is the establishment of relationships; once established, the strong constraint emerges so that the same relationship cannot be established again. The other side of the same constraint is that before synthesis elements must have the potential to establish a relationship. It follows that in synthesis elements change—they change in the kinds and numbers of relationships they can establish and nothing else. The structural–systemic definition

of ‘quality’ jumps out now almost by itself (at least it did it to me about eight years ago; I even remember the exact location where I was riding my bicycle when the definition “came” to me). So I define quality in this way: *Quality is the potential of a structure to become into relationship with another structure.*

I have one example to demonstrate what this abstract definition means. Gold is one of the least reactive chemical elements. It is not soluble—does not enter into a chemical compound with other elements—in nitric acid. So gold does not have a quality that would permit it to enter into this relationship, whereas silver, for example, does. That is why an “acid test” nitric acid can be used to distinguish gold from several other metals. Gold is obviously qualitatively different from other metals. Now we see what “qualitative difference” means in structural–systemic theory. Gold has a unique set of relationships (chemical, mechanical, cultural, etc.) it can enter into with other structures. It is, thus, qualitatively distinguished from other metals, whose unique set of qualities is, at least partly, different from that of gold.

After I defined quality for myself, I found some definitions provided by philosophers that are in many respects similar to the one I propose. The definitions that are relevant were proposed by Aristotle and Hegel, respectively. This is not surprising, rather it shows, again, that structural–systemic thinking emerged from Aristotelian thought and was further elaborated by Hegel—both connections I have discussed elsewhere (e.g., Toomela 2012). I provide both definitions in order to help the reader connect SSCT with its philosophical roots.

Aristotle gave four very different definitions of quality (Aristotle 1941a, b). Out of the four, the following is relevant in this context:

[...] by Quality I do not here mean a property of substance (in that sense that which constitutes a specific distinction is a quality) but a passive quality in virtue of which a thing is said to be acted on or to be incapable of being acted on (Aristotle 1941c, p. 305, Bk.V, 226<sup>a</sup>; see also Aristotle 1941a, p. 871, Bk.XI, 1068<sup>b</sup> for the same definition).

So, for Aristotle quality was a *passive* characteristic of a thing; things either can or cannot be acted on. To be acted on means to come into a relationship with something else because one thing can affect the other only by forming a relationship with it. If a thing can be acted on, it means that something else—that acts on it—comes into a relationship with it. Silver can be acted on by nitric acid but gold cannot. Thus, the first has and the second does not have a quality affected by that acid.

Hegel, whose views on causality were very similar to those of Aristotle, defined quality in relation to properties of a thing, in a way also very similar to Aristotle. According to Hegel:

*Quality is the immediate determinateness of something, the negative itself through which being is something. Thus property of the thing is the negativity of reflection through which Existence in general is an existent and, as simple self-identity, a thing-in-itself. [...] A thing has properties; they are, first, the determinate relations of the thing to another thing; property exists only as a mode of relationship between them and is therefore the external reflection and the side of the thing’s positedness. But, secondly, the thing in this positedness is in itself [...] A thing has the property of effecting this or that in another thing and of expressing itself in a peculiar manner in its relation to it. It demonstrates this property only under the condition that the other thing has a corresponding constitution [...] Through its properties*

the thing becomes cause, and cause is this, that it preserves itself as effect (Hegel 1969, pp. 487–488).

In this quote, Hegel’s ‘property’ is conceptually similar to ‘quality’ as defined here; property is “a mode of relationship.” Hegel, in fact, also defined a thing through its properties (qualities, in my terms):

The determinateness through which one thing is *this* thing only, lies solely in its properties. Through them it distinguishes itself from other things, because property is negative reflection and a distinguishing; the thing therefore contains the difference of itself from other things solely in its property (Hegel 1969, pp. 490–491).

Here we saw that for Hegel properties—qualities, if using my term—are *relations* of a thing with other things. If there would be nothing with which a thing could come into relationship with, that thing would be out of our world; there would even be no way to know that it exists. Hegel also makes it clear that relationship is never determined unidirectionally. A thing can affect another thing only if that other thing has a corresponding quality that makes effects possible. We also find here the understanding that a thing is determined only by its qualities (i.e., Hegelian properties). A thing is what it is through the qualities it has, through its potential to come into relationships with other things. Taken together, a thing, i.e., a system or structure is defined by its qualities, its potential for relating to other structures. What is meant by ‘qualitative difference’ becomes also unequivocally clear: structures with different potentials for coming into relationships with something else are qualitatively different. On the other hand, we also see that quality is a relational notion; it is not characteristic of an isolated thing in itself. Thus, quality is always a contextual notion.

Let us take an example from psychology. I have a slight problem here finding a good example because the choices are almost endless. Any change in mental development, for example, is a qualitative change in a person. If, for instance, I learn a new word, my qualities change. I can relate to environments in a novel way every time someone uses that word in my presence, and I also can use the word. Yet, again, quality is about relations. So, if I use that new word when talking to a person who does not know the word, the relationship of understanding each other does not emerge. Thus, my qualities are not mine alone; they are simultaneously determined by my qualities and the corresponding qualities of possible environments I may encounter.

Many conceptual problems of science can be solved based on this definition of quality. The discussion of these problems goes beyond the scope of this chapter. Here I only mention that, following the proposed definition, we see that different structures may share some qualities and yet be qualitatively different, as in other qualities they may not be overlapping. Enormously important methodological consequences follow from this observation. One of the most underestimated and, yet, most fundamental problems to be solved in psychology is discovering what mental processes underlie observed behaviors. The problem is that externally similar behaviors may emerge on the basis of different mental processes and vice versa (e.g., Toomela 2008, 2010b). So far there has been no theory that would show how in principle it is possible to distinguish internally different—and directly nonobservable—structures that underlie (mental) processes when the external observable outcomes, behaviors,



are identical. SSCT provides the needed methodological principle: different mental structures, even when they share some qualities, must be different in other qualities, in other potentials for establishing relationships between mental elements and with the world. By systematically varying environments of individuals—because it is always environment in relation to which a behavior emerges—it becomes possible to discover which structural, environmental differences correspond to which differences and similarities in observed behaviors. Differences in similar environments and similarities in different environments, thus, give the researcher the ground to distinguish directly nonobservable mental structures underlying observed behaviors.

It is true that most psychological research is based on manipulation with the environment, yet other epistemologies do not permit discovering what particular mental structures underlie studied behaviors. So efficient causality psychology, i.e., the mainstream today, can only establish names for regularities in observed behaviors. There is ‘neuroticism’ that causes neurotic behavior, and there is ‘intelligence’ that causes intelligent behavior, etc. Such names are not true scientific explanations. Also, CCT seems to not provide methodological ground for solving the problem of matching similar behaviors to potentially different underlying mental structures and vice versa. Certainly many individual and environmental characteristics that associate with different behaviors can be discovered. Additionally, CCT epistemology is much more powerful than the current mainstream because, in CCT, causal concepts are added to the primitive efficient causality framework. Yet there seems to be no methodological principle in CCT that would follow from it and explicate how exactly correspondence between mind and behavior is established.

### ***Back to Downward Causality***

As I showed above, the CCT principle of downward (and upward) causality is contradictory if analyzed in the context of a systems theory. Both CCT and SSCT suggest that with the emergence of a higher-order whole, the elements also change. In CCT it is suggested that it is a causal “effect” of a whole to its parts. According to SSCT, however, nothing like that is, in principle, possible. A whole cannot be separated from its parts and, therefore, it also cannot become a causal agent in relation to its parts. Yet the parts change when synthesized into a whole. After defining quality, it is easy to see how the issue is solved in SSCT.

According to SSCT, a novel whole emerges when qualities of to become a part of a whole is realized in the process of synthesis and potential relationships of elements become actual. In this process, qualities of elements change—they become neither in relationships they have already established nor in other relationships they could have formed before synthesis. For example, a free atom of hydrogen that could form relationships with many other atoms, including another atom of hydrogen to establish a molecule of hydrogen,  $H_2$ , cannot establish a connection with another atom of H after becoming part of the whole  $H_2O$ . The molecule of water, in turn, acquires new qualities, novel relationships become possible, among them are those that may also

be unique to molecules of water and to no other substance in the universe. Parts of the molecule of water, also acquire new qualities *qua* parts of the whole; when the whole molecule forms novel kinds of relationships then its parts are required to participate in these new relations. Thus, parts acquire new qualities together, while losing other qualities, when synthesized into a higher-order whole.

Thus, there is no downward causality; qualities of elements change through the actualization of their potential for relationships on one hand. On the other hand, the same parts that lose their qualities also acquire novel qualities *qua* inseparable parts of the whole they belong to. These two kinds of qualitative change would be misleadingly called downward causality in CCT. In the best case, ‘downward causality’ is just an unnecessary metaphor.

### *Catalytic Causality*

In Valsiner’s account, a general scheme of systemic causality, that involves catalytic causality, is described as follows:

The process of synthesizing two separate substrates (A, B) into a new compound (AB) is made possible through a catalyst (C) which temporarily binds to the input substrates – first to A (arriving at intermediate compound (CA), then to B (arriving at intermediate compound CAB, binding A and B into one whole). The catalyst then releases the newly synthesized compound AB and recreates itself (C). Without the binding role of the catalyst the synthesis need not be possible; the direct, unmediated synthesis  $\{A + B \rightarrow AB\}$  cannot proceed (Valsiner 2007, p. 373).

Valsiner’s account given in this form can be accepted in SSCT: a catalyst is understood as a substrate, which becomes a part of an intermediate system in a chain of systemic transformations. Later, however, the idea of catalytic causality, as applied to psychology, was modified. The concept of catalysis seems to move away from a systemic account and comes closer to the primitive efficient causality view. First, instead of being understood as a (potential) part of a system in a chain of systemic transformations, catalyst becomes ‘conditions.’ Another important aspect of modifying the concept of catalysis is separating it from the notion of causality. Both ideas are expressed in the following quote:

The microgenesis of sense-making is a catalyzed, not directly causal, process. The use of the notion of catalysis—study of conditions under which something happens, rather than asserting causality—is still not widespread in psychology (Salvatore and Valsiner 2010, p. 13).

Here CCT moves closer to the efficient causality view, but is still considerably more advanced if compared with the latter. It happens when bringing in the concept of “conditions under which something happens.” With this concept, elements of a system become separate from conditions even though they are essentially the same. If “conditions” are not conceptualized as elements of a system, the efficient linear causality intrudes back to the concept of catalytic causality:

Because the phenomena is a result of interacting and exchanging parts within a system, the catalyst has an important function of changing the relationships and interactions between one or more parts within the system. [...] system causality implies the change of one relationship within the system will yield a different result. Therefore, the catalytic overcoming of a barrier, resulting in the changing of a relationship not usually changed, alters the system as a whole, causing some novel (sometimes rare) phenomena (Beckstead et al. 2009, p. 73).

We see that “catalyst . . . has an important function of changing the relationships . . . catalytic overcoming of a barrier . . . causing . . . phenomena” is presented with notions very similar to efficient causality. It seems as if catalyst is just another efficient cause with effects on relationships. The relation of catalysis to causality becomes more confusing, however, because in other places it is directly stated that catalysis is not causal: “phenomena are not caused, but rather, are catalyzed” (Beckstead et al. 2009, p. 77).

Further, as catalysis in some cases is not necessary for a process to emerge, and causality implies necessity in CCT, catalysis is not strictly causal:

The catalyst does not *cause* in the strict sense of  $A \rightarrow B$ , or “if preceding cause, then following effect”. For example, in some cases, and across both disciplines, the product can still form without the conditions presented by the catalyst. Although this may require a long period of time or other necessary conditions, it is still possible. Therefore the catalyst is not a causal concept. If not causal then what? The catalyst has the same abstract function in both disciplines—functioning as a helper in the reaction process. The way in which the catalyst helps in the reaction process is by activation (Cabell 2011a, p. 7).

So instead of causing events to take place, a catalyst “helps” and help is given “by activation.” Yet in other descriptions of CCT principles, we find that catalysts are necessary:

Semiotic catalysis refers to a process that provides the conditions necessary—but not by themselves sufficient—to produce a particular qualitative change in a system. [...] A theory of semiotic catalysis, then, is a theory of enablement—one that activates the functions and mechanisms of other signs within the cultural psychological system (Cabell 2011b, p. 10).

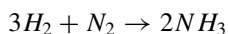
In the quotation above, again, efficient causality language is used; it can be implied that changes in a system can be “produced” by other processes, among them is—necessary but not sufficient—catalysis. Also, catalysis “activates;” this term also implies the cause/ before  $\rightarrow$  effect/ after linear efficient causality principle. Considering many contradictory and confusing ideas in descriptions of CCT, it is not surprising that in the end the concept of catalysis has turned from an explanatory principle to a metaphor: “I propose using the metaphor of the catalyst and of catalysis” (Cabell 2011b, p. 7). The concept of catalytic causality turned into a metaphor loses all explanatory content, however—because metaphors are false. Metaphors can be used as heuristic devices but not as theories (cf. Dooremalen and Borsboom 2010).

### ***Catalysis According to SSCT***

The principle of catalysis is fully concordant with SSCT and can be explained using its principles without involving vague terms, such as ‘help,’ ‘activation,’ ‘condition,’

etc. I will cite an example from chemistry, where the mechanisms of catalysis are increasingly understood and explained scientifically (i.e., in terms of structural–systemic causality according to the terminology used in this chapter).

I provide an example of ammonia, which was described in detail by Swathi and Sebastian (2008). Ammonia is, among other ways, produced from nitrogen and hydrogen according to the following formula:



When mixing the two gases at room temperature, however, the reaction does not occur because the bond between the two nitrogen atoms is very strong and, for the reaction to occur, this bond needs to be broken first. In terms of SSCT, thus, the qualities of N have changed when the higher order molecule,  $N_2$ , has been synthesized. In order to make the reaction possible, the qualities of N need to be changed; it must have a quality to come into a relationship with H (I will reiterate that, according to SSCT, quality is the potential of a structure to come into a relationship with another structure). The reaction presented in the formula occurs, however, if an iron catalyst is used.

The mechanism of how a catalyst is involved in this reaction was revealed by Gerhard Ertl. In order to understand the description of the catalytic process, three terms need to be defined first: *physisorption*, *chemisorption*, and *desorption*. These terms are related to processes that take place on the surface of the catalyst. These three terms are defined as follows:

When a molecular species approaches a surface, it can undergo several processes near the surface. It may just bind to the surface by van der Waals interactions, a process that is known as *physisorption*. Alternatively, it may form chemical bonds with the surface atoms, leading to *chemisorption*. Sometimes a molecule may undergo dissociation at the surface and the constituent fragments form chemical bonds with the surface. If one of the fragments finds a suitable adsorbed species nearby, it may then react with such a species on the surface and form new products, which leave the surface in a process known as *desorption* (Swathi and Sebastian 2008, p. 552, my emphasis).

The whole process of catalysis is understood in this way:

The first step is the adsorption of nitrogen and hydrogen molecules on to the iron surface. Nitrogen at first physisorbs as a molecule, and then dissociates into atoms, which remain chemisorbed on the surface. On the other hand, hydrogen molecule chemisorbs dissociatively, to give hydrogen atoms on the surface. The chemisorbed nitrogen atom then immediately picks up three hydrogen atoms, one by one leading to the formation of ammonia. Finally the ammonia molecule desorbs from the surface (Swathi and Sebastian, 2008, p. 555).

This description contains several important ideas about catalysis as understood in SSCT. First, sometimes synthesis of a certain whole is possible only in several steps. Several steps are needed when the elements of to-become-a-novel-whole are parts of other systems. In that case, these other systems need to be dissociated first to change the qualities of the elements needed for the synthesis. Systems change only when they form a relationship with some other system. In this case, this other system is called a catalyst. A catalyst is a system that forms a temporary relationship with a

system composed of elements, whose qualities need to change. After the qualities of the elements have changed, the final synthesis can occur. In this synthesis, the relationship with the catalyst is broken and new relationships between elements of the emergent whole are formed.

### ***Is it Possible to Apply the Chemical Principles of Catalysis to Mental and Cultural Processes?***

Psychology has suffered—and is suffering—from reductionism, when principles of lower-level organization are used as explanations for higher-order structures. Physical processes, for example, are constrained by certain principles and laws. An attempt to explain living and mental processes by the same laws would be reductionist because living systems are higher-order structures of physical bodies, which laws and principles are specific to the living structures only. In mainstream psychology, reductionism is extremely common; processes of the brain or, even worse, genes, have been used in an attempt to explain almost every mental process.

An anti-reductionist stance, however, can be as misleading as a reductionist stance. In opposition to reductionism, it is easy to slip into denying the role of lower-level principles to higher-order syntheses. Antireductionism of this kind results, for example, in theories of culture that do not take into account an individual and the fact that all cultural individuals are also living organisms. For example, both in semiotics and in certain schools of (cultural) psychology, it is assumed that there are ‘signs’ or ‘symbols’ in the environment of an individual. This idea is fundamentally misleading due to biological constraints on the ways an individual can relate to his or her environment. Namely, the only (sic!) way to relate mentally to the environment is through sensory organs. Yet sensory organs dissociate the sensed environment into tens of thousands (in hearing, for example) or even millions of pieces (in vision) (see, e.g., Levine 2000, for biology of sensation). We sense the world only with receptors; the complex and organized perception is the fully individual creation synthesized on the basis of receptor activation or inhibition. Thus, symbols are also not in the environment. In the environment there are certain physical objects and phenomena that have the qualities to become symbols, when an individual constructs the meanings of sensed events.

In the hierarchically organized world, the laws and principles are actually asymmetric: all lower-level principles apply and constrain all higher-order systems, but higher-order systems are organized according to the laws and principles that apply only to this synthetic level and not to lower levels of organization. So all living organisms are subordinated to the principles of physics but only living organisms are subordinated to the principles of life. To understand life, thus, requires understanding both physical and biological principles; otherwise there is always a danger of attributing principles of life to what actually belongs to the realm of physics. Understanding of the mind, in turn, is not possible unless physical and biological principles are taken into account and distinguished from psychological principles.

It follows that the principle of catalysis can be applied to the analysis of mental and cultural systems without modification. Obviously, such application is not identical to the application of the principle in chemistry—qualitatively different kinds of elements and qualitatively different kinds of relationships between elements must be subordinated to the principle of catalysis in chemistry and psychology, respectively.

Thus, catalysis is not a metaphor for psychology. The concept of catalysis should also not be related to terms like ‘help’ or ‘directing,’ which just hide the structural–systemic essence of catalytic processes. There is no need to create theoretical confusion with talk of ‘context,’ ‘condition,’ or ‘mediator.’ There are just systems that are situated among other systems which either are or are not characterized by qualities that come into a relationship with a given system. ‘Catalysis’ is a very useful concept here that helps us to understand the dynamics of systemic changes and refers to the fact that occasionally higher-order wholes can emerge only in a chain of systemic reorganizations where some elements need to be dissociated from other systems before their synthesis into some other system becomes possible.

## **What the Concept of Catalysis Can Offer to (Cultural) Psychology**

Now we can return to the beginning of this chapter. The question was whether the concept of catalytic causality can be useful for (cultural) psychology. I think the discussion above allows us to conclude that the answer is definitely yes, the concept can be very useful. Yet, as I also demonstrated, there are two different theories in the context of which the concept can be used. Structural–systemic causality theory, as I have tried to show, is a powerful metatheory in the context of which the concept of catalysis becomes productive. A discussion regarding the application of SSCT in psychology is also beyond the scope of this chapter. This epistemology has been used by several eminent scholars before, among them Vygotsky and Luria. Both of them were explicitly relying on the theory I call structural–systemic (see also Toomela [in press-a](#), [in press-b](#)). As far as I know, catalysis has not been explicitly applied in structural–systemic schools of psychology, yet, Valsiner and his followers have introduced a very valuable idea for developing SSCT.

The situation is more complicated when catalysis is used in the context of a metatheory that I have referred to as CCT. On one hand, in the context of the primitive efficient causality epistemology followed by the majority of psychologists today, the advancement is obvious and enormously important. It only supports the conclusion, achieved in other publications, that during the last 60 years mainstream psychology has produced almost nothing theoretically noteworthy (Toomela [2007a](#), [b](#), [2010c](#); Toomela and Valsiner [2010](#)). Obviously there is little hope for mainstream psychology to advance theoretically on the basis of primitive and out-of-date epistemology, as is clearly demonstrated by CCT.

On the other hand, however, I tried to demonstrate in this chapter that CCT is more confusing and less efficient than SSCT. In that perspective, I would suggest not to go further with CCT, as an alternative—SSCT—seems to be more useful.

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