Chapter 3
How Methodology Became a Toolbox—And How it Escapes from that Box

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How jelly gets inside a candy? There are three ways:
1. *Take a small ball of a caramel, cover it with a jelly, and turn inside out;*
2. *Take a small ball of a caramel, drill a hole into it, and fill the hole with a jelly; and*
3. *THE JELLY HAS ALWAYS BEEN THERE*

The understanding that research methodology comprises an essential part of scientific theories about phenomena that are studied is not always brought into the center of theoretical reasoning. The inevitable connection of methodology and statements about the nature of the phenomenon studied becomes obvious when we ask for the proofs of theoretical statements about the phenomenon that a theory should explain. The only scientific way to give the proofs for a theory requires description of the research methodology—who was studied with what assessment methods and which was the exact procedure of data collection. If the analysis of the research methodology reveals questionable procedures or implicit restrictive theoretically not justified assumptions, all theory based on such a methodology must be questioned as well.

Methodological Status of the Modern Mainstream Psychology

Anokhin—a Russian neurophysiologist and the founder of the functional systems theory, characterized the situation in the field of studies of the conditioned reflex in early 1960s as follows:

> Extraordinarily complicating circumstance for the development of a scientific school is the situation where all different kinds of hypotheses, proven, plausible, and even questionable, suddenly acquire the meaning of unbreakable dogmas, absolutely reliable truths. History of science shows that from this moment on usually the progress of scientific research is

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> inhibited, search for new ways is disrupted, growth into extension begins, endless duplication and variation of unimportant experiments without clear signs of generalizations and movement ahead emerges. (Anokhin, 1978b, pp. 154–155, my translation).

Modern mainstream psychology fits this description too well. In the methodological perspective, modern mainstream psychology relies heavily on unproven hypotheses and assumptions. For instance, modern mainstream personality research is based on non-representative samples of undergraduates or participants with exceptionally high level of education (Endler & Speer, 1998; Mallon, Kingsley, Affleck, & Tennen, 1998). It would not be a problem if the theories built on studies of such restricted samples would be constrained to highly educated persons. In modern personality studies, however, it is assumed that findings from restricted samples can be extended to all adults. This extension would be, of course, theoretically possible. But without direct empirical proof for such extension the status of personality theories remains questionable. In fact, personality structure revealed by common to modern mainstream psychology factor analytic methods in persons with low level of education does not correspond to that obtained in studies of highly educated persons (Toomela, 2003c).

This kind of example, however, scratches only the surface of the fundamental problems inherent to modern mainstream psychology. The basic way of thinking does not need to change in order to extend studies to unrepresented groups of humans. Modern mainstream psychology, however, relies on fundamental unproven assumptions that even have not turned into hypotheses but accepted without questioning. One of such assumptions, for instance, is related to the interpretation of data. It is simply *assumed* that all kinds of statistical data analysis methods based on covariation of variables can be used for understanding mental phenomena. Closer analysis of the question whether statistical data analysis can provide theoretically meaningful interpretation of collected data and lead to understanding of studied mental phenomena leads to unwanted conclusion: statistical data analysis methods used in modern mainstream psychology are not suitable for the development of the theory of mental processes (Toomela, 2008b). This fact—maybe controversial at the moment, but absolutely necessary to analyze before continuing with this pervasive today way of studies—would already be sufficient to declare that last 60 years of mainstream psychology have gone astray and majority of studies conducted during this period of time should simply be forgotten as useless for the development of psychology.

This conclusion can be supported by a long list of fundamental theoretical problems, each of them alone sufficient to reach the same conclusion—modern mainstream psychology is founded on erroneous principles. Modern mainstream psychology fails in 11 ways:

1. it is more concerned with isolated facts than with the development of a general theory;
2. focuses mostly on quantitative data;
3. ignores the fact that externally the same environment can psychologically be very different and not only external but also psychological environment must be “controlled” in the studies;

4. studies isolated fragments and ignores the role of a whole where the fragments naturally belong;
5. ignores single cases which do not conform to statistical generalizations based on groups;
6. relies on the analysis of variables and ignores the problem that variables encode information about behavior that may rely on psychologically very different mechanisms;
7. erroneously assumes that lack of covariation between variables is evidence for the lack of causal relationships between phenomena characterized by variables;
8. erroneously assumes that individual mind can be understood by generalizations made over groups of studied persons;
9. studies phenomena without defining the object of studies;
10. "explains" psychical events with past events, such as genes or evolution, without understanding that past can materially have no effect on the present; and
11. ignores dynamic and emergent properties of mind (see for detailed analyses of these issues, in addition to references below, Toomela, 2000a, 2008a,c).

Basic Questions to New Methodology

Theories about studied phenomena change together with accumulation of knowledge. Therefore, methodology as part of theories must also change. When new aspects of studied phenomena are revealed, it must be asked whether the methodology commonly used corresponds to new theories. The questions that need to be answered are fundamental. Instead of asking whether personality structure as revealed by factor analysis comprises five or some other number of factors, for instance, it must be asked, whether factor analysis based on inter-individual variation is appropriate at all for understanding personality structure. If the answer to that question turns out to be *no* (the answer to that question is no, indeed, cf. Molenaar, 2004; Molenaar & Valsiner, 2005; Toomela, 2008b, 2009b), then entirely different research methodology must be developed.

The new methodology should be built on explication of fundamental assumptions that underlie methodology, as much as possible at the current level of science development. In this book specifically the methodology for studying the dynamic processes is discussed from various perspectives. In order to build theoretically justified dynamic methodology, some important issues must be thoroughly understood before it becomes possible to delineate the main characteristics of the methodology.

The first question to be asked is whether actually the methodology for studying mental and social processes should be dynamic at all. Theoretically it is entirely possible that for understanding phenomena, even if the phenomena themselves are dynamic, there is no need explicitly addressing of dynamics at all. Perhaps it is possible to understand mental and social processes by using some static theoretical constructs alone?

Second question follows from the answer to the first question. If there are theoretical reasons to accept dynamic methodology then what is understood by the term 'dynamic' must be clearly defined. Always when there is more than one definition available for the same scientific notion it should be made clear which of the several available definitions is used in the particular theory that incorporates this notion. Otherwise the situation becomes incomprehensible; different scholars use the same name for studying qualitatively different phenomena and, naturally, end up with incompatible interpretations of the studied phenomena. Modern studies of culture, for instance, comprise one such field of psychology where many researchers conduct studies in different countries and assume that such cross-country psychology (Toomela, 2003a) can reveal something about culture. Other researchers, in turn, may study culture as a special kind of an environment that can be different for different persons living in the same country. At the same time, there can be important similarities between certain groups of persons living in different countries; such groups—University students, for example—may be culturally 'strangers' in their own country (Marsella, Dubanoski, Hamada, & Morse, 2000; Poortinga & van Hemert, 2001). Cross-country psychology cannot be incorporated into cultural theories where culture is assumed to vary inside a country.

These two questions are addressed in this chapter before delineating the requirements for the dynamic methodology. The approach taken here may look surprising: instead of building entirely new understanding it is assumed here that many answers to these fundamentally important questions can be found not in the future but in the past of psychology. There are strong reasons, however, to suggest that the pre-World-War II Continental-European psychology was theoretically substantially richer than the modern mainstream psychology (Toomela, 2007a, 2007b, 2009a, in press).

Do Social and Behavioral Sciences Really Need a Dynamic Methodology?

Human actions—as actions—are dynamic already by definition. It does not necessary follow, however, that methodology used for understanding these actions needs to aim directly at the dynamicity. Static explanation may still be possible. As with many other notions in psychology, the notions of causality, explanation, and understanding have been defined differently. Theoretical need for static or dynamic kind of explanation can directly be related to differences in understanding of causality.

Modern Mainstream Psychology and Linear Nondynamic Cause → Effect Thinking

Modern mainstream psychology follows a specific way to understand the notions of causality, explanation, and understanding. I analyzed the content of nine recent

randomly chosen Anglo-American textbooks of psychology (many of them were published several times, up to the 14th ed.). Most of the textbooks declared that the goal of psychology is to describe, understand and explain. Understanding and explaining needs description of causality. With no exception causality was understood in one and the same way: causality is only related to linear cause-and-effect relationships (Atkinson, Atkinson, Smith, Bem, & Nolen-Hoeksema, 1993; Bernstein, Roy, Srull, & Wickens, 1988; Carlson, Buskist, Martin, Hogg, & Abrams, 1997; Feldman, 1993; Gleitman, Fridlund, & Reisberg, 1999; Grusec, Lockhart, & Walters, 1990; Myers, 1995; Roediger, Capaldi, Paris, Polivy, & Herman, 1996; Smith et al., 2003). Such understanding is not limited to introductory textbooks. The same position can be found in professional-level general theoretical accounts of psychology (e.g., Bem & Looren de Jong, 1997; Lakoff & Johnson, 1999) as well as in works particularly dedicated to study of causality in psychology (e.g., Pearl, 2000; Sloman, 2005; Spirtes, Glymour, & Scheines, 2000). As I am going to demonstrate below, such a primitive view on causality hinders the development of the science of mind, psychology.

Cause-and-effect science does not need dynamic methodology at all. All explanations in such science are essentially static. If causality is understood as a linear relationship between a cause and an effect, then all the explanation searched for is reduced to identifying the causes. Event *A* is understood as a cause of another event *B*, if *A* is repeatedly observed before *B*, is contiguous to *B*, and seems to be necessarily related to the *B* (see for philosophical roots of this kind of thinking, Descartes, 1985a,b,c,d,e; Hume, 1999, 2000). Explanation essentially ends with identifying the probable causes. Cause itself in such understanding is static, dynamic aspect of causality is secondary; dynamicity is related only to the process in which cause causes an effect.

There are many constructs in the modern mainstream psychology that essentially are supposed to explain dynamics by static theoretical constructs, by linear efficient causes. Performance on intelligence tests, for example, is explained in the modern mainstream psychology by the static construct of intelligence which is supposed to be bigger or smaller in different individuals. Such quantitative differences are supposed to underlie individual differences in IQ test results (e.g., Mackintosh, 1998). In this context it is important that intelligence test performance always takes place in time and therefore is a dynamic process. Nevertheless, this dynamicity is not relevant for modern mainstream psychology because test performance emerges only as an effect of a static cause, intelligence. Personality is explained similarly in the modern mainstream psychology. According to the dominant today Five Factor Theory of personality, personality system is composed of biologically determined Basic Tendencies—Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness (Allik & McCrae, 2002; McCrae & Costa, 1996, 1999). These basic tendencies are essentially understood as causes of behavioral stability over time and situations. This kind of explanation, even though aimed at understanding human dynamic activities, is static. All dynamicity is explained by static constructs that act similarly over time and situations. This way of reasoning is fully justified in the linear cause → effect thinking because it is assumed that

there are always more effects than causes (cf. Descartes, 1985a,b,c,d,e). Therefore a few identified causes can lead to numerous effects; one personality dimension may cause similar behaviors in many different situations and over time.

Pre-WWII Continental-European Psychology and Dynamic Structuralist Thinking

There is a fundamental problem with the linear cause → effect thinking. The problem is that the explanations found are not satisfactory. If, for example, we know that a wristwatch was broken because it fell from the table, we would not be able to know whether and if yes, then how, the watch can be repaired. We would need to know something different about the watch—what parts in what relationships should be there in the working watch, and what parts and/or relationships between those parts were altered because of falling. This is another way to conceptualize causation, explanation, and understanding. Philosophical roots of this kind of thinking can be found in Aristotle, who distinguished in *Metaphysics* (Aristotle, 1941) not one but four complementary kinds of causes:

> All the causes […] fall under four senses […] some are cause as the *substratum* (e.g., the parts), others as the *essence* (the whole, the synthesis, and the form). The semen, the physician, the adviser, and in general the agent, are all *sources of change* or of rest. The remainder are causes as the *end* and the good of the other things; for that for the sake of which other things are tends to be the best and the end of the other things […] (p. 753).

Usually in modern philosophical literature these four causes are named *material cause*, *formal cause*, *efficient cause*, and *final cause*, respectively. Linear cause → effect thinking assumes that causality is fully covered by the efficient cause. Aristotelian way of thinking was adopted, in a modified version, by scholars in the pre-WWII psychology. The beginning of the modern psychology is usually associated with the first experimental psychology laboratory in psychology opened by Wilhelm Wundt in 1879 at the University of Leipzig, Germany. According to Wundt (1897), attributes of psychical causality can be discovered by studying Psychical Elements, Psychical Compounds, Interconnections of Psychical Compounds, and Psychical Developments. Only on the basis of knowledge from studying the mentioned aspects of mind, Psychical Causality and its Laws can be formulated: "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, emphasis in the original). So, dynamicity—Psychical Developments—was an essential part of explanation already in Wundt's thinking.

The view according to which mind can be understood as a hierarchically developing whole composed of distinguishable elements in specific relationships is called *structuralism* (Titchener, 1898, 1899). Structuralist position was taken by many eminent psychologists in the end of the 19th and the beginning of the 20th century, such as Kirkpatrick (1909), Koffka (1935), Köhler (1959), Külpe (1909), Ladd (1894), Sully (1892), Vygotsky (1994), Vygotsky and Luria (1994), Werner

(1948), and Wertheimer (1925). Thus, structural position was widespread and shared by many among the most eminent psychologists of the time. It might be mentioned that even though the basic principles were shared by many, there were some differences in emphasis. Gestalt psychologists, for example, emphasized the characteristics of the whole in their theory. Nevertheless, Gestalt psychology was essentially structural:

> In psychology we may go so far as to say that one of the main tasks of Gestalt psychology is that of indicating the genuine rather than fictitious parts of wholes (Köhler, 1959, p. 98).

Structuralist thinking that characterized especially pre-WWII Continental-European psychology, has been practically abandoned by the mainstream psychology since about 1950s. It is important to mention, that there seems to be no scientific reasons to replace structuralist thinking with oversimplified linear cause → effect thinking (cf. Toomela, 2007a). Actually on the contrary, it seems that most important discoveries made by eminent mainstream psychologists during last half of a century turn out to be rediscoveries of principles well known to Continental-European psychologists before the WWII (Toomela, in press). The only justified reason I have been able to find for accepting only cause → effect thinking was provided by David Hume. According to him, the reason why only this kind of knowledge should be searched for is human ignorance! He declared that it is simply impossible to know anything beyond direct sensory observation of relationships between objects in the world; there is no way to know anything about the essence of hidden from direct observation "causal powers" as he called them (Hume, 1999, 2000). This position is obviously contrary to the spirit of any scientific pursuit for understanding.

It is interesting that even Humean thinking may lead to the study of dynamicity. In his era time was understood by many as composed of independent sequential particles. Following from this idea Hume (2000) wrote in 1740:

> 'Tis evident, that time or duration consists of different parts: For otherwise we cou'd not conceive a longer or shorter duration. 'Tis also evident, that these parts are not co-existent: For that quality of the co-existence of parts belongs to extension, and is what distinguishes it from duration. Now as time is compos'd of parts, that are not co-existent; an unchangeable object, since it produces none but co-existent impressions, produces none that can give us the idea of time; and consequently that idea must be deriv'd from a succession of changeable objects, and time in its first appearance can never be sever'd from such a succession (p. 29).

So, Hume clearly distinguished between static and dynamic aspects of the world. More importantly, he also suggested that dynamic world—that takes place in successive time—is related to *change* of objects in the world. Hume did not deny that world beyond sensory perception is complex; he acknowledged repeatedly that externally similar event can be based on hidden from direct observation different processes. He only denied the possibility that humans are ever able to understand these hidden powers. Structuralist thinking is an attempt to conceptualize the hidden from direct observation processes. Modern science is full of examples how phenomena in the world are explained structurally—phenomena are understood as qualitatively novel wholes that are composed of distinguishable (not separable!) elements in specific relationships. Often this way of thinking is also called systemic (von Bertalanffy,

1968). Physical objects are understood as wholes composed of atoms which, in turn, are built from subatomic particles; genetic processes are understood with the help of the theory of a gene; human body is understood as a system of interacting organs; all chemistry is structuralist to the roots. Modern medicine is based on structuralist-systemic thinking as well (Toomela, 2005). At the most basic level, psychology should not be different from other sciences because all sciences, including psychology, search for understanding and explaining the world beyond senses. There is no scientific reason to assume that psychology should be constrained to efficient causal thinking when in all other sciences structuralist-systemic conceptualization of causation, understanding, and explanation has been remarkably efficient. Analysis of the pre-WWII psychology also demonstrates that structuralist psychology was theoretically much ahead of the modern mainstream psychology (Toomela, 2007a, 2007b, 2009a, in press).

Where is Dynamics in Structuralist-Systemic Explanation?

Structuralist explanations may, superficially, seem static because structuralist position holds that no explanation can be sufficient without description of the structure of the studied phenomena—what are the elements and in which relationship that comprise the whole. This part of explanation is necessary indeed, because there is no way to conceptualize a process without description of a structure.

I am aware that many modern psychologist would suggest that they are studying processes and it is wrong to talk about static structures at all (e.g., Smith & Thelen, 1993; Thelen, 1995; Thelen & Smith, 1994). But let us try for a moment to construct an understanding of a process without using any concept that would refer to a structure; all concepts that would refer to distinguishable parts of the world would not be allowed in that case. What if we would like to try to understand sensory processes, vision, for instance? We know that a process of light-wave … no, can we talk about light-wave because light seems to be corpuscular and field phenomenon at the same time? … but OK, light is a field phenomenon and therefore maybe (I would not be so sure about that) a pure process, and we can begin in this way … we know that a light-wave that enters the eye … no, *eye* is not allowed as an element of the biological organism, no eye, therefore … a process of light-wave interacts with the biological (is *biological* actually allowed because it implies biological organisms?) electrochemical (maybe *chemical* is also not allowed because chemistry is structural science?) processes; in the process of interaction of these two processes a process of sensation emerges; first interaction between simple processes … no, *simple* is a dangerous term because we need criteria for distinguishing between simple and complex; how to do that without structural language, I am not aware of … so … first interactions between earlier processes take place; and then later these earlier processes interact with later processes that are also biological electrochemical processes; in these biological electrochemical processes psychological processes emerge, etc. Looks nonsense to me. Summing up, there seems to be no

way to explain processes without using any concept that would refer to some structure. The opposite, however, is entirely acceptable—structures can be described without mentioning processes. Therefore, structural thinking is essential part of any understanding.

There are some principles fundamentally important that explain why we need to describe structure in explanation of a dynamic phenomenon. First, structure constrains processes; not every process is possible with the particular structure. There is no way to make a stone alive without completely changing its structure, without making it a not-stone; there is also no way for a human anencephalic person to become conscious about oneself. The world is full of such structural constraints on processes. Therefore processes cannot be understood without describing structural limitations to them.

Second, pure process theory is completely unable to explain any change; we can name different processes, but explanation requires more. This 'more', again, comes with structural description. In structuralist theory, change can be related to one of two kinds: Either an element is included or excluded from the existing structure or the relationships between the same elements change. A wristwatch can contain all and only necessary parts, but if these parts are in wrong relationships, the watch will not show time. So, in structural theory change can be understood only as a change in structure; even more, the only (structuralist, not primitive efficient) cause for a change is related to temporal, successive change of elements of a structure and/or relationships between structural elements. Watch would never brake if there would be neither changing relationships between elements of it nor changing relationships between a watch as a whole with the surrounding environment.

Taken together, structuralist position holds that there is no understanding possible without describing static in a certain time-period structure. Structural theory, nevertheless, also explains why and in which sense structural theory must inevitably be dynamic. The reason is that properties of elements change when they enter into a hierarchically higher level whole (Koffka, 1935; Köhler, 1959; Vygotsky, 1982b, 1994; see also Toomela, 1996). Without clothes, humans would not survive long in Nordic winter. The same human is not the same after putting clothes on. The clothes are not the same too any more; socks start to move together with a hat, for instance, when they are both on the person. Here lies the reason why structural theory must be dynamic: the elements of a structure must be described before they enter the structure; otherwise we are not able to distinguish what properties characterize an element as such and what properties of an element emerge because the element is already included into the whole. In other words, coherently structural theory must be developmental; elements should be observed before they enter the whole, in the process when they enter the whole, and when they already are in the new whole.

Before going further, two more dynamic structural concepts needs to be introduced. First, in psychology it has been discovered a long time ago that externally similar behaviors may rely on different directly unobservable psychic processes and externally different behaviors may stem from the same underlying process (e.g., James, 1950; Koffka, 1935; Lewin, 1935; Toomela, 2008b; Vygotsky, 1996; Vygotsky & Luria, 1994; Werner, 1948). In structural terms it means that different

mental structures may underlie externally similar behaviors (e.g., Luria, 1969, 1973). So, the next aspect of structural dynamics is related to development—the particular composition of structures that underlie externally similar processes can change in phylogenesis as well as in ontogenesis. We need to agree with Hume that the only way to acquire any knowledge about world is through senses, through observing processes of the world. The major difficulty emerges when we need to reveal a composition of more than one hidden from direct observation structure if these different structures underlie externally similar processes. A scientist actually has a more fundamental difficulty; first it is necessary to discover at all that externally similar processes are based on internally different structures. So dynamic methodology needs to face this difficulty as well.

And second, mental and corresponding behavioral processes evolve in time. Therefore particular composition of mental and behavioral structures active at any given moment change in real time. This rule of functioning characterizes both non-human (e.g., Anokhin, 1975, 1978a) and human (e.g., Luria, 1969, 1973) mental and behavioral acts.

How to Conceptualize Dynamics?

Linear Efficient Causal Approach to Dynamics

Different views to causality and explanation that can be identified in psychology—linear efficient cause and structural—imply different views on how to understand what are dynamics, change, and development. Modern psychology warded off the developmental perspective from its theoretical core, questions are asked about being (ontology) of psychological phenomena but not about their becoming (Valsiner, 2003). This characteristic of the modern mainstream psychology can be understood as resulting from the oversimplified efficient causal thinking. In efficient cause thinking all the explanation and understanding becomes reduced to identification of causes. This kind of explanation itself, as was already shown by Hume (2000), is static:

> The relation of cause and effect [… …] *The objects it presents are fixt and unalterable*. The impressions of the memory never change in any considerable degree; and each impression draws along with it a precise idea, which takes its place in the imagination, as something *solid and real, certain and invariable*. (p. 76, my emphasis).

This way of thinking is essentially static because time dimension is excluded from the explanation. Causes are assumed to precede effects, including the effect being an emergence of novelty; if explanation is constrained to description of causes then there is no question how exactly cause leads to an effect, the process of the emergence of the effect is irrelevant to a theory. All dynamic questions are in this way excluded from the theories.

Observations of changes in the studied phenomena cannot always be understood by simply identifying causes. Apparently the hardest situation to cope with in this

respect is met by psychologists who are supposed to study development. Efficient causal thinking can accept one kind of change, which is quantitative change. Novelty is always explained by the effect of some static 'causal powers' to use a Humean term; in situations when such explanation turns out to be insufficient it is simply stated that all the change is related to quantitative growth. This kind of explanation replaced, for instance, structural stage theories with theories of quantitative growth around 1970s (see on different conceptualization of developmental stages, Toomela, 2000c).

To further support the link between efficient causal thinking and non-developmental nature of theories based on such thinking another interesting phenomenon in the history of psychology is relevant. Before the WWII, theory of brain and brain-mind relationships was in the periphery of psychology. This issue was discussed, of course, but as a separate question the answer to which would not change fundamentally theories of mind of that time (cf. e.g., Koffka, 1935; Köhler, 1940, 1959). In modern mainstream psychology the studies of brain and brain-mind relationships became increasingly important. It seems more and more that the only really "scientific" psychology in modern times is biological psychology. Nowadays, the majority of the most cited psychologist are either in the field of neuropsychology or genetics (cf. Toomela, 2007b) This increasing emphasis on "biological bases" of psychological processes is a natural consequence of efficient causal thinking. On the one hand, causes are material, they need to exist somewhere. On the other hand, emergence of novelty must be reduced to some cause that preceded the effect in time. These two propositions lead to the search for the place where causes are present before the phenomenon is observed. And what does exist before the phenomenon of mind is biological body, and nervous system as part of the body directly connectible to psychological processes. Therefore the brain must be the ultimate cause of all mental processes. There is no need to answer the question how exactly brain became able to be a cause of mind; it is sufficient to attribute this potential to some never explicated process that took place somewhere earlier in time, in evolution. So, essentially, modern mainstream psychology based on efficient causal thinking is forced to believe that, for every individual, the causes of mental processes have always been there, in the brain. And the psychology becomes reduced to finding these ultimate causes in the brain or in hereditary mechanisms that determine the properties of the brain. Modern Five Factor Theory, for instance, "explains" personality exactly in this way (Allik & McCrae, 2002; McCrae & Costa, 1996, 1999). This illuminating for efficient causality thinking explanation is not an explanation for structuralist thinking at all; on the contrary, such identified connection between a cause and an effect needs an explanation itself.

Other Approaches to Dynamics

As the motto of this chapter shows, this kind of belief is not the only way to explain phenomena around us. The jelly, indeed, may always have been in the candy, and the personality dimensions or intelligence may always have been in the individual's

brain or genes, but there are other possibilities of explanation as well. For psychology, these other possibilities are based on the idea of dynamics, change and emergence of novel phenomena. Structural psychology would explain emergence by introduction of new elements to the system and/or change of relationships between existing already in the system elements. Modern stage theories of development, for example, do not assume that all developmental change is related to quantitative growth; rather, development is related to differentiation and reintegration of the differentiated elements of the developing mind (e.g., Case, 1992; Fischer & Bidell, 1998; Toomela, 2003b). It is noteworthy in this context, that these modern theories all have their roots in pre-WWII Continental-European psychology, particularly in Piagetian and/or Vygotskian thinking.

In this context it would be inappropriate not to mention one increasingly popular today approach to the study of mind, dynamic systems approach. Dynamic systems approach tries to explicitly to address the issues of dynamics in different processes. Closer analysis of dynamic systems approach, however, reveals fundamental theoretical problems related to it (cf. e.g., Smith & Thelen, 1993; Thelen, 1995; Thelen & Smith, 1994; and Chapters 26, 27 in this book). Detailed analysis of these problems is beyond the scope of this chapter. Nevertheless, three questionable practices of that approach that first come to mind can be mentioned:

1. dynamic systems approach studies processes and sometimes implicitly, sometimes explicitly, denies the need for studying structural bases of the processes. I already described above, why nonstructural process-oriented approaches are misleading.
2. dynamic systems approach is mostly based on statistical analysis of variables. This approach is theoretically misleading too (Toomela, 2008b).
3. dynamic systems approach acknowledges the idea that changes observed in studied phenomena can be non-linear. But there is more than one kind of non-linear dynamics. Dynamic systems approach usually acknowledges only continuous changes whereas structural approach would mostly characterize many changes as discontinuous. So, for a dynamic systems approach it is entirely legitimate to talk about the size of some influence For instance, in dynamic systems approach there can be "small" influences related to "big" changes. Qualitative changes, however, are qualitative, small or big are quantitative characteristics which may lack any qualitative interpretation altogether. Non-continuous qualitative changes, that characterize structural reorganizations, are as a rule ignored by dynamic systems approach. According to structuralist theory, together with abandoning the notion of non-continuous qualitative change, understanding of emergence, birth of novelty would be abandoned too.

In addition to these problems, there seem to be others. For instance, several fundamental concepts of the dynamic systems approach, such as 'attractor' or 'self-organization' are too vaguely defined for understanding real world phenomena even if the definitions of these concepts are clear mathematically. Also, dynamic systems approach does not define the notion of 'process' clearly enough. In this approach processes can be assumed to be causes; for instance, Chapter 26 in this book suggest

that "Individual differences in cortical architecture are neither due to genetic nor to environmental influences, but are caused by nonlinear developmental processes." Ontological status of 'process' should be made clear here. For a structural approach process or a change cannot be a cause of anything, rather, process is characteristic of a structure changing in time.

Taken together, I believe dynamic systems approach that has aimed to explain developmental processes, dynamics, is not able to reach this aim. There are too many fundamental questions related to this approach that need to be answered before the power of it could be demonstrated.

Efficient Causality Epistemology and its Research Methodology

Toolbox Methodology of Research in Modern Mainstream Psychology

Modern mainstream psychology mainly searches for explanation and understanding in the framework of efficient causality; identification of causes of psychological events is its main aim. As mentioned above, event *A* is understood as a cause of another event *B*, if *A* is repeatedly observed before *B*, is contiguous to *B*, and seems to be necessarily related to the *B*. In efficient causality thinking, it is implicitly today and explicitly in the philosophical roots of this kind of thinking (cf. Hume, 1999, 2000), accepted that it is impossible to understand the real causal powers hidden from direct observation; the only basis for discovering causal relationships is repeated observation of relationships between two contiguous events, one, a cause, preceding the other, the effect.

I am aware that modern mainstream psychologists would disagree with this statement; they would claim that their aim is explanation that goes beyond identification of causes. In majority of cases—and it is majority that determines the mainstream—this is not true. If we analyze theories modern mainstream psychology proposes, we discover in most instances that the psychological phenomena are eventually explained by the presence of some construct, such as intelligence, dimensions of personality, values, attitudes, etc., that are not further explained by themselves. If further explanation is searched for, then they are searched in phenomena that causally (only efficient causality is covered with this notion here) precede the explaining construct. So, intelligence and personality dimensions are explained by genes which, in turn, are explained by evolution. Values and attitudes are often explained similarly, but the "causes" are found in the environment, in social relationships and culture.

Limited efficient causality epistemology of research is directly related to very limited understanding of research methodology. Differently from other sciences, in modern psychology it is assumed that one and the same kind of methodology can be applied to all studied phenomena independently of the nature of what is studied.

This methodology is quantitative; statistical data analysis becomes almost the only acceptable research tool. All study procedures are constructed and data are collected in the way that allows the data to be analyzed statistically. What is searched for in such statistical analyses follows naturally from efficient causality epistemology: covariation of events. For this epistemology identification of covariation between events encoded in variables is the main aim, causes are identified on the basis of it.

Accumulation of observations forces the researchers to the conclusion that simple linear cause-effect explanation is sometimes too clearly in contradiction with the observations. Instead of looking for other kinds of research methodology, the same methodology is developed further. So simple pairwise correlation became insufficient and correlational procedures were and are developed further. Now we have not only relatively simple Multiple Regression, Canonical Correlation, and Factor Analysis procedures but also increasingly complex methods of Structural Equation Modeling and several other sophisticated methods to discover or to "confirm" complex patterns of covariations. Different statistical techniques for comparison of group means are essentially identical to correlational procedures; in comparison of group means covariation between group membership and other variables is searched for.

Research in this efficient causality epistemological frame becomes methodologically independent of the phenomena studied. All what is needed to know for conducting research is a collection of statistical data analysis procedures and a list of ways how to create variables that can be analyzed in this way. Modern mainstream psychology ignores the facts that clearly show the inadequacy of the toolbox methodology, the methodology which basically ignores the characteristics of the phenomena studied.

For instance, modern understanding of test validity is based on numerous statistical procedures for discovering covariations between test items or between a test and some other criterion test. The fundamental question is, is this approach appropriate for psychology? Asking this question gives an unwanted answer: the only question about validity is whether a measurement tool measures what it is intended to measure or not; and correlational procedures are not adequate for studying validity (Borsboom, Mellenbergh, & van Heerden, 2004).

Another, more general question to be asked is whether information encoded in variables can in principle allow unambiguous interpretation of them through statistical data analysis. Answering this question leads to the need for a new kind of methodology because the analysis of the ontology and epistemology of a variable shows that variables used in psychology cannot be interpreted unambiguously. Therefore no statistical procedure, that operates with ambiguously defined variables—practically all modern quantitative psychology—turns out to be theoretically noninterpretable (Toomela, 2008b).

From yet another perspective, the question to be taken seriously by the modern mainstream psychology should be whether the modern way of interpreting data at the group level can be adequate for understanding individuals. Psyche, after all, is a phenomenon that exists at the level of an individual. Group level analyses turn out to be inadequate too (Molenaar, 2004; Molenaar & Valsiner, 2005; Toomela, 2009b).

Are There Reasons to Look for Future Methodology in the Past?

In the course of the development of a science it would be natural to discover again and again that new theories do not correspond to old methodologies and most fundamental questions need to be asked again and answered in novel ways. Human understanding develops and old understanding needs to be replaced by a new kind of understanding (Kuhn, 1970; Vygotsky, 1982a). Psychology seems to be in a curious situation where many necessary questions and answers should be searched for not in the future but in the past of the science, particularly in the pre-WWII Continental-European psychology. That older psychology was explicitly structural, dynamic-developmental, and—explicitly and in a theoretically justified way—rejected the oversimplified associationist psychology that was built on efficient causality epistemology. Roots of structural thinking that takes emergence, change and development to be the fundamental concepts for all theories, can be traced back at least to dialectical thinking of Hegel. For him, the first Notions of his scientific logic were *being* and *nothing* and *becoming*; the concept of emergence was central to his philosophy. He also required that theories should always be developmental:

> Thoroughness seems to require that the beginning, as the foundation on which everything is built, should be examined before anything else, in fact that we should not go any further until it has been firmly established and if, on the other hand, it is not, we should reject all that follows. (Hegel, 1969, p. 41).

Gestalt psychology took as one of its most important theoretical concepts the idea of wholeness: wholes have qualities that do not characterize its elements. In this kind of thinking not only linear but also non-linearly continuous explanations would be inadequate; what was necessary to understand was the emergence of entirely novel qualities, the explanations need to explain discontinuities. The explanations in Gestalt psychology contained structural ideas of elements, relationships between elements, and emergent hierarchically higher level wholes. Pre-WWII Austrian-German psychology was one of the centers of structuralist thinking (cf. Toomela, 2007a, 2009a; Watson, 1934). The other centre became Russian psychology, especially the cultural-historical school of psychology founded by Vygotsky and developed by Luria and others (Luria, 1969, 1979; Toomela, 1996, 2000b, 2003a; Vygotsky, 1982b, 1994; Vygotsky & Luria, 1994) and functional-systemic school of neurophysiology (Anokhin, 1975, 1978a).

In this context it becomes a question how and why psychology rejected the fruitful methodological and theoretical principles common to pre-WWII Continental-European psychology and restricted thinking to fundamentally limited efficient causality epistemology and corresponding statistical quantitative methodology. There seems to be no rational reason for that change to take place (Toomela, 2007a). Already more than a century ago, it was suggested, “it is clear that the theory that antecedence and consequence are the sole content of the idea of causation fails altogether to square with the facts of life and nature” (Carlile, 1895b, p. 224; see also Carlile, 1895a). Nevertheless, cause-and-effect science became dominant in psychology after the WWII. The space limits do not permit to analyze in this chapter the possible reasons

as to why more developed thinking was replaced with less developed thinking in psychology. It is worthy to mention, though, that modern mainstream psychology has been historically and geographically "blind" during last half of a century; most important "discoveries" of modern psychology turn out to be rediscoveries of what was known by earlier scholars (Toomela, in press). Therefore it is justified to ask whether history can be a source for methodological ideas that would be novel in the modern context. The aim of such historical approach, would not be a call for doing psychology in the old way but rather a call for understanding that not everything that is new is better than the old and not everything that disappeared in the history of psychology disappeared for rational reasons (Toomela, 2007b).

Characteristics of Structuralist Dynamic Methodology

The aims of the structuralist thinking are related to the understanding of structures; this understanding requires description of the elements of a structure, specific relationships between the elements, and qualities of the emergent whole. Elements, however, change in qualities when included into a higher order whole. Next, externally similar behaviors are often based on internally different mental structures, these structures change in phylogenesis and ontogenesis. Furthermore, mental processes and behaviors evolve in time; at different moments the same behavior and mental act underlying it, is also structurally different. Therefore structuralist methodology must be dynamic to the roots: it is necessary to study elements before the enter a whole; it is necessary to study the process in which the elements are organized into an emergent whole; and it is necessary to study the emergent whole itself. In other words, structuralist methodology must be developmental.

I even will not pretend that I am able to provide a full theoretical coverage of methodological issues necessary to understand for building a systematically dynamic-structural research methodology. The biggest challenge the science of psychology faces, I believe, is related to the structuralist understanding that psychologists are studying a whole, a whole of mind. It follows that study of every single aspect of mind must be conducted in the framework of understanding where exactly this studied aspect stands in the whole structure of mind. In other words, we need a unified theory of psychology; without such unified theory psychology cannot lead to understanding of mind in principle (Toomela, 2007c). So far, we do not have such theory.

Next, structuralist methodology is based on understanding that methodology is an essential part of the theories about phenomena. Contrary to current modern mainstream practice of using basically the same methodology for studying everything, we need a methodology that corresponds to the studied phenomena. Methodological and substantial parts of a theory interact: substance is constrained by methodology and methodology depends on our current level of understanding the substance. Last 60 years have been dedicated mostly to identification of efficient causes of mental phenomena; this knowledge is not very useful for understanding

the hidden from direct observation secret powers, if to use Humean terminology, themselves. Therefore, our understanding of substance of mind is too limited to allow full understanding the methodology we need.

Nevertheless, I believe there are some methodological principles that should be followed; all these principles, more or less directly, stem from structuralist epistemology of the pre-WWII Continental-European psychology. In this chapter I scratched only a tip of the iceberg of theoretical questions related to the issues of causality, explanation, and understanding—the issues that underlie all scientific enterprises. All methodological issues need also thorough theoretical justification that is not possible to provide in this chapter for two reasons. One is the simple reason of space limitations and the other is a simple limitation of the author's current ignorance level. Therefore I only provide a kind of cook-book recipe list of principles that I have discussed in more details elsewhere. I have no reasons to believe that this list includes all necessary elements. But equally I have reasons to believe that these principles are important to follow. Here is the list. The list is constructed so that every next principle is more and more concrete, specific to the study of psychology. It is also important that none of the principles should be isolated from others; all principles can be fully understood only in the context of the other principles in the list.

First, methodology of research must be theoretically justified at different levels of analysis. The most general level of analysis is related to the issues of the nature of causality, understanding, and explanation. Structural-dynamic methodology assumes that scientific explanation is a description of structure; that description includes the description of elements that comprise the whole, specific relationships between these elements, and the emergent properties of the whole.

Second, elements can be described only before they enter the structure, therefore the research methodology is developmental-dynamic. Elements must be studied before they enter the whole, in the process of synthesis of the whole, and in the emerged whole. (See for a discussion of these first two issues this chapter and in Toomela, 1996, 2000b,c, 2003a,b).

Third, following from the principles of the structuralist theory, an element is understood as part of a whole. Therefore understanding requires a unified theory, theory that explicates the characteristics of a whole (Toomela, 2007c; Vygotsky, 1982a).

Fourth, there can be no methodology adequate for studying everything. Particularly, quantitative-statistical variable-based methodology should be rejected as inappropriate for understanding mind. Sufficient reason for this rejection is structuralist understanding that similar wholes can be built from different elements and different wholes can be built from similar elements. In psychology it means that externally the same behaviors may rely on internally different psychological structures and different behaviors may emerge from the same psychological structures. Variables encode information about behaviors, not about psychological processes per se. Therefore variables used in psychology cannot be interpreted unambiguously; and no statistical data analysis procedure can reduce this ambiguity of variables (Toomela, 2008b). The methodology psychology needs, must be qualitative. This

qualitative methodology must be based on series of single-case studies (Toomela, 2009b) with tools and procedures that correspond to the phenomena studied.

Fifth, qualitative methodology needed, is different from modern understanding of qualitative research. Modern mainstream methodology in most cases rejects the need for interference with study situations; data are based only on direct or indirect observations. However, any observation without experiment or theoretically justified interference with the research situation is open to the fallacy of "subjectivity." Structural qualitative psychology must go beyond mere observation, to experiment or theoretically justified constraining of the study situation for the reason already mentioned—only behaviors can be observed, but behaviors externally similar may rely on internally different psychological structures and vice versa. Without constraining study situations it is not possible to distinguish between different psychological structures that manifest in similar behaviors (Toomela, 2009a,b).

Sixth, theory must contain only components which existence is proved; operational definition of entities with research tools used in studies is inadequate. This requirement is often not followed in modern theories. Instead, very often it can be suspected that explanatory constructs are abstractions with no explicated connection to existing elements of mental structures. We should be aware that research methodology in many cases can lead to construction of nonexistent in studied phenomena entities. Factor analysis on group data, for instance, can create prototypical abstractions that characterize no single individual studied (Toomela, 2008b). If we find in some theory constructs, such as conscientiousness in personality psychology, we need to ask whether conscientiousness really exists in every individual. And, of course, we need to define explicitly, what it means to have conscientiousness as an entity in mind. The other side of the same requirement would be to define, what it means *not to have* such and such an entity in the mind. If there is a true entity, then it must be possible to observe situations where the entity is not included in a whole. This definition must not be operational; structure of the measurement tool cannot be theoretical justification for the existence of an entity or element as it is assumed in modern personality or intelligence psychology.

Seventh, interaction between substance and methodological parts of theories implies that theoretical substance concepts must also be explicitly defined. This problem is especially serious in psychology where we find numerous qualitatively different definitions for a notion. Among them, emotion (Kleinginna & Kleinginna, 1981a), motivation (Kleinginna & Kleinginna, 1981b), culture (Kroeber & Kluckhohn, 1952), intelligence (Jensen, 1998), and personality (Allport, 1937) to mention just some of the common concepts used in modern psychology. If, for example, a cross-country psychologist (cf. Toomela, 2003a) believes that comparison of groups of individuals from different countries reveals something about culture then results of such studies cannot be meaningfully incorporated into cultural theories in which culture is understood as a kind of environment that can vary inside countries or even inside individuals. Without explicitly showing which of the numerous definitions and why underlies studies it is not possible to build appropriate research methodology (Toomela, 2009a).

Finally, methodology that looks for "proofs" for a theory mainly by increasing the number of observations is not acceptable. Support for a theory and theoretical

generalization comes not from blind replication of study results by increasing the number of participants of a study but through testing the explicated in theory qualitative predictions in multiple qualitatively different settings, in as diverse contexts as theoretically justified (Toomela, 2009b).

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