Chapter 6
Milieus of Creativity: The Role of Places, Environments, and Spatial Contexts

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Although some of the earliest case studies on famous scientists addressed the importance of parents, peer groups, teachers, and fortuitous events for creative persons (e.g., Candolle, 1873; Ellis, 1926; Ostwald, 1909), interactions with the environment did not figure in the first theoretical conceptions of creativity. Researchers claimed that creative persons are gifted with special innate talents and capacities that others lack and that creativity is a gift or innate talent that cannot be acquired or taught (see Boden, 2004, pp. 14–15). This concept eventually raised a number of questions. For example, why are highly creative individuals not evenly distributed over time and space? Why are certain cities and historical periods characterized by great creativity in the visual arts, music, and science, whereas others are not? Why are certain research departments or universities so successful at copiously producing outstanding creative scientists, whereas others are not? Why does the large majority of Nobel Prize winners stem from such a small share of universities? Reflecting growing interest in the social environment as a variable, these questions indicated a change in creativity research.

However, interest in *spatial* disparities of creativity and in the impact of spatial contexts, spatial settings and spatial relations on creativity did not evolve until the late twentieth century. One reason for such belatedness is that new, original, and valuable ideas and topics often encounter resistance because they usually threaten continuities and tradition and may destroy existing paradigms, power relations, and self-efficacy. Both ignorance and the highly valued preexisting knowledge of experts can block novel ideas and can lead merely to the production of tried and trusted correct answers (Cropley, 2006, p. 402).

Eventually, an ever greater number of scholars accepted that creativity is not an innate attribute of a single individual, no matter how intelligent and talented that person might be. It was recognized that creative ideas emerge and develop in complex, dynamic interaction between the creator and his or her environments (see, for example, Amabile, 1983a, 1988, 1996; Amabile et al., 1990, 1996; Csikszentmihalyi, 1988, 1999; Ericsson, 1996; Feldman et al., 1994; Gardner,

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1988, 1993a, b, 1995; Mayer, 1999; Mumford, 1995; Sternberg & Lubart, 1999). It was realized that creative ideas arise from a large set of well-developed skills and a rich body of domain-relevant knowledge that must be acquired through laborious apprenticeship (Simonton, 2000, p. 152). Creativity, in other words, therefore requires time and certain environmental conditions.

Second, viewing creativity from an interactional perspective accentuates the relevance of situational, contextual, and cultural determinants and various layers of existential dimensions. Place matters, because a stimulating environment and a talented individual must come together and interact before a creative process can occur (see Sternberg & Lubart, 1991). That process requires preparation through learning, gaining experience, and identifying and solving problems. It takes cognitive skills and results from complex and dynamic interaction between the actor and his or her surroundings. This individual potential for creativity has to be actualized and cultivated by the family, the school environment, role models, organizational structures, challenges, disciplinary cultures, and chance opportunities in professional careers. As this viewpoint suggests, interaction of this sort is not mechanistic. Creative, talented people are not just raised, trained, and embedded in particular milieus. In their careers they tend to be attracted to certain institutions and places where they can develop their abilities and ideas, have the occasions to interact with other knowledgeable agents, procure the necessary support, be inspired, tackle challenges, and command the necessary resources. "Complex problem solving implies the efficient interaction between a solver and the situational requirements of the task and involves a solver's cognitive, emotional, personal, and social abilities and knowledge" (Frensch & Funke, 1995, p. 18). In short, the interactional perspective posits that the social and material environment, with its ability to promote or hinder such development, is an important constituent of creativity.

A third reason for the turn to the spatiality of creativity is that early problem-finding and problem-solving depend on perceptual discernment and environmental sensitivity, that is, on "the ability to be aware of and to correctly identify events within one's environment" (Carlozzi et al., 1995, p. 366). A number of studies support the hypothesis that creative persons have a heightened perceptual awareness (Stamm, 1967, p. 93) and that they are likely to be more sensitive to environmental stimuli than are less creative individuals (Barron, 1969; Carlozzi et al., 1995, p. 371). Because of the great sensitivity, keen attention, and prior knowledge that creative individuals have, they perceive and identify upcoming problems and new trends and research questions earlier than others do.

The principal aim of this chapter is to show that the generation, evaluation, and adoption of creative ideas and products vary spatially and that the spatiality and spatial distribution of creative processes should not be ignored. With the study of creativity becoming increasingly multifaceted, my second aim is to explain why various lines of research and insights from multiple disciplines should be brought into a common framework. The purpose is to encourage the cross-fertilization of ideas and to avoid the trap of disciplinary (and dogmatic) insularity. My third concern is to discuss results and methodological problems of creativity research from a geographical perspective and to clarify misunderstandings that might

complicate transdisciplinary discourse between human geography and other social and behavioral sciences.

Definitions, Types, Domains, and Degrees of Creativity

Definitions of Creativity

The aspects of creativity, the scales and units of research, and the approaches that are of interest in the study of creativity differ from one group of scholars to the next. Be they philosophers, psychologists, historians, art critics, geographers, sociologists, economists, architects, urban planners, or scholars from some other discipline, they all bring their own questions, approaches, concepts, and methodologies to bear on the subject. This variety has a number of advantages, for it enables each field of inquiry to provide new insights not obtainable in the others. But it also entails problems and misunderstandings. With regard to indicators, theoretical concepts, and empirical methods, research on creative individuals diverges as much from the study of creative organizations as the latter does from inquiry into creative environments. The more the term *creativity* has acquired buzzword status in public debate (e.g. creative industries and creative class) and the more remote its use has become from what it is understood to mean in psychology, the greater the need has become to clarify the word. I do not intend to comment on each of the more than one hundred different definitions of creativity. Instead, I wish to discuss some problems of delimitation and specification.

Most definitions of creativity contain the key adjectives (or synonyms) that appear in the definition by Boden (2004): "creativity is the ability to come up with ideas or artifacts that are *new*, *surprising* and *valuable*" (p. 1; italics added). Creative people typically address topics that are unnoticed, underrated, or not understood by others. New, original, and valuable ideas or products are inevitably scarce in their initial stage (start-up period) and are therefore confined to a small proportion of people and places. As soon as a creative idea or product has been accepted by much of the population, as soon as it disseminates to a large number of places, it ceases to be considered novel or surprising. The definition of creativity therefore implies scarcity, which is the opposite of ubiquity.

Many authors, such as the psychologists Simonton (2000) and Funke (2000, p. 284), have argued that creativity is an all-pervasive phenomenon of human nature. All people constantly need and apply creativity to solve their everyday problems. However, creativity is a matter of degree, and its meaning shifts according to discipline and spatial scale. One should therefore distinguish between various types and fields of creativity. Boden (1994, pp. 76–77, 2004, p. 2), for instance, recommends drawing a line between psychological creativity and historical creativity. To her, psychological creativity involves coming up with a surprising, valuable idea that is new to the person to whom it occurs, regardless of how many other people have had that idea before. Historical creativity means that no one else has had the

idea or made the artifact before (as far as is known), that it has arisen for the first time in human history. Both types of creativity interact with their environment, and both can result from environmental stimuli, cues, or prompts. In this sense, a distinction between psychological and historical creativity or between everyday problem-solving and outstanding achievements is necessary in order to avoid misunderstandings.

Geographically speaking, it is an important fact that most definitions of creativity include a relation to a context, environment, organization, group, or field. Briskman (1980) claims that one of the most striking features about creative products "is their appropriateness, the 'internal connection' which exists between these products and the background against which they emerge" (p. 98). Stein (1953) suggests that "creative work is a novel work that is accepted as tenable or useful or satisfying by a group in some point in time" (p. 311). Oldham and Cummings (1996) define creative performance "as products, ideas, or procedures that satisfy two conditions: (1) they are novel or original and (2) they are potentially relevant for, or useful to, an organization" (p. 608).

In the field of management, Woodman, Sawyer, and Griffin (1993, p. 293) define creativity as the generation of a valuable, useful new product, service, idea, procedure, or process by individuals working together in a complex social system. According to Ford (1996) "creativity is a subjective judgment made by members of the field about the novelty and value of a product; it is not an inherent quality that can be measured independent of social-construction processes within a field" (p. 1115). He defines creativity "as a domain-specific, subjective judgment of the novelty and value of an outcome of a particular action" (p. 1115). Similarly, Shalley, Gilson, and Blum (2000, p. 215) stated that "creativity involves the production, conceptualization, or development of novel and useful ideas, processes, or procedures by an individual or by a group of individuals working together." According to D'Agostino (1984, pp. 88–102), true human creativity involves novelty, value, appropriateness to context, and unpredictability in terms of antecedent knowledge, available recipes, existing rules, and environmental stimuli. I note, however, that values are a result of evaluations and vary over time and space. Quality in itself has no meaning in the absence of a domain in which it is realized and a field by which it is judged (Gardner, 1995, p. 38).

A work or idea is not necessarily novel merely by being different from what preceded it. There must be some merit or value in being different. As the philosopher Hausman (1979) states, eccentricities lack the criterion of value. Briskman (1980) claims that one of the most striking features about creative products "is their appropriateness, the 'internal connection' which exists between these products and the background against which they emerge" (p. 98).

To avoid misunderstandings, creativity as a trait or input variable should be differentiated from creativity as a process and creativity as an achievement or output variable (see Wierenga & van Bruggen, 1998, p. 84). The psychologists True (1966, p. 34) and Klausmeier (1961, p. 4) distinguish between creative ability and creative capacity, with ability meaning the power to perform an act now and capacity referring to what the person might be able to do given maturation, education, and interaction with other people.

Categories of Problems and Modes of Thinking

When focusing on the interaction between perceived problem, problem-solver, and the environment or when differentiating between innovation and creativity, between creativity and intelligence, or between types and degrees of creativity, I find it helpful to categorize problems according to the modes of thinking they call for. The first distinction is between convergent and divergent thinking. Guilford (1967) considered convergent thought to be a logical process that leads to an exact solution. In contrast, divergent thought describes atypical conceptual associations, a change of perspective, a deviation from the mainstream, and a broadening of the horizon. Convergent thinking is oriented to one correct or conventional answer that is deemed best. It is tied to existing knowledge, it emphasizes logic and accuracy, and it leaves no room for ambiguity. Divergent thinking means thinking in different directions and searching for new paths. It involves the production of multiple or alternative answers from available information and requires unexpected combinations, links between remote associations, and transformations of information into unexpected forms (Cropley, 2006; Runco & Okuda, 1988). "Convergent thinking usually generates *orthodoxy*, whereas divergent thinking always generates *variability*" (Cropley, 2006, p. 392).

DeBono (1968) distinguishes between vertical and lateral thought processes. The vertical thinker, in solving a problem, digs a preexisting hole deeper; the lateral thinker digs a new hole. The work of the vertical thinker can be monitored by management more easily than the work of the lateral or creative thinker can. Creative thinkers are self-directed; it is almost impossible to wedge them into a uniform scheme, especially if it involves detailed supervision of all aspects of work (Suojanen & Brooke, 1971, p. 19).

Koestler (1964) discriminates between associative and bisociative thinking. Associative thinking is based on habit; set routines; adherence to rules, disciplinary paradigms, and boundaries; and the use of rationality and logic. Bisociative thinking is characterized by overlapping separate domains of thought, a lack of attention to existing rules and disciplinary boundaries, and an emphasis on imagery and intuition. According to Scott and Bruce (1994, p. 587), associative thinking represents the systematic problem-solving style working within established methods or procedures, whereas bisociate thinking stands for the intuitive problem-solving style. Similarly, the Gestaltists (K. Duncker, W. Köhler, and M. Wertheimer) discriminated between *productive* and *reproductive* thought (see Funke, 2000, p. 290). Reproductive thought describes cognitive processes that need only to be recalled in order to solve a problem or task. An example is the recalling of a mathematical operation, a physics equation, or a cooking recipe. Even if the cake has never before been baked and the equation never solved—that is, even if the result is new—the calculation method or the recipe is known. In the case of productive thought, the path to the solution must first be discovered or construed.

Another way of demarcating various categories of creativity is to discriminate between well-defined and ill-defined problems (Unsworth, 2001), open and closed problems (Jaušovec, 2000), and analytical and creative problems. A well-defined

problem is a means–end analysis, the most frequent process that humans use when they solve everyday problems. It is precisely what rational behavior or rational problem-solving is about. "The information necessary to solve a well-defined problem is usually specified precisely in the statement of the problem itself. In the case of ill-defined problems, it is often unclear what kind of information exactly is relevant to the problem at hand" (Jaušovec, 2000, p. 214). Means–end analysis is not suitable for studying open goals, dynamic evolution, or ill-defined problems. In an analytical problem, all necessary conditions are stated and only one solution is possible. A mathematical equation can be solved by logic alone. Success at solving it depends primarily on whether the solver is familiar with the logic and rules. A creative problem is one that is open to a variety of solutions. It takes flexibility, imagination, and interaction with the environment to solve that kind of problem. The artist or poet is not praised as creative for following rules known before producing his or her picture or poem but rather for bringing forth something that did not previously exist. The creative process in art, music, and many fields of basic research is open ended. Artists or scientists in basic research normally do not know from the beginning what they are about. If they knew completely where their work was heading, they could not be engaged in creative work (see Maitland, 1976, p. 397; Tomas, 1958, pp. 1–3).

In early studies, convergent thinking and divergent thinking were often presented as conflicting or competing processes. Convergent thinking was regarded as detrimental to creativity, and divergent thinking was almost equated with creativity. Opinion in this regard seems to have shifted somewhat, however. Cropley (2006) argues that a creative process requires a combination of divergent and convergent thinking. "Divergent thinking and convergent thinking seem to add something to each other or even to compensate for defects in each other" (p. 401). He suggests a distinction between generating novelty and evaluating novelty's risk. The generation of novelty stems mainly from divergent thinking. But the risks of introducing novelty have to be explored by convergent thinking and logic.

From a geographer's point of view, it seems important to distinguish between knowledge based on cases, that is, knowledge acquired in *places* (e.g., in the field, archives, museums, and laboratories) and knowledge based on rules and logic (mathematics). The former kind of knowledge depends more on interactions with the environment than the latter does.

Intelligence, Knowledge, Creativity, and Innovation: Their Interplay, Interrelationship, and Delimitation

High levels of intelligence or knowledge do not guarantee creativity. Intelligence and knowledge are necessary, but not sufficient, conditions for creativity. Intelligence and creativity are separate, albeit interdependent, variables (see Chapter 7 by Kaufman in this book; Sternberg & O'Hara, 1999). According to Shekerjian (1990), creativity is not the direct result of intelligence, talent, or skills. It comes

instead from having an open "beginner's mind," being curious, practicing divergent thinking, seeing relationships between apparently unrelated factors, drawing on intuition, and tolerating the "long dance of uncertainty" that precedes most breakthroughs (Saaty, 1998, p. 10). The interplay between creativity and intelligence varies according to the problems to be solved and the different phases of a creative process. Intelligence is needed for in-depth thinking and for the development of techniques to solve *defined* problems. Creativity is needed in order to conceive new ideas and new alternatives with which to solve problems. "To analyze problems in detail, we need intelligence. But we need creativity to synthesize and create structure to obtain higher level abstraction of problems" (Saaty, 1998, pp. 9–10). Robinson (1970) states that intelligence is not the initiator or driving force of creativity, that it becomes important only at a later stage, when the new ideas already produced by the mind must be critically evaluated and their implications worked out.

Couger (1995) shows that creativity and intelligence are only moderately related. They are strongly related up to an IQ of 120, after which point the relation disappears. In a relaxed and unconstrained environment, intelligence and creativity do not seem to be related (see also Saaty, 1998, p. 10). In other words, intelligence tests are not very useful in measuring potential for creativity. Another nonlinear relationship is that between knowledge and creativity. One must have knowledge to produce something new, but creativity goes beyond knowledge (Weisberg, 1999). "Knowledge may provide the basic elements, the building blocks out of which are constructed new ideas, but in order for these building blocks to be available, the mortar holding the old ideas together must not be too strong" (p. 226).

When a creative process enters the phase of elaboration and verification (see below, "Stages of the Creative Process"), then creativity joins the stage of innovation. Of course, it may be futile to draw a line between creativity and innovation when analyzing the spatial distribution of creative or innovative products on the spatial macroscale (e.g., patent intensity in provinces or nation-states). But the distinction should be made at least in microscale analysis and in theoretical discussions. Creativity is related to the generation of new and valuable ideas, whereas innovation is more about the *implementation* of those ideas. Most innovations begin with creative ideas, but many highly creative ideas are never implemented or adopted. Many creative individuals fail to act on their ideas because they lack the resources or interest to continue developing them. In many cases the innovator applying a creative idea did not generate it.

It is therefore hardly surprising that the skills, personal traits, organizational structures, and styles of leadership needed for creativity are not the same as those needed for innovativeness. Creativity is linked to an intuitive problem-solving style; innovation, more to a systematic problem-solving style. Successful innovation depends not only on creative ideas but also on the ability to attract venture capital, design new organizational processes, communicate the value of a new idea, persuade people, and "manage impressions" (Kasof, 1995; Magyari-Beck, 1998). In the innovative process, leaders have to set goals, manage attention, coordinate and control actions, raise capital, promote the cohesiveness of their team, and study the market. In the creative process, leaders have to arrange for incentives, supportive

environments, new interactions, and exchanges between knowledgeable people. They have to encourage the autonomy and self-esteem of the group members and their willingness to take risks.

Drawing on Amabile (1988) and Staw (1990), Oldham and Cummings (1996) apply these distinctions between creativity and innovation specifically to the realms of performance and organization: "Creative performance refers to products, ideas, and so forth produced at the individual level, whereas innovation refers to the successful implementation of these products at the organizational level" (Oldham & Cummings, 1996, p. 608). Woodman et al. (1993, p. 293) understand creativity as a subset of the broader domain of innovation. They characterize innovation as part of an even broader construct of organizational change. Organizational change can include innovations and creativity, but a good deal of organizational change takes place without innovation.

Categories and Domains of Creativity

To avoid misunderstandings, one should distinguish between various levels and forms of creativity. Many creative processes include some kind of problem-solving, but not all kinds of creativity can be reduced to problem-solving. In the performing arts, visual arts, music, and similar fields, creativity is expressed through performance, self-expression, or self-actualization. Finding and identifying new problems and raising new research questions may be much more creative than solving the problem itself is—and may contribute more to the advance of science (see Sadler & Green, 1977, p. 157).

Differentiating between open and closed problems (see Jaušovec, 2000), Unsworth (2001) proposes four categories of creativity: expected and proactive creativity for open problems and responsive and contributory creativity for closed problems (see Fig. 6.1). Responsive and expected creativity are externally driven; contributory creativity and proactive creativity are self-determined or driven by internal motivation. Responsive creativity can be planned and organized (e.g. the contributions of a think tank, or the Manhattan project). Expected and proactive creativity involve scanning, categorizing, and interpreting the environment to find a problem, evaluating a perceived situation, and then defining the problem in such a way that it can be solved (Unsworth, 2001, p. 294). Expected and responsive creativity have external drivers for engagement; proactive and contributory creativity have internal drivers.

Saaty (1998) distinguishes between deductive and inductive creativity. Deductive creativity is the ability "to face a new application instance to which we might bring to bear past knowledge of similar situations" (p. 10). Inductive creativity "looks at all that experience and attempts to induce from it a description of the larger system from which the problem instances flow" (p. 10). In Chapter 12 of this book, Boden distinguishes combinatorial, exploratory, and transformational. Abel (Chapter 4) suggests a distinction between strong and weak creativity. Most authors agree that a distinction between various types and levels of creativity is necessary.

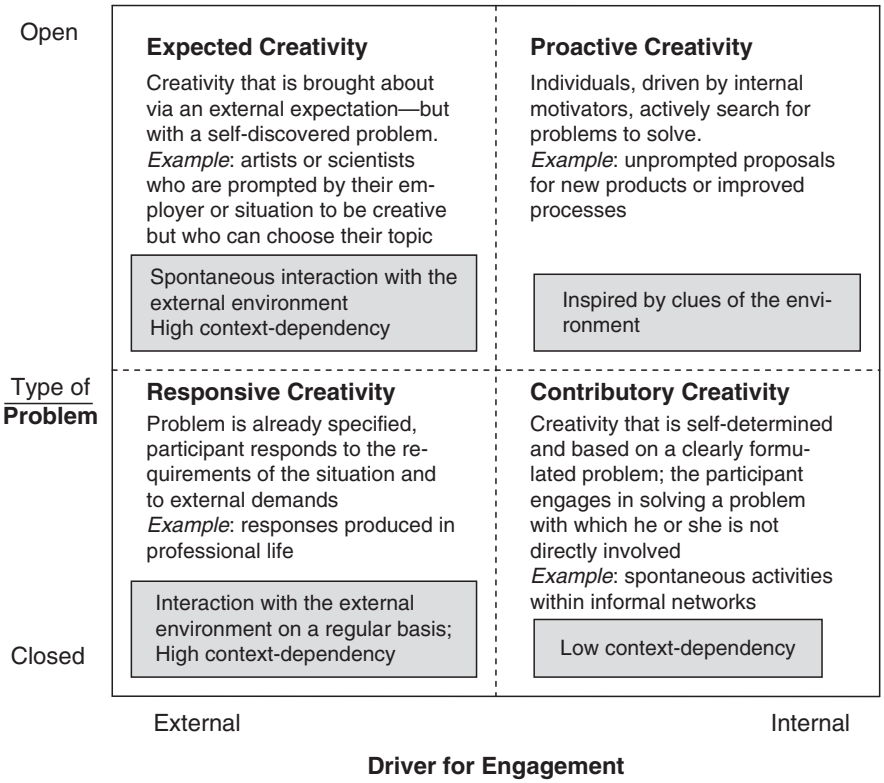

Fig. 6.1 Types of creativity (Unsworth, 2001, p. 291, modified by P. Meusburger)

Judgment of creativity needs a frame of reference. In science and the arts alike, certain rules, paradigms, conventions, expectations, and evaluation procedures develop and come to be regarded as binding in the relevant community, discipline or area, at least for a particular period of time (see Kroeber, 1944). Potential geniuses who cannot fit in or who are unwilling to abide by the given rules or conventions will be either doomed or frustrated. If they are successful, they might launch a new paradigm. Some authors use the term *domain* to refer to these knowledge and evaluation structures of discipline and control. Li and Gardner (1993) define "domain as bodies of disciplined knowledge that have been structured culturally and that can be acquired, practiced, and advanced through the act of creating. … A domain can be described as a unified structure that is rooted in culture" (p. 95). According to Csikszentmihalyi (1999, p. 314), an environment has "two salient aspects: a cultural, or symbolic aspect which here is called the domain; and a social aspect called the field. Creativity is a process that can be observed only at the intersection where individuals, domains, and fields interact" (p. 314). A domain consists of a set of rules; a field consists of persons working within the same domain.

Boden (2004) uses the term *conceptual space* instead of domain. She defines conceptual spaces as structured styles of thought (see also Chapter 12 in this book). Conceptual spaces include ways of writing, styles of painting, theories in science, fashions in couture or cooking, that is, any disciplined way of thinking that is familiar and valued by a certain social group. Li and Gardner (1993, pp. 96–97) explain their concept of domains by comparing Chinese and Western painting. The two domains differ in the way objects are represented and in the materials and media that are used. The differences between Chinese and Western paintings have little to do with personal choices or capabilities but with "choices imposed by the different painting domains in which the respective artists practice and create. … The chief distinguishing characteristics of the two domains impose unique constraints on the process of creativity" (Li & Gardner, 1993, p. 94). Similar rules exist in some scientific disciplines or research departments. They stipulate the approaches or methods that should be preferred and where good research should be published. The anticipatory obedience or self-censorship that such spatially divergent expectations induce in young researchers might favor their professional career but not necessarily their creativity.

As long as a product, scientific concept, or piece of art has not been validated by peers, experts, or users, it is not regarded as creative. These frames of reference or domains can comprise a few dozen experts or millions of supporters. The relevance and power of domains grows and shrinks in the course of time and varies in the spatial dimension. Many scientific disciplines and fields of art are fragmented into domains contradicting and opposing each other. Concepts that are highly respected within one domain (e.g., rational agent in neoclassical economics or constructivism in cultural studies) may be heavily criticized or even ridiculed in other domains. Kasimir Malevich's painting *Black Square* on a white ground is considered by some art critiques to be one of the most important artworks of the twentieth century. For them Malevich (1878–1935) is the legendary, radical, and influential representative of abstract modernism in Russia and the founder of Suprematism. However, the constructivists of Moscow and St. Petersburg (e.g., Vladimir Tatlin) fundamentally criticized the spiritual aspects of Suprematism. They represented a radically materialistic position and sponsored "production art," which emerged after the October Revolution. It would be an interesting challenge to map and interpret the development and diffusion of networks clinging to the one or other of these domains.

The Measurement of Creativity

I do not intend to elaborate on the numerous methods of measuring creativity (for details see Eysenck, 1994; Chapter 7 by Kaufman in this book). But because theories are influenced by empirical results and because empirical results are influenced by ways of measuring, some remarks on measurement seem necessary. Most authors probably agree that creativity is not reducible to mere quantitative scientific analysis. Some aspects of creativity are accessible only through qualitative methods.

At least four main approaches to ascertaining and studying creativity exist. The first one involves analyzing the biographies of creative persons or evaluating what eminent scientists or artists reveal about how they produced their creative work. This methodology has been in use since the mid-nineteenth century (Galton, 1869; Ostwald, 1909). Biographies include quantitative data (e.g., about creative output and age), qualitative data (e.g., narratives and reported emotions and frustrations of creative people), and interpretations of the meaning of relationships with other people. Many Nobel Prize winners, artists, and other thinkers have left diaries, letters, records, or autobiographies or have been interviewed about the steps of their creative process, the way in which they achieved their outstanding results, and the manner in which their environment supported or impeded their work. With the autobiography being primarily a self-interpretation and a means of self-creation (see Mayer, 1999, pp. 455–457; Vidal, 2003, p. 76), this procedure does not deliver objective results but rather evidence that "this is how those who are accepted as being creative say they work" (Westland, 1969, p. 128). Analysts of interactions and relations ask which teachers creative people have been predominantly influenced by, which interactions with other scientists creative people have profited from most, and which kind of field work triggered their new insights. Researchers can standardize and objectively score such self-reports by distributing personality inventories to the test persons (see Rees & Goldman, 1961).

The second main approach to creativity centers on the question of whether people who are regarded as creative in certain fields exhibit similar personality traits. Scientists using this approach design and apply tests to measure the creative potential of persons in order to predict their possible creativity. One kind of such creativity test measures performance from which creativity can be judged. Another kind assesses the creative personality. Both must grapple with two issues. The first is whether they identify creative ability and distinguish between intelligence and creativity or rather measure something else (e.g., originality) instead. The second issue is the fact that they focus on just one side of the interaction—the creative potential or disposition of a person—and more or less ignore the role of the environment.

The third approach is experimental and "uses cognitive task analysis to specify the component processes in creative thinking" (Mayer, 1999, p. 454). Its experiments are performed in controlled environments (artificial contexts). The purpose of this psychometric approach is to find out whether people generally produce a greater number of creative ideas under certain social, organizational, or environmental conditions than under others (for an overview see Plucker & Renzulli, 1999). By changing the procedure, situation, or information to which the participants are exposed in an experiment and by then comparing the responses of those persons, psychologists try to discover which environmental factors help or hinder creativity. A similar method is to evaluate the work environment or climate of organizations. The climate for creativity can be measured by several psychometrical instruments, such as KEYS, which is designed to provide reliable and valid assessments of factors in the work environment that are likely to influence innovation and the generation of creative ideas (Amabile, 1995; Amabile et al., 1996, p. 1155).

The fourth approach is preferably applied on the spatial meso- and macroscales. It aids investigations into the question of why certain time periods, places, cities, or contexts have produced more eminent creative artists and scientists or more creative products (as measured by the number of patents, scientific awards and inventions, for example) than others have (see Brix, 1993, 2003).

The question of whether researchers should tend to concentrate on creative persons, creative products, creative processes, or rather on preconditions for creativity touches not only on disciplinary traditions and scientific interests but also on the matter of data availability. Process models of creativity are not superior to outcome models. Both are needed, for they have complementary functions and fulfill different purposes.

Stages of the Creative Process

Creativity is not a sudden insight but a lengthy process. Since Wallas (1926) and Patrick (1937), it has been generally accepted that a creative process has four or more stages (Funke, 2000; Runco, 1993; Weisberg, 1999; see also Funke's Chapter 1 in this book). Insight is only one of them. Equally important are the stages of preparation; incubation; verification; and acceptance within an organization, discipline, or market. The classical model has four stages. Funke (2000) distinguishes between five stages. Cropley (2006) described six stages: preparation, incubation, illumination, verification, communication, and validation (p. 402). The following description follows Funke (2000, pp. 288–289, see chapter 1 in this book).

Stage 1: Preparation. The preparation phase includes problem-finding, information gathering, and formulation of preliminary ideas. It involves conscious work and draws on a person's education, analytical skills, and problem-relevant knowledge (Lubart, 2000–2001, p. 296). In order to be creative, a person has to have been involved in a specific problem or to have studied the foundations of a discipline and the works of his or her predecessors over a substantial period. The institutions and places of early learning and scientific or artistic socialization, fortuitous events in life, and path dependencies in the early career of a person can have a crucial influence on that individual's intellectual development and future creative processes.

Stage 2: Incubation. A number of authors (e.g., Dreistadt, 1969; Koestler, 1964; Miller, 2000; Niederland, 1967) have studied the importance of latent stages of creativity and have underlined the role of incubation. Incubation refers to the temporary abandonment of conscious, rational, problem-solving endeavors, which are often pursued when a person has reached an apparent dead end in his or her work. It often makes sense to temporarily set aside a problem for which a creative solution is being sought. Throughout phases of inactivity, the human brain evidently continues working. During this incubation stage, existing associative ideas diminish in the memory and are altered by new information from the environment that is superimposed.

Being unaware of the processes that take place during the incubation stage, the creative individual cannot actively influence them (Funke, 2000, p. 288). Mandler

(1992) has extensively studied processes in which solutions to a problem seem to appear suddenly after a period of incubation. Miller (2000) describes how information held in long-term memory can be processed in the unconscious and then find its way into conscious thought:

> Activation is maintained in the unconscious as the result of a previous intense conscious desire to solve the problem at hand. This activation can spread in the unconscious in ways that might not have been possible within the confines of conscious thought. (p. 337)
>
> Psychological tests indicate that people do not experience sudden illuminations without previous conscious or unconscious reasoning. (p. 332)

According to Westfall (1983, pp. 41–42) and Holmes (1986, p. 22), Newton's law of universal gravitation was not a sudden moment of insight but the result of incredibly intense concentration that Newton sustained over some 30 months.

Stage 3: Insight. During incubation, various psychological processes culminate in the moment of insight (Bloomberg, 1967, p. 130; Götz, 1981, p. 300). At a certain point in time, a recombined conceptual association penetrates the threshold of consciousness and delivers a moment of inspiration. Such an illumination occurs when the individual becomes aware of the creative moment, which follows the relevant preparation and subsequent incubation (Funke, 2000, p. 289).

Stage 4: Evaluation. The creative insight gained from the moment of inspiration must be evaluated for its usefulness or appropriateness by the creator and his or her audience. In the history of scientific discoveries, many new phenomena (e.g., those found by Copernicus, Kepler, Galileo, and Freud) were noticed long before they were accepted, but their significance was not realized by the relevant gatekeepers or audience (see Koestler, 1964; Symington, 1987). Kepler knew for 3 years that the planets did not move in perfect circles, but he would not believe it. Freud took up the earlier observations of Breuer, Charcot, and Chrobak, all of whom knew about the sexual aetiology of hysteria, but was less tenaciously attached to the medical manner of practice and was therefore able to countenance the bisociation of two matrices (Symington, 1987, p. 284). Because guidelines of domains or hegemonic science cultures and paradigms vary spatially, the same idea or product will be evaluated differently at various locations. If an evaluation takes place too early, many creative ideas will be killed by critics before they reach the stage of elaboration. At some places scientists have more freedom and time to develop and elaborate their ideas and experiments than in other areas.

Stage 5: Elaboration and verification. After an idea or work has been evaluated, factors such as the availability of resources (venture capital), alliances, public opinion, and power structures become significant in its verification and implementation. Individuals sense problems, develop ideas, present them to the group, learn from the group, work out issues in solitude, and then return to the group to keep modifying and enhancing their ideas (Drazin et al., 1999, p. 290). If the team embraces the creative idea, it has to be approved by the organization's decision-makers and then financed and transformed into a creative product. It is then up to the market to accept that product. Creative processes at the organizational level may emerge from a process of negotiating multiple and potentially competing interests both between different groups within an organization and with external institutions (Drazin et al., 1999).

Stages 1, 4, and 5 of this lengthy process are thought to be much more concatenated with environments, spatial contexts, and spatial relations than phases 2 and 3 are. But future contributions from perceptual psychology and brain research may show that incubation and insight are more influenced by environmental prompts than is presently known. Lubart (2000–2001) discusses some limitations of stage-based models of creative processes and suggests that these models need to be revised or replaced. He and others (e.g., Treffinger, 1995) suggest moving away from the idea of a fixed sequence of activities and toward three sets of processes—understanding the problem, generating ideas, and planning for action (see p. 300). These processes take place in all stages, and their sequence is not fixed.

Explaining Spatial Disparities of Creativity and Conceptualizing the Impact of Places, Environments, and Contexts on Creativity

From the Creative Personality to Multidimensional Models of Creativity

Since the early 1980s, an increasing number of authors have sought to explain creativity by introducing multidimensional models that include contexts and environments (Amabile, 1983a, b, 1988, 1996; Amabile et al., 1990, 1996; Clitheroe et al., 1998; Csikszentmihalyi, 1988, 1990; Ford, 1996; Hennessey & Amabile, 1988; Isaksen et al., 2000–2001; Oldham & Cummings, 1996; Shalley, 1995; Shalley et al., 2000; Woodman et al., 1993). They have dealt primarily with the question of how personal traits, group characteristics, work environments, organizational structures, cultures, and political conditions interact and how they thereby foster or inhibit creativity or innovative activities. The units of research, number of dimensions, and levels of aggregation taken into account by these models vary according to the research interests, disciplines, and methodologies in question.

Frensch and Funke (1995, p. 7) stated that a problem is defined not only by task features but also by the interaction between task requirement, environmental context, and the personal goals and traits of the person attempting to solve it. Scholars emphasizing task features rather than environment–solver interaction seem to take it for granted that persons do not typically differ in terms of their knowledge and absorptive capacity. These researchers therefore tend to believe that all actors perceive situations in a similar (rational) way. The interactionist approach suggests that the prior knowledge, expertise, experience, and "positionality"[1] of persons determine whether and how soon they are able to perceive a problem, risk,

[1] The term comes from gender studies and means that the position in a social system (gender, for example) influences the goals and perception of a person.

or opportunity and how they interpret and react to environmental prompts. Place, space, milieu, network, and spatial context become important as soon as the issue of interaction between person, organization, and environment is broached and as soon as existing models of creativity are expanded to include external influences and intraorganizational factors.

> A contextual approach to organizational creativity focuses on the prompts that initiate creative behaviour, including the role of prompts in suggesting appropriate goals and potential outcomes, and prompts as the basis for judgments about the creativeness of outcomes of the creative process. (Clitheroe et al., 1998, p. 108)

There is abundant empirical evidence of the close relationship between social environment and creativity. In one study, for example, projects rated high in creativity had significantly different work environments from those rated low in creativity (Amabile & Conti, 1999, p. 631). Much less is known about how an environment influences or triggers creative processes. Scholars disagree on how to conceptualize the term *environment*. Is an environment a social or a spatial phenomenon? Is an environment the sum of socioeconomic variables or a social macrophenomenon? What motives are there for including spatial concepts in creativity research?

One reason to turn to spatial contexts and environments as factors of creativity is that creativity research centering predominantly on isolated variables has come to very inconsistent or contradictory results. Some of these inconsistencies have resulted from taking individual variables out of context and from failing to take into account that correlations between variables differ in the spatial dimension from one context to the next. A second reason is that humans are highly contextual beings and that context-dependencies rather increase than diminish in highly specialized societies. On pages 122–126 I specify in more detail why working in the presence of others or moving from one environment to the other may affect the creativity of individuals and groups. Single variables or models ignoring spatial contexts apparently have less power to explain creativity than some spatial categories do. The various personal, organizational, material, cultural, and political factors affecting creativity interact, merge, and modify each other in specific places or areas and lead to spatially rooted macrophenomena called milieu, environment, action setting, context, or "knowledgescapes." According to Matthiesen (2006, 2007), knowledgescapes focus on the interplay of formal and informal interaction networks and milieus in knowledge-based spatial dynamics. Knowledgescapes are contextualized by different knowledge cultures and constituting distinctive knowledge-based forms of habitus of a specific city region. The knowledgescapes heuristics are focused on comparing particular and distinctive developmental pathways within knowledge-based city-regional developments.

Explaining how an environment or context can have an impact on creative processes makes it necessary to clarify concepts. In a book intended to bridge gaps between disciplines and address nongeographers, it does well to remember that geographers do not entirely agree on the exact definitions of the categories presented in the next section. Some authors use the terms *environment* and *spatial context* synonymously.

Spatial Categories and Their Possible Relations to Creativity

Spatial categories have various characteristics in common but differ from each other in several ways. All spatial categories have the capacity to facilitate or impede interactions. All spatial categories comprise institutions, infrastructure, resources, job opportunities, challenges, and risks. All categories can function as a projection screen of symbolic capital and are used in everyday, reductionist language to absorb the reputation of individuals and organizations working in that spatial unit.

Place. The smallest spatial category is the location (site or spot) where a person performs an activity, faces a challenge, or perceives stimuli and clues. Locations are transformed to culturally determined places by a process that Graumann (1996, 2002) calls appropriation (*Aneignung*). Appropriation literally means making something one's own and taking it for one's own use. (Fischer-Kowalski & Erb, 2003, use the term *colonization* instead of appropriation.) Appropriation of space occurs:

> by marking, naming, defining, categorizing, and evaluating space as appropriate or inappropriate, owned or free, by signs, words, rules, regulations, and laws; but also by regular locomotion resulting in paths and roads; by the cultivation of nature as subsistence of supply of resources; … by building, constructing, and settling; but also by the artistic and scientific representation of space; and finally by the overcoming of distance by developing means of communication. (Graumann, 2002, p. 104)

According to Canter (1977), "a place is the result of relationships between actions, conceptions, and physical attributes" (p. 159). Places are "the major building blocks for understanding human actions in their naturally occurring context" (Canter, 1985, p. 215). A place has an address, materiality, image, reputation, and an *individual* history and identity. Places are part of shared experience—"they cannot be specified independently of the people experiencing them" (Canter, 1986, p.8). The experience of place has been characterized by Canter (1985) "as having three integrated components: activities, evaluations, and physical form" (p. 231). Unlike situations, places have a distinct, enduring existence and are inevitably intertwined with the physical properties and history of their location (Canter, 1985, p. 216). The physical form of places and their functions have *Aufforderungscharakter* (valence, or the capacity to unite, react, or interact with something else). They summon people who have particular intentions and who command specific knowledge and experience, calling upon them to engage in or refrain from certain activities. Whether the term *place* stands for a room, location, neighborhood, or city depends on the scale of analysis.

Action setting. The terms *behavior setting* (Barker, 1968) or *action setting* (Weichhart, 2003) indicate consistent and organized people–environment interaction that result in extraindividual behavior patterns. Action settings have a physical structure intentionally designed for a specific cultural purpose (e.g., church, office, motorway, or laboratory). They have a clearly defined function maintained and organized by certain material settings, programs, and rules that structure behavior and define certain kinds of actions as inappropriate. The action setting consists of the interdependence between a physical milieu and standing patterns of behavior that are unique to the setting. The expectations elicited by the purpose, rules, and restrictions of an action setting induce in people a collective behavior based on

anticipatory obedience or self-censorship in the sense that individuals evaluate their own performance, actions, and artifacts through the eyes of their audience, supervisors, or critics. By complying with the rules of an action setting, people try to avoid sanctions or to achieve approval. At every place, an individual must be aware of the pattern of activities that might be expected in that location, but action settings have more stable and more controlled place rules.

Administrative area and region. Administratively demarcated areas may gain relevance for creativity research when certain rules, regulatory frameworks (abolition of censorship, freedom of expression), practices, resources or other factors influencing creativity are valid in or restricted to clearly defined spaces. Mild forms of such influences are research policies, research funding, and evaluation procedures that authorities prescribe for certain administrative areas (states). Harsher versions are censorship, interdiction or restriction of research, sanctions on certain research topics, and prohibition of study abroad. The ideological background of Stalinism for research in biology and the Allied ban of a large variety of research in occupied Germany from 1945 and valid through the early 1950s (Gimbel, 1990) were effective in precisely defined administrative areas.

The concept of region shares many characteristics with the term *area*, but most authors would agree that regions are defined by former or present *functional* relations. Because functional relations are influenced by available transport lines, communication technologies, politics, language barriers, power relations, and so on, their porous and ill-defined boundaries constantly change. Demarcating functional relations (regions) is a scientific task; demarcating administrative areas is a political act. However, long-standing functional regions can become administrative areas by political decision. For pragmatic reasons, administrative areas are also important for creativity research. Most statistics and indicators describing the socioeconomic preconditions for creativity or its output are related to administrative units (e.g., census wards, municipalities, metropolitan areas, provinces, states). The interpretation of spatial patterns of indicators related to administrative areas is a highly efficient heuristic method of evaluating the preconditions for creative processes and discovering underlying factors of influence.

Environment. The term *environment* refers to both subjectively perceived and objective, relatively stable qualities of an individual's or group's physical and social surroundings (see Clitheroe et al., 1998, p. 105). Unlike a place that is locally fixed in absolute or relative space, an environment is actor or system centered. A subject of intentionality is physical; it occupies a place and has a viewpoint from which environmental objects are perceived and remembered (Graumann, 2002, p. 98) and from which relations are maintained.

With regard to social systems (e.g., organizations and institutions), an *internal environment* differs from the *external environment*. A social system's external environment comprises all those elements (persons, material objects, and places) to which a social system has established relatively stable and regular relations and by which a person or social system can be affected in its goals, motivation, learning processes, and capacities. It consists of institutions, competitors, customers, infrastructure, job opportunities, and social structures as well as of attitudes, values,

policies, hegemonic ideologies, and pressures of public opinion prevailing in the spaces of a person's or an organization's activities. Organizations live in symbiosis with their external environment and shape their environment. They communicate with it; make transactions; obtain and exchange energy, goods, and services; and supply the environment with their products and services. Individuals and social systems must make timely, effective responses to environmental changes; profit (to varying degrees) from the environment's potential; and are endangered by its risks and uncertainty. Both the definition of important environmental elements and the dependency of a person or social system on the external environment vary with the type of task, the available resources and capacities, the autonomy of a social system, and the degree of uncertainty confronting the social system. This is the main reason why interactions between actor (organization) and environment have an ideographic character that cannot be put into general rules.

Spatial context. In this chapter the term *spatial context* is conceptualized as a social macrophenomenon that represents a totality of interdependent factors of influence. It is an intersection of various social, cultural, economic, and material spheres or matrices. It represents a kind of superordinate concept that includes objective and subjectively perceived factors, the psychological aspects of interpersonal relationships, and the rules and programs of action settings. A spatial context it is not represented by an accumulation but rather a bundling—in the sense meant by Schumpeter (1912/1934)—and an interdependence of various factors. It is not equivalent to a container but to a catalyst in which various objectively and subjectively perceived facts, individuals, institutions, resources, infrastructure, opportunities, restrictions, norms, rules, and cultures interact, intermingle in their mutual dependencies, and modify each other in a defined area. A slight change in one variable, such as the trust in institutions or personal relationships, the availability of resources, or the competence of leaders, will also affect other variables, such as the openness of information exchange, the style of supervision, or intrinsic motivation. The totality of these interacting items offers potential that may stimulate or hamper creative processes.

Atomistic or holistic perspective? The conventional approach to perception assumes that a stimulus activates a specific receptor in the nervous system and that the pattern of receptor stimulation is interpreted with the memory of past experiences to glean information about the environment. In this approach a person must interpret disconnected stimuli in order to construct something meaningful about the environment (for details see Bell et al., 2001, p. 65). Gibson (1979) believed that perception is more holistic, meaning that properties of the environment are perceived as meaningful entities, not as distinct points. Gibson (1960), Canter (1977), and other psychologists have explained the need to have environmental psychologists orient their research to molar units of the environment, that is, to "wholes endowed with significance" (Canter, 1977, p. 1; for details about molar and molecular approaches, see also Bonnes & Secchiaroli, 1995, pp. 68—71, 134–135, 170–171). Gibson (1960) proposes that stimuli be considered in a "molar" rather than a "molecular" sense. Molar stimuli are represented by "what an organism is responding to, and not by what excites all the little receptors" (p. 700). To Gibson

and many other psychologists, cognitive perception is a holistic phenomenon, for it deals with the perception of meanings and not, as with visual perception, to the perception of simple stimuli or patterns.

A similar turn is apparent in other social sciences. Schluchter (2005, p. 24) explains why sociology should not restrict itself to methodological individualism but should include social macrophenomena. However, some human geographers, aware that terms such as *landscape* have been applied unscientifically in the past, still hesitate to use them to refer to a spatial totality. Social and behavioral sciences still see-saw between the two poles of atomistic/mechanistic and holistic or system-oriented perspectives.

From the viewpoint of human geography, one can describe the nature of a spatial context by using the metaphor of a seedbed. The seedbed's outcome depends on many variables, including the type and quality of the soil, the characteristics and quality of the seeds, the amount of precipitation and evaporation, the average annual temperature, the duration of the vegetation period, the availability of fertilizers, and competition between the crops. Though perhaps trivial, it is worth stating that soil, seeds, water, temperature, and other necessary factors must interact at a clearly defined place. Proximity without interaction will not lead to the desired results. If one important factor is absent or does not contribute to the processes in the usual way, the crops will not develop as expected. Some deserts have very fertile soils and are full of seeds, but as long there is not enough water the seeds cannot develop. The seedbed metaphor makes it plain that the study of discrete variables has little power to explain the outcome of the seedbed. What counts is the interaction of these variables at a certain location. And that interaction does not occur automatically; it must be initiated. Hot spots of brain power are like seedbeds, too; they are potential, not independent, factors of influence. It would be a mistake to assume that nearby agents (neighbors) automatically interact and that each of them perceives and uses the available potential or that they depend to a similar extent on exchanging information with the environment. Most observers of the seedbed will not be aware of the chemical, physical, and biological processes occurring between the elements of the seedbed. Neither do they have the knowledge to understand the processes occurring within the plants. Most agents, in their life worlds, have a reductionist view focused on the lot, for the details simply are not known.

The Impact of the Macroscale on Creativity: Socioeconomic Structures and Value Systems

The historical persistence of large-scale spatial disparities of socioeconomic structures. Highly developed, wealthy societies provide better or more expensive educational institutions; attract more eminent scientists and artists; have greater rates of specialization, experimentation, and risk-taking; provide more venture capital; have more complex economic relations; and can invest more in expensive basic research than subsistence or illiterate societies. However, even very wealthy

societies and hegemonic states have extremely large internal spatial disparities of creativity. When asking why creative acts concentrate at certain places or in specific environments and regions, one must study both the process of creativity itself and the preconditions or antecedents of creativity.

The antecedents enabling or promoting creativity operate on various spatial scales. On the spatial macroscale they comprise the hierarchy of urban systems and the established capacity of places and regions to attract, keep, support, and inspire talented, knowledgeable, and potentially creative people. Such large-scale disparities in economic and scientific attractiveness are the result of long historical processes governing the spatial division of labor, uneven economic development, educational policies, spatial power relations, migration patterns of talented people, and various path dependencies.

Places differ in the complexity of their economic structure, the quality of the jobs they offer, the location of power and decision-making, the spatial extension of their economic relations, and their scientific reputation. Some places and areas act like magnets attracting the most ambitious artists, scientists, and other talented persons. They offer these people outstanding scientific equipment and resources (venture capital), give them the freedom to experiment and break with traditions (as illustrated in Vienna by Schönberg's 12-tone music, Freud's psychoanalysis, and the artists of the "Secession" movement). These places offer them platforms from which to exhibit their creative ideas and products, grant them access to high level international networks, and enable them to gain reputation. The reputation of a place is interrelated with its degree of international connectivity and its potential for face-to-face contact with top-ranking experts of various domains.

Other places and regions constantly lose most of their talented young generation, intellectuals, scientists, and artists through persistent brain drain or brain overflow caused by lack of opportunities and demand, underdevelopment, or political restrictions. These spatial disparities and hierarchies of social, cultural, and economic attractiveness are constantly in flux. Though disparities between the centers and the peripheries have remarkable historical continuity and are perpetually reproduced by the asymmetry of power relations, some magnets eventually lose their attractiveness for various reasons, and the artists, intellectuals, and scientists leave for more engaging places. These processes on the spatial macroscale create certain hot spots of brainpower. They are characterized by a high density and large spatial concentration of workplaces for scientists, intellectuals, artists, innovative entrepreneurs, highly skilled experts, top-level decision-makers of various sectors, and sophisticated research infrastructure (Meusburger, 1998, 2000). In 1980, Budapest and the capitals of the 19 Hungarian provinces (0.6% of all Hungarian cities and villages) accounted for 35% of the country's total population, but offered 96.1% of all jobs for university graduates in personal and business services, 88.7% of all jobs for university graduates in science and research, 88.6% of all jobs for university graduates in cultural services, and the vast majority of highly skilled jobs in other economic sectors (Meusburger, 1997, pp. 132–133). The more than 3,000 remaining Hungarian villages and towns almost entirely lacked the most important precondition for creative milieus, a highly skilled labor force. Consequently, these peripheral areas had virtually no foreign capital in after the introduction of market

economy, an imbalance that only reinforced the disparities that already existed between the center and the periphery.

The impact of cultures, world-views, and research policies. Both the generation and evaluation of creative ideas are affected by prevailing cultures, worldviews, political systems, academic evaluation systems, policies on the recruitment of scholars, and research funding. Ruling classes, powerful bureaucracies, or religious leaders who are afraid that novelties potentially threaten their status or the power structure of their system will be reluctant to introduce the relevant innovations. In many cases it is epistemic power that determines what is to be regarded as a creative product, art, or useful technology. In some places creative ideas are recognized, fostered, and implemented very early; in others, they are not regarded as useful or appropriate, so their implementation may be delayed or rejected.

> Ancient Chinese society is a good example of a central authority supported by a powerful bureaucracy that was able to resist for centuries the spread of new ideas. Despite enormous early cultural advances and a great number of creative individuals, Chinese society believed the use of gunpowder for weapons and that of movable type for the printing of books were bad ideas. (Csikszentmihalyi, 1999, p. 323)

> A new idea will face difficulties in being recognized as creative if the field is defensive, rigid, or embedded in a social system that discourages novelty. For instance, the aridity of Soviet genetics in the thirties was not … a fault of the scientists who made up the field, but of the peculiar agenda of the broader social system of which the field was a part. (Csikszentmihalyi, 1988, p. 331)

Research policies, ways of research funding, and evaluation systems define what good scholarship or good publishing is. However, the criteria and methods that are used to evaluate scientific quality differ from one group of disciplines to the next, and applying the criteria of one discipline to evaluate all other disciplines interferes with scientific creativity. Drawing on Torrance's (1995) claim that incompleteness and disharmony can present openings for creativity, Ambrose (2006) and Schorske (1997) distinguish between two types of academic disciplines: the fractured-porous (e.g., political science, English studies, or human geography) and unified-insular (e.g., analytic philosophy, large parts of psychology, economics).

The fractured-porous disciplines lack internal consensus about methods and theories and are less policed by gatekeepers than the fields of the other category are. The fractured-porous disciplines "tend to be internally contested, inclusive of diverse ideas, and in the process of re-conceiving their fundamental conceptual frameworks" (Ambrose, 2006, p. 77). They lack intradisciplinary interdependence because of their fragmented conceptual frameworks, which reflect warring camps of conflicting groups that vie for attention and supremacy. Because they show strong *interdisciplinary* interdependence and because their porous borders allow the importation of constructs from a wide variety of neighboring disciplines, they seem to be more open to new topics and theoretical perspectives (Ambrose, 2006, p. 82).

The tightly unified-insular disciplines are firmly bounded and heavily policed by journals and career promotions and reflect confidence in their conceptual foundations (see Ambrose, 2006, p. 77). Scholars in unified-insular disciplines "face much less incompleteness and disharmony because they receive reminders about the certainty of investigative methods and the apparent solidity of the conceptual

foundations that underpin those methods" (Ambrose, 2006, p. 80). According to Schorske (1997) the unified disciplines achieved their unity by tenaciously preserving their core assumptions and methods, purging themselves of diverse inquiry methods, narrowing the scope of investigation, and marginalizing investigative trajectories ill suited to its entrenched core assumptions (see also Ambrose, 2006, pp. 77–78). "Members of unified-insular disciplines are highly interdependent *within* their fields because they strongly agree on the fundamental conceptual frameworks and research methods that define and constrain their work. However, they strongly reject interdependence when it comes to *interdisciplinary* sharing and collaboration because of their impervious disciplinary borders" (Ambrose, 2006, p. 82).

Unified-insular disciplines are more likely to suppress divergent thinking because they enforce consensus about fundamental assumptions and research methods through their policing of publishing and academic recruitment. In contrast, the fractured-porous disciplines appear to encourage divergent thought. The "porous border that surrounds a fragmented field enables the importation of multidisciplinary constructs that stir up additional divergence of thought" (Ambrose, 2006, p. 81). Centrifugal impulses, lack of consensus, and fragmentation and splintering of topics seem to entail more dynamics and creativity than is the case in disciplines that tenaciously preserve their core assumptions and methods for long periods (Ambrose, 2006, p. 78). These two types of disciplinary outlook also shape the scientific policies and evaluation systems of universities, research foundations, and nations. Some evaluation systems allow more fragmentation of scientific cultures, more splintering of topics, and more diverse criteria of scientific excellence than others, with the result that they can respond more readily to societal and political changes.

The Impact of the Mesoscale on Creativity: Organizational Structures and Climates

Organizations are the spatial mesoscale on which creative processes are greatly influenced. An organization is a goal-oriented and information-processing social system that perceives, scans, interprets, and diagnoses information from the environment and from its own elements in order to remain competitive and adapt its goals and structures to new challenges. A primary task of organizations is to reduce the degree of uncertainty and complexity confronting them, both internally and in relation to the external environment.

Through their vertical division of labor, organizations contribute to internal hierarchies of decision-making and spatial disparities of professional skills. These structural features and characteristics of the organizational climate bear significantly on employees' creative performance at work (Amabile, 1988; Oldham & Cummings, 1996; Redmond & Mumford, 1993; Staw, 1990), either supporting or impairing it. Along with organizational culture and spatial relations, they affect whether organizations can attract, recruit, and keep creative persons and whether such individuals are positively stimulated by the work environment and able to

develop their creativity. All these factors determine whether creative people are hindered in realizing their ideas, whether the organization accepts and promotes creative ideas in time, and whether incompetent supervisors or mediocre teams block them.

To conceptualize the faculties and dynamics affecting creativity at the mesolevel, it is justified in organization theory and system theory to speak of organizational intelligence, organizational learning, and organizational memories. "Organizational intelligence is an organization's capability to process, interpret, encode, manipulate, and access information in a purposeful, goal-directed manner, so it can increase its adaptive potential in the environment in which it operates" (Glynn, 1996, p. 1088). One may also speak of creative organizations. Indeed, organizations themselves *have* to be creative if they are to attain their goals and survive competition, for it is within organizations that most creative ideas are evaluated, executed, or verified.

This kind of influence extends beyond organizations, too. Even isolated artists or poets must deal with some organization or other if they want to exhibit or publish their work. With the assistance of organizations, individual agents can shape socioeconomic structures on the *macro*scale.

Organizational structure. Many structural features of an organization are important for creative processes. Some of them are:

- The job complexity and skill variety within the organization
- The design of work settings
- The architecture or arrangement of formal communication, decision-making, and authority within the organization
- The degree of centralization or decentralization of decision-making
- The professional and social competence of supervisors and decision-makers
- The style of supervision, evaluation, and conflict-resolution
- Principles of staff recruitment
- The span of control at various hierarchical levels
- The degree of autonomy that different levels of the organization enjoy
- The availability of resources
- The organization's ability to respond to opportunities and risks of the environment; and
- The formalized structure of communication with the environment

Effective obstacles to creativity are rigid adherence to rules, strong hierarchies, and incompetence of supervisors unfamiliar with the subordinates' areas of specialization (for details see Williams & Yang, 1999, p. 375).

Structures of decision-making and competence distribution within an organization cannot be deliberately altered. They depend on the goals, the external environment, and internal resources of the social system. Disruption of formerly stable relations to the environment, rapid changes of the environment, and growing uncertainty imply the need to shift power to those who have the competence necessary for solving the new challenges and averting crises. In threat-rigidity theory, this kind of response is referred to as the "mechanistic shift" (Staw et al., 1981,

p. 516) that organizations go through under threatening conditions. In those times, they centralize control, conserve resources, restrict information flow, and rely on familiar, well-practiced routines (see also Amabile & Conti, 1999, p. 631).

Group composition affects group performance and plays an important role in creating a potentially stimulating environment (Smith, 1971, p. 495). Research on the relationship between team composition and team performance (Hoffman, 1959; Hoffman & Maier, 1961; Hoffman & Smith, 1960; Smith, 1971) has found that groups in which the members' personalities are heterogeneous tend to produce high-quality solutions to problems. The reason given is that the members apparently stimulate one another constructively and that they mutually correct their errors. Some large companies assess cultural diversity so important that they introduced diversity management.

Organizational culture and organizational climate. Some authors use the terms *organizational culture* and *organizational climate* synonymously; others do not. Schein (1985) defines culture as "a pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems" (p. 19). To Forehand and Gilmer (1964), organizational climate means "the set of characteristics that describe an organization and that (a) distinguish the organization from other organizations, (b) are relatively enduring over time, and (c) influence the behavior of people in the organization" (p. 362). Tagiuri (1968) considers this definition deficient because it takes no account of individual perceptions. He notes that members of an organization interpret its climate in ways that affect their attitudes and motivation. He defines climate as "the relatively enduring quality of the total [organizational] environment that (a) is experienced by the occupants, (b) influences their behavior, and (c) can be described in terms of the values of a particular set of characteristics (or attributes) of the environment" (p. 25). With similar emphasis on the individual, Isaksen et al. (2000–2001) break the term climate down into two aspects. They define organizational climate "as the recurring patterns of behavior, attitudes, and feelings that characterize life in the organization" (p. 172) and regard psychological climate as referring to the individual perceptions of the patterns of behavior.

In an additional consideration of organizational culture and climate, Denison (1996) writes that:

> [I]nteraction reproduces a symbolic world that gives culture both a great stability and a certain precarious and fragile nature rooted in the dependence of the system on individual cognition and action. *Climate,* in contrast, portrays organizational environments as being rooted in the organization's value system, but tends to present these social environments in relatively static terms, describing them in terms of a fixed (and broadly applicable) set of dimensions. (p. 624)

> [C]limate refers to a *situation* and its link to thoughts, feelings, and behaviors of organizational members. Thus, it is temporal, subjective, and often subject to direct manipulation by people with power and influence. Culture, in contrast, refers to an evolved context (within which a situation may be embedded). Thus, it is rooted in history, collectively held, and sufficiently complex to resist many attempts at direct manipulation. (p. 644)

Another difference between culture and climate is that the climate of an organization can be altered relatively quickly by external pressure—such as the downsizing of a firm—or internal changes such as the replacement of group leaders. Culture refers more to the deep and enduring structure of organizations, which is rooted in values, beliefs, traditions, and assumptions held by organizational members (Denison, 1996; Gagliardi, 1986; Isaksen et al., 2000–2001).

With regard to creativity, the important questions are whether the culture of an organization tends to breed conformity and risk aversion (see Cummings, 1965, p. 224), whether certain paradigms should be followed, or whether the culture tolerates deviation from what is traditional. Are new members of an organization confronted with ready-made questions, solutions, and answers, or is a diversity of viewpoints, novelty, and innovation encouraged? Phenomenologically, *climate* is external to the individual, but cognitively the climate is internal to the extent that it is affected by individual perceptions (Woodman & King, 1978, p. 818). Following James, Hater, Gent, and Bruni (1978, p. 786), Scott and Bruce (1994) define the climate of an organization "as individual cognitive representations of the organizational setting expressed in terms that reflect psychologically meaningful interpretations of the situation" (p. 581). The climate of the work environment represents "signals [that] individuals receive concerning organizational expectations for behavior and potential outcomes of behavior" (Scott & Bruce, 1994, p. 582). According to Campbell, Dunnette, Lawler, and Weick (1970):

> [We] might define climate as a set of attributes specific to a particular organization that may be induced from the way that organization deals with its members and its environment. For the individual member within the organization, climate takes the form of a set of attributes and expectancies which describe the organization in terms of both static characteristics (such as degree of autonomy) and behavior-outcome and outcome-outcome contingencies. (p. 390)

The measurement of organizational climate poses a difficult methodological problem (for details see Hellriegel & Slocum, 1974; Isaksen et al., 1999; James & Jones, 1974). Allegedly objective attributes will be perceived and evaluated differently by the members of an organization, depending on their motivation, status, and personal experience. A senior manager, for instance, will perceive the climate of his or her organization differently than a blue-collar worker at the bottom of the hierarchy, so comparison of the two perspectives does not contribute much to research knowledge. Nor does an attempt to average people's job satisfaction or perception of organizational climate. Variance in perceptually measured climate scores might be related to differences in individuals rather than to differences in situations (James & Jones, 1974, p. 1103). Because most large and complex organizations are spread over many locations, the category "climate of an organization" should be expressed in the plural. Each large organization has many different climates that vary from one hierarchic level to the other and from one work group to the next.

Dimensions of social relations in the structure, climate, and culture of organizations. The structure, climate, and culture of organizations are shaped by social relations and can be fully understood only if one takes the following three issues into account.

1. The role of group work, brainstorming, solitude, and working in the presence of others

A vast amount of literature on idea generation and creativity is influenced by the brainstorming paradigm (Osborn, 1953; for an overview see Paulus & Yang, 2000). It rests on two assumptions: that group work and group discussion offer a chance to combine formerly unrelated ideas and that a group's chances of generating a creative response to a challenge improve with the number of different views and knowledge bases there are in a discussion. Under certain conditions, group discussion may contribute to "combining known but previously unrelated facts and ideas in such a way that new ones emerge" (Shalley, 1995, p. 484), generating new ideas and boosting overall productivity. The cognitive theory of group creativity (Brown et al., 1998; Paulus, 2000; Paulus et al., 2000) posits conditions under which effects of cognitive stimulation can be observed in groups. However, the underlying assumption seems to be that all participants in a brainstorming group (a) have the same prior knowledge and the same intrinsic motivations and goals, (b) are all interested in sharing their knowledge with others, and (c) will automatically consider the arguments of others. Recent research is inconclusive about the effects of brainstorming and group work on creativity (Mullen et al., 1991; Paulus, 2000; Paulus & Dzindolet, 1993; Paulus et al., 1995, 2000; Paulus & Yang, 2000). A certain skepticism stems from the argument that brainstorming and group work can act as a stimulus by offering new experiences, ideas, and learning opportunities but that it can also exert pressure on the individual to conform to the mediocre ideas of the majority. Collaborative projects tend to suppress individual initiative and independence. It is thus asserted that brainstorming and group work apparently are not major factors in scientific creative achievement. "There is little doubt that in the realm of highest creativity there is only one creative instrument: the individual mind and spirit of the creator. The landmarks of scientific invention have been established by a handful of *lone* investigators" (Raudsepp, 1958, p. 71).

Empirical results of many studies have supported the hypothesis that group discussion can lead group members to copy each other's responses. In a study on the effects of prior group discussion on individual creativity, for example, Andre, Schumer, and Whitaker (1979) found that group discussion led to a lower total number of different responses being produced by the group than by a comparable number of individuals working alone (p. 111). It appears as though "conformity within small groups inhibits individual creativity. Group discussion acts not as a catalyst to individual divergent thinking but merely allows individuals to adopt the different ideas of other individuals" (p. 119). Similarly, an experiment on group influence on creativity in mathematics found that "those pupils working as individuals have a higher creativity score than those working in groups" (Banghart & Spraker, 1963, p. 260). These observations may explain why tight networks or scientific schools eventually lead to a certain fixation on specific topics, methods, or paradigms. In short, group work or strong integration in teams may keep individuals from following their own inclinations and interests.

Many authors seem to understate the difficulties of and barriers to knowledge management, knowledge exchange, and idea-sharing in groups or organizations.

This tendency is especially noticeable among researchers who do not distinguish between knowledge and information or who apply a naïve model of knowledge transfer built on the neoclassical concept of knowledge diffusion (for a critique of this approach, see Meusburger, 2008, pp. 70–74). Andre et al. (1979) have shown that groups using the brainstorming rules generate substantially fewer ideas than the same number of individuals brainstorming in isolation. Similarly, Lindgren and Lindgren (1965, p. 23) and Dunnette, Campbell, and Jaastad (1963) have shown that individuals brainstorming alone are more creative than when brainstorming in a group. As Andre et al. (1979) suggest, "in a practical situation where many alternative solutions to a problem are desired, it would be better to set individuals working alone and then pool their contributions" (p. 122). Separateness and solitude can serve as a protective shield for the scientist or artist.

There are a number of reasons why brainstorming does not always lead to the desired effect and why creativity may be blocked by group work (the following overview draws mainly on Paulus & Yang, 2000). Explaining why group discussion can inhibit creativity, Andre et al. (1979) write:

1. The social nature of the group makes individual performance public, and individuals may be reluctant to express unusual or "far out" ideas because of anxiety over how they will be received. Under this rationale conformity within the group will inhibit individual productivity[,] leading to lower group performance.
2. An individual within the group, perhaps the most creative, may dominate discussion[,] with the remaining individuals simply following his lead (p. 112).

Other scholars concur that creativity can be undermined by such unwillingness to state one's ideas and by the social loafing or free-riding that may ensue when individuals do not feel accountable or feel their efforts are not needed by the group (Karau & Williams, 1993; Kerr & Bruun, 1983). Another factor that reduces creativity is that some individuals cannot adequately express their ideas when someone else is talking (Diehl & Stroebe, 1991; Lamm & Trommsdorff, 1973). Instead, certain members use such meetings to establish their own reputation rather than listen to others. That kind of encounter frequently ends in competition for reputational capital, not in the exchange of ideas (Drazin et al., 1999, p. 295; Sutton & Hargadon, 1996, p. 706). Antipathy between group members and fear of losing status are additional problems that often thwart attempts to generate and exchange ideas within groups. Lack of support in a group quickly extinguishes the spark of originality, and a hostile group climate often wipes out minority views. Moreover, some team members may be disinclined to take responsibility for their actions, and others may not be prepared to share the benefits of their creative ideas with the group. Some participants may be preoccupied with their own ideas and not pay much attention to those generated by others (Paulus & Yang, 2000, p. 86). Glynn (1996) and Nemeth (1986) demonstrated that the positions expressed by a majority of individuals tended to foster convergent thinking, limit the number of presented alternatives, and enforce conformity to the prevailing views.

Hearing others generate ideas does not necessarily enhance one's performance, either. Individuals cannot be forced to participate in the interaction process of other

group members, for some members of the group may lack the prior knowledge necessary for understanding the possible benefits for their own work. Still others may be preoccupied with different topics and lack the attention or interest required for the transfer of knowledge. Time, too, partly explains why brainstorming and its attendant levels of creativity may be disappointing. The incubation hypothesis suggests that "individuals do carefully process the shared information but may lack sufficient occasion to demonstrate the stimulation value of this information during the sharing session. … It may take some time to reflect on the shared information and to integrate this with one's own ideas" (Paulus & Yang, 2000, p. 79; see also Paulus et al., 2000).

However, Kurtzberg and Amabile (2000–2001) point out that researchers have focused predominantly on brainstorming in groups and have paid little attention to team-level creativity. They note that the vast majority of studies on group brainstorming has occurred in a laboratory setting, with groups of participants who had no knowledge of each other's strengths and weaknesses and no strong incentive to create mutual understanding. Effective group problem-solving can occur with the right combination of personalities, the right amount of diversity, sufficient resources, and cooperative process behaviors (see Kurtzberg & Amabile, 2000–2001, p. 288).

Working in the presence of others is not the same as brainstorming. Various authors (Amabile et al., 1990; Shalley, 1995; Zajonc, 1965) have examined the effects that co-action, audience surveillance, expected evaluation, and goal-setting have on creativity. Shalley (1995) reported that the highest levels of creativity occurred when individuals had a creativity goal while working alone and expecting to be evaluated. Matlin and Zajonc (1968) found that surveillance had a significant negative effect on originality, which is an important component of creativity. According to Zajonc (1965), audiences and co-actors intensify "drive/arousal," which facilitates simple, well-learned, dominant responses but impairs complex, counterinstitutional, subordinate processes (quoted in Shalley, 1995, p. 486).

Working in the presence of others can have ambiguous effects. It can be distracting or inspiring. It can either energize people or disrupt their performance, "depending upon whether their attention is focused on dominant or subordinate responses" (Shalley, 1995, p. 486). Large office spaces or the presence of many co-actors lead to an increase in the speed and accuracy with which simple, routine tasks are performed and to a decline in performance on complex tasks (Bond & Titus, 1983; Shalley, 1995). "Individuals working alone on an open-ended, ill-structured task will have higher levels of creativity than individuals working in the presence of co-actors" (Shalley, 1995, p. 486).

Several studies support the hypothesis that solitude, sensory deprivation, and restricted environmental stimulation techniques promote cognitive processes, problem-solving creativity, and scientific thinking and reinforce aspects of imagery (Andre et al., 1979; Arieti, 1976; Forgays & Forgays, 1992; Norlander et al., 1998; Shore, 1971; Suedfeld, 1968, 1980; Suedfeld & Landon, 1970; Suedfeld et al., 1987). According to Shalley (1995), attentional overload may cause individuals to

rely on preexisting schemata and routines and may lead to a restriction of cognitive focusing. In contrast, it is assumed that solitude may aid complex cognition (Forgays & Forgays, 1992; Shore, 1971). Arieti (1976) and Suedfeld (1974) consider aloneness conducive to creativity. They mention a long list of eminently creative philosophers, scientists, and religious leaders whose lives are marked by solitude and remoteness (Suedfeld et al., 1987, p. 220).

Arieti (1976) regards inactivity, daydreaming and the lack of external distraction as cultivating creative thought. Suedfeld et al. (1987) hypothesized that low stimulation will enhance creative behavior. They tested their hypothesis by using the Restricted Environmental Stimulation Technique (REST) in an experiment chamber or flotation tank that induces relaxation, lowers arousal, and allows the individual to concentrate on thoughts, feelings, and memories. Suedfeld and Landon (1970) reported evidence that divergent thinking is enhanced under conditions of sensory deprivation. Suedfeld et al. (1987), Forgays and Forgays (1992), and Norlander et al. (1998) explored whether flotation facilitated creative problem-solving ability and originality and whether it positively affected creative performance. All three studies arrived at the same conclusion, which is summed up by Forgays and Forgays (1992):

> Floaters increased their post- over their pre-scores on creativity and vigor, and maintain their curiosity level while they decreased anxiety, tension, depression, and fatigue scores, as compared with controls. It appears, then, that float subjects are alert but relaxed and that these conditions may conduce to the creativity benefits obtained. (p. 333)

Forgays and Forgays also found that "higher creative persons respond to isolation more positively and that such a response pattern may aid their creative process" (p. 333). Floating is associated with increased vigor and a reduction in depression, confusion, hostility, and fatigue (p. 334).

Many studies confirm the important role of solitude, interpersonal distance, and reduced ambient stimulation in enhancing creative thought, but others underline the importance of environmental stimuli as well. This apparent contradiction is explicable in several ways. First, it indicates that creative individuals need periods of intensive stimulation as well as periods of solitude. People seek solitude in order to avoid overstimulation and various stressors associated with excessive proximity. A sequence of group work (brainstorming, stimulation) and individual work (solitude) may produce the best results. Second, group experience does inhibit creativity for the items discussed by the participants, but it may serve as a trigger or catalyst for individual creativity for subsequent items (Andre et al., 1979, p. 122). Third, many past psychological studies on creativity used ad-hoc groups. The relationship found between individual and group performance may not hold for preexisting groups whose members trust each other and have a long history of successful cooperation (Andre et al., 1979, p. 119). Fourth, the composition of the group, the age of group members, and the duration of their successful cooperation may have an important bearing.

> Young groups might be expected to benefit more from the stimulation of heterogeneously composed groups than will old groups. (Smith, 1971, p. 491)

> Findings generally support the expectation that a heterogeneously composed team will be superior in group performance. This is particularly the case for young groups, where there may be greater need for a higher level of stimulation and energetic interaction. (Smith, 1971, p. 493)

2. Personality of leaders and leadership style

The effect and perception of an organizational structure and climate with regard to creativity is modified by the personality of leaders. It shapes their style of goal-setting, decision-making, supervising, and evaluating, which, in turn, influence the effect of other factors. Leaders express organizational norms and values, structure the nature of group interaction, condition subordinates' perceptions of the work environment, and affect in many other ways the performance and creativity of organizations. They can enhance or diminish the subordinate's feeling of self-efficacy and self-esteem and the individual's willingness to pursue risky or original ideas (see Redmond & Mumford, 1993). Creative achievement is enhanced by superiors who show consideration for the feelings and interests of employees; encourage their subordinates to voice their own concerns; give positive, mainly informative feedback; facilitate employee skill development; and promote personal initiative and risk-taking at work. Creative performance in a group or organization is likely to languish under supervisors, who rigidly control their subordinates, closely monitor employee behavior, introduce rigid operating procedures, make decisions without employee input, prove less competent than their subordinates, and suffer from a sense of inferiority (Amabile, 1988; Amabile & Conti, 1999; Amabile et al., 1996; Amabile & Gryskiewicz, 1989; Andrews & Farris, 1967; Oldham & Cummings, 1996; Shalley et al., 2000; Stahl & Koser, 1978; West, 1989).

Collectively, these authors have reported that teams of scientists produced their most creative results when they were:

- Allowed substantial freedom in the way the work was done
- Encouraged rather than controlled by their supervisors
- Given opportunities to influence important decisions and choose the processes of evaluation
- Permitted to ask novel or disturbing questions, and
- Invited to come up with unusual solutions

Other prerequisites of creativity that supervisors can influence are:

- The degree of open information flow across departments
- Mutual receptiveness to other domains or disciplines
- Shared commitment to a project
- Fair and supportive assessment of new ideas
- Reward and recognition of creativity
- Participatory management and decision-making
- Open interaction between supervisor and subordinates, and
- Diversity in team members' knowledge bases (disciplinary background)

Hage and Dewar (1973) found that the values of organizational leaders explained more variance in organizational innovation rates than any single structural dimension. To sum up, research has shown that inducing positive affects can enhance

creative problem-solving, whereas generating negative emotions, particularly anxiety, has been associated with lowered creative performance (for an overview see Clapham, 2000–2001).

3. Job satisfaction

Many authors assume that a high level of job satisfaction contributes positively to organizational effectiveness and enhances creative performance and that job dissatisfaction is detrimental to organizations (for an overview see O'Reilly, 1991). They argue that dissatisfied members will quit their organizations and that other employees will remain in the organization but respond either passively by accepting their situation or exhibit passive withdrawal behavior. However, March and Simon (1958), Simonton (2000), van Gundy (1987), Zhou and George (2001) and others question this idea and suggest that job dissatisfaction can also lead to creativity when individuals have "an active and constructive response to their dissatisfaction" (Zhou & George, 2001, p. 684). They argue that discontentment with the status quo can spur organizational change when dissatisfied members of the organization come up with new ideas to do things better or gain new intrinsic motivation to improve their current work situation. Under certain conditions, employees' job dissatisfaction may actually lead to a more creative performance because some employees dissatisfied with the situation will actively try to improve conditions. Exceptional creativity seldom emerges from the most supportive or harmonious environment.

Indeed, some studies maintain that creative potential seems to require exposure to diversifying experiences or cultural diversity that help weaken the constraints imposed by conventional socialization (Simonton, 2000, p. 153). This view is too simplistic, however. Its accuracy depends on the type and circumstances of cultural diversity. The consequences of cultural diversity that stems from cooperating elites differ from those of cultural diversity arising from segregated, disadvantaged and unskilled minorities being in conflict with each other.

Surprisingly, more research has been done on environmental factors enhancing creativity than on those that undermine it. This preoccupation belies the fact that impediments to creativity, such as incompetent leaders, lack of resources, and internal strife, are experienced on a daily basis much more explicitly than factors enhancing creativity, which may not be recognized at all because they are regarded as normal or self-evident.

The Spatial Microscale: Personal Traits of Creative Individuals and Their Relations to the Environment

For many decades, creativity research in psychology, management studies, career studies, art criticism, and philosophy focused mainly on the relationships between creativity and personality, on the search for personal characteristics relating positively or negatively to creativity, and on the identification of traits predictive of creative performance. Some of the early studies related creativity to pathology or neurotic conflicts (for an overview see Becker, 2000–2001; Burchard, 1952; Eissler,

1967; Rees & Goldman, 1961; Schuldberg, 2000–2001; Symington, 1987). Some psychoanalysts believe that artistic creation arises from the unconscious and is motivated by an unfulfilled ambition, an erotic wish, or oral regression (Bergler, 1950; Rees & Goldman, 1961, p. 145). Eissler (1967), Symington (1987), and others have shown that many "great men" were suicidal or suffered from severe injury to infantile narcissism. Other authors (e.g., Slochower, 1967, pp. 4–5) regard crises, periods of sharp transition, and conflicts as a precondition for the highest forms of creativity. Dante had to go through the Inferno to find Eden, and through Purgatory to reach Paradise.

Other authors criticize this psychopathological approach, charging that too much emphasis has been placed on the neurotic affiliations of artistic creation or scientific excellence. Symington (1987) claimed that "psycho-analytic theory is too pathology-oriented to be of much help to us in understanding creative genius" (p. 286). According to Scott (1965), there is "no support for the common-sense belief that creativity stems from neurosis or that creative individuals are inevitably psychologically sick, physically frail, and socially irresponsible" (p. 219). However, there is ample evidence that large numbers of highly creative people had life histories marked by severe frustration, deprivations, and traumatic experiences.

Attributes of creative people. Most authors agree that certain personality characteristics relate to, enhance, or correlate with creativity. In the literature of various disciplines, the most frequently mentioned attributes of this kind are motivation; mental energy; a high level of multiple intelligence; ideational fluency; wide-ranging interests; a disposition to the integration of diverse stimuli; attraction to complexity; intuition; aesthetic sensitivity; general effectiveness of performance; existential security that permits a high degree of nonconformity and allows time for reflective thought; an urge to seek self-fulfillment in a unique manner of the individual's own choosing; a heightened desire for attention, reputation, and social appreciation; above-average adaptive flexibility; originality; curiosity; self-confidence; a marked degree of independence in thought and action (field independence); tolerance of uncertainty and ambiguity; openness to experiencing the inner self and the outer world; a rich and vivid fantasy life; above-average memory for imaginary information; spontaneous flexibility; high level of self-assertion, self-esteem, and self-confidence; a willingness to take risks; nonconformity; an ability to synthesize and rearrange existing facts in order to come up with a new and useful answer to a problem; persistence in the development of ideas; a strong sense of destiny with a marked degree of resoluteness; and a tendency to cling tenaciously to a project in the face of repeated or perceived failure or disagreement and critique of others (Amabile, 1988; Banghart & Spraker, 1963; Barron, 1955; Barron & Harrington, 1981; Carlozzi et al., 1995; Earl, 1987; Eulie, 1984; Funke, 2000; Gardner, 1995; Givens, 1962; Goldsmith & Matherley, 1988; Gough, 1979; Hocevar, 1980; Martindale, 1989; Niederland, 1967; Norlander et al., 1998; Oldham & Cummings, 1996; Rokeach, 1954, 1960; Runco, 1988, 1994; Shalley, 1995; Shaw, 1987; Simonton, 1999; Thomas, 1955).

Rather than discuss or evaluate the pertinence of these variables to creativity studies and the inconsistency of some of the research results, I assert that most of

these personal traits are neither innate nor isolated from the social environment. They are learned, activated, affected, or developed through relations and interactions between actor and environment. Some of the characteristics or cognitive frameworks do influence a person's goals and motivation others impair the perception and interpretation of the environment; another group of traits influences social relations. Also associated with the social environment are personal constraints and personal traits *inimical* to creativity—such as depression, learned helplessness, lack of self-esteem, inability to concentrate, or a sense of being controlled by others.

Scholars disagree on the existence of innate ideas or innate knowledge. Most researchers prefer the terms *innate capacities* or *propensities* instead of innate knowledge. Rescher (1966) uses the term *innate* (p. 210) to refer to all intellectual capacities that enable humans to develop other capacities. He regards innate mental propensities as a range of tendencies, inclinations, and dispositions relating to the functioning of the human mind (p. 206). The capacity to *learn* calculus or attain fluency in a foreign language are innate; the ability to *solve* calculus problems or speak a foreign language are unquestionably acquired (Rescher, 1966, p. 206). The capacities to recognize and discern structural patterns, regularities, and similarities or to use analogies are also innate.

Motivation. The creative performance of individuals is influenced both by intrinsic and extrinsic motivation. Intrinsic motivation is one of the most important determinants of creativity. Extrinsic motivation, according to a number of studies, does not enhance creativity (Amabile & Gryskiewicz, 1989; Amabile, 1988; Oldham & Cummings, 1996; Runco, 1993; Shalley, 1995; Shalley & Perry-Smith, 2001; Woodman & Schoenfeldt, 1990). Other researchers (e.g., Eisenberger & Rhoades, 2001; Eisenberger et al., 1999) find that extrinsic motivation, too, can increase creativity when the reward is contingent on creativity. They have shown that extrinsic motivation can do so by enhancing self-determination and intrinsic task interest. Extrinsic motives might enhance self-determination and influence choice of field, type of task, or implementation strategy rather than a person's work on the task itself (Mumford, 2003, p. 112).

Intrinsic motivation not only constitutes tenacity and a strong inner drive for achievement. Together with prior knowledge, sensitivity, and curiosity, it also moderates the relationship between external stimuli, attention, perception, and behavior. Intrinsic motivation and prior knowledge direct attention to certain environmental signs and patterns and help avoid attentional overload, which is regarded as an obstacle to creativity. Ample empirical evidence shows that people's creativity peaks when their motivation is primarily intrinsic and fed by the challenge of their work, their interest in and curiosity about problem-solving, and their satisfaction and enjoyment (Amabile, 1983a, 1988; Amabile et al., 1996, p. 1158).

Intrinsic motivation can be encouraged or eroded by external factors. Organizational impasses, internal strife, rigid supervision, lack of resources, corruption, and incompetent leaders may decrease intrinsic motivation. According to the Cognitive Evaluation Theory (Deci & Ryan, 1980, 1985), situational factors can affect intrinsic motivation by two means: control (e.g., pressure to achieve a certain outcome) and information (e.g., feedback that people receive about their

self-determination and task competency) (Shalley & Perry-Smith, 2001, p. 3). Some authors (Amabile, 1979; Amabile et al., 1990; Shalley, 1995; Shalley & Oldham, 1985) suggest that expecting evaluation can have dysfunctional consequences for intrinsic motivation. Individuals, they argue, may no longer dare to take risks or play with ideas, for any failure of a risky experiment may prompt a negative assessment. However, the direction of the response to expected evaluation seems to depend at least partly on the *kind* of evaluation involved. The research of Shalley and Perry-Smith (2001), for instance, indicates that "individuals who expected an informational evaluation had higher intrinsic motivation and creativity than those who expected a controlling evaluation" (p. 15).

Cooper and Jayatilaka (2006) propose a third type of motivation important for creativity: motivation that comes from an individual's feelings of obligation.

> This motivation has characteristics in common with extrinsic motivation in that it is linked to extrinsic rewards. However, in contrast to extrinsic motivation, rewards that may result in obligation motivation are not contingent on task performance. (p. 154)
>
> There appears to be a powerful rule of reciprocation that is pervasive in all human societies, and which results in our feeling obligated to the future repayment of help, favors, and gifts. (p. 156)

Openness of cognitive frameworks. Another focus of research on the spatial microscale of creativity is the relative openness of a person's cognitive framework that has an impact on how a person receives, understands, and evaluates information and acts on stimuli of the environment. Rokeach (1954, 1960) suggested that highly dogmatic people exhibit a closed way of thinking, a tendency to distort incoming information and meanings, and an intolerant attitude toward those with dissimilar values or beliefs. Creativity and dogmatism seem to be inversely related to each other. According to Ohnmacht and McMorris (1971), for example, the problem-solving ability of dogmatic individuals has been found to decline when the problems to be solved require the ability to synthesize rather than analyze. Highly creative experimental participants exhibit greater flexibility and tolerance for novelty, ambiguity, and incongruity than less creative ones do (Martindale et al., 1974, p. 317) and are therefore able to attend to a wider range of environmental stimuli and to absorb or activate a variety of knowledge bases.

Openness and flexibility are also related to empathy and emotions. Several studies support the hypothesis that empathy (affective sensitivity) and creativity are related processes (Alligood, 1991; Gallo, 1989; Kalliopuska, 1992). Carlozzi et al. (1995) hypothesized that empathy is positively related to creativity and expressiveness and inversely related to dogmatism. An affective concern for the relationship between self and others seems to heighten one's sensitivity to the environment as well. Research shows that there is a strong connection between cognitive and affective processes and that emotion can contribute to creativity in several ways (Lubart & Getz, 1997; Russ, 1993). Lubart and Getz (1997, p. 286) argue that people in an emotional state may notice stimuli in the environment that they would usually overlook and that they may interpret stimuli in novel ways because of their emotional perspective.

Ego development, autonomy, and field independence. Many individual traits of creativity and the quality of interaction between two or more individuals are related to self-esteem and ego development. Investigations by Workman and Stillion (1974)

seem to confirm "a positive relationship between creativity and ego development, since all creativity sub-scores, as well as total creativity, were significantly related to ego development" (p. 193). A creative person needs self-esteem for various reasons. Abandoning common frames of reference entails uncertainty, isolation, criticism, opposition, and self-doubt. A person needs perseverance not only in order to concentrate on a certain topic for lengthy period but also in order to overcome the various hurdles encountered during the processes of acceptance and implementation. Creativity requires one to take risks, and self-trust makes one immune to rejection by evaluators, journal editors, and peer groups. Creative people seem to be less threatened by failure and criticism than noncreative individuals are. If the self-trust feedback loop is strong enough, individuals will be intensely concerned with their initial vision and will be able to carry on despite apparent rejection (Earl, 1987, p. 423). Funke (2000, p. 295) points out that individuals must be entirely convinced of the value and significance of their creative action and not allow themselves to be negatively affected by others' criticism and disparagement. Self-perception and self-confidence develop in the framework of social relations and spatial settings. They are shaped by past success and failure and derived from the image and status of one's place of work, the reputation of the organization one belongs to, and places and spatial contexts with which people identify themselves.

Witkin, Dyke, Faterson, Goodenough, and Karp (1962) introduced the concept of field independence, which means autonomy, freedom from a scientific discipline's strict rules or shared beliefs, and freedom from the restrictive effects of dependency on others. Creative persons must free themselves from orthodox means of solving problems, from given structures and rules. Field independence is a necessary, but not sufficient, condition for creativity. Creative individuals are likely to be field independent, but not all field-independent subjects are creative. Gordon and Marquis (1966) and Bloomberg (1967, 1971) report that field-independent persons were consistently more creative than field-dependent persons. Similar conclusions about the importance of independence are drawn by Hanák (1993), who analyzes the marginality of creative Jews in the Vienna of 1900. A stage of independence and integrity offers marginal men a sort of cognitive privilege (p. 149). However, Ohnmacht and McMorris (1971) warn not to oversimplify these relations. Autonomy and field independence are closely related with other characteristics, and it may well be that only the cumulative effect of these related variables has an impact on creativity.

Research on self-esteem bears out the theory of cognitive tuning, which rests on the assumption that a relationship exists between affect and creativity (Friedman & Förster 2002). Positive affective states facilitate creative problem-solving (Isen et al., 1987) and bolster cognitive flexibility. It is posited that individuals in a positive affective state become more inclined to take risks and adopt a relatively heuristic processing style in which the likelihood of generating novel alternatives rises (Friedman & Förster 2002; Isen, 1987). In contrast, negative affective states entail risk aversion, increase adherence to established plans of action, and lead to diminished originality.

Self-esteem and self-confidence are important prerequisites of creativity, but ego defenses exert a dysfunctional influence in contexts where change and innovation are desirable. They reduce the organization's ability to learn and adapt. The most

important ego defenses seem to be denial of reality, rationalization (an attempt to justify needs, feelings, and behavior), idealization (overevaluation), fantasy (unconscious endeavor to fulfill or gratify difficult or impossible goals and aspirations), and symbolization (Brown & Starkey, 2000; Laughlin, 1970).

Sensitivity to the environment, acuteness of perception and observation. People see what they have become sensitive to, what has made an impression on them. Being aware of and sensitive to the environment, not falling into routine, taking nothing in the external environment for granted, and retaining the capacity to be surprised all belong to the realm of creative activities in both the arts and science (see Robinson, 1970, p. 9). Perceiving the environment in predetermined categories hinders creativity. Artists and other creative individuals often show an "unusually intensive sensitivity to reality" (Kleinschmidt, 1978, p. 52). Creative individuals (especially artists) are said to have greater sensory responsiveness and heightened sensitivity to their inner and outer world (Niederland, 1967, p. 12).

> Only by really looking at the world, and by constantly perceiving it afresh, can we hope to break down our stereotyped sets of responses and open up the opportunity to discover different structures in the reality that surrounds us. … We must learn to see … with our eyes and not with our brains, to perceive the world as it appears to us *before* memory with all its habitual associations and interpretations and the intellect with all its categories and conditioned reflexes have time to step in. (Robinson, 1970, p. 5)

Creativity is not merely a matter of inventing solutions, it also involves identifying the important problems of the future (see Patton, 2002, p. 125). Many of these problems are identified by dealing with challenges and risks of the environment. Many traits of creative persons are learned through interaction with the environment, or they shape the perception of the environment or influence the interaction with the environment (see Fig. 6.2).

Theoretical Issues Concerning the Spatiality of Creative Behavior

> *Chance favors only the prepared mind.*
>
> Louis Pasteur (as quoted in Cropley, 2006, p. 394)

Relations between the physical environment and creative processes. As long as scholars focus on the social environment, they can avoid a host of philosophical and scientific controversies. However, a growing number of researchers demand that social and behavioral scientists no longer ignore the physical world, especially the ecological environment. The relationships between characteristics of the physical environment and psychological processes are still hotly contested. Is the physical environment only what appears through perceptual experience or does there exist a "real world" outside perception? How much do the "perceptual world" and the "real world" correspond? To what extent are individual differences in perceiving the environment due to biological or psychological dispositions and unconscious

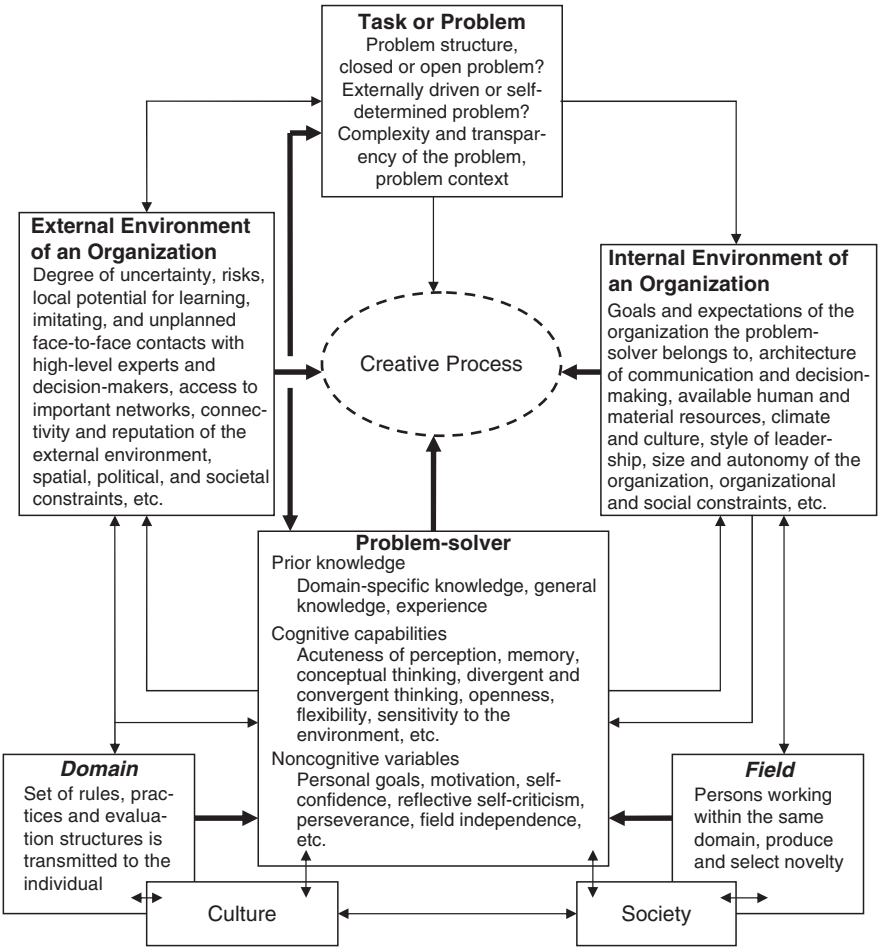

Fig. 6.2 Relations between task, environment, and problem-solver (design P. Meusburger)

processes? Can the social and cultural meaning of an environment be separated from that environment's materiality? Does the Cartesian distinction between the material and symbolic world still make sense? Is perception a holistic or a mechanistic phenomenon? What do we know about subconscious processes of perception and information-processing? Philosophers and psychologists have been concerned with some of these questions since the beginnings of their disciplines. Disputes continue to pit the phenomenological orientation (Gestalt theory) against the "New Look" school of perception, Brunswik's (1956, 1957) theory of the lens model against Gibson's (1979) ecological perception (see Bonnes & Secchiaroli, 1995, pp. 20–58), and holistic approaches against mechanistic ones.

In the conventional approach to perception, perception of the external environment is a function of several different interpretive psychological processes. It is

assumed that a stimulus activates a specific nervous system receptor and that the individual interprets the pattern of receptor stimulation by drawing on memories of past experiences in order to gather information about the environment. According to this approach, humans must interpret unconnected stimuli in order to construct something meaningful about the environment (for details see Bell et al., 2001, p. 65). Gibson (1979) believes that perception is more holistic than that. He holds that properties of the environment are perceived not as distinct points but rather as meaningful entities.

Until the 1990s, most social and behavioral scientists argued that it was mainly the psychological, symbolic, and functional meaning of places, environmental structures, and spatial arrangement of objects that influenced behavior and creativity. In recent years, however, researchers have argued against neglecting the role of the materiality of objects and of the corporeality of persons (Funke, 2007; Gieryn, 2000, 2002a, b; Graumann, 2002; Jöns, 2003, 2006; Meusburger, 2008). A Cartesian distinction between the material and symbolic worlds no longer makes sense in an explanation of the actions of individuals in space. Therefore, environmental psychology (for an overview see Bell et. al., 2001; Bonnes & Secchiaroli, 1995; Funke, 2007; Graumann, 2002; Graumann & Kruse, 2003), environmental anthropology (Berkes, 1999; Biersack, 1999; Neves-Graça, 2003, 2007), human geography (Jöns, 2003, 2006; Klüter, 2003; Koch, 2003; Salbaum, 2008; Weichhart, 2003), and sociology (Fischer-Kowalski & Erb, 2003; Fischer-Kowalski & Weisz, 1998) have developed concepts to bridge the old dichotomy between the material and social. Given Bateson's epistemology (Bateson, 1972; Bateson & Bateson, 1987), environmental anthropologists no longer accept views that reduce ecosystems and environments to culturally constructed categories. A main premise of an approach derived from Bateson is that human–environmental relations are characterized by their mutual causality, that they co-construct one another (Berkes, 1999; Neves-Graça, 2007; Rappaport, 1979). According to Neves-Graça (2007), "human-environmental relations are recursively linked, … such that knowledge, forms of knowing, and experiences of past human-environmental practices are constantly being re-embedded in new contexts that are themselves simultaneously sociocultural, historical and ecological. Hence, the ontological condition of human-environmental relations is irreducibly interactive and dynamic" (pp. 149–150). The subject is integrated into the context and socialized by the context. It adapts to the environment but also actively adjusts and shapes the environment according to its capabilities, resources, and position in the context. Places and environments have a physical reality that can be structured by humans. This spatial positioning of objects is decoded, synthesized, and interpreted by other agents who give the spatial patterns a social meaning.

In many cases the symbolic meaning and function of an object cannot be separated from its materiality. It is not only the symbolic meaning of a banknote that enables its bearer to buy a good; it is also the note's materiality, which is carefully checked by the banker or shop owner in order to distinguish legal tender from counterfeits. It is the materiality of a painting that enables experts to decide whether it is an authentic work of a certain artist or a well-made copy. It is the materiality

of shelters that constitutes their function and meaning. The physical environment provides a wide variety of experiences and learning opportunities and can enhance creative processes (McCoy & Evans, 2002, p. 409). After traumatic events the physical environment assumes the role of a conditioned stimulus that elicits a conditioned response. Just the sight, sound, or smell of a traumatic environmental experience may trigger a negative reaction such as a phobia, anxiety disorder, or panic attack (Anthony & Watkins, 2002, p. 131). Furthermore, some material objects can direct or stop actions long before individuals have had a chance to attach a meaning to them. An unknown danger, too, can have devastating effects.

In studying the relations between environment and psychological processes or the role of environments as archives and external memories, one might find it helpful to follow Neisser (1987), who distinguishes between perceptual-visual processes (seeing) and perceptual-cognitive processes (thinking, categorizing) and between direct perception and theory-dependent categorizations. Perceptual-visual processes are based on the direct intake of objectively existing information, whereas perceptual-cognitive processes go beyond that information on the basis of beliefs about the world. Thinking and categorizing rely on inferential processes of cognitive functioning and are "anchored to the sociocultural characteristics of the context" (Bonnes & Secchiaroli, 1995, p. 32). A similar point is made by Funke (2007), who argues that the perception of space takes place at two levels, the "surface level" and the "deep level" (pp. 245–250). The perception of space at the surface level is based on the physiology of the sensory system, which analyzes depth cues visible to the human eye, interprets smells and sounds, and reconstructs the environment in a three-dimensional model of reality in the perceiver's head. The perception of space at the deep level has to do with functional aspects, that is, with the meaning and significance of space as communicated between persons. At the deep level, places, regions, and landscapes have the function of an external memory or archive (see Funke, 2007, p. 245). A detailed description of the role of landscapes as external memory is presented by Wassmann (2003) and Wassmann & Keck (2007). Because space perception "requires an analysis of personal memories for certain places" (Funke, 2007, p. 251), perceptual processes are inseparable from human memory. A similar argument is used by the transactional school of perception, whose adherents focus on perceptual phenomena but tend to consider the perceptual issue to be part of the more general one of the individual's relationship to the surrounding world.

Some ecologically relevant affordances, or "invariant functional properties of objects as they are encountered in the course of an organism's active exploration" (Bell et. al., 2001, p. 65; see also Gibson, 1979), can be perceived directly with little or no complex interpretation. They convey a great deal of information without elaborate processing by higher brain centers. Other environmental signals, prompts, and juxtapositions send ambiguous or polyvalent messages, which are perceived and interpreted very differently by actors with varying prior knowledge, experience, memory, absorptive capacities, or ambitions. If a stimulus is ambiguous, then perceivers must draw more heavily on their own knowledge base, their ability to recognize and interpret patterns, their memory, and the social-psychological group

dynamics than if the stimulus is unambiguous. Only motivated, experienced, and capable persons are able to perceive and interpret ambiguous environmental clues and stimuli in a way that they can make timely use of the locally offered potential or avoid imminent risks. The ability to recognize the meaning and value of ambivalent cues and patterns early is one of the most important attributes of creative persons and successful decision-makers.

Many orientation skills, habits, and routines, such as driving a car or skiing downhill, are directed through subconscious perception of material objects and codes of the environment. The model by Clitheroe et al. (1998) assumes that "prompts are the starting point of an intentional or unintentional psychological and/or behavioral process. Prompts may come from social or physical features of the contexts; from individuals participating in the context; or from a wide array of extracontextual sources such as published research results, news media, or the internet" (p. 106). Whatever an individual's talent, the conditions under which he or she works can significantly raise or lower the level of creativity (Amabile, 1996, p. 17).

The effects that a place, context, or environment has on creative processes cannot be precisely forecast. A context or environment means potential; it is an offer or risk that some agents will perceive and take into account and that others will disregard. Contexts and environments indirectly "influence creative performance by shaping critical psychological processes rather than directly influencing creative performance" (Choi, 2004, p. 197). A context can affect individual creativity in a number of ways. It can structure problem-solving efforts (Mumford & Gustafson, 1988) or shape the nature and conditions under which individual capacities are developed and applied (Redmond & Mumford, 1993). It can sharpen the individual's intrinsic and extrinsic motivation to pursue new ideas and take risks, and it can furnish or withhold the needed resources. It can raise or lower the likelihood of meeting prominent or inspiring people and can make for solitude or overstimulation and stressors. However, the predictive power of social macrophenomena such as spatial context, environment, or place is much greater than that of any discrete variable studied in laboratory experiments.

Place dependence and emotional attachment to places. Comparatively little controversy exists about which relations between environment (context) and behavior can be subsumed by the terms *place dependence*, and *place attachment*. Individuals depend on places. They are emotionally attached to places, are satisfied with places or gather regularly at specific places for various functional, symbolic, and emotional reasons. Places act as a meeting point or catalyst bringing people, ideas, and resources together. Place dependence exists when scientists need expensive scientific infrastructure for their daily work, when they need frequent and regular face-to-face contact with other experts, or when they want to avail themselves of an institution's reputation or when they seek the liberty of uncontrolled discussions. Even the most talented and best prepared individual cannot be creative if he or she has no chance to work or perform. A surgeon needs a patient, a conductor needs an orchestra, and a chemist needs a laboratory in order to develop and demonstrate his or her creativity. An institution's quality of scientific infrastructure (e.g., libraries, laboratories, and computers), amount of resources, community of experienced researchers, and scientific standing affect the range of possible research questions,

the quality of research output, and the institution's capacity to attract and retain outstanding scholars. Being prepared to tackle a challenge is not enough; one must also meet the right people and be at the right place at the right time.

Places differ according to their functions, connectivity, and the range and quality of their interactions with other places. Some professions derive part of their identity, reputation, authority, and authenticity from the places they "belong to." The formation of identity is largely shaped by relations to others, both by identification with others and differentiation from others. The probability of spontaneously meeting the knowledgeable others who are needed for interaction and inspiration as well as for critique, judgment, and evaluation varies from place to place. The dependency on face-to-face communication and infrastructure, and thus the importance of place dependence, varies from one profession and discipline to the next. An artist needs a different environment to develop his or her creativity than a banker; a high-energy physicist, a different environment than a theoretical physicist. Place dependency varies according to stages of a creative process as well. Latent or preliminary phases of inspiration, incubation, and preparatory processes of creativity need different types of environments than do periods of elaboration, which likewise require contexts different from those needed in phases of evaluating, showing and marketing. Each phase has its own demands for stimulation, distraction, solitude, organizational support, publicity, and frequency of face-to-face contact.

Individuals can be emotionally attached to certain places and environments. Places are embedded in contexts of feeling, emotion, and memory and can have an atmospheric quality.

> It is above all the symbolic effects and the atmospheric qualities of places that motivate those who have the necessary material, social and cultural resources (wealth, power) to turn places into "scenes," to establish spatial orders that tell "stories" (narrative spaces) and in their symbolic effect convey an atmosphere of amazement, of fascination, and of cultural and social support, of belonging and identity while, at the same time, the existing power and rule relationships can be reproduced and legitimized. (Hennings, 2007, p. 129)

If agents repeatedly have negative experiences at certain places, they may project their negative emotions and fears onto these places with the effect that places evoke in them negative feelings or anxiety when they return to them. A specific environment or spatial context can destroy self-esteem and arouse anxiety, whereas another environment can foster the feeling of security and enhance capability beliefs, motivation, ideational fluency, or the willingness to take risks. With trauma victims a particular place or space may later repeatedly unleash the memory of the trauma (what one has tried to bury in the subconscious). Crowded public spaces often set off panic attacks or agoraphobia (Anthony & Watkins, 2002). "The physical environment assumes the role of a conditioned stimulus that elicits a conditioned response. Just the sight, sound, or smell of a traumatic environmental experience may trigger a negative reaction" (p. 131).

Affective memories can be activated through pictures, objects, names, and scenes. Places and environments can serve as triggers for the episodic memory, which makes the recollection of an episode possible. Lubart and Getz (1997) use the metaphor of a tuning fork to describe the relation between object, memory, and emotion. Depending on a person's emotional state and experience, external stimuli can start a particular tuning fork vibrating.

The environment: Opportunities to learn and experiment. Humans acquire much of their knowledge by interacting with the social and material environment, gathering experience, and developing skills when performing tasks and solving problems in a specific context. Problems to be solved vary spatially, as do the opportunities to imitate successful individuals. The localized necessity of coping repeatedly with specific challenges and solving particular problems steers attention to certain topics, sharpens the perception of particular clues and patterns, builds specialized knowledge bases, and sparks motivational processes that can give rise to new ideas and actions. A stimulating and enriched early environment is an important factor in developing intelligence and creativity and may have an even stronger impact than the environments in later career phases. Children and students learn a great deal through their identification with parents, teachers, mentors, and other role models. If students adopt the attitudes of their teachers, it is not necessarily imitation but rather "the integration of attitudes about the self, about how one finds self-satisfaction and self-fulfillment" (Berlin, 1960, p. 99). In order to meet the expectations or gain the recognition of the mentors or peers, students must internalize the rules of the domain and the context. The context tells the informed actor what kind of behavior will be regarded as appropriate within certain limits.

Learning to survive in a given environment for an extended period equips or adapts agents for particular challenges and situations. Social systems operating for an extended period in specific physical environments (e.g., rain forests, deserts, or polar regions) have developed certain techniques, strategies, competencies, knowledge bases, and value systems to help them adjust to their environment and adapt it. Similar opportunities and necessities to learn derive from social and cultural environments as well. Artists, scientists, and engineers are not the only people who evaluate their work before they complete it. Friends, adversaries, teachers, students, colleagues, reviewers, critics, and the general audience often participate in the creative process by joining in the evaluation of emerging works or previous ones. "The evaluation itself contributes to the value of the work: that is, the evaluative acts that go into the initial creation of the work and its later actualization, form part of an organic whole' " (Leddy, 1994, p. 173). The criticisms and encouragement of others enrich or diminish the scholar's or artist's self-concept and self-esteem and influence that person's intrinsic motivation.

The evaluation process—another important part of the scientist's or artist's creative experience—also varies spatially. An idea, theory, or piece of work that is praised and admired in one location may be misunderstood, heavily criticized, or rejected in others. University departments, research institutions, and art schools differ in their learning environments, conditions of professional socialization, chances to communicate with experienced and knowledgeable experts, material and personal resources, attitudes, expectations, value systems, credentials, reputation, and socioemotional relationships that support or impede creative processes.

Places and spatial contexts as potential for serendipitous interactions. In some special fields of painting, music, or science, only a few select critics and discussion partners serve as a valid reference point (see Funke, 2000, p. 292). Colonies of artists (Murnau in Bavaria, or Worpswede northeast of Bremen), architects (Bauhaus

in Dessau), or scientists (development of the nuclear bomb at Los Alamos) were able to achieve their goals successfully in remote rural locations primarily because their projects were self-sustaining in their evaluation processes. Other projects depend on transgressing social and scientific systems (Acham, 2003, p. 292) and crossing disciplinary boundaries; drawing analogies from completely different domains that previously had nothing to do with one another; consulting a broad variety of knowledge bases; and face-to-face contact with experts, evaluators, and critics of many different disciplines. Only major, functionally complex cities offering a large variety of professional skills, scientific disciplines, artistic styles, cultural experiences, and economic and cultural diversity provide such potential for unplanned contact. Díaz de Chumaceiro (1998, 1999, 2004) and others have shown that chance events, unplanned contact, or serendipity have led many scientists (e.g., Pasteur, Fleming, Röntgen, Becquerel, Edison, Galvani, Nobel, and Freud) to breakthroughs or have decisively shaped and affected their choice and pursuit of a career. Serendipity is the unexpected finding of valuable ideas, persons, and things. In this context *true serendipity* is defined as the accidental finding of something valuable but unsought, *pseudoserendipity* is discovery by accidental means of things sought (for details see Díaz de Chumaceiro, 2004, pp. 346–347).

What makes a location attractive is the *possible*, not the actual, contact with other highly creative persons. It is the place's *imagined*, not the real, advantages, that make a location attractive. Whether and how often this potential is activated through communication and interaction is another question. The fact that millions of people play the lottery indicates that possibility is a strong driving force that influences behavior. In most lines of work, the probability of profiting from serendipitous opportunities or interactions is much higher in some spatial contexts than in others.

Members of prestigious university departments, editors of international journals, and researchers integrated into powerful research clusters and long-range research programs demonstrate that long-term proximity to the epistemic centers of disciplinary power affords a scientist prestige, reputation, and strategic advantages and facilitates his or her access to resources. Over time, though, it can have detrimental effects on that person's creativity. There is much empirical evidence that a position near the "key persons" may give scientists the illusion of moving automatically in the right direction or being at the frontier of research. The impact of leading journals makes it difficult for scientists to abandon dominating paradigms or to come up with divergent and provocative thinking. Large research programs and clusters keep scholars on tracks favored or supported by politics or project leaders. Some creative scientists and artists are very proficient at alternating between proximity and distance to epistemological power or between publicity and solitude. They need proximity to experienced, knowledgeable, and challenging people for inspiration, ideas, motivation and emotional support. They then seek distance and solitude in order to avoid strict paradigms and elaborate their still poorly conceived ideas or products without the interference of early critique. In some disciplines, periods of data-gathering, experimentation, and elaboration are place dependent because they depend on expensive instruments or field work. In other fields, this period may also be spent in solitude. However, when it comes to showing and marketing results,

proximity to the important decision-makers of a discipline and platforms of attention is helpful.

The environment of a single city or area seldom offers all the incentives, inspiration, and learning opportunities that an artist, artisan, or scholar needs to develop his or her creativity. Mobility increases professional experience and stimulates "new patterns of thinking" (Törnqvist 2004, p. 236). Creative persons are therefore supposed to be mobile and circulate from one place (court, university) to the next so that they experience different work environments; learn from different cultures, professional practices, and knowledge bases; and focus attention on new issues, techniques, and methods. Spatial mobility and—ultimately—location in one of the epistemic centers of one's profession has become a status symbol or sign of excellence in certain professions.

Open Debates and Suggestions for Further Research

Additional research is needed on the role of the time dimension, unconscious information-processing during the incubation phase, the neurological principals of creative thought, the relations between knowledge and action, cultural impacts on creativity, and various other questions. There is much empirical evidence that creativity does not proceed in linear or hierarchical paths but rather in uneven, chaotic bursts in response to problems that erupt over time (Drazin et al., 1999; Kazanjian, 1988; Peterson, 1998). The generation and introduction of creative ideas is easier in some periods than in others. The chance to make certain organizational changes or transform systems is relatively brief. If a creative idea comes too early or too late, it will not be accepted or successfully implemented. Histories of science, inventions, and the arts contain many examples of lengthy lags between the date of an idea's conception or a product's creation and the moment when that idea or product was regarded as valuable and creative. These histories brim with disappointing accounts of highly creative ideas and products that have been ignored by informed, well-educated people (see Magyari-Beck, 1998). Many artists whose paintings are sold today for millions of dollars were not considered as creative in their own lifetimes. Cropley (2006, p. 396) describes how the mathematical propositions of Evariste Galois (e.g., the Galois Theory), who is now regarded as one of history's most original mathematicians, were judged to have no foundation in mathematical knowledge and to lack effectiveness. "His divergent thinking could not gain recognition until convergent thinking had advanced sufficiently to make the effective novelty of his ideas apparent" (pp. 396–397).

The time dimension, too, plays an important role in understanding the interplay of agent and structure. Individuals react differently to the influence of macrolevel factors across multiple periods of time (see Drazin et al., 1999, p. 290). A number of papers (Gray, 1958, 1961, 1966; Munro, 1962; Simonton, 1975, 1979, 1981) suggest that the ups and downs in creativity are the effects of underlying cycles in the political, economic, and social milieu. When the peaks of these cycles converge, the result is a period of great florescence in the arts and sciences (Simonton, 1981, p. 628).

Another problem related to time is the "nemesis of creativity" (Anspach, 1952). All creative actions become habitual after a time. Styles and patterns developed in

creative periods may eventually become selective and controlling. Creative insights or new revolutionary paradigms introduced by geniuses are worshipped and finally end in a new orthodoxy constraining the creativity of the next generation. "Leading thinkers often bring forth a visionary new thought framework only to have it concretized by well-meaning but shortsighted followers" (Ambrose, 2006, p. 83). This tendency is described by Koestler (1964):

> The new territory opened up by the impetuous advance of a few geniuses, acting as a spearhead, is subsequently occupied by the solid phalanxes of mediocrity; and soon the revolution turns into a new orthodoxy with its unavoidable symptoms of one-sidedness, over-specialization, loss of contact with other provinces of knowledge, and, ultimately, estrangement from reality. We see this happening—unavoidably it seems—at various times in the history of various sciences. The emergent orthodoxy hardens into a 'closed system' of thought, unwilling or unable to assimilate new empirical data or adjust itself to significant changes in other fields of knowledge. (p. 225)

Answers to some of the following questions would greatly help explain some of the still obscure relationships between environment, learning and action: How are colors, smells, sounds, and spatial patterns perceived and how are they processed in different emotional dispositions? What is the evolutionary perspective of the cognitive unconscious (Reber, 1992)? To which extent can intuition or inspiration be triggered by images of the environment? What are the basic neurological principles of creative thought, inspiration, and memory? How does the mind forget and remember (Schacter, 1992)? Is there a neuroscience of creativity? How far can neural structures be epigenetically influenced by variations in external stimulation or by learning? To what extent is the creative process recursive? What provokes recursion? Which contextual variables lead to modifications in the creative process?

Certain theoretical terms, such as *creative industries*, *creative classes*, and *creative cities* (Department of Culture, Media and Sport, 1998; Florida, 2002, 2005), need further debate and clarification. Suggesting that creative cities can "be made," they fascinate politicians and administrators alike. Such expressions have spawned a new policy area and have become buzzwords in recent years. But they and the empirical methodologies used to define creative cities and creative industries are roundly criticized in academia, for they widely fail to reflect decades of creativity research and have little to do with the definition of creativity developed in psychology. According to the British government's Department of Culture, Media and Sport (1998), for instance, creative industries include advertising, architecture, the art and antiques market, crafts, design, designer fashion, film, interactive leisure software, music, the performing arts, publishing, software, and television and radio (p. 1). Jeffcutt (2005) states that creative industries

> are shaped by interconnection between the media/information industries and the cultural/arts sector. … The creative industries are shaped by interconnection between diverse domains (or forms) of creative endeavor (i.e. visual art, craft, print, video, music, etc.) that are brought together through new opportunities for the use of digital media technologies. (p. 104)

Do these interconnections really entail creativity? Is any TV production and any yellow press journal creative? Do plagiarism in music or routine products in advertising conform to the definition of creativity (new, original, and valuable)? What

about the industries *not* mentioned in the British government's list? Do they lack creative people and products? The attempt to label certain industries or professions as creative and the rest, by omission, as noncreative without evaluating their ideas and products contradicts any definition of creativity accepted in the core disciplines of creativity research.

Many psychologists and human geographers regard the term *creative industry* as inappropriate. For if a person accepts the concept of psychological creativity and the assumption that anybody is creative in his or her daily problem-solving, then it makes no sense to distinguish between creative and noncreative industries. If one adopts the concept of historical creativity, then one must accept that creativity can be neither predicted nor administered, that a given profession has only a tiny proportion of historically creative people, and that members of a given profession are not invariably creative. If these propositions are accepted, then it makes no sense to label a whole industry or whole groups of professions as creative before evaluating their ideas and products. Neither the advertising nor the media industry perpetually engage in creative processes and continuously invent and fabricate creative products.

With regard to creative milieus (environments, contexts, and so forth), it may have become evident that the transdisciplinary discourse between human geography and other social and behavioral sciences has not yet come to an endpoint. Indeed, the promising start of this discourse suggests that this long journey will bring many new insights for all who participate.

References

Acham, K. (2003). Zu den Bedingungen der Entstehung von Neuem in der Wissenschaft [Conditions of the emergence of novelty in science]. In W. Berka, E. Brix, & C. Smekal (Eds.), *Woher kommt das Neue? Kreativität in Wissenschaft und Kunst* (pp. 1–28). Vienna: Böhlau.

Alligood, M. R. (1991). Testing Roger's theory of accelerating change: The relationship among creativity, actualization, and empathy in persons 18 to 92 years of age. *Western Journal of Nursing Research*, *13*, 84–96.

Amabile, T. M. (1979). Effects of external evaluation on artistic creativity. *Journal of Personality and Social Psychology*, *37*, 221–233.

Amabile, T. M. (1983a). *The social psychology of creativity*. New York: Springer.

Amabile, T. M. (1983b). Social psychology of creativity: A componential conceptualization. *Journal of Personality and Social Psychology*, *45*, 357–377.

Amabile, T. M. (1988). A model of creativity and innovation in organizations. In B. M. Staw & L. L. Cummings (Eds.), *Research in organizational behavior*, Vol. 10, (pp. 123–167). Greenwich, CT: JAI Press.

Amabile, T. M. (1995). *KEYS: Assessing the climate for creativity*. Greensboro, NC: Center for Creative Leadership.

Amabile, T. M. (1996). Creativity in context: Update to the social psychology of creativity. New York: Westview Press.

Amabile, T. M. & Conti R. (1999). Changes in the work environment for creativity during downsizing. *The Academy of Management Journal*, *42*, 630–640.

Amabile, T. M. & Gryskiewicz, N. (1989). The creative environment scales: The work environment inventory. *Creative Research Journal*, *2*, 231–254.

Amabile, T. M., Goldfarb, P., & Brackfield, S. (1990). Social influences on creativity: Evaluation, co-action, and surveillance. *Creativity Research Journal*, *3*, 6–21.
Amabile, T. M., Conti R., Coon, H., Lazenby, J., & Herron, M. (1996). Assessing the work environment for creativity. *The Academy of Management Journal*, *39*, 1154–1184.
Ambrose, D. (2006). Large-scale contextual influences on creativity: Evolving academic disciplines and global value systems. *Creativity Research Journal*, *18*, 75–85.
Andre, T., Schumer, H., & Whitaker, P. (1979). Group discussion and individual creativity. *Journal of General Psychology*, *100*, 111–123.
Andrews, F. M. & Farris, G. F. (1967). Supervisory practices and innovation in scientific teams. *Personnel Psychology*, *20*, 497–515.
Anspach, E. (1952). The nemesis of creativity: Observations on our occupation of Germany. *Social Research*, *19*, 403–429.
Anthony, K. & Watkins, N. (2002). Exploring pathology: Relationships between clinical and environmental psychology. In R. B. Bechtel & A. Churchman (Eds.), *Handbook of environmental psychology* (pp. 129–145). New York: Wiley.
Arieti, S. (1976). *Creativity: The magic synthesis*. New York: Basic Books.
Banghart, F. D. & Spraker, H. S. (1963). Group influence on creativity in mathematics. *The Journal of Experimental Education*, *31*, 257–263.
Barker, R. G. (1968). *Ecological psychology: Concepts and methods for studying the environment of human behavior*. Stanford, CA: Stanford University Press.
Barron, F. (1955). The disposition toward originality. *Journal of Abnormal and Social Psychology*, *51*, 478–485.
Barron, F. (1969). *Creative person and creative process*. New York: Holt, Rinehardt & Winston.
Barron, F. B. & Harrington, D. M. (1981). Creativity, intelligence, and personality. *Annual Review of Psychology*, *32*, 439–476.
Bateson, G. (1972). *Steps to an ecology of mind*. New York: Ballantine Books.
Bateson, G. & Bateson, M. (1987). *Angels fear: Towards an epistemology of the sacred*. Toronto: Bantam Books.
Becker, G. (2000–2001). The association of creativity and psychopathology: Its cultural-historical origins. *Creativity Research Journal*, *13*, 45–53.
Bell, P. A., Greene, T. C., Fisher, J. D., & Baum, A. (2001). *Environmental psychology*. 5th edition. Forth Worth, TX: Harcourt College Publishers.
Bergler, E. (1950). *The writer and psychoanalysis*. Garden City, NY: Doubleday.
Berkes, F. (1999). *Sacred ecology: Traditional ecological knowledge and resource management*. Philadelphia, PA: Taylor & Francis.
Berlin, I. N. (1960). Aspects of creativity and the learning process. *American Imago—A Psychoanalytic Journal for the Arts and Sciences*, *17*, 83–99.
Biersack, A. (1999). Introduction: From the "new ecology" to the new ecologies. *American Anthropologist*, New Series, *101*, 5–18.
Bloomberg, M. (1967). An inquiry into the relationship between field independence-dependence and creativity. *Journal of Psychology*, *67*, 127–140.
Bloomberg, M. (1971). Creativity as related to field independence and mobility. *Journal of Genetic Psychology*, *118*, 3–12.
Boden, M. (1994). What is creativity? In M. Boden (Ed.), *Dimensions of creativity* (pp. 75–117). Cambridge, MA: MIT Press.
Boden, M. (2004). In a nutshell. In M. Boden (Ed.), *The creative mind: Myths and mechanisms* (revised and expanded 2nd ed.). London: Routledge (pp. 1–24).
Bond, C. F., Jr. & Titus, L. J. (1983). Social facilitation: A meta-analysis of 241 studies. *Psychological Bulletin*, *94*, 265–292.
Bonnes, M. & Secchiaroli, G. (1995). *Environmental psychology*. London: Sage.
Briskman, L. (1980). Creative product and creative process in science and the arts. *Inquiry: An interdisciplinary journal of philosophy 23*, 83–106.
Brown, A. D. & Starkey, K. (2000). Organizational identity and learning: A psychodynamic perspective. *The Academy of Management Review*, *25*, 102–120.

Brown, V., Tumeo, M., Larey, T. S., & Paulus, P. B. (1998). Modeling cognitive interactions during group brainstorming. *Small Group Research*, *29*, 495–526.

Brunswik, E. (1956). *Perception and the representative design of psychological experiments*. Berkeley, CA: University of California Press.

Brunswik, E. (1957). Scope and aspects of cognitive problems. In J. S. Bruner (Ed.), *Contemporary approaches to cognition* (pp. 5–31). Cambridge, MA: Harvard University Press.

Burchard, E. M. L. (1952). The use of projective techniques in the analysis of creativity. *Journal of Projective Techniques*, *16*, 412–427.

Campbell, J., Dunnette, M. D., Lawler, E. E., & Weick, K. E. (1970). *Managerial behavior, performance, and effectiveness*. New York: McGraw-Hill.

Candolle, A. de (1873). *Histoire des sciences et des savants depuis deux siecles* [History of science and scholarship over two centuries]. Geneva, Switzerland: Georg.

Canter, D. (1977). *The psychology of places*. London: Architectural Press.

Canter, D. (1985). Putting situations in their place: Foundations for a bridge between social and environmental psychology. In A. Furnham (Ed.), *Social behavior in context* (pp. 208–239). London: Allyn & Bacon.

Carlozzi, A., Bull, K. S., Eells, G. T., & Hurlburt, J. D. (1995). Empathy as related to creativity, dogmatism, and expressiveness. *Journal of Psychology*, *129*, 365–373.

Choi, J. N. (2004). Individual and contextual predictors of creative performance: The mediating role of psychological processes. *Creativity Research Journal*, *16*, 187–199.

Clapham, M. M. (2000–2001). The effects of affect manipulation and information exposure on divergent thinking. *Creativity Research Journal*, *13*, 335–350.

Clitheroe, H. C., Stokols, D., & Zmuidzinas, M. (1998). Conceptualizing the context of environment and behavior. *Journal of Environmental Psychology*, *18*, 103–112.

Cooper, R. B. & Jayatilaka, B. (2006). Group creativity: The effects of extrinsic, intrinsic, and obligation motivations. *Creativity Research Journal*, *18*, 153–172.

Couger, J. D. (1995). *Creative problem solving and opportunity finding*. Danvers, MA: Boyd & Fraser.

Cropley, A. (2006). In praise of convergent thinking. *Creativity Research Journal*, 18, 391–404.

Csikszentmihalyi, M. (1990). The domain of creativity. In M. A. Runco & R. S. Albert (Eds.), *Theories of creativity* (pp. 190–212). Newbury Park, CA: Sage.

Csikszentmihalyi, M. (1988). Society, culture, and person: A systems view of creativity. In R. J. Sternberg (Ed.), *The nature of creativity* (pp. 325–339). Cambridge, England: Cambridge University Press.

Csikszentmihalyi, M. (1999). Implications of a systems perspective for the study of creativity. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 313–335). New York: Cambridge University Press.

Cummings, L. L. (1965). Organizational climates for creativity. *The Academy of Management Journal*, *8*, 220–227.

D'Agostino, F. (1984). Chomsky on creativity. *Synthese*, *58*, 85–117.

DeBono, E. (1968). *New Think*. New York: Basic Books.

Deci, E. L. & Ryan, R. M. (1980). The empirical exploration of intrinsic motivational processes. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 13, pp. 39–80). New York: Academic Press.

Deci, E. L. & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum.

Denison, D. R. (1996). What is the difference between organizational culture and organizational climate? A native's point of view on a decade of paradigm wars. *The Academy of Management Review*, *21*, 619–654.

Department of Culture, Media and Sport (DCMS) (1998). *The creative industries mapping report*. London: HMSO.

Díaz de Chumaceiro, C. L. (1998). Serendipity in Freud's career: Before Paris. *Creativity Research Journal*, *11*, 79–81.

Díaz de Chumaceiro, C. L. (1999). Research on career paths: Serendipity and its analog. *Creativity Research Journal*, *12*, 227–229.
Díaz de Chumaceiro, C. L. (2004). Serendipity and pseudoserendipity in career paths of successful women: Orchestra conductors. *Creativity Research Journal*, *16*, 345–356.
Diehl, M. & Stroebe, W. (1991). Productivity loss in idea-generating groups: Tracking down the blocking effect. *Journal of Personality and Social Psychology*, *61*, 392–403.
Drazin, R., Glynn, M. A., & Kazanjian, R. K. (1999). Multilevel theorizing about creativity in organizations: A sensemaking perspective. *The Academy of Management Review*, *24*, 286–307.
Dreistadt, R. (1969). The use of analogies and incubation in obtaining insight in creative problem solving. *Journal of Psychology*, *71*, 159–175.
Dunnette, M. D., Campbell, J., & Jaastad, K. (1963). The effect of group participation on brainstorming effectiveness for two industrial samples. *Journal of Applied Psychology*, *47*, 30–37.
Earl, W. L. (1987). Creativity and self-trust: A field study. *Adolescence*, *22*, 419–432.
Eisenberger, R. & Rhoades, L. (2001). Incremental effects of reward on creativity. *Journal of Personality and Social Psychology*, *81*, 728–741.
Eisenberger, R., Rhoades, L., & Cameron, J. (1999). Does pay for performance increase or decrease perceived self-determination and intrinsic motivation? *Journal of Personality and Social Psychology*, *77*, 1026–1040.
Eissler, K. R. (1967). Psychopathology and creativity. *American Imago—A Psychoanalytic Journal for the Arts and Sciences*, *24*, 35–81.
Ellis, H. (1926). *A study of British genius* (rev. ed.). Boston, MA: Houghton Mifflin.
Ericsson, K. A. (Ed.) (1996). *The road to excellence: The acquisition of expert performance in the arts and sciences, sports, and games*. Mahwah, NJ: Erlbaum.
Eulie, J. (1984). Creativity: Its implications for social studies. *Social Studies*, *75*, 28–31.
Eysenck, H. J. (1994). The measurement of creativity. In M. A. Boden (Ed.), *Dimensions of creativity* (pp. 199–242). Cambridge, MA: MIT Press.
Feldman, D. H., Csikszentmihalyi, M., & Gardner, H. (1994). *Changing the world: A framework for the study of creativity*. New York: Praeger.
Fischer-Kowalski, M. & Erb, K. (2003). Gesellschaftlicher Stoffwechsel im Raum. Auf der Suche nach einem sozialwissenschaftlichen Zugang zur biophysischen Realität [Societal metabolism in space: In search of a social science approach to biophysical reality]. In G. Kohlhepp, A. Leidlmair, & F. Scholz (Series Eds.) & P. Meusburger & T. Schwan (Vol. Eds.), *Erdkundliches Wissen: Vol. 135. Humanökologie: Ansätze zur Überwindung der Natur-Kultur-Dichotomie* (pp. 257–285). Stuttgart, Germany: Steiner.
Fischer-Kowalski, M. & Weisz, H. (1998). Society as a hybrid between material and symbolic realms: Towards a theoretical framework of society–nature interaction. *Advances in Human Ecology*, *8*, 215–251.
Florida, R. (2002). *The rise of the creative class: And how it's transforming work, leisure, community and everyday life*. New York: Basic Books.
Florida, R. L. (2005). *Cities and the creative class*. New York: Routledge.
Ford, C. M. (1996). A theory of individual creative action in multiple social domains. *The Academy of Management Review*, *21*, 1112–1142.
Forehand, G. A. & Gilmer, B. (1964). Environmental variation in studies of organizational behavior. *Psychological Bulletin*, *62*, 361–382.
Forgays, D. G. & Forgays, D. K. (1992). Creativity enhancement through flotation isolation. *Journal of Environmental Psychology*, *12*, 329–335.
Frensch, P. A. & Funke, J. (1995). Definitions, traditions, and a general framework for understanding complex problem solving. In P. A. Frensch & J. Funke (Eds.), *Complex problem solving: The European perspective* (pp. 3–25). Hillsdale, NJ: Erlbaum.
Friedman, R. S. & Förster, J. (2002). The influence of approach and avoidance motor actions on creative cognition. *Journal of Experimental Social Psychology*, *38*, 41–55.
Funke, J. (2000). Psychologie der Kreativität (Psychology of creativity). In R. M. Holm-Hadulla (Ed.), *Kreativität*. Heidelberger Jahrbücher 44 (pp. 283–300). Heidelberg, Germany: Springer.

Funke, J. (2007). The perception of space from a psychological perspective. In J. Wassmann & K. Stockhaus (Eds.), *Experiencing new worlds* (pp. 245–257). New York: Berghahn Books.
Gagliardi, P. (1986). The creation and change of organizational cultures: A conceptual framework. *Organization Studies*, *7*, 117–134.
Gallo, D. (1989). Educating for empathy, reason and imagination. *Journal of Creative Behavior*, *23*, 98–115.
Galton, F. (1869). *Hereditary genius: An inquiry into its laws and consequences*. London: Macmillan.
Gardner, H. (1988). Creative lives and creative works: A synthetic scientific approach. In R. J. Sternberg (Ed.), *The nature of creativity* (pp. 298–321). New York: Cambridge University Press.
Gardner, H. (1993a). *Frames of mind: The theory of multiple intelligences*. New York: Basic Books, London: HarperCollins.
Gardner, H. (1993b). *Creating minds: An anatomy of creativity as seen through the lives of Freud, Einstein, Picasso, Stravinsky, Eliot, Graham, and Gandhi*. New York: Basic Books.
Gardner, H. (1995). Creativity: New views from psychology and education. *RSA Journal*, 143, 5459, 33–42.
Gibson, J. J. (1960). The concept of stimulus in psychology. *American Psychologist*, *15*, 694–703.
Gibson, J. J. (1979). *An ecological approach to visual perception*. Boston, MA: Houghton Mifflin.
Gieryn, T. F. (2000). A space for place in sociology. *Annual Reviews of Sociology*, *26*, 463–496.
Gieryn, T. F. (2002a). Give place a chance: Reply to Gans. *City & Community*, *1*, 341–343.
Gieryn, T. F. (2002b). What buildings do. *Theory and Society*, *31*, 35–74.
Gimbel, J. (1990). *Science, technology, and reparations: Exploitation and plunder in postwar Germany*. Stanford, CA: Stanford University Press.
Givens, P. R. (1962). Identifying and encouraging creative processes: The characteristics of the creative individual and the environment that fosters them. *Journal of Higher Education*, *33*, 295–301.
Glynn, M. A. (1996). Innovative genius: A framework for relating individual and organizational intelligences to innovation. *The Academy of Management Review*, *21*, 1081–1111.
Goldsmith, R. E. & Matherley, T. A. (1988). Creativity and self-esteem: A multiple operationalization validity study. *Journal of Psychology*, *122*, 47–56.
Gordon, G. & Marquis, S. (1966). Freedom, visibility of consequences, and scientific innovation. *The American Journal of Sociology*, *72*, 195–202.
Götz, I. L. (1981). On defining creativity. *The Journal of Aesthetics and Art Criticism*, *39*, 297–301.
Gough, H. G. (1979). A creative personality scale for the Adjective Check List. *Journal of Personality and Social Psychology*, *37*, 1398–1405.
Graumann, C.-F. (1996). Aneignung [Appropriation]. In L. Kruse, C.-F. Graumann, & E. Lantermann (Eds.), *Ökologische Psychologie. Ein Handbuch in Schlüsselbegriffen* (pp. 124–130). Weinheim, Germany: Psychologie Verlags Union.
Graumann, C.-F. (2002). The phenomenological approach to people–environment studies. In R. B. Bechtel & A. Churchman (Eds.), *Handbook of Environmental Psychology* (pp. 95–113). New York: Wiley.
Graumann, C.-F. & Kruse, L. (2003). Räumliche Umwelt. Die Perspektive der humanökologisch orientierten Umweltpsychologie [Spatial environment: The perspective of environmental psychology oriented to human ecology]. In G. Kohlhepp, A. Leidlmair, & F. Scholz (Series Eds.) & P. Meusburger & T. Schwan (Vol. Eds.), *Erdkundliches Wissen: Vol. 135. Humanökologie: Ansätze zur Überwindung der Natur-Kultur-Dichotomie* (pp. 239–256). Stuttgart, Germany: Steiner.
Gray, C. E. (1958). An analysis of Graeco-Roman development: The epicyclical evolution of Graeco-Roman civilization. *American Anthropologist*, New Series, *60*, 13–31.
Gray, C. E. (1961). An epicyclical model for Western civilization. *American Anthropologist*, New Series, *63*, 1014–1037.

Gray, C. E. (1966). Measurement of Creativity in Western civilization. *American Anthropologist*, New Series, *68*, 1384–1417.

Guilford, J. P. (1967). *The nature of human intelligence*. New York: McGraw Hill.

Hage, J. & Dewar, R. (1973). Elite values versus organizational structure in predicting innovation. *Administrative Science Quarterly*, *18*, 279–290.

Hanák, P. (1993). Social marginality and cultural creativity in Vienna and Budapest (1890–1914). In E. Brix & A. Janik (Eds.), *Kreatives Milieu. Wien um 1900* (pp. 128–161). Vienna: Verlag für Geschichte und Politik.

Hausman, C. R. (1979). Criteria of creativity. *Philosophy and Phenomenological Research*, *40*, 237–249.

Hellriegel, D. & Slocum, J. W. (1974). Organizational climate: Measures, research and contingencies. *The Academy of Management Journal*, *17*, 255–280.

Hennessey, B. A. & Amabile, T. M. (1988). The conditions of creativity. In R. J. Sternberg (Ed.), *The nature of creativity* (pp. 11–38). Cambridge, England: Cambridge University Press.

Hennings, W. (2007). On the constitution of space and the construction of places: Java's magic axis. In J. Wassmann & K. Stockhaus (Eds.), *Experiencing new worlds* (pp. 125–145). New York/Oxford, England: Berghahn Books.

Hocevar, D. (1980). Intelligence, divergent thinking, and creativity. *Intelligence*, *4*, 25–40.

Hoffman, L. R. (1959). Homogeneity of member personality and its effects on group problem-solving. *Journal of Abnormal and Social Psychology*, *58*, 27–32.

Hoffman, L. R. & Maier, N. R. F. (1961). Quality and acceptance of problem solutions by members of homogeneous and heterogeneous groups. *Journal of Abnormal und Social Psychology*, *62*, 401–407.

Hoffman, L. R. & Smith, C. G. (1960). Some factors affecting the behavior of members of problem-solving groups. *Sociometry*, *23*, 273–291.

Holmes, F. L. (1986). Patterns of scientific creativity. *Bulletin of the History of Medicine*, *60*, 19–35.

Isaksen, S. G., Lauer, K. J., & Ekvall, G. (1999). Situational outlook questionnaire: A measure of the climate for creativity and change. *Psychological Reports*, *85*, 665–674.

Isaksen, S. G., Lauer, K. J., Ekvall, G., & Britz, A. (2000–2001). Perceptions of the best and worst climates for creativity: Preliminary validation evidence for the situational outlook questionnaire. *Creativity Research Journal*, *13*, 171–184.

Isen, A. M. (1987). Positive affect, cognitive processes, and social behavior. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 20, pp. 203–253). New York: Academic.

Isen, A. M., Daubman, K. A., & Nowicki, G. P. (1987). Positive affect facilitates creative problem solving. *Journal of Personality and Social Psychology*, *52*, 1122–1131.

James, L. R. & Jones, A. P. (1974). Organizational climate: A review of theory and research. *Psychological Bulletin*, *81*, 1096–1112.

James, L., Hater, J., Gent, M., & Bruni, J. (1978). Psychological climate: Implications from cognitive social learning theory and interactional psychology. *Personnel Psychology*, *31*, 783–813.

Jaušovec, N. (2000). Differences in cognitive processes between gifted, intelligent, creative, and average individuals while solving complex problems: An EEG study. *Intelligence*, *28*, 213–237.

Jeffcutt, P. (2005). The organizing of creativity in knowledge economies: Exploring strategic issues. In D. Rooney, G. Hearn, & A. Ninan (Eds.), *Handbook on the knowledge economy* (pp. 102–117). Cheltenham/Northampton/UK: Edward Elgar.

Jöns, H. (2003). *Grenzüberschreitende Mobilität und Kooperation in den Wissenschaften. Deutschlandaufenthalte US-amerikanischer Humboldt-Forschungspreisträger aus einer erweiterten Akteursnetzwerkperspektive* [Cross-boundary mobility and cooperation in the sciences: U.S. Humboldt Research Award winners in Germany from an expanded actor-network perspective] (Heidelberger Geographische Arbeiten No. 116). Heidelberg, Germany: Selbstverlag des Geographischen Instituts.

Jöns, H. (2006). Dynamic hybrids and the geographies of technoscience: Discussing conceptual resources beyond the human/non-human binary. *Social & Cultural Geography*, *7*, 559–580.

Kalliopuska, M. (1992). Creative way of living. *Psychological Reports*, *70*, 11–14.

Karau, S. J. & Williams, K. D. (1993). Social loafing: A meta-analytic review and theoretical integration. *Journal of Personality and Social Psychology*, *65*, 681–706.
Kasof, J. (1995). Explaining creativity: The attributional perspective. *Creativity Research Journal*, *8*, 311–366.
Kazanjian, R. K. (1988). Relation of dominant problems to stages of growth in technology-based new ventures. *The Academy of Management Journal*, *31*, 257–279.
Kerr, N. L. & Bruun, S. E. (1983). Dispensability of member effort and group motivation losses: Free-rider effects. *Journal of Personality and Social Psychology*, *44*, 78–94.
Klausmeier, H. J. (1961). *Learning and human abilities: Educational psychology*. New York: Harper & Brothers.
Kleinschmidt, H. (1978). American Imago on psychoanalysis, art, and creativity: 1964–1976. *American Imago—A Psychoanalytic Journal for the Arts and Sciences*, *35*, 45–58.
Klüter, H. (2003). Raum als Umgebung (Space as environment). In G. Kohlhepp, A. Leidlmair, & F. Scholz (Series Eds.) & P. Meusburger & T. Schwan (Vol. Eds.), *Erdkundliches Wissen: Vol. 135. Humanökologie: Ansätze zur Überwindung der Natur-Kultur-Dichotomie* (pp. 217–238). Stuttgart, Germany: Steiner.
Koch, A. (2003). Raumkonstruktionen [Space constructs]. In G. Kohlhepp, A. Leidlmair, & F. Scholz (Series Eds.) & P. Meusburger & T. Schwan (Vol. Eds.), *Erdkundliches Wissen: Vol. 135. Humanökologie: Ansätze zur Überwindung der Natur-Kultur-Dichotomie* (pp. 175–196). Stuttgart, Germany: Steiner.
Koestler, A. (1964). *The act of creation*. London: Hutchinson.
Kroeber, A. L. (1944). *Configurations of culture growth*. Berkeley, CA: University of California Press.
Kurtzberg, T. R. & Amabile, T. (2000–2001). From Guilford to creative synergy: Opening the black box of team-level creativity. *Creativity Research Journal*, *13*, 285–294.
Lamm, H. & Trommsdorff, G. (1973). Group versus individual performance on tasks requiring ideational proficiency (brainstorming): A review. *European Journal of Social Psychology*, *3*, 361–387.
Laughlin, H. P. (1970). *The ego and its defenses*. New York: Appleton-Century-Crofts.
Leddy, T. (1994). A pragmatist theory of artistic creativity. *Journal of Value Inquiry*, *28*, 169–180.
Li, J. & Gardner, H. (1993). How domains constrain creativity. *American Behavioral Scientist*, *37*, 94–101.
Lindgren, H. C. & Lindgren, F. (1965). Creativity, brainstorming, and orneriness: A cross-cultural study. *The Journal of Social Psychology*, (ISSN-0022-4545) *67*, 23–30.
Lubart, T. I. (2000–2001). Models of the creative process: Past, present and future. *Creativity Research Journal*, *13*, 295–308.
Lubart, T. I. & Getz, I. (1997). Emotion, metaphor, and the creative process. *Creativity Research Journal*, *10*, 285–301.
Magyari-Beck, I. (1998). Is creativity a real phenomenon? *Creativity Research Journal*, *11*, 83–88.
Maitland, J. (1976). Creativity. *The Journal of Aesthetics and Art Criticism*, *34*, 397–409.
Mandler, G. (1992). Memory, arousal, and mood: A theoretical integration. In S. A. Christianson (Ed.), *The handbook of emotion and memory: Research and theory* (pp. 93–110). Hillsdale, NJ: Erlbaum.
March, J. & Simon, H. (1958). *Organizations*. New York: Wiley.
Martindale, C. (1989). Personality, situation, and creativity. In J. A. Glover, R. R. Ronning, & C. R. Reynolds (Eds.), *Handbook of creativity* (pp. 211–232). New York: Plenum Press.
Martindale, C., Abrams, L., & Hines D. (1974). Creativity and resistance to cognitive dissonance. *The Journal of Social Psychology*, (ISSN-00224545) *92*, 317–318.
Matlin, M. W. & Zajonc, R. B. (1968). Social facilitation of word associations. *Journal of Personality and Social Psychology*, *10*, 455–460.
Matthiesen, U. (2006). Raum und Wissen. Wissensmilieus und KnowledgeScapes als Inkubatoren für zukunftsfähige stadtregionale Entwicklungsdynamiken? [Space and Knowledge: Knowledge milieus and knowledgescapes as incubators for sustainable urban development dynamics]. In D. Tänzler, H. Knoblauch, & H. Soeffner (Eds.), *Zur Kritik der Wissensgesellschaft* (pp. 155–188). Konstanz, Germany: UVK Verlagsgesellschaft.

Matthiesen, U. (2007). Wissensmilieus und KnowledgeScapes [Knowledge milieus and knowledgescapes]. In R. Schützeichel (Ed.), *Handbuch Wissenssoziologie und Wissensforschung* (pp. 679–693). Konstanz, Germany: UVK Verlagsgesellschaft.

Mayer, R. E. (1999). Fifty years of creativity research. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 449–460). New York: Cambridge University Press.

McCoy, J. M. & Evans, G. W. (2002). The potential role of the physical environment in fostering creativity. *Creativity Research Journal*, *14*, 409–426.

Meusburger, P. (1997). Spatial and social inequality in communist countries and in the first period of the transformation process to a market economy: The example of Hungary. *Geographical Review of Japan, Series B*, *70*, 126–143.

Meusburger, P. (1998). *Bildungsgeographie. Wissen und Ausbildung in der räumlichen Dimension* [Geography of education: Knowledge and education in the spatial dimension]. Heidelberg, Germany: Spektrum Akademischer Verlag.

Meusburger, P. (2000). The spatial concentration of knowledge: Some theoretical considerations. *Erdkunde*, *54*, 352–364.

Meusburger, P. (2008). The nexus between knowledge and space. In P. Meusburger (Series Eds.) & P. Meusburger, M. Welker, & E. Wunder (Vol. Eds.), *Knowledge and space: Vol. 1. Clashes of Knowledge. Orthodoxies and heterodoxies in science and religion* (pp. 35–90). Dordrecht, The Netherlands: Springer.

Miller, A. I. (2000). *Insights of genius: Imagery and creativity in science and art*. Cambridge, MA: MIT Press.

Mullen, B., Johnson, C., & Salas, E. (1991). Productivity loss in brainstorming groups: A meta-analytic integration. *Basic and Applied Social Psychology*, *12*, 3–23.

Mumford, M. D. (1995). Situational influences on creative achievement: Attributions or interactions? *Creativity Research Journal*, *8*, 405–412.

Mumford, M. D. (2003). Where have we been, where are we going? Taking stock in creativity research. *Creativity Research Journal*, *15*, 107–120.

Mumford, M. D. & Gustafson, S. B. (1988). Creativity syndrome: Integration, application, and innovation. *Psychological Bulletin*, *103*, 27–43.

Munro, T. (1962). What causes creative epochs in the arts? *The Journal of Aesthetics and Art Criticism*, *21*, 35–48.

Neisser, U. (1987). From direct perception to conceptual structure. In U. Neisser (Ed.), *Concepts and conceptual development: Ecological and intellectual factors in categorization* (pp. 11–23). Cambridge, England: Cambridge University Press.

Nemeth, C. (1986). Differential contributions of majority and minority influences. *Psychological Review*, *93*, 23–32.

Neves-Graça, K. (2003). Investigating ecology: Cognitions in human-environmental relationships. In G. Kohlhepp, A. Leidlmair, & F. Scholz (Series Eds.) & P. Meusburger & T. Schwan (Vol. Eds.), *Erdkundliches Wissen: Vol. 135. Humanökologie: Ansätze zur Überwindung der Natur-Kultur-Dichotomie* (pp. 309–326). Stuttgart, Germany: Steiner.

Neves-Graça, K. (2007). Elementary methodological tools for a recursive approach to human-environmental relations. In J. Wassmann & K. Stockhaus (Eds.), *Experiencing new worlds* (pp. 146–164). New York: Berghahn Books.

Niederland, W. G. (1967). Clinical aspects of creativity. *American Imago*, *24*, 6–34.

Norlander, T., Bergman, H., & Archer, T. (1998). Effects of flotation REST on creative problem solving and originality. *Journal of Environmental Psychology*, *18*, 399–408.

Ohnmacht, F. W. & McMorris, R. F. (1971). Creativity as a function of field independence and dogmatism. *Journal of Psychology*, *79*, 165–168.

Oldham, G. R. & Cummings, A. (1996). Employee creativity: Personal and contextual factors at work. *The Academy of Management Journal*, *39*, 607–634.

O'Reilly, C. A. (1991). Organizational behavior: Where we've been, where we are going. In M. R. Rosenzweig & L. W. Porter (Eds.), *Annual review of psychology* (Vol. 42, pp. 427–458). Palo Alto, CA: Annual Reviews.

Osborn, A. F. (1953). Applied imagination. Principles and procedures of creative thinking. New York: Charles Scribner's.

Ostwald, W. (1909). *Grosse Männer* [Great men]. Leipzig: Akademische Verlagsgesellschaft.

Patrick, C. (1937). Creative thought in artists. *Journal of Psychology*, *4*, 35–73.
Patton, J. D. (2002). The role of problem pioneers in creative innovation. *Creativity Research Journal*, *14*, 111–126.
Paulus, P. B. (2000). Groups, teams, and creativity: The creative potential of idea-generating groups. *Applied Psychology: An International Review*, *49*, 237–262.
Paulus, P. B. & Dzindolet, M. T. (1993). Social influence processes in group brainstorming. *Journal of Personality and Social Psychology*, *64*, 575–586.
Paulus, P. B. & Yang, H. (2000). Idea generation in groups: A basis for creativity in organizations. *Organizational Behavior and Human Decision Processes*, *82*, 76–87.
Paulus, P. B., Larey, T. S., & Ortega, A. H. (1995). Performance and perception of brainstormers in an organizational setting. *Basic and Applied Social Psychology*, *17*, 249–265.
Paulus, P. B., Larey, T. S., & Dzindolet, M. T. (2000). Creativity in groups and teams. In M. Turner (Ed.), *Groups at work: Advances in theory and research* (pp. 319–338). Hillsdale, NJ: Hampton.
Peterson, M. F. (1998). Embedded organizational event: The units of process in organizational science. *Organization Science*, *9*, 16–33.
Plucker, J. A. & Renzulli, J. S. (1999). Psychometric approaches to the study of human creativity. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 35–61). New York: Cambridge University Press.
Rappaport, R. (1979). *Ecology, meaning and religion*. Richmond, CA: North Atlantic Books.
Raudsepp, E. (1958). The industrial climate for creativity: An opinion study of 105 experts. *Management Review*, *47*, 4–8 and 70–75.
Reber, A. S. (1992). The cognitive unconscious: An evolutionary perspective. *Consciousness and Cognition*, *1*, 93–133.
Redmond, M. R. & Mumford, M. D. (1993). Putting creativity to work: Effects of leader behavior on subordinate creativity. *Organizational Behavior and Human Decision Processes*, *55*, 120–151.
Rees, M. & Goldman, M. (1961). Some relationships between creativity and personality. *Journal of General Psychology*, *65*, 145–161.
Rescher, N. (1966). A new look at the problem of innate ideas. *The British Journal for the Philosophy of Science*, *17*, 205–218.
Robinson, J. (1970). Valéry's view of mental creativity. *Yale French Studies*, *44*, 3–18.
Rokeach, M. (1954). The nature and meaning of dogmatism. *Psychological Review*, *61*, 194–204.
Rokeach, M. (1960). *The open and closed mind*. New York: Basic Books.
Runco, M. A. (1988). Creativity research: Originality, utility, and integration. *Creativity Research Journal*, *1*, 1–7.
Runco, M. A. (1993). Operant theories of insight, originality, and creativity. *American Behavioral Scientist*, *37*, 54–67.
Runco, M. A. (1994). *Problem finding, problem solving, and creativity*. Norwood, NJ: Ablex.
Runco, M. A. & Okuda, S. M. (1988). Problem discovery, divergent thinking, and the creative process. *Journal of Youth and Adolescence*, *17*, 213–222.
Russ, S. W. (1993). *Affect and creativity: The role of affect and play in the creative process*. Hillsdale, NJ: Erlbaum.
Saaty, T. L. (1998). Reflections and projections on creativity in operations research and management science: A pressing need for a shift in paradigm. *Operations Research*, *46*, 9–16.
Sadler, W. A. & Green, S. (1977). Feature Essay. *Contemporary Sociology: A Journal of Reviews*, *6*, 156–159.
Salbaum, J. (2008). Zeichen der Mehrdeutigkeit [Signs of polyvalence]. In H. Eigner, B. Ratter, & R. Dikau (Eds.), *Umwelt als System—System als Umwelt? Systemtheorien auf dem Prüfstand* (pp.155–169). Munich, Germany: Oekom.
Schacter, D. L. (1992). Understanding implicit memory: A cognitive neuroscience approach. *American Psychologist*, *47*, 559–569.
Schein, E. (1985). *Organizational culture and leadership*. San Francisco, CA: Jossey-Bass.
Schluchter, W (2005). Handlung, Ordnung und Kultur. Studien zu einem Forschungsprogramm im Anschluss an Max Weber [Action, order, and culture: Studies for a research program building on Max Weber]. Tübingen, Germany: Mohr Siebeck.

Schorske, C. E. (1997). The new rigorism in the human sciences: 1940–1960. In T. Bender & C. E. Schorske (Eds.), *American academic culture in transformation: Fifty years, four disciplines* (pp. 309–329). Princeton, NJ: Princeton University Press.

Schuldberg, D. (2000–2001). Creativity and psychopathology: Categories, dimensions, and dynamics. *Creativity Research Journal*, *13*, 105–110.

Schumpeter, J. A. (1934). *The theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle*. Harvard Economic Studies, Vol. 46. Cambridge, MA: Harvard University Press (Original German work published 1912)

Scott, S. G. & Bruce, R. A. (1994). Determinants of innovative behavior: A Path model of individual innovation in the workplace. *The Academy of Management Journal*, *37*, 580–607.

Scott, W. E. (1965). The creative individual. *The Academy of Management Journal*, *8*, 211–219.

Shalley, C. E. (1995). Effects of coaction, expected evaluation, and goal setting on creativity and productivity. *The Academy of Management Journal*, *38*, 483–503.

Shalley, C. E. & Oldham, G. R. (1985). Effects of goal difficulty and expected evaluation on intrinsic motivation: A laboratory study. *The Academy of Management Journal*, *28*, 628–640.

Shalley, C. E. & Perry-Smith, J. E. (2001). Effects of social-psychological factors on creative performance: The role of informational and controlling expected evaluation and modeling experience. *Organizational Behavior and Human Decision Processes*, *84*, 1–22.

Shalley, C. E., Gilson, L., & Blum, T. C. (2000). Matching creativity requirements and the work environment: Effects on satisfaction and intentions to leave. *The Academy of Management Journal*, *43*, 215–223.

Shaw, G. A. (1987). Creativity and Hypermnesia for words and pictures. *Journal of General Psychology*, *114*, 167–178.

Shekerjian, F. (1990). *Uncommon genius: How great ideas are born*. New York: Viking.

Shore, E. (1971). Sensory deprivation, preconscious processes and scientific thinking. *American Journal of Orthopsychiatry*, *41*, 574–580.

Simonton, D. K. (1975). Sociocultural context of individual creativity: A transhistorical time-series analysis. *Journal of Personality and Social Psychology*, *32*, 1119–1133.

Simonton, D. K. (1979). Multiple discovery and invention: Zeitgeist, genius, or chance? *Journal of Personality and Social Psychology*, *37*, 1603–1616.

Simonton, D. K. (1981). Creativity in Western civilization: Intrinsic and extrinsic causes. *American Anthropologist, New Series*, *83*, 628–630.

Simonton, D. K. (1999). Creativity from a historiometric perspective. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 116–133). New York: Cambridge University Press.

Simonton, D. K. (2000). Creativity: Cognitive, personal, developmental, and social aspects. *American Psychologist*, *55*, 151–158.

Slochower, H. (1967). Genius, psychopathology and creativity. *American Imago*, *24*, 3–5.

Smith, C. G. (1971). Scientific performance and the composition of research teams. *Administrative Science Quarterly*, *16*, 486–496.

Stahl, M. J. & Koser, M. C. (1978). Weighted productivity in R & D: Some associated individual and organizational variables. *IEEE Transactions on Engineering Management*, *EM-25*, 20–24.

Stamm, J. (1967). Creativity and sublimation. *American Imago*, *24*, 82–97.

Staw, B. M. (1990). An evolutionary approach to creativity and innovation. In M. A. West & J. L. Farr (Eds.), *Innovation and creativity at work* (pp. 287–308). Chichester, UK: Wiley.

Staw, B. M., Sandelands, L. E., & Dutton, J. E. (1981). Threat-rigidity effects in organizational behavior: A multilevel analysis. *Administrative Science Quarterly*, *26*, 501–524.

Stein, M. (1953). Creativity and culture. *Journal of Psychology*, *36*, 311–322.

Sternberg, R. E. & Lubart, T. I. (1991). An investment theory of creativity and its development. *Human Development*, *34*, 1–31.

Sternberg, R. E. & Lubart T. I. (1999). The concept of creativity: Prospects and paradigms. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 3–15). New York: Cambridge University Press.

Sternberg, R. E. & O'Hara, L. A. (1999). Creativity and intelligence. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 251–272). New York: Cambridge University Press.

Suedfeld, P. (1968). The cognitive effects of sensory deprivation: The role of task complexity. *Canadian Journal of Psychology*, *22*, 302–307.

Suedfeld, P. (1974). Social isolation: A case for interdisciplinary research. *Canadian Psychologist*, *15*, 1–15.

Suedfeld, P. (1980). *Restricted environmental stimulation: Research and clinical applications*. New York: Wiley.

Suedfeld, P. & Landon, P. B. (1970). Motivational arousal and task complexity: Support for a model of cognitive changes in sensory deprivation. *Journal of Experimental Psychology*, *83*, 329–330.

Suedfeld, P., Metcalfe, J., & Bluck, S. (1987). Enhancement of scientific creativity by flotation REST (restricted environmental stimulation technique). *Journal of Environmental Psychology*, *7*, 219–231.

Suojanen, W. & Brooke, S. (1971). The management of creativity. *California Management Review*, *14*, 1, 17–23.

Sutton, R. I. & Hargadon, A. (1996). Brainstorming groups in context: Effectiveness in a product design firm. *Administrative Science Quarterly*, *41*, 685–718.

Symington, N. (1987). The sources of creativity. *American Imago*, *44*, 275–287.

Tagiuri, R. (1968). The concept of organizational climate. In R. Tagiuri & G. H. Litwin (Eds.), *Organizational climate: Explorations of a concept* (pp. 11–32). Boston, MA: Harvard University Press.

Thomas, C. A. (1955). *Creativity in science: The eight annual Arthur Dehon Little memorial lecture*. Cambridge, MA: MIT.

Törnqvist, G. (2004). Creativity in time and space. *Geografiska Annaler*, *86 B*, 227–243.

Torrance, E. P. (1995). *Why fly: A philosophy of creativity*. Norwood, NJ: Ablex.

Treffinger, D. J. (1995). Creative problem solving: Overview and educational implications. *Educational Psychology Review*, 7, 301–312.

True, S. (1966). A study of the relation of general semantics and creativity. *Journal of Experimental Education*, *34*, 34–40.

Unsworth, K. (2001). Unpacking creativity. *The Academy of Management Review*, *26*, 289–297.

Van Gundy, A. (1987). Organizational creativity and innovation. In S. G. Isaksen (Ed.), *Frontiers of creativity research* (pp. 358–379). Buffalo, NY: Bearly.

Vidal, F. (2003). Contextual biography and the evolving systems approach to creativity. *Creativity Research Journal*, *15*, 73–82.

Wallas, G. (1926). *The art of thought*. New York: Harcourt, Brace and Company.

Wassmann, J. (2003). Landscape and memory in Papua New Guinea. In H. Gebhardt & H. Kiesel (Eds.), *Weltbilder* (pp. 329–346). Heidelberger Jahrbücher No. 47. Berlin: Springer.

Wassmann, J. & Keck, V. (2007). Introduction. In J. Wassmann & K. Stockhaus (Eds.), *Experiencing new worlds* (pp. 1–18). New York: Berghahn Books.

Weichhart, P. (2003). Gesellschaftlicher Metabolismus und Action Settings. Die Verknüpfung von Sach- und Sozialstrukturen im alltagsweltlichen Handeln [Social metabolism and action settings: The link between technical and social structures in everyday action]. In G. Kohlhepp, A. Leidlmair, & F. Scholz (Series Eds.) & P. Meusburger & T. Schwan (Vol. Eds.), *Erdkundliches Wissen: Vol. 135. Humanökologie: Ansätze zur Überwindung der Natur-Kultur-Dichotomie* (pp. 15–44). Stuttgart, Germany: Steiner.

Weisberg, R. W. (1999). Creativity and knowledge: A challenge to theories. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 226–250). New York: Cambridge University Press.

West, M. A. (1989). Innovation amongst health care professionals. *Social Behaviour*, *4*, 173–184.

Westfall, R. S. (1983). Newton's development of the *Principia*. In R. Aris, T. Davis, & R. H. Stuewer (Eds.), *Springs of scientific creativity. Essays on founders of modern science* (pp. 21–43). Minneapolis, MN: University of Minnesota Press.

Westland, G. (1969). The investigation of creativity. *The Journal of Aesthetics and Art Criticism*, *28*, 127–131.

Wierenga, B. & van Bruggen, G. H. (1998). The dependent variable in research into the effects of creative support systems: Quality and quantity of ideas. *MIS Quarterly*, *22*, 81–87.

Williams, W. M. & Yang, L. T. (1999). Organizational creativity. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 373–391). New York: Cambridge University Press.

Witkin, H. A., Dyke, R. B., Faterson, H. F. Goodenough, D. R., & Karp, S. A. (1962). *Psychological differentiation*. New York: Wiley.

Woodman, R. W. & King, D. C. (1978). Organizational climate: Science or folklore? *The Academy of Management Review*, *3*, 816–826.

Woodman, R. W. & Schoenfeldt, L. F. (1990). An interactionist model of creative behavior. *Journal of Creative Behavior*, *24*, 279–290.

Woodman, R. W., Sawyer, J. E., & Griffin, R. W. (1993). Toward a theory of organizational creativity. *The Academy of Management Review*, *18*, 293–321.

Workman, E. A. & Stillion, J. M. (1974). The relationship between creativity and ego development. *The Journal of Psychology*, *88*, 191–195.

Zajonc, R. B. (1965). Social facilitation. *Science*, *149*, 269–274.

Zhou, J. & George, J. M. (2001). When job dissatisfaction leads to creativity: Encouraging the expression of voice. *The Academy of Management Journal*, *44*, 682–696.