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Acategoriality as Mental Instability

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Mental representations are based upon categories in which the state of a mental system is stable. Acategorial states, on the other hand, are distinguished by unstable behavior. A refined and compact terminology for the description of categorial and acategorial mental states and their stability properties is introduced within the framework of the theory of dynamical systems. The relevant concepts are illustrated by selected empirical observations in cognitive neuroscience. Alterations of the category of the first person singular and features of creative activity will be discussed as examples for the phenomenology of acategorial states.

The scientific investigation of mental processes began in the nineteenth century with the development of the field of psychology, with the work of Fechner, Helmholtz, Wundt and others. Psychological research was mainly carried out in the spirit of an "external perspective," also called "third person perspective." But unlike contemporary practice, the so-called "first person perspective" (introspection) was also regarded as an admissible approach, for example by James and Titchener. It was particularly elaborated within philosophical phenomenology by Bergson, Whitehead, Husserl, and later by Heidegger and Merleau–Ponty.

The study of mental processes changed significantly in the 1940s, when von Neumann, Turing, and Wiener began to examine the epistemological foundations of the natural sciences. This was done in the spirit of then highly popular positivistic approaches, with their rigorous criteria regarding formal description and empirical verification. As far as these epistemological questions are related to the capabilities and limits of cognitive systems, the idea developed quickly that these systems process information in a computer-like way. Chomsky, Minsky, and Simon are the protagonists of this idea,

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which today is subsumed under the term cognitivism and which can be regarded as a precursor of contemporary, highly diversified cognitive sciences.

The conception that cognitive systems are responsible for the internal processing of information representing external reality has been criticized as too simple in many respects (see, for example, Varela, 1990). First, the relation between internal mental representations and elements of an external reality is not at all unidirectional, but bidirectional. In addition to the realistic (sensualistic, bottom–up) component of this relation, there is a constructivistic (top–down) component, which can be massively influential in particular situations (see, for example, Emrich, 1990). Second, it is difficult to cover more than purely syntactic aspects of information processing using the computer metaphor alone. Aspects of meaning and its conversion into action require more involved approaches, if it is not assumed that semantics follows from syntax "automatically," as it were (see Atmanspacher, 1993).

Cognitivism has become a strong direction for the investigation of cognitive processes, but there were and are alternative views. Already at the end of the nineteenth century, James pointed out that, in addition to mental representations ("substantive states") themselves, transient states between them ("transitive states") are important as well. The two kinds of states differ in their pace of change:

> When the rate [of change of a subjective state] is slow we are aware of the object of our thought in a comparatively restful and stable way. When rapid, we are aware of a passage, a relation, a transition *from*, or *between* it and something else . . . . *Let us call the resting-places the "substantive parts," and the places of flight the "transitive parts," of the stream of thought.* It then appears that the main end of our thinking is at all times the attainment of some other subjective part than the one from which we have just been dislodged. And we may say that the main use of the transitive parts is to lead from one substantive conclusion to another. (James, 1890/1950, p. 243)

Although current cognitive science hardly considers transient states, several authors (Bailey, 1999; Galin, 1994; Mangan, 1993) revitalized the antinomy of "substantive parts" and "transitive parts" and related it to James's terms of the "nucleus" and the "fringe" of mental states. Such states play a crucial role in meditation techniques and spiritual conceptions, especially in Eastern cultures (see Wallace, 1998). In addition, transient states could achieve paramount significance for the investigation of so-called altered (anomalous) states of consciousness (Taylor, 1984). Moreover, it is evident that each transition between two mental representations requires a process passing through transient states that are located in between.

Jean Gebser, a philosopher whose work emphasized the development of structures of consciousness, suggested the term "acategoriality" to characterize such transitive states:

> Every categorial system is an idealized ordering schema by which actual phenomena are fixed and absolutized; as such it is a three-dimensional framework with a static and spatial character. Such categorial systems are able to deal with the world only within a three-dimensional and conceptual world-view. We shall have to be accustomed to recognizing acategorial elements . . . . Wherever we are able to perceive acategorial effectualities as such and not as categorial fixities, the world will become transparent. (Gebser, 1986, pp. 285–286)

This programmatic quote makes clear that Gebser's concept of acategoriality aims at a description of states of consciousness beyond usual categorial representations. However, an integration of Gebser's description of acategorial states into the relevant sciences is not straightforward at all. His accounts are conceived rather heuristically and often too abstract to be easily translated into scientific terminology.

The present contribution tries to enable such a translation and to relate it to results of modern cognitive neuroscience. The conceptual framework is adopted from the theory of dynamical systems, whose influence on models of cognitive processes has considerably increased within the last twenty years (see Fell, 2004; Freeman, 1995; Nicolis, 1991; van Gelder, 1998). The stability (or instability, respectively) of dynamical systems is the key concept utilized in this framework. Our central argument is that instabilities in mental systems possess a number of characteristic features which are related to Gebser's acategorial states.

In order to make this relation more explicit, it will first be briefly reviewed how stability properties are treated in dynamical systems. The corresponding framework will then be used to describe ("metaphorically") the stability or instability of mental states. The merits of such a description — especially with respect to a precise terminology and a classification of different mental states — will be demonstrated. Subsequently, experimental results from psychological and neurophysiological studies concerning unstable aspects of perception will be presented. Finally, phenomenological aspects of acategorial and unstable mental states will be discussed.

Stability Properties of Dynamical Systems

The state of a dynamical system, evolving continuously as a function of time, is characterized by a number n of properties, or observables, which are the coordinates of an n-dimensional state space. The trajectory of the state of the system in its state space describes the evolution of the system in a very compact fashion.

The stability of such systems concerning small perturbations or fluctuations with respect to a reference state is usually evaluated by a so-called stability analysis. The relevant literature (see, for example, Guckenheimer and

Holmes, 1983, or Leven, Koch, and Pompe, 1994) offers details of this procedure. The final result of the stability analysis are numerical values λ_i (i = 1,..., n), the so-called Ljapunov exponents, quantifying how and to what extent fluctuations vary as time proceeds.

Positive Ljapunov exponents indicate an exponential growth of fluctuations, whereas negative values indicate that they are damped exponentially. The sum of all Ljapunov exponents is smaller than zero for dissipative systems and equal to zero for conservative systems. In the dissipative case there exists a subspace of the state space, onto which the trajectory of the system is restricted (after an initial "transient" phase). This subspace is called the attractor of the system. Another subspace, which is constituted by all those (initial) states asymptotically evolving into the attractor, is called the basin of attraction. For a given attractor, the Ljapunov exponents are independent of the initial conditions. Moreover, they are invariant with respect to continuous transformations of the observables representing the coordinates of the state space.

In the simplest case, an attractor is a point in state space ("fixed point"), and all λ_i are negative. If there is no other attractor in the state space, the entire (admissible) state space is the corresponding basin of attraction. Particularly interesting (and complicated) are situations in which the sum of all λ_i is negative, yet individual λ_i are positive. In this case one speaks of "strange attractors" or "chaotic attractors." The behavior of a corresponding system is "chaotic," although it obeys entirely deterministic equations.

The stability of attractors can be studied *qualitatively* using a method also introduced by Ljapunov (see Alligood, Sauer, and Yorke 1996, chapter 7.6). In order to do so, a function $V = V(\mathbf{x}) \geq 0$ is considered in a neighborhood G of a reference state $\mathbf{x}_r$, where $V = 0$ for $\mathbf{x} = \mathbf{x}_r$. The temporal derivative $\frac{dV}{dt}$ describes the temporal change of V along the trajectory of the system in G. Intuitively, the significance of V is that of a potential, whose extremal properties in G determine the stability of a state $\mathbf{x}_r$:

1. A state $\mathbf{x}_r$ is *stable*, if $\frac{dV}{dt} \leq 0$ in G. In this case, V is called a Ljapunov function.

   (a) A state $\mathbf{x}_r$ is *marginally stable*, if $\frac{dV}{dt} = 0$ everywhere in G.
   (b) A state $\mathbf{x}_r$ is *asymptotically stable*, if $\frac{dV}{dt} < 0$ in G (except at $\mathbf{x}_r$ itself).

2. A state $\mathbf{x}_r$ is *unstable*, if $\frac{dV}{dt} > 0$ in G

In the simple case of a fixed point attractor in one dimension, Figure 1b illustrates the case 1(b) [above] for a quadratic potential $V(x) = \alpha x^2$, $\alpha > 0$, which is concave in the neighborhood of $\mathbf{x}_r$ ($\nabla^2 V > 0$). The solution $\mathbf{x}_r$ at the minimum of V is an asymptotically stable fixed point with one negative Ljapunov exponent, whose value corresponds to ∇V, the gradient of V. In case 1(a) [above], the gradient of the potential vanishes ($\nabla V = 0$), and each solution for this potential is marginally stable (Figure 1a). This corresponds to a Ljapunov exponent which vanishes as well.

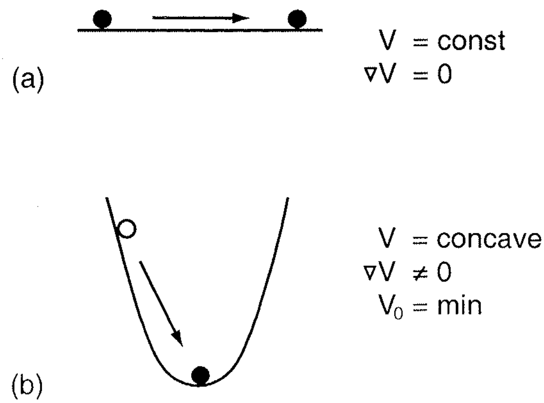

Figure 1: Kinds of stability of a state: (a) marginal stability for a constant potential V with gradient $\nabla V = 0$; (b) asymptotic stability at a critical point V_0 of a concave potential with a non-vanishing gradient $\nabla V \neq 0$.

A combination of case 2 with case 1(b) is illustrated in Figure 2. In the neighborhood of $\mathbf{x}_r$, at the local maximum, V is convex ($\nabla^2 V < 0$), whereas V is concave around the potential minima. The solution at the local maximum is therefore unstable. If the system is in such a state, it will spontaneously relax into one of the two asymptotically stable minima. During this relaxation, the potential difference ΔV will be converted into the motion of the state. The regions left and right of the local maximum are basins of

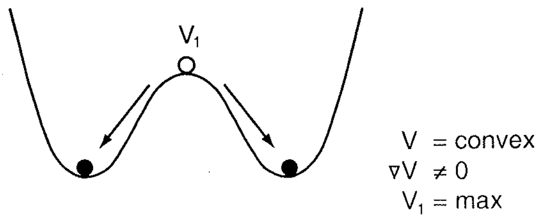

Figure 2: States in the neighborhood of a critical point V_1 of a locally convex potential are unstable and relax into adjacent potential minima.

attraction for two coexisting attractors. (For potentials with more than one independent variable, V_1 is usually a saddle rather than a local maximum.)

Stability Properties of Mental States

In recent years there has been a steady trend to describe the behavior of neural networks and cognitive systems, respectively, in terms of nonlinear dynamical systems (Haken and Stadler, 1990; Kaneko and Tsuda, 2000). Applications extend as far as into psychological therapies (Caspar, 2002; Grawe, 1998). Freeman (1979) was the first to introduce corresponding approaches in neurophysiology, and only a little later Nicolis proposed a related description of cognitive processes (for more recent accounts see Beer, 2000; Fell, 2004; Tsuda, 2001; van Gelder, 1998).

The central idea (cf. Nicolis, 1991) is that internal mental representations, the basic "objects" of a cognitive system, play the role of "attractors" for neurally encoded external stimuli. The relation between the description of cognitive systems and the formal theory of dynamical systems can basically be characterized by three points.

1. The cognitive system, which is materially realized by a neural network, is treated as a dynamical system S.
2. Mental representations within the cognitive system are treated as coexisting attractors of S with particular stability properties.
3. Neurally encoded stimuli within the cognitive system are treated as initial conditions of S, whose temporal evolution leads to an attractor.

In this scenario, the creation and/or evolution of mental representations remain unconsidered so far. Moreover, the state space in which the dynamics evolve often remains undefined or is not even addressed. Obviously, mental and material states and properties, respectively, of a system need not be identical a priori. Therefore, many approaches are based on assumed, but poorly understood correlations between the two.

Cognitive processes which are represented by the mapping of a stimulus onto a mental representation can be illustrated by the motion of a state in a potential. The form of the potential then characterizes the stability properties which the possible states of the considered system can have. The states themselves and their associated observables can be conceived in two basically different ways. One can consider both states of "consciousness," or of the mental/cognitive system, and states of the material/neural system correlated with them.

The subsequent discussion focuses on the former option, so that the notion of "state" refers to a state ϕ of the mental system (which can be conscious or unconscious). The state space remains unspecified insofar as no (canonical) formalization of mental observables is available so far. Furthermore, the exact form of the dynamics of states ϕ remains unspecified insofar as no corresponding equations of motion are known. And, finally, the significance of the potential V, which is often (e.g., in physics) related to the concept of energy, remains undefined. To what extent mental systems can have "mental energy" is an unresolved matter (for historical perspective, see Elkana, 1974). Given these limitations, the following deliberations should be understood as a formal framework which has to be both specified and concretized.

Mental Representations and Stable Categorial States

It is mandatory to distinguish potentials V and states ϕ if one wants to utilize the theory of dynamical systems for the description of mental systems. A state ϕ can be located anywhere on a potential (hyper-) surface. Stability is a property of a state ϕ on such a potential surface. This means that mental representations regarded as attractors or potentials provide boundary conditions for the motion of a mental state $\phi(t)$ as a function of time. If a mental state is located in the minimum of a potential (i.e., on an attractor), the corresponding mental representation is "activated" or "actualized." In psychological terms, "one thinks something," "has a picture of something," or one feels or anticipates something.

If a mental state is located in a particular mental representation, it is (asymptotically) stable with respect to perturbations (compare Figure 1b). The measure of stability can be quantified, e.g., by Ljapunov exponents. Representations with shallow potential minima stabilize mental states less than those with deep potential minima. Accordingly, less or more effort is necessary for a mental state to "leave" a particular representation. If this happens, the corresponding mental representation may be considered as "deactivated" or "potentialized."

However, not only states can be temporally modified, $\phi = \phi(t)$, but also potential surfaces $V = V(t)$ can evolve. Not only can the dynamics of a state activate or deactivate an already existing mental representation, but new representations can be generated or existing ones can be altered. New representations are created when the mental system generates new potentials; old representations are changed when the corresponding potentials are deformed. Interesting parallels to this differentiation, which will be discussed below in greater detail, can be found in psychological applications of process philosophy, especially according to Whitehead (Brown, 2000).

It should be pointed out again that the illustration in Figure 1b refers to an especially simple special case, a caricature as it were. It is to be expected that mental representations are not limited to fixed point attractors or limit cycles (periodic processes), but in general correspond to chaotic attractors.

Asymptotically stable states according to Figure 1b are states which Gebser called categorial. Their stability indicates what he denoted as the fixation of a static world of concepts. Gebser's categorial states correspond to James's stable substantive states.

The case of marginal stability of ϕ illustrated in Figure 1a characterizes the limiting case in which V vanishes or is constant anywhere in the neighborhood of a state ϕ. This case can be psychologically interpreted as an "unbounded" state which "goes without thinking," a kind of content-free state referring to nothing. In this respect one can speak of a non-categorial state. Smallest perturbations, which are neither damped nor amplified, will cause ϕ to change.

The process of a deactivation of a mental representation means that the state $\phi(t)$ has to be changed to such an extent that it leaves not only the attractor but also the basin of attraction of V, and moves towards another attractor where it finally arrives. A corresponding dynamic of ϕ necessarily exceeds the conceptual repertoire of mental representations, stable categories and substantive states.

Mental Instabilities and Acategorial States

Insofar as mental representations are asymptotically stable, a transition between them is possible only via an unstable intermediate state. Figure 2 illustrates this situation. To effect the transition, $\phi(t)$ has to overcome the potential barrier ΔV. (As an alternative, one could think of quantum mechanical processes — so-called tunneling processes — whose realization in the brain is discussed controversially, however.) The stronger the stability of the involved representations, the smaller is the probability of a spontaneous transition. A particularly illustrative and frequently studied class of such transitions is the perception of bi- or multistable stimuli (see, for example, Kruse and Stadler, 1995).

Moreover, the attribution of meaning is a crucial issue requiring changes of the state ϕ. So-called "aha-experiences" in particular are obviously related to changes between representations or to the emergence of novel representations (Atmanspacher, 1992). This does not only require a change of ϕ, but also a change of the potential surface V. For instance, it can be expected that the depth of existing potential minima increases with learning, that is, the stability of a state increases with increasing α in a potential of the form $V = \alpha x^2$.

Another possibility consists in the differentiation of existing representations, where a potential with a minimum is deformed in such a way that two minima are generated. Such a kind of symmetry-breaking can be described by changing the parameter α from positive to negative values in a potential $V = \alpha x^2 + \beta x^4$ ($\beta > 0$), where the case $\alpha > 0$ is qualitatively similar to the

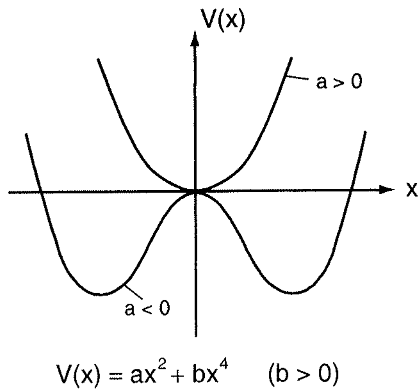

Figure 3: Deformation of a potential whose minimum ($\alpha > 0$) becomes a local maximum ($\alpha < 0$) with two new minima emerging. A state in the new potential relaxes from the formerly stable solution at $x = 0$ into one of the two new stable solutions. Since only one of the two symmetric solutions can be chosen, this is called a symmetry-breaking.

quadratic one-minimum potential (see Figure 3). Conversely, one could think of the integration of representations by increasing α from a given negative value until it becomes positive.

In James's terminology, the process leading from one to another "substantive" state corresponds to a temporal sequence of "transitive" states. The unstable point at V_1 in Figure 2 is a "transitive" state distinguished by a local maximum of V. James writes:

> Now it is very difficult, introspectively, to see the transitive parts as what they really are. If they are but flights to a conclusion, stopping them to look at them before the conclusion is reached is really annihilating them. Whilst if we wait till the conclusion *be* reached, it so exceeds them in vigor and stability that it quite eclipses and swallows them up in its glare. Let anyone try to cut a thought across in the middle and get a look at its section, and he will see how difficult the introspective observation of the transitive acts is . . . . The results of this introspective difficulty are baleful. If to hold fast and observe the transitive parts of thought's stream be so hard, then the great blunder to which all schools are liable must be the failure to register them, and the undue emphasizing of the more substantive parts of the stream. (1890/1950, p. 243f)

Gebser addresses transitive states at a local maximum of V with his concept of acategoriality and emphasizes their temporal, dynamical aspect:

> Something with a temporal character cannot be spatially fixed. It cannot be fixed or prescribed in any form, and if we attempt to do so we change it by measurement into a spatial quantity and rob it of its true character. This is a clear indication that the qualities of time which are today pressing toward awareness cannot be expressed in mere categorial systems. (1986, p. 308)

The mentioned "unfixable temporal qualities" can — in a more prosaic way — be related to the evasive, transient behavior of complex systems around instabilities. This situation is not governed by the equations of motion describing the system on its attractor. As a consequence, the trajectory of a system in the vicinity of instabilities cannot be predicted by its equations of motion.

Experimental Material

Distinguishing mental representations (in V) and mental states ϕ from each other offers the possibility to treat both, V and ϕ, and their dynamics, $V(t)$ and $\phi(t)$, separate from each other. Of course, this does not imply that V and ϕ are ultimately independent from each other; however, their differentiation allows us to explicitly describe potential interdependencies of V and ϕ. In the following sections we will outline some paradigmatic results whose interpretation is based on the motion of a mental state ϕ in different potentials V.

Psychological Results: Binocular Depth Inversion

For several decades, Emrich (1990) and his group have been studying perceptive illusions which can be modeled using the approach discussed above. Emrich's original idea was to demonstrate that, in addition to a "sensualistic" (bottom–up) and a "constructivistic" (top–down) component in the process of perception, a so-called "censor" has to be considered as a third element. This censor defines the interplay between the other two components and hereby moderates the "illusory extent" of a perceptive act (Emrich, 1989).

As an experimental paradigm for corresponding results the method of binocular depth inversion was applied, which generates a particular variant of a visual illusion. Objects whose plausibility differs depending on different orientations, e.g., ordinary masks versus inverted masks, are shown to subjects. Properly illuminated, inverted masks (nose backward) are not recognized appropriately by normal subjects, but they are interpreted as ordinary masks (nose forward). The corresponding effect of illusion is an example for censoring as mentioned above. Since inverted masks usually do not occur in everyday life, the mental system tends to ignore any evidence that the masks appear not as ordinary masks, and maps the stimulus on the representation of an ordinary mask.

Additional interesting observations have been reported by Leweke, Schneider, Radwan, Schmidt, and Emrich (2000). They observed that the censor is weakened if subjects are under the influence of psychoactive cannabinoids, so that inverted masks indeed are recognized as what they are. A related study with schizophrenic patients provided similar results. It seems that schizophrenia implies a malfunction of the censoring activity which facilitates the identification of the inverted masks (Schneider, Borsutzky, Seifert, Leweke, Huber, Rollnik, and Emrich 2002).

Within the approach proposed here, the censor can be easily understood by the stability properties of the mental states which are involved in the contributing mental representations. Obviously, both the influence of cannabinoids and specific processes in schizophrenia seem to imply that the potential differences distinguishing existing categories (mental representations) decrease. Thus, the basin of attraction of the implausible (inverted mask) representation is increased. Small alterations due to the switch of the stimulus from ordinary mask to inverted mask are no longer damped out within the plausible (ordinary mask) representation, but can lead to a switch of the representation.

In this way, the censor component is naturally integrated into the picture and, at the same time, acquires direct explanatory power. The censor is strong if the involved potentials are deep and the corresponding states are stable, which can happen as a result of learning or habituation processes. By contrast, the censor is weak if the potentials are flat and the corresponding states tend to be marginally stable, e.g., at the beginning of a learning process or with blurring memory. (The interesting link to memory structures and processes, respectively, will not be further elaborated here.)

Within this interpretational framework for the censor function, the change of V is primarily considered and determines the dynamics of mental states ϕ. At the physiological level, such a change should be accompanied by a change of the connectivities in the neuronal assemblies involved, thus implying that categories become hardly distinguishable from each other or almost disappear, respectively. In the experiments described, this is caused by exogenous influences (cannabinoids) and long-time endogenous (disease-induced) influences, respectively.

Physiological Results: Perception of Bistable Stimuli

A situation in which the dynamic of ϕ operates on a time scale different from the depth inversion paradigm is the perception of bistable stimuli. Here, the dynamic $\phi(t)$ is tightly coupled to a fast dynamic $V(t)$. Moreover, $\phi(t)$ is influenced by fluctuations which can be significant, especially around instabilities, for the behavior of the system.

A standard example for a bistable stimulus is the Necker cube. Compared to other stimuli with higher complexity, its semantic content is essentially limited to 3-D interpretation. This has the advantage that the cognitive processes during the perception of the Necker cube can be considered as fairly basic. The two perspectives under which the Necker cube can be perceived constitute two mental representations, thus two potential minima V. The state ϕ evolves spontaneously from one potential minimum into the other after a few seconds (Borsellino, de Marco, Alazetta, Rinesi, and Bartolini 1972).

In James's terminology, this situation corresponds to two substantive states, between which the transitive domain is located. The Necker cube example shows illustratively that the difficulty of an introspective perception of this transitive domain is due to the fact that transiency is tied to instability. Intuitively, one would assume that the unstable situation must somehow be stabilized to be introspectively accessible, or any introspective access must refer to a completely different mode, e.g., some dynamical instead of structural aspect of "representation." This, however, is speculation so far.

Less speculative is the question for a neural correlate of the perceptual reversal. Two types of correlates that have often been reported are 40Hz (γ–band) oscillations in the EEG as well as the often observed P300 component, a positivity at around 300 msec in event related potentials. Both correlates, however, are not specific for the reversal process itself, but rather accompany many mental processes that require attention.

Recently an early negativity at about 250 msec was found as a highly specific correlate for the reversal process for ambiguous stimuli using a modified experimental setup (Kornmeier, Bach, and Atmanspacher 2003). The evidence of this result was supported by the fact that another negativity at about 200 msec was observed for the switch between two different, externally presented non-ambiguous perspectives of the Necker cube. The time difference of 50 msec indicates that exogenously induced reversals are processed faster than endogenous reversals, which (e.g., due to endogenous 3-D interpretation) require additional top–down mechanisms.

Such endogenous, "constructivistic" components of perception complement the naive–realistic ("sensualistic") idea that perception (only) refers to exogenously occurring events. The discussed results show that differences between the perception of endogenously and exogenously induced reversals concerning almost the same stimulus can be empirically demonstrated. Although both "constructivistic" and "realistic" elements play a role in both variants, their relative contribution differs: the processing of ambiguous, bistable stimuli requires more top–down processing than the processing of successive non-ambiguous stimuli.

On the Phenomenology of Acategorial Mental States

Non-Categorial and Acategorial States

As an alternative to asymptotically stable representations and corresponding categorial states, the criterion of stability provides two additional options. One of them is the limiting case of a flat potential V with vanishing gradient, where no categories exist and mental states are marginally stable. This means that states ϕ are displaced by arbitrarily small perturbations or fluctuations. Asymptotically stable behavior as required for a reliable representation of categories does not occur in this situation: states ϕ are *non-categorial.*

The second option refers to the unstable regions between asymptotically stable representations. Such a situation presupposes the existence of categories. However, the state ϕ of the mental system does not actualize one of these categories but something "in between" them. If the state ϕ is located in the neighborhood of an instability, it will move towards one of the neighboring minima under the influence of the corresponding potential valley.

Following Gebser's proposal, a mental state in the (close) neighborhood of an instability of V is called *acategorial.* In James's terminology one would speak of "fringe consciousness" if a non-dynamic, structural conception is preferred. From a dynamical point of view, states in the neighborhood of instabilities are "transitive" states. Without external influence, they move spontaneously into "substantive" stable states in categories. The duration of this motion is determined by the stability properties of these categories.

An essential difference between non-categorial and acategorial states consists in their fundamentally different location within V. Interpreting different values of V in a wide sense, and provisional with respect to an adequate definition, as a kind of "psychic energy" (e.g., as an attentional effort), acategorial states are always "energetically excited" and they "relax spontaneously" if this is not explicitly prevented. By contrast, non-categorial states are "energetically neutral" insofar as marginal stability offers no "energy differences" in the neighborhood of any considered state.

What could prevent the evasiveness of acategorial states due to their spontaneous relaxation? First, there is the option to balance the relaxation dynamics $\phi(t)$ with an externally controlled dynamics $V(t)$, permanently readjusting the potential V with respect to the motion of the state ϕ. At the neuronal level this would mean that the connectivity matrix of the neuronal assemblies defining V would have to be adapted to the dynamics of ϕ with an extremely fine tuning. Such a strategy could be understood analogous to the balancing acts of an "equilibrium artist," in terms of a kind of "mental acrobatics."

Under particular circumstances, another possibility is to stabilize locally unstable parts of a neuronal assembly by their global coupling. Atmanspacher and Wiedenmann (1999) proposed this idea which has recently been worked out concretely by Atmanspacher and Scheingraber (2005) [see also Atmanspacher, Filk, and Scheingraber, 2005]. Its essence is that stabilization in this setting operates inherently and without any need for external control.

Non-categorial and acategorial states have in common that neither of them actualizes representations in a traditional sense. It is unclear which cognitive content is perceived if these states can be sustained long enough to enable the emergence of a phenomenally experienced perception. It is likely that this cannot happen in an ordinary state of consciousness but requires the training of special degrees of awareness.

Methods for a systematic generation of corresponding altered states of awareness play a central role in the spiritual traditions of Eastern cultures. An outstanding example is the Buddhist Satipatthana–Sutta, lectures on the "foundations of mindfulness" (Nyanaponika, 2000; see also Gäng, 1996), dating back to the first century B.C. They present detailed instructions for the perception of increasingly subtle objects of phenomenal experience. Starting with the perception of the body and its autonomous functions (e.g., respiration), progressive training expands awareness to emotional states and mental processes including those constituting the perceiving subject. This requires that the awareness does not adhere to any object of perception. In other words, such awareness does not refer to stable categorial states:

> The practice of pure attention will bring it forcibly home that change is always with us; that even in a minute fraction of time the frequency of occurring changes is beyond our ken. Probably for the first time it will strike us in what kind of world we are actually living, namely its exclusively dynamical nature, within which static notions can only be meaningful for practical orientation or scientific and philosophical ordering schemes. (Nyanaponika, 2000, p. 34)

The similarity of this quotation with Gebser's characterization of acategoriality is striking.

Due to the significant conceptual differences between non-categorial and acategorial states, important differences in their phenomenal perception are to be expected. This is reflected by a heuristic model developed in a clinical–therapeutic context by Petzold (1993, pp. 248–270). Starting from the ordinary receptive and reflexive awareness in the (categorial) wake state, altered processes of consciousness are described in two directions, either with a decreasing or an increasing reflexivity of the associated cognitive operations. Petzold proposes a spectrum of consciousness extending from an "areflexive" consciousness (quasi non-categorial "unconscious" in the terminology of this contribution) over increasingly reflexive categorial states up to acategorial hyper- and transreflexive states. These different states are accompanied by different qualities of experience in tinge, lucidity, intensity and range.

A regression, which can be induced by body therapies (cf. Petzold, 1996, pp. 104–110), can lead to a decreasing role of reflexive thinking and to associative, increasingly pictorial experiences with growing involvement of emotions and autonomous physiological functions. In the limiting case of areflexive unconsciousness, a bodily centering is achieved without a representation of the subject separated from its physiological functions. This process corresponds to a temporary regression of the functions of the mental system which develops an ego-representation with increasing category formation and conceptual thinking only during its ontogenetic evolution. The "subsidence" into the bodily, which is connected with a gradual loss of the excentric observer distance, is connected with experiential qualities such as "dark," "deep," "diffuse" for the individual concerned. Petzold distinguishes such a non-categorial "experience of unity" from states of "hyperreflexive lucid consciousness," in which usually drawn distinctions are lifted without obfuscated consciousness or lost categorial differentiation (Petzold, 1993, p. 261): "Here, centricity and excentricity do not fall apart, subject–object distinctions are overcome — an *integral consciousness*, which nevertheless does not abandon complexity or level off differences."

States of lucid consciousness occur together with creative activity and contemplative practice, but also spontaneously in other situations. They are associated with creative inspiration, existential insight, and experiences of wholeness or religious content. They can lead as far as to the limits of a transreflexive "nothing-consciousness," to experiences of void as they are addressed in Eastern spiritual traditions. States of lucid consciousness are comparatively rare and of short duration; they are unstable. They are described as "bright," "clear," "high" and are distinguished by a strong experience of evidence. The characteristics of lucid consciousness suggest an acategorial scenario which must not be confused with the non-categoriality of unconscious states:

> As far as hyperreflexive lucid consciousness is concerned, two possible misunderstandings must be dispelled: identifying *lucid consciousness* (or nothing-consciousness) with the *unconscious* . . . as well as relating lucid consciousness to an interior orientation . . . . It is precisely lucid consciousness, as an immersion into the milieu of the body and, thus, into the lifeworld, which lifts the opposition of inside and outside. As the Buddhist teachers do not get tired to indicate, lucid consciousness in the sense of *mindfulness* is intended, not drifting away into trance-like depths. (Petzold, 1993, pp. 260–261)

The Category of the First Person Singular

The category of the first person singular, the "I" or "ego," can be regarded as one of the most basic mental representations. Although it is not given a priori, it seems that its generation and development over time is something like an anthropological constant — even if the very complex manifestations of an ego are everything else than uniform. Among the extensive body of literature on this topic we refer to Metzinger (2003), who speaks of a "self-model" in this context.

The stability properties of the ego category are crucial for the continuous maintenance of the perception of one's own identity. In this context, the distinction between two different modi is essential, in which deviations from a stable ego are possible. Both the destabilization of the category, hence a flattening of the potential V, and the dynamics of the mental state ϕ out of a (more or less) stable category can lead to such deviations.

The varieties of altered states of consciousness constitute rich material which can be used to illustrate this distinction empirically. A flattening of the potential would correspond to a regression into ontogenetically earlier levels of the categorial differentiation and integration of mental representations. Therefore, it leads inevitably to a diminished stability of the ego representation — in the limiting case as far as to the borders of non-categoriality.

However, a destabilization of the ego category can also be initiated by dissociative processes. Dissociation can be regarded as a concept generalizing different variants within the wide range between loosening the context among categories and, ultimately, their dissolution (Scharfetter, 1999, p. 52). Different from regression, where levels of differentiation and integration are both diminished, differentiated partial categories of the mental system are conserved in dissociation. Due to impaired integration efforts, those partial categories loose their context by becoming decoupled from more complex categories to which they originally belong. The dissociation of different ego categories in multiple personality disorders can therefore be understood as the disintegration of an originally stable ego category as a whole into partial categories which are stable and between which transitions of the mental state ϕ are possible. As a result, different ego categories can emerge which are not necessarily linked to each other consciously.

Following the results by Schneider et al. (2002), it can be assumed that schizophrenic symptoms fall into the same class of destabilized potentials and are conditioned by the loss of integrative functions. From the point of view of the dissociation model, schizophrenia is the most extreme form of pathological dissociation. In limiting cases, the category of the ego can become entirely fragmented (see Scharfetter, 1999). Metzinger (1997, 2003) describes a number of further kinds of ego impairment such as neglects, anosognosia and obsessions, up to mystical experiences.

With particular regard to mystical experiences, the concept of acategorial states as a conceptual alternative to non-categorial scenarios such as regression, schizophrenia and depersonalization is an interesting option. Descriptions of mystical experiences show a phenomenology which, if taken together, differ from the mentioned psychic disorders. Stace (1960) elaborated some elementary features based on sources of most different mystical traditions (compare Wulff, 2000, pp. 400–401):

1. No separated physical and mental objects are represented; rather, a "pure," "void," or "unified" conscious state emerges.
2. Spatial and temporal localization are lifted.
3. The experience has real and objective character.
4. It is accompanied by an intense emotion of peace, joy, bliss, and blessedness.
5. It is experienced as contact with something "sacred," "divine" or "absolute."
6. Fundamental opposites appear as unified, laws of logic as abolished, and normal intellectual functions as replaced by a "higher" mode.
7. The experience cannot be communicated in conventional language.

Ego alterations corresponding to acategorial mental states are assumed *not* to lead to a dissolution of the ego category. This category is maintained, but the state of consciousness itself is no longer located within the category. One can imagine this as a kind of "in between" state, at the border of the ego, or between ego and non-ego, as it were. (In case of multiple personality disorders, this is conceivable as a transition state between different ego categories.)

How could an acategorial state outside (or at the border) of an existing ego category be experienced? With regard to this question, there is a long tradition in Eastern philosophies, in particular in the discipline of mindfulness meditation:

> The three contemplations of feeling, state of mind and mental objects dealing with the mental part of man converge, as does the contemplation of the body, in the central concept of the Buddha, the concept of egolessness (anatta). Its essence is that the entire reality until its most sublime manifestations is void of eternal ego and inertial substance. The whole discourse on the "foundations of mindfulness" may be regarded as a comprehensive instruction for the realization of the liberating truth of egolessness. It will bring about not only a deep and thorough understanding of that truth but also its visible demonstration through an experience achievable by exercise. (Nyanaponika, 2000, p. 72)

Classic Zen anecdotes point out how acategorial experiences can be hampered by being attached to the category of the ego (according to Kluge, 1986, p. 27):

A monk:	Where is the Tao?
Kuan:	Directly before us.

The monk:	Why don't I see it?
Kuan:	You cannot see it because of your egotism.
The monk:	If I cannot see it because of my egotism, is Your Reverence able to see it?
Kuan:	As long as there is an "I" and a "You," this makes the situation difficult and no Tao can be seen.
The monk:	Can it be seen, when there is neither "I" nor "You"?
Kuan:	When there is neither "I" nor "You," who should be able to see it here?

A particularly important element of meditation in the practice of Zen Buddhism is the use of koans. They are rationally unsolvable problems and questions which the meditating subject has to deal with until his or her ego becomes abandoned. Suzuki comments:

> The koan is neither a riddle nor a joke. It pursues a very serious goal, namely arousing doubt, which it carries to extremes . . . . All rivers surely reach the ocean somewhere, but the koan stands in the way like an iron wall and resists even the most intense intellectual efforts . . . . We waver, we doubt, we get anxious and excited since we do not know how to break through this apparently insurmountable obstacle . . . . This attack of our deepest essence against the koan opens, unexpectedly, hitherto unknown realms of the mind. From an intellectual point of view this means transgressing the boundary of logical dualism, but at the same time it is a rebirth . . . . (1980, pp. 150–151)

Suzuki compares the acategorial border experience of the so-called "satori" with a rebirth. This is related to the Buddhist notion of the "Great Death," meaning "to die for ordinary life, a death putting an end to the analyzing mind and liberating us from the idea of an ego" (Suzuki, 1994, p. 27). This idea is not entirely foreign to occidental literature. For instance, Musil uses a very similar figure of thinking when he writes:

> To die is just a consequence of our way to live. We live from one thought to another. For our thoughts and affects do not flow quietly as a stream, but they "occur to us," they fall into us like stones. If you observe yourself accurately, you feel that the soul does not change its colors gradually, but thoughts jump out of it like numbers out of a black hole. Now you have a thought or an affect, and suddenly another one stands there as if it jumped out of nothing. If you are attentive you can even sense the instant between two thoughts, in which everything is black. This instant, once recognized, is nothing else than death for us. (2002, pp. 171–172)

Autobiographical reports on the experience of a drastically relativized ego category, which does not fit standard psychopathological patterns, have been published by Roberts (1982) and Segal (1998) [for a recent review see Hunt, 2000]. Possibly more familiar and common experiences are the "flow-experiences" studied by Csikszentmihalyi (1975). Human beings at the limits of their capacities in physical, artistic or other competences report the incidental experience of being completely absorbed in their activities. This "fusion" of agents with their activity shows acategorial characteristics. Challenging activities of this kind are unlikely to proceed automatically or without the controlling functions of an ego category. The other side

> . . . paradoxically, is a feeling which seems to make the sense of control irrelevant. Many people we interviewed, especially those who most enjoy whatever they are doing, mentioned that at the height of their involvement with the activity they lose a sense of themselves as a separate entity, and feel harmony and even a merging of identity with the environment. In some ways, this finding ought not to be unexpected. The great Eastern traditions of physical and "spiritual" control, for instance, are clearly built around this same paradox. (Czikszentmihalyi, 1975, p. 194)

Studying such experiences, it is important to distinguish the dissolution of the ego, thus the loss of the corresponding category, from the lifted bondage to a still existing ego category in the sense of acategoriality. The first case may be related to a change of a potential V to the effect that its gradient vanishes, while the second case can be related to a dynamics of a mental state ϕ which is conceivable independently of a change of V. Gebser formulates this difference as the difference between the loss of the ego and freedom from the ego:

> Only the overcoming of the "I," the concomitant overcoming of egolessness and egotism, places us in the sphere of ego-freedom . . . . Ego-freedom means freedom from the "I"; it is not a loss or a denial of the "I," not an ego-cide but an overcoming of ego. Ego-consciousness was the characteristic of the mental consciousness structure; freedom from the "I" is the characteristic of the integral consciousness structure. (1986, p. 532)

One of the pioneers of the idea of a relativized ego was Jung. He uses the notion of the "self" to refer to situations beyond the ordinary category of the ego and comprising largely unconscious realms. According to Jung there are connections of the ego-complex and corresponding ordinary states of consciousness with a substantially larger realm, from which the ego is regarded to emerge (see the definitions in Jung, 1995, §730, §§814–816). Such connections offer the possibility of extreme expansions of the worldview, which are neither categorially restricted nor strictly delimited from the world of external objects (see Holm, 2001, chapters 4.5, 6.5). The category of the ego appears, projectively as it were, as a personified manifestation of the self. In this picture, the relation of self and ego is context-dependent: while the ego is included in the self from the perspective of the self, the self is antinomically opposed to the ego from the perspective of the ego.

The relativization of the category of the first person singular has recently achieved much consideration as a central topic in transpersonal psychology and psychotherapy (see Tart, 1991). In this respect, Wilber (1983) has pointed out frequent misunderstandings based on the so-called "pre/trans-fallacy," confusing different modes of consciousness which clearly refer to pre- or non-categorial experiences on the one hand and trans- or acategorial experiences on the other.

Acategorial Elements of Creative Processes

The formation of an ego-complex can be understood as a tedious process which — if the many possible modifications of an ego representation over time are taken into account — is of lifelong duration. The event at which an individual experiences itself as an ego for the first time should be understood as an instantaneous and ephemeral "aha"-experience, in which a category is formed. However, such experiences are not restricted to the development of an ego. They are a basic feature of any creative activity providing any kind of insight. A comprehensive review of different aspects of and approaches to this field of research is due to Knoblich and Öllinger (2005).

Based on a wealth of biographical material on creative thinking, mainly in mathematics and physics, Hadamard (1954) suggests four stages, each of which is inevitable for genuinely creative work. He calls these stages *preparation*, *incubation*, *illumination*, and *verification*. The first and the last of them mainly function at the level of conscious, analytical thinking. The second and the third stages, however, strongly involve unconscious processes as the core of actual insight. Here is a compact characterization of Hadamard's scheme with some additional comments.

1. *Preparation*: As emphasized by Poincaré, no creative insight can "happen except after some days of voluntary effort which has appeared absolutely fruitless" (Hadamard, 1954, pp. 12ff). Intense conscious work on a problem, sometimes even for years (as Gauss reported in a letter to Olbers; see Hadamard, p. 15), precedes the final solution. Frustrating efforts without success characterize this stage.
2. *Incubation*: At some point the problem is removed from conscious focus, intentionally or by distraction, but the preceding conscious work has set the unconscious machinery going. Poincaré comments that unconscious elements "rose in crowds; I felt them collide" (Hadamard, pp. 12ff), and Einstein remarked that "this combinatory play seems to be the essential feature in creative thought" (Hadamard, appendix II).
3. *Illumination*: When "the mentioned associative play is sufficiently established" (Hadamard, appendix II), "pairs [of unconscious elements] interlocked, so to speak, making a stable combination" (Hadamard, pp. 12ff). A particular configuration of unconscious elements stabilizes and, thereby, becomes conscious. This is the crucial

moment in which an insight reveals itself. Often this happens holistically, not successively unfolded in time.

4. *Verification*: Finally, this insight has to be reconstructed in a logical way, i.e., by a succession of rational arguments which can be communicated. "Conventional words or signs have to be sought for laboriously only in a secondary stage" (Hadamard, appendix II).

A particular difficulty of the last stage has to do with the fact that typically insight does not present itself by way of successive steps, but as an holistic impression. Logical steps of a mathematical proof or the succession of tones ultimately constituting a musical composition are results of a temporal sequentialization of such an holistic impression. An appropriate example is the following letter by Mozart:

> When I feel well and in good humor, or when I am taking a drive or walking after a good meal, or in the night when I cannot sleep, thoughts crowd into my mind as easily as you could wish. Whence and how do they come? I do not know and I have nothing to do with it. Those which please me, I keep in my head and hum them; at least others have told me that I do so. Once I have my theme, another melody comes, linking itself to the first one, in accordance with the needs of the composition as a whole: the counterpoint, the part of each instrument, and all these melodic fragments at last produce the entire work. Then my soul is on fire with inspiration, if however nothing occurs to distract my attention. The work grows; I keep expanding it, conceiving it more and more clearly until I have the entire composition finished in my head though it may be long. Then my mind seizes it as a glance of my eye, a beautiful picture, or a handsome youth. It does not come to me successively, with its various parts worked out in detail, as they will be later on, but it is in its entirety that my imagination lets me hear it. (Hadamard, 1954, p. 16)

Max Frisch describes the same phenomenon in different words:

> Time? It would be just a magic tool unfolding and making visible our essence by disentangling life, the omnipresence of all possibilities, into successive stages; only therefore it seems like a transformation to us, and therefore it urges us to assume that time, the successive, is not essential but apparent, an ancillary tool, an unwind that shows us in succession what actually is interleaved, a simultaneity which we cannot perceive as such as we cannot perceive the colors of light when its rays are not refracted and spectrally decomposed. Our consciousness is the refracting prism decomposing our life into a succession of stages, and dreaming is that other lens which focuses it back into its original whole; dream and poetry, which tries to comply with it in this sense. (1997, p. 15)

Simonton (1998) has developed a fairly detailed "chance-configuration model" for the second and third stages above, in which the central issue is stability. The permutating unconscious elements during incubation are not (asymptotically) stable, but float freely, coming and going by chance until a particular one among these configurations has stability properties implying its transition into a conscious categorial representation. In an evolutionary formulation of creative processes, stability provides a selection criterion among many chance possibilities.

In Simonton's model, creative processes are explicitly related to a transition from unconscious to conscious domains of the psyche. The formation of a novel category, which is experienced as yielding insight, can be characterized by a deformation of the potential landscape leading to a novel minimum of V (and, maybe, changing the vicinity of this minimum decisively). Thus, the aspect of novelty which is an essential criterion for creativity, is settled at the level of conscious processing. It is inevitable for a concrete "aha"-experience that the mental state ϕ is not yet located within the newly forming category, but moves into it simultaneously with the process of category formation.

The question of why and how particular configurations are distinguished by their stability is left unanswered in Simonton's approach. In this respect, some speculative ideas concerning the role of the unconscious, formulated by Pauli and inspired by Jungian depth psychology, are of interest. Similar to other so-called "dual aspect" approaches, Pauli and Jung proposed the idea of psychophysical correspondences ("synchronicities") between psychological and physical subdomains of an underlying hypothetical background reality:

> A cosmic order detracted from our voluntary influence must be postulated which governs *both* external material objects *and* inner images. *The ordering factors must be considered beyond the distinction of physical and psychic* — as Plato's "ideas" share the character of a "notion" with that of a "natural force." I am very much in favor of calling these "ordering factors" "archetypes"; but then it would be inadmissible to *define* them as contents of the *psyche*. Instead, the inner images are *psychic* manifestations of the archetypes, which, however, also would have to create, produce, cause *everything* in the material world that happens according to the laws of nature. The laws of the material world would thus refer to the *physical manifestations of the archetypes*. (Pauli, 1948/1993)

In Jung's depth psychology, the elements of the psychophysically neutral background reality are denoted as archetypes, which "coordinate" (in an unspecified manner) correspondences between mental and material states. Similar conceptions can be found in the history of philosophy, e.g., Spinoza, Leibniz, and Fechner argued explicitly in the same way during the pioneering days of psychology (cf. Pauen, 2001). Among physicists of the twentieth century, related ideas were taken up by Wigner, Bohm and, more recently, d'Espagnat and Primas with different terminologies (cf. Atmanspacher, 2003). In their conceptions, mental and material domains acquire clearly epistemic significance whereas the basic "objective order" is considered as ontic relative to its decomposition into those domains.

In such a framework, the origin of the stability properties addressed above must be conceived at the level of the objective, psychophysically neutral order. Stable configurations would manifest themselves in the selection of particular correspondences out of many possible ones. Since any archetypal order is empirically inaccessible per definition, these correspondences are the only option to obtain indications for the psychophysically neutral domain of archetypes. Examples of serendipity as described by Simonton (1988), resembling features of Jungian synchronicity, are interesting candidates fitting into this picture.

At this point it becomes clear that Jung's conception of an ego which is relativized by an archetypal self is not comprehensible without explicitly taking into account the psychophysical problem. If the relativization of the ego is to be successful, the connection to the psychophysically neutral domain of the archetypal self must be developed at least so far as to realize that the distinction of the psychical and the physical is not a priori given. It is evident that this can have enormous consequences for the worldview and the lifeworld of human beings.

Summary

This contribution presents a formal and conceptual framework to describe the dynamics of mental states in terms of their stability properties. Mental states are understood as states of the mental system which evolve in a state space characterized by a generalized potential surface. Its local minima correspond to mental representations or categories, respectively. They are actualized if they are occupied by asymptotically stable *categorial* states.

Since there is always a local maximum between two potential minima, transitions between stable categorial states must pass through instabilities. The behavior of the mental system in the vicinity of instabilities is a topic which — with historical exceptions such as William James — was and is notoriously neglected in most of the relevant literature. Jean Gebser proposed the concept of *acategorial* states in this context. A state is acategorial if it is located between possible categorial states, i.e., between mental representations.

Recent results in cognitive neuroscience can be elegantly and compactly described using the concepts of instability and acategoriality. For instance, censored perceptions, leading to illusions in particular situations, can be understood in terms of the stability of the involved categories. Another example is the perception of multistable stimuli, intrinsically containing the switch from one existing category to another.

Using acategorial states to analyze introspective reports of unusual mental experiences is particularly promising. A rich repertoire in this direction are alterations in the representation of the first person singular, the category of the ego, which only partially fit ordinary patterns of psychopathology. The difference between a mental state within an almost dissolved ego-category and a mental state located outside of an existing ego-category is conceptually similar to the difference between a weakly stable categorial state and an acategorial state. Particular processes accompanying particular stages of creative activity can be addressed in the same framework.

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