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A FUNCTIONAL-DESIGN APPROACH TO MOTIVATION AND SELF-REGULATION

THE DYNAMICS OF PERSONALITY SYSTEMS INTERACTIONS

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I. INTRODUCTION

This chapter explores the mechanisms underlying motivation and self-regulation from a functional-design perspective. Traditional approaches emphasize the mediating role of beliefs and other cognitive contents. An example of this approach is classical expectancy-value theory according to which a student's motivation to invest time and effort depends on his or her expectation of success and on the perceived value of good achievement (Atkinson & Feather, 1966; Heckhausen, 1977, 1991). In a similar vein, the degree to which students are able to self-regulate the enactment of their work-related intentions is attributed to their self-efficacy beliefs; that is, their beliefs that they will be able to initiate and successfully perform the intended behavior (Bandura, 1977; Peterson, Maier, & Seligman, 1993). This chapter is based on a different approach: Instead of focusing on

cognitive *content*, such as beliefs, expectations, or causal attributions, the basic properties of the functional architecture underlying motivation and self-regulation are analyzed.

Learned helplessness is a practical example that illustrates the difference between content-based and functional explanations: After exposure to uncontrollable failure, many people lose their motivation and show impaired performance just as depressed patients do in response to adverse life conditions (Peterson et al., 1993). According to traditional theorizing, those motivational and cognitive deficits are attributable to negative beliefs, such as pessimistic beliefs about one's own abilities (e.g., Seligman, Nolen-Hoeksema, Thornton, & Thornton, 1990). In contrast, according to a functional account, pessimistic beliefs and motivational deficits are consequences rather than causes of performance deficits that occur when people are confronted with uncontrollable failure: Experimental evidence shows that generalized pessimistic control beliefs typically occur after, not before, people develop symptoms of helplessness and depression (Kuhl, 1981; Lewinsohn, Steinmetz, Larson, & Franklin, 1981). According to these findings, learned helplessness and depression cannot be remedied through making people believe in their abilities as attempted in cognitive therapy (Bandura, 1977; Beck, 1979; Peterson et al., 1993) until one has established the necessary abilities. Specifying the mechanisms that underlie self-regulatory abilities has been the target of functional approaches to self-regulation (Kuhl, 1984; Mischel & Mischel, 1983). In the first part of this chapter, mechanisms that affect self-regulation irrespective of the content of thought are analyzed in the context of action control theory (Kuhl, 1984, 1992). Examples of relevant mechanisms that may cause symptoms of helplessness and other self-regulatory deficits are impaired mood regulation (emotion control), impaired control of unwanted thoughts (attention control), impaired ability to restore one's motivation (motivation control), especially under frustrating or threatening conditions (state orientation), and impaired access to holistic (implicit) self-representations (e.g., representations of one's own needs, values, feelings, and action alternatives available).

Searching for functional mechanisms underlying motivation and self-regulation is, of course, not incompatible with the notion that the content of thought such as cognitive beliefs can have a functional significance. Even if many cognitive beliefs merely reflect functional deficits after they develop, there is no reason to disclaim the possibility that sometimes beliefs do have a causal impact on behavior as discussed in other chapters of this volume. The functional framework described in this chapter is meant to extend rather than replace content-based approaches: It spells out the mechanisms that affect self-regulatory behavior over and above the self-regulatory effects of cognitive beliefs and strategies in the ways explained in other chapters of this volume.

As suggested by the examples described in the preceding paragraph, self-regulation is not a homogeneous entity that can be described by global concepts such as self-efficacy or willpower. Instead, several forms of self-regulation can be distinguished, each of which can be decomposed into several functions. Each self-regulatory mode can be described in terms of a characteristic configuration of certain macrosystems that form the building blocks of motivation and self-regulation. As will be pointed out in this chapter, these basic building blocks are not identical to the ones used in cognitive science, such as working memory, long-term memory, and executive control (e.g., Baddeley, 1986). Moreover, self-regulation does not depend only on various configurations of cognitive macrosystems, but also on certain "subcognitive" mechanisms that can be related to classical concepts of energy and motivation. Because these dynamic concepts are especially important for some poorly understood components of self-regulation, I will discuss them in detail in this chapter.

A. COGNITIVE VERSUS DYNAMIC CONCEPTS OF MOTIVATION

Motivation is sometimes regarded as the problem child of psychology. Compared to her cognitive brothers and sisters, she does not receive much attention and support, and she does not always seem to pamper her parents with great accomplishments. Some cognitive observers do not even regard motivation as a legitimate member of the family. During the shift from "folk to science" in cognitive psychology (Stich, 1983), one investigator put a common opinion this way: "Motivation is a derived phenomenon" (Norman, 1980). This is to say that cognitive mechanisms, such as perception, attention, memory, and consciousness, suffice to explain goal-directed behavior. Once the dominant knowledge structures of an individual are known, we can explain his or her behavior: "Tell me what goals a person has and I will tell you what this person will be doing." The amount of attention and other cognitive resources that are devoted to a goal presumably determines the extent to which it guides behavior. Cognitive psychologists like the concept of goal because, compared to other motivational concepts, it seems best suited for a cognitive reinterpretation of motivation: Goals can be considered a special category of cognitive representations. No wonder that goals have become a preferred topic in research on human motivation: They seem to enable us to study motivation by taking advantage of the methodological advances in cognitive science.

There is more to motivation than goals or other cognitive representations, such as expectations, beliefs, and values. The focus of this chapter is on noncognitive aspects of motivation. Some of them may be called *subcognitive*; others could be classified as *supra-* or *metacognitive*.

This chapter has four parts. Following a brief summary of action control theory, I first discuss some dynamic concepts of motivation proposed in

Freud's and Kurt Lewin's theories. The most famous operationalization of the dynamic concepts of needs and intentions is Bluma Zeigarnik's demonstration of superior recall of information related to uncompleted intentions. As a second step, I analyze some of the reasons why these dynamic concepts fell short of providing a sufficient theoretical and methodological paradigm for motivational psychology. This will take us back to the roots of motivational concepts: Ancient philosophy has explicated many concepts underlying our commonsense conceptions of motivation. I use Aristotle's (1975) concept of motivation as an illustration of the roots of a type of dynamic concept that forms an antithesis to Lewin's conception. After making these steps "ahead by going back" to the past, I try to point out a way back to the future in the third part, where I report some ideas that I developed in my search for a synthesis of the ancient and commonsense concepts of motivation, on the one hand, and dynamic concepts proposed by classical motivational psychology, on the other hand. I illustrate this attempted synthesis with an outline of my theory of personality systems interactions (PSI theory). PSI theory specifies the differences between the concepts of motivation and self-regulation, and integrates them within a coherent framework. In the fourth part, I conclude with some reflections about future directions in motivational research. This outlook amounts to a critique of what I call content-based explanations of self-regulated behavior. According to my view, content-based explanations will be extended more and more, sometimes even replaced by functional accounts when motivational psychology learns to identify the basic mechanisms of motivation.

B. THE THEORY OF ACTION CONTROL

The introductory remarks about learned helplessness illustrate a functional-design alternative to traditional content-based accounts. My basic assumption (Kuhl, 1981) that the primary cause of helplessness phenomena may be a functional deficit rather than a particular type of cognitive content (e.g., pessimistic control beliefs) was the starting point for the development of a theory of action control, which extended classical motivation theory to incorporate self-regulatory processes. According to this theory, a person can believe in his or her self-efficacy or can be highly motivated and still might not be able to enact intentions he or she is committed to if self-regulatory abilities are insufficient. The term "action control" was chosen to avoid the term "self-regulation," which could not be explicated in functional-design terms at that time. The concept of action control emphasizes the assumed effects of the processes described: It summarizes all processes that facilitate the enactment of intended actions. According to action control theory (Kuhl, 1984), these processes are based on various mechanisms or strategies that help maintain a

difficult intention active in memory and shield it from competing action tendencies (Kuhl, 1984). Examples are strategies like *attention control* (e.g., focusing on information related to an uncompleted intention rather than to distracting information), *motivation control* (e.g., enhancing the subjective attractiveness of an intended action), *emotion control* (e.g., disengaging from a sad mood if it renders enactment of an intention difficult), and *coping with failure* (e.g., using failure as self-corrective information rather than responding to it with self-handicapping emotionality).

In recent years, this theory could be extended to incorporate a functional account of the self and its role in action control (Kuhl, 1996, 1998, in press). Originally, action control strategies were conceived of as consciously controlled processes that enhance the activational strength of intention-related cognitions and emotions, and suppress processes that would strengthen competing action tendencies. As will be pointed out later in this chapter, the conscious form of action control, which is based on suppression of nonintended processing, is only one of two fundamentally different forms of central (i.e., volitional) control of motivational processes. The second mode of volition is called *self-regulation*. It is described in terms of largely implicit (unconscious) processes that integrate as many subsystems and processes as possible for the support of a chosen action. In contrast, the conscious form of action control, which is called *self-control*, is based on suppression of many subsystems and processes to reduce the risk that any competing action tendency takes over and jeopardizes the enactment of a difficult intention. An example of self-control is a student who attempts to enact his or her intention to study by inhibiting all thoughts related to attractive alternatives such as talking with friends or going to the movies. Self-regulation is characterized by a different approach: The student would pay attention to all his or her needs, emotions, and thoughts, and find a way for each of them to be taken care of either simultaneously (e.g., study with friends) or successively. This openness to self-related thoughts and feelings that is characteristic of self-regulation can be compared to an inner democracy, whereas self-control can be described in terms of an inner dictatorship. In the first case, the self forms the basis or "agent" of self-regulation, providing cognitive and emotional support for self-generated goals and actions. In the second case, the self is the target of self-control; that is, self-related thoughts and feelings are suppressed to reduce the risk that any self-related thought or feeling that might be incompatible with the current conscious intention could take over.

At this point of theory development, many theoretical questions arise. What is the self and how can it be explained in functional terms. What are the conditions that determine whether self-control or self-regulation is activated? What role do positive and negative affects play in this process? How are motivational processes that provide the energy for the enactment

of intentions affected by volitional processes? These questions require a substantially broader theoretical framework than the original theory of action control. In the remainder of this chapter, I describe the theory of personality systems interactions (PSI theory), which was developed to answer the questions raised by the extended theory of action control. I begin with one of the most challenging (and most neglected) questions regarding the concept of motivational energy: What does it mean in functional terms when a student says, "I want to study, but I do not have the energy to do so"? How can the energy necessary for volitional action be conceptualized and how does it affect the interaction among cognitive systems involved in volitional action?

II. DYNAMIC CONCEPTS IN CLASSICAL THEORIES OF MOTIVATION

The first problem arising at the cognition–motivation interface concerns the divergent nature of cognition versus motivation: Classical concepts of motivation are subcognitive.¹ The impulses originating in Freud's id were not endowed with cognitive insights. Freud's concept of libido as the universal energy underlying all motivated behavior left little room for higher forms of intelligence. In Lewin's (1935) theory, needs were described in terms of tension systems that do not release their energy until an appropriate goal is attained. He called these systems *dynamic systems* to express the waxing and waning properties of what he considered the driving forces of motivation. According to this view, a person can reflect intensely about an aspired goal state without necessarily performing any appropriate action: In addition to a cognitive representation of a goal, some subcognitive driving force seems to be necessary to move the organism toward the goal. Atkinson & Birch (1970) developed a mathematical model of similar dynamic aspects of motivation three decades ago. This model and the theory underlying it was ahead of its time for at least two reasons: First, psychology was busy elaborating a scientific basis for the assessment and analysis of cognitive processes. Second, the specific type of theorizing proposed by Atkinson and Birch would have required a

¹The term "subcognitive" describes nonrepresentational processes. A common example is global arousal, which relates to a process that does not represent some aspect of the external or internal world, but can affect the activational strength of representations. Affects (but not emotions) are conceptualized as subcognitive processes as well. The terms "metacognitive" and "supracognitive" relate to representations about representations. Although virtually any cognitive representation is a "metarepresentation" in the sense that it aggregates more elementary representations, I use the term in the sense of some knowledge that represents a combination of subcognitive and cognitive states (e.g., a representation of a wish to buy a car, where wish has a subcognitive component, such as a positive affect associated with the cognitive representation of a car).

paradigm shift: Their model assumed bidirectional causal relationships among motivational variables at a time when everyone was eager to apply the unidirectional logic of classical experimental methodology and the analysis of variance model derived from it.

Today we have less reason to avoid dynamic concepts: We can handle the mathematical intricacies of nonlinear bidirectional causality as exemplified by models on fractals, deterministic chaos, and synergetics (Haken, 1981). In an application of a simple chaos model, I found support for the capacity that a model allowing for bidirectional (nonlinear) causality had for explaining level of aspiration data (Kuhl, 1985).

Besides the neglect of bidirectional causality, there are two additional causes of the difficulty to integrate dynamic concepts in motivational research: The neglect of subcognitive mechanisms and the conceptual underspecification of dynamic concepts.

A. NEGLECT OF SUBCOGNITIVE MECHANISMS

Compared to the theoretical and methodological advances made in cognitive research, dynamic concepts still have the aura of sunken Freudian vessels (perhaps of *Titanic* dimensions) that are buried in the deep waters of the unconscious, unable to make contact with the daylight where they easily could be observed and examined. Fortunately, new perspectives for examining dynamic processes are emerging today. First, advances made in the neurosciences make a strong case for subcognitive processes. One of the well-known examples is LeDoux's (1995) research on two neurobiological routes from perception toward affect generation: A direct route reaching affect-generating structures (e.g., the amygdala) without a cognitive loop and an indirect route that enables cognitive structures to modulate affect-generating subcortical mechanisms.

The neurobiological evidence for a direct mechanism that generates affect without the intervention of higher-order cognitive processes (presumably mediated by the cortex) provides a strong argument against cognitive reductionism (cf. Zajonc, 1980): Affective reactions to a situation cannot be explained fully on the basis of what a person thinks or believes. The term "subcognitive" denotes the component of affectivity that is not mediated by higher-order cognitive processing. Motivation and self-regulation depend on the type of affective response characteristic of an individual (Atkinson, 1958; Heckhausen, 1991; Klinger, 1977; Kuhl, 1984, 1992). The introductory remarks concerning the relationship between the content of thought and motivation are corroborated by neurobiological evidence (LeDoux, 1995): Exploring people's beliefs and other cognitive contents does not suffice to explain the affective basis of motivation and volition. A student may have problems experiencing positive affect and

intrinsic motivation with a task and enacting his or her intentions to work on it even if he or she has been made to believe that he or she can handle the task.

B. UNDERSPECIFICATION OF DYNAMIC CONCEPTS

The evidence for subcognitive processes underlying affect generation suggests that there is more to motivation than cognitive contents such as goals, expectations, and other beliefs. However, this evidence does not tell us much about the specific features of dynamic mechanisms. Some theorists have specified motivational energy in terms of a mechanism that "channelizes" available undirected neuronal energy in favor of some goal representation (Klinger, *in press*; Nuttin, 1984). Cognitive theories use dynamic concepts in some sense; for instance, when referring to the activational strengths of specific or global memory structures (Anderson, 1983; Kahneman, 1973). However, when motivational psychologists speak of dynamic properties such as "energy," they do not mean quite the same that cognitive psychologists describe in terms of activation or arousal. This leads us to central questions of motivation: What exactly does the dynamic component add to the system? What does it mean in functional terms when we say that a student is motivated (e.g., beyond saying that he or she has increased arousal or positive control beliefs)?

According to Lewin's dynamic theory of motivation, the dynamic component can be described as a certain form of motivational energy that is necessary to maintain uncompleted intentions active in memory and that facilitates their performance under certain conditions. The motivational energy that facilitates initiation of study behavior and persistent efforts toward achieving relevant goals increases with increasing strengths of underlying needs and attractiveness of the goal; energy decreases when the goal has been attained or substitute goals have been achieved (e.g., when one has succeeded on an alternative task that is sufficiently similar to the one originally attempted).

Similar ideas about dynamic properties of the organism are reflected in many theories of motivation (Atkinson & Birch, 1970; Freud, 1938/1989; Heckhausen, 1991; Lewin, 1935; McClelland, Atkinson, Clark, & Lowell, 1953; Murray, 1938). How can we make progress in explaining such intuitive concepts of motivational dynamics contained in classical theories? The scientific status of the dynamic concepts contained in those theories critically depends on the extent to which they can be operationalized. Zeigarnik (1927) used superior recall of uncompleted compared to completed tasks as a measure of the degree of tension energizing an intentional system: When participants were asked at the end of her experiments which tasks they recalled, they reported more uncompleted than completed tasks. This finding was interpreted in terms of Lewin's hypothesis that uncompleted tasks relate to intentions that are kept in a state of

tension until they are completed. Unfortunately, this intention-superiority effect did not replicate as a main effect (Atkinson, 1953; van Bergen, 1968). Zeigarnik had her participants work on several tasks and interrupted them on half of the tasks. A typical finding that demonstrates an interaction rather than the main effect expected on the basis of Lewin's theory is shown in Figure 1: In this study, the Zeigarnik effect, that is, superior recall of uncompleted compared to completed tasks, was obtained in a group of depressed students, whereas nondepressed participants showed the opposite effect (Johnson, Petzel, Hartney, & Morgan, 1983). This interaction between personality and the intention-superiority effect appears paradoxical in the context of classical theorizing about dynamic processes: Why should depressed individuals, who typically suffer from a lack of energy, be characterized by increased activation of their intentions? As I point out later, I believe that this paradox contains the key to understanding the subcognitive mechanisms working at the interface of motivation and self-regulation. Both cognitive and traditional motivational approaches reach their limits in accounting for this paradoxical interaction.

Another problem relates to a methodological issue: Free recall had been criticized as a measure of the activational status of intention-related

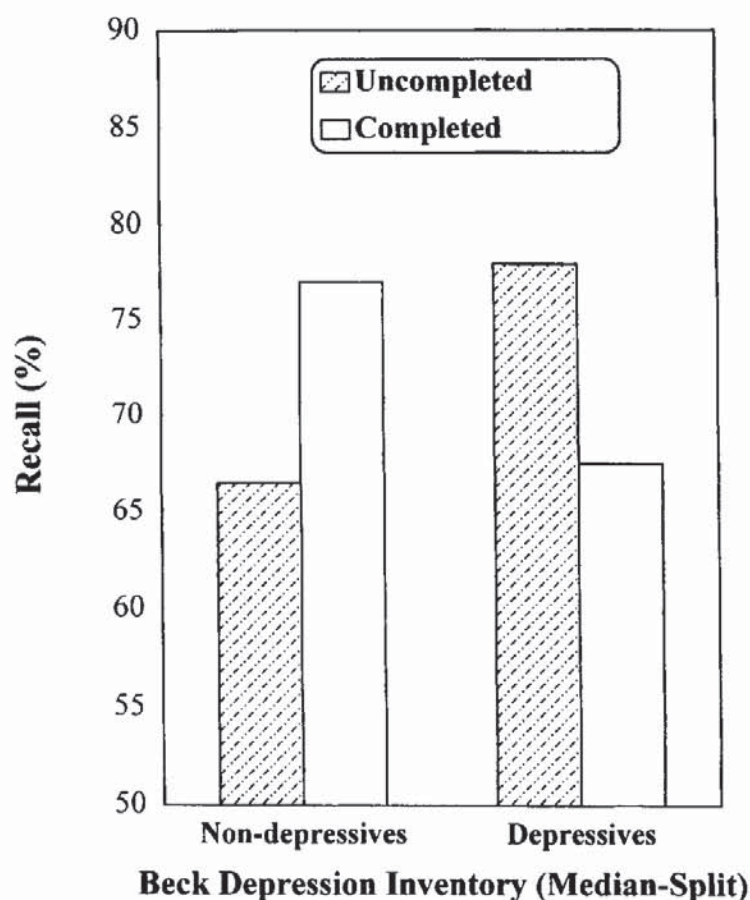


FIGURE 1 Recall of completed versus uncompleted tasks as a function of degree of depression. After Johnson et al., 1983.

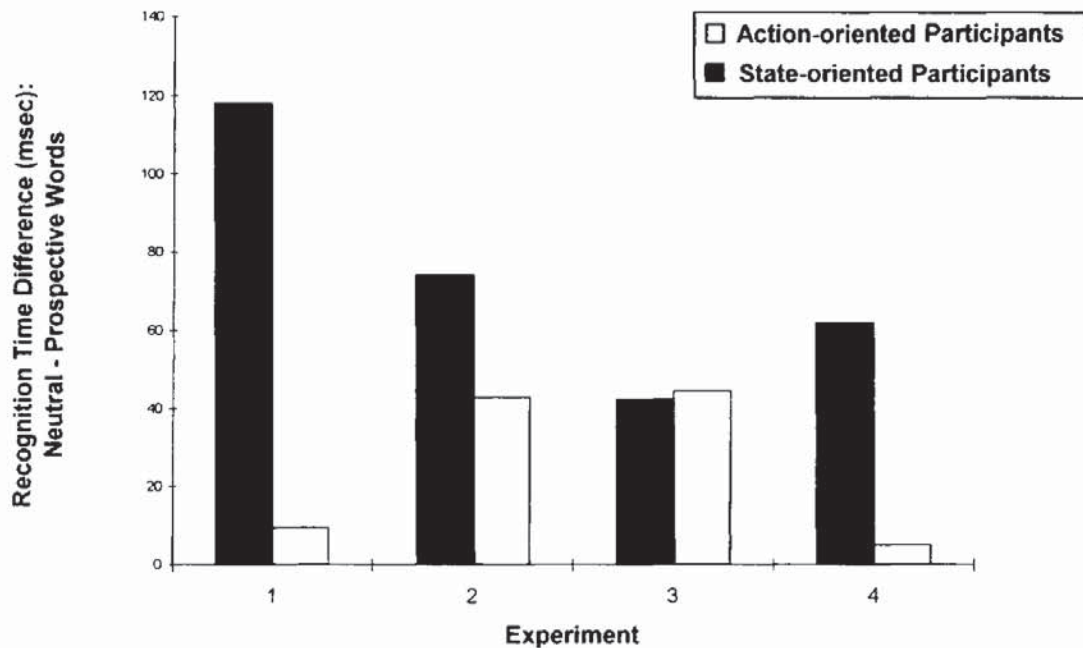


FIGURE 2 Memory superiority for intention-related (prospective) words as a function of a personality disposition for self-regulatory recruitment of energy for the enactment of intended actions. After Goschke and Kuhl (1993).

information because of several methodological shortcomings (Heckhausen, 1991, p. 125ff). However, Goschke and Kuhl (1993) obtained a similar pattern of results in a series of studies using recognition latencies as a measure of subthreshold activation of words related to uncompleted intentions compared to activation of neutral words. In the four experiments summarized in Figure 2, a personality disposition that can be regarded as a nonpathological analog of depression (i.e., prospective state orientation) was associated consistently with an intention-superiority effect, that is, shorter recognition latencies for words related to an uncompleted intention, (i.e., prospective words) as compared to neutral words (Figure 2). Prospective state orientation is assessed by a self-report scale that describes examples of hesitation and lack of energy to initiate intended behaviors. This construct is especially interesting in the context of self-regulation: As pointed out in a later section, research findings suggest that the basic mechanism underlying this construct can be described in terms of the ability for *self-motivation* (i.e., the ability to generate positive affect or other states that facilitate volitional action without the support of external prompts).² The findings from Goschke and Kuhl's (1993) experiments

²The special status of intention-related information in memory also has been demonstrated in research on prospective memory, although this research typically ignores individual differences (Brandimonte, Einstein, & McDaniel, 1996). Although not explained in the text, the failure to find individual differences in the intention-superiority effect in Experiment 3 (Figure 2) was theoretically predicted on the basis of a critical feature in which this experiment differed from the other three studies (i.e., self-initiation rather than external control of enactment).

confirm the paradoxical findings from the Johnson et al. (1983) study (Figure 1): A personality disposition (i.e., state orientation) that can be regarded as a nonpathological component of depression in terms of reduced behavioral energy or "hesitation" (Kuhl & Helle, 1986) was associated with an increased activation of intention-related information (as indicated by faster recognition times for prospective words).

III. ARISTOTLE'S DYNAMIC CONCEPTS

The paradoxical interaction between personality and prospective memory highlights the limitations of classical dynamic concepts. What is wrong with these concepts? In my view, classical approaches specified the functional locus of motivational energy in too global terms. According to Lewin, the locus of energization was in structures underlying needs and *quasi needs* (which he called intentions to express his assumption that intentions had dynamic properties that were similar to those of needs). This assumption directly leads to the paradox mentioned: How can it be true that people characterized by a lack of energy observable in terms of behavioral inhibition (e.g., depressed or state-oriented individuals) show indications of heightened energization when measures of prospective memory (i.e., memory for intentions) are obtained? We clearly need a more differentiated model of dynamic aspects of motivation, a model that describes the flow of energy across various subsystems. In Lewin's theory, flow of energy was confined to the within-system exchange among similar intentions. What are the conditions that control energy flow between intention memory and systems relevant for the control of intended behavior? What are the functional characteristics of systems among which motivational energy flows? In search for an answer to these questions, I found this conclusion that Aristotle drew two and a half milleniums ago in his *Nicomachean Ethics*: "It is not thought as such that can move anything, but thought which is for the sake of something and is practical."

According to Aristotle's insight, we cannot expect cognition to instigate behavior all the time. As I show later, this assumption is not easily compatible with cognitive models of human behavior that are based on the idea that, to predict behavior, it suffices to study cognitive contents and mechanisms supporting them as, for instance, the resources allocated to goal representations activated in an organism at a given point in time. Aristotle maintained that additional conditions have to be met until thoughts can move anything; that is, until they have motivational significance. Note that the roots of the term "motivation" are related to the word "move," the term Aristotle used in what amounts to an abbreviated formulation of a model of human motivation.

A. FUNCTIONAL EXPLANATION OF ARISTOTLE'S THEORY OF MOTIVATION

Today we prefer a more functional language to express assumptions about psychological mechanisms. I already suggested that Aristotle's term "thought" can be understood in terms of motivationally significant cognitive representations, specifically representations of goals and cognitive representations of appropriate instrumental behavioral routines (i.e., intentions). When can we say that motivationally significant cognitions are "for the sake of something"? In my view, this term can be interpreted in terms of the meaningfulness of a goal or an action considered within the broader context of an individual's needs, values, and social environments. A goal or an action is meaningful, it is "for the sake of something," to the extent that it is compatible with an individual's needs, values, interpersonal relationships, and other aspects of what is called the self and its social context. Aristotle's statement emphasizes a second requirement for a cognitively represented goal to be able to instigate behavior: A thought has to be practical before it can move anything. What does Aristotle's additional determinant of motivation, *practicality*, mean in functional terms? A goal or an action is practical to the extent that it can be translated into behavioral routines available to the organism. Accordingly, my translation of Aristotle's model of motivation into functional language reads as follows:

Cognitive representations of goals and anticipated instrumental activities are not endowed with dynamic properties, that is, they do not energize or facilitate behavior until their compatibility with a personal meaning structure (e.g., the self) has been established and/or until they have been translated into specific behavioral routines available to the organism.

In my view, this functional account of Aristotle's model of motivation entails the chance to make some progress in solving the problems left by the dynamic concepts contained in the theories of Freud, Lewin, Zeigarnik, and Atkinson. Global concepts of energy, dynamic forces, or motivational tendencies can be decomposed into more specific concepts. Motivational energy (i.e., activation of mental structures contributing to the instigation of goal-directed behavior) can come from various subsystems. According to my functional account of Aristotle's distinctions, the sources of motivational energy (i.e., behavioral facilitation) he refers to can be described in terms of energy flowing to and from the three subsystems depicted in Figure 3: (1) a subsystem that generates self-representations and self-compatible goals (i.e., goals that are "for the sake of something"; not necessarily conscious), (2) a subsystem that generates explicit, consciously accessible representations of intended actions (i.e., motivational thoughts), and (3) a subsystem that generates specific behavioral routines (i.e., thoughts that are practical). Adding a perceptual system specialized to

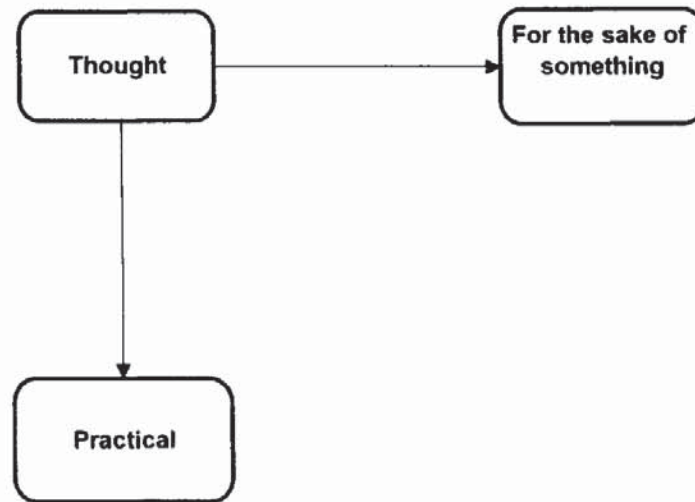


FIGURE 3 Aristotle's theory of volitional action.

the identification and recognition of objects in various modalities to this table, we have a list of what I consider the minimum number of macrosystems that have to be distinguished to arrive at a differentiated theory of energy flow among systems relevant for goal-directed action: (1) a system that provides extended (holistic) representations of internal and external contexts, including integrated self-representations (EM); (2) a system that supports explicit, sequential, and analytical operations for problem solving, including an explicit memory for difficult intentions (IM); (3) a system that controls the performance of intuitively available behavioral routines (IBC); and (4) a system that recognizes familiar “objects” perceived in the inner or outer world (OR) and identifies novel objects on the basis of mismatches between representations of familiar objects and new objects encountered.

B. SYSTEMS INTERACTIONS: MODULATION OF CONNECTIVITY AMONG SUBSYSTEMS

There is another, even more subtle implication in Aristotle's model. This aspect of his concept of motivation relates to the definition of dynamic properties; that is, the properties of a system that facilitate overt action. Aristotle did not say that strength of motivation is a function of the activational strength of a thought, nor did he describe motivation as a function of the activational strength of “practicality” (his term for appropriate habits or behavioral programs). Instead, he considered the *relationships* between a thought and whatever makes it practical and whatever makes it be for the sake of something as the essential condition for its motivational significance; that is, for its ability to move anything.

To put it in more functional language, it is the connectivity among systems that is the essence of the dynamic properties of a thought: The connectivity between systems that generate anticipated (intended) actions, on the one hand, and systems that generate self-representations (that tell the individual whether an action anticipated in thought is for the sake of something) as well as systems that control appropriate behavioral routines, on the other hand. This view dramatically contrasts with classical and modern approaches to motivation. According to Freud and Lewin, it is the "steam" accumulated in the motivational engine that makes it move. The dynamics of motivation are described in terms of the energy level of the total system or of some critical subsystem. In contrast, Aristotle's model implies that the degree to which a thought can move the individual critically depends on the connectivity this thought has with subsystems that control the motivational meaning and with subsystems that control the execution of actions intended by that thought (Figure 3). Birch, Atkinson, and Bongort (1986) developed a similar model when they described the functional significance of thought for the instigation of behavior.

The theoretical significance of this definition of dynamic properties hardly can be overestimated. In my view, virtually all concepts we use, including motivational or even dynamic concepts, do not denote intersystemic connectivity. Instead, they describe the dynamic properties of single systems. Our dynamic concepts, like arousal, motivation, and memory activation, typically describe properties of single entities rather than relationships among entities. Well-known examples in personality research are constructs such as introversion, neuroticism, and anxiety. According to Eysenck (1967), introverts are not very sociable because they typically are overaroused and they avoid social contacts because they would boost their level of arousal beyond the optimum medium level. Neuroticism and anxiety are identified with the sensitivity of the limbic mechanism; for example, sensitivity of the punishment system (Gray, 1987).

There are some cognitive and some neurobiological approaches that differentiate global concepts of arousal, for instance, into sensory arousal versus motor activation (e.g., Pribram & McGuiness, 1992). There are also models that focus on connectivities among subsystems, for example, interactions between anterior and posterior attentional networks (Posner & Rothbart, 1992). However, none of these approaches takes into account anything similar to Aristotle's concept of motivation, which I interpret in terms of the modulation of connectivities among various subsystems through subcognitive mechanisms. Dynamic parameters that describe the connectivity among subsystems are not common in psychology. The construct of action versus state orientation that I mentioned is an exception: It describes an intersystemic modulation parameter. Prospective action ori-

entation describes the extent to which a thought can become practical or, in functional terms, the extent to which the pathway between intention memory (i.e., the assumed locus of an action-related thought) and subsystems storing appropriate behavioral routines is energized or inhibited. A global form of arousal that activates all mental systems indiscriminately cannot explain the dynamic paradox suggested by the findings described in Figures 1 and 2: Why can goal representations or intentions be highly energized (as indicated by superior memory performance) without mechanisms controlling appropriate behaviors being energized as well? How can the passivity associated with depression or prospective state orientation be explained despite the high activational status of intentions in those individuals?

Activation of a system like intention memory can be strong and still the activation of its connection with other systems can be weak. A person can strongly intend to engage in a course of action, but lack the motivational energy to keep on track because the intention is not sufficiently connected with systems that provide meaning and/or practicality. In personality research, we should search not only for individual differences in the arousability of subsystems, but also for personality dispositions that affect the arousability of systems connections. As I point out later, the dissociability between the two types of arousability (i.e., arousability of systems versus arousability of the connection between systems) also can be explained on the basis of differential developmental conditions that affect arousability of systems versus arousability of systems connections (Kuhl, *in press*; Kuhl & Völker, 1998).

What are the specific mechanism terms like “energy flow” or “activation” referring to? We are talking about an intermediate level of analysis between the level of microactivations of cognitive contents (e.g., through priming) and the global level of arousal of the total system or of specific subsystems. How can we describe the mechanisms underlying motivational dynamics on this intermediate level? What are the rules according to which the relative activations of the pathways among the four macrosystems I mentioned are controlled? How can the functional characteristics of the four macrosystems be described in detail? How can we operationalize the dynamics of motivation, that is, the temporal changes of activation of each macrosystem? Finally, how can a theory of motivational dynamics resolve paradoxes like the one I mentioned (i.e., the finding that people suffering from an energy deficit such as depression or state-orientation seem to have more energy available for the activation of their goals and intentions)? I will now provide a brief outline of the theory of personality systems interactions (PSI theory) that I have developed to find some answers to these questions.

IV. PERSONALITY SYSTEMS INTERACTION THEORY

Before explaining some details of this theory, I should mention one important point in which it departs from traditional theorizing on human motivation. Traditionally, motivational psychology has been concerned with the determinants of goal-directed behavior rather than with the mechanics of the system that enables an organism to move toward aspired objects. Cognitive psychologists sometimes have criticized their motivational colleagues because the latter do not deal with the mechanisms underlying the control of behavior. The reason why motivational psychologists have not considered cognitive mechanisms essential to their work can be illustrated by the following example: When somebody has the task to predict the itineraries of a traveling salesman, he or she does not take the engine of the salesman's car apart to figure out how it works. This example illustrates the traditional partition of labor between cognitive and motivational psychology: Cognitive psychologists study the mechanics of the mental machinery, whereas motivational psychologists study its purposive aspects; that is, the determinants of goal-directed behavior.

According to my view, there is a fundamental flaw in this type of reasoning. If we want to develop a deeper understanding of motivation and volition, we have to part with this segregation of purpose and mechanism. The reason for this statement follows from my previous analysis: To the extent that a differentiated concept of motivational dynamics amounts to the changes in activation of cognitive macrosystems, we can no longer ignore those macrosystems. The point I wish to make is this: We cannot investigate the dynamics of motivation unless we develop some understanding of the cognitive macrosystems whose dynamic interactions we wish to explore. The transition from global concepts of energy to more specific concepts of energy flow among mental macrosystems forces us to abandon the traditional partition of labor. Specifically, we need to develop an understanding of some functional characteristics of the two elementary macrosystems that support object recognition and performance of behavioral routines, and the two high-level macrosystems that support implicit self-representations, on the one hand, and explicit representations of behavioral intentions, on the other hand. We cannot accomplish a better understanding of the energy flow among these systems without developing a better understanding of their nature.

How much can we learn from cognitive science about the four systems? The first pair of systems relates to phenomena investigated in various cognitive fields (i.e., object recognition and intuitive behavior control). Compared to them, the second pair of systems [i.e., intention memory (including explicit commitments and ideals) and extension memory (including self-representations and motives)] is located on a high level of integration addressed in the areas of personality and motivation rather than in

cognitive science. However, in contrast to the cognitive approach, it is uncommon in the area of personality psychology to talk about high-level concepts such as the self in terms of systems whose mechanisms are to be analyzed. The concept of self (Baumeister & Tice, 1986; Kihlstrom & Klein, 1997; Markus & Nurius, 1986) is a good example for a hypothetical construct of personality theory that usually is not identified with a concrete mechanism, let alone with a neurobiological system. In PSI theory, both the two low-level and the two high-level systems are conceptualized in terms of cognitive-motivational macrosystems whose functional characteristics can be specified in some detail. Table 1 summarizes functional characteristics associated with each of the four motivationally relevant macrosystems. Each of these characteristics is supported by experimental research (see Kuhl, 1998) for an overview of relevant research) and is further discussed in the following section.

A. ELEMENTARY SYSTEMS: INTUITIVE BEHAVIOR CONTROL AND OBJECT RECOGNITION

What can we say about the functional characteristics of each of the four macrosystems? What do we know about the low-level system controlling object recognition and about the system controlling behavioral routines on an intuitive basis, that is, with little or no intervention of conscious intentions? Some functional characteristics of intuitive behavior control can be found in research on motor control (e.g., Jeannerod, 1994). Interesting details stem from research on organisms whose behavior is under

TABLE 1 Functional Characteristics of Four Cognitive Macrosystems

| | Behavioral systems | Experiential systems |
|--------------------------|---|--|
| High-inferential systems | Intention memory (IM)/thinking (left hemispheric) <ul style="list-style-type: none"> • Analytical (critical feature) • Sequential • Vulnerable • Slow • Accurate • Decoupling from emotions | Extension memory (EM)/feeling (right hemispheric) <ul style="list-style-type: none"> • Holistic (family resemblance) • Parallel • Robust • Fast • Impressionistic • Close interaction with autonomic reactions |
| Low-inferential systems | Intuitive behavior control (IBC) <ul style="list-style-type: none"> • Contextual • Cross-modal • Presence and future oriented • Anticipation • Holistic • Robust | Object recognition (OR) <ul style="list-style-type: none"> • Decontextualized • Modality specific • Past oriented • Recognition • Analytical • Vulnerable |

the control of intuitive mechanisms because they do not have explicit intentionality: Developmental research on motor learning in infants has yielded interesting insights into the functional details of mechanisms underlying intuitive control of behavior. One of the earliest intuitive behavior programs is already observable in neonates: It regulates emotional contagion and imitation of emotional expression (Meltzoff & Moore, 1989, 1994). These programs seem to be an essential prerequisite for the later development of intuitive programs for social interaction (Keller, Gauda, Miranda, & Schölmerich, 1985; Papoušek & Papoušek, 1987). High integration of contextual information from within and across various modalities is one of the characteristics in which systems underlying intuitive behavior control differ from object perception systems (Table 1): Whereas systems supporting intuitive behavior integrate information from various modalities and context information within modalities, systems underlying object recognition keep information from various modalities separate and yield object representations that are rather independent of and constant across various contextual variations (e.g., recognizing the identity of an object independent of its distance, its color, or its luminance).

The focus on recognition of objects that are identical to templates that have been stored in the past is the reason why object recognition is characterized by an orientation toward the past, whereas intuitive behavior control is characterized by present and future orientations (Table 1). The mechanisms underlying parallel distributed processing in on-line sensorimotor control are rather robust (Table 1): Degraded input can be handled as long as it has some family resemblance with the procedural knowledge available (Rumelhart & McClelland, 1986).

B. HIGH-LEVEL SYSTEMS: INTENTION MEMORY AND ANALYTICAL THINKING VERSUS EXTENSION MEMORY AND INTUITIVE FEELING

Analytical Thinking and the Memory for Explicit Intentions

What can we say about the functional characteristics of high-level macrosystems such as intention memory and self-representations? Interestingly, the dualism of intuitive and analytical styles also occurs on the level of higher-order cognitive processing: Analytical thinking shares its precision-oriented nature with object perception, whereas holistic feeling has the global and holistic type of processing in common with intuitive behavior control. A particularly important component of analytical thinking relates to the ability to form explicit representations of intended actions. Research demonstrating a neurobiological basis of intention memory shows that a memory for intended actions (set) can be separated from working memory (Fuster, 1995). According to the PSI theory, intention memory stores explicit, consciously accessible representations of anticipated action sequences, whereas working memory typically stores sensory

information that includes cues that signal opportunities for executing intentions. Explicit representation of sequences of intended actions are attributed to left-hemispheric (prefrontal) processing (Knight & Grabowecky, 1995).

In a recent series of studies exploring additional characteristics that intention memory does not share with working memory, we came to the conclusion that intention memory is characterized by a special mechanism that controls facilitation and inhibition of the pathway between its analytical or verbal representations of intended actions and systems that control behavioral routines for performing such actions (Kuhl & Kazén, in press). In a broader context, we can regard intention memory as a pivotal part of a network of subsystems that underlie analytical thinking, verbal processing, and other functions that support planning (Shallice, 1988). Planning and explicit representation of an intended action are necessary whenever intuitive programs are not available to reach a goal; that is, whenever a problem needs to be solved or when the system has to delay responding until an appropriate situation for performing an intended action is encountered. In these situations, it is useful to maintain an explicit representation of an intended action active in memory until it can be performed; that is, until the difficulty to enact the intention is removed. I have called this condition for volitional control of action *difficulty of enactment* (Kuhl, 1984). Inhibition of the pathway between intention memory and the intuitive behavior control system now can be explained as an inherent function of intention memory: Because this memory system is designed for situations in which an intended action cannot (or should not) be carried out yet, inhibition of the pathway to behavior control systems can be considered to be an integral functional component of intention memory.

Feeling and the Implicit Memory for Self-Representations

The second high-level macrosystem has been widely neglected in psychological research. Like intuitive behavior control, it relates to the concept of intuition. Personality psychologists have claimed for many decades that there is a form of unconscious information processing that differs from analytical thinking: Freud's primary as opposed to secondary process, Jung's "feeling" as opposed to "thinking," McClelland's (1985) implicit versus explicit motives, and Epstein's distinction between experiential and analytical thinking styles (Epstein, Pacini, Denes-Raj, & Heier, 1996) are examples of intuitive processing. However, these concepts do not go very far to spell out the specific mechanisms in which the two types of processes differ, let alone specify differences among high-level versus low-level intuitive systems.³ A few decades ago, cognitive psychologists did not see any reason to distinguish the mechanisms underlying intuition

³It can be shown that the experiential system of Epstein et al. (1996) relates to an elementary intuitive system rather than to the high-level system called feeling here (cf. Kuhl, 1998a).

from analytical problem solving that could be simulated on a computer: Intuitive problem solving was considered nothing else but fast, automated analytical problem solving (Simon & Simon, 1978). I challenged that position at a time when there were no tools for modeling intuition in computer models and when experimental techniques for studying intuition were very limited (Kuhl, 1983).

Both limitations have been overcome in recent research on what is called *parallel-holistic processing* (e.g., Beeman et al., 1994; Smith & Shapiro, 1989) and *implicit learning* (Goschke, 1997; Nissen & Bullemer, 1987; Reber & Squire, 1994). Moreover, advances made in computer modeling of parallel-distributed processing (Rumelhart & McClelland, 1986) enable us today to spell out the differences between sequential-analytical thinking and intuitive-holistic processing in great detail. On the basis of these models, we can explain why intuitive processing (on both elementary and higher-order levels of processing) is faster than analytical processing and why intuitive processing nonetheless integrates much more information, is much more robust (e.g., in dealing with incomplete input), and is more flexible than analytical processing (see Kuhl, 1998a, for a discussion of this research in the context of PSI theory).

Even the neurobiological mechanisms underlying these functional distinctions are being investigated today: Functional and even neuroanatomical differences between the left and right hemispheres of the brain help explain why the two types of processing are so different (Bradshaw, 1989). The neuroanatomical organization of the left hemisphere is comparable to an ensemble of many highly specialized "experts" rather than a global network that integrates information from a vast variety of input systems: Compared to the right hemisphere, the left hemisphere consists of a greater number of rather small neuronal networks, each having a higher dendritic arborization than the more extended right hemispheric networks (Scheibel et al., 1985). High specialization combined with low integration is also a feature that characterizes analytical people whose left hemisphere dominates cognitive processing. Analytical thinking is characterized by high competition between rather than integration of alternatives: An object is either good or bad, useful or useless, whereas holistic processing is better equipped to integrate seemingly contradictory aspects of an object or a person.

How can high-level and low-level intuitive processing be distinguished? In the context of a theory of personality, I have especially emphasized one aspect in which high-level intuitive processing (i.e., feeling) differs from the low-level intuitive system discussed earlier (i.e., intuitive behavior control): According to my view, high-level intuitive-holistic processing forms the basis of implicit *self-representations*; that is, integrated representations of internal states such as needs, emotions, somatic feelings (e.g., muscle tensions), and values. This assumption breaks with traditional views in

personality psychology: It adds a highly sophisticated nonconscious system to Freud's and Jung's rather archaic unconscious, and it differs from current conceptions of self in its implicit nature: Whereas approaches to the concept of self that can be found in current personality and social psychology relate to explicit beliefs about the self, PSI theory postulates an implicit or "intuitive" knowledge base that integrates an extended network of representations of own states, including personal preferences, needs, emotional states, options for action in particular situations, and past experiences involving the self (cf. the concept of autonoetic consciousness: Tulving, 1985; Wheeler, Stuss, & Tulving, 1997).⁴

Because of the extended nature of the networks underlying self-representations, the memory system that supports implicit self-representations is called *extension memory* (Table 1): Whenever this system participates in decision making and action, one can be sure that a great number of needs, preferences, values, and other self-aspects are taken into account on the basis of multiple-constraint satisfaction principles that describe parallel processing (see Smith, 1996, for a summary of PDP models applicable to personality research). That right-hemispheric processing provides more extended semantic networks was demonstrated in an elegant experiment on "summation priming" (Beeman et al., 1994): Three words that had weak pairwise semantic relationships, but were highly associated when taken as a whole (e.g., foot; cry; glass) were contrasted with word triples that did not have such a configurational or summation effect (e.g., dog, church, phone). The configurational triples yielded a priming effect on a subsequent target word that was related to the configurational meaning of the triple: The target word (e.g., cut) was identified faster when it was preceded by the configurational triple than when it was preceded by a control triple. Most importantly, the summation priming was substantially stronger when the target word was shown in the left visual field; that is, when the right hemisphere had a processing advantage. This finding confirms the assumption that, compared to the left hemisphere, the right hemisphere provides more extended semantic networks, resulting in superior detection of holistic and configurational relationships between a pattern of objects perceived. From a motivational perspective, this capacity can help an individual confronted with a new situation to find, within milliseconds, an action that is in accordance with a variety of self-aspects, without the necessity to check explicitly each particular self-aspect in a

⁴Tulving and his associates explored episodic memory and autonoetic consciousness in terms of consciously accessible information about autobiographical experiences (Wheeler et al., 1997). The connection I propose between high-level implicit self-representations and autonoetic consciousness is based on the assumption that conscious representations of self-related experiences are based on an unconscious background or "context" memory (cf. Baars, 1988). The relationship between this implicit context memory, which places constraints on what can become conscious, bears some similarity to Freud's concept of the preconscious.

sequential way. This is to say that access to an implicit self-system enables self-determined action in the sense described by humanistic psychology (Maslow, 1970; Rogers, 1961) and, more recently, in self-determination theory (Deci & Ryan, 1991).

Extension Memory and Self-Regulation of Affect

As a final comment on the functional characteristics of extension memory and the self-system, I would like to emphasize its close connectedness with the autonomic system (Table 1). In fact, the right hemisphere of the brain is much better equipped to elicit and inhibit emotional reactions than the left hemisphere (Dawson & Schell, 1982; Gainotti, 1989). Presenting a romantic movie to the right hemisphere by keeping it in the left visual field elicits a considerably higher amplitude of autonomic responses (e.g., changes in blood pressure) than producing a left-hemispheric advantage in processing the movie (Wittling, 1990). I use the term "feeling" to express this additional aspect of the mechanism underlying implicit self-representations and other contents of extension memory. This term (which Jung used as one of his rational functions) nicely combines the cognitive and the emotional components of the particular type of implicit knowledge to which I wish to refer. Besides its reference to emotional states, the term "feeling" denotes tacit knowledge. When we cannot explain how we perform a certain task or how we arrived at a particular solution, we refer to an intuitive feeling (I don't know how I did it, I just feel it is right this way). In clinical practice, the asymmetry between the two hemispheres in its connectedness with affect-generating systems provides an explanation of the fact that explaining an emotional problem analytically usually does not suffice to cope with the emotional reactions associated with it: To the contrary, because the left hemisphere is characterized by a high degree of decoupling between cognition and emotion (Wittling, 1990), analyzing a problem without transforming the outcome of this analysis into "felt experience" can make it even more difficult to cope with emotionally (Perls, 1973).

The most important implication of the assumption that self-representations are based on implicit, right-hemispheric processes relates to self-regulation of affect. The close interaction between right-hemispheric activity and emotional processes explains a multitude of findings that suggest that access to differentiated self-representations (e.g., Linville, 1987) and intrinsically motivated self-determined action based on such representations (Deci & Ryan, 1991) are positively related to emotional support of self-determined action in educational, marital, and many other settings, which in turn is positively related to indices of psychological and physical well-being (Brunstein, 1993; Ryan, Kuhl, & Deci, 1997; Sheldon & Kasser, 1998). The capacity for affect regulation associated with the feeling system is important for another reason: It is one of the functional properties in

which the two intuitive systems differ. Although intuitive behavior control and feeling share the characteristics of parallel-distributed processing (e.g., speed, robustness), the former does not have the affect regulation capacity associated with the latter. On the basis of this and several other arguments, it can be shown that the holistic-experiential (as opposed to analytical) system of Epstein et al. (1996) seems to capture a component of intuitive behavior control rather than feeling: Their measure of "intuitive style" is associated with naive and esoteric thinking patterns (Epstein et al., 1996, Table 3) and is not associated with measures of active, action-oriented emotional coping.

The Neurobiological Basis of Self-Relaxation

The neurobiological mechanisms underlying the important relationships between self-determination and psychological as well physical well-being are being revealed in current research on the stress-reducing function of the hippocampus (Sapolsky, 1992). There is an increasing consensus among neuroscientists that the common aspect to the various functions of the hippocampus relates to its capacity to form an enormous number of instantaneous and organized associations among sensations from the external and internal world (Jacobs & Nadel, 1985; Sutherland & Rudy, 1989). Tolman's concept of cognitive maps nicely expresses the holistic characteristics of hippocampal functions. According to recent research and connectionistic modeling, the hippocampus supports all cognitive (neocortical) systems that integrate many isolated pieces of information into a coherent representation that provides an organized overview of perceptual, spatial, and cognitive representations (McClelland, McNaughton, & O'Reilly, 1995; Squire, 1992). It seems plausible to assume that the coherence-producing function of the hippocampus relates not only to the representation of external, but also of internal environments. Integrated self-representations can be regarded as holistic representations of "inner environments" (emotions, needs, values etc.). This extrapolation of the findings concerning hippocampal functions has the advantage that it explains why activation of self-representations facilitates downregulation⁵ of negative affect and other adverse correlates of threatening and stressful experiences (Linville, 1987; Ryan, 1995; Sheldon & Kasser, 1998): Activa-

⁵The term "downregulation" denotes an active, self-regulatory process through which affect intensity is reduced. Throughout this chapter, this term is preferred to more common terms (e.g., controlling anger or coping with sadness) because the latter often are interpreted in terms of conscious attempts to control emotions, whereas downregulation relates to largely unconsciously operating mechanisms. The term "downregulation" per se is not confined to a particular mechanism through which negative affect is reduced. The second modulation assumption refers only to one of several mechanisms that serve this purpose (i.e., reducing negative affect through activation of relevant self-representations). Another example of a mechanism that reduces negative affect is an acquired disposition to replace negative affect by positive affect without accessing relevant self-representations.

tion of the hippocampus causes a downregulation of cortisol concentration in response to stress (Sapolsky, 1992). To the extent that hippocampal activity is needed for construing an on-line model of self-interests (as for many other configurational representations), we can understand why activation of self-representations reduces stress and its many adverse consequences. Moreover, findings that demonstrate inhibition of hippocampal activity when stress levels exceed a critical threshold (Pavlidis, Watanabe, Magarinos, & McEwen, 1995) might shed some light upon the neurobiological mechanisms underlying the second modulation assumption of PSI theory, which states that critical levels of negative affect that cannot be downregulated inhibit access to self-representations. These modulation assumptions that form the core of PSI theory are explained now.

C. AFFECT-COGNITION MODULATION

Now that I have provided a rough sketch of the four most important macrosystems involved in the mechanics of goal-directed action, the interrupted task of developing a differentiated view of energy flow can be resumed. As can be seen from Figure 4, the energy flow among the four macrosystems is described in terms of mutual antagonistic relationships: Like the muscles enabling a human arm to bend and stretch, the four macrosystems work together on the basis of reciprocal antagonisms (depicted by dashed lines in Figure 4): The more strongly one system is activated, the more strongly it inhibits the activation of adjacent systems. To keep the presentation simple, not all antagonistic effects are depicted

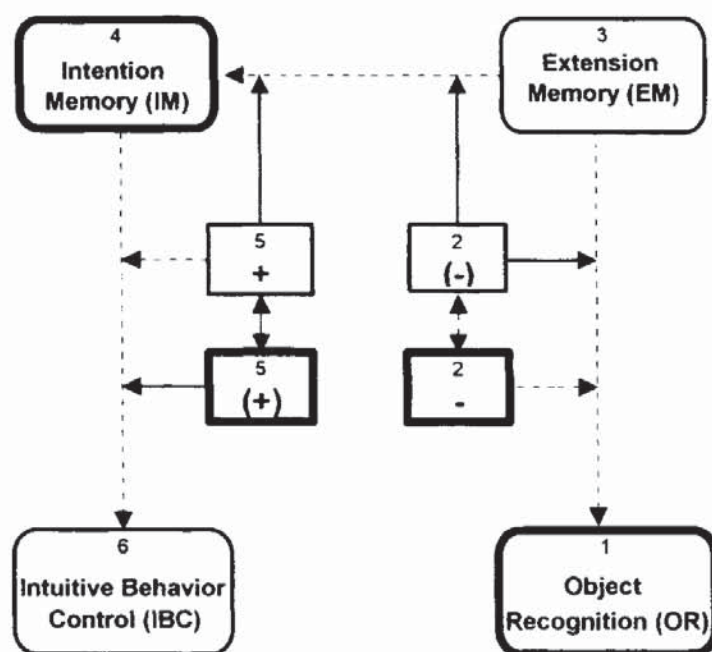


FIGURE 4 A theory of volitional action that forms the core of PSI theory.

in the figure: The figure shows top-down inhibition (indicated by dashed lines) of intuitive behavior control as a function of the activational strength of intention memory (delayed responding or impulse control), top-down inhibition of object recognition as a function of activational strength of extension memory and integrated self-representations (repression of unwanted perceptions), and a suppression of intention memory as a function of the strength of extension memory (EM) activation (e.g., refraining from conscious goal pursuit and planning after activation of implicit self-representations in EM). The reverse antagonisms (not depicted in Figure 4) also hold (if included in the figure, the modulatory effects from affective states also would have to be reversed). For example, the more strongly someone focuses on an explicit goal by maintaining its representation active in intention memory, the more difficult it can become to access extension memory. Inhibition of intuitive behavior control (IBC) through activation of intention memory explains the introductory paradox: Prospective state orientation and, to a much stronger extent, depression, are associated with frequent failure to initiate intended actions, because explicit representations of uncompleted intentions are excessively maintained active in intention memory. According to this interpretation, depression is attributable to the excessive operation of a mechanism that is normally adaptive because it helps maintain a difficult intention in mind and delay action until a problem is solved or a good opportunity is encountered: The inhibition of the pathway between intention memory and its intuitive output system normally helps avoid premature action. The antagonistic relationship between intention and extension memories (Figure 4) explains rigidity: Alternative goals or actions are difficult to perceive in the case of a strong activation of intention memory, because intention memory causes an underactivation of extension memory, that is, of the system that normally provides extended networks of possible actions and possible selves: As a result, people who focus too hard on explicit goals or intentions cannot think easily of alternative actions should the chosen path fail.

What role do positive and negative affects play in this dynamic flow of activation among cognitive macrosystems? There is a wide consensus in psychology concerning the process of affect generation: Affects arise either on the basis of innate or acquired needs and conditioned responses to a variety of stimuli that need not even be consciously processed (Zajonc, 1980) or they are generated on the basis of elaborated cognitive evaluation of an event in terms of predictability and controllability (Lazarus, 1984). As mentioned before, these two sources of affect generation can be integrated (Kuhl, 1983; LeDoux, 1995). According to PSI theory, affects modulate the (antagonistic) dynamic relationships between macrosystems, quite in the sense that I have defined the term "dynamic" in the context of Aristotle's theory of motivation: In addition to the content-specific effects of affects in regulating approach and avoidance motivation (Atkinson &

Birch, 1970; Elliot & Church, 1997; Lewin, 1935), affects also have a dynamic significance because they strengthen or release inhibitory activation relationships among macrosystems. The two core assumptions of PSI theory describe this dynamic significance of affective processes in terms of the subcognitive mechanisms that modulate the changes in activation of the pathways among macrosystems.

1. First Modulation Assumption (Volitional Facilitation Assumption). Positive affect ($A+$) releases the inhibition of the pathway between intention memory (IM) and the intuitive behavior control (IBC) system, whereas downregulated (inhibited) positive affect [$A(+)$] facilitates maintenance of intentions in IM by strengthening the inhibitory relationship between IM and IBC.

2. Second Modulation Assumption (Self-Facilitation Assumption). Downregulation of negative affect [$A(-)$] facilitates access to integrated self-representations and other contents of extension memory (EM) by strengthening the inhibitory effect extension memory has on sensory input stemming from unexpected or unwanted information provided by the object recognition system (OR).

Unconscious Volition

PSI theory specifies the conditions that determine the energy level of each cognitive macrosystem and the conditions facilitating information exchange among antagonistic systems. For example, information flow from intention memory (IM) to its output systems (IBC) is facilitated if an affective change from low positive affect to positive affect takes place. This affect-modulated flow of information among systems is not assumed to be dependent on conscious control of behavior. Therefore, PSI theory extends action control theory (Kuhl, 1984) by spelling out unconscious components of volitional processes. This is to say that the extended theory departs from everyday conceptions of willful action (volition) by postulating several unconscious components of what we normally consider a largely conscious process, according to our daily introspections: Accessing extension memory and integrated self-representations (e.g., through downregulation of negative affect) is regarded as a largely unconscious process, activating intuitively available programs to enact intentions (e.g., through activation of positive affect) does not require a conscious process, and so forth.

Besides descriptions of the functional profiles of the four macrosystems, PSI theory contains five additional modulation assumptions. It is beyond the scope of this presentation to provide a detailed description of these assumption and the phenomena explained by them (see Kuhl, 1998a, for a more detailed account). A brief overview may suffice (Table 2). In a

TABLE 2 Modulation Assumptions of PSI Theory and Some Applications^a

| Modulation assumptions | Applications (explained throughout the chapter) | Relevant studies |
|--|--|--|
| 1. Volitional facilitation: A + → [IBC * IM] | Interaction: Personality × Zeigarnik Stroop removal | Atkinson (1953); Johnson et al. (1983) Kuhl & Kazén (in press) |
| 2. Self facilitation (vs. inhibition of access to self-representations and other components of EM through A -): A(-) → [EM/OR] | Alienation Self-infiltration Interaction: Personality × Yerkes-Dodson | Klinger (1977); Kuhl & Beckmann (1994b) Kuhl & Kazén (1994a) Atkinson (1974); Eysenck (1967) |
| 3. Volitional inhibition: IM → A(+) | Self-discrepancy Intention superiority Procrastination [cf. entry 1] | Higgins (1987) Goschke & Kuhl (1993) Beswick & Man (1994) |
| 4. Self-relaxation (vs. emotional sensitization): EM → A(-) | Uncontrollable Rumination [See also entry 2] | Kuhl & Baumann (in press); Martin & Tesser, 1989; Nolen-Hoeksema et al. (1994) |
| 5. Self-motivation: EM → A + | Intrinsic motivation Incentive escalation | Deci & Ryan (1991) Beckmann & Kuhl (1984) |
| 6. Systems conditioning (Figure 5) | Development of self-regulation of affect | Kuhl & Völker (1998); Kuhl (1998) |
| 7. Self-actualization: A + ← EM & IM → A(+) A - ← IM & EM → A(-) | Emotional dialectics Volitional efficiency Self-growth | Oettingen (1997); Fuhrmann & Kuhl (1998) |

^aSymbols: A + = positive affect; A(+) = inhibition of positive affect; A - = negative affect; A(-) = inhibition of negative affect (downregulation); IM = intention memory; EM = extension memory; IBC = intuitive behavior control; OR = object recognition; → = increases; ← = is increased by; ↔ = increases and is increased by; [X * Y] = facilitatory pathway connecting system X and system Y; [X/Y] = inhibitory pathway between system X and Y.

nutshell, the additional assumptions describe reversals and extensions of the first two modulation assumptions.

3. Volitional Inhibition. The third modulation assumption is the reversal of the first: Activation of intention memory reduces positive affect (volitional inhibition). This part of PSI theory provides a possible mechanism underlying Higgins's (1987) findings, which showed that confronting individuals with information related to ideal self-aspects reduced their positive affective states: Thinking of ideal self-aspects (i.e., something one would like to be) should increase the risk that intention memory is overloaded with unrealistic intentions, which in turn should reduce positive

affect, according to the volitional inhibition assumption (Table 2). Kuhl & Helle's (1986) finding that state-oriented as well as depressed participants enacted fewer intentions after induction of an uncompleted intention is attributed to the same mechanism.

4. Self-Relaxation. The fourth modulation assumption is the reversal of the second: It describes downregulation of negative affect through the activation of extension memory mentioned earlier. This self-relaxation assumption can explain the therapeutical (i.e., distress-reducing) effect of engaging in creative work or of finding meaning in one's previous, present, or future life (Frankl, 1981; Klinger, 1977, in press; Perls, 1973): Any activity that capitalizes on the extended semantic networks provided by extension memory and the feeling system supported by it can help down-regulate negative affect. Finding meaning amounts to a search for configurational information not unlike the type of processing studied in the aforementioned experiments on summation priming (Beeman et al., 1994): Finding a deeper meaning in a difficult personal experience (e.g., the death of a loved person) can be described in terms of constructing relationships between this experience and a variety of self-aspects (e.g., one's needs, one's strengths and weaknesses, and one's aspirations for the future), and discovering new personal implications that emerge from the configuration of all the self-aspects encountered. A great number of research findings are consistent with the view that the right hemisphere supports the global and extended type of information processing that also is associated with implicit self-representations, according to PSI theory (Bradshaw, 1989; Hellige, 1990; Tucker & Williamson, 1984). The prefrontal region of the right hemisphere seems to be especially relevant for the self-representational portion of extension memory, including integrated memories of personal experiences (autonoetic consciousness: Wheeler, et al., 1997). I already mentioned some of the evidence that demonstrates how strongly the right hemisphere is involved in the control of emotional responses, as reflected, for example, in right-hemispheric superiority in the control of cardiovascular responses (Posner & Rothbart, 1992; Wittling, 1990) and skin conductance (Dawson & Schell, 1982). In light of the theoretical and empirical arguments that suggest a close interaction between the hippocampus and neocortical systems involved in the construction of configurational knowledge (McClelland et al., 1995; Sutherland & Rudy, 1989), the stress-reducing function of the hippocampus (Sapolsky, 1992) can become associated indirectly with the activation of those neocortical systems as well.

For the present purposes, it is not necessary to analyze the details of the complex processes involved in these systems interactions. However, it is important to acknowledge these findings from cognitive and neuroscience research because they define constraints for the formulation of psychological models of affect regulation: The accessibility of an extended semantic

network that provides integrated representations of external and internal (self-related) contexts (i.e., extension memory) should be considered an important determinant of the capacity for self-relaxation. Empirical research is consistent with this assumption. For example, in a study by Linville (1987), the interaction between life stress and self-complexity as assessed, for instance, on the basis of the number of distinct features with which participants described themselves was a significant predictor of subsequent indices of subjective stress, psychosomatic complaints, and depressive symptoms. Other examples for this type of coping can be found in research on mastery orientation (Dweck, 1986) and in the study of active coping styles that transform threats to one's self-esteem aroused by difficult tasks into the experience of challenges that are associated with moderate degrees of negative emotionality and with facilitation of performance. The second modulation assumption provides an explanation of these facilitatory effects: The very system that helps reduce negative affect (i.e., extension memory) provides extended semantic networks that facilitate performance, especially in tasks that draw upon remote associations and creative solutions.

5. Self-Motivation. The fifth modulation assumption describes self-motivation, that is, the generation of positive affect associated with a goal or an activity on the basis of activation of appropriate self-representations (e.g., values associated with the activity). The mechanism described in this assumption provides an explanation of the positive effects of intrinsic motivation and self-determination on emotional well-being (Deci & Ryan, 1991; Kuhl, in press; Sheldon & Elliot, in press): According to the self-motivation assumption, intrinsic motivation critically depends on the accessibility of the self-system. There are many empirical findings that demonstrate that the value or positive affect associated with an object increases once a decision for that object has been made. For example, Langer (1975) found that people who were given free lottery tickets and later were asked to sell them requested considerably higher prices for them (i.e., an average of \$8.67) if they had been given a free choice to select their ticket compared to a group who had received an experimenter-selected ticket (\$1.96). Similar increases in value were obtained in quite different settings provided the conditions were conducive to the activation of the self-system, for example, through free choice like in Langer's experiment (Festinger & Walster, 1964) or through other conditions: Participants accepted the arguments of a message more (e.g., rate them more positively) if they were induced to argue in favor of them in a role play (Janis & King, 1954). According to PSI theory, these and many similar phenomena can be attributed to a common self-regulatory mechanism: The top-down generation of positive affect toward an object once its relevance for an activated self-aspect has been detected (self-motivation).

This is to say that one common mechanism can explain a diversity of phenomena that have been attributed to quite different mechanisms such as "illusion of control" (Langer, 1975) or reductions of cognitive dissonance (Festinger & Walster, 1964).

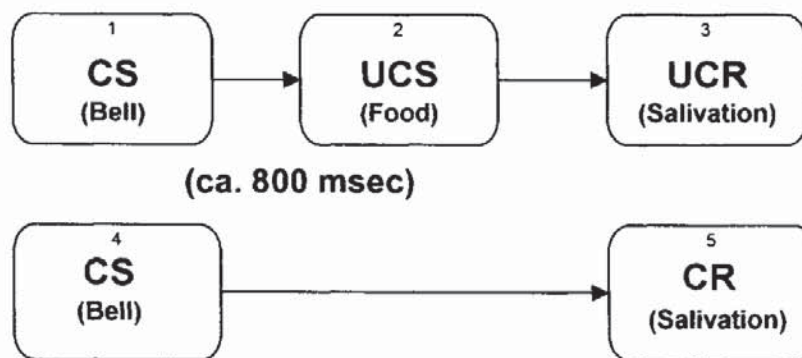
PSI theory extends the range of conditions that facilitate self-motivation to any situation that activates the self. According to the second modulation assumption (self-facilitation), arousal of negative affect (conscious or not) should activate the self as long as it can be downregulated by the individual. Experiments (Festinger & Carlsmith, 1959) that show increases in perceived value (increased liking of a boring experiment) after induction of insufficient justification (e.g., receiving low pay for participation) can be interpreted in this way. According to this view, people increased their evaluation of a boring activity not to reduce the cognitive dissonance between contradictory beliefs (e.g., I have participated in this experiment for little money versus the experiment is boring), but because being underpaid induces a mild increase in negative affect, whose downregulation activates the self system (including all mechanisms associated with it such as self-motivation). Self-motivation not only helps people to become involved in tasks that are not attractive in themselves, but it also facilitates decision making: Beckmann and Kuhl (1984) found that participants who scored high on prospective action orientation (i.e., low on hesitation), showed gradual increases of a tentatively preferred apartment during the decision-making process, even though no new information concerning the apartments offered for rent was introduced. This finding confirms the theoretical interpretation of prospective action orientation mentioned earlier: Apparently, initiative is related to a mechanism that actively recruits facilitatory energy once a self-based decision to do something has been made.

6. Systems Conditioning. How does the degree of participation of the self-system in action control develop? According to the systems-conditioning assumption of PSI theory, whenever two subsystems are repeatedly activated within a time window, the pathway between the two systems is strengthened. This generalization from classical conditioning to the conditioning of intersystemic pathways is to explain the development of self-relaxation and self-motivation, the two major forms in which the self-system modulates affect and behavior. How can systems conditioning be compared to classical conditioning? The analogy is based on two assumptions. First, the expression of negative or positive affect is associated with an activation of the self-system. Second, there are external cues that have a "prewired" (unconditioned) effect on affect regulation: A mother's encouraging vocalizations or her initiation of eye contact facilitates positive affect, whereas her reassuring vocalization and her touching the baby inhibits negative affect. Whenever maternal responses that downregulate

or arouse negative or positive affects, respectively, follow the child's expression of negative or positive affect supposedly mediated by an activation of the self-system (e.g., when the child is bothered by or interested in an object), the association between the child's self-system and downregulation or arousal of affect is strengthened (Figure 5). As a result, the child acquires the capacity to downregulate negative affect or activate positive affect without external stimulation of affect-generating systems.

In a similar way, positive affect gradually comes under the control of the self-system when positive self-expressions (e.g., the baby is looking toward an interesting object or the first-grader shows interest in the first words he or she can write) are answered promptly and adequately by another person. The positive affect that is automatically elicited by the

Classical Conditioning: Formation of new S-R Associations



Systems Conditioning: Formation of New Associations Among Systems

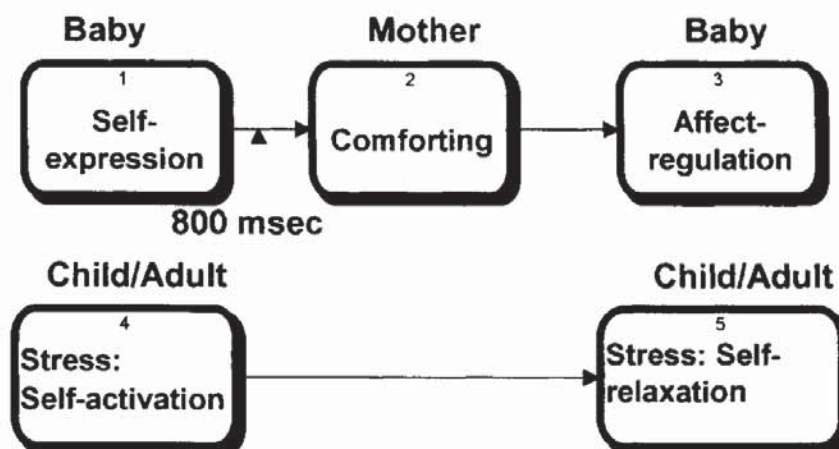


FIGURE 5 The systems-conditioning model.

friendly gesture of an interaction partner becomes conditioned upon the self-system provided the self was activated shortly before and the response semantically matches the self-expression. A positive treatment that does not occur in response to a self-expression cannot have this effect. In other words, during development, whenever a sufficient number of opportunities are encountered for associating activation of the self with the elicitation of positive or the downregulation of negative affect, the self acquires the capacity to control positive and negative affects, respectively. To the extent that the self-system participates in the regulation of positive affect, more aspects of an individual's needs, values, affects, and so forth are taken into consideration whenever he or she is pursuing a goal. According to this model, an excessive tendency toward non-self-determined extrinsic motivation (e.g., striving for money, status symbols, or other material goals) can be attributed to a weak connectivity between the self-system and subcognitive systems involved in the generation of positive affect (Gray, 1987).

The systems-conditioning model specifies the functional basis of autonomy-supporting conditions, which presumably facilitate self-determined action (Ryan, 1995): These conditions can now be characterized by temporally contingent and behaviorally adequate responding to the self-expressions of the child. Similar assumptions are described by the concept of responsivity in attachment research (Bowlby, 1969) or by the psychoanalytical concept of mirroring the child's self-expressions (Kohut, 1985). Parental reliance on controlling conditions (that undermine self-determination and intrinsic motivation; Deci & Ryan, 1991) can be regarded as a special case of a failure to respond adequately and contingently to the child's self-expressions: When caretakers induce or force a child to do something, they do not respond to the child's self-expressions. In connection with the sixth assumption (Table 2), which describes how the connectivity between the self-system and affect-generating subcognitive systems develops in early childhood (i.e., the systems-conditioning assumption), the self-motivation assumption explains why "money does not make happy" (as a German proverb says): A rather short-lived and shallow satisfaction is typically associated with goal attainment that is not mediated through self-activation; in other words, with goal attainment that is "extrinsically" motivated according to the terminology of self-determination theory (Deci & Ryan, 1991), because the satisfaction is confined to the concrete goal at hand unless it is integrated in an implicit self-representational structure connecting it with various needs of the organism. A model that describes part of the extended network of self-aspects that underlie self-determination was proposed by Sheldon and Kasser (1995). Whenever goals are perceived to be integrated in and supported by an individual's self-representational system, people invest more time and effort, feel less exhausted, are more persistent, and are more successful in pursuing their goals (Sheldon & Elliot, 1998).

How can the beneficial effects of self-determination be explained from a functional design point of view? PSI theory provides a simple explanation based on the operation of a common mechanism. Whenever the self-system does not participate in the selection and performance of behavior, the affective consequences of goal attainment are rather local, that is, they are confined to a brief consummatory episode related to goal attainment: In this case, every affective response requires another goal attainment episode. In contrast, participation of the self-system in the instigation of behavior provides a more extended activation of associated affect, temporally and motivationally. This double extendedness of the affective consequences of self-determined behavior can be derived from the two major functional characteristics of the self-system: According to PSI theory, the self-system is conceived of (1) as an implicit background monitoring system whose operation is not confined to conscious episodes (e.g., those elicited by attainment of explicitly represented goals) and (2) as being supported by an extended network of needs, values, and many other self-aspects. This explains the greater satisfaction derived from intrinsic, self-determined goals: Participation of the self-system in goal selection and performance provides access to a great variety of self-aspects, each of which can contribute positive affect to the activity in question. Finally, the satisfaction derived from a self-determined activity should last longer than satisfaction derived from attainment of an extrinsic goal (temporal extension of satisfaction), and self-determined activity should reach deeper into the need and values structure of the organism (spatial extension of satisfaction). Both the temporal and the spatial extendedness of the positive affect can be attributed to the operational characteristics of extension memory and self-representations that are considered part of it: Extension memory is a background monitoring system that provides temporally persisting connections with a great variety of even remote (deep) structures.

Preference for Symbiotic Relationships

In a similar vein, the systems-conditioning assumption combined with the self-relaxation assumption explains why some people have problems accepting their partners' emotional autonomy or why some students need more emotional support from their teachers than others. In accordance with predictions derived from PSI theory, personality styles characterized by an impaired capacity for self-relaxation (i.e., impaired downregulation of negative feelings like frustration or loneliness) are associated with problems in relationships, because of a preference for symbiotic forms of interactions; that is, interactions that do not leave much room for the partners' emotional autonomy. The partner is not allowed to have his or her own emotions because he or she is needed as an external regulator of the other partner's emotional well-being. In positive cases in which a person's need for external mood regulation is met by the responsiveness of

a loving partner or an understanding teacher, deficits in affect regulation acquired during childhood should be remedied as common wisdom suggests (e.g., the fairy tale prince who rescues the neglected young girl). In a recent study (Gunsch, 1996), a particular form of state orientation that is related to uncontrollable rumination after exposure to aversive events (i.e., failure-related state orientation or preoccupation) was among the personality styles associated with symbiotic preferences, that is, preferences for the partner not to have emotions and emotional developments of his or her own. This aspect of state orientation is assessed on the basis of reports of uncontrollable ruminations. The self-relaxation assumption also explains, in combination with the second modulation assumption, why the same type of individuals suffer from uncontrollable intrusive thoughts and have an increased tendency to mistake others' expectations and preferences as their own (self-infiltration; Kuhl & Kazén, 1994a): To the extent that these individuals cannot downregulate the negative affect associated with aversive events, stressful life events make them lose access to integrated self-representations that are necessary to identify and reject self-alien (unwanted) thoughts or social demands.

Rumination versus Repression

Unimpeded access to the self-system also is needed to inhibit unwanted perceptions and thoughts effectively, that is, before they reach conscious awareness. Self-reports of frequent uncontrollable ruminations are used to assess a second form of state orientation that can interfere with volitional action in addition to the hesitation form of state orientation already discussed (Kuhl & Beckmann, 1994a). Suppression of unwanted thoughts through conscious mechanisms seems to be far less effective (Wegner, 1994) than repression through the activation of implicit self-representations at early stages of processing. The assumption that individuals that have a good self-relaxation ability (i.e., action-oriented individuals) repress unwanted thoughts before they reach consciousness was corroborated in a recent study: When aversive words (remindful of painful life events) were shown briefly before presentation of a task, action-oriented participants showed particular components of event-related potentials as early as 180 and 600 ms after word onset; that is, at stages of processing at which conscious attempts to suppress the word cannot be performed (Haschke & Kuhl, 1994). Our hypothesis that these components were related to action-oriented individuals' tendency to disregard unwanted information at early stages of processing was corroborated by the finding that these components disappeared when participants were instructed to pay explicit attention to the aversive material. The short time window of an event-related potential (ERP) associated with the downregulation of negative affect fits surprisingly well into the time range expected on the basis of the systems-conditioning model (Figure 5): Conditioning works best when the

interval between UCS (here, self-expression) and CS (here, external cues regulating affect) is rather short, that is, below 1 s (Mazur, 1990). Evidence from attachment research highlights the importance of prompt (< 1 s) succession of maternal reactions to an infants self-expressions for the former to be effective (Papoušek & Papoušek, 1987). Children whose mothers consistently failed to respond to eye contact initiated by them when they were babies (10 to 14 weeks) within a time window of 800 ms cannot easily downregulate negative emotions later in childhood (Keller & Gauda, 1987).

To the extent that self-regulation of affect is based on a systems-conditioning mechanism that amounts to an internalization of a process that originally features prompt (responsive) external regulation of affect, it should be expected that the affect regulation process (i.e., self-relaxation or self-motivation) controlled by the self-system should happen within a similar time window. The ERP findings cited are consistent with this expectation: Action-oriented participants showed a strong response (P600) 600 ms after the onset of words that reminded them of negative life events: The strong response disappeared when the participants were asked to continue reflecting about those experiences once reminded of them (Haschke & Kuhl, 1994). In contrast, state-oriented individuals (who reported uncontrollable ruminations in everyday life) did not show the P600 response when instructed to suppress experiences aroused by the words or when instructed to focus upon such experiences. In accordance with the self-facilitation assumption (Table 2), another study (Rosahl, Tennigkeit, Kuhl, & Haschke, 1993) confirmed that action-oriented individuals showed superior performance after negative compared to neutral words when a complex memory task followed 3 s after exposure to the word. This is what should be expected if downregulation of negative affect facilitates the activation of self-representations and other contents of extension memory (that were presumably needed for the memory scanning task used in the Rosahl et al., 1993, study).

7. Self-Actualization. Finally, the seventh modulation assumption (cf. Table 2) specifies *affective change* (i.e., the ability to switch between positive and negative affects associated with an object) as the basis for self-actualization with its two basic components: (1) *self-development* (i.e., integrating new experiences into a coherent self-representational system) and (2) *volitional efficiency* (enacting one's intentions). Self-development requires frequent shifts between negative states (e.g., allowing feelings of pain, weakness, or guilt to occur) and downregulation of negative states through activation of relevant self-structures (e.g., former experiences and needs or values that are relevant for the negative event encountered). According to the second modulation assumption, perseverating periods of unattenuated negative affect inhibit self-access. In addition to keeping the

self-system from repressing new experiences that may be unexpected or even unwanted, inhibited self-access is expected to render integration of painful experiences within a coherent self-representational system difficult. This implication of the second modulation assumption explains why traumatic experiences can lead to dissociation of related memories from relevant self-representations: The individual cannot retrieve those experiences easily because they are encoded like unconnected "islands" that cannot be retrieved when relevant self-representations are activated. On the other hand, without occasional states of negative emotionality, the self-system would be active all the time (i.e., making a self-assertive personality), but it would have no opportunity to grow by integrating new experiences (a deficit that is associated with the antisocial personality disorder). Without occasional downregulation of negative affect, the system also would be unable to grow, but for a different reason: Isolated needs, preferences, affects, and other sensations constantly would be accumulated without being integrated in a coherent self-representation (resulting in a personality characterized by low self-esteem and fragmentation rather than integration of the many isolated self-experiences accumulated).

In sum, the basis for self-development is the capacity for emotional change as illustrated by the ability to shift between positive and negative sides of an object, of a personal experience, or of a goal on the basis of relevant self-representations (i.e., self-driven emotional dialectics). Personality styles or disorders associated with a tendency to avoid negative affect through generating positive affect in threatening situations (e.g., histrionic personality disorder) or through actionism (e.g., compulsive personality disorder) should be associated with retarded self-growth, according to the self-actualization assumption, just as personality styles or disorders presumably associated with an excessive tendency to activate self-representations for repressing negative emotions (e.g., antisocial and paranoid personality). A questionnaire assessing these and other personality styles that may be regarded as nonpathological analogs of personality disorders was used recently to test assumptions derived from a model that defines each style or disorder in terms of a combination of high or low sensitivity for positive and negative affect, respectively, and the dominant macrosystem expected on the basis of the modulation assumptions (Kuhl & Kazén, 1997). Consistent with expectations, styles associated with high sensitivity for negative affect (e.g., avoidant and dependent) were negatively correlated with the ability to think of some positive aspect of personality features that had been rated as negative beforehand; moreover, these styles also were associated with a reduced capacity to form consistent and valid representation for one's own or one's partner's preferences. Reduced ability for positive reframing confirms the hypothesized fixation on negative affect, whereas impaired knowledge of self or others (alienation)

confirms inhibited access to extension memory as predicted by the second modulation assumption.

Applying the self-actualization assumption to the action-control side of the model (i.e., the left half of Figure 4) relates affective change to volitional efficiency. According to the first modulation assumption, maintenance of a difficult intention in intention memory requires downregulation of positive affect, whereas its enactment requires the generation of positive affect at an appropriate time. Emotional fixation on positive affect or its inhibition developed in early childhood or later should interfere with the enactment or with the maintenance component, respectively. Constantly low positive affect should be associated with an (over-) efficient maintenance of difficult intentions (e.g., high ideals) in intention memory, but a low ability to act upon those intentions, whereas constantly high positive affect (conscious or not) should be associated with the opposite pattern. Hyperactivity can be regarded as an example for the latter case. Hyperkinetic children's difficulty maintaining a chosen course of action (through maintaining the relevant intention active in intention memory and inhibiting premature action) can be attributed to their inability to downregulate positive affect aroused when interesting action alternatives are encountered (Barkley, 1997). On the other hand, depressed individuals who have problems generating positive mood have no problems maintaining uncompleted intentions and self-ideals active in memory (Higgins, 1987), but they do have problems acting according to their intentions (Kammer, 1994; Kuhl & Kazén, 1994b). According to the self-actualization assumption, an efficient cooperation of the two antagonistic systems involved in the enactment of difficult intentions (i.e., IM and IBC systems) requires a change between positive affect (e.g., through focusing on the attractive sides of a goal) and its downregulation (e.g., through focusing on the difficulties to be overcome). In accordance with (but unaware of) this derivation, Oettingen (1997) found in a series of studies that participants enacted more of their intentions when they were instructed to switch between positive fantasies about goal attainment and a focus on the difficulties of enactment (compared to control groups that were instructed to focus either on positive fantasies or on difficulties).

D. MICROANALYTIC TESTING OF DYNAMIC MODULATION EFFECTS

Despite the empirical research mentioned that supports the modulation assumptions, new methods have to be developed to assess modulation effects more and more directly. Miguel Kazén and I developed a method for examining the effects of brief (i.e., phasic) activations of personality systems such as affect generators and intention memory. Specifically, we modified the familiar Stroop task to investigate the microdynamics of

personality systems interactions (Kuhl & Kazén, in press). In the familiar version of this task, response times are increased when individuals are asked to name the color of the ink in which an incongruent color word is printed (e.g., to say "green" when the word RED is printed in green ink), compared to a control condition in which the color of neutral stimuli (e.g., XXXX) is to be named. We chose this task because it requires participants to perform the two central operations addressed in the first modulation assumption: (1) maintain a difficult intention active in memory (i.e., name the color of the ink rather than read the color word) and (2) establish the connection between intention memory and relevant output systems. According to the volitional facilitation assumption (i.e., the first modulation assumption), the connection between intention memory and relevant output systems should be facilitated by positive affect. To the extent that intention memory is loaded with the difficult intention to name the color of the ink rather than perform the simpler response of reading the color word, brief presentation of positive words prior to the onset of the incongruent color word should facilitate performance. The data confirmed this reasoning. In fact, after presentation of positive words (e.g., love and success), participants often were even faster in the difficult condition (i.e., naming the ink color of incongruent color words) than in the easy condition (i.e., naming the color of XXXX). In other words, the well-known Stroop interference effect replicated in hundreds of experiments can be completely removed simply by using positive words as warning stimuli to announce the onset of the color words, provided special measures are taken to ensure that intention memory is loaded (Kuhl & Kazén, in press). Cognitive models of Stroop interference do not suffice for a full description of the processes involved. According to PSI theory, affective modulation of the pathways between cognitive macrosystems must be taken into account (Kuhl & Kazén, in press).

V. BACK TO THE FUTURE: FROM CONTENTS TO MECHANISMS

In this final section, I discuss several applications of the theory that may help delineate a perspective for future research on motivation and self-regulation. What opportunities does the dynamic theory I have outlined provide for future research? How does it explain familiar phenomena such as success-oriented individuals' preferences of intermediate risks, changes in cognitive beliefs induced in experiments on cognitive dissonance, or mood effects on attitude change through persuasion? What perspectives are opened by dynamic reinterpretations of familiar phenomena? After contrasting explanations based on mechanisms with traditional content-

based explanations, I conclude with a description of new techniques for the assessment of self-regulatory functions.

A. REINTERPRETATION OF FAMILIAR PHENOMENA

Preference for Intermediate Risks

One of the basic findings of achievement motivation research relates to risk preference: Success-oriented individuals typically prefer intermediate levels of difficulty, whereas individuals who score high on fear of failure do not show this preference consistently (Atkinson & Feather, 1966; Heckhausen, 1977; Schneider, 1973). According to most theories, this phenomenon is attributable to some content of success-oriented individuals' beliefs. For example, people prefer intermediately difficult tasks because they believe that these tasks provide a realistic compromise between desirability, which is highest at very difficult tasks, and attainability of success, which is highest at easy tasks (Atkinson & Feather, 1966). According to another content-based interpretation, people prefer moderate risks because they believe that intermediate difficulty levels yield the maximum information about their ability (Trope & Brickman, 1975). Another example can be found in attribution theory: Preference for intermediate risks occur because people believe that intermediately difficult tasks provide the best opportunities to attribute success to one's own efforts (Weiner, 1974). Common to these competing theories is the assumption that it is the content of people's beliefs that determines their action.

What explanation has PSI theory to offer? It should be noted first that content-based explanations are fully compatible with PSI theory: The theory presupposes transfer of information among macrosystems. Consequently, it expects effects of the content of information processed within and across macrosystems. As pointed out at the outset, the many examples that illustrate how the content of beliefs and strategies people use may affect their self-regulation and other behaviors are perfectly compatible with PSI theory. However, PSI theory offers an additional causal factor that affects behavior control. This factor is based on mechanisms rather than contents. Specifically, the additional explanation is based on the dynamic changes of energy flowing among macrosystems. According to this view, an additional cause of the observed preferences of intermediate risks in success-oriented individuals is related to their ability to switch among the activation of intention memory and the activation of intuitive behavioral control system. In other words, people characterized by strong positive achievement needs are able to initiate the changes themselves that Oettingen (1997) found to be so effective when externally controlled: Successive changes from (1) positive affective anticipations (e.g., basking in anticipated success) and (2) focusing on the difficult aspects of challenging

goals and vice versa resulted in a higher rate of enactment of intended activities than positive anticipations or focusing on difficulties of enactment alone. Individuals scoring high on fear of failure scales would be expected to prefer either difficult or easy tasks: For example, difficult tasks should be preferred by individuals who are fixated on low positive mood states in achievement situations that would result in a biased activation of intention memory in combination with its inhibitory influence on the activation of the behavioral output system (IBC). Recall that intention memory is designed for the maintenance of difficult intentions. Hence the preference for difficult tasks would result simply from the overactivation of the system designed for difficult tasks, irrespective of the content of the beliefs activated at the time.⁶

Attitude Change

Whereas risk preference relates to the left-hand side of the model (Figure 4), attitude change in response to persuasive attempts is more closely related to the right-hand side of the model: According to this view, attitude change depends on the dynamics between existing self-representations and new input processed by the object perception system. The practical importance of attitude change research can be seen in many situations in which people are to be motivated or persuaded. Examples are not restricted to the domain of attitude change per se (e.g., health campaigns and political campaigns). The success of parents' attempts to exert influence on their children or teachers' efforts to motivate their students depends on the degree to which the messages communicated elicit attitude change. Improvement of educational efforts depends on the degree to which we make progress in understanding the processes underlying attitude change. Should parents and teachers create a happy or a more serious (reflective) atmosphere before they communicate important messages? Under what conditions would they have to invest much effort in providing strong arguments? Answers to such question critically depend on how the processes underlying attitude change are explained. According to common theorizing, attitude change is affected mainly by cognitive contents such as people's beliefs about the credibility and status of the source, their thoughts about the soundness of the arguments, and so forth. PSI

⁶Nonetheless, preference for high difficulties also can be mediated by beliefs people form after they perceive their behavior (whose primary cause would be low positive affect and excessive activation of intention memory resulting from it). Subjects seem to form such beliefs that produce an optimal fit with the behavior they observe in themselves (Bem, 1967; Festinger, 1957). Such beliefs can intensify the preferences they make. The extent to which a given preference (e.g., for difficult tasks) is mediated by a cognitive belief (e.g., I like difficult tasks because I do not have to be ashamed if I fail on them) or by a content-free mechanism (low positive affect leading to high activation of intention memory) cannot be estimated on introspective data alone (see Goschke & Kuhl, 1993 and Kuhl & Kazén, in press, for a method for the nonreactive assessment of the activation of intention memory).

theory provides additional possible causes for observed effects that go beyond content-based explanations.

Many examples of the latter explanations can be found in the literature. An example is the attribution of attitude change to beliefs concerning the credibility or status of the person communicating a persuasive message (Petty, Cacioppo, & Goldman, 1981) or the attribution of attitude change to the informational content of feelings (Schwarz, Bless, & Bohner, 1991). According to the latter view, happy moods make people believe that the environment is safe, leading them to conclude that it is not necessary to scrutinize information in that environment. How does this "mood-as-information" model explain the finding that attitude change is enhanced after induction of a happy mood when the message contains weak arguments, but is reduced when message arguments are strong (Petty, Wells, & Brock, 1976)? According to the model, happy people believe that there is not much good reason for thinking about the arguments of a message (because they feel safe). As a result, strong arguments cannot unfold their strengths, whereas the unconvincing nature of weak arguments is less likely to be detected. The amount of thinking is operationalized in this research by the persuasion superiority of strong over weak arguments. According to PSI theory, we can use a similar argument without having to refer to the content of people's beliefs. People need not have any beliefs about the low usefulness of thinking in safe situations, because the dampening effect of positive mood on the activation of thinking works independent of the content of thought. According to the first modulation assumption, the dampening of thinking through positive mood can be attributed to the dynamics of personality systems interactions. If enhanced thinking is the basis of the effectiveness of strong arguments, reduced effectiveness of such arguments in happy people could be explained without referring to particular belief contents.

It should be noted, however, that PSI theory leaves open the question of whether or not the persuasion superiority effect is based on enhanced thinking. Another possibility is that people are less persuaded by weak compared to strong arguments when their self-representations are activated, which should facilitate rejection of weak arguments. The more one has access to one's self-representations, the easier it should be to reject arguments that are not compatible with the self (which should be especially true for weak arguments). This mechanism is not very likely to occur, however, when people are exposed to depressing and/or counterattitudinal messages as in the cited experiments. According to the second modulation assumption, self-activation is more likely to occur when negative affect is reduced, for example, by an uplifting rather than a depressing message. Uplifting message contents have been investigated in the context of another content-based model of mood-persuasion interactions that is called the *hedonic-contingency model* (Wegener, Petty, & Smith, 1995).

According to this model, happy people did not think much about the message provided in earlier experiments because the message typically was counterattitudinal and/or depressing. In other words, happy people avoid thinking about a message only if it is likely to destroy their good mood; for example, when it is challenging their own beliefs or has a depressing content. Consistent with this prediction, Wegener et al. (1995) found indications of persuasion superiority of strong arguments (interpreted as an indication of good thinking), even after induction of a happy mood, provided the message had an uplifting rather than a depressing hedonic content.

As mentioned, there is an alternative to explaining the superiority of strong arguments on the basis of people's beliefs about the usefulness of thinking with regard to their hypothetical mood maintenance goals. According to the second modulation assumption of PSI theory, uplifting information activates self-representations because it helps downregulate negative affect (in the cited study, the uplifting message described a political plan to reduce tuition). To the extent that, compared to sad mood, happy mood provides better grounds for downregulation of negative affect (presumably associated with paying tuition in this experiment), one would expect greater rejection of weak arguments in happy participants. The results reported by Wegener et al. (1995) are consistent with this derivation.

This example illustrates that PSI theory suggests another factor involved in the dynamics of attitude change: Strong and weak arguments differ not only in cognitive aspects, for example, in the logical soundness of their message. In addition, they may differ in their affective qualities. For example, strong arguments sometimes can elicit more positive affective reactions than weak arguments. Compared to the typical mood induction procedures, these effects should be rather short-lived (phasic) affective changes that need not even reach conscious awareness. PSI theory suggests paying as much attention to such phasic subconscious affective changes as to the tonic effects of mood induction procedures. If the dynamics of the activation of self-representations affect attitude change, one can derive interesting predictions regarding individual differences. In light of the evidence that indicates that action-oriented people have a good ability to downregulate negative affect (Kuhl & Beckmann, 1994a), one should expect that they should be more inclined to reject a persuasive attempt if they are confronted with weak arguments that elicit a rather short-lived negative affect.

According to the second modulation assumption, negative affect elicited by weak arguments should activate self-representations in action-oriented individuals because of their tendency to downregulate negative affect. As outlined before, access to self-representations should facilitate rejection of weak arguments. This prediction was confirmed in a study by Ciupka

(1991) in which managers were exposed to persuasive attempts of an experimenter who played the role of the boss trying to talk the manager out of a previously made personnel decision (Figure 6). As expected, the discussion time that elapsed until managers gave in (e.g., by admitting that there was some truth to the counterarguments) was higher in action-oriented compared to state-oriented participants if the experimenter started with weak arguments (according to the manager's own ratings obtained at an earlier occasion). Presumably, weak arguments lead to an enhanced activation of self-representations (e.g., as if one were asking oneself, "What is my own opinion") in action-oriented participants because they downregulated the negative affect associated with the weak arguments (recall that the activation of the self system is an integral part of the downregulation process, according to the self-relaxation assumption; Table 2). Consistent with this explanation, state-oriented individuals showed the opposite effect: They gave in earlier in a condition in which the discussion started with weak arguments. Presumably, state-oriented participants could not downregulate the negative affect elicited by weak arguments and, as a result, had more difficulties accessing self-representations, according to the second modulation assumption. If the interpretation is correct that action-oriented participants' greater resistance to persuasion after initial exposure to weak arguments was mediated by an extra activation of their self-system (expected as a result of their downregulating negative affect),

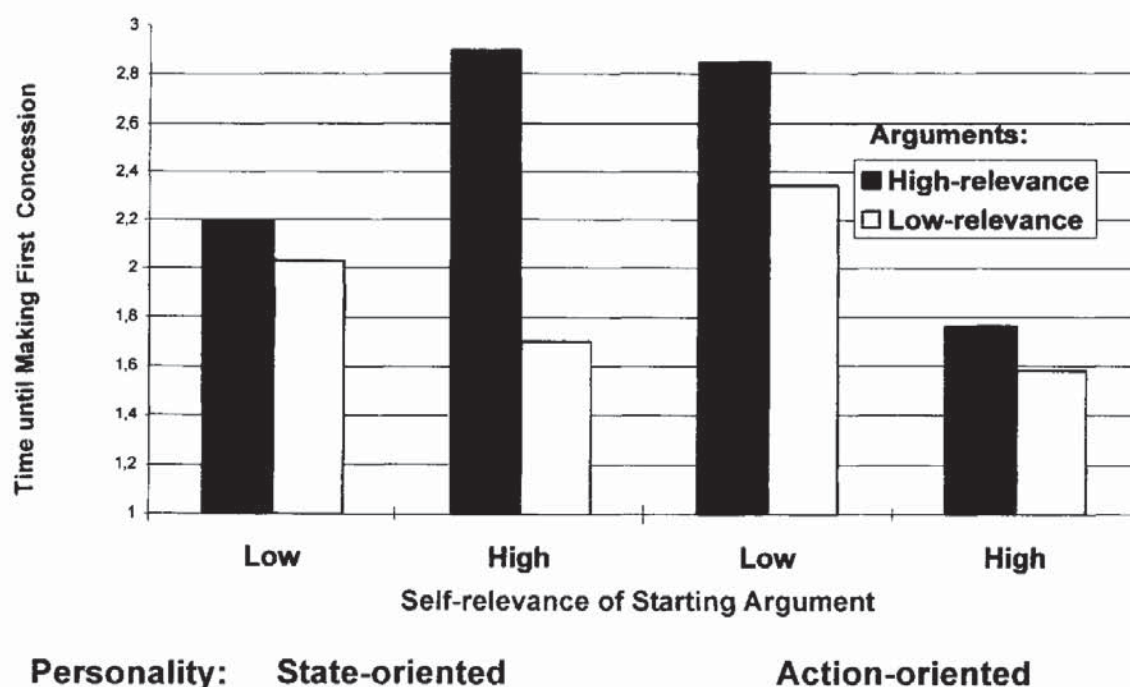


FIGURE 6 Resistance to persuasion as a function of self-relevance of arguments, relevance of starting argument, and personality.

this group should have higher ratings of self-esteem in the weak-start condition, but not in the condition that began with strong arguments. This pattern was indeed obtained in Ciupka's study. Interactions similar to the one shown in Figure 6 were reported in studies using a personality measure to assess uncertainty orientation (Sorrentino, Bobocel, Gitta, & Olson, 1988). Uncertainty-oriented individuals approach uncertain situations because they are confident they can reduce uncertainty by seeking information. The similarity between action orientation and uncertainty orientation is obvious: Both constructs describe dispositions toward using complex information processing resources that are especially suited for mastering mildly threatening (challenging) situations.

The results obtained in this persuasion study can be derived from PSI theory if one makes the assumption that weak arguments not only differ from strong ones in content, but also in their affective quality. A direct test of the assumption that the interaction between mood and personality affects persuasibility was conducted in a series of studies based on Asch's (1956) experiment on conformity (Beckmann, 1997). In these studies, participants were confronted with false perceptual judgments of other individuals (confederates of the experimenter) who maintained that the length of a line was equal to that of a standard line (which, in reality, had a different length). In an experimental condition that was intended to induce a negative mood state (extended pretreatment with a boring and monotonous task), state-oriented participants (scoring high on the preoccupation component of state orientation) displayed considerably more conformity than did action-oriented participants. In the control condition that did not involve any manipulation of mood, the former showed conformity as low as action-oriented participants. According to the explanation suggested by PSI theory, state-oriented individuals are less efficient than action-oriented ones to downregulate negative affect induced in the experimental condition. As a result, they are subject to a weaker activation of the self-system, which is needed for rejection of unacceptable suggestions from others.

B. DECOMPOSING SELF-REGULATION: NEW SELF-REPORT AND OBJECTIVE ASSESSMENT TECHNIQUES

The applications of PSI theory just described illustrate how well-known phenomena can be explained in a new way. Energy flow among the four motivationally relevant macrosystems is modulated by affective states and affects the extent to which each of the four macrosystems participates in volitional action and subjective experience. Affective states also modulate volitional processes: The explicit, self-suppressive type of volitional action (i.e., self-control) emphasized in the original theory of action control (Kuhl, 1984) should be facilitated by negative affect, whereas positive

affect presumably facilitates the implicit, self-driven type of action control (i.e., self-regulation) mentioned in the first part of this chapter.

The implications of the dynamics of personality systems interactions for self-regulation assessment now can be summarized. Global concepts of self-efficacy or will-power should be decomposed into many specific functions. Arno Fuhrmann and I developed a new self-report instrument that decomposes self-regulation in up to 30 functions (Kuhl & Fuhrmann, 1998). The instrument is called the *volitional components inventory* (VCI) and is available in a checklist (VCC) and in a traditional questionnaire format (VCQ). Because of space limitations I can provide only a brief summary of the structure of the VCI. At the first level of analysis, four modes of volition are distinguished. Two modes are facilitatory and two modes, are inhibitory. Self-regulation and self-control are the two facilitating modes, whereas volitional inhibition and inhibition of self-access are the inhibitory modes. Positive affect facilitates self-regulation and reduces volitional inhibition, whereas negative affect increases inhibition of self-access (unless downregulated) and facilitates the self-control mode. This set of formal statements summarizes the basic assumptions of the theory of volition that can be derived from PSI theory.

The formal statements come to life when one illustrates the four modes in terms of the system configurations that are characteristic of each of them. Specifically, self-regulation can be compared to an "inner democracy" as illustrated by the following scenario: A student is confronted with a difficult task that initially arouses some uncertainty as to whether he or she is able to solve it. Like many other forms of challenge, uncertainty should arouse a mild degree of negative affect (conscious or not). The student is able to downregulate this negative affect and feels an increase in self-esteem (presumably resulting from increased access to extension memory including self-representations that downregulation produces according to the second modulation assumption). Increased access to extension memory facilitates task performance, especially where new and creative solutions have to be found. Access to extension memory not only facilitates task performance, but also intrinsic motivation. Because the self-system is repeatedly activated during task performance (as a result of downregulation of negative affect that is sometimes needed when a new difficulty arises), the various mechanisms depending on self-activation also are facilitated, especially self-motivation. Intrinsic motivation is increased because of the many positively valued self-aspects that can be experienced (not necessarily conscious) during task performance, because the self-system is activated with each episode of downregulated negative affect. This amounts to a functional account of the democracy metaphor. The system behaves as if it were taking votes: Each time extension memory is activated, a great number of self-aspects are accessible and contribute whatever affective responses are associated with them. If the majority of

self-aspects are associated with positive affect, the self system supports the ongoing activity emotionally and further stabilizes the positive emotional state through repeated self-motivational episodes. If the majority of self-aspects elicited by the task contribute negative affects and this balance cannot be changed by self-motivation, the self system would reject the current path, or even the subgoal or the task at hand. On a more formal level, this scenario can be succinctly described by the system configuration listed in the first line of Table 3.

Data that show that the VCI scales that presumably assess the various components of self-regulation can predict objective measures of self-regulatory efficiency are reported by Kuhl and Fuhrmann (1998). Significant correlations between a standardized measure of resistance to temptation and VCI scale values ($> .50$) were obtained for four subscales employed to assess functional components of the self-regulation mode (i.e., self-directed attention, self-determination, impulse control, and initiative). The standardized measure of resistance to temptation was an adult version of the computer-aided Self-Regulation and Concentration Test for Children (SRTC). This test decomposes various volitional functions involved in resistance to temptation (e.g., self-regulation versus self-control and attentional deficit versus self-regulatory deficit) during a simple, but monotonous, task that is occasionally accompanied by a distracting tree-climbing competition that appears in another sector of the screen. Individuals cannot control the outcome of that race, but they are tempted to

TABLE 3 Configuration of Subsystems Characterizing Various Volitional Modes or Functions^a

| Mode or function | Level of | | Relative activation of | |
|--|-----------------|-----------------|--------------------------|--------------------|
| | Positive affect | Negative affect | High-inferential systems | Elementary systems |
| 1) Self-regulation | $A + \geq A(+)$ | $A(-) > A -$ | $EM > IM$ | $IBC > OR$ |
| 2) Self-control | $A(+)\geq A +$ | $A - > A(-)$ | $EM < IM$ | $IBC < OR$ |
| 3) Volitional inhibition (hesitation) | $A(+)\gg A +$ | $A - > A(-)$ | $EM \ll IM$ | $IBC < OR$ |
| 4) Inhibited self-access (preoccupation) | $A(+)> A +$ | $A - \gg A(-)$ | $EM < IM$ | $IBC \ll OR$ |

^aSymbols: $A +$ = positive affect; $A(+)$ = inhibition of positive affect; $A -$ = negative affect; $A(-)$ = inhibition of negative affect (downregulation); IM = intention memory; EM = extension memory; IBC = intuitive behavior control; OR = object recognition; \rightarrow = increases; \leftrightarrow = increases and is increased by; $>$ = is more activated than; \gg = is chronically much more activated than; $<$ = is less activated than; \ll = is chronically less activated than; \geq = is sometimes more and sometimes less activated than ("affective flexibility").

watch it because, depending on its outcome, they receive or lose extra points in their accounts. Even small drops in speed or increases in the variance of response times can be used as indicators of failures to resist the temptation to glance across the screen from the task field to the racing grounds (cf. Kuhl & Kraska, 1989, 1992).

As can be seen from line 2 in Table 3, the situation would change dramatically if negative affect could not be downregulated actively through an activation of extension memory. This volitional mode, which is called self-control, can be compared to an inner dictatorship: Access to the self is suppressed now ($EM < IM$). This is to say that both the cognitive resources of extension memory for finding new and unusual solutions are blocked together with the self-motivational resources that depend on self-access. In other words, in this self-control mode, a student would behave very self-disciplined, would not become easily distracted by alternative interests (because they are buried in the deactivated self), and would be able to perform well as long as told what to do (the left-hemispheric verbal abilities and memory for explicit intentions are even strongly activated), but would have difficulties as soon as unusual solutions were required. Easy external control is enhanced because the self system cannot "protest" against (i.e., inhibit) unwanted suggestions. It cannot check even the compatibility of an instruction with the self because the self-representational system is inhibited ($EM < IM$). This aspect of the system configuration assumed for self-control explains why self-disciplined people score higher on authoritarianism.

Increased conformity and inclination to introject self-alien expectations of others also was found in state-oriented individuals of the preoccupation type (Kuhl & Beckmann, 1994b). According to the analysis illustrated in Table 3, state orientation can be interpreted as a chronified version of inhibiting self-access (preoccupation) or volitional action (hesitation) under conditions of threat or frustration, respectively. If high negative affect cannot be downregulated for long periods (see line 4 in Table 3), uncontrollable rumination is expected because the object recognition system is especially sensitive in this case and the self-system can no longer check whether a thought or a feeling is wanted or whether it should be ignored (Table 3, line 4). To the extent that activation of the self system is a prerequisite for checking self-compatibility, it becomes more and more difficult to identify, let alone suppress thoughts, feelings, or wishes that would not "win an election" if the self system could take a vote across all self-aspects, no matter whether these self-alien elements come from within the system or from others. When the self system is inhibited, there is an increased risk to get stuck with an activity or thought that satisfies the isolated interest of a local operator (e.g., the wish to think about a past

failure), but is not in accordance with the decision made on the level of the integrated self (e.g., to concentrate on the task at hand).

Health Behavior

I now illustrate the explanatory usefulness of this account with one example. In a study of university students' abilities to enact new intentions to improve their nutritional behavior, Fuhrmann and Kuhl (1998) found that students leaning more toward the self-regulation mode enacted more of their intentions than students who had higher scores on self-control scales of the VCC. A somewhat counterintuitive finding was that this pattern was obtained only in a condition in which participants were instructed to set easy goals and reward themselves even for small successes when filling in their daily self-monitoring sheets. In a self-punishment condition in which participants were instructed to (mildly) punish themselves for failures, should they detect any during self-monitoring, differences in volitional efficiency were completely reversed: Now participants leaning toward self-control outperformed their self-regulation friends in the number of intended behavioral changes that actually were performed (e.g., eat more broccoli). Obviously, this striking finding qualifies intervention programs that typically are biased toward self-reward strategies.

How can PSI theory explain this interaction? Why did self-controlled individuals' abilities to stick to their intentions deteriorate when they were instructed to reward themselves for their successes? With a self-control style, extension memory and self-representations are notoriously inhibited (Table 3). This should impair the ability to integrate new goals into the existing self-representational system (i.e., whole-heartedly endorse them and identify with them). Positive affect associated with self-reward should reduce the impairment and help release the inhibition of self-access that normally results from increased negative emotionality in these individuals, according to the model in Table 3 (line 2). As a result, many task-irrelevant self-interests, but not the new goals, are activated with enhanced self-access (because the latter are less likely to be integrated in the self system in individuals leaning toward the self-suppressive self-control mode). In other words, once an individual has employed self-control strategies for some time, he or she becomes dependent on negative emotionality to maintain volitional efficiency. Only a prolonged period of training for the release of inhibition of self-access and the integration of self-compatible goals into the self (after extensive self-compatibility checking) can restore the ability to put the self back into the service of self-selected goals. Recall that successful self-actualization consists of both self-awareness (i.e., uninhibited self-access) and volitional facilitation. A balanced coordination of these two aspects of self-actualization requires emotional flexibility; that is, the ability to shift from positive to negative affect and vice versa.

VI. CONCLUSION

Let me come to some conclusions. I hope I have shown that a differentiated view of energy flow between personality systems provides access to an additional category of determinants of goal-directed action. PSI theory challenges cognitive approaches to the explanation of goal-directed action by spelling out the conditions under which cognitive performance is modulated by affect and relevant personality dispositions. Admittedly, compared to sophisticated cognitive reasons for action, the dynamics of action described in PSI theory may hurt our need to view ourselves as purely rational human beings. We do not like to see ourselves driven by blind energies moving forth and back among macrosystems in the brain. However, there is no reason to identify PSI theory with such a passive conception of humans. The energy flow among personality systems merely forms the constraints under which even the most differentiated cognitive contents can unfold their power. Taking these constraints seriously will increase our degrees of freedom rather than reduce them to blind flows of energies. Examples are efforts toward improving personality training, toward optimizing conditions for personal development and self-growth, and even for therapy (Fuhrmann & Kuhl, 1998; Hartmann & Kuhl, in press): Taking into account the dynamics of systems interactions opens new opportunities wherever traditional attempts at changing critical behaviors or cognitive beliefs reach their limits. In my research on learned helplessness and depression, I found evidence for this conclusion: Whenever people show impairments of performance or volitional action that cannot fully be explained by cognitive beliefs (e.g., low perceived self-efficacy) or by the lack of task-oriented intentions (Kuhl, 1981), interventions designed to change the affective basis of systems interactions can remove helplessness effects even in state-oriented individuals whose performance normally declines following failure experiences (Kuhl & Weiss, 1994).

The most important implications of the theory that describes the dynamic flow of energy among the four motivationally relevant macrosystems can be summarized by the following six conclusions. PSI theory not only challenges reductionistic cognitive approaches, it also differentiates traditional motivational concepts in at least six ways:

1. *Dynamic versus content-based explanations.* PSI theory adds dynamic interpretations based on energization of subsystems to approaches that explain behavior on the basis of cognitive contents. Obviously, cognitive contents of thought can have a causal effect on goal-directed action. The dynamic mechanisms described by PSI theory simply can be added to content-based processes. Whenever we are dealing with individual exemplars of the system we are studying, contents of thoughts and feelings quickly can become more important than the general content-free laws of

energy flow among subsystems. A child can be motivated only if we understand the content of her or his thoughts and feelings and respond to them promptly and adequately. Nonetheless, the general mechanisms of energy flow might place some constraints on what can be achieved by attempts to change cognitive contents and strategies.

2. *Modulatory versus motivational effects of incentives.* The second of my conclusions relates to the fact that PSI theory calls attention to dynamic effects of incentives that work over and above the motivational effects attributed to them by classical theorizing: Positive incentives not only elicit approach behavior, but also modulate the interaction between intention memory and its output systems. Negative affect not only elicits avoidance behavior, but also modulates the interaction between integrated self-representations and unexpected or unwanted object perceptions including unwanted ruminations or unwanted recommendations by others (Kuhl & Baumann, in press; Kuhl & Kazén, 1994a).

3. *Action control: Specific rather than global activation.* PSI theory elaborates the dynamics underlying intentional action. Lewin's conception of tension systems could not explain the interactions between personality and the Zeigarnik effect (e.g., Atkinson, 1953; Johnson et al., 1983). According to PSI theory, excessive superiority of explicit memory for uncompleted intentions does not occur in people who do not easily develop long-lasting periods of reduced positive affect or an enhanced focus on unrealistic ideals (i.e., it is not expected in action-oriented, nondepressed individuals). Note that implicit memory for uncompleted intentions can be intact for both action and state-oriented individuals (Goschke & Kuhl, 1998).

4. *Performance deficits: Impaired self-relaxation rather than understimulation.* The fourth implication the flow-of-energy model has for motivation relates to the relationship between negative affect and performance. Whereas the action-related part of PSI theory differentiates the Zeigarnik effect, the experience-related part differentiates the second pillar of classical motivation theory reflected in interactions between arousal (or negative affect) and personality (Atkinson, 1974; Eysenck, 1967; Yerkes & Dodson, 1908): Performance deficits that result from aversive experiences are expected only in individuals whose capacity for self-based downregulation of negative affect is overtaxed by a threatening experience. Moreover, performance deficits are confined to tasks that place considerable demands on extension memory and/or integrated self-representations.

5. *Functional separation of personality constructs.* As a fifth contribution of PSI theory, I showed how the distinction between activation of systems and activation of connections between systems helps explain the communalities and differences between overlapping personality constructs such as state orientation, introversion, neuroticism, and anxiety. Whereas introversion, neuroticism, and anxiety can be interpreted in terms of the arousability of affect generation systems (i.e., inhibition of positive affect, arousal,

and negative affect, respectively), state orientation relates to the capacity for the self-regulation of such affective states.

6. *Motives: Beyond the travelling salesman analogy.* Finally, a sixth implication relates to the concept of motives. If we want to understand the way motives energize and direct behavior, we cannot ignore the machinery of the system any longer. The traveling salesman analogy has been misleading. Purpose and design cannot be separated nicely as suggested by classical philosophy. How do basic needs and motives interact with the extended cognitive machinery? PSI theory addresses not only the dynamic changes of activation of the four macrosystems that seem to be most relevant for goal-directed action, but it also integrates what we know from cognitive research about the functional characteristics of each of these macrosystems. From an evolutionary point of view, there is no reason to expect that different motives are expressed in behavior through the same macrosystem. Each system seems to be designed for a different motive. For example, affiliative needs critically rely on intuitive behavior control and are frustrated easily with too much explicit intentionality and planning (Papoušek & Papoušek, 1987). On the other hand, the satisfaction of needs for competence and achievement should benefit from explicit intentionality and planning. Explicit memory for difficult intentions is the prerequisite for planning and problem solving in achievement contexts. The need for autonomy, self-assertiveness, and power may benefit most from uninhibited access to integrated self-representations and intention memory. It follows from this analysis that a fixation on inhibited positive affect (or on negative affect), acquired in childhood and/or genetically prepared (e.g., in schizoid personality disorders), should be especially harmful for establishing healthy social relationships, whereas a fixation on positive affect (e.g., in histrionic personality disorders) should be harmful for the development of healthy achievement motivation. Likewise, exaggerated sensitivity for negative affect should be difficult for the conflict-free development of the need for autonomy and power (e.g., in avoidant, dependent, or borderline personalities), whereas a strong bias toward downregulation of negative affect should interfere with attachment behavior based on the need for security (e.g., in paranoid, narcissistic, or antisocial personality disorders).

Motive-Cognition Coalitions

According to PSI theory, these prototypical coalitions between each motive and its optimal macrosystem configuration are mediated by affective dispositions. The coalition between affiliative needs and intuitive behavior control (IBC) requires a disposition toward positive affect to develop during early parent-child interactions, the coalition between the achievement motive and explicit intentionality and planning requires the ability to tolerate frustration and states of inhibited positive affect, and,

finally, the coalition between the needs for self-expression and power and integrated self-representations require the early development of competence for self-relaxation as described in the systems-conditioning model (Kuhl, 1998; Kuhl & Völker, 1998). It can be concluded from this account that developmental conditions departing from these ideal profiles can produce other coalitions between motives and the cognitive machinery. These coalitions may be useful to adapt to special environments: A coalition of planning and affiliative needs can be adaptive when social approval can be attained through personal achievements, manipulation, or even cheating, whereas a coalition between power-related needs and inhibited self-access (resulting from a low ability for self-relaxation) can be useful to adapt to an environment that does not allow for direct expression of self-related concerns as, for instance, when a child learns to support the needs of the family at the expense of personal needs. Obviously, such nonprototypical coalitions between motives and affect-modulated cognitive systems can turn out to be maladaptive if the environmental conditions change later in life.

The important methodological conclusion from this account relates to motive measurement: A motive no longer should be assessed without simultaneously assessing the system configuration with which it is associated. My colleagues and I have developed new tests to assess the degree to which each of the three motives tends to be expressed through each of the four macrosystems. Separate instruments to assess motive-cognition coalitions have been developed for people's explicit representations of their needs (i.e., the Motives-Enactment-Test; Kuhl, 1997) and for implicit motives (i.e., the Projective Multi-Motive Test; Kuhl & Scheffer, 1998).

Aristotelian Thinking Reconsidered

As a final remark, I would like to resume my introductory reflections concerning motivation being the problem child of psychology. I think this problem child is about to grow up. There is no longer a reason for her to copy her cognitive brothers and sisters who can do the things they do so efficiently. We do not have to copy the architectures they prefer; for example, the one consisting of short-term memory, long-term memory, and executive control. There is no need for us to reduce motivation to goal representations and cognitive mechanisms. The essence of motivation lies in the inarticulate forms of energy flow among personality-relevant macrosystems that establishes the connections among those systems. It is an interesting irony that we can find the roots of this holistic view of motivation in the work of an ancient philosopher who was criticized by Zeigarnik's teacher for offering content-based rather than dynamic explanations (Lewin, 1935). According to my analysis, we kept the problematic parts (i.e., the focus on intentional contents as the basis of motivation) and disposed of the promising parts of Aristotle's theory of motivation (i.e., his

definition of motivation in terms of connections among psychological states or systems). In his famous article proposing a shift from Aristotelian to Galilean thinking in psychology, Lewin (1935) correctly identified the problematic part of Aristotle's approach to motivation and to science in general (i.e., the focus on content-based properties of the objects whose behavior is to be explained). However, Lewin failed to identify what I consider the roots of a differentiated approach to what Lewin (1935) established as the conceptual platform of motivation theory: The dynamic waxing and waning of systems that mediate the behavioral enactment of motivational forces.

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