

Information-Processing and Constructivist Models of Cognitive Therapy: A Philosophical Divergence

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The primary intent of the present paper is to provide a philosophical and historical context for understanding recent developments in the theory and practice of cognitive therapy—in particular, the emergence of information-processing and constructivist approaches. Toward this end, the logical positivist-*Weltanschauungen* distinction in the philosophy of science is outlined followed by a brief historical portrayal of psychology's dialectic shifts between exogenic and endogenic perspectives. It is these contrasts that are believed to offer a philosophical basis by which information-processing and constructivist models of cognitive therapy may be differentiated. While information-processing models appear to reflect an ontology and epistemology most closely aligned with an exogenic perspective, constructivist approaches, on the other hand, clearly suggest a philosophical shift toward an endogenic position. It is further proposed that this fundamental philosophical divergence has led each approach to conceptualize client symptomatology, treatment, and the roles of client and therapist in a manner consonant with their respective ontological and epistemological commitments.

The re-emergence of cognition as a legitimate and formative domain of scientific inquiry represents one of the most significant developments in late 20th-century psychology (Baars, 1986; Dember, 1974; DeMey, 1982; Gardner, 1985; Mahoney, 1977). Although advances in both experimental cognitive psychology and the interdisciplinary field of cognitive science have had a profound impact upon psychology as a whole, the areas of clinical and counseling psychology have become particularly fertile grounds for the proliferation of cognitively-oriented theories and therapies (Dobson, 1988; Foreyt and Rathjen, 1978; Hoffman, 1984; Kendall, 1986; Kendall and Hollon, 1979; Mahoney and Arnkoff, 1978; Mahoney and Freeman, 1985; Reda and Mahoney, 1984). In 1970 there were only three approaches most frequently associated with the generic notion of "cognitive therapy"—Kelly's (1955) *personal construct approach*; Ellis' (1962) *rational emotive therapy*; and Beck's (1963, 1970) *cognitive therapy*. By way of contrast, a recent account of current trends and developments in cognitive therapy has identified at least 20 distinguishable forms (Mahoney and Lyddon, 1988).

Although the sheer number and diversity of cognitive therapies attests to the authenticity of a “cognitive revolution” in clinical theory and practice, little attention has been given to the epistemological assumptions that may be associated with various therapeutic approaches subsumed under the rubric “cognitive.” Perhaps one reason for the lack of attention to epistemological issues is that epistemological questions—that is, those questions concerned with the nature of knowledge and human knowing—have heretofore largely been restricted to the province of philosophical inquiry. Only recently have psychologists begun to consider the epistemological implications of their theories and methods (Gergen, 1985a; Koch, 1981; Royce and Powell, 1983; Sampson, 1977, 1978; Weimer, 1979). In order to bring some of these implications into critical relief, a brief overview of the philosophical foundations and historical character of psychological knowledge is offered.

Philosophical and Historical Contexts

Two Views of Scientific Knowledge

Although a complete historical analysis of the philosophy of science is clearly beyond the scope of this article, it does prove useful to understand recent trends of development in cognitive psychology within a broader historical and philosophical context. The history of the philosophy of science may be portrayed as being represented by two general approaches to understanding the structure of scientific knowledge. These two intellectual traditions, known as the *logical positivist* and the *Weltanschauungen* philosophies of science (Suppe, 1974), can be distinguished largely in terms of fundamental epistemological orientations. Logical positivism (or logical empiricism as it later came to be called) exerted near total dominance over the philosophy of science for decades. Having its origins in a school of philosophy that developed in Vienna during the twentieth century, logical positivism held that the meaning of statements is equated with the empirical operations designed to investigate them. Thus, logical positivism equates scientific knowledge with its observational base and assumes that what we take to be knowledge of the world is the product of induction and the subsequent building and testing of general hypothesis. In essence, scientific theory is assumed to reflect or map reality in a direct manner.

In contrast to this “received view” of scientific knowledge, several historians and philosophers of science draw attention to the idea that science is done from within a conceptual scheme which determines for the most part which questions are worth asking about a phenomenon and which sort of answers are acceptable (Feyerabend, 1965, 1970; Habermas, 1971; Hanson, 1961; Kuhn, 1970; Polanyi, 1958; Radnitzky, 1970). Referred to as the *Weltanschauungen* philosophy of science, this alternative view presents a challenge to the logical

positivist conception of scientific knowledge as built upon a foundation of theory-free (and value-free) observations and has underscored the *theory-dependent* nature of scientific observations, meanings, and facts (Suppe, 1974). The *Weltanschauungen* view holds that any specific theory or concept (or "fact") presupposes a more general theoretical model within which the specific theory or concept is formulated. Succinctly stated, conception is prior to perception. Gergen (1985a), echoing this philosophical criticism of the positivist depiction of scientific knowledge, makes this point exactly when he asks

How can theoretical categories be induced or derived from observation . . . if the process of identifying observational attributes itself relies on one's possessing categories? How can theoretical categories map or reflect the world if each definition used to link category and observation itself requires a definition? How can words map reality when the major constraints over word usage are furnished by linguistic context? (pp. 266-267)

These and other revealing questions have largely gone unanswered and have contributed to the demise of the logical positivist view within the domain of philosophical inquiry leaving positivism without a viable logic of justification (Weimer, 1979).

Exogenic-Endogenic Antimony in Psychology

The antithetical nature of the logical positivist-*Weltanschauungen* perspectives in the history of the philosophy of science appears to parallel recent portrayals of the dichotomous nature of psychology's knowledge base. Buss (1978), for example, argues that the discipline of psychology has historically shifted back and forth between two world views based upon a cyclic transformation of the subject-object relation. According to Buss, the essence of these world views is captured by two prototypic statements: (1) reality constructs the person and (2) the person constructs reality. While the former assumes an invariant set of causal variables whose prior actions are thought to determine an individual's present behavior (as in the behavioral and psychoanalytic traditions), the latter emphasizes the important function of people's views of themselves and their circumstances in formulating their behavior (e.g., structuralism, humanistic tradition, and cognitive psychology).

In a similar vein, Gergen (1982, 1985b) suggests that the history of psychology can largely be written as a series of pendulum swings between two major and competing traditions that may be differentiated in terms of basic epistemological orientations—the *exogenic* and the *endogenic* perspectives. According to Gergen, the exogenic perspectives can be traced to such thinkers as Locke, Hume, the Mills, and various logical empiricists and assumes that knowledge copies the contours of the world. The behaviorist paradigm has become the epitome of the exogenic orientation in American psychology.

As psychology developed in the United States, guided as it was by both pragmatist and positivist philosophies, it took on a strong exogenic character. Behaviorism (along with

neobehaviorism) placed (and continues to place) the major determinants of human activity in the environment. If the organism is to adapt successfully, it is claimed, its knowledge must adequately represent or reflect that environment. (Gergen, 1985b, p. 8)

The endogenic perspective, by way of contrast, is associated with the views of Spinoza, Kant, Nietzsche and various phenomenologists and is based upon the foundational assumption that knowledge depends upon processes endemic to the organism. Gestalt psychology, with its emphasis upon "built in" tendencies toward perceptual organization represents a prototypic exemplar of the endogenic perspective in psychology. On the surface, the recent emergence of cognitive psychology also appears to represent a distinct shift toward an endogenic perspective. However, in spite of its general focus upon mediational and "black box" processes, such a conclusion may be a bit premature due to cognitive psychology's continued philosophical alliance with positivist psychology. Gergen (1985a) has succinctly made this point when he argues that

. . . cognitivism has not yet—neither in social psychology nor in psychology more generally—overturned the exogenic perspective because the exogenic perspective forms the metatheoretical base of the science itself. That is, the contemporary conception of psychological science is a by-product of empiricist or exogenic philosophy—committed as it has been to rendering an account of objective knowledge of the world. (p. 269)

This brief portrayal of the philosophical foundations and historical character of psychological knowledge leads one to conclude that while the last vestiges of positivist philosophy of science are disappearing from the philosophical landscape, science in general, and psychology in particular, are still imbued with a logical positivist, exogenic epistemology (Mahoney, 1976; Weimer, 1979). Such is the philosophical context in which information-processing and constructivist approaches to cognition and cognitive therapy are evolving. The general theoretical parameters, recent developments, and representative models of cognitive therapy associated with information processing and constructivist approaches are the foci of the following two sections of this paper.

Information-Processing Paradigm

The information-processing approach to cognition views humans as active seekers and users of information (Merluzzi, Rudy, and Glass, 1981). Most accounts highlight the "inward" flow of information from the sense organs which proceeds through the human cognitive system in a series of temporally-defined stages of feature abstraction. The essence of this perspective is embodied in the cognitive system's capacity to acquire potentially useful information, interpret and transform the information into meaningful patterns, and use those patterns in choosing appropriate responses.

Information-processing theories tend to endorse what Weimer (1977) terms a *sensory metatheory of mind*. From this perspective the brain is characterized as a relatively passive recipient of information "given" in the environmental

array. Ontologically, this is essentially a realism-based philosophy in which reality is presumed to be singular, stable, and external. Moreover, sensory metatheory embraces a traditional view of the nervous system as consisting of two distinct and functionally separate processes: sensory and motor. In other words, cognition is thought to proceed in a linear fashion and entail distinct sensory (input) and action (output) processes. In order to address the question of how input becomes translated into output, "sensory" theorists have hypothesized a number of intermediate connective constructs—neural switchboards, associative networks, schemata, executive programs, storage and retrieval mechanisms, and so on. It is evident that the most influential metaphor associated with information-processing models of cognition is that of the brain-as-computer analogy.

Recent Theoretical Developments

Cognitive psychology's information-processing paradigm influences the way a number of researchers conceptualize cognitive phenomena within a clinical context (Goldfried and Robins, 1982, 1983; Greenberg and Safran, 1980; Hollon and Kriss, 1984; Ingram, 1986; Kanfer and Hagerman, 1986; Marzillier, 1980; Meichenbaum and Gilmore, 1984; Safran and Greenberg, 1982; Turk and Salovey, 1985; Turk and Speers, 1983; Winfrey and Goldfried, 1986). Gardner (1985) points out that cognitive scientists rest their discipline on the assumption that "human cognitive activity must be described in terms of symbols, schemas, images, ideas, and other forms of representations" (p. 39). At a representational level of analysis, information-processing approaches have directed their attention to three interdependent, but conceptually distinct construct domains—cognitive structures, cognitive events, and cognitive processes.

Cognitive structures: Schemata. Within the information-processing perspective, *schemata* (singular: *schema*) are the cognitive structures of the human mind (Turk and Speers, 1983). A schema represents organized knowledge about a given concept and contains both the attributes of that concept and the principle relationships among the attributes (Fiske and Taylor, 1984). Viewed as an organized representation of prior experience, a schema becomes strengthened when similar information is repeatedly processed and thus stored in the same structure. These structures are conceived not only as classificatory and storage mechanisms for previously acquired information, but are also believed to play an active role in the processing of new information by selectively attending to certain features of experience and ignoring others (Hollon and Kriss, 1984).

Cognitive events: The output of processing. In schematic processing research the content and characteristics (latency, frequency, pattern, etc.) of retrieved information are used to make inferences about the nature and organization

of underlying cognitive structures. Consequently, within an information-processing framework, cognitive content is of two types: (1) that which is stored in cognitive structures and (2) that which is retrieved and available in the form of conscious cognitive *events* (Meichenbaum and Gilmore, 1984), also termed cognitive *products* (Hollon and Kriss, 1984). According to Meichenbaum and Gilmore (1984), cognitive events are "conscious, identifiable thoughts and images. They occur in an individual's stream of consciousness or they can be readily retrieved upon request" (p. 274). Thus, while cognitive structures are the storage mechanisms for the raw data of the central nervous system, cognitive events and products represent the result or *output* of information processing.

Cognitive processes: Heuristics and biases. From an information processing perspective, cognitive processes are posited to explain how cognitive structures lead to cognitive products. Functioning as the basic transformational rules which convert input into judgments, cognitive processes may be thought of as being analogous to computer software. Drawing upon this analogy, Hollon and Kriss (1984) state:

... these processes determine how incoming information is perceived, encoded, stored, combined, and altered with respect to information and structures already in the system, and how that existing information is retrieved and these existing structures are engaged, disengaged, or altered. (p. 40)

Recent cognitive and social psychological research investigating the *accuracy* of cognitive products in lay inference provides some empirical support for certain biases in cognitive processing (Tversky and Kahneman, 1981). The underlying assumption of this line of inquiry is that it is theoretically possible to distinguish between an accurate and inaccurate inference. Within this framework, an accurate (normative) inference is one that is based upon a logical synthesis of all the information available to the individual, whereas an inaccurate (non-normative) inference is one which ignores relevant base rate or correlational data. For examples, Tversky and Kahneman (1974) suggest that when making judgments under conditions of uncertainty (unavailability of information), individuals employ a number of *heuristics* to process information which frequently result in biased cognitive products. Two heuristics that have been extensively studied are those of *representativeness* and *availability*.

The *representativeness* heuristic is thought to be used when one is making inferences about probability (Kahneman and Tversky, 1973). This strategy is believed to be employed when making judgments about how likely it is that a particular person or event is a member of a certain category (i.e., matches the essential features of some schema) or how likely a given outcome is to be explained by a particular set of antecedent conditions (Turk and Salovey, 1985). Asked to say which sequence of heads and tails is more likely to occur, H-T-H-T-T-H or T-T-T-H-H-H, most individuals will choose the

former (since "irregularity" is an essential feature of randomness) even though both series are equally probable. Category membership is determined on the basis of a few characteristics thought to be representative of that category rather than relevant statistical considerations.

According to Tversky and Kahneman (1974) *availability* is a heuristic that is used to estimate the frequency or probability of an event or an outcome by the ease with which instances or associations come to mind. This strategy is characterized by the use of the most readily available information or thought as if it were the most relevant and predictive. Nisbett and Ross (1980) suggest that the ease with which information is brought to mind may be a function of such factors as recency, saliency, or stereotypic preconceptions, even though these factors may be irrelevant and may bias predictions and decision making. The availability heuristic has been invoked to account for inferences in which the occurrence of a schema-relevant event appears to be more likely than it actually is. Because one's own personal experience is so readily available, an individual may assume that the frequency of an event in his/her own experience is indicative of the frequency of that event in general. The tendency to perceive and remember events largely from one's own perspective and experience has been termed *egocentric bias* (Turk and Salovey, 1983). This bias is most apparent when one generates a *false consensus*; that is, when one overestimates the extent to which others agree with his/her attitudes or behavior. A number of experiments describe the tendency for individuals to assume that other people share their perceptions and opinions (Nisbett and Ross, 1980; Ross, Green, and House, 1977). These studies consistently show that individuals tend to believe that a larger percentage of others hold the same opinions that they themselves hold (or make the same choices that they make) than is actually the case.

Models of Cognitive Therapy

The overriding implication of the experimental and theoretical work on the biasing role of schemata in lay inference is that *all* individuals engage in aberrant styles of cognitive processing. Because so much of this research has been conducted with normal populations, it is not clear how these processes may generalize to clinical samples. Recently though, a number of investigators have become intrigued with the prospect that the "distortions" in information processing attributed to clinical populations (Beck, 1967; Ellis, 1962) may prove to be ubiquitous heuristics and biases found in all human beings (Goldfried and Robins, 1982, 1983; Hollon and Kriss, 1984; Meichenbaum and Gilmore, 1984; Turk and Salovey, 1985).

In a recent theoretical paper, Turk and Salovey (1985) discuss the clinical relevance of a number of heuristic and biases arising from schematic processing, including selective attention, confirmatory biases, egocentric biases,

availability and representativeness heuristics, and illusory correlation. For example, they suggest that one mechanism responsible for the maintenance of maladaptive beliefs may be *confirmatory bias*. Confirmatory bias is defined as the tendency to encode, process, and retrieve schema-consistent information and is believed to play a role in both the search for information and in determining behaviors which create their own consequences—a *self-fulfilling prophecy*. Results from a number of social psychological studies corroborate the operation of confirmatory biasing processes (Snyder, 1981; Snyder, Campbell, and Preston, 1982; Snyder and Cantor, 1979; Snyder and Swann, 1978). Meichenbaum and Gilmore (1984) similarly describe the significant role that they believe heuristics and schema-confirming biases play in depressive disorders

Such untested assumptions lead many depressed patients to confirm their own hypothesized undesirability by defensive social behaviors that contribute to social rejection. This rejection is "available," then interpreted as being "representative," inevitable, and proof of the initial assumption of low personal worth. Thus, the client's behavior may create responses in others that confirm maladaptive beliefs. In this way a self-defeating cycle may be created and perpetuated. (p. 280)

Thus, according to these clinical extensions of schema theory the distorted and maladaptive cognitive products exhibited by clients in therapy are assumed to reflect universal biases and heuristics associated with the encoding and retrieval of information in a schema-confirming fashion.

Therapeutic strategies for modifying schemata. In addition to exploring the role that schematic processing biases may play in the development and maintenance of the various kinds of problems clients present, clinical researchers have become interested in how the schemata associated with such problems may undergo change or modification. Although cognitive and social psychology research dealing with the relationship between schemata and cognitive processes is quite extensive, the question of how schemata may be *altered* has not formally been addressed by these literatures (Taylor and Crocker, 1981; Winfrey and Goldfried, 1986). In spite of this state of affairs, Nisbett and Ross (1980) offer some guidelines for inducing change in schemata related to self and others. These authors suggest that one may obtain more realistic appraisals of oneself and others by adopting scientific-like strategies of gathering information.

Our contention . . . is that accurate perceptions of self and accurate perceptions of others ultimately depend on the successful performance of the same "scientific" tasks—that is, collecting, coding and recalling data, assessing covariations, inferring causal relationships, and testing hypotheses. (Nisbett and Ross, 1980, p. 195)

Hollon and Kriss (1984) have recently proposed a number of treatment strategies designed to offset schematic-biasing processes—several of which are in accord with the above recommendation by Nisbett and Ross. For example, they recommend training clients in *systematic self-monitoring* skills, *obser-*

vation of multiple outcomes (trials) and *formal prediction generation and recording*. The method they offer as a way of countering false consensus bias also conforms to a scientific-like task. They suggest that in order to recognize that their personal beliefs are idiosyncratic and not necessarily shared by others, clients should *unobtrusively poll other people* about their views. In this way, they may obtain a more representative (or accurate) picture of other's opinions. Hollon and Kriss note that inaccuracies in recalling earlier events may as often be a function of retrieval failure as to any systemic distortion at the time of encoding and the authors also offer strategies designed to facilitate accurate retrieval (e.g., *memorial reconstruction of detail and perspective change*).

Goldfried and Robins (1982) have also delineated a set of strategies intended to effect lasting change in clients' self schemata by helping them properly encode, store, and retrieve corrective therapeutic experiences. These included helping clients to (a) discriminate between past and present functioning, (b) adopt an objective rather than subjective perspective, (c) retrieve past success, and (d) align expectancies, anticipatory feelings, behaviors, objective consequences, and self-evaluation. Recently, Winfrey and Goldfried (1986) have expanded on the efforts of Goldfried and Robbins by offering four clinical guidelines for changing self schemata. First, they suggest that throughout the therapy process, but particularly early on, it is important to *provide a context* in therapy that prepares the client to expect to encode new information. They propose that informing clients of their natural tendency to resist new information (i.e., "disconfirming evidence") may be an important strategy toward this end. So that clients may accumulate sufficient schema-inconsistent information from which a new self schema may be formed, Winfrey and Goldfried propose that therapists should encourage clients to *attend to events*. They contend that such "bottom-up" events processing provides clients with more "objective evidence" from which they can reinterpret their faulty views.

Winfrey and Goldfried (1986) suggest once clients have begun to make desired changes in their lives, bottom-up events processing should be balanced with a top-down, schema-driven perspective in order to ensure both the maintenance of the new self schema and the matching of new self-referent inputs. This may be established according to their third clinical guideline: *encouraging the use of new self schemata*. Two procedures that they propose may be particularly effective at encouraging such top-down processing have been previously enumerated by Goldfried and Robbins (1982): (1) the addition of an objective vantage point to the client's subjective outlook and (2) client retrieval of past successes. While the former strategy is believed to both encourage internal rather than external attributions of clients' novel success experiences and facilitate self-efficacy expectations, the later is similar to the "scientific-like" strategies recommended by Hollon and Kriss (1984) and involves having clients monitor and record their successful coping efforts. Both strategies are designed to circumvent the biased retrieval of new situational

evidence and provide clients with a readily available reminder of their progress. *Maintaining new self schemata through social interaction* is the final guideline offered by Winfrey and Goldfried. This suggestion is based on the notion that an important part of self schema change involves validation of new client behaviors by significant others. Such supportive interactions are thought to increase the probability of self-confirmatory feedback and thus ensure lasting self schema change.

To summarize, the general conceptualization of clinical phenomena within an information processing framework assumes that maladaptive cognitions associated with clinical samples are a product of the same biases and heuristics that underlie non-normative cognitive products in lay inference. As exemplified by the work of Hollon and Kriss (1984), Goldfried and Robins (1982, 1983), Winfrey and Goldfried (1986), and others, clinical researchers have recently begun to formulate therapeutic strategies designed to correct the inaccuracies associated with both the encoding and retrieval of schema-relevant information. Within this context the emerging role of the cognitive therapist is succinctly described by Goldfried and Robins (1982):

... the therapist's primary task is to assist clients in recognizing, accurately classifying, storing, and retrieving those life experiences that contradict their faulty conceptions of themselves. Having done so, clients should be in the position of drawing more accurate conclusions about themselves. (p. 52)

The Constructivist Paradigm

The constructivist paradigm is based on the assertion that humans actively create their personal realities. According to this view each individual constructs his/her own representational models of self and world relationships and these models, in turn, become experiential frameworks from which the individual orders and assigns meaning to new experiences.

Recent elaborations of a constructivist approach to cognition (cf. Burrell, 1987; Guidano, 1987; Guidano and Liotti, 1983; Mahoney, 1985, in press) rest upon the basic premises associated with what Weimer (1977) labels a *motor metatheory of mind*. According to Weimer, current theory and research in cognitive psychology is neither cognitive nor adequate as a psychology because it shares an inadequate conceptual framework with its predecessors (such as behaviorism). Weimer contends that

Both cognitive psychology and behavioristic psychology fail because they embrace a *sensory* conception of mind. Conversely, an adequate and truly cognitive psychology must adopt a different metatheoretical framework and explore theories consonant with what can be called a *motor* conception of mind. (1977, p. 268)

Citing converging lines of neurophysiological evidence (cf. Eccles, 1973; Pribram, 1971), Weimer argues that sensory metatheories are based upon an outmoded conception of human neurophysiology—one that draws the classic

distinction between “sensory” and “motor” pathways. Within a motor metatheory framework, however, sensory processes are not differentiated from motor processes. They are instead construed as being mediated by the same neural pathways and thus are viewed as functionally undifferentiated. As a result, Weimer’s motor metatheory challenges the traditional distinction between input and output that is fundamental to sensory metatheory:

What the motor metatheory asserts is that there is no sharp separation between sensory and motor components of the nervous system which can be made on functional grounds, and that the mental or cognitive realm is intrinsically motoric, like all the nervous system. The mind is intrinsically a motor system, and the sensory order by which we are acquainted with external objects as well as ourselves . . . is a product of what are, correctly interpreted, constructive motor skills. (Weimer, 1977, p. 272)

From a motor metatheory perspective, the problem of how input and output may be connected does not arise. Because sensory/perceptual processes and motor/action processes are not considered to be functionally nor physiologically distinct, there is no need to invoke some sort of executive processing program or associationistic network of connections to address the question of how input gets translated into output (i.e., the Hoffding step).

In his presentation of motor metatheory, Weimer (1977) argues that the central nervous system not only constructs its output, but, to a large extent, also constructs its input. Thus, where sensory metatheories emphasize the importance of *feedback mechanisms* in learning and adjustment, motor metatheories combine feedback mechanisms with *feedforward mechanisms*—processes that actively constrain the nature and range of assimilable experience (Mahoney, 1985). This emphasis upon the role of feedforward processes in cognitive functioning serves to underscore the productive, generative, and creative capabilities of the human mind. Forms and facets of constructivist thinking are represented by a number of contemporary writers: Arbib and Hesse (1986), Bartlett (1932), Bransford, Barclay, and Franks (1972), Cofer (1973), Collins and Hagen (1979), Hayek (1952), Mandler (1984), Piaget (1954), Shaw and Bransford, (1977), and Turvey (1974).

Tacit ordering processes. In line with recent reconsiderations concerning the role of unconscious processes in psychological theory (Bowers and Meichenbaum, 1984; Shevrin and Dickman, 1980), the constructivist paradigm tends to endorse a view of knowledge organization founded upon the primacy of abstract ordering processes (Mahoney and Lyddon, 1988). An important contribution to this view has been the philosophical and theoretical work of Friedrich von Hayek (Hayek, 1952, 1967, 1978). For example, in his analysis of the structure and function of the nervous system and in his formulation of the “primacy of the abstract,” Hayek (1952) emphasized the central role of abstract knowledge in psychological experience. According to Hayek, psychological qualities arise from the nervous system’s ability to actively impose abstractions on the fundamentally nonpsychological information in the

environmental array. It is important to note that while this position does not deny the existence of information outside the bounds of our physiological apparatus, our knowledge of such information is necessarily indirect and is guided by processes outside of our conscious awarenesses. The major implication of this proposition is that the *abstract* principle (i.e., classification rule) always precedes knowledge of a particular event or psychological experience. In Weimer's (1982) words,

. . . particulars in experience can only become the particulars that they are in virtue of the prior organization and classificatory ability of the nervous system. Classification of information as sensory is the result of complicated neural activity rather than the beginning of it. (p. 266)

The image of the human mind that emerges from these formulations is that of a "deep structure" system of abstract rules of action capable of generating a rich variety of "surface structure" phenomenal experience (Chomsky, 1957, 1975; Polanyi, 1958; Weimer, 1982).

Recent Theoretical Developments

It has been suggested that two important trends in late 20th century psychology have been the *developmental* and *systems movements* (Guidano, 1987; Mahoney, in press; Mahoney and Lyddon, 1988). While the former represents an increasing interest in both the study of human psychological development across the lifespan and fundamental processes of change, the latter reflects a growing interest in the dynamics of interactive systems and their transformations over time. Recent developments in constructivist cognitive theory and therapy converge upon these emerging metatrends. Conceptual contributions from evolutionary epistemology, dissipative structure theory, and attachment theory are three illustrations of this convergence.

Evolutionary epistemology. The study of human knowledge and human knowing has recently become the providence of a specialized discipline known as *epistemology* (Emery and Csikszentmihalyi, 1981). One branch of epistemology known as *evolutionary epistemology* (cf. Callebaut and Pinxten, 1987; Campbell, 1974, 1975; Jantsch, 1980; Popper, 1972; Popper and Eccles, 1977; Radnitzky and Bartley, 1987) has come to play a prominent role in shaping the theoretical underpinnings of clinical constructivists (Burrell, 1987; Guidano, 1984, 1987; Guidano and Liotti, 1983, 1985; Mahoney, in press). Founded on the premise that knowledge has evolved along with other aspects of life, evolutionary epistemology conceptualizes knowledge growth as a trial and error process involving (a) spontaneous and random *variation* (i.e., the introduction of novel patterns and rules of action), (b) competitive *selection* (i.e., selective retention and/or elimination of particular variations), and (c) *preservation* and *propagation* of adaptive knowledge structures and traditions (Burrell, 1987; Campbell, 1974).

The conceptualization of the origin and growth of knowledge from an evolutionary perspective underscores an adaptive function for cognitive representations. Some constructivists are quick to point out, however, that it is the *viability* (i.e., flexibility, resilience, generativity, etc.) rather than the *validity* (i.e., degree of correspondence to some absolute standard or external referent) of one's cognitive representations of self/world relationships that are believed to be crucial determinants of adjustment (Burrell, 1987; Mahoney, in press). According to this constructivist view of adaptation, cognitive representations are

... abstract and predominantly tacit working models (a) with intrinsic affective-behavioral dimensions, (b) that serve primarily to *constrain* experience (impose edges, negatives, etc.) rather than *prescribe* it, and (c) that, in being felt, acted, and reflected upon by all of us, are continuously being "winnowed" through "natural" selecting reciprocal exchanges with the world. (Mahoney and Nezworski, 1985, p. 469)

This view may be contrasted with information processing models which tend to judge the adaptive value of encoded and stored mental representations by the degree to which they reflect valid, accurate, and explicit "copies" of the external world.

Dissipative structure theory. Recent conceptualizations of living and social systems as comprising complex, self-organizing processes capable of actively and adaptively transforming basic system structures and which function in response to environmental perturbations (cf. Jantsch, 1980, 1981; Maturana and Varela, 1987; Prigogine, 1980; Prigogine and Stengers, 1984; Varela, 1979; Zeleny, 1980, 1981) are salient themes associated with emergent views of constructivist cognitive theory and therapy (Guidano, 1984, 1987; Guidano and Liotti, 1985; Mahoney, in press). The theoretical scaffolding for these recent conceptualizations is built upon Nobel laureate Ilya Prigogine's pioneering work in physical chemistry and his formulation of *dissipative structure theory* (Prigogine, 1980).

Prigogine was awarded the 1977 Nobel prize for his study of nonequilibrium "dissipative structures" in chemical reaction systems (Glansdorff and Prigogine, 1971; Prigogine, Nicolis, and Babloyantz, 1972). Dissipative structures are physical and chemical systems that spontaneously develop ordered structures of increasing complexity that at times take on patterns that resemble the self-renewing and transformational properties of living systems. Prigogine's study of these "far from equilibrium" systems and subsequent mathematical analyses of their processes provided the empirical basis for the foundational principle of dissipative structure theory: *order through fluctuation* (Prigogine, 1976). According to this principle, order and organization may arise "spontaneously" out of disorder and chaos through a process of "self-organization." Prigogine and Stengers (1984) state:

We now know that far from equilibrium, new types of structures may originate spontaneously. In far-from-equilibrium conditions we may have transformation from disorder,

from thermal chaos, into order. New dynamic states of matter may originate, states that reflect the interaction of a given system with its surroundings. We have called these new structures *dissipative structures* to emphasize the constructive role of dissipative processes in their formation. (p. 12)

The idea that order arises *because* of disorder not *despite* it necessitates a reinterpretation of Newton's Second Law of Thermodynamics and its foundational concept of *entropy* (the notion that structured forms move irreversibly toward increasing decay, disorder, and eventual equilibrium). The primary implication is that the Second Law may be restricted in the type of phenomena it can predict and explain. For example, Prigogine demonstrated that the tendency of mass and energy to seek a state of equilibrium (entropy) applies only to *closed systems* (i.e., self-contained systems with no flow of matter or energy between the system and its environment), but is not applicable to *open, developing systems* (i.e., systems capable of exchanging both matter and energy with their environment). In other words, under conditions of openness, the deleterious effects of entropy are dissipated into the environment and the basic structure of the system is dynamically maintained. However, if an open system is confronted with sufficient stress to push ordering fluctuations beyond a critical "bifurcation point," the system may either collapse or exhibit a nonlinear, *qualitative* change in structure in the direction of greater complexity and higher organization. In the latter case, this new level of organization is capable of accommodating the energy flow that exceeded the system's prior dynamic state.

Dissipative structure theory has recently been integrated with constructivist portrayals of humans as active, self-construing, developing systems (Guidano, 1987; Mahoney, 1985, in press). Furthermore, the concept of "order through fluctuation" has been depicted as holding important implications for the disciplines of medicine and psychology by suggesting that disorder, disequilibrium, and distress may be conceptualized as "natural" phenomena which play a vital role in a system's transformation toward a more viable, higher-order organization (Capra, 1983; Dossey, 1982; Lyddon, 1987). When applied to the realm of psychotherapy, for example, the disorganizing effect of affective intensity is viewed by some constructivists as a fundamental component of the change process. According to this view, the experience of increasing levels of emotional intensity may function as a dissipative process which can "push" the cognitive system to a new level of organization or self knowledge (Guidano, 1987; Mahoney, 1988; Mahoney and Lyddon, 1988). In these portrayals, emotional intensity reflects a significant shift from emotional equilibrium that is often related to an identifiable stressor. If the individual's available coping capacities are sufficient to assimilate the present challenge, the episode is concluded and life tends to return to "business as usual." On the other hand, if the individual's attempts to cope and re-equilibrate are not successful, a period of crisis may ensue, accompanied by oscillating pat-

terns of emotional disequilibrium and disorganization. Mahoney (1988) identifies two possible developmental outcomes related to this state of affairs—regressive and progressive development. Regressive developments characterized by an indefinite psychological “entrenchment” in these repetitive cycles of disequilibrium and is presumably related to the maintenance of obsolete knowing structures. Progressive development, however, involves the emergence of “higher-order knowing structures” that are capable of accommodating the current life challenge and re-establishing a dynamic state of equilibrium. This more complex level of equilibrium is maintained until it, in turn, is challenged by new demands that initiate another lifespan episode of disequilibrium and disorganization.

Attachment theory. Although most theories of psychopathology and treatment place widespread emphasis on developmental antecedents, the study of psychopathology has been largely separate from that of development (Achenbach, 1986). Recent expressions of constructivist cognitive theory and therapy, however, have begun to bridge this juncture by placing a greater emphasis upon personal and emotional adjustment throughout the lifespan (Guidano, 1987; Guidano and Liotti, 1983; Liotti, 1984; Mahoney, 1988). The central link between developmental and clinical phenomena in these constructivist renditions has been provided by John Bowlby's (1977a, 1977b, 1980, 1985) theory of *attachment*. According to Bowlby (1977a)

... attachment theory is a way of conceptualizing the propensity of human beings to make strong affectional bonds to particular others and of explaining the many forms of emotional distress and personality disturbance, including anxiety, anger, depression, and emotional detachment, to which unwilling separation and loss given rise. (p. 127)

At the root of Bowlby's theory is the notion that attachment behavior is determined by an innate system of control. Within this system, separation from the attachment figure leads to feelings of anxiety which, in turn, are thought to trigger a variety of behaviors (e.g., crying, searching, following, clinging, etc.) that represent attempts to restore contact with the attachment figure.

In Bowlby's terms a child will develop a secure sense of attachment if parents provide a safe base and encourage the child's exploration of his/her environment. Failures to develop a secure sense of attachment (i.e., “anxious attachments”) are believed to be related to one or more patterns of parenting characterized by unresponsiveness to the child's care eliciting behaviors, discontinuities in treatment over time, or threats of loss of love or abandonment. Because anxious attachment patterns are hypothesized to be related to later psychopathology, Bowlby contends they have important implications for therapy. In essence, he suggests that the primary task of the therapist should be that of providing a secure base from which the client may explore (a) representational models of self and attachment figure relationships, (b) how these models may have developed during childhood and adolescence, and (c) how they continue to influence his/her personal and emotional

development (Bowlby, 1977a, 1977b, 1985). From a constructivist perspective, attachment theory provides a developmental framework for explaining the way in which the personal meaning systems are actively generated, maintained, and transformed in the context of emotional attachments and detachments throughout the lifespan (Guidano, 1987; Mahoney and Lyddon, 1988).

Models of Cognitive Therapy

In recent years a variety of constructivist approaches have appeared in the cognitive therapy literature (Arnkoff, 1980; Burrell, 1987; Guidano, 1984, 1987; Guidano and Liotti, 1983; 1985; Joyce-Moniz, 1985; Landfield and Leitner, 1980; Mahoney, 1985, 1988; Mancuso and Adams-Weber, 1982; Neimeyer, 1985; Rowe, 1978, 1983). Although these models emphasize different aspects of constructivist theory, all share a common regard for the personal and social reality of the client (Mahoney and Lyddon, 1988). Burrell's (1987) motor-evolutionary approach and Guidano and Liotti's (1983) integrative model are illustrative of this trend.

Burrell's motor-evolutionary approach. According to Burrell (1987), the integration of evolutionary epistemology with motor metatheory underscores the importance of *error* as a necessary condition for the growth of knowledge. According to this view, an individual's perceptions of "error," "surprise," or "lack of fit," provide the necessary variation fundamental to the development of his/her tacit rules of action. In his outline of a *motor-evolutionary* approach to cognitive therapy, Burrell thus assigns a central role to negative knowledge or error in the therapeutic process. For example, he suggests that most therapeutic "know-how" is not based on *prescriptive techniques* and explicit knowledge of exactly what to do in a given situation, but rather upon *proscriptive abstract rules* derived over time from one's knowledge of what not to do. In Burrell's (1987) words:

Rather than seeking such [prescriptive] "techniques," we ought to be concerned with the discovery of general principles (abstract proscriptive rules) to govern and which already govern our conduct as therapists, instantiated within perceived errors. We ought to be more concerned with the abstract don'ts than with the particular do's and we may learn about such principles by looking for and studying our errors. (p. 229)

Extending this line of reasoning Burrell (1987) contends that the therapeutic relationship may be viewed in two ways—one which is consonant with evolutionary processes, the other which is not. According to Burrell, these two views correspond to Hayek's (1973) distinction between two types of order: a *taxis* (a "made order") and a *kosmos* (a "spontaneous order"). To elaborate, a *taxis* is a highly structured, centrally planned, order by human design in which individual action follows explicitly prescribed rules in pursuit of specified goals (e.g., centrally planned corporations and economies). In contrast, a

kosmos is an order which is spontaneous, unplanned, lacks specifiable goals, and is formed through the operation of abstract proscriptive rules (e.g., free market economies; most human communication). Burrell proposes that although a taxis conceptualization of therapy (e.g., the behavior therapy tradition and some cognitive-behavioral perspectives) may be adaptive in relatively simple contexts in which one has a clearly circumscribed goal and knows all the relevant particulars, such a view is not adaptive in more complex contexts of social interaction. Thus, he argues that a motor-evolutionary perspective necessitates a view of therapy as a kosmos in which control is decentralized and both therapist and client play an active role in determining its direction and course. According to Burrell (1987)

Particular goals may not be specified, and therapy proceeds as a "winnowing and sifting" process according to the abstract rules of action of therapist and client. Therapy is not restricted to conscious design; therapist and client may utilize their tacit knowledge and variation is implicitly and explicitly sanctioned. (p. 230)

Burrell's proposal that therapy should be viewed as a kosmos is an argument for operation according to abstract proscriptive principles rather than according to explicit prescriptive techniques.

Guidano and Liotti's integrative model. Perhaps one of the most comprehensive approaches to constructivist cognitive therapy to date is exemplified by the work of the Italian researchers Vittorio F. Guidano and Gianni Liotti (Guidano, 1984, 1987; Guidano and Liotti, 1983, 1985). The theoretical foundation of their integrative model of knowledge organization, development, and change centers around several interlocking themes: Lakatos' (1970) research programme heuristic in the philosophy of science, the basic tenets of Popper's (1972, 1977) critical rationalism and evolutionary epistemology, Weimer's (1977) motor theory of the mind, Piaget's (1954, 1955) conceptions of cognitive growth, and Bowlby's (1977a, 1977b) attachment theory. The influence of the latter theorist is most apparent in their conceptualization of cognitive dysfunction.

Guidano and Liotti (1983) present a model of cognitive dysfunction based upon the quality and course of attachment processes and exploratory behavior during the formative years of development. According to these theorists, it is important that a therapist understand the fundamental cognitive themes and attachment processes that typically accompany a client's particular pattern of disturbed behavior and emotion. They identify four separate patterns of dysfunctional attachment which correspond to the development of the same number of clinical syndromes: agoraphobia (and related multiple phobias), depression, eating disorders, and obsessive-compulsive patterns. Although the delineation of the complex interrelationships among early emotional attachment processes, exploratory behavior, and subsequent patterns of cognitive dysfunction are beyond the scope of this presentation, the main

classes of dysfunctional attachment and impeded exploration are outlined by Guidano and Liotti (1983) as follows:

- (1) Both attachment and exploration can be hampered by the relative absence of reliable attachment figures.
- (2) An anxious attachment, defined by the *expectation* of losing an attachment figure, impedes autonomous exploratory behavior, since the child will refuse to leave the proximity of this attachment figure.
- (3) An attachment figure may actively prohibit autonomous exploration, through threats and punishment.
- (4) The behavior of attachment figures can be so contradictory and misleading that it is impossible for the child to develop a coherent, precise, and unambiguous set of expectations about his or her capabilities of establishing attachment, about exploratory ability, and about the reliability of other people in affectional bonds. (pp. 102-103)

According to Guidano and Liotti (1983), the role of abnormal attachment patterns and hampered exploration in the etiology of cognitive dysfunction holds significant implications for the psychotherapeutic relationship. Through the creation of a context in which the client's personal identity and unique way of construing the world are respected, the therapeutic relationship can become a *secure base for exploration*. In other words, therapy is conceptualized as an exploratory collaboration between therapist and client which enables the client to identify the basic assumptions that underlie his/her own concepts of reality.

In line with constructivist theory, Guidano and Liotti (1983) distinguish between two types of cognitive change: superficial and deep. *Superficial change* corresponds to the reorganization of the client's attitude toward certain life situations and events, whereas *deep change* involves a reorganization of the patterns of attitude toward oneself and is accompanied by a restructuring of one's perceived personal identity. While superficial change may be induced by providing instructions to clients to rehearse coping statements to fear-, sadness-, or anger-producing situations, Guidano (1987) contends that the reorganization of the client's model of self and reality (i.e., deep change) is entirely dependent upon the *client's* ability to make explicit the available sets of tacit rules. Thus, rather than imposing new knowledge upon the client in the form of logical or rational challenges to his/her causal theories and models, it is the task of the therapist to respect the directionality of the client's tacit knowledge and guide the client's exploration into the nature and history of his/her personal cognitive models. Guidano (1987) states that a process-oriented therapist

... does not consider the achievement of a therapeutic goal as a matter of choosing the "right" technique, but rather, he/she always uses existing techniques—or even "invents" new techniques—within the strategy of guiding the client's processes to make the tacit explicit. (Guidano, 1987, p. 223)

Such an approach is founded upon an inherent trust in the client's tacit processes and a belief in the self-organizing ability of all living systems.

As reflected in the contemporary works of Burrell, Guidano, Liotti, Mahoney, and others, constructivist cognitive therapies emphasize proactive processes in adaptation. A person is viewed as an evolving organic unit which moves through various contexts, each of which elicits differential demands. Through a process of exploring and adapting to the environment, abstract rules of action are constructed which serve as guides for future knowing and adaptation. Constructivist themes stress the importance of unconscious processes (abstract rules of action) in human functioning, emotional attachments throughout the lifespan, self-organizing processes in individual development, and the value of a therapeutic context in which individuals may safely explore and transform their personal meanings and realities in the direction of more adaptive representations of their life experiences.

The Exogenic-Endogenic Dialectic Revisited

Examination of the above trends of development associated with information-processing and constructivist approaches to cognition and cognitive therapy points to a fundamental philosophical differentiation between the two approaches. It is proposed that the essence of this differentiation closely parallels the exogenic-endogenic character of (a) the logical positivist-*Weltanschauungen* distinction in the philosophy of science and (b) the dialectic shifts in psychological world views described by Buss (1978) and Gergen (1985a). For example, the information-processing approach to cognition is fundamentally exogenic in character. Assumptions of a relatively fixed and accessible reality imply a "received view" of human knowledge grounded in a logical positivist philosophy of science. This view has its roots in the philosophy of John Locke which ultimately developed into associationism and the behaviorist tradition. For example, Locke used the metaphor of placing ideas in a cabinet to describe the mind and its ideas:

The senses at first let in particular ideas, and furnish the yet empty cabinet; and the mind by degrees growing familiar with some of them, they are lodged in the memory, and the names got to them. Afterwards the mind, proceeding farther, abstracts them, and by degrees learns the use of general names. In this manner, the mind comes to be furnished with ideas and language, the materials about which to exercise its discursive faculty; and the use of reason becomes daily more visible, as these materials, that give it employment increase. (cited in Barclay, 1978, p. 147)

This description of the "mind's work" is distinctly similar in form to contemporary information-processing portrayals of cognition as a unidirectional process whereby information passes through several structural features of the cognitive system (sensory, short-term, and long-term stores) and is subject to an exact sequence of control processes (i.e., processes which determine what happens to information in a store).

The philosophical character of the constructivist approach to cognition,

on the other hand, is basically endogenic. The constructivist contention that reality is not fixed but rather relative, changeable, and a function of personally and socially constructed conceptual schemes suggests a philosophical alignment with a *Weltanschauungen* view of scientific knowledge. Constructivism has its formative roots in the 18th- and 19th-century writings of Immanuel Kant (1791/1969), Giambattista Vico (1744/1948), and Hans Vaihinger (1911/1924) which embrace the basic epistemological assumption that knowledge is necessarily grounded within individually and socially constituted symbolic structures. This view perhaps receives its most complete statement in the neo-Kantian philosophy of Cassirer (1944)

. . . man lives in a symbolic universe. Language, myth, art and religion are parts of this universe. They are the varied threads which weave the symbolic net, the tangled web of human experience. All human progress in thought and experience refines upon and strengthens this net. No longer can man confront reality immediately; he cannot see it, as if it were face to face. Physical reality seems to recede in proportion as man's symbolic activity advances. Instead of dealing with things themselves man is in a sense conversing with himself. He has so enveloped himself in linguistic forms, in artistic images, in mythical symbols or religious rites that he cannot see or know anything except by the interposition of this artificial medium. His situation is the same in the theoretical as in the practical sphere. Even here man does not live in a world of hard facts. (p. 25)

Contemporary constructivist approaches to cognition, by fundamentally imbuing the mind with constructive, meaning-making activity, continue to elaborate upon this endogenic philosophical tradition.

In order to further delineate these contrasts within the practical realm of psychotherapy, the following analysis suggests that the most fundamental differences between information-processing and constructivist models of cognitive therapy are ontological and epistemological in nature. It is these basic philosophical divergences which, in turn, are proposed to have led each model to develop (a) contrasting conceptualizations of clinical phenomena and treatment foci and (b) differing emphases on the roles of the client and therapist in the change process.

Views of Reality and Knowing

Information-processing and constructivist models of cognitive therapy not only tend to endorse very different views of reality, but also subscribe to very different assumptions about how we come to know this reality. The information-processing approaches, for example, tend to be associated with a philosophy of *realism*—an ontological position which posits the existence of an external and stable reality. Operating within a sensory metatheory context (Weimer, 1977), these models assume that knowing involves the ability to accurately encode, store, and retrieve representational copies of the external world. Presumably, the more accurately one's mental representations correspond to this reality, the greater the potential benefit they hold toward

facilitating one's personal adjustment. In contrast, constructivist models of cognitive therapy endorse an ontology of *relativism* which views reality not as stable and neatly external, but rather as a dynamic, personal and collective construction of order in experience (Mahoney and Lyddon, 1988). Embedded within a motor metatheory framework (Weimer, 1977) and its emphasis upon the role of feedforward as well as feedback processes, constructivist models tend to view reality as a personal construction based upon both internally generated and externally derived sources of stimulation to which the individual is responsive. In other words, the mind is

. . . an active, constructive system, capable of producing not only its output but also, to a large extent, the input it receives, including the basic sensations underlying the construction of itself. (Guidano, 1984, p. 33)

Furthermore, the constructivist emphasis upon the primacy of tacit ordering processes underscores the notion that one does not form explicit blueprints of reality that govern the particulars of behavior, but rather constructs an abstract model of reality that constrains (i.e., imposes edges) but does not specify particulars (see Weimer, 1973, for an extended treatment of this notion).

Views of Client Symptomatology and Treatment

The fundamental differences in philosophical views of reality and knowing between information-processing and constructivist orientations result in contrasting conceptualizations of client symptomatology and different notions as to what constitute appropriate therapeutic goals. For example, the general conceptualization of clinical phenomena associated with information-processing models of cognitive therapy assumes that maladaptive client behavior and emotionality are a function of certain biases and heuristics inherent to the cognitive systems which serve to distort the processing of accurate representations of the world. As a result, the general therapeutic task becomes one of helping clients to formulate more realistic and accurate appraisals of themselves and their experiences. The correction of such misconceptions is presumed to be functionally related to the attenuation of clients' experience of emotional disequilibrium. The constructivist view of reality, on the other hand, leads to a shift in conceptualization of clinical phenomena from that of making a priori judgements about the *accuracy* of the explicit content of one's mental representations (i.e., questions of their rationality, validity, and/or correspondence to reality) to that of exploring the *personal meanings* and potential adaptive value that such representations may hold for the individual at this point in his/her personal development. Furthermore, instead of equating intense negative emotions as undesirable, disruptive experiences which should be controlled (or eliminated), a number of constructivists have underscored an adaptive role that intense emotionality may

play in human functioning (cf. Greenberg and Safran, 1987; Guidano, 1987; Mahoney, 1988). According to these writers, intense emotions are viewed as powerful "knowing processes" in and of themselves and may function as important precursors to deep structural change or cognitive reorganization. From this perspective, the therapeutic process thus becomes one of allowing the individual to fully explore this emotionality and understand its unique relationship to his/her developmental attachment history and current life situation.

Roles of the Client and Therapist

As previously noted, the information-processing approach to cognition tends to highlight the "inward flow" of information from the sense organs and the selective processing and storage of such information in organized forms, or schemata. These schemata, in turn, are thought to bias subsequent information processing in a schema-consistent fashion. In clinical populations these biasing tendencies are presumed to contribute to inaccurate, distorted, and unrealistic perceptions of self and others. Within this context, the role of the client tends to become that of a recipient of therapist technical guidance in the form of information and methods designed to help the client properly encode, store, and retrieve corrective therapeutic experiences. Thus, consistent with a realism-based philosophy, treatment tends to involve an "outward to inward flow" (i.e., from therapist to client) of more "objective" sources of information that are believed to aid the client in the formation of more accurate, rational, and valid representations of him/herself and the world.

Constructivist approaches tend to differ from information-processing approaches in their conceptualization of the roles of client and therapist. In constructivist cognitive therapy the therapist does not play a dominant role but rather is the facilitator of a process of self exploration in which the client is the primary navigator. The therapist seeks to provide a safe and supportive context in which the client may explore his/her own developmental, self-organizational, and proactive processes (i.e., attachment patterns, emotional disequilibria, personal meanings, and relationships with self and others). As Mahoney (1985) has suggested, constructivist approaches tend to represent a shift in strategic emphasis away from what a therapist does *to* the client toward what the client is actively involved in *doing* to himself or herself. The goal is to facilitate the client's self-construction of new meanings rather than to provide him/her with some "pre-packaged" meanings in the form of therapeutic instruction and information.

Concluding Remarks

Several contemporary writers have suggested that the field of experimental cognitive psychology might provide a "common language" that may trans-

cent theoretical and practical differences among the psychotherapies (Goldfried, 1979; Kazdin, 1984; Messer and Winokur, 1980; Ryle, 1978, 1980; Safran, 1984; Sarason, 1979; Shevrin and Dickman, 1980). Such a superordinate language system, it is argued, might serve to facilitate communication among theoreticians and between clinicians and researchers. While the heuristic value of this suggestion is generally supported by an emergent and incremental interface between the clinical and cognitive sciences (Mahoney, 1988), it is important that those looking to cognitive psychology to provide a common language base for communication realize that the field neither speaks a single dialect nor presumes to represent a unified view of cognition. A diversity of cognitive language systems abounds, each with its own unique set of suppositions and presuppositions and theoretical constructs.

The present paper has proposed that: (1) the field of cognitive psychology is currently guided by at least two contrasting perspectives which serve as broad conceptual networks for theory construction and empirical investigation—the information-processing and constructivist paradigms; (2) these two paradigms reflect a philosophical divergence in relation to fundamental ontological and epistemological assumptions—assumptions which closely parallel the exogenic-endogenic character of the history of scientific and psychological knowledge; and (3) recent models of cognitive therapy based upon these two paradigms of cognition continue to play out this exogenic-endogenic dialectic in their respective conceptualizations of client symptomatology, treatment, and the roles of client and therapist. In regard to the latter contention, the exogenic character of information-processing models is evident in their “outward to inward” schematic-processing formulations of cognition and their general emphasis upon the development of therapeutic strategies aimed at correcting client inaccuracies associated with the encoding, storage, and retrieval of information. These conceptualizations appear to be primarily concerned with the force of external reality and bringing the client into better conformity (or correspondence) with this reality. From this perspective knowing is a relatively passive process whereby the client is “impregnated” from without—that is, change tends to come from outside the client in the form of accurate (valid, rational) therapeutic information that ideally should bear maximal correspondence to external reality.

The endogenic quality of constructivist approaches, on the other hand, is apparent in their position of ontological relativism and view of humans as active construers and organizers of personal and social realities. Constructivists are primarily concerned with the internal realm of the individual (i.e., the *Lebenswelt*, or world of subjective ideas) and its role in the change process. The recent incorporation of diverse concepts from evolutionary epistemology, dissipative structure theory, and attachment theory into constructivist models serves to underscore an endogenic position by emphasizing the importance of basic developmental and self-organizational tenden-

cies inherent to the human organism.

In conclusion, information-processing and constructivist approaches to cognitive therapy are logically related to fundamental ontological and epistemological perspectives. It is these personal visions of reality and knowledge that guide clinical researchers and practitioners associated with each approach in their quest to understand their clients, themselves as helpers, and the process of change.

References

- Achenbach, T.M. (1986). Developmental perspectives on psychotherapy and behavior change. In S.L. Garfield and A.E. Bergin (Eds.), *Handbook of psychotherapy and behavior change* (pp. 117-154). New York: John Wiley.
- Arbib, M.A., and Hesse, M.B. (1986). *The construction of reality*. Cambridge, Massachusetts: Cambridge University Press.
- Arnkoff, D.B. (1980). Psychotherapy from the perspective of cognitive theory. In M.J. Mahoney (Ed.), *Psychotherapy process* (pp. 339-361). New York: Plenum.
- Baars, B.J. (1986). *The cognitive revolution in psychology*. New York: Guilford.
- Barclay, J.R. (1978). *Foundations of counseling strategies*. New York: Krieger.
- Bartlett, F. (1932). *Remembering*. Cambridge, Massachusetts: Cambridge University Press.
- Beck, A.T. (1963). Thinking and depression, I. Idiosyncratic content and cognitive distortion. *Archives of General Psychiatry*, 9, 324-333.
- Beck, A.T. (1967). *Depression: Clinical, experimental, and theoretical aspects*. New York: Hoeber.
- Beck, A.T. (1970). Cognitive therapy: Nature and relation to behavior therapy. *Behavior Therapy*, 1, 184-200.
- Beck, A.T., Emery, G., and Greenberg, R.L. (1985). *Anxiety disorders and phobias: A cognitive perspective*. New York: Basic Books.
- Bowers, K.S., and Meichenbaum, D. (Eds.) (1984). *The unconscious reconsidered*. New York: Wiley-Interscience.
- Bowlby, J. (1977a). The making and breaking of affectional bonds: I. Etiology and psychopathology in the light of attachment theory. *British Journal of Psychiatry*, 130, 421-431.
- Bowlby, J. (1977b). The making and breaking of affectional bonds: II. Some principles of psychotherapy. *British Journal of Psychiatry*, 130, 421-431.
- Bowlby, J. (1980). *Attachment and loss, Vol. III: Loss: Sadness and depression*. London: Hogarth.
- Bowlby, J. (1985). The role of childhood experience in cognitive disturbance. In M.J. Mahoney and A. Freeman (Eds.), *Cognition and psychotherapy* (pp. 181-199). New York: Plenum.
- Bransford, J.D., Barclay, J.R., and Franks, J.J. (1972). Sentence meaning: A constructivist versus interpretive approach. *Cognitive Psychology*, 3, 193-209.
- Burrell, M.J. (1987). Cognitive psychology, epistemology and psychotherapy: A motor-evolutionary perspective. *Psychotherapy*, 24, 225-232.
- Buss, A.R. (1978). The structure of scientific revolutions. *Journal of the History of the Behavioral Sciences*, 14, 57-64.
- Callebaut, W., and Pinxten, R. (1987). *Evolutionary epistemology: A multiparadigm program*. Boston: D. Reidel.
- Campbell, D.T. (1974). Evolutionary epistemology. In P.A. Schilpp (Ed.), *The philosophy of Karl Popper, Vol. 14, I and II* (pp. 413-463). LaSalle, Illinois: Open Court.
- Campbell, D.T. (1975). On the conflicts between biological and social evolution and between psychology and moral tradition. *American Psychologist*, 30, 1103-1126.
- Capra, F. (1983). *The turning point*. New York: Bantam.
- Cassir, E. (1944). *Essay on man*. New Haven: Yale University Press.
- Chomsky, N. (1957). *Syntactic structures*. The Hague: Mouton.
- Chomsky, N. (1975). *Reflections on language*. New York: Pantheon.

- Cofer, C.N. (1973). Constructive processes in memory. *American Scientist*, 61, 537-543.
- Collins, J.T., and Hagen, J.W. (1979). A constructivist account of the development of perception, attention, and memory. In G.A. Hale and M. Lewis (Eds.), *Attention and cognitive development* (pp. 65-96). New York: Plenum.
- Dember, W.N. (1974). Motivation and the cognitive revolution. *American Psychologist*, 29, 161-168.
- DeMey, M. (1982). *The cognitive paradigm*. Boston: D. Reidel.
- Dobson, K.S. (Ed.) (1988). *Handbook of cognitive-behavioral therapies*. New York: Guilford.
- Dossey, L. (1982). *Space, time, and medicine*. London: Shambhala.
- Eccles, J.C. (1973). *The understanding of the brain*. New York: McGraw-Hill.
- Ellis, A. (1962). *Reason and emotion in psychotherapy*. New York: Lyle Stuart.
- Emery, O.B., and Csikszentmihalyi, M. (1981). An epistemological approach to psychiatry: On the psychology/psychopathology of knowledge. *Journal of Mind and Behavior*, 2, 375-396.
- Feyerabend, P.K. (1965). Problems of empiricism. In R.G. Colodny (Ed.), *Beyond the edge of certainty* (pp. 145-260). Englewood Cliffs, New Jersey: Prentice-Hall.
- Feyerabend, P.K. (1970). Against method: Outline of an anarchistic theory of knowledge. In M. Radner and S. Winokur (Eds.), *Minnesota studies in the philosophy of science, Vol. IV: Theories and methods of physics and psychology* (pp. 17-130). Minneapolis: University of Minnesota Press.
- Fiske, S.T., and Taylor, S.T. (1984). *Social cognition*. New York: Random House.
- Foreyt, J.P., and Rathjen, D. (Eds.) (1978). *Cognitive behavior therapy: Research and application*. New York: Plenum.
- Gardner, H. (1985). *The mind's new science: A history of the cognitive revolution*. New York: Basic Books.
- Gergen, K.J. (1982). *Toward transformation in social knowledge*. New York: Springer-Verlag.
- Gergen, K.J. (1985a). The social constructionist movement in modern psychology. *American Psychologist*, 40, 266-275.
- Gergen, K.J. (1985b). Social constructionist inquiry: Context and implications. In K.J. Gergen and K.E. Davis (Eds.), *The social construction of the person* (pp. 3-18). New York: Springer-Verlag.
- Glandsdorff, P., and Prigogine, I. (1971). *Thermodynamic theory of structure, stability, and fluctuations*. New York: Wiley-Interscience.
- Goldfried, M.R. (1979). Anxiety reduction through cognitive-behavioral intervention. In P.C. Kendall and S.D. Hollon (Eds.), *Cognitive-behavioral interventions: Theory, research, and procedures* (pp. 117-152). New York: Academic Press.
- Goldfried, M.R., and Robins, C. (1982). On the facilitation of self-efficacy. *Cognitive Therapy and Research*, 6, 361-369.
- Goldfried, M.R., and Robins, C. (1983). Self-schema, cognitive bias, and the processing of therapeutic experiences. In P.C. Kendall (Ed.), *Advances in cognitive-behavioral research and therapy, Vol. 2* (pp. 33-80). New York: Academic Press.
- Greenberg, L.S., and Safran, J.D. (1980). Encoding, information processing, and the cognitive behavior therapies. *Canadian Psychology*, 21, 59-66.
- Greenberg, L.S., and Safran, J.D. (1987). *Emotion in psychotherapy: Affect, cognition, and the process of change*. New York: Guilford.
- Guidano, V.F. (1984). A constructivist outline of cognitive processes. In M.A. Reda and M.J. Mahoney (Eds.), *Cognitive psychotherapies: Recent developments in theory, research, and practice* (pp. 31-45). Cambridge, Massachusetts: Ballinger.
- Guidano, V.F. (1987). *Complexity of the self: A developmental approach to psychopathology and therapy*. New York: Guilford.
- Guidano, V.F., and Liotti, G.A. (1983). *Cognitive processes and emotional disorders*. New York: Guilford.
- Guidano, V.F., and Liotti, G.A. (1985). A constructivist foundation for cognitive therapy. In M.J. Mahoney and A. Freeman (Eds.), *Cognition and psychotherapy* (pp. 101-142). New York: Plenum.
- Habermas, J. (1971). *Knowledge and human interests*. Boston: Beacon.
- Hanson, N.R. (1961). *Patterns of discovery: An inquiry into the conceptual foundations of science*. Cambridge, England: University Press.
- Hayek, F.A. (1952). *The sensory order*. Chicago: University of Chicago Press.
- Hayek, F.A. (1967). *Studies in philosophy, politics, and economics*. New York: Simon and Schuster.

- Hayek, F.A. (1973). *Law, legislation, and liberty, Vol. 1: Rules and order*. Chicago: University of Chicago Press.
- Hayek, F.A. (1978). *New studies in philosophy, politics, economics, and the history of ideas*. Chicago: University of Chicago Press.
- Hoffman, N. (Ed.). (1984). *Foundations of cognitive therapy: Theoretical methods and practical applications*. New York: Plenum.
- Hollon, S.D., and Kriss, M.R. (1984). Cognitive factors in clinical research and practice. *Clinical Psychology Review*, 4, 35-76.
- Humphreys, W.C. (Ed.) (1969). *Perception and discovery: An introduction to scientific inquiry*. San Francisco: Freeman-Cooper.
- Ingram, R. (1986). *Information processing approaches to clinical psychology*. Orlando: Academic Press.
- Jantsch, E. (1980). *The self organizing universe: Scientific and human implications of the emerging paradigm of evolution*. New York: Pergamon.
- Jantsch, E. (Ed.) (1981). *The evolutionary vision: Toward a unifying paradigm of physical, biological, and sociocultural evolution*. Boulder, Colorado: Westview Press.
- Joyce-Moniz, L. (1985). Epistemological therapy and constructivism. In M.J. Mahoney and A. Freeman (Eds.), *Cognition and psychotherapy* (pp. 143-179). New York: Plenum.
- Kahneman, D., and Tversky, A. (1973). On the psychology of prediction. *Psychological Review*, 80, 237-251.
- Kanfer, F.H., and Hagerman, S.M. (1986). Behavior therapy and the information-processing paradigm. In S. Reiss and R.R. Bootzin (Eds.), *Theoretical issues in behavior therapy* (pp. 3-33). Orlando: Academic Press.
- Kant, I. (1969). *Critique of pure reason*. New York: St. Martin's Press. (Originally published 1791)
- Kazdin, A.E. (1984). Integration of psychodynamic and behavioral therapies: Conceptual versus empirical synthesis. In H. Arkowitz and S.B. Messer (Eds.), *Psychoanalytic therapy and behavior therapy: Is integration possible?* (pp. 139-170). New York: Plenum.
- Kelly, G. (1955). *The psychology of personal constructs*. New York: Norton.
- Kendall, P.C. (Ed.) (1986). *Advances in cognitive-behavioral research and therapy, Vol. 5*. New York: Academic Press.
- Kendall, P.C., and Hollon, S.D. (Eds.) (1979). *Cognitive-behavioral interventions: Theory, research, and procedures*. New York: Academic Press.
- Kimble, G.A. (1984). Psychology's two cultures. *American Psychologist*, 39, 833-839.
- Koch, S. (1981). The nature and limits of psychological knowledge. *American Psychologist*, 36, 257-269.
- Kuhn, T.S. (1970). *The structure of scientific revolutions*. Chicago: University of Chicago Press.
- Lakatos, I. (1970). Falsification and the methodology of scientific research programmes. In I. Lakatos and A. Musgrave (Eds.), *Criticism and the growth of knowledge*. (pp. 91-196). London: Cambridge University Press.
- Landfield, A.W., and Leitner, L.M. (1980). *Personal construct psychology*. New York: John-Wiley.
- Liotti, G. (1984). Cognitive therapy, attachment theory, and psychiatric nosology: A clinical and theoretical inquiry into their interdependence. In M.A. Reda and M.J. Mahoney (Eds.), *Cognitive psychotherapies: Recent developments in theory, research, and practice* (pp. 211-232). Cambridge, Massachusetts: Ballinger.
- Lyddon, W.J. (1987). Emerging views of health: A challenge to rationalist doctrines of medical thought. *Journal of Mind and Behavior*, 8, 365-394.
- Mahoney, M.J. (1976). *Scientist as subject: The psychological imperative*. Cambridge, Massachusetts: Ballinger.
- Mahoney, M.J. (1977). Reflections on the cognitive learning trend in psychotherapy. *American Psychologist*, 32, 5-13.
- Mahoney, M.J. (1985). Psychotherapy and human change processes. In M.J. Mahoney and A. Freeman (Eds.), *Cognition and psychotherapy* (pp. 3-48). New York: Plenum.
- Mahoney, M.J. (1988). The cognitive sciences and psychotherapy: Patterns in a developing relationship. In K.S. Dobson (Ed.), *The handbook of cognitive psychotherapy* (pp. 357-386). New York: Guilford.
- Mahoney, M.J. (in press). *Human change processes: Notes on the facilitation of personal development*. New York: Basic Books.

- Mahoney, M.J., and Arnkoff, D. (1978). Cognitive and self-control therapies. In S.L. Garfield and A.E. Bergin (Eds.), *Handbook of psychotherapy and behavior change* (pp. 689-722). New York: John Wiley.
- Mahoney, M.J., and Freeman, A. (Eds.). (1985). *Cognition and psychotherapy*. New York: Plenum.
- Mahoney, M.J., and Lyddon, W.J. (1988). Recent developments in cognitive approaches to counseling and psychotherapy. *The Counseling Psychologist*, 16, 190-234.
- Mahoney, M.J., and Nezworski, M.T. (1985). Cognitive-behavioral approaches to children's problems. *Journal of Abnormal Child Psychology*, 13, 467-476.
- Mancuso, J.C., and Adams-Webber, J.R. (Eds.). (1982). *The construing person*. New York: Praeger.
- Mandler, G. (1984). *Mind and body: Psychology of emotions and stress*. New York: Norton.
- Marzillier, J.S. (1980). Cognitive therapy and behavioral practice. *Behaviour Research and Therapy*, 18, 249-258.
- Maturana, H.R., and Varela, F.J. (1987). *The tree of knowledge: The biological roots of human understanding*. Boston: New Science Library.
- Meichenbaum, D., and Gilmore, B. (1984). The nature of unconscious processes: A cognitive-behavioral perspective. In K.S. Bowers and D. Meichenbaum (Eds.), *The unconscious reconsidered* (pp. 273-298). New York: John Wiley.
- Merluzzi, T.V., Rudy, T.E., and Glass, C.R. (1981). The information-processing paradigm: Implications for clinical science. In T.V. Merluzzi, C.R. Glass, and M. Genest (Eds.), *Cognitive assessment* (pp. 77-124). New York: Guilford Press.
- Messer, S.B., and Winokur, M. (1980). Some limits to the integration of psychoanalytic and behavior therapy. *American Psychologist*, 35, 818-827.
- Neimeyer, R.A. (1985). Personal constructs in clinical practice. In P.C. Kendall (Ed.), *Advances in cognitive-behavioral research and therapy*, Vol. 2 (pp. 275-339). New York: Academic Press.
- Nisbett, R.E., and Ross, L. (1980). *Human inference: Strategies and shortcomings of social judgment*. Englewood Cliffs, New Jersey: Prentice-Hall.
- Piaget, J. (1954). *The construction of reality in the child*. New York: Basic Books.
- Piaget, J. (1955). *The language and thought of a child*. New York: New American Library. (Originally published 1926)
- Polanyi, M. (1958). *Personal knowledge: Towards a post-critical philosophy*. Chicago: University of Chicago Press.
- Popper, K.R. (1972). *Objective knowledge: An evolutionary approach*. Oxford: Clarendon Press.
- Popper, K.R. (1977). Part I. In K.R. Popper and J.C. Eccles (Eds.), *The self and its brain* (pp. 3-224). Boston: Routledge and Kegan Paul.
- Popper, K.R., and Eccles, J.C. (Eds.) (1977). *The self and its brain*. Boston: Routledge and Kegan Paul.
- Pribram, K. (1971). *Language of the brain: Experimental paradoxes and principles in neuropsychology*. Englewood Cliffs, New Jersey: Prentice-Hall.
- Prigogine, I. (1976). Order through fluctuation: Self-organization and social system. In E. Jantsch and C.H. Waddington (Eds.), *Evolution and consciousness: Human systems in transitions* (pp. 93-126). Reading, Massachusetts: Addison-Wesley.
- Prigogine, I. (1980). *From being to becoming: Time and complexity in the physical sciences*. San Francisco: W.H. Freeman.
- Prigogine, I., Nicolis, G., and Babbolyantz, A. (1972). Thermodynamics of evolution. *Physics Today*, 25, Nos. 11 and 12.
- Prigogine, I., and Stengers, I. (1984). *Order out of chaos: Man's new dialogue with nature*. New York: Bantam.
- Radnitzky, G. (1970). *Contemporary schools of metascience (2nd Edition)*. Goteborg: Akademiforlaget.
- Radnitzky, G., and Bartley, W.W. (Eds.) (1987). *Evolutionary epistemology, theory of rationality, and the sociology of knowledge*. La Salle, Illinois: Open Court.
- Reda, M.A., and Mahoney, M.J. (Eds.) (1984). *Cognitive psychotherapies: Recent developments in theory, research, and practice*. Cambridge, Massachusetts: Ballinger.
- Ross, L., Greene, D., and House, P. (1977). The "false consensus effect": An egocentric bias in social perception and attribution processes. *Journal of Experimental and Social Psychology*, 13, 279-301.
- Rowe, D. (1978). *The experience of depression*. New York: Wiley.

- Rowe, D. (1983). *Depression. The way out of your prison*. London: Routledge and Kegan Paul.
- Royce, J.R., and Powell, A. (1983). *Theory of personality and individual differences: Factors, systems, and processes*. Englewood Cliffs, New Jersey: Prentice-Hall.
- Ryle, A. (1978). A common language for the psychotherapies? *British Journal of Psychiatry*, 132, 585-594.
- Ryle, A. (1980). *Psychotherapy: A cognitive integration of theory and practice*. London: Academic Press.
- Safran, J. (1984). Assessing the cognitive-interpersonal cycle. *Cognitive Therapy and Research*, 8, 333-347.
- Safran, J.D., and Greenberg, L.S. (1982). Cognitive appraisal and reappraisal: Implications for clinical practice. *Cognitive Therapy and Research*, 6, 251-258.
- Sampson, E.E. (1977). Psychology and the American ideal. *Journal of Personality and Social Psychology*, 35, 767-782.
- Sampson, E.E. (1978). Scientific paradigms and social values: Wanted—a scientific revolution. *Journal of Personality and Social Psychology*, 36, 1332-1343.
- Sarason, J.G. (1979). Three lacunae of cognitive therapy. *Cognitive Therapy and Research*, 3, 223-235.
- Shaw, R., and Bransford, J. (Eds.) (1977). *Perceiving, acting, and knowing: Toward an ecological psychology*. Hillsdale, New Jersey: Erlbaum.
- Shevrin, H., and Dickman, S. (1980). The psychological unconscious: A necessary assumption for all psychological theory? *American Psychologist*, 35, 421-434.
- Snyder, M. (1981). Seek, and ye shall find: Testing hypotheses about other people. In E.T. Higgins, C.P. Herman, and M.P. Zanna (Eds.), *Social cognition: The Ontario symposium* (pp. 277-303). Hillsdale, New Jersey: Erlbaum.
- Snyder, M., Campbell, B.H., and Preston, E. (1982). Testing hypotheses about human nature: Assessing the accuracy of social stereotypes. *Social Cognition*, 1, 256-272.
- Snyder, M., and Cantor, N. (1979). Testing hypotheses about other people: The use of historical knowledge. *Journal of Experimental Social Psychology*, 15, 330-342.
- Snyder, M., and Swann, W.B., Jr. (1978). Behavioral confirmation in social interaction: From social perception to social reality. *Journal of Experimental Social Psychology*, 14, 146-162.
- Suppe, F. (1974). The search for philosophic understanding of scientific theories. In F. Suppe (Ed.), *The structure of scientific theories* (pp. 3-232). Urbana, Illinois: University of Illinois Press.
- Taylor, S.E., and Crocker, J. (1981). Schematic bases of social information processing. In E.T. Higgins, P. Hermann, and M.P. Zanna (Eds.), *The Ontario symposium on personality and social psychology*, Vol. 1 (pp. 89-134). Hillsdale, New Jersey: Erlbaum.
- Turk, D.C., and Salovey, P. (1985). Cognitive structures, cognitive processes, and cognitive-behavior modification: I. Client issues. *Cognitive Therapy and Research*, 9, 1-17.
- Turk, D.C., and Speers, M.A. (1983). Cognitive schemata and cognitive processes in cognitive-behavioral interventions: Going beyond the information given. In P.C. Kendall (Ed.), *Advances in behavioral research and therapy*, Vol. 2. (pp. 1-32). New York: Academic Press.
- Turvey, M.T. (1974). Constructive theory, perceptual systems, and tacit knowledge. In W.B. Weimer and D.S. Palermo (Eds.), *Cognition and the symbolic processes* Vol. 1. (pp. 165-180). Hillsdale, New Jersey: Erlbaum.
- Tversky, A., and Kahneman, D. (1974). Judgement under uncertainty: Heuristics and biases. *Science*, 185, 1124-1131.
- Tversky, A., and Kahneman, D. (1981). The framing of decisions and the rationality of choice. *Science*, 211, 453-458.
- Vaihinger, H. (1924). *The philosophy of "as if."* London: Routledge and Kegan Paul. (Originally published 1911)
- Varela, F.J. (1979). *Principles of biological autonomy*. New York: Elsevier North Holland.
- Vico, G. (1948). *The new science*. [T.G. Bergin and M.H. Fisch. Trans.] Ithaca, New York: Cornell University Press. (Originally published 1744)
- Weimer, W.B. (1973). Psycholinguistics and Plato's paradoxes of the *Meno*. *American Psychologist*, 28, 15-33.
- Weimer, W.B. (1977). A conceptual framework for cognitive psychology: Motor theories of the mind. In R. Shaw and J. Bransford (Eds.), *Perceiving, acting, and knowing* (pp. 267-311). Hillsdale, New Jersey: Erlbaum.
- Weimer, W.B. (1979). *Notes on the methodology of scientific research*. Hillsdale, New Jersey: Erlbaum.

- Weimer, W.B. (1982). Hayek's approach to the problem of complex phenomena: An introduction to the theoretical psychology of *The sensory order*. In W.B. Weimer and D.S. Palermo (Eds.), *Cognition and the symbolic processes*, Vol. 2 (pp. 241-285). Hillsdale, New Jersey: Erlbaum.
- Winfrey, L., and Goldfried, M.R. (1986). Information processing and the human change process. In R.E. Ingram (Ed.), *Information processing approaches to clinical psychology* (pp. 241-258). New York: Academic Press.
- Zeleny, M. (Ed.) (1980). *Autopoiesis, dissipative structures, and spontaneous social orders*. Washington, DC: American Association for the Advancement of Science.
- Zeleny, M. (Ed.). (1981). *Autopoiesis: A theory of living organization*. New York: North Holland.