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When Emanuel Peterfreund's *Information, Systems, and Psychoanalysis* appeared in 1971, it posed a new and unusual challenge to traditional psychoanalytic beliefs. Peterfreund's work was not simply a development of ideas that were already competing within the ideological arena marked out by Freud's discovery of unconscious mental activity. More significantly, it presented a new framework of ideas within which the unique achievements of traditional psychoanalysis could be integrated with the profound conceptual changes currently taking place throughout the natural and biological sciences.

The effects of these changes are still only beginning to be felt, but they have already produced a picture of the universe quite different from that of Freud's time, a picture in which information has replaced energy as the central unifying concept. My primary objective in this essay will be to trace the significance of this changing world picture for psychoanalysis. *Information, Systems, and Psychoanalysis* has a central role in this inquiry. It raised many of the basic questions that must be answered if psychoanalysis is to maintain its position at the forefront of scientific thought.

Rubinstein (1975, 1980), whose investigations of psychoanalysis as a

revolutionary episode in the history of science have cast a bright light on the conceptual problems inherited by psychoanalytic theory from the prepsychoanalytic past (1975,1980), says in his preface to *Information, Systems, and Psychoanalysis*: "We are here on an adventurous journey, into what, from the viewpoint of most analysts, must appear as strange and exotic territory. But it is a journey that must be undertaken. The alternative is a standstill, as a consequence of which current metapsychology will most likely become increasingly alienated from science generally and hence scientifically irrelevant" (p. 6). And, in a recent symposium on the significance of Peterfreund's work, Bowlby (1981) notes:

> The material of psychoanalysis, it is sometimes contended, is not a kind that can be dealt with by means of conventional scientific procedures: it needs special procedures of its own. An alternative reaction is to search the current scientific scene to discover whether any of the more recent concepts and theories that have been developed can be harnessed to provide a model for psychoanalysis better fitted to its subject matter. This is what Emanuel Peterfreund has done. (p. 187)

Reppen (1981), in his introduction to the same symposium, remarks: "It is curious that Peterfreund in his updating of Freud delivers another narcissistic blow to man's old view of himself as central in the universe. To Freud's earlier observation that man is not master in his own house must now be added the notion that man may be merely an automaton-one must hasten to add, perhaps to soften the injury, an incredibly complicated one" (p. 159). Reppen seems to be suggesting that this narcissistic injury was responsible in large part for the "considerable neglect" from which Peterfreund's work has suffered. This neglect

has taken place, as Reppen notes, despite Peterfreund's training and origins in the mainstream of psychoanalysis. Peterfreund, who attended the City College of New York and the University of Chicago Medical School, trained at the New York Psychoanalytic Institute. He is an associate clinical professor of psychiatry at Mount Sinai Medical School as well as a member of the American Psychoanalytic Association.

The resistance to Peterfreund's revolutionary contribution to psychoanalytic theory illustrates the difficulties encountered by a scientific community when its investment in the past becomes an obstacle to further advancement. *Information, Systems, and Psychoanalysis* goes directly to the heart of the problem in the older theory. It provides a point of view, first of all, from which the conceptual inconsistencies of traditional metapsychology can be clearly inspected. It makes the cumbersome improvisations required to circumvent these inconsistencies visible for what they are.

As in the psychoanalytic process itself, the diagnosis is the beginning of the cure. A different kind of theory was needed, a theory at once simpler in its essentials and more advanced in its powers of implication, the kind of theory Copernicus offered to the tradition-mired astronomers. While many analysts were wondering whether the desperate remedy to the problem of theoretical obsolescence was to cut the remaining ties between psychoanalysis and the rest of the science, Peterfreund was showing that better science was the only real choice.

SCIENCE AND PSYCHOANALYSIS

Freud was fascinated by the emotional shock effects produced by sudden, radical changes in the scientific world view. He saw the massive resistance to Copernicus and Darwin as evidence that their discoveries had undermined a collective fantasy of human centrality and mastery. He believed that psychoanalysis was meeting the same massive resistance because his discovery of the unconscious had undermined that fantasy even further (Freud, 1914).

Freud showed how tentative is our control over our own minds and how much of what we ordinarily consider to be within our conscious control is better thought of as belonging to something external to our self-awareness, a "psychic apparatus" functioning outside our consciousness and our capabilities for rational decision making. But his imagery for representing the psychological opposition between what he called the "I" and the "it" was little more than a metaphorical letting loose in the human mind of the purely physical forces that had been tamed during the nineteenth century in the factory and the laboratory.

Natural science in Freud's time was dominated by the notion of energy. The conceptual vocabulary from which Freud created his metapsychology was formed by the great advances in the physical sciences during his own lifetime. The discovery of the various forms and manifestations of physical energy, their interchangeability, and the conservation of quantities through transformations from one form of energy to another, made it appear that the physical universe had

been completely understood. The human mind seemed to stand outside this rush of physical transformations, as an interested but uninvolved observer.

Part of the shock effect of psychoanalysis resulted from its refutation of the myth of progress engendered by the advances in the physical sciences. This idea had been grasped by many as a replacement for the outmoded religious mythology that put humankind at the center of creation. But another aspect of the shock was its appropriation of the vocabulary of the physical sciences to reach its pessimistic conclusions about the power of the human mind. Freud's success in turning the myth of scientific progress against itself seemed to finish off whatever was left of collective human narcissism.

Nevertheless, the psychoanalysts who followed Freud developed a myth of their own, a myth that became an obstacle to further theoretical changes. If the discovery of the unconscious meant the ultimate deflation of human vanity and self-deception, then no further surprises about the nature of the mind could come from the other sciences. Any claim to that effect would have to be treated as a denial of the importance of the unconscious. The psychoanalysis of Freud's time would become the permanent basis for "a general psychology," even though its conceptual scheme had been inherited from nineteenth-century physics.

But, as *Information, Systems, and Psychoanalysis* repeatedly points out, science in our own time has moved in a direction that makes nineteenth-century

physics increasingly irrelevant to psychology. Contemporary science is primarily concerned not with forces but with structures and procedures. Its subject matter is the accumulation of patterned information in complex systems, biological and otherwise. An organism is no longer thought of by biologists as a collection of chemical reactions, but as a hierarchy of organizational structures. Within this conceptual framework, the human mind takes its place as a system like others, differing in the degree of its complexity but not in its possession of unique attributes or qualities.

Despite Freud's repeated minimizing of the role of rational thought in determining human behavior, his model of the mind in conflict requires the presence of a rational human agency—the ego—striving through intelligent procedures to dominate the naturally occurring chaos of instinctual forces (Freud, 1923). Freud's attempt to derive the structure of the ego from an evolutionary process guided only by the clashing of these unstructured natural forces was brilliantly conceived but doomed to failure from the beginning. Without a scientific conception that included information and structure as essential features of all natural process, it could not succeed.

To complete Freud's project for understanding the origin and development of the ego as a sequence of natural events, it is necessary to see that the natural world includes not only the clash of unstructured forces but, even more important, a hierarchy of procedures for conserving and transforming information

as well. Taking this approach, we are drawn inevitably to the idea that the large-scale intelligent procedures used by the human mind to do its work in the real world must be integrated systems of smaller and smaller intelligent subprocedures. These subprocedures, in turn, must exist independently in relatively simple nonhuman systems—in the genetic mechanisms of the living cell, for instance, and in intelligent computer programs.

Although psychoanalysis seems in retrospect to have been the first of the information sciences (Pribram & Gill, 1976), Freud's energic metaphor for the world of nature did not allow him to anticipate either the shocking realization that we share our sapience with microorganisms and machines or the freedom from anthropomorphic misconceptions that follows from the realization. By introducing psychoanalysis to the higher level of generalization made possible by concepts of information processing, Peterfreund restored the discovery of the unconscious to its proper place in the continuing sequence of disillusionments that must accompany the progress of science. Freud's momentous contributions were relieved of the burden of incredibility assumed by all final revelations.

THE PRIVILEGED EGO

The realization that the executive ego is also an "it" has not yet penetrated very deeply into the psychoanalytic consciousness. Peterfreund showed that the privileged ego, exempt from the constraints that apply to all other natural

systems, has been a refuge for psychoanalysts from the seriousness of Freud's scientific goals. Many analysts appear to believe that it would be "dehumanizing" to venture even a single step beyond the limit of Freud's personal achievement in unmasking the mechanical element in human mental life. Some have even insisted that subjective emotion, the most complex of integrative experiences, receives its due as an influence on human life only when it is represented with the poetic simplicity of a thunderstorm or a tidal wave. (The science of our grandparents' generation always seems soothingly humanistic when compared with our own.)

Information, Systems, and Psychoanalysis met this resistance head-on. Part 1, "A Critique of Current Psychoanalytic Theory," made the privileged ego the special target of its criticism. To the analyst who already thinks of the ego as an organizational concept rather than as the experiencing self, Peterfreund's proposal to remove this familiar term from the lexicon of psychoanalytic theory entirely may seem rather bewildering. But, despite the emphasis placed on this concept by the psychoanalytic ego psychologists, confusion on this point is still widespread in the psychoanalytic community. (Hartmann's [1950,1952] attempts to integrate organizational concepts into a theoretical framework derived from the concept of energy could never be fully convincing, for reasons already discussed here.)

Peterfreund's proposal was intended to focus attention on the inconsistency that results when the ego is exempted from the chaotic imagery with which Freud

depicted the rest of the psychic apparatus. By disregarding the role of the ego as an organizational structure in ego psychology, Peterfreund was deliberately sharpening the contrast between the inconsistencies of the older theory and the rigor promised by the new. As a tactic in the reform of psychoanalytic theory, this move may have misled many of the analysts he was trying to reach. As a statement that the structural attributes of the ego are not derivable from the energic axioms of the metapsychology, however, it has its own internal logic.

THE INFORMATION FRAMEWORK

Part 2 of *Information, Systems, and Psychoanalysis* (Peterfreund, 1971) "Basic Information-Systems Concepts," outlined the new frame of reference within which Peterfreund was locating psychoanalysis. Here, with the collaboration of Jacob Schwartz, a computer scientist, he presented a technically rigorous view of information

> [as] having to do with…patterns of physical events or the relationship between patterns of events. A pattern of one physical form can be transduced into a pattern of another physical form, and the latter in turn can be transduced into a pattern of still another physical form. What remains the same in this sequence is the information; it is the common factor in the sequence of changing patterns [p. 115].

What will seem strange to the psychoanalyst in this view is its neutrality with respect to the origin and meaning of the patterns being transduced or transmitted. Information is not necessarily "about" anything. It doesn't have to be

a “message” from a “transmitter” to a “receiver.” The motivation, if any, of the agents concerned, if any, is a separate problem to be taken up at another structural level. When a tree falls in the forest, a pattern of compression waves radiates through the surrounding atmosphere. This pattern constitutes information. Whether it falls on the ear of an organism, and whether that organism can interpret the information as the sound of a tree falling, are separate questions entirely. Peterfreund thus begins with the fundamental distinction in information theory. It separates the physical traces of events, the “evidence,” from any possible interpretation of their meaning or significance. The sound of a tree falling is a function not only of the pattern of air waves radiating from the tree, but of the information contained in the ear and brain of the listening organism as well.

How can this distinction be useful to the psychoanalyst? The analyst is concerned precisely with questions about the highest levels of organization, questions about motivation and meaning. That the sound of middle C is heard when the air is vibrating at so many cycles per second is hardly relevant to the experience of the opera lover. In contrast to Peterfreund’s position, Rosenblatt and Thickstun (1978) would restrict the use of the term “information” to the coded record of the physical events within the listening and interpreting organism or machine. This, they believe, would overcome the trivialization that might occur if “every nonrandom phenomenon in the observable universe” were considered to be information. But I think Peterfreund’s point that the more general definition

has greater power is a valid one, especially when psychopathology is concerned. The internally coded record of a physical event must in some essential respect be isomorphic with the actual event. For a particular listener or processor, how "nonrandom phenomena" are recognized as being both nonrandom and relevant to the listener's or processor's interests and needs, is still an important empirical question.

Peterfreund's formulation provides the useful reminder that in every hierarchical system, all constraints that apply at a lower level of the system also apply at all higher levels. We can substitute a patient relating a fantasy for the tree falling in the forest. What is heard by the listener is a function of the information contained in the listener's ear and brain as much as in the words and the tone of the speaker, but the listener must begin by responding to what is actually there in the patient's communication.

If the analyst hears what he or she considers to be evidence of a repressed infantile wish, the analyst's judgment must be tempered by specific information about the patient's state of mind at the moment and at crucial moments in the past, by general information about human development and the psychic mechanisms of repression and symptom formation, and, finally, by information about the analyst's own state of mind in the present and throughout his past. This information must all be internally consistent and it must all fit together to form the optimal interpretation.

Peterfreund points out that at any moment in a typical analysis much of this information is either unavailable or unverifiable. A major function of psychoanalytic theory in the clinical situation is to provide hypotheses to fill in temporarily for the missing information. When these hypotheses are themselves consistent they can be helpful to the analyst in organizing the information actually available and in identifying specific questions that still need to be answered. But if the analyst's hypotheses contain internal contradictions, they will necessarily produce distortions in what the analyst hears.

Because every theoretical formulation is the product of its own historical development, it will always be subject to further modification as new information becomes available. Information theory suggests a number of ways to minimize the consequences of having to work with a fallible theory. One is to be on the alert for inconsistencies between levels in the hierarchy of theories that supports the theory in question. This means that although biological and psychological theory cannot "explain" the particular phenomena with which the psychoanalyst is concerned, no hypothesis of psychoanalysis can be allowed to contradict what is known at the time about biological and psychological processes.

Perhaps the most dramatic example of a contradiction in the hierarchy of theories underlying psychoanalysis is the one that resulted from the discovery by Aserinsky and Kleitman (1953) that dreaming sleep occurs in a constantly repeated pattern of 10 to 20 minute periods occurring at regular 90-minute cycles

throughout the night, regardless of the content of the dreams. This laboratory finding renders untenable the traditional psychoanalytic view that dreams are *caused* by the eruption of repressed impulses from the unconscious (Freud, 1900). It takes nothing away from the clinical observation that repressed wishes are *expressed* in the content of dreams, of course. But it does undercut the entire theoretical structure built on the assumption that impulses are capable of achieving expression without the cooperation of the executive apparatus.

In the case of dreaming, the executive apparatus is creating and delimiting the opportunities for repressed wishes to be expressed as dream contents. This implies that the expression of the repressed wishes is not the result of a self-initiated drive for discharge but part of an adaptive process for evaluating the urgency of the impulses being aroused by current life experience (Palombo, 1978, 1980). A consistent psychoanalytic theory will have to take these nonpsychoanalytic facts into account. This example illustrates the general point that every higher-level theory has embedded within it a host of lower-level theoretical assumptions. For this reason, psychoanalytic theory cannot be skimmed off the top of the human sciences and treated as if it were completely independent.

Without an explicit awareness of lower-level assumptions, it is difficult to specify what would constitute reliable evidence for or against a prediction made by a higher-level theory. Observations and predictions must each be formulated at

the same level of precision to be useful in testing the validity of a prediction. For the psychoanalyst trying to match global theoretical conceptualizations with fragmented samples of the patient's intrapsychic experience, this can be critical. Information theory can be of considerable help here, because it requires the theorist to be clear about relationships between hierarchical levels and component subsystems.

The result is an opportunity to subdivide a problem as often as necessary for its components to match the scale of the phenomena being observed. John Clippinger's brilliant computer simulation of a patient's production in psychoanalytic therapy provides a dramatic demonstration of this method at work (1977). The simulation begins with a repressed sexual wish uncovered toward the end of a session. Five interacting structures transform this input by generating a formal expression for the wish, giving it a linguistic form, censoring it, revising it to conform to the censorship, and reintegrating the censored version with aspects of the original wish.

The output of the simulation is a passage that almost exactly matches the transcript of an earlier interaction during the hour in which the patient's conflict was expressed in what seems like a random and aimless digression. Of special importance is the network of connections among the five internal structures of the simulation that Clippinger calls Leibnitz, Calvin, Machiavelli, Cicero and Freud. Each of these structures has the power to interrupt and modify the output

produced by some but not all of the others. The original wish passes through each of these structures many times. By dividing the processing among these interacting components, Clippinger was able to master the complexity of the patient's internal production of the text.

Peterfreund gives priority to what can be directly monitored in the therapeutic situation—the feedback loops that regulate the interaction of the patient and the analyst. The importance of feedback as an error-correcting procedure was recognized by Shannon and Weaver (1949) as early as 1942. Monitoring the differences between the current situation and the desired outcome was shown to be an essential feature of any complex problem-solving system by Newell, Shaw, and Simon (1957). Miller, Galanter, and Pribram (1960) applied this principle as a general tool for analyzing the behavior of organisms. They showed that every action performed by an organism presupposes a preexisting goal and a plan for reaching that goal. After an action has been completed, its success in reaching the designated goal is evaluated by the organism. Before any subsequent action is to be taken, errors are identified and the plan modified to reduce them. The stream of behavior produced by the system is therefore the integration of many repetitive cycles of planning, acting, evaluating, and correcting.

Analysts who understand only a part of what they need to know about a patient can add to their understanding by breaking down the patient's stream of behavior, identifying the patient's moment-to-moment goals, reconstructing the

patient's plans for achieving them, and noting how the patient modifies the plans when they fail. To do this, analysts must continually test their own theoretical formulations for *their* success in helping to identify the *patient's* goals and to reconstruct his or her plans. From the analysis of these feedback loops, larger structures can be discovered. For example, it is quite likely that the patient has his or her own set of more general plans for modifying unsuccessful moment-to-moment plans. These more general plans may be either adaptive or defensive. If adaptive, they will enhance the flow of information through the patient-analyst system. If defensive, they will constrict the flow of information. The same may be said for analysts' procedures for dealing with discrepancies between their theoretical formulations and the patient's actual behavior. Most of this monitoring and processing takes place outside the analyst's direct awareness. It is usually referred to in noncognitive terms, as intuition, identification or empathy.

Peterfreund's argument suggests that there is nothing to lose and everything to be gained in making these procedures explicit. His new book, *The Process of Psychoanalytic Therapy* (1983), shows how ideas derived from information theory can make a critical difference in the technique of psychoanalysis. This important practical issue will be considered, along with this new work, later in this chapter.

THE SELF-INITIATING IMPULSE

The conceptual distinctions of information theory lead to significant

theoretical differences with traditional psychoanalytic metapsychology. As I mentioned earlier, the idea of a self-initiating impulse has been radically undermined by the findings of the sleep laboratory. But this idea is also incompatible with the information theory point of view on very general grounds, as well as with the principle of psychic determinism, emphasized by Freud as a major discovery of psychoanalysis. Within the information-processing framework, the Freudian "impulse" is actually a compound formed by matching competing demands for the gratification of a need with competing plans for achieving a desired gratification. At any moment, priorities must be assigned to current needs and then an optimal plan chosen from the many possible plans available. The choice of a plan will depend on many determining factors. If the demand is an urgent one, for example, the corresponding action will very likely follow a preplanned routine designed to be set in motion on extremely short notice. A preplanned action of this kind will necessarily be simple, direct, nonspecific, and inflexible. These are the characteristics used in traditional psychoanalytic theory to support the notion that "impulses" are self-initiating, peremptory, and indifferent to the particular channel for discharge open to them at the moment. This, in turn, is taken to justify the radical separation of "impulses" from other forms of mental activity.

That neurotic patients see their impulses as alien objects breaking into their minds from outside is evidence that the mechanism of repression is at work, nothing more. Since the objective of psychoanalytic treatment is to overcome

patients' needs for such dramatic misrepresentation of their own mental contents, it is surprising to find many psychoanalysts feeling that a scientific theory of the neuroses should adopt this subjective misperception.

A misunderstanding that comes up again and again in my conversations with other analysts about this issue is the belief that terms like "planning," "decision making," "goal seeking" and "problem solving" are anthropomorphisms inappropriate for describing the simplest expressions of biological and emotional need. When I point out that these operations can be carried out at any level of complexity and that very simple computer programs act in ways that can only be described in these terms, they tell me that the human mind is not logical like the computer. I asked one rather thoughtful senior colleague if she believed that the human mind is more like a pot of boiling water. After a moment's reflection, she nodded her head and, in all seriousness, said yes.

We are talking here about programming structures built up from conditional statements that take the following form: "If X is true, carry out the next instruction, Y; otherwise jump to instruction Z." The logical result of this procedure would be exactly the same as in the case of an "impulse" seeking discharge through one (preferred) channel but moving on to another if it finds that the first one is not accessible. The structure of the discharge channels and their gates is no less a logical structure than that of the computer program. The difference is not in the logic, but in the relationship between the logical elements

and the activity of the system as a whole. In the computer program, as in the simplest organism, the logical structure is incorporated into the process that initiates, regulates, and terminates the activity of the system. For example, the X in the statement, "if X is true, do Y," is not usually a value fixed before the execution of the program, but rather is the result of a computation determined while the program is actually running. Interlocking feedback loops give the system the potential for combining simple logical structures to form more complex ones. The logical structure is flexible, active, and self-modifying.

In contrast, the logical structure that determines the discharge pathway of the "impulse" in traditional psychoanalytic theory is rigid, passive, and inert. Because the impetus for the act of discharge comes entirely from the impulse, the logical structure has no motivation to respond to the passage of the impulse or to modify itself as a result. It is simply not an interested party to the transaction. For this reason, it is often represented metaphorically as a hydraulic system of rigid channels and solid barriers.

It is difficult to imagine either how or why such a system would evolve into an executive ego capable of adapting itself to a complex external environment. "Reality" is supposedly the agent of change here, but, to my knowledge, neither a mechanism nor a source of motivation has ever been proposed through which such a system might be capable of organizing itself to interact with the outside world. This conceptual poverty is the price psychoanalysis has been willing to pay

for a selfinitiated "impulse" that operates outside the adaptive information-processing structure of the organism in which it resides.

HIERARCHICAL STRUCTURE

Part 3 of Peterfreund's (1971) *Information, Systems, and Psychoanalysis*, attempts to show how complex hierarchical structures that evolve naturally from simpler information-processing structures can give a comprehensive account of the subject matter of psychoanalysis with a significant gain in coherence. A critical issue is whether the systems of structures traditionally classified as "id" and "ego" can be distinguished through their relationship or lack of relationship to the outside world.

Peterfreund argues persuasively that a motivational structure, as the id is considered to be, must be able to direct its activity toward actual opportunities for gratification and not merely to rigid "discharge channels" (see Rosenblatt & Thickstun, 1977, 1978, for a fuller development of this theme). An immature and vulnerable organism cannot afford the luxury of self-initiating impulses lacking an adaptive function. The human infant is a little different in this regard from its phylogenetic ancestors. With the protection and support of its parents, it can afford, temporarily, the *fantasy* of an autonomous impulse life. But even if the infant could actually dispense with an adaptively functioning psychic apparatus in the earliest weeks or months of life, there is no possible scenario through which

even a temporarily nonadaptive psychic apparatus could have survived the evolutionary struggle.

For similar reasons, there is no possibility that an adaptive ego could evolve ontogenetically from a primitive psychic apparatus that itself lacks the capacity to adapt. The Freudian id is a concept that ruptures the evolutionary sequence just at the point of its crucial transition from slow-motion information processing in the genetic mechanisms to highspeed information processing in the brain. Interposing a state of chaos between these intimately interactive stages of evolution is mythological thinking, supported, like all mythological thinking, by out-of-date science. It makes little difference that the out-of-date science in this instance is only a century old.

Peterfreund's proposals for a unified conceptual framework represent an important advance over the "continuum" of structures extending from id to ego suggested in 1963 by Gill. It replaces the one dimensional continuum with a multiply branching hierarchy, in which id functions are distinguished from ego functions by their relative simplicity and more direct relationship to biological events, but not by a lack of adaptive significance.

FEELING AND FUNCTION

The psychic apparatus in Peterfreund's theory is driven not by subjective feeling states, but by adaptive decision making. As we know, important decisions

made in pathological states may have serious maladaptive effects. Peterfreund points out that this is often due to a deficiency in the quality or appropriateness of the information on which the decisions are based, because of repression and other information-degrading defensive operations. Alternatively, it may be due to developmental defects caused by failures of feedback at crucial stages of structure building. The subjective experience of an intruding impulse is a mental representation of the faulty outcome of a decision-making procedure. It is not an actual perception of the psychic apparatus at work.

Since this is a point that is difficult for many people to grasp, I think it is worth elaborating. A frequent complaint about information theory is that it does not "account for" the subjective experience of feeling or the motivating effects of feeling states. As we noted in the example of the falling tree, two very different kinds of theory are required to understand the nature of the information generated by an event and the interpretation of that information by a living observer. This is no less so when the event and the observation take place within a single person.

Although a systematic method of interpretation may produce substantial benefits (as Freud's system of dream interpretation does), it does not constitute a scientific theory if it explains only the subjective interpretation of events by the human mind and not the events themselves. Freud was aware of the importance of this issue when he tried to supplement his method of dream interpretation with

a theory of dream construction. Now that many of the original assumptions of that theory have been refuted in the sleep laboratory, it is possible to see more clearly that the interpretive method is largely independent of it.

Maintaining this distinction can be helpful. It means that (1) the interpretive method will not be any less valuable if the old theory of dream construction loses its persuasiveness, but (2) the interpretive method is very likely to be improved if it is supported by a more accurate understanding of the psychological events underlying the subjective states of dreaming. "Psychological" in this context refers to the vast amount of information processing that normally takes place outside conscious awareness, even during sleep.

The sensory impressions experienced by the dreamer are something quite distinct from this underlying process. So, too, are the dreamer's affective states. Freud's psychic energy theory was a response to his realization that neurotic patients acted as if they were "feeling" something they were not subjectively aware of. The supposed transformations of psychic energy represented the unknown events underlying the otherwise inappropriate actions. The idea that these actions are the expression of "unconscious affects" is contrary to the spirit of Freud's attempt to support his observations with a noncircular scientific explanation. Information theory is a more rigorous approach to the underlying events that Freud was trying to reach.

Peterfreund shows that the traditional treatment of feelings in psychoanalytic discourse (not necessarily Freud's) is dualistic and inconsistent. The complaint that information theory is too complicated to explain the directness and simplicity of instinctual impulses is contradicted by the objection that it is not complicated enough to explain the subtlety and discriminative capacity of higher-level feeling states usually associated with the ego. These include, among many others, esthetic judgment, creative inspiration, and empathic identification.

These higher-level feeling states are usually described in two different and mutually exclusive ways, often at the same time. In the more traditional description, higher-level feeling states are considered to be cognitive processes that are simply accompanied by painful or pleasurable affective charges of varying intensity. Here the complaint that information theory is inadequate to explain these states is irrelevant from the beginning, because for this model there is no structural relationship of any kind between thought and feeling. Feeling is either painful or pleasurable. Any element of differentiation belongs to the cognitive rather than the affective order.

In the more current psychoanalytic approach, higher-level feeling states are derived from lower-level states through a process of internal differentiation and maturation, under the guidance of the developing ego. This idea is more consistent with the data of child observation accumulated over many decades. But the crucial point is that this process of differentiation and maturation cannot be described

without the concepts of information theory. A simple thing cannot evolve into a complex one except through a reorganization of its original substance. Information theory is the science of organization. A simple feeling, like the pleasure of sex, and a complex feeling, like the mature love of a sexual partner, are somehow made of the same stuff, differently arranged and organized. That observation was and is still the underpinning of Freud's therapeutic method.

Both these descriptions of higher-level feeling states lead, if thought through independently, to information theory. The failure of one well-known attempt to circumvent this conclusion can be helpful in understanding why. Hartmann (1952) tried to derive the development of psychic structure from the process Freud called "neutralization." His idea seems to have been that when sexual and aggressive energies are mixed in the right proportions, their "active principles" react with each other to form a stable product. (We will overlook for the moment the absence of a mechanism for determining "the right proportions" or for regulating the process of mixing, whatever that is taken to be.)

The analogy is clearly with the chemistry of acids and bases. When solutions of an acid and a base are mixed, their ionic components, initially distributed at random in the solution, combine and precipitate out to form a crystalline structure lacking the corrosive properties of the original reagents. The salt formed in this way becomes the metaphor for the ego. But the structure of the salt is simply an endless repetition of a simple geometric form. It is an arrangement with

no capacity to change in response to events or to incorporate any new information from its environment into its own structure. The "growth" of the crystal has nothing whatever to do with the maturation of the ego. As a metaphor for human development it is completely lifeless.

But a tolerance for dead metaphor as a substitute for missing theory is not uncommon in the psychoanalytic world. For some, a theory need not be any more than a recognizable word picture. Its purpose is to resemble the mind, rather than to explain it. Like my friend who thought that a pot of boiling water is a meaningful representation of the mind, they believe that a muddled theory is needed to do justice to the muddle of motivations contained in the unconscious.

THE PERSISTENCE OF THE PRIMITIVE

This brings me to an important area in which Peterfreund's thinking needs to be supplemented by a further application of information theory. This is where he tries, unsuccessfully in my opinion, to deal with an important set of observations that motivates much of the dualism in psychoanalytic thought. One might call this issue "the persistence of the primitive."

As Peterfreund sketches the hierarchy of psychic functions, he stresses the dimension of complexity almost to the exclusion of other differences that may exist between lower-and higher-level functions. The picture he presents is one in which simpler functions appear to lose their individual identities as they are

incorporated into or evolve into the more complex. In information-processing language, the levels of the hierarchy are "tightly coupled" (Pattee, 1973). An example in nature is the multicellular organism. This is a hierarchy in which the smallest units, the cells, combine to form the tissues; the tissues join to make organs; and, finally, the organs interact to constitute the complete organism. Only at the level of the organism as a whole is there anything that can be called an independent unit.

This might appear at first glance to be a natural model for the psychic apparatus, functioning as it does as the control system for an organism. Schafer (1976), for example, makes a point of insisting that only the hierarchical level of the whole person be acknowledged by the psychoanalyst. But in taking this position, Schafer disregards another of Freud's (1911) major discoveries, that at least two levels of the psychic apparatus—the primary and secondary processes—are, in functional terms, only "loosely coupled." Hierarchical levels that are loosely coupled function independently of one another. In the large-scale organization of matter, for example, stars and galaxies are very loosely coupled. Emergent properties often appear when a higher level is only loosely coupled with those below it, as when molecular properties emerge from atomic interaction or linguistic behavior from hominid intelligence. Living systems are loosely coupled with their physical environments, although tightly coupled within themselves.

Interesting questions arise when we try to determine the conditions under

which tight couplings seem to change to loose couplings and vice versa. The origin of life is one of these, as is the separation of individual galaxies from the primordial mass of matter and energy. A possible definition of psychoanalysis might be "the study of the psychic conditions in which the coupling of primary and secondary processes changes from tight to loose and back again."

Peterfreund prepares us for the view of the primary process as a loosely coupled level of psychic organization when he speaks of it as an information-processing activity that takes place at a lower level of complexity than waking thought. For him, the critical question is the membership of the primary process in the hierarchy of adaptive functions. He tries to derive the functional properties of primary process activity from the features it has in common with more complex cognitive activities that have clear-cut information-processing functions.

This demonstration is persuasive, but it fails to answer a question that has drawn some public criticism to Peterfreund's work. This, once again, is the question of the persistence of the primitive. Why, if the primary process is simply a lower level of psychic functioning, does it take on a life of its own, both in dreaming and in other mental states, where it appears at times to intervene in the normal processes of waking thought? Why, under these conditions, is it only loosely coupled with the higher-level activities into which one might expect it to be absorbed? (We are putting aside for the moment the observation that the primary process is always at work behind the scene of waking consciousness,

supplying memories and correspondences not accessible through the normal channels of logical or narrative thought. Under ordinary circumstances of waking life the primary process does function as if it were tightly coupled to the higher levels of mental activity.)

How are we to explain those occasions, most notably dreaming, in which the primary process appears to be very loosely coupled, if at all, with more advanced forms of cognitive activity? There is a simple and straightforward information-processing explanation. The primary process has its own cognitive function that is separate from, although necessary to, the functioning of higher-level processes. This explanation implies that the adaptive goals of primary process activity can and must be achieved independently of whatever further use the secondary process may make of them.

When we observe the primary process working to accomplish its own adaptive goals, as in dreaming, it is only loosely coupled to higher processes. When we observe the products of the primary process being utilized directly in the pursuit of goals of a higher order, as they are, for example, in the creative process, the two levels of mental activity appear to be tightly coupled. The "products" of the primary process I refer to are the uniquely individual associative links that combine to form the treelike structure of human long-term memory. These links connect the isolated elements of our experience across a range of contexts much wider than their original historical relationships. They provide the

raw materials for all forms of reasoning by analogy, from simple problem solving to inspired acts of the creative imagination.

In dreaming we find the primary process doing its normal adaptive task of matching new experience with related experience of the past. The dream image is a composite of past and present events, a test, as in Galton's photographic method, of their "family resemblance." (Freud (1900) described how Galton had superimposed photographs of family members to find their common features. He suggested that the mechanism of condensation in dreaming is doing the same with events and experiences.) The process of dreaming is physiologically isolated from waking thought so that the full resources of the sensory projection mechanisms can be used for this task. (Palombo, 1976, 1978).

Loose coupling of the primary process is also characteristic of the neuroses. But the explanation for it in this case is not the same as it is in dreaming. In neurotic symptom formation, the uncoupling of primary and secondary processes is an artifact, the result of pathological defensive operations motivated by anxiety. It was one of Freud's (1894) earliest discoveries that this uncoupling of consciousness does not result, as intended by the defenses, in the exclusion of primary process input from the behavioral control mechanisms. Instead, the primary process input influences behavior directly, without passing through the normal sorting and filtering by higher-level cognitive processes.

This capacity for independent action is strong evidence that behavioral control did not pass automatically from the lower to the higher structures as the cognitive hierarchy evolved. The higher-level structures must be something much more like coordinating mechanisms than structures of direct control. Control actually remains distributed at all levels, perhaps most tenaciously at the lowest. It is the conscious illusion of control that makes neurotic patients vulnerable to sabotage by the products of their repressed and unintegrated primary process activity.

THEORY IN PRACTICE

How is the theoretical difference between the self-initiating impulse and loosely coupled lower-level information-processing structures applicable to the psychoanalytic treatment process? The traditional theory addresses itself to two kinds of therapeutic events, the release of dammed up psychic energy at the primary process level and the acquisition of insight at the secondary process level. Through the insight that comes from having the "unconscious made conscious," the released energy is said to be redirected into more adaptive discharge channels.

The problem with this model is that it fails to account for the building of new psychic structure during an analysis. It rests on the assumption that the therapeutic effect of psychoanalysis results exclusively from the removal of

defensive barriers to the utilization of already existing structure. Developmental theory and object relations theory have moved far beyond this view of psychoanalytic therapy, but they have not supplied a rigorous theoretical alternative to it. Despite its enormous promise for psychoanalysis, for example, Piaget's information-processing approach to development has not yet been successfully assimilated by object relations theory. But even without new theory, the empirical evidence gathered in the analyst's office shows very little correlation between patients' conscious insight and the therapeutic benefit of analytic work.

It has become the custom in the psychoanalytic world to speak of analytic treatment as an integrative process that may become conscious to the patient in varying degrees. And it is customary to speak of the integration of the more primitive aspects of the patient's mental life into the larger structure of his or her ego. How this happens in the day-to-day work of the analysis remains a mystery for the traditional theoretical model, which does not provide the mechanisms for this transformation. Most particularly, it does not allow for the active participation of the primary process in the work of integration.

From the information-processing point of view, the treatment process is a series of coordinations or couplings that bring lower-level functions isolated by the defenses into a more collaborative relationship with higher-level functions within the hierarchical structure of the ego. The primary process is not merely a passive partner in this work, a source of energy to fuel the organizing activity of

the ego. It supplies vital information about current needs and about the accumulated record of past events in which similar needs were acted on with varyingly successful outcomes.

As the analysis proceeds, defensively isolated associative structures are restored to functioning through the reopening of blocked connecting pathways. At the same time, new pathways are constructed and integrated into a reorganized set of more efficient higher-level structures, as required by the particular circumstances at each point in the patient's development. A vital part of every analysis is the discovery of these requirements. Nothing of the complexity of interaction among the multiple components of the patient's psychic apparatus is captured by (or comprehensible to) a theory that views all change as the simple rechanneling of impulses.

Peterfreund's long chapter on the treatment process in *Information, Systems, and Psychoanalysis* (1971) appears near the end of the book, but was actually written first. It describes the treatment process from a more intuitive position derived from an examination of the analyst's empathic identification with the patient as a feedback process that governs the progress of treatment. In a series of later papers (1973,1975a, 1975b, 1978, 1980; Peterfreund & Franceschini, 1973), particularly in "How Does the Analyst Listen? On Models and Strategies in the Psychoanalytic Process," Peterfreund (1975a) refined and expanded this application of information theory to the treatment situation.

A HEURISTIC APPROACH TO PSYCHOANALYTIC TREATMENT

These later ideas have been brought together in *The Process of Psychoanalytic Therapy* (Peterfreund, 1983). As in the earlier works, Peterfreund's emphasis is on the role of feedback processes in the moment-to-moment interaction between patient and analyst, rather than on the long-term buildup of psychic structure within the patient. This is a return to the problem of technique that originally motivated his interest in information theory. He mentions his concern that his efforts to promote the assimilation of a comprehensive new theoretical system into psychoanalytic thought may have diverted attention from his more concrete technical proposals.

The Process of Psychoanalytic Therapy attempts to circumvent this problem by separating the technical issues, as far as that is possible, from the theoretical. Traditional ideas are criticized in this work not because they are inconsistent or illogical, but because they impede the flow of information between the patient and the analyst. Although information-processing concepts underlie the technical approach, information-processing terminology is replaced for the most part by more familiar language. Questions of the scientific authenticity and historical development of psychoanalysis are relegated to the remote periphery of the discussion. Everything is subordinated to the single issue of clinical efficacy.

The result is a profoundly illuminating demonstration of the applicability of information theory to a central problem of clinical psychoanalysis. The book

begins with a discussion of the analyst's use of theoretical knowledge in working with a patient. Peterfreund distinguishes between stereotyped and flexible approaches, which he compares with the "algorithmic" and "heuristic" methods of problem solving used by intelligent computer programs.

In the algorithmic method, a fixed sequence of procedures is designed that will guarantee the desired result if followed precisely. This way of doing things works only for very simple problems, where a limited number of possible outcomes can be evaluated within a reasonable time. In more complex situations, the problem solver must be able to search the enormous array of possible solutions by comparing the alternatives at each decision point according to the probable outcomes calculated from its previous experience with similar situations. It must also be able to back up from a disadvantageous position when past experience has failed to provide the required solution for the problem immediately at hand and return to the previous decision point to begin the search once again.

This method is heuristic because it allows the problem solver to find his or her way without knowing the exact dimensions of the problem in advance. The problem solver is discovering what the problem is in the process of solving it. ("Heuristic" comes from the Greek verb *heurein*, to find or discover, as in "Eureka!") This is, Peterfreund says, what analysts are required to do. When they approach a patient's problem heuristically, they use their own theoretical

knowledge to evaluate the probabilities at the many decision points that must be traversed in the process of discovering the real nature of the problem. They must be able to judge whether their theoretical expectations have been fulfilled as the process continues and to back up and modify their expectations when they have not.

Analysts who are working stereotypically do not follow these steps. They allow themselves to think they understand the problem before having had the opportunity to investigate it. They then try to fit what the patient says in the office into their initial formulations and tend to ignore or misinterpret whatever fails to fit. Although this might seem like an easy pitfall for any well-meaning analyst to avoid, Peterfreund shows with examples taken from the psychoanalytic literature and from his own experience that there are many hidden traps for the unwary. Most important, he shows that the reductionistic bias of traditional theory encourages the tendencies to clinical stereotyping created by the paucity and distortion of information with which the analyst must always contend.

Over and over again, it becomes clear how the analytic interchange can be transformed from a feedback loop into a vicious circle if the analyst allows theoretical expectations to interfere with efforts to discover what really happened in the mind of the patient during development and current life situation. Problems can be resolved if the analyst cuts through the circularity of the patient's defensive operations and directs the patient's attention to the fact or feeling missing from

the repetitive story he or she has been telling. Peterfreund reports his successful interventions and his missed opportunities with equal objectivity, using follow-up inquiries as well as retrospective reconstruction to pinpoint the critical turn in each case.

The idea of the self-initiated impulse reappears in this context as an obstacle to the therapeutic process. After Freud's (1905) disillusionment with his mistaken idea that hysterical patients had been seduced by their fathers, he began to see the actual events of his patients' lives (intrapsychic as well as interpersonal) as of only minor significance. The real sources of the patients' difficulties were their dominating instinctual impulses. These impulses could seize on and control any fragment of the patients' experience that suited them as a means to their expression or "discharge."

Patients' presentations were valuable pictures they provided as they had been those experiences. The specific details of that experience were somehow relevant to their illness, but could not be identified with their causes. The lack of coherence in the patients' life stories was evidence of conflict in dealing with their impulses, but the missing details of the stories were not expected to explain the nature of the conflicts.

Few analysts (certainly not Freud himself) have tried to model their conduct of analytic treatment exclusively on this rigid schema. But Peterfreund shows how

the idea of the self-initiating impulse can operate in the background as a justification for denying the analyst's need to know the specific details of the patient's life story. The two kinds of impulse, aggressive and libidinal, are a small but well-known quantity. It is not unreasonable to try to resolve uncertainties about the meaning of the patient's communications by appeal to the most primitive features of instinctual life. The extensive clinical examples in *The Process of Psychoanalytic Therapy* show that these assumptions can be fatal to the progress of an analysis.

WORKING MODELS

To describe his technique for bringing coherence to the patient's life story, Peterfreund adopts Bowlby's conception of "working models." These are, in Bowlby's (1969) words, "the internal worlds of traditional psychoanalytic theory seen in a new perspective" (p. 82). In Peterfreund's thinking, these models are like the stored programs used by a computer. They provide not only a representation of some limited area of experiences, but also a plan of action for operating within that area. Unlike the vast majority of computer programs currently in operation, however, working models are self-modifying in the light of further experience.

They are, in other words, component systems in the overall adaptive structure that generates and regulates the experience and behavior of the person. Many of these components are actually miniature versions of the entire system,

functional representations of the system as a whole. They can be temporarily modified for the purpose of exploration and experimentation, so that they can perform what Freud called “trial actions” with minimal risk.

None of these miniature representations is complete, of course. They are simulations, constructed from a variety of simplifying assumptions. For this reason, a great many of them are required to represent the overall system to itself, including its various modalities of interaction with the outside world. Conflict between the models is not only possible but inevitable. Leibnitz, Calvin, Machiavelli, Cicero, and Freud in Clippinger’s (1977) simulation are each working models within the larger working model of the main program itself.

Peterfreund lists eight major working models employed by the analyst. The first is the analyst’s knowledge of the world in general, as it operates in normal circumstances. Second is the analyst’s model of his or her own personal history and the stable elements of his or her own selfrepresentation. Third is the normal developmental sequence of cognitive and emotional experience. Fourth is the phenomenology of the analytic process. Fifth is the analyst’s general clinical experience. Sixth is the analyst’s model of the particular patient as a “total experiencing human being.” The seventh model includes two theoretical metamodels, one a theory that explains psychopathological mechanisms, the other a theory that accounts for the therapeutic effect of the analytic process. Finally, there is an eighth model, a higher-level metamodel that integrates the explanatory

concepts generated by all the others. There are obviously a great many component models at all levels with varying degrees of independence and interdependence. When the analyst processes the information provided by the patient, he refers it to each of his own relevant working models. The analyst then begins the sometimes arduous labor of reconciling inconsistencies that develop among the various models as they are updated by the new information.

Most of *The Process of Psychoanalytic Therapy* is devoted to a discussion of clinical cases in which the reconciliation of these inconsistencies required both flexibility and insight from the analyst. Peterfreund's illustrations are themselves models of the therapeutic process at work. It would be a grave injustice to try to condense them into a few words in a brief essay such as this one. Suffice it so say that *The Process of Psychoanalytic Therapy* is probably the best book of its kind available to teachers and students of psychoanalytic therapy today.

Beyond this major work of Peterfreund's, one can see still another contribution of information theory to clinical psychoanalysis. This will be a rigorous account of primary process activity as it relates to the therapeutic process. The patient's primary process thought is, in fact, the primary source of information about the patient's earliest experience in dealing with his or her needs and wishes. The primary process of the analyst functions in the therapeutic situation by matching his or her internal models of the patient's mental life with the derivative representations of that early experience communicated to the

analyst by the patient.

Peterfreund (1983) brings us to the edge of this conception when he says, for example:

> All working models are changed by the very information received. They must be constantly updated, adapted, readapted, checked and rechecked for consistency—both for internal consistency as well as for consistency with other models. Such processes are basic aspects of learning and are apparently in large part associated with the phenomena we call "consciousness" or "awareness" [p. 83].

The "larger part" not associated with consciousness or awareness has attracted the puzzled attention of psychoanalysts for a very long time. Peterfreund's translation of "empathy" into a system of working models is an important step toward the solution of the puzzle.

CONCLUSION

The movement of history has carried psychoanalysis beyond the limits of Freud's extraordinary achievement. Peterfreund's contributions mark the entrance of psychoanalysis into a new era of scientific thought. As with all pioneers, he leaves many tasks of exploration and consolidation to be done. But he has established the broad outlines of a comprehensive new framework within which traditional psychoanalysis can be safely embedded.

Scientific revolutions, no matter how long postponed, have an inevitability

about them. They succeed by sheltering the living tradition within a reconceptualization of greater power and comprehensiveness. Copernicus' first concern when he turned the solar system inside out was to save the phenomena of astronomical observation. Peterfreund's work has already fulfilled the promise of information theory to extend the conceptual universe of psychoanalysis while making its day-to-day observations clearer and more precise.

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