The Journal of Mind and Behavior
Spring and Summer 1986, Volume 7, Numbers 2 and 3
Pages 345 [215]-378 [248]
ISSN 0271-0137
ISBN 0-930195-02-7

Logical Structure and the Cognitive Psychology of Dreaming

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It is suggested that dreaming exhibits logical structures such as *either/or* and *negation* relations, but that the modes of expression of logical relations in imaginal processes are different from typical waking modes. While it was Freud who first pointed out such structures in his *The Interpretation of Dreams*, it is suggested that logical relations in dreaming can be studied independently of the psychoanalytic framework. Historical reasons for the lack of research into the logical structure of dreaming are explored. Preliminary data are presented along with methodological strategies for eliciting logical relations. The validity and definition of dream "content" and dream symbolism are discussed as well as implications for establishing a field of "dream" research. Attention is paid to the concept of abstract feature analysis in cognitive psychology.

The conceptual distinction between the study of *dreams*, on the one hand, and the study of *dreaming*, on the other hand, has become not only an accepted distinction, but a kind of covert Maginot Line dividing those who study the content of *dreams* (e.g., interpretation of dream symbols; the meaning of dreams) from those who study *dreaming* as a process (e.g., REM and NREM differences; memory storage and retrieval). While the distinction between dreams and dreaming is a useful one in terms of levels of analyses, beneath this distinction lies a history of entrenched ideological disagreement—a history which has tended to preclude the study of cognitive operations ostensibly idiosyncratic to sleep mentation. As a consequence, certain aspects of dream cognition have not been considered appropriate to most mainstream models of cognition. In effect, they have been relegated to the study of *dreams*, and therefore, have been erroneously lumped into the category of content-interpretation. By and large this Maginot Line has held.

The purpose of this paper is to suggest that research into logical structures found in dream cognition, although integral to and dependent upon an analysis of dream content, are no more dependent upon dream interpretation than the content-dependent study of the distinction between REM and NREM *dreaming*. More specifically, the area of cognition this paper outlines

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and suggests as an area of dream research is what will be here generically termed logical structure analysis. It is assumed that dreaming is not devoid of a consistent and systemic set of logical relations, but rather that there exists a *dreaming* logic characterized by a set of operational structures not typically found in the waking state.

There have been general structural approaches to dreaming. Foulkes's (1978) digraph theory, a *Scoring System for Latent Structure* (SSLS) is based on a linguistic propositional analysis. Other similar structural approaches have also been suggested by Gass (1975) and Suppes and Warren (1975) which, as Foulkes points out, are attempts by way of notational and algebraic operations to systematize the dream as a set of propositions concerned with developing transformation rules between an "unconscious" modelled as a set of linguistic propositions and its conscious analogues. In anthropology, an approach based on Levi-Strauss's (1966) structural, cognitive analysis of preliterate myths has been applied to dreaming by Kuper (1979) and Kuper and Stone (1982). For purposes of this paper, what is termed "logical structure" is a subset of a potentially more encompassing structural approach to dreaming yet to be developed.

The concept of "structure" has come to be used in a variety of ways (see Wilden, 1972). While it is beyond the scope of this paper to define a structural approach to dreaming, of which logical structure is a subset, it is nevertheless important to generally define how the concept of structure relates to this paper. Suffice it to say at this point that a structural approach to dreaming is concerned with the *formal* aspects of dreaming as opposed to *content* aspects; such an approach is concerned with abstract relationships in dreaming, whether they be propositional, logical, organizational, developmental, or the processes involved in the storage and retrieval of information.

Logical Relations in the Dream State

Historically, dreaming has been considered to be devoid of logic as the term is commonly understood. Dreaming does, however, appear to exhibit a set of logical operations of a kind not typically observed in waking thought. We are indebted to Freud for this initial insight. In the work that Freud considered to be his greatest achievement, *The Interpretation of Dreams* (1961), he says of dreaming, "Little attention is paid to the logical relations between thoughts; those relations are ultimately given disguised representation in certain *formal* characteristics of dreams" (p. 507). For example, Freud points out that *temporal repetition* in dreaming is the cognitive equivalent of *numerical multiplication* of an object (p. 373).

Despite the framing of "logical relations" and "formal characteristics" of dreaming in psychoanalytic assumptions, such as "latent dream thoughts" and "disguise" mechanisms, it will be suggested that they can be studied inde-

pendently of psychoanalytic notions; such logical properties belong, from a structural perspective, to cognitive research on dreaming and not to the interpretive study of dreams.

Over the decades it has become socially fashionable—indeed almost professionally necessary in academic psychology—to denigrate Freud's work. Although *The Interpretation of Dreams* is not scientifically acceptable by modern standards, it is nevertheless a veritable generating plant of powerful hypotheses demanding investigation by cognitive psychology. Despite the trend to denigrate this work, clearly it is a complex and original example of creative thought yet to be equalled in the history of dream research. For all of its shortcomings, it remains one of the enduring works of western civilization.

Since Freud's work, logical relations in dreaming have largely been ignored, not only by those in cognitive psychology, but even by psychoanalysts. Due to this omission, it is appropriate to review some of the reasons responsible for the lack of research into the logical structure of dreaming. While specifically pertinent to research into logical relations in dreaming, the following reasons also relate directly to why dream research in general has been ignored by cognitive psychology.

Cognition: Waking and Sleeping

Historically, the difference between waking mentation and sleeping mentation in western culture has been considered a distinct one, with the possible exception of the view held by the early associationists in psychology and philosophy (MacKenzie, 1965). It is the perception of this difference that has in large measure been responsible for cognitive psychology viewing dream data as neither relevant to the study of waking cognition in specific, nor to the study of cognition in general. Four basic phases seem evident in the modern conceptual development of this perceived difference. These phases help to clarify the historical background which has led to the contemporary neglect of dreaming in psychology. The following phases provide a general sketch of these historical developments.

The first is the *Freudian Phase*, extending roughly from 1899 to 1952. Freud went to great lengths to demonstrate that dreams were not at all like waking thought processes. In discussing the transformation of unconscious dream-thoughts into the dream content, Freud (1961) said that dream-work is peculiar to dream life (p. 507), and claimed that it "diverges farther from our picture of waking thought than has been supposed . . ." (p. 507). Moreover, dream-work, according to Freud, is not simply more careless and forgetful and more incomplete than waking thought; "*it is completely different from it qualitatively*" (p. 507, italics added). Further, Freud flatly denied the existence of any intellectual operations in the dream. When waking-like operations did seem

to take place, he dismissed them as "deceitful." In fact, says Freud, they are "part of the material of the dream-thoughts and not a presentation of the intellectual work performed during the dream itself" (p. 313).

When Freud recognized that certain dreams appear to be similar to waking thought, he constructed a separate category called "dream fantasies"—a category he also dismissed as not part of the dream state proper, just as he did with sleep onset imagery. In taking great pains to maintain the bizarre and irrational character of the dream, Freud nevertheless noted the nocturnal imaginal productions that did not fit into his scheme. He also noted other dreams which were thought-like. What he probably was noting are what we now call NREM dreams. To further separate dreaming from waking cognition, he denied the existence of any creative use of language in the dream state, maintaining that language production in the dream state was simply a mechanical recombination of old memories. (Heynick [1981, 1985] has clearly and methodologically demonstrated, however, that most language production in dreaming is created in the same manner as during waking discourse).

To complete the separation between waking and dreaming cognition, Freud constructed the concept of "secondary revision," which, by definition, attributes any thought-like aspects of dreaming to the intrusive overlay of waking intellectual operations. Finally, there exists a paradox here in Freud's defense of the dream as different from waking thought. Namely, if the manifest dream is a result of disguised and censored dream-thoughts, how is it that we can even recognize the manifest dream as making any sense at all: are there real objects and events in some kind of relationship? The answer is Freud's concept of secondary revision, which he says imposes waking thought into the dream. If this is the only way we can recognize the dream as sensible at all, then secondary revision or waking thought is in fact part of the dream, at least empirically. Without it there is, in fact, no dream as we understand it. Just as there is no sound if no one is present to hear it (there may be wave forms or "vibrations," but no sound), there may be a "pure dream" (i.e., "wave forms," but unless there is a receiving apparatus, we cannot "know" that there is). The dream as we know it is, by any definition, to some degree thought-like. The dream as we know it, therefore, is not *distorted* by waking thought. *The dream is simply the dream* collected under various conditions. Perhaps the pure dream is the dream of pre-verbal children (as indicated by sounds and movements during sleep)—a sensory-motor-action phenomenon.

Freud was determined to demonstrate that dreaming cognition was completely different from waking cognition. Why was he so determined? The answer, as pointed out by Foulkes (1978), boils down to this: "The very integrity of Freud's major discoveries is at stake. . . . [A]ny surrender, however small to rationalism, would ultimately serve to put the entire psychoanalytic enterprise in jeopardy" (p. 71). All of Freud's *systemic* maneuvers function to

protect his concept of the irrational unconscious psychic censorship, disguised dream-thoughts, wish fulfillment, and the symbolic transformation of the sexual etiology of dreams. In this first phase, then, dream cognition was viewed as quite distinct from waking cognition. So pervasive was this view that it inhibited generations of dream research by academic psychology.

The second phase is the *REM versus NREM phase*, originating in 1953 with Aserinsky and Kleitman's discovery of rapid eye movement sleep (i.e., REM; ascending stage-one sleep) and extending roughly to the mid 1970s. In the psychophysiological study of dreaming, it was intially thought that mentation in the REM state constituted the dream state proper. Dreams reported in this condition were thought to be dream-like (i.e., bizarre, distortive), while non-REM mentation, which, by definition, was not considered to be a dream, was more "thought-like." During this laboratory research explosion, it became evident that most dreams were *not* bizarre. Having access to nearly all of the REM dreams of a subject on a given night in a sleep laboratory yielded a radically different view of dreaming than having access to only spontaneously recalled home dreams.

It was at this historical point that the data-base for dream research was significantly transformed both quantitatively and qualitatively[1]. As the reconsideration of these early research conclusions continues, however, it is becoming increasingly accepted that the definition of dreaming is certainly not limited to the REM state (see Cartwright, 1978; Fiss 1984; Foulkes, 1985). In addition, it is very apparent that most sleep mentation—REM or NREM—is not dream-like, but is in fact, more thought-like. This second phase, then, was the first modern step in reframing the dream state into a more rational and waking-state cognitive process. As dreaming came to be increasingly considered more like waking cognition, the road was paved for the next phase of investigation, in which dream data equalled legitimate cognitive data.

The third phase in the reframing of dreaming into the parameters of waking cognition is the *Sleep Mentation Phase*, extending roughly from the mid 1970s to the present. This phase is the first serious endeavor, from a cognitive perspective, to consider dream data as equivalent to waking cognition. Singer's (1966) seminal work on daydreaming can be considered a vanguard to this phase. As a consequence of this shift, the term "sleep mentation" was coined apparently as a cognitive corollary of the distinction between the study of dreams, on the one hand, and dreaming, on the other hand. This distinction between dreams and dreaming was created in order to sever the connection to Freudian dream interpretation research. The term "sleep mentation,"

[1]Though sleep laboratory research is not a necessity for all dream research, it is the best means for obtaining a complete series of successive dreams. Such a dream series may reveal in a continuous way a set of logical transformations through different stages of sleep that home dreams or spontaneously recalled dreams may not reveal.

however, goes one step further, completely severing the semantic connection to the term "dream." Thus, the "dream" no longer exists, only mentation during sleep exists: dream research's own revisionist historical rewrite. The new term also functioned to skirt the early controversy of whether dreaming was limited to the REM state, or whether the dreaming was to be considered a NREM phenomenon as well. Sleep mentation experiments examine mental activity in *all* stages of sleep.

Using the framework of experimental cognitive psychology, sleep mentation utilizes the dream report to study such cognitive processes as abstraction, memory storage and retrieval, concept formation, imagery production, and other cognitive processes extant in cognitive psychology, but not those processes ostensibly peculiar to dream cognition. In fact, Arkin, Antrobus, and Ellman (1978) appear to exclude from sleep mentation research the very processes that seem to make dream cognition unique from waking cognition. Accordingly, Arkin et al. (1978) assert that "The details of dream-work mechanisms such as condensation, displacement, influence of extra psychic censorship and so on are out of the scope of this [*The Mind in Sleep*] book" (p. 3). For purposes of their volume at least, it can be seen that in the flight from any possible association with dream interpretation, all cognitive peculiarities of the dream are lumped together with psychoanalytic notions. The notion of "censorship" is lumped into the same category as condensation and displacement. Peculiar cognitive operations such as "reversals" and other dream-work operations are, in one sentence, relegated to a Freudian oblivion.

More recently, Foulkes (1982, 1985) has developed what he calls a cognitive-psychological model of dream production which is fundamentally equivalent to the "sleep mentation" approach. Any difference is largely semantic. Foulkes, however, does recognize singular cognitive operations of the dream-state, such as reversals and condensation. However, Foulkes suggests that such processes can be explained by mainstream models of waking cognition which exclude a motivational level of analysis, thereby reducing their possible uniqueness by ignoring—indeed denying—a level of explanation that is not considered congruent with the mainstream cognitive models. It should be pointed out that while some mainstream information processing models of cognition do incorporate the construct of motivation into their theoretical and empirical design, the incorporation is a global goal-orientation approach to motivation, not a psychodynamic concept of motivation, and certainly not a non-conscious intentionality model.

Foulkes's model (1985) assumes that "the sleeping mind is not functionally distinct from the waking mind; hence dreaming does not depend on *mental process* or systems that are in anyway unique to sleep" (p. 1, italics added). By ignoring particular dream data, by narrowly focusing on the similarities of dream cognition to waking cognition, thereby reframing dream data into

mainstream information processing models, current assumptions about how the mind functions are maintained. As it is commonly understood, the "rational" model of mind has been saved.

Just as Freud was determined to demonstrate that dream cognition was completely different from waking thought, so are sleep mentation/cognition models determined to demonstrate that dream cognition is equivalent to waking cognition. Just as the very integrity of Freud's discoveries were at stake with any surrender, however small, to rationalism, serving to put Freud's entire psychoanalytic system in jeopardy, so too, by a reversal of the same logic, it now appears that the very integrity of current cognitive models of mind is at stake, with any surrender, however small, to a perceived irrationalism—an irrationalism that will place the entire mainstream cognitive enterprise in jeopardy. Just as all of Freud's systemic maneuvers function to protect his concept of the irrational unconscious, so too do all of the systemic maneuvers demanded by mainstream cognitive models function to protect the concept of the waking rational biocomputer model of mind.

Foulkes is probably correct in assuming that the sleeping mind is not functionally distinct from the waking mind, given the level of analysis upon which he is working, that is, on the basic level of mnemonic storage and retrieval. But, given other neurological levels of processing, the operations are probably of a different order of organization.

The fourth phase in the conceptual development of the analysis of the relationship between waking and dreaming cognition is incipient and not well-defined, running temporally parallel to phase three. This phase may be termed the *Symbolic Cognition Phase*. Currently, this phase is constituted by differing perspectives as exemplified by the clinical oriented sleep laboratory research of Cartwright (1984) on dreaming and depression; Kramer, McQuarrie, and Bonnet (1980) on problem solving in dreaming; Hartmann (1984) on the nightmare; LaBerge (1985), LaBerge, Nagel, Dement, and Zarcone (1981), and Gackenbach and Schillig (1983) on lucid dreaming; Haskell (1985a, 1985b, 1986b, 1986c) on dream-work related cognitive operations in both the dreaming and waking state; Hunt (1982, 1985) on the phenomenology of dreaming; and Palombo (1978) on a psychodynamic-information processing model of memory.

Tying these otherwise disparate research areas together are the following working assumptions: (1) while dreaming is basically continuous with waking thought processes, it is not necessarily identical to it; (2) dreaming is a motivated, ego-involvement process; (3) dream content is a symbolic transformation of affective, and motivational-ego processes that can be understood on a manifest level as symbolic correlates of waking psychosocial concerns. In short, as Cartwright (1978) points out, dreaming is a "cognitive activity to be understood on its own merits . . ." (p. 66). This fourth phase is

characterized by a more integrative and phenomenal level of analysis, by which it accounts for the relationship between waking and dreaming cognition.

There are clear signs that any attempt to dichotomize or to fuse waking and dreaming cognition is not the most productive way to resolve the issue. Hunt (1985), approaching the problem from a phenomenological level of analysis, maintains that

> . . . the important distinction empirically may not be between dreaming and waking at all, but between symbolic consciousness manifested as such in emergent creative imagination and consciousness subordinated to the pragmatic demands of constructing and maintaining the everyday common sense world—a distinction cutting across both dreaming and wakefulness. (p. 6)

It is difficult to imagine two researchers more disparate than Hunt and Foulkes, one researching the dream state from a phenomenological, altered state of consciousness level of analysis, and the other researching the dream state from an information processing level of analysis where the dream *production system* is explained as the diffuse activation of modular mnemonic systems. Foulkes (1985) says in his latest volume, "The evidence reviewed in this chapter suggests that dreaming is not bound to any particular state—neither to REM sleep nor to sleep more generally" (p. 76). Yet, both agree that a distinction between waking cognition and dreaming cognition is not the significant aspect in dream research; both Foulkes and Hunt envision cognitive processes that go beyond the distinction of waking versus dreaming cognition. For them the issue is that of "symbolic consciousness."

But here their agreement ends. First, their level of analysis is different, and as such, though it may sound as if both are positing similar positions, they are not; in fact, they are speaking parallel to each other. Second, following from their different levels of analysis, their concept of a "symbolic consciousness" varies. For Hunt, symbolic consciousness is constituted by nonconscious "meanings" that are represented in symbolic consciousness; whereas for Foulkes, symbolic consciousness is simply the ability to think about things that are not physically present. Finally, while both researchers recognize the cognitive peculiarities of dream data (e.g., reversals), Hunt claims such are motivated operations, while for Foulkes they are not (at least this is his claim in his recent works [1985]—a reversal of his earlier claim [1978]).

Moffitt, Hoffmann, Wells, Armitage, and Shearer (1985) and Purcell, Mullington, Moffitt, Hoffmann, and Rigeau (1985) have argued, from their psychophysiological research, that dreaming exhibits, as does waking consciousness, a high degree of self-reflexiveness. Contrary to most psychophysiological researchers, these authors suggest that self-reflexiveness is exhibited more in REM than in NREM sleep. They also suggest an integration of dream cognition research and cognitive psychology. Though psychophysio-

logical researchers, both Moffitt's and Purcell's works are included in stage four here for the simple reason that their psychophysiological approach is designed to focus upon a "phenomenological" level of analysis, similar to the research on lucid dreaming of Gackenbach and Schillig (1983), and of LaBerge (1985). None of these researchers would reduce dreaming to a waking state parameter as do most cognitive models.

The significant point, however, in this historical analysis of the perceived distinctions between waking and dreaming cognition, is that the fourth phase of dream research shows signs of reorganizing and reaching beyond the historical dichotomies that have pervaded dream research[2]. The present analysis of logical structures in both dreaming and waking cognition will reflect a similar perspective.

Cognitive Imaging Operations in Dreaming

In delineating an area of dream cognition research, illustrations will be presented initially from Freud's *The Interpretation of Dreams*. Examples will be drawn from other areas of research as well, including certain cognitive operations found in the waking state that are similar to other cognitive operations ostensibly peculiar to the dream state. These illustrations serve to delineate a number of different aspects pertaining to logical relations from both the sleeping and waking states, which are generated under various methodological conditions.

It is the purpose of this paper to point out and propose an area of research. It is not the purpose here to claim that the data used in evidential support of this area of research have been demonstrated to be necessarily valid. Accordingly, it should be noted that not all of the illustrations and data presented, especially those taken from Freud, can be adequately replicated and reconstructed. With regard to Freud's illustrations, he often stated, it seems, only what he thought was appropriate to psychoanalytic purposes. In addition, some of Freud's examples depend upon the interpretation of latent dream thoughts, just the kind of data to which research psychologists justifiably object. Nevertheless, such examples make excellent hypotheticals, independent of their construct veridicality.

A reading of *The Interpretation of Dreams* with a cognitive perspective in mind clearly shows that Freud was not entirely unconcerned with cognitive structures in dreaming, but he was too focused on content and symbolism

[2]It is time for someone to write a comprehensive, detailed and documented history and analysis of contemporary dream research. A history, properly done, would most likely reveal some significant relationships that would have a direct bearing on research. My own thumbnail historical analysis is presented here—developed on its own in the writing of this paper as a way of trying to understand the issues being addressed.

for psychotherapeutic purposes to have investigated them from a purely cognitive perspective. If Freud had been more the cognitive psychologist, and less the clinician, *The Interpretation of Dreams*, as well as the history of cognitive psychology, would look far different than it currently does. But, it is all the more to Freud's credit as a clinician to have recognized such important cognitive phenomena.

Logical Relations

For Freud, language is composed of two basic categories of words. First, there are content words such as nouns and adjectives; second, there are conjunction or function words such as "but," "and," "either," "or," "just as," "if" and others. Freud claimed that dreaming disregards function words. Freud says (1961)

> Imagination in dreams is without the power of conceptual speech. It is obligated to paint what it has to say pictorially, and since there are no concepts to exercise an attenuating influence, it makes full and powerful use of the pictorial form. (p. 84)

In other words, dreaming must represent such logical relations in pictorial or imaging structures; these conceptual-verbal relations must be translated into dreaming "proper." For Freud, dreaming "proper" is pictorial. The narrowness of this definition not withstanding, the point is that some waking state cognitive operations must be presented in a different mode in the dream state; this mode, ostensibly peculiar to the dream imaging process, is that of imaginal-action[3].

According to Freud, logical connection, for instance, is expressed by events occurring "simultaneously in time" (p. 314); the abstraction of temporal repetition is expressed by the "numerical repetition of an event" (p. 373); the relation of "just as" by the relation of similarity (p. 320). As for causal relations, they are expressed in two ways. First, in some dreams

> a division into a shorter preliminary dream and longer dream sequel does in fact signify that there is a causal relation between the two . . . .The other method . . . consists in one image in the dream . . . being transformed into another. (p. 316)

The second method, Freud says, should only be considered a causal relation if the same transformation takes place before our eyes. In both cases the mode

[3]Freud considers the dream proper to be pictorial only. But the congenitally blind have dreams. This definition of course, is now no longer held by most dream researchers. Freud did not have at his disposal modern laboratory methods. If he did, his dream theory would have developed quite differently.

in which causal relations are demonstrated is by a kind of spatial sequential transformation.

A further structure that relates to the logic of classes and "inclusivity" is the illustration of a dream-within-a-dream. According to Freud, if a subject has a dream within another dream, it expresses repudiation of the dream of which the dream-within-a-dream is a part (p. 338), again demonstrating imaginal-action as the mode of expressing cognitive operations. Further, Freud claims that " 'no' seems not to exist as far as dreams are concerned" (p. 318). That is, a linguistic negative must be expressed in non-verbal imaging processes. He cites dreams where "no" is expressed by the reversal of things, by the "turning around the other way" of things and by turning things "up side down" (p. 326). For example, in a dream where climbing a set of stairs was difficult at first and became easier as the person climbed higher, Freud interpreted this reversal of normal action sequence as a negation of the thought or proposition being considered in the dream.

In a similar manner, contradiction is expressed in imaginal-action. "Not being able to do something" in a dream is a way of expressing a contradiction or a "no" (p. 337). Another way of expressing a contradiction, according to Freud, is to turn something into its opposite (p. 471). Finally, regarding "either-or" relations, Freud claims that they cannot be expressed in dreams except by both alternatives being inserted into the text with both appearing equally valid (p. 316). In such cases, says Freud, the rule is to "treat the two apparent alternatives as of equal validity and link them together with an 'and' " (p. 317). It is clear that Freud was concerned with cognitive operations in dreaming, and was a pioneer in recognizing and systematically investigating them. With this introductory set of illustrations we can now turn to the contemporary problem of researching logical structures found in the dream state.

Researching Logical-Imaging Structures

Almost all attempts to manipulate dreaming, as Foulkes (1985) has correctly observed, have been to alter its content. One of the major problems in researching dream content, as pointed out by Antrobus (1978), concerns maintaining a sufficient degree of predictive control. Going a step further, Foulkes (1982) has echoed the widely accepted belief that dream content is not "manipulatable except in the crudest of ways" (p. 171). Certainly, evidence supports the claims of both Antrobus and Foulkes, if all dream processes that depend on the analysis of content are lumped into the traditional definition of "content-analysis." The traditional problem with researching content, however, applies neither to the manipulation of logical operations, nor to researching abstract conceptual features embedded in the content of the dream. Research into logical structure analysis is not to be lumped into the

category of content-analysis (this important point will be discussed in more detail later). Moreover, there are research strategies for the control and manipulation of such structures.

This paper will now present some possible research strategies, while at the same time further delineating what constitutes logical structure analysis. It is suggested that the structure of logical relations occurring on some levels of dream imaging takes the form of an action-logic where objects, things and events are physically manipulated and move about in imaginal (symbolic) space.

Various methodologies have been used to manipulate dream content (Rechtschaffen and Foulkes, 1965; Witkin and Lewis, 1967). Early experiments stimulated sleeping subjects by sprinkling water on them and subsequently examined dream reports for signs of symbolic incorporation of the stimuli (Dement and Wolpert, 1958). In a presleep approach, Cartwright, Bernick, Borowitz, and Kling (1969) had subjects view an emotionally provocative film and subsequently examined the dream reports for symbolic representation of the film content. No serious researcher really expected these kinds of methods to yield anything other than crude results. What is needed are methods to program more specific transformations. Such programming methods do exist.

While Freud was perhaps the first to systematically delineate cognitive operations in dreaming, a contemporary of his, Herbert Silberer (1951), whom Freud quotes in *The Interpretation of Dreams*, described dream-like cognitive transformations outside of what is usually (and certainly outside of Freud's view) considered the dream state. Silberer's method might be regarded as phenomenological, but as will be shown below, his method yielded results identical to cognitive transformations elicited by modern conditioning techniques.

Phenomenological Strategy

Prior to entering a sleep onset state, Silberer (1951) describes a method whereby he (as his own subject) would concentrate on an abstract thought (stimulus) which, as he slipped into a hypnogogic state, would be transformed into an imaging structure (response). For example, when Silberer consciously thought of

(**Stimulus**) improving an uneven passage in an essay . . .

he was writing, that thought was imaginally transformed into the imaging structure of seeing himself

(**Response**) planing a piece of wood (p. 202).

In another example, Silberer says he was contemplating

(**Stimulus**) the nature of the transubjectivity of valid judgements.

This abstract thought was imaginally transformed into

(**Response**) a transparent sphere in mid air with people around it whose heads reached into the sphere. (p. 198)

These abstract thoughts, then, were transformed as Silberer went from sleep onset into imaginal manipulation of objects. Cognitive operations are represented by manipulating imaginal objects. In the first example, where improving an *uneven* passage is transformed into the cognitive equivalent of *planing a piece of wood*, the abstract feature of the thought is maintained. That is, the planing of wood is for improving *uneven* edges of surfaces. *The essential structure of the proposition is held invariant across a transformation of content.* Normally such phenomenological data are held suspect by most laboratory researchers, and are viewed as "Freudian symbolism." Similar findings, however, have been generated by laboratory conditioning methods.

Conditioning Strategy

An experimental method for control and manipulation of cognitive processes in dreaming has been carried out by Antrobus (1978). Subjects in a waking state were conditioned to an avoidance procedure designed to discriminate specific classes of visual stimuli. The stimulus classes were associated with specific tones which were subsequently presented to subjects (in a sleep laboratory) while they were in a sleep state. Subjects reported having dreams which incorporated the visual stimuli associated with the tone. According to Antrobus, preliminary results from this method suggest that subjects dream of events which have many of the same features as the original, conditioned visual stimuli. Specific objects and people in the dream, however, are different from the conditioned visual stimuli. For example,

(**Stimulus**) a man cutting the bark off a tree with a cane knife.

In response to this conditioned visual stimuli, a female subject dreamed of

(**Response**) cutting a pie with a kitchen knife. (p. 576)

In pilot research Antrobus (1986) has elicited other dreams using conditioning procedures. Such methods seem to hold great promise not only for

manipulating dreaming and studying content, but more importantly, for studying cognitive structure.

While these findings tend to support the view that dream imaging is constructed of abstract features and is not the result of experience being literally represented as real objects and events retrieved from memory, the important point here is that Antrobus has demonstrated the partial control and manipulation of dreaming. The next step, says Antrobus, is to use these techniques to determine the upper limit of abstract visual features and the complexity of their organization. It is at this juncture that dream research and cognitive psychology can clearly be seen to be of significance to each other, with dreaming representing an important body of data for cognitive psychology, and with cognitive psychology supplying an important set of methods and procedures for dream research.

It seems evident that the only essential difference between the Silberer experiment utilizing hypnogogic or sleep onset transformations and Antrobus's conditioning of visual stimuli concerns the method of stimulating the cognitive transformations. Both sets of findings are significant for the study of logical structure analysis. It is also evident that neither experiment, though dependent on the analysis of imaginal content, represents content-focused research anymore than the assessment of the difference between REM and NREM dreaming is content-focused research. Other strategies also exist for manipulating the dreaming state. Just as conditioning techniques can be used to manipulate dreaming, so accordingly, can hypnosis be used as a method of initiating cognitive transformations.

Hypnotic Strategy

Since the study of content-related issues in dream research has been the clinician's territory, historically, most methods for researching content-related issues have tended to reflect that terrain. Evolving out of clinical therapeutics, hypnosis has only recently gained scientific respectability in psychology, largely dué to the pioneering work of Hilgard (1977) at Stanford University, and Martin Orne's laboratory at the University of Pennsylvania.

The significance of hypnosis as a research tool has not passed unnoticed in dream research. For example, Domhoff (1967), commenting on the inadequacy of free-association as a method of analyzing the symbolic content of dreams, states

> What is needed is an experimental technique, a method for *controlling dream content* and for producing and translating dream symbolism. Such a potential technique, viewed by many with great promise despite its checkered history, is hypnosis. (p. 206)

While Domhoff is basically speaking about dream interpretation—à la content—the important point of the quote is the recognition of hypnosis as

a method for the manipulation of dreaming. Hypnosis has been used both clinically and experimentally to program dreams. Early research is reviewed in Arkin, Hastey, and Reiser (1966); Evans, Gustafson, O'Connell, Orne, and Shor (1970); Mazer (1951); Moss (1967); Sacerdote (1967); Stross and Shevrin (1969). Later developments are reviewed by Tart (1965a, 1965b) who concludes from his own research and from his review of the literature that "*at present . . . post hypnotic suggestion seems to be the most powerful and precise method for affecting dream content . . .*" (1965b, p. 85, italics added).

As indicated earlier, the problem with methods for controlling dream content is that they have not in fact done so, but rather have affected *structure* in a manner similar to the Silberer and Antrobus experiments. Specific content in terms of identical objects and events appears almost impossible to control. *Hence, studies of "content control" are in fact misnomers. It is the abstract features or structure that have, in effect, been controlled.* This is not surprising if it is assumed that dream imaging, as Foulkes (1985) suggests, is not the result of real world memory, but is the result of abstract feature storage. It would seem to follow, then, that direct programming of structure rather than content would be most amenable to successful manipulation.

The so-called symbolic transformations of content, as in the above Silberer and Antrobus experiments, may simply (or not so simply) be the constructive mnemonic retrieval of contents isomorphic to abstract features of the programming or stimulus situation. The semantics (content) as it were, are selected to cohere to the syntax (features). In any event, for the purposes of this paper, it is the *formal* abstract features, or the structures of dreaming that may prove more useful to research, since structure apparently is not as variable as content. More will be said about this later.

A hypnotic methodology is, in principle, a simple one: a subject is put in a hypnotic "state" with the post hypnotic suggestion to have a dream demonstrating in imaginal form (not linguistic) a given structure or logical operation. Some related research, both hypnotic and non-hypnotic, does exist that can be used to demonstrate logical structure analysis. The first logical operation to be illustrated is that of "negation."

It will be recalled that, as Freud claimed, "no," as a linguistic negative, does not exist in imaginal dreaming except by "reversal" of objects or events. If it is assumed that dreaming—on the level of imaging as opposed to a mnemonic production level—functions as an analogue computer, then dreaming must have some other than linguistic means of asserting a negation. An analogue computer can not express "not-a." Analogue computers deal in degrees of likeness. Perhaps the closest thing analogue computers have to abstract syntax is sequence; they deal with things rather than abstract relations.

The first illustrations of imaging a negation structure were derived from induced dreaming while in a hypnotic state. This is in contradistinction to

a post hypnotically suggested nocturnal dream. While the following two experiments were not designed to demonstrate a logical negation structure, they nevertheless can be so analyzed and, thus, are used here to provide initial illustrations. A subject (see Farber and Fisher [1967], p. 126) was given the stimulus situation of

> (**Stimulus**) being falsely accused by a friend of cheating on an examination. The subject was to become angry but due to circumstances the subject was to be *unable to deny* the accusation.

As a consequence of this hypnotic suggestion the subject had a hypnotic "dream" that

> (**Response**) a dentist was trying to pull her tooth in spite of her protesting that the nurse had *taken the anaesthetic out of the wrong bottle.* (p. 126)

The "no" or negation is expressed here by protesting and by a *reversal* of the anesthetic bottles (and thus not being anesthetized).

Another illustration, programmed for quite another purpose by Mazer (1951), can be used here to demonstrate imaginal negation operations. Using the Farber and Fisher stimulus situation above a subject was exposed to

> (**Stimulus**) being accused but not being able to deny an accusation.

The subject dreamed of playing baseball:

> (**Response**) someone hit the ball and in running to first base, knocked the subject over. The subject got up and tried to hit the runner but could not do so. The subject kept swinging at the runner but could not seem to hit him.

Once again, negation is expressed in an action-mode by not being able to do something. It is interesting to note that both of the above "dreams" use the same imaginal-action modes to express a negation, as Freud noted—that is, reversal, and not being able to act. It is also interesting that these examples of negation derive from hypnotic dreaming and not from nocturnal dreaming, as were Freud's examples.

In a pilot experiment, I programmed (instructed) a subject while in hypnosis to have a post hypnotic nocturnal dream. The subject was instructed that

> (**Stimulus**) someone would be doing something that he did not like and he (the subject) would say "no," but not in a verbal form.

The subject had a dream that night that there were

(**Response**) people in his house doing all kinds of things he did not like. He opened the front door widely. He stood there and stared at them.

It is clear that he was expressing negation by imaginally asking them to leave by his actions.

In terms of expressing negation by reversals, Freud seems to use *reversal* and *inversion* interchangeably. It is difficult to assess these two operations in Freud's work, however, because while some illustrations are overtly and directly manifest in the dream imagery, other illustrations are derived from so-called latent dream thoughts, or by interpretation. There are indications that reversal and inversion operations are not of identical logical structure (Haskell, 1984, 1985c). In examining related operations, Werner and Kaplan (1963) point out that Freud seemed to treat contrariety and contradiction as a unitary category (p. 472). Research in this area is practically non-existent.

Other observations of cognitive operations expressed in imaginal form concern that of either-or relations. It will be recalled that according to Freud the relation of either-or cannot be expressed in dreaming as it is in the waking state. In another pilot experiment, I instructed a subject in hypnosis that he would have a nocturnal dream in which he would have a choice, namely, he would dream that

(**Stimulus**) he could *either* play baseball *or* he could go to the movies.

It was explained that the essential aspect of the dream was the either-or relation. Either-or was emphasized to him three times in a very pronounced two part rhythmical manner. Spontaneous post hypnotic amnesia for the suggestion occurred. The subject dreamed

(**Response**) he was playing tennis, but it also seemed he was not playing tennis; that it was *felt* to be simultaneously him and not him who was playing tennis. He stated that he did not know whether he was playing tennis or not.

Two basic aspects of the dream seem structurally significant to the either-or relation. First, the either-or relation was imaginally represented in that the subject did not know whether he was playing tennis *or* not. He *either* was *or* he was not. Secondly, the very double structure of the either-or relation was represented by the subject matter (content) of the dream: tennis. Presumably this structure was selected in, at least partially, by the double tonal rhythm of the presentation of either-or, a two part structure as in the game of tennis.

In a second informal experiment on the either-or relation, it was suggested to a subject during a group hypnosis programming session that she would

(**Stimulus**) have a dream in which you have an either-or choice. You can either go to the movie or you can read a book.

In response to this suggestion, the subject dreamed that she

(**Response**) could not decide whether to go to the senior prom dance, or to baby-sit. The next scene was that the mother of the child the subject was to baby-sit came to pick her up. She got into the car but the mother dropped her off at the prom.

In yet another hypnotically programmed nocturnal either-or dream, the subject was instructed to

(**Stimulus**) have a dream in which an either-or situation is represented in images.

In response to this suggestion, the subject dreamed that burglars entered her house and said if she obeyed orders, she would not be hurt, but if she did not, she would be hurt or killed. Thus, faced with an either-or choice the subject found herself on the porch with the burglars. The porch then

(**Response**) flipped upside down and back again. When in one position, the subject was obeying the burglars, while in the other position she was disobeying them.

The significant cognitive structure is displayed by flipping the porch upside down, demonstrating two opposing alternatives. In other words, the porch was the imaginal physical object that was manipulated. This action, like the others cited above, is a cognitive operation representing negation and either-or relations.

It is clear that in these either-or dreams, the two alternatives of an either-or relation are included. In the first illustration, there appears to be *doubt* about which alternative was true; in the second illustration, a *compromise* solution seemed to be reached; in the third, *opposite* alternatives were demonstrated. It is conceivable that the type of logical structure used in imagining the either-or relation is determined by the specific assessment of the relation i.e., doubt, compromise, or by an opposite or contrasting relation. It is perhaps noteworthy to compare the either-or response of the tennis dream

to the previous examples of negation dreams. While the tennis illustration is primarily an illustration of the either-or relation, it also appears to be congruent with the findings that one of the ways of expressing "negation" or "no" in a dream is to turn a "no" into its opposite. The negation aspect of the either-or dream is represented by the porch being turned upside down. It is tempting to try to abstract out further patterns to these cognitive operations, but the evidence here is obviously much too limited and sketchy to do anything other than suggest an area of future research.

Analogic Strategy

In my own work, (Haskell, 1982, 1983, 1984, 1985c) on the analysis of verbal report protocols in waking discourse, I have found reversals and inversions to reflect different cognitive operations. The mode of expression of these operations are ostensibly atypical and are similar to the mode of expression found in dreaming. In analyzing the structure of literal discourse, I have found that there often exists a subliteral level of meaning, where cognitive operations frequently correspond to those observed in dreaming that Freud described as dream-work mechanisms. Using a qualitative method of analysis and validation procedures, I have observed that names and initials, for example, are cognitively selected into a piece of waking, ostensibly literal discourse, which on a subliteral or symbolic level references and expresses a speaker's nonconscious or covert feelings regarding the discourse situation.

In one discourse protocol the novelist *Harold Robbins* was discussed, as was a bar called the *Hofbrau*, a restaurant called *Benihana*, and the topic of *Rh negative blood*[4]. These literal references are also subliteral references that present the initials of a target person in the discourse situation about whom the speaker had a non-conscious affective concern. The initials referenced were R.H., the initials of the researcher, who was a member of the discourse situation. It will be noticed that sometimes the initials were *reversed*, e.g., Harold Robbins, and sometimes they were not, e.g., Rh negative. The function of this reversal served as a negation. The findings that some of the initials were reversed appears to be an inconsistency. But an analysis of the protocol reveals an interesting cognitive operation: invariably, when reversal is *not* used, names and initials are expressed in a *context of negativity*. That is, the context itself expresses the negation. For example, in discussing the work of Harold Robbins, nothing negative was expressed, so the negation is expressed by the reversal of the initials; however, in the Rh negative blood example, no reversal was necessary, as the negative is expressed in the very phase itself. The ex-

[4]The name Benihana is in fact a reference to the initials R.H. The "B" is the standard exchange of Bob for Robert.

pression of negation, i.e., in this case negative affect toward the referent, is expressed both by reversals and by context. There are probably as many different subliteral operations as there are aspects or nuances to the literal concept of negation.

Inversion is yet another expression of negation. Inversions change something into its opposite, for example, changing the signs on an algebraic equation from "+" to "−". In a discourse situation, *hyperactivity* was initiated as a discussion topic just after a person entered the discourse situation late and was hurriedly taking a seat. It was said by a member that there were nine hyperactive males in the population for every one hyperactive female. This 9:1 ratio was the reverse of the actual male to female ratio in the discourse setting: the discussants numbered nine females to one male. The researcher, in noting the 9:1 ratio—disregarding its male-female content—pointed out that the ratio was the same as the composition of the discourse setting. After an awkward silence, a male member selected-in a literal story about where he worked where a co-worker had *turned* step ladders *upside down*. Then he added another story about his work place where a worker *switched the signs on the rest room door.* These two literal stories were "imaginal" inversion operations "symbolically" expressing the fact that the researcher had the ratio wrong—in terms of male-female composition. Inversion operations seem to express *disagreement* or contradiction, whereas reversals express negativity or contrariety.

Waking Imaging

Werner and Kaplan (1963), in their classic work, performed instructive research along the lines being suggested here, but using *waking imaging* procedures. As Werner and Kaplan point out, "the representation of ideas of negation in waking imagery has not been studied systematically" (p. 472). This situation remains largely unchanged since the time of their writing. In their pilot research on waking and hypnotic imaging, Werner and Kaplan found differences in the imaginal representations of contrariety and contradiction. They found images in such imaginal productions in the opposite direction for contrariety and contradiction. They conclude that there is no reason why similar representation should not also be found in dreaming.

Still other evidence of cognitive operations, different from typical waking cognitive operations expressed in imaging form, comes from the classic Clark University studies of microgenesis (Werner and Kaplan, 1963). In a series of experiments, it was found, similar to Freud's reports on dream-work mechanisms, that in dreaming the "and" relation tended to transform connectedness into simultaniety. In exploring "because" relations, the response of a subject requested to image the phrase

(**Stimulus**) "intelligent because cautious"

reported the imagery of a

(**Response**) girl who is neat walking around a puddle.

According to Werner and Kaplan (1963), walking around the puddle equals "caution," demonstrated intelligent behavior, "and in this way 'because' was expressed" (p. 459). The authors also state that the representations of the "because" relation were more multi-form than in dreams (p. 469). The fact is, however, there is not sufficient evidence, nor a precise enough methodology, to assess the magnitude of such data. Nevertheless, such findings are intriguing. It is interesting to note, but not surprising from the perspective of this paper, that Werner and Kaplan found no difference between waking and hypnotic imagery operations.

Discussion and Implications

The implications of researching nocturnal imaging, or the dream state, to investigate cognitive processes are seemingly as numerous as they are potentially important for explaining the full range of human cognition. The identification of an array or group of operational structures could increase our current understanding of logical and psycho-logical development and function. Such research may yield several forms of cognition not readily apparent in waking thought, and inform us about the basic structure(s) of cognition.

It has been suggested by an initial set of illustrations that such cognitive operations as "causal," "negation," "if," "and" relations, "because" relations, "either-or" relations, "temporal" relations, "just-as" relations, "transformations," and "logical classes" are performed in dreaming by imaging operations, including "simultanaiety," numerical multiplication, reversals, turning things around, turning things upside down, transforming things into their opposite, and so on. Just as in everyday life, there appears to be analogue-action processes where negation may be expressed by shaking one's head, or turning one's back. It has also been suggested that some of these cognitive operations may be idiosyncratic to the imaginal state, insofar as they are not evident in typical waking cognitive processes. It is now appropriate to examine this view more closely.

Explaining "Anomalous" Cognitive Oddities

From the imaging structures presented in this paper, as well as other cognitive peculiarities observed in dreaming cognition pointed out for so long by psychoanalysts, it appears reasonable not to dismiss cognitive peculiarities on the basis of preconceived assumptions about how the mind works. As

indicated earlier, the reduction of dream cognition by cognitive models to a non-motivationally based framework may lead us to disregard forms of cognitive operations not typically evident in waking cognition. With few exceptions (Martindale, 1981; Norman, 1979) cognitive psychologists have ignored atypical cognitive processes. The cognitive operation of "reversal" will again serve as an example of the problematic under discussion.

In what seems to be a reversal of his earlier position, Foulkes (1978) suggests that reversals in dreaming are not motivated or purposeful operations, but are, rather, analogous to speech errors (Foulkes, 1985). In this earlier work Foulkes (1978) says, ". . . one could hardly bring dreams into cognitive psychology while leaving motives, particularly unconscious irrational ones behind" (p. 19). Granted, while Foulkes translates Freudian language into his own linguistic propositional and inner-speech model, he nevertheless attributes non-conscious purposeful motivation to so-called irrational cognitive processes in dreaming. In his later work, however, Foulkes (1982) says that research from semantic memory suggests that reversals in dreaming may *simply* reflect the way we code information about the world, that is ". . . we may code directly what a concept's opposite *is*, or what a concept specifically *is not*" (p. 178, italics added). He says further "That independently established semantic distance would be inversely related to the likelihood that concepts and their opposites would be confused in dream construction" (p. 178). Foulkes suggests, first, that dream peculiarities such as reversals are not meaningful and, therefore, are not motivated; second, Foulkes is claiming that such oddities can be explained in the same manner as speech errors: that reversals and opposites in dreaming are the simple result of confusion due to the closeness of semantic associations and mnemonic coding processes.

In his latest volume Foulkes (1985) says that "Reversals may prove explicable not from the old Freudian adage that 'You *really* hate that "loved" person,' but from the fact that part of what we know about people, objects, and events is what they are not" (p. 161). There is little doubt that Foulkes is correct in his explanation. But he is probably only partially correct. There is another aspect to be explained: he explicates the *how* but not the *why*. To explain, for example, the neuromuscular mechanics of my writing these words does not explain my purpose or motivation for doing so. The *how* is one level of analysis, the *why* is yet another. To deny the latter is to reduce all human behavior to that of an automaton. Moreover, to render a global conclusion about motivation on the basis of such a narrow range of data as speech errors is a fundamental mistake of inferential logic and misuse of a model. In short, it just does not make sense in terms of a wider range of experience and data, just as the solipsistic argument that the world disappears when my eyes are closed makes no pragmatic sense at all.

The illustrations presented here from both the dreaming and the waking

state suggest a motivational basis to such ostensible oddities. In any event, these so-called anomalous operations are important to a cognitive science whether they are researched on a motivational level of analysis or not. Their importance has at least been recognized by Foulkes (1985). In discussing reversals, condensations, and displacement in dreaming he says,

> If empirical study confirms that even the odder moments of dreaming . . . are also lawful products of an organized mind but rather differently activated memory systems, then . . . an explanation of *how* the oddities of dreaming are lawful can be used as supporting data in the construction of general models of memory. (p. 162)

Somehow it appears to be an assumption that if these oddities are viewed as motivated, then they would not be lawful on the level of analysis on which Foulkes is focusing. But the lawful mechanics of my writing these words are no less lawful whether I am writing them from a motivational base or not. Further, in terms of the above quote, it should be added that an explanation of the *motivational base* of these oddities of dreaming can also be used in the construction of general models of memory and cognition just as non-motivational models can.

A further implication of my argument is that the so-called anomalous cognitive operations brought together and presented here directly support the observation that the significant issue generated by such research goes beyond the traditional boundaries of dream research. The fundamental issue is that of symbolic consciousness. Dream research thereby becomes a limited or special case of that field of study. As the cognitive operations were found to be similar in dreaming, hypnosis, waking imagery, and in the normal function of waking discourse processes, similar kinds of cognitive operations have also been found in the structural analysis of cultural myths (Levi-Strauss, 1966). They are also found in the study of poetics and some schizophrenic language. With appropriate methodologies to control and manipulate these "symbolic" operations, dream research seems to offer a direct approach to these mental operations.

The Problem of Content in Dream Research

The term *content* in dream research remains an undefined term. It is important now to bring some definition to it, as the unexamined assumptions linked to the term have precluded areas of research addressed in this paper. By attempting to clarify what is meant by content, perhaps areas of dream research largely ignored by all but clinically-oriented researchers will be viewed as valid *cognitive* research.

As indicated earlier, in the western scientific tradition, the study of dreams in general and dream content in particular has tended to be linked with dream

interpretation, usually of the Freudian kind, and has thereby been considered the domain of the clinician. With the advent of the psychophysiological study of the REM state or the study of the process of *dreaming*, the limited use of content became acceptable in research. The comparing of the content of REM imagery and NREM mentation was the basis of distinguishing between REM dream and NREM dreams. The use of content in the study of *dreams*, on the other hand, was, and largely remains, linked to dream interpretation—with some exceptions. Content had also been linked to the de-coding of dream symbolism.

Nevertheless, the analysis of dream content is generally ignored by most psychophysiological (or REM) researchers. Presumably, this is directly related to content analysis being associated with psychoanalytic dream interpretation, and the assumption made by many psychophysiological researchers that dream images are the consequences of the *random* firing of subcortical neurons. Thus, in REM research pertaining to physical changes, it is assumed that all changes in physiological processes associated with REM sleep are the result of the REM state itself and not of dream content occurring in the REM state. Accordingly, most researchers investigating the effects of REM sleep on physical health conditions assume that dream content is not involved in stress responses frequently occurring during REM. In a recent article in the *New England Journal of Medicine* (Guilleminault, Pool, Motta, and Gillis, 1984), which cited four cases of Sinus Arrest (myocardial asystoles of up to nine seconds in duration), the analysis of dream content was not a part of the causal assessment of the problem. However, dream content has been considered to have a significant impact on medical conditions (Cheek, 1963; Saul, Sheppard, Selby, Lhamon, and Sacks, 1954). For more recent research, see the work of Levitan (1980), Smith (this volume), and Warnes, (1982). For a general review see Haskell (1985a, 1985b).

The first breakthrough into a non-interpretation approach to dream content was the content analysis of Hall and Van de Castle (1966), which is basically a tabulatory accounting of various categories of events and objects clearly present in the dream report: that is, the frequency of indoor settings versus out-of-door settings, the frequency of houses versus public buildings and so on, all of which are compared along various demographic dimensions such as the content of male versus female dreams, age, etc. But even content analysis was laden with Freudian interpretative overtones. Since the Hall and Van de Castle research, extensive content studies have been conducted by psychologists, sociologists, and anthropologists using comparative, tabulatory, and correlational methods free of psychodynamic interpretations. These approaches should be considered as belonging to the study of *dreaming* and not to the study of *dreams*. The stigma still generally attached to dream research notwithstanding, the area of content analysis appears relatively accepted by

those within the field of dream research, but remains somewhat suspect by those outside the field and indeed even by some researchers inside the field who consider their work to be process oriented as opposed to content oriented.

The fact is, however, that much of process research cannot be accomplished without an analysis of content. The REM versus NREM and sleep onset research is a prime historical example, as is the research on children's dreams. There is no basic difference between the use *of* content by those who are process oriented and those who study content for itself. Both types of investigators use content, albeit, they use it to achieve different ends: the former to assess the level of cognitive development as reflected in children's dreams or to distinguish between REM and NREM dreams; the latter to assess, for example, the difference between male and female dreams. Whereas the former researchers analyze dream content to further understand dream process, the latter researchers analyze dream content to further understand social psychological phenomena. In many cases the study of the *process* of dreaming cannot be divorced from the study of content. By and large, however, the study of content analysis, *per se*, has been lumped, without logical justification, into the study of *dreams* via dream interpretation. This is a compounded problem, as the term "interpretation" like the term "content" has remained largely undefined and is only rhetorically used to dismiss any aspect of dream research that does not, at first glance, seem to fit into experimental methodologies. This latter approach to content and interpretation is generally understood implicitly, and is not based upon an objective analysis of the problem.

The distinction between the study of *dreams* on the one hand, and the study of *dreaming* on the other hand, a distinction once necessary to separate the scientific study of the dream state from interpretation type research, appears no longer useful. In fact, it is a confusing distinction. New definitions are needed. New approaches and methods often make possible a reconceptualization of traditional catgegories, just as the reconceptualization of old data often leads to the development of new approaches. The data and methods presented here suggest a definition of terms more in keeping with the research. The dichotomy between *dreams* and *dreaming* is much too global to adequately fit the complexity of dream research. Accordingly, the following six areas are tentatively offered as descriptive definitions of dream research.

Interpretation research. This area is constituted by the tracing of dream content and symbolism back to its ostensible origins in the Freudian constructs of latent dream thoughts (out of which the manifest dream develops) by methods such as free association—which facilitates that reconstruction, tracing the dream back to early traumatic events in the dreamer's life, and the attribution of the meaning of the dream to the dreamer's personal life.

Content research. This area is constituted by traditional content analysis methods. Tabulations, frequency counts, and correlations of the objects, ac-

tions, demographic variables, and other contents observed in the dream report are compiled and analyzed interrelationally in terms of individual and collective dream reports.

Social psychological research. This area is constituted by the use of content data for purposes of relating content findings to traditional areas of social and behavioral research such as male-female differences, age differences, racial or ethnic differences, sexual ideologies, social values, personality, and psychopathology correlations. In short, dream content findings can be approached in the same way as any behavioral scientist would approach a set of data[5].

Cognitive research. This area is constituted by mainstream cognitive models being applied to dream data such as mnemonic storage and retrieval, concept formation, and other *processes* of dreaming; and by the study of other structural or formal characteristics of dreaming such as organization within dream series, narrative development, problem solving, logical operations, and other cognitive functions related to the issue of consciousness.

Psychophysiological research. This area is constituted by the study of neurological, biological, chemical, and other physiologic processes attendent to the dream state.

None of these research areas is necessarily mutually exclusive, nor have I presented an exhaustive list. In addition, each area would have its *applied* uses. The distinction between *dreams* and *dreaming* is only minimally useful, if at all. To the extent that it is useful, however, the study of dreams should only be applied to dream interpretation as defined above, with all other areas to be included in the study of *dreaming*. Preferably, the distinction should be dropped, using only the generic heading "Dream Research," with each subarea separately identified.

The Problem of Symbolism

An important implication of this paper is that the study of so-called dream symbolism does not necessarily belong solely to dream interpretation research. It is the methodological and theoretical approach to symbolism that should assign it to a research category, not the subject matter itself. As was seen in the experiment cited earlier, the conditioning of subjects to a visual stimulus prior to sleep yields a dream imaging transformation of that stimulus which can be regarded as "symbolic." This investigatory process is not identical to

[5]Since dreaming is largely involuntary, dream research can be included among what social psychologists call unobtrusive methods of investigation (Bromely and Saxe, 1980). For example, subjects have become wise or sophisticated to questions about racial attitudes and thus respond accordingly. With analysis of data from dreams one has access to data not subject to conscious control (see Haskell, 1986a).

interpretation, however. It does not require a theoretical tracing via association of a "symbol's" origin. Its origins are known. Its "*historical source*" is known. The methods presented here for the study of logical relations function essentially the same as the conditioning strategy. With such methods so-called symbolic cognition can be studied cognitively. As to the separate problem of why particular content responses are selected-in as representative of, or equivalent to, the original stimulus, other methods need to be developed to explain the motivational basis of why particular contents are selected, perhaps along the lines of the early work of Moss (1967), using the semantic differential.

It is possible that much of what is now viewed as symbolic involves the same processes as dream imaging. In the Antrobus example cited above, where the response to a conditioned visual stimulus of cutting the bark off a tree with a cane knife was transformed into a dream of cutting a piece of pie with a knife, the example would traditionally be viewed by clinicians as a symbolic transformation of unconscious processes distorted by defense mechanisms. It is likely that many naturally occurring transformations are the result of non-conscious motivations and cognitive defense maneuvers (see the related experimental work of Dixon [1971, 1981]; Silverman and Weinberger [1985]). There is always the motivational question, even in the Antrobus experiment, of why the particular content of "pie" was selected as the transformative object. But that is an additional issue. The point is that all such symbolic transformations are probably based on a non-conscious abstract-feature analysis.

In a very real sense the content in all of the illustrations presented here can validly be considered to be metaphoric. Recent research into cognitive processes underlying metaphoric or analogic thought suggests an abstract-feature base (see Haskell 1986a, 1986b; Honech and Hoffman, 1980). In short, whether the research object is dream imaging, waking imagery (of selected kinds), metaphoric cognition, or symbolism, the basic cognitive operation responsible for its generation—the particularity of the content selection, i.e., whether a pie, bark, or cake—is an *abstract feature analysis* based upon an *abstract structure*. This structure is probably "hard-wired" into the brain (see Haskell, 1984; Marks 1978). The operation is similar to the mathematical function of *transformation of invariance*.

Just as in mathematical operations, where one can "plug-in" apples, peaches, pears, plums, or Buicks, so too, with cognitive structure operations in dreaming, multiple contents can be selected into the imaging process as long as they are in some way isomorphic to an abstract structure. This would explain what Freud meant by the symbol being overdetermined. That is, for any given *abstract meaning structure* (read: mathematical function) there are multiple objects, things, events (read: content) that can be used as representatives of that abstract meaning structure.

In this regard, there is little doubt that if a subject were conditioned to a given visual stimulus and stimulated by the identical stimuli on successive nights, the identical content of the transformation would seldom if ever be repeated, as there is a vast array of "equivalent mnemonic units" to isomorphically represent the referent. Thus, when our literary and Freudian colleagues maintain that the symbol is pregnant with meaning, they are quite correct—metaphorically speaking. It is a pregnancy with a potential of multiple births. *From this point of view control over dream content is not in fact control over content but control over abstract (meaning) storage structures. It is the failure to realize this fundamental distinction that has led to the conclusion that dreaming cannot be adequately controlled.* Indeed, it appears as though *specific* content cannot be controlled, but this is irrelevant since meaning is probably *derived from* structure and not content as is commonly thought.

A structural investigation of dream data may yield information about cognitive functions. In his classic work, *Play, Dreams and Imitation in Childhood,* Piaget (1962) critiques Freud's explanation of symbolism. In contradistinction to Freud's theory that dream symbolism is the result of censorship, Piaget considers unconscious symbolism a rudimentary form of cognition resulting from the process of *assimilation* in relation to other internal schemas, as opposed to the *process of accommodation* to external reality. Thus, the dream is overwhelmingly a private cognitive matrix of meaning that can only be understood in its own terms, and these terms relate to internal structure.

In an article clearly explicating Piaget's contribution to a theory of dreaming, Castle (1971) correctly points out that structurally "dreams say exactly what they mean" (p. 104). The structure being referred to, however, is defined in general terms, that is, as the general movement and organization of imagery, presumably analogous to sensory-motor action sequences and preoperational thought. For Piaget (Castle, 1971), dream structure is itself the meaning of the dream. What is needed are concepts to describe and understand it (p. 105). Structure may facilitate the re-evaluation of internal conflicts, a kind of structural problem solving. In Freudian dream theory the internal mechanisms by which conflicts are resolved are not at all clear. Presumably the story presented in a dream is somehow parallel to the real-life conflict situation, and when resolution occurs in the dream story, it is thereby resolved in the psychological reality. But this does not cognitively explain how the resolution is accomplished.

As indicated above, while specific imaginal content may be important, the essential mechanism of resolution is probably structural. For example, the cognitive operation of negation or contradiction transformed in the dream to imaginal action forms is the essential resolution mechanism, for these imaginal action forms or structures, i.e., turning something upside down, are based on abstract features which are generic. In this sense the specific im-

aginal content used to perform the operations are of little relevance. *The resolution resides not in the content or its being traced to its origin; rather the structure itself is the resolution, since it is an abstraction of the common mnemonic features of all content that is related to the problem.*

It is a tenet of psychoanalytic doctrine that the unconscious contains no sense of time. Thus, on an unconscious level the abstract features linking the parent figure to the therapist and leading the patient to respond to the therapist, as the patient responded to parents during childhood, is what is termed the transference relationship. Perhaps this also explains the clinical observation—from behavioral to psychodynamic therapies—that when one problem is solved there often occurs a ripple effect: other related problems seem to get resolved even though they have not been directly worked on. Therapies based on learning theories often attribute the ripple effect to stimulus generalization. From a logical structure perspective the capacity for stimulus generalization itself, however, is dependent on abstract feature analysis (Haskell, 1969). In fact, it may turn out that it is abstract structures which underlie the recognition of any similarity (Haskell, 1986b). It is interesting to note here that what is called "abstract feature analysis" in cognitive psychology (see Anderson, 1980) is, in fact, a method based on the hoary problem of comparing two phenomena by the similarities existing between them, the very same process (i.e., seeing similarities) involved in the analysis of symbolism in dreams. The cognitive operation of matching A to A1 or A to B to abstract out their similarities is identical in doing feature analysis, on the one hand, or matching the symbolic content of a dream, or generating and understanding metaphoric or analogic thought, on the other hand. While the former is acceptable in cognitive research, the latter is not. The only variable that is different, however, is the subject matter upon which feature analysis is performed.

Research Variables

A further implication of this paper is that operational structures may vary along different dimensions, i.e., REM, NREM, early or late periods of sleep, waking imagery, hypnotic depth, and so on. Structures probably vary in terms of cognitive development (Haskell, 1986b). Thus, there exists the possibility of classifying stages of operational structures and observing their developmental evolution and linkages, a kind of Piagetian epigenetic model of development of logical structures. The use of cross sectional studies in effect becomes a micro-genesis of development, with the "time line" being replaced by a series of discrete and qualitatively different states (i.e., different sleep stages and their respective mentation reports).

While controversy exists about whether REM mentation and other NREM

mentations during sleep are similar (Foulkes, 1985), so too there is controversy about whether hypnotic dreams (i.e., programmed imaginal productions while in hypnosis) are equivalent to posthypnotically suggested nocturnal dreams (Barber, 1962; Brenman, 1949), and whether dreams in the sleep laboratory (hypnotically suggested or natural) are equivalent (Evans, 1979) to at-home dreams. These problems may present difficulties for traditional areas of sleep and dream research, but for cognitive structure research, such differences are instructive for assessing logical operations along a developmental continuum.

Another interesting research question issuing from the framework of this paper would be to hypnotically "age regress" a subject through various stages of cognitive development to ascertain if and how *cognitive tasks, externally applied,* differ developmentally. Although age regressed studies have been done comparing hypnotically regressed *performances* via Piaget's stages of cognitive development (Reiff and Scheerer, 1959), these studies were later found to be problematic (O'Connell, Shor, and Orne, 1970). I suspect, however, that results may be different working with *imaginal* operational structures as opposed to *performance* tasks, just as there is a difference between what is widely recognized as *primary* versus *secondary* hypnotic responses. The former are actual motor responses such as arm levitation; the latter responses are more psychological in nature, such as amnesia. To engage in physical action would require a greater magnitude of dissociation from the normal reality-testing operations. It is easier to distort psychological or imagining processes than physical action. A similar methodological issue can be seen in the literature on subception type phenomena. In this field, the issue is known as response bias (see Dixon, 1981). Thus, because correct age regressed criterion are not generally met using motor performance tasks, it does not appear to follow that imaginal performance would not meet criterion level, especially for the dissociated dream states where motor action is absent and thus would not provide interference overlay.

A disadvantage of using hypnosis is that not all individuals are appropriate subjects. Tart (1965b) maintains that only a minority of subjects are amenable to this method. Evans (1979, p. 157) maintains that average to good subjects (as measured by standard hypnotic susceptibility scales) are appropriate. However, the type of induction used for most laboratory hypnotic research is not what many clinicians would consider adequate, either in terms of time, technique, or motivational variables (Erickson, 1980). With appropriate preparations, the pool of potential subjects may be larger than the research literature indicates. For example, a generally unrecognized variable in programming subjects for any purpose is the personal *meaningfulness* of the program for the subject. This variable appears in different research areas. Cartwright (1978) points this out in dream content manipulation research. The pioneering work of Cheek (1964, 1966), who discovered that suggestions in-

advertently administered to surgical patients while under general anaesthesia are processed cognitively, also attests that meaningfulness of the suggestion is a significant variable. Cheek found that for such inadvertent suggestions to be effective they had to be personally "meaningful" ones. That stimuli must be meaningful in order to be effective has also been found in work using subliminal perception technques (Dixon, 1981; Silverman and Weinberger, 1985). This variable is largely overlooked in psychological research.

The advantage experimental work holds over clinical research has been the careful control of variables. The advantage of clinical work has been the inclusion of subject motivation, inductions tailored specifically to the subject, and the rapport between clinician and subject—all significant variables in inducing a "state" of hypnosis. Perhaps the study of cognitive structure by hypnosis can provide the opportunity for the laboratory psychologist and the clinician to merge their strengths—not only in terms of bringing dreams into the laboratory but in the creation of more adequate methodologies as well.

Researching operational structures has advantages over imaginal content studies. First, as in the early studies of unconscious symbolism, controlling for a subject's knowledge of symbolism, is a problem. Second, expectations and demand characteristics should theoretically not be an influence upon structure. It may be assumed that logical structure is perhaps wired-in neurologically (Marks, 1978; McCulloch and Pitts, 1947) and/or that it is relatively impervious to experience (Piaget, 1971). Third, unlike content studies of imaginal production using hypnosis, it should not matter if the dream is a result of hypnotic suggestion or expectancy suggestion. An exception to this third factor might occur when we try to assess operational structures developmentally.

As research on the cognitive structure of dreams continues to accumulate, it may well provide coordinates within which content and meaning can be located, just as syntax functions in relation to word structure: the structure of a dream reporter may well provide a framework for analyzing dream content. In a similar manner, knowing the structure of semantically disordered speech, or imaginal and hallucinated productions, may provide a method of access to distorted meaning. Since particular structures may be related to some forms of thought disorders, research into logical relations in dreaming could be developed into a diagnostic tool. Further, should it be found that such operational structures do, in certain syndromes, breakdown, analysis of structure might prove valuable as a diagnostic criterion, especially if such structures can be placed within a developmental scheme. Inquiry into the logical structure of dreaming promises to be an important direction for future research.

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