DREAM DEVELOPMENT AND COGNITIVE PROCESSING

IN READING DISABLED CHILDREN

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CURRICULUM STUDIORUM

Stephen Butler was born in Montreal in 1958. He grew up in Montreal and attended Loyola High School followed by John Abbott College where he received a diploma in Social Sciences and Humanities. He obtained an Honours Bsc. in Psychology from Trent University, Peterborough, Ontario in 1981. Upon completion of this undergraduate degree, he enrolled in the doctoral program in Clinical Psychology at the University of Ottawa.

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ABSTRACT

Recent experimental dream research has suggested a relationship between cognitive capability and the sophistication of nocturnal mentation (Foulkes, 1982). The present study further examined this relationship by comparing formal and representational characteristics of REM mentation of children with a specific reading disability (*n*=10) with those of gender and age-matched normal subjects (*n*=14). All children were eight to nine years of age and were administered a battery of cognitive tests, including measures of intelligence, sequential and simultaneous processing, and language development. The reading disabled children were characterized by difficulties in the sequential processing of information and less well-developed language abilities. Sleep patterns were polygraphically monitored for six consecutive nights. The initial four nights were for adaption; content arousals were made during REM sleep periods on the final two nights. In addition to the traditional dependent measures of recall rate and word count, formal qualities of REM reports were assessed for the presence of self-representation, type of dream imagery, temporal sequence and organization, and narrative richness (Foulkes & Schmidt, 1983).

Of the 14 variables examined, only three significantly differentiated between groups. The dream reports from reading disabled children were characterized by shorter temporal sequences and were described using fewer words. Those from normal subjects contained a smaller proportion of temporal units where a self-character was present. On the basis of these analyses, REM dreams of reading disabled and normal subjects appear quite similar. Nevertheless, the observed differences appear to be related to the sequential processing impairments of the reading disabled children. Additionally, a different pattern of correlations between waking cognitive measures and dream variables was found in the normal and reading disabled groups. Trends in these data indicate that frequency and length of dream reports, as well as the active participation of a self character in the dream, were significantly related to normal children's reasoning and expressive language skills. In reading disabled children, REM recall rate and extensiveness of material recalled were significantly associated with visual-spatial memory processes. The results of this study suggest a relationship between waking cognitive development and dream formation. The cognitive deficits in reading disabled children appear to have influenced their ability to sustain dream sequences, indicating that specific cognitive abilities may affect certain formal characteristics of REM mentation.

DREAM DEVELOPMENT AND COGNITIVE PROCESSING IN READING DISABLED CHILDREN

Introduction

I - Cognitive Perspectives On REM Dreaming

In the last ten years a substantial amount of research, particularly in the fields of neuropsychology and psychobiology, has been devoted to the investigation of information processing during rapid eye movement (REM) sleep. The information processing thesis has been pursued experimentally in both animals (primarily rats and mice) and humans. The former group of studies has generated a number of hypotheses basically suggesting a close relationship between REM sleep and learning/memory processes (Fishbein & Gutwein, 1977; McGrath & Cohen, 1978; Pearlman, 1978; Smith & Butler, 1982; Smith, Young, & Young, 1980) despite inconsistent and often negative findings (Albert, Cicala, & Siegel, 1970; Hicks & Paulus, 1973; Plutter, Matthews, Tucker, & Cook, 1974). The latter area of research has looked at information processing during REM sleep in the context of creative thinking (Lewin & Glaubman, 1975), problem-solving (Cohen & Cox, 1975; Dave, 1979), and dream incubation (DeKoninck & Koulack, 1975; Foulkes, 1967; Kramer & Roth, 1973). Generally, the results in the human studies are less clear cut, more open to multiple interpretations, and more complex than those of animal studies.

There is also evidence suggesting that the density and organization of eye movements during REM sleep may serve as a physiological correlate of information processing at this time. For example, Prevost, DeKoninck, Barry, & Broughton (1974) reported both an increase in total REM sleep time and a significant decrease in vertical rapid eye movement density in subjects who had to learn to function normally despite wearing glasses exposing them to an inverted visual field. Prevost et al. (1974) cite these findings as strong support for Dewan's (1969) P information-processing hypothesis (to be presented shortly). In addition; the organization of rapid eye movements into well-defined patterns typified by discrete bursting activity during REM has been correlated with physical and mental maturation of the human organism (Costaldo & Krynicki, 1974; Petre-Quadens & De Lee, 1974; Tanguay, Ornitz, & Ritvo, 1976). Autistic and differentially handicapped children show abnormalities in these patterns. De la Peña, Dement, & Zarcone (1973) suggested a parallel between the sophistication of eye movement patterns during wakefulness as indices of perceptual-cognitive processes and their "mature" organization during REM sleep. In terms of REM dreaming, these authors concluded "that the hypothesized and observed correlation between the eye movements of REM sleep and wakefulness implies a correlation between certain parameters of waking perceptual-cognitive processes and REM sleep dreams, the nature of which is influenced by experimental or maturational considerations (De la Pena et al., 1973, p.409)." Finally, eye movement density is greater after REM sleep deprivation indicating that rebound REM sleep may differ from normal REM sleep in a qualitative way.

The most influential of the various hypotheses advocating some type of information-processing activity during REM sleep is Dewan's P hypothesis (Dewan, 1969). In this scheme REM sleep is viewed as a specific biological state serving an adaptive function in mammalian organisms. In general, this function entails the formation of new "programs" enabling the organism to cope more effectively with the environment. Dewan suggests that during REM sleep information initially accessed during wakefulness undergoes further analyses such as comparison, computation, and integration. This process is characterized by the revision and transformation of both past and present information from semipermanent or incompletely coded states to more permanent or more completely coded states (Cohen, 1979). Dewan refers to this information-processing activity as "off-line" programming, and suggests that the major function of

REM sleep is to allow the opportunity for such processing to occur. In addition, the importance of REM sleep to this function is related to the ontogenetic and phylogenetic development of mammalian organisms - for example, REM sleep would play an integral role in the processing of information during infancy and childhood in more complex mammals, and in modifying brain operations at cognitive and neurological levels (Cohen, 1979). Dewan's theoretical notions are in accord with a number of theorists employing an information-processing model of REM dreaming. This group of authors (Breger, 1967; Greenberg & Leiderman, 1966; Greenberg & Pearlman, 1975; Hawkins, 1966; Palombo, 1978a) postulates that during REM dreaming information of recent events is linked with accumulated past experiences and transferred into permanent memory.

Thus, a tentative theoretical and empirical basis exists for the notion that purposeful information processing occurs during REM sleep. Specific characteristics of rapid eye movements may represent a physiological correlate of this activity. The majority of this research stresses a memory consolidation function of REM sleep which prepares the organism for more complex learning. Nevertheless, as succinctly noted by Antrobus (1977), a major difficulty with hypothesizing a memory function for REM sleep is the lack of empirical evidence concerning the type(s) of information processing during REM sleep, or the operations performed on such information. To render such an hypothesis plausible would require more explicit knowledge of the input to the processor, mediating mechanisms, and output. These issues have begun to be investigated very recently in the context of REM dreaming, often from the perspective of cognitive theory (e.g., Antrobus, 1979; Foulkes, 1982a, 1982b; Palombo, 1980). The goals articulated by Antrobus are being pursued by cognitively oriented dream theorists in terms of three interrelated questions: 1) What form(s) of information-processing occur(s) during dreaming?; 2) What cognitive operations and processes construct the dream?; and, 3) What cognitive skills are necessary in order to dream? A discussion of the relevant theoretical positions and empirical data with respect to these questions will now follow.

Experimentally oriented dream theorists integrating research from dream psychology and cognitive psychology are unified in their assertion that dreaming is complex symbolic activity created and maintained by lawful cognitive operations and processes (Hunt, 1982). From this area of research, two major conceptualizations of the dream experience have emerged, and each approach emphasizes different cognitive processing modes and hemispheric influences as being responsible for dreaming.

One approach regards the dream as a form of creative visual-imaginal thought constructed primarily through visual-spatial and wholistic perceptual processes (Bakan, 1978; Galin, 1974; Hillman, 1977; Ornstein, 1972). This processing proceeds simultaneously (Hunt, 1982) and is believed by many to be mediated by right-hemisphere functioning (Bakan, 1978; Broughton, 1975; Ornstein, 1972). Hunt (1982) suggests that the theoretical origins of this hypothesis can be traced to two distinctive views of cognition and language. The first is founded on the wholistic-cognitive tradition developed by theorists such as Arnheim (1969, 1974), Vygotsky (1962) and Werner and Kaplan (1963). These authors suggest that all recombinatory symbolic activity, including dreaming, is based "on visual-spatial imagination and imagery-based metaphor, with language as its communicative form of expression only (Hunt, 1982, p.562)." The second view postulates that the visual-imaginal character of dreaming represents a form of recombinatory cognition (Hunt, 1982) that is qualitatively different from language processing and has its own developmental history. This form of symbolic activity has been compared to primary process thinking (Bakan, 1978), primitive tribal thinking (Cooper, 1975), and narcissism (Jung, 1961; Kohut, 1977; Winnicott, 1971). Significantly, both perspectives stress that dreaming is ultimately rooted in simultaneous/ wholistic processing which is spatial-imaginal in character and distinct from language.

Evidence to support the spatial-imaginal hypothesis is drawn from neurophysiological, clinical, and anecdotal sources. Studies which have investigated hemispheric lateralization of cognitive functions in neurologically healthy subjects (Doyle, Ornstein, & Galin, 1974; Galin & Ornstein, 1972; McGee, Humphree, & McAdam, 1973), in individuals with lateralized brain injury (Luria, 1966; Milner, 1971; Zangwill, 1960), and in subjects where interhemispheric connections have been severed (Gazzaniga, 1970; Milner & Taylor, 1972; Sperry, 1974; Sperry, Gazzaniga, & Bogen, 1969) suggest that in right-handed subjects the left cerebral hemisphere mediates linguistic and analytical processes, and the right hemisphere visuospatial and wholistic processes. Studies employing EEG measures as indicators of differential hemispheric involvement on verbal and spatial tasks have generated similar hypotheses (Doyle, Ornstein, & Galin, 1974; Galin & Ellis, 1977; Galin & Ornstein, 1972). Descriptively, the left-hemisphere mode of functioning has been believed to be conceptual, linear, rational, propositional, and secondary process, whereas that of the right hemisphere is considered to be concrete, imagistic, metaphoric, appositional, and primary process (Bakan, 1978). More recently, studies of interhemispheric differences have shifted emphasis away from dichotomies based on the content of information being processed by each hemisphere towards those reflecting the processing strategies and capacities which characterize each hemisphere (Levy & Trevarthen, 1976; Springer & Deutsch, 1981). This process orientation focuses more on an analytic/sequential versus wholistic/simultaneous dichotomy rather than the traditional verbal versus non-verbal one. The sequential-simultaneous processing dichotomy has also been considered within the context of complicated models of hemispheric functioning (e.g., Goldberg & Costa, 1981).

In conjunction with this body of research the hypothesis that dreaming is primarily a right hemispheric activity has received support from EEG studies of inter-hemispheric differences during sleep (Goldstein, 1979; Goldstein, Stoltzfus, & Gardocki, 1972; Herman, Roffwarg, & Hirshkovitz, 1981; Hirshkovitz, Ware, & Karacan, 1980; Rosekind, Coates, & Zarcone, 1979), and from observations reporting discontinuation of dreaming in patients with right posterior lesions (Humphrey & Zangwill, 1951). Also, evidence has been presented indicating that the REM-NREM cycle is part of a fundamental biorhythmic cycle related to shifts in hemispheric dominance and consequently to modes of cognitive functioning (Broughton, 1975; Kleitman, 1969). Broughton (1975) postulates that REM dreaming represents the ascension of the fantasy-intuitive activities of right-hemisphere functioning during this cycle. Bakan (1978), in addition to citing neurophysiological evidence, draws from numerous clinical and anecdotal sources to propose a similar hypothesis. Basically, he suggests that the right hemisphere mediates more primitive forms of cognition, such as primary process ideation, imagery, and fantasy evident in REM dreaming.

The spatial-imaginal hypothesis has received qualified empirical (Hunt, 1982) and theoretical (Palombo, 1978a, 1978b, 1979, 1980) support. Working from a phenomenological perspective, Hunt (1982) conducted a study on dream bizzareness to ascertain whether the "deep" structure of symbolic activity in dreaming was visual-spatial or verbal-propositional (Foulkes, 1982a - a position to be considered shortly). Normative dreaming was defined as "a constructed everyday life-space (Hunt, 1982, p.613)" periodically overcome by symbolic activity. Dream bizzareness was studied as an empirical indicator of the intrusion of symbolic functioning in 166 laboratory dreams (n=29) and 930 home dreams (n=78). The results were interpreted as showing the roots of recombinatory cognition in dreaming to be predominantly visual-spatial.

Palombo (1978a, 1978b) has advanced an information-processing memory model of REM dreaming bearing structural affinities with a spatial-imaginal account of dream formation. He suggests the primary mechanism in dream construction is comparison by superimposition, a process whereby primitive computational forms of an experiential character are linked together. Comparison by superimposition is a "method for comparing the representation of whole experiences including the sensory imagery in all modalities which defines the cognitive aspect of the experience, as well as the affective loading which measures its significance to the organism (Palombo, 1978b, p.472)." Hence, dreaming is a lower-order cognitive activity simultaneously creating new connections in our experience without prior knowledge of the full meaning of these experiences (Palombo, 1980). Comparison by superimposition does so on the basis of similarity and transcends our logical categories in the process. Palombo contrasts the difference between this type of cognitive functioning and higher-mental processes such as language as the difference between dreaming and dream interpretation, hypothesis finding and hypothesis testing, synthesis and analysis, and right brain and left brain. In context with the material presented thus far, this theory of dream construction would appear to rely on the simultaneous processing of sensory, perceptual, and mental-imaginal information. However, none of these possibilities is explicitly discussed in Palombo's work.

In summary, the most prominent data to support the spatial-imaginal hypothesis come from experimental and clinical neurophysiology and are correlational in nature. However, the evidence is not unanimous. Several investigators (Antrobus, Ehrlichman, & Weiner, 1978; Ehrlichman, Antrobus, & Weiner, 1985; Pivik, Bylsma, Busby, & Sawyer, 1982) have failed to replicate findings of right hemisphere dominance during REM sleep. Furthermore, the EEG-based research as a whole suggests that inter-hemispheric relationships during REM sleep are complicated and may vary with subject characteristics, scalp recording sites, and EEG frequency (Pivik et al., 1982). The findings of cessation of dreaming in subjects who incurred right-hemisphere injuries are also open to question. Humphrey and Zangwill's (1951) conclusions were based on patients' daytime impressions of dream activity which had occurred during the preceding evening. These reports were made before the discovery of vivid dreaming during REM sleep and hence prior to the use of laboratory awakenings. Subsequent research (Goodenough, Shapiro, Holden, & Steinscriber, 1959) has shown that laboratory dream reports elicited upon REM sleep awakenings often differ from those given the following day (Kerr & Foulkes, 1981). It may also be argued that the conclusions of Hunt (1982) supporting the spatial-imaginal hypothesis are open to question. This study ultimately wished to discover whether the "deep" structure or roots of symbolic activity in dreaming is visual-spatial or verbal-propositional. To accomplish this it would seem necessary for the authors to discriminate between "surface" presentation and "deep" structure. However, by interpreting phenomenologically what they have operationally defined as cognitive activity, i.e., dream bizarreness was most frequently reported as visual anomalies and therefore emerges ultimately from visual-spatial origins, the authors do not allow for the necessary discrimination and therefore could not have arrived at any different conclusions.

The most serious objection to the spatial-imaginal hypothesis remains the lack of research either manipulating or focusing more directly on the relationship between cognitive processes believed to be involved in dreaming and dream mentation. The spatial-imaginal hypothesis suggests that wholistic/simultaneous processing of predominantly perceptual (i.e., visual-spatial) and imaginal components is among the most salient features of REM dream construction. However, there are relatively few studies which have operationally defined these aspects of cognitive functioning in terms of reliable test measures in the context of REM dreaming. Furthermore, investigators who support this theoretical position have yet to present a coherent cognitive framework which attempts to explain the interaction of perceptual, imaginal, and linguistic codes in creating and regulating dream production. Therefore, based on the data presented, the conclusion that REM dreaming is predominantly a right-hemisphere function formed primarily through visual-spatial and wholistic perceptual processing which proceeds simultaneously is not justified at this time.

The second major conceptualization of REM dreaming has been put forth by David Foulkes (1978, 1982a, 1982b, 1985) who has generated a great deal of research oriented towards establishing a cognitive-psychological model of REM dreaming. This model attempts to answer the three questions posed earlier: 1) What is dreaming?; 2) How is the dream constructed?; and, 3) What skills are necessary for dreaming to occur?

From Foulkes' point of view, dreaming is thinking (Foulkes, 1982b). In more technical terms, it is defined as "a skilled cognitive act in which memories and knowledge are reprocessed leading to generation of generally well-organized dream narratives (Foulkes, 1982a, p.169)." These narratives consist of the sequential unfolding of visuo-spatial imagery according to a theme. It is hypothesized that thematic and sequential organization of the dream underlie and take precedence over visual-imaginal realization of the dream. Foulkes (1978) likens the dream to a story with a "deep" verbal-propositional formal structure generating a "surface" visual-imaginal presentation. The frontal regions of the left-hemisphere believed to mediate the verbal intentionality of waking narrative discourse (Luria, 1973) are also suggested as being responsible for the hypothesized strong narrative quality of dreams (Kerr & Foulkes, 1981). The thematic and coherent nature of dreaming has also been noted by other investigators (Cohen, 1977; Rechtschaffen, 1978). The following quote tersely summarizes Foulkes' position and contrasts it with the previous spatial-imaginal hypothesis which often stresses right-hemisphere functioning in dreaming.

"The right hemisphere model itself is beset with empirical difficulties and rests on a confusion of the surface re-presentations of most dreams, which are visual, with the under-lying processes of their generation, which must involve integrative-narrative mechanisms of left-hemisphere localization and have a strongly verbal basis (Foulkes, 1982b, p.227)."

Foulkes (1978, 1982b) presents a structural model (Palombo, 1979) of dream formation suggesting that dreaming is constructed largely through verbal-linguistic processing. Foulkes' early theoretical formulation of this perspective integrated Chomskyian transformational linguistics, cognitive psychology, and structural-linguistic interpretations of Freud (Edelson, 1972, 1975; Lacan, 1977). This is evident from Foulkes' statement that

"the other cognitive phenomenon akin to dreaming is language and that models of linguistic competence and performance are highly relevant to conceptualization in dream psychology; that a cognitive-linguistic approach to dreaming is compatible with, indeed most strikingly encodes, the best insights of Freud's model of dream formation and of his method of dream interpretation (1978, p. XV)."

Very briefly, Foulkes proposed that the motivational structures responsible for initiating the dream were "representational or ideational in quality, and linguistic and propositional in form (Foulkes, 1978, p.20)." These representational elements were transformed into visual images according to grammatical (i.e., syntactic) laws. On a more complex level, it was hypothesized that language enabled these elements to be hierarchically and serially ordered in organized structures as complex as thematic narratives (Foulkes, 1978). Ultimately, these structures served as meta-plans which initiated the dream sequence.

Foulkes (1982a) has refined this model in light of information-processing theory and recent psycholinguistic research (Foss & Hakes, 1978). He suggests that dreaming results from lawful operations which symbolic processes undergo in an information-processing system (Foulkes, 1982a). A model of speech production is employed as a heuristic device to explain dream production. This tentative model emphasizes the formal syntactic character of dreaming, and the cognitive operations and mechanisms which are concerned with presenting a thematic and literally comprehensible narrative. Dreaming is hypothesized as originating where speech comprehension ends, at the semantic level of long-term memory (LTM). With the advent of REM sleep, multiple and diverse representational units are simultaneously activated or disinhibited. Subsequently, this information will undergo transformations and increasing organization through semantic, syntactic, and lexical stages of processing to create the dream. At the semantic level, mixed concepts, features, propositions, and their inferences become partially structured and consistent in time. Then, a number of syntactic developments takes place generally referred to by Foulkes (1982a) as syntactic-thematic planning. The goal of these operations is basically to select an appropriate mode of discourse, either narration and/or life simulation, and guarantee that the material processed through this stage is propositionally well-formed and thematically consistent with the on-going dream. The result of thematic planning is linguistic output organized into semantic-syntactic structures which are given lexical items. The lexicon is accessed via the phonetic code. Finally, this phonetically coded information becomes input to modality specific representation systems responsible for generating imagery and affect.

This simplified presentation of Foulkes' model of dream construction (Foulkes, 1982a) illustrates his hypothesis that the verbal system is by and large responsible for dream formation and therefore supplies the input to its visual-imaginal realization. Foulkes reports that,

"I want to make the admittedly controversial suggestion not only that lexical processing is a dominant factor in midrange stages of dream construction but also that imaginal processing may not even enter the process of dream construction until after the point of lexical look-up. Because dreaming consists of organized sequences of visual-spatial imagery, a sequential plan must take precedence over the selection of the particular imaginal components that implement the plan. I propose that this plan is the output of a verbal processing system and that it accounts for the thematic coherence of dreaming. The concept of a limited capacity verbal processing system, with both syntactic and lexical components, explains the orderliness of REM experience despite the diffuse and sometimes inconsistent nature of the contents activated in LTM during REM sleep (Foulkes, 1982a, p.184)."

Foulkes cites experimental and anecdotal evidence to support this hypothesis. Neurophysiologically, patients who cannot create kinematic imagery (Turner's Syndrome) (Kerr, Foulkes, & Jurkovic, 1978), as well as those who are congenitally blind (Kerr, Foulkes, & Schmidt, 1982; Kirtley, 1975), seem to dream without any visual-imaginal realization. The latter group's dreaming is described as an experience-simulation unaccompanied by visual imagery (Foulkes, 1982a). Also, anecdotal reports from aphasic patients have indicate they may not experience dreams at all (Foulkes, 1978). Foulkes suggests this is related to their loss of "inner speech" and supposedly the capacity to formulate thoughts in syntactic frames with lexical items. Developmentally, data from a longitudinal study of dreams in children from 3-15 years of age suggest that increasing dream development and visual-imaginal activity are dependent on symbolic operations which are not figurative in nature (Foulkes, 1982b). In addition, Foulkes deduces the involvement of a verbal system in dream construction from content characteristics of dreaming. Our dreams contain speech and conversation (Snyder, 1970) which are frequently linguistically complex (Salzarulo & Cippoli, 1974) and at times closely connected to the entire dream experience

(Arkin, 1978). Of course, narrative continuity in dreaming is also taken as an indication of the participation of higher-integrative mechanisms, such as the verbal system. Finally, Foulkes interprets findings showing decreased left-hemisphere functioning during REM as a phenomenon relative to wakefulness and not as a sign of disengagement (Foulkes, 1982a).

A second major component of Foulkes' cognitive-psychological model of REM dreaming emphasizes the relationship between overall cognitive development, analytic processing skills, and dream development. From the results of his five-year longitudinal study of dreams in children from 3-15 years of age in which an average of 16 children were studied at each age level level (Foulkes, 1982b), Foulkes concluded that the capability for dream generation involves cognitive abilities which must be developed and whose growth follows waking cognitive maturation. Children seem to be able to symbolically recreate in dreaming only what they had learned to represent in waking life. The representational skills necessary for dreaming are hypothesized as being analytic in nature, involving the capacity to differentiate and integrate information (Foulkes, 1982b).

The results of the longitudinal study also indicate that qualitative increases in dreaming are discontinuous and limited to shifts in waking cognitive functioning. Foulkes outlines these changes in a chronology corresponding to Piaget's stages of cognitive development. The major transformation in children's dream functioning occurs with their accession to concrete-operational thought at approximately seven to nine years of age. The major changes at this time involve significant advancements in dream narrative organization and complexity, as well as in the representation of self in dreams. For the first time, REM dreaming moves from isolated mental acts to coherent dramatic narratives characterized by "strongly programmed and continuous dream imagery with "a mind of its own" (Foulkes, 1982b, p.136)." These scenarios contain significantly more references to a self character who participates in the activities and interactions of the dream. Also, for the first time feelings began to appear in a fairly substantial number of REM dream reports. In short, the children are now able to construct and maintain a dream world where they can symbolically move the "self" (Foulkes, 1982b) and therefore extend the realm of dream possibility. Foulkes reports that,

"By and large, REM dreams of talented eight and nine year olds are indistinguishable from our own both in terms of their formal structure and of how they are influenced by enduring motives and by more superficial traits of character or behavior (Foulkes, 1982b, p.148)."

These developments in children's dreams were reflected by increases in dream report rate, report length and complexity, content categories measuring participation by a dream character, and REM ratios calculating the relationship of subtle cognitive action to gross physical action. Generally, children who reported relatively complex dreams at this age level scored high on measures of cognitive maturation (Laurendeau-Pinard Test), figural ability (e.g., Children's Embedded Figures Test, Block Design), and waking narrative complexity. Specifically, REM report rate was highly correlated with tests of visuo-spatial analysis and verbally-mediated knowledge. In addition, based on cognitive measures associated with dream development in three to nine year olds, Foulkes suggested that the appearance of adult-like dreaming in concrete-operational children may have depended on growing language competence (Foulkes, 1982b).

Foulkes has recently (Foulkes, 1982c) offered numerous theoretical observations concerning children's experience of affect in REM dreaming, as well as the role of mental imagery in dream formation, and evaluated them in the context of cognitive development. The observations on dream affect are based on data from the longitudinal study which indicated that dreams reported in early childhood were nearly devoid of affect. The appearance of affect in reports of older children was seen to follow a gradual course, but the majority of dreams reported in later childhood and early adolescence still did not contain affect. Foulkes also noted that children's dreams which contained interactional content often were unaccompanied by feelings when one would expect them to occur. Foulkes suggests that the experience of feeling in REM dreaming is a relatively late development and in comparison with linguistic and imaginal processing may be of secondary importance in dream formation. Generally, he maintains that the ability to recreate feelings in dreams is dependent upon overall cognitive maturation and therefore the establishment of the necessary mental-symbolic processing capabilities.

Foulkes' observations concerning the role of mental imagery in the evolution of REM dreaming address two interrelated issues; namely, a) to what extent is visual-perceptual experience a necessary component of image-formation in REM dream production?; and, b) does imaginal representation in REM dreams depend on more fundamental advancements in cognitive functioning? With respect to the former issue, Foulkes (1982b) draws on studies comparing REM dreaming in blind and sighted subjects (Kerr et al., 1982; Kirkley, 1975). Briefly, congenitally blind subjects are able to represent complex spatial relationships in dream images and report thematically rich and complex dream scenarios in the absence of visual imagery. Correspondingly, adventitiously blind subjects who became blind during adolescence reported visual imaginal representations of people and places encountered solely prior to the onset of their blindness, and also continue to experience dreams visually. Foulkes concludes these results suggest that cognitive processing in adult dreaming is not dependent on recent visual experience (adventitiously blind) or well-developed forms of visual representation (congenitally blind). These hypotheses receive some indirect support from recent studies investigating the performance of blind and sighted subjects on tasks assessing the capacity to employ mental-imagery (Carpenter & Eisenberg, 1978; Kerr, 1983). Generally, these studies report that the performance of blind and sighted subjects on imagery tasks is similar in almost all respects. They provide convincing evidence that imaginal representation is not dependent on the visual processing system (Kerr, 1983) and, in conjunction with a growing number of studies (Baddeley & Liberman, as described in Baddeley, 1976; Kerr & Neisser, 1983; Neisser & Kerr, 1973; Shepard & Metzler, 1971), indicate that "imaging" may in fact rely on spatial processing which is not tied to any specific sensory modality. Interestingly, deficits in sighted subjects on tasks believed to be indices of the capacity for creating kinematic visual imagery are also associated with an inability to report dreams in which kinematic visual imagery is experienced (Kerr et al., 1978; Kerr & Foulkes, 1981). Taken together, the entire range of studies indicate that REM dreaming may incorporate different forms of imaginal representation, and these forms may be operationally defined and measured by performance on waking cognitive tasks.

In regard to the latter issue of mental imagery and its relationship to cognitive maturation, Foulkes cites the work of Piaget and Inhelder (1971) in conjunction with data from his longitudinal study to suggest that the capacity to create and transform mental imagery in REM dreaming is dependent on the achievement of operational thinking (Foulkes, 1982c). Thus, the capacity to dream does not simply arise as a consequence of perception. An extremely simplified synopsis of this viewpoint is as follows. Based on a series of experiments, Piaget and Inhelder (1971) postulate that the progression through the stages of cognitive development and the ontogenesis of kinematic imagery are interrelated processes. Initially, the pre-operational child appears capable only of producing static images. With the advent of concrete-operations, in Piaget's words, "a capacity for imaginal anticipation makes its first appearance , enabling the subject to reconstitute kinetic or transformation processes, and even foresee other simple sequences (Piaget & Inhelder, 1971, p.358)." Piaget goes on to suggest that the appearance of kinematic imagery is probably related to conservation abilities, a hypothesis recently supported in a study by Kerr, Corbitt, & Jurkovic (1980).

Foulkes interprets his longitudinal data which show a parallel progression in visual dream imagery as independently supporting Piaget and Inhelder's general postulate.

More recently, Foulkes (1985) has offered his most theoretically detailed account of dreaming as cognition. He reiterates the thesis that dreaming is symbolically mediated and dependent on the development of interpretive systems whose goal is to organize and make sense of experience. The emphasis on conceptual development and verbal processes in dream construction remains, accompanied by a more explicit account of the role of higher order cognitive functions in dream formation.

Foulkes' cognitive-psychological model of REM dreaming and its corresponding emphasis on cognitive maturation and analytic processes of a verbal-linguistic nature have been questioned on empirical and theoretical grounds (Palombo, 1979; Haskell, 1986a, 1986b; Hunt, 1982). Extensive critiques have been made in both areas by Hunt (1982) in a review article attempting a rapproachement between the phenomenological and cognitive theories of REM dreaming. Hunt's theoretical position, which is central to his analysis, can be summarized as follows: He suggests there are two main aspects to REM dreaming, a core of dream "realism" and specific forms of recombinatory symbolic processing which periodically interact with the realistic dream scenario. The first aspect is based on an organism's fundamental capacity to disassemble and rearrange perceptual schemata. Thus, if creatures can "perceive", "learn", and "remember", they can also dream (Hunt, 1982). The primacy of perception in creating dream imagery in Hunt's model is the basis for his first critique of Foulkes' position. He argues that in several studies Foulkes and his associates (Foulkes, 1978; Kerr et al., 1978) continually misrepresent visual-imaginal dream theories by implicitly advocating a "sensory reproduction" rather than a "constructionalist" view of perception - the latter conception being generally recognized by most cognitive theorists. The second aspect of REM dreaming in Hunt's model, i.e., recombinatory symbolic activity, includes verbal-propositional and visual-spatial forms of representation whose appearance in dreaming depends upon overall cognitive maturation. Recombinatory symbolic activity entails a capacity to re-constitute experience by de-centering from immediate perceptual events. This theoretical distinction is the basis for the more empirically relevant of Hunt's criticisms. First, he suggests that the correlation of dream recall with visual-spatial abilities in Foulkes' longitudinal study may reflect a growing capacity to abstract information from a complex experiential or perceptual set rather than qualitative advancements in dreaming per se. Second, he disputes the privileged position of linguistic processing over visual-spatial processing in Foulkes' model. Results showing ~~the~~ cessation of dreaming in aphasics have been inconclusive (Schanfald, Pearlman, Greenberg, & Kleefield, 1980) and at times negative (Geschwind, 1981). Also, Hunt suggests that the presence of verbalizations of sensed spatial distortions, and an almost complete absence of auditory or tactile qualities in the dream reports of Turner's syndrome patients, renders a verbal-linguistic interpretation of their dreams quite tentative. Along similar lines, Palombo (1979) disputes Foulkes' emphasis on the narrative quality of dreaming and his subsequent inference that higher-onset integrative mechanisms of a verbal-linguistic nature must be involved in dream construction. Palombo suggests that narration is most often confined to single episodes and absent from the larger sequences which make up more complete REM reports. As previously mentioned, Palombo proposes that the basic units of dreaming are primitive computational forms of an experiential character rather than linguistically-shaped propositions. He also indicates that Foulkes' accentuation of language processing in symbolic functioning provides for a rather constricted view of cognition.

Foulkes (1982a, 1982b) has replied to the criticisms questioning the validity of dream report data as indicators of actual developmental changes in dream production, as well as to objections to his emphasis on language processing in dream production. In the former instance he concurs that because dream experience is approached via the dream report, data indicating developmental changes in dream production may possibly be artifacts of dream retrieval and/or description. However, he argues against this interpretation on the following empirical grounds (Foulkes, 1982a, 1982b): 1) changes in dream report data such as shifts from static to active verbs, animal to human characters and body-state to social-interactive content are difficult to accommodate by a description and/or retrieval hypothesis; 2) correlational data from the longitudinal study do not indicate that improvements in REM reporting are dependent on measures of memory and/or descriptive ability; 3) it seems implausible that the correlations between figural/analytic abilities and quantitative and qualitative changes in REM dream reporting in early and middle childhood reflect relationships affecting solely dream reporting; 4) two early adolescent males with abnormally low scores on figural/analytic measures reported very few dreams for their age and it would seem highly unlikely that these deficits contributed solely to difficulties in describing or retrieving dreams; and, 5) when studied in a laboratory setting, adult chronic dream non-reporters (at home) with low scores on a figural/analytic task (Block Design) reported significantly fewer dreams than non-reporters with high scores on the same figural/analytic task.

In regard to the latter dispute over the emphasis on linguistic processing in dream production, Foulkes states that his model does not imply that "dreaming is (or involves) language" but rather that, "whatever their abstract similarities and differences, dreaming and language may share a common real-time production system (Foulkes, 1982a, p.170)." Interestingly, as noted by Hunt (1982), a study by Hauri, Sawyer, and Rechtschaffen (1967) indicates a possible compromise between the verbal-propositional and spatial-imaginal hypotheses. These investigators reported that features of plot and vivid, distorted imaginal features in dreams compromise distinct statistical factors. Accordingly, it is possible that verbal-propositional and spatial-imaginal operations differentially contribute to various types and/or degrees of dream experiences. Similarly, recent cognitive research suggests that the relationship between verbal and imaginal systems may be more subtle and complex than previously believed (Anderson, 1978). Thus, a dichotomization and hierarchic polarization of these processing systems may not be ultimately useful or correct. In general, one of the major tasks of cognitively-oriented dream research appears to be the investigation of interrelationships among aspects of cognitive functioning believed to be involved in dream formation. This will require a thorough assessment of the waking developmental cognitive status of the subject, and therefore careful delineation and operational definition of the abilities which will be evaluated.

In summary, two major conceptualizations of dreaming have developed in cognitively-oriented dream research. Each emphasizes different cognitive processing modes and hemispheric influences as mediating dream functioning. The first focuses on visual-spatial and wholistic-perceptual processes which operate simultaneously on information. The second stresses analytic processing of a verbal-linguistic nature which proceeds sequentially. Importantly, this approach also proposes that dream development is directly related to general cognitive maturation and hence the ability to represent experience and knowledge. At this time, the former notion rests largely on theoretical grounds. The most prominent data to support this hypothesis come from experimental studies and clinical neurophysiology. Based on these data, the suggestion is made that dreaming is predominantly a right-hemisphere function and the inference is made that visual-spatial and wholistic-perceptual processing contribute almost exclusively to dream formation. The latter hypotheses are more theoretically explicit and empirically based. The data to support these hypotheses come from developmental studies and neurophysiological evidence. Based on these data, the most plausible statement appears to be that dreaming requires cognitive skills and is dependent upon overall cognitive development. Trends in these findings suggest verbal-linguistic competence may be necessary for the achievement of adult levels of dreaming.

In general, there is a lack of more direct empirical evidence denoting the role of specific cognitive processes and skills in dreaming. Following the questions cited from Antrobus (1977) at the beginning of the paper, more explicit knowledge of the operations and types of information processed during REM dreaming is necessary. In terms of the material presented, it is difficult to predict the differential involvement of analytic/sequential and wholistic/simultaneous processing (hereafter referred to as sequential and simultaneous processing), as well as the input from the verbal and perceptual systems, in dream formation. However, one approach to the investigation of the relationship between certain cognitive capabilities and dream construction is to study children with specific deficits in cognitive functioning and measure associated characteristics of dream mentation. The nature of the cognitive deficits can be operationally defined and specified by administering a battery of cognitive and neurocognitive tests. Changes in dream mentation, i.e., in formal structure and forms of representation, can be measured through indices such as recall rate, report length, and dream rating scales. Furthermore, in conjunction with Foulkes' data (1982b), children with specific cognitive deficits can be studied during the critical period for dream development which appears to be the transition to concrete- operational thought. Children with specific reading disablities constitute a viable subject population for such a study. The following selective review will present research on the relationship between disorders of cognitive functioning in reading disabled children.

II - Cognitive Processing Impairments in Reading Disabled Children

The term developmental dyslexia or specific reading disability commonly refers to the presence of a critical and pervasive reading disorder in otherwise normal children (Vellutino, 1979a). Estimates of children with reading disabilities in the school population have ranged from between four and eight percent (Benton, 1978) to as high as 15 percent (Satz, Taylor, Friel, & Fletcher, 1978). In addition, life history investigations indicate that reading and learning difficulties early on in school may foreshadow more serious disturbances in late adolescence and early adulthood (Albee, Lane, & Reuter, 1964; Lane & Albee, 1970; Robins, 1966; Watt & Lubensky, 1976).

Research into reading disabilities is characterized by diversity, contradiction, and controversy regarding definition, etiology, and treatment of these disabilities (Malatesha & Dougan, 1982). Developmental dyslexia has been traditionally defined as "a disorder manifested by difficulty in learning to read despite conventional instruction, adequate intelligence, and socio-cultural opportunity. It is dependent upon fundamental cognitive disabilities which are frequently of a constitutional origin (Critchley, 1970, p.11)." However, as noted by several investigators, the reference to a neurological or constitutional basis is an assumption and the definition as a whole is ambiguous and one largely by exclusion (Eisenberg, 1978; Naylor, 1980; Satz & Morris, 1981; Taylor, Fletcher & Satz, 1982). In general, complex and varying factors contribute to the disorder, and elucidation of these factors will entail careful differentiation among individuals (Doehring, Trites, Patel & Fiedorowicz, 1981; Taylor et al., 1982).

A major controversy in reading disability research has been whether the disorder is a unitary phenomenon or represents a heterogeneous group of disorders (Malatesha & Dougan, 1982). Early studies in particular were characterized by a search for a unitary cause underlying reading deficits. However, differences in subject populations, experimental methodology and design for testing reading and non-reading skills have made it untenable to construct an explanation of reading deficits based on results from single-syndrome studies (Doehring, et al., 1981). The more prevalent theoretical position is that reading disabled children are quite heterogeneous in regard to academic, cognitive, neurological, and social development (Fletcher & Satz, 1979). Furthermore, interpretation of these differences may depend on a more thorough and fundamental understanding of reading acquisition processes in normal readers (Doehring, 1978). The following is a brief and selective review of the single-syndrome and reading-subtype literature.

The most popular single-syndrome explanation of specific reading disability (Vellutino, 1979a) has been that this disorder is caused by deficiencies in visual attention, visual perception or visual memory that interfere with normal processing of the graphic features of letters or of the orthographic regularities of printed words. Typically, an underlying neurological dysfunction has been inferred (Orton, 1925, 1937; Silver & Hagin, 1970) because in order to read, children must actively attend to linguistic stimuli by extracting information from print during eye-movement fixations (Vellutino, 1979a). At present, however, there is no strong evidence to support the hypothesis that deficits in visual processing could be a unitary cause of reading disabilities. Where these types of deficits have been found, they have been interpreted as interactive language problems (Doehring et al., 1981), reflecting a difficulty translating verbal information into a visual code (Vellutino, 1979a). Nevertheless, as will be demonstrated later, visual-perceptual processing deficits have often been mentioned in reading disability subtypes (e.g., Pirozzolo, 1979) and also in relation to developmental changes in reading acquisition (Satz & Sparrow, 1970; Satz et al., 1978).

Deficits in auditory processing (Wepman, 1975) and inter-sensory integration (Birch, 1962) have also been suggested as unitary causes of reading disabilities. With respect to the former area, Tallal (1980) indicated that some reading disabilities may be found in children with severe language impairments stemming from auditory processing deficits. Extensive reviews of the latter area conclude, however, that no empirical basis exists to justify this hypothesis (Friedes, 1974; Vellutino, 1979a). Vellutino (1979a) suggested that problems in visual-auditory integration may reflect either global verbal skill deficiencies or a specific dysfunction coordinating visual and verbal information.

Reading disabilities may also result from a specific deficit in the linguistic processing of speech which could interfere with recoding from printed to spoken form (Doehring et al., 1981). Research by Brandt and Rosen (1980) indicates that reading disabled children do not have significant difficulty abstracting linguistic features and perceiving strings of phonemes. However, Fox and Routh (1975, 1980) and Liberman and Shankweiler (1977, 1979) provide considerable evidence that these children do encounter great difficulty abstracting or becoming consciously aware of phonemes embedded in the continuous speech signal. Lack of this ability, which could be essential for recoding from print to speech, may hinder progress in code acquisition and reading in general (Doehring et al., 1981; Vellutino, 1981). Nevertheless, further investigation is needed to determine the exact role of phonological processing both within and across subjects at different stages of reading acquisition (Fletcher, Satz & Scholes, 1981).

Several investigators have found that poor readers differ from normal readers in serial order recall of various types of sensory stimuli, regardless of modality (Senft, 1969; Senft & Freudl, 1971, 1972). The differences are particularly evident when material is to be recalled on tasks tapping short-term memory. It has been suggested that poor readers sustain a specific or generalized deficiency in sequencing ability (Bakker, 1967; Corkin, 1974; Doehring, 1965; Zurif & Carsen, 1970). However, the theoretical assumptions of this hypothesis have been questioned on the basis of recent conceptualizations of human memory (Vellutino, 1979a). Furthermore, there is insufficient data to evaluate the theory at this time.

In an extensive review by Jorm (1979) short-term memory deficits were proposed as a unitary cause of specific reading disabilities. He suggested that short-term memory impairments can account for readers' susceptibility to problems in temporally ordering information and in phonological processing. However, memory deficits were not apparent when phonological recoding was prevented (Cermak, Goldberg, Cermak & Daly, 1980). In a series of studies, Liberman and Shankweiler (1979) concluded that both temporal order and memory deficits involve difficulties with phonetic coding. Finally, no investigators have found methods to test memory actually involved in reading (Doehring et al., 1981). Therefore, even if difficulties on memory tasks are demonstrated they may not relate directly to reading problems.

One prominent hypothesis put forth to account for specific reading disabilities has proposed incomplete cerebral lateralization as a unifying cause. Originally, Orton (1937) postulated that a physiological defect prevented the establishment of unilateral cerebral dominance and the acquisition of reading proficiency. More recent versions of this hypothesis suggest less than normal lateralization of language processes in the left hemisphere in those with reading disabilities (Doehring et al., 1981). The primary evidence to support these claims has traditionally been based on behavioral reports of increased incidence of left handedness, or crossed hand and eye dominance in reading disabled children. However, considerable evidence suggests there are no important differences between normal and poor readers in this regard (Ginsburg & Hartwick, 1971; Guyer & Friedman, 1975; Silver & Hagin, 1970). Some data indicate that directional confusion is correlated with reading disorders (Ginsburg & Hartwick, 1971; Satz & Sparrow, 1970).

Recent developments in neurophysiology have allowed the lateralization hypothesis to be tested using dichotic listening and visual field techniques. Based on this hypothesis, reading disabled children should exhibit less cerebral asymmetry on these tasks than normal controls. However, a number of thorough reviews concur that no consistent differences have been found (Leong, 1980; Naylor, 1980; Satz, 1976). It is unclear at present whether these findings reflect methodological problems due to experimental techniques, refutation of the hypothesis, or failure to account for heterogeneous groups of disabled readers (Doehring et al., 1981). For example, recent studies investigating hemispheric differences in subtype populations (Pirozzolo, 1979; Taylor et al., 1982) and with the use of more technically innovative neurophysiological techniques (Duffy, Burchfield & Lambroso, 1979; Hier, Lemay, Rosenberg & Perlo, 1978) appear to support the lateralization hypothesis.

The most influential and comprehensive theory in single-syndrome research has been put forth by Vellutino (1979a, 1981). His verbal processing theory states that reading disabilities result from deficits in the semantic, syntactic, or phonological components of reading. Generally, Vellutino (1981) proposes that poor readers exhibit several deficits in linguistic functioning and sequential and general verbal organization. These children have difficulties associating visual and verbal symbols, and word processing strategies are inflexible, either over-analytic, slow and prodding, or global and superficial. In addition, they have not acquired the functional codes at each representative level at which word constituents can be processed. Poor readers generally fail to develop necessary linguistic mental representation and manifest hallmarks of linguistic immaturity (Byrne, 1981).

Impairments in linguistic functioning and/or visual-verbal integration in poor readers are manifest in significant disparities between this group and normal readers on various measures of verbal processing (Vellutino, 1979a). These include dysfunction in short- and long-term memory for both meaningful and non-meaningful material, deficiencies in verbal classification and visual-verbal association learning, and difficulties in rapid naming of both concrete and symbolic stimuli. The linguistic deficits outlined here are believed to be of a subtle, rather than global, nature.

Vellutino's model has been criticized heavily by Fletcher and Satz (1979) for failure to consider heterogeneity in reading disorders and developmental changes in reading acquisition, and for making unjustified inferences from differences in task performance to hypothesized language deficits without more detailed knowledge of mediating mechanisms. Vellutino (1979b) has replied that the occurrence, nature, and interaction of linguistic deficiencies may constitute the basis of qualitatively different reading disabled subtypes.

Although not readily classifiable as part of the single-syndrome area of research, studies recently investigating the relationship between conceptual development and reading achievement bear directly on the questions of cognitive processing in reading disabled children and those addressed in the proposed study on dream development in this subject population. The major work in this area has been done by Elkind and associates (Briggs & Elkind, 1973; Elkind, 1964; Elkind, Koegler & Go, 1962; Elkind & Scott, 1962) who suggest that the achievement of reading proficiency may be related to changes in visual-perceptual organization that characterize the shift from pre-operational to concrete-operational thought. This hypothesis has received support from Maman (1981) who found significant differences between exceptional readers in kindergarten and grade 4 dyslexics on a measure of visual-perceptual schematization and visual-perceptual exploration associated with concrete-operational thought. However, no differences were found in overall conceptual capability as measured by tests of conservation. In general, an extensive review of this promising area by Vellutino (1979a) indicates that results are inconclusive and characterized by methodological problems. In particular, standardized test measures of Piagetian concepts are needed.

The increasing realization that reading disabilities may take several forms with respect to achievement patterns and/or associated cognitive-information processing abilities, which possibly vary as a function of etiology or age, has produced an abundance of research on reading subtypes (Satz & Morris, 1981). Satz and Morris' scheme for classifying these studies will be used as a heuristic device in presenting relevant material from this area of investigation.

A number of studies have used clinical-inferential methods to classify reading disabled children into distinct groups. Mattis, French, and Rapin (1975) and Mattis (1978) have presented a formal theory of subtypes based on the assumption that children require adequate language development, visual-spatial perception, and motor-speech blending to be able to read. Their studies indicate three non-overlapping subtypes, namely, a language disorder group, an articulatory and grapho-motor dyscoordination subtype, and a visual-spatial perceptual disorder subtype. The authors were able to correctly classify 90% of their reading disabled subjects in one study and 78% in a second study. Two major criticisms of Mattis et al., are important (Satz & Morris, 1981). First, arriving at subtypes based on prior rules may not reflect the potential structure(s) of the data. Second, it is puzzling that no children had common features among subtypes thereby generating a mixed group. Several clinical and empirical studies report children who demonstrated a mixed pattern of performance or achievement variables (Boder, 1973; Denckla, 1972; Ingram, Mason & Blackburn, 1970; Keeney & Keeney, 1968; Owen, 1978; Petraskas & Rourke, 1979; Rourke & Finlayson, 1975; Smith, 1970).

Boder (1973) conducted a quantitative and qualitative analysis of reading and spelling achievement patterns on 107 reading disabled children between 8 and 16 years of age. Three subtypes emerged which encompassed 100 of the children. Children classified as subtype 1 were described as "dysphonetic" readers, exhibiting selective impairments in analyzing the phonetic properties of words and syllables. They lacked word analysis skills and were unable to sound out and blend component words and syllables. This group, which comprised 67% of classifiable children, approached written material in a global fashion and relied on sight alone. The second subtype was a "dyseidetic" group who had selective impairments remembering and discriminating visual gestalts. This subtype, which accounted for 10% of the population studied, adopted a strategy of phonetic analysis and appeared to read laboriously as if they had seen each word for the first time. The third subtype was a mixed "dysphonetic-dyseidetic" group which comprised 23% of the children. They had deficiencies in both phonetic analysis and visual discrimination. Their word attack skills were fragmented, unpredictable, and bizarre. The strength of this study lies in its clinical analysis of each child's approach to written material. Correspondingly, its weakness is that the subtypes are abstractions from visual inspection of the data and therefore lack statistical verification or derivation (Satz & Morris, 1981).

Integrating his own work (Pirozzolo, 1979; Pirozzolo & Rayner, 1978) and other studies in the subtype literature (Boder, 1971, 1973; Mattis et al., 1975; Myklebust, 1965; Quiros, 1964), Pirozzolo concludes that strong support exists for the notion of at least two neurobehavioral subtypes of developmental dyslexia. The first subtype is an auditory-linguistic group composed of children impaired on tasks requiring rapid, complex, linguistic processing. Their reading and writing contain errors predominantly involving the sight-sound relationship of words. This group also shows a pattern of eye movements typical of children just learning to read. Pirozzolo compares this group to the dysphonetic subtype of Boder (1973) and general language impairment subtype of

Mattis et al. (1975) and Kinsbourne and Warrington (1963).

The second subtype is a visual-spatial group impaired on tasks requiring visual discrimination, analysis, and memory. This group scores low on tests of visual imagery, visuo-constructive ability, and visual-motor coordination, and had characteristic deficiencies analyzing the visual features of a text. They also exhibited a very atypical eye movement pattern while reading. Pirozzolo postulates a deficiency in the spatial mechanism that guides the eye to account for the problem. Pirozzolo (1979) suggests that auditory-linguistic dyslexia results from late maturation of the fiber pathways involved in left-hemisphere language functions, whereas visuo-spatial dyslexia is thought to occur as a result of late maturation of fiber pathways in left-hemisphere visual-association areas.

This brief and selective review of clinical-inferential subtypes highlights some of the findings, flaws, and limitations of these studies. Many authors report distinct reading disabled groups based on either linguistic or visual-perceptual deficits, or a mixture of both. However, these groups were often derived from visual inspection techniques or prior rules and theoretical assumptions. Also, varying numbers of unclassifiable children were usually reported and many studies did not employ a control group of normal readers.

A number of recent studies have used multivariate statistical techniques to define homogeneous subtypes in reading disabled children. Doehring and Hoshko (1977) sought to derive homogeneous subtypes based on the Q-factor analytic technique. Three major subtypes emerged from data accumulated by administering 31 tests of reading related skills to each child. The first subtype included children (n=13) with good performance on all visual-matching and on three of the auditory-visual-matching tests, but who showed poor performance on the oral reading tests. These children were classified as exhibiting a Type O (oral reading) reading deficit. The second group (n=11) exhibited good performance on visual scanning tests, poor performance on oral reading tests, and even poorer performance on auditory-visual letter matching. The authors defined this pattern of reading problems as a Type A (associative) deficit and suggested the basic difficulty of children in this group could "involve intermodal association between visual-verbal and auditory-verbal stimuli, or could be restricted to the auditory-verbal aspect (Doerhing et al., 1981, p.82)." The final subtype (n=8) showed good visual and auditory-visual matching of words and syllables. This subtype was referred to as a Type S (sequence) deficit, reflecting children's difficulties in responding to pronounceable sequences of letters as units. These subtypes were confirmed in a second study (Doehring, Hoshko & Bryans, 1979) which employed a large sample of normal readers

($\underline{n}$=31). Doehring et al. (1981) have reported results from a study evaluating the interaction of reading, language, and neuropsychological deficits. In this study, 70 of 88 subjects were successfully classified according to the three subtypes determined from previous studies, and subsequently administered a battery of language and neuropsychological tests. Several interesting conclusions were drawn by the authors from their results: first, the prevalence of linguistic difficulties in the sample as a whole appears to conform to Vellutino's (1979a) verbal processing hypothesis; second, their results did not contradict previous suggestions that reading disabilities tend to involve deficits in the basic mechanisms of reading, language, and cognition rather than higher-level deficiencies of comprehension and inference (Doehring et al., 1981, p.203); and finally, they propose more reading subtypes will probably emerge based on population samples, classification methods, and general refinements in methodology and theory. The major criticism of the work of Doehring and his associates (Satz & Morris, 1981) has been the use of the controversial Q-technique (Fleiss, Lawler, Platman & Fendl, 1971; Fleiss & Zubin, 1969).

Petrauskas and Rourke (1979) also used the Q-technique and administered 44 neuropsychological tests assessing a wide variety of cognitive, motor, and tactile skills to 160 children

(133 reading disabled; 27 normal) between the ages of seven and nine. These subjects were randomly assigned to two groups. Three major subtypes were reported which classified 50% of the sample. The first subtype, accounting for the largest number of subjects (*n*=40), had mild impairments in concept formation, word blending, immediate memory for digits, and moderate to severe impairment in verbal fluency and sentence memory. A language disorder similar to that reported by Mattis et al. (1975) was attributed to this group by the authors. Subtype 2 showed mild impairment in sentence memory, and moderate to severe impairment in finger recognition and immediate visual-spatial memory (*n*=26). Furthermore, this group showed uniformly poor performance on WRAT reading, spelling, and arithmetic subtests. These authors could not find a comparable group in the literature and suggested that the pattern of deficits reflected neurological dysfunction in the posterior regions of the left hemisphere. The third group had mild impairment in finger recognition, mild to moderate impairment in verbal fluency, sentence memory, and immediate visual-spatial memory, and moderate to severe impairment in concept formation. This group was deemed similar to the articulation and graphomotor dyscoordination group of Mattis et al. (1975, 1978). Two other subtypes were found yet designated unreliable (Satz & Morris, 1981). The major criticism of this study is its use of the Q-technique and a disproportionately small sample of normal readers.

Satz and Morris (1981) employed cluster analysis on a population of 236 children to define target and comparison groups, and to subsequently discriminate reading disabled subtypes. Five distinct subtypes emerged on the basis of neuropsychological and achievement variables. The first subtype (*n*=24) consisted of children severely impaired on all language measures. Performance on non-language perceptual tests for the global-language group were within normal limits. The second subtype (*n*=14) was selectively impaired on naming tasks. The third subtype (*n*=10) was a mixed global language and perceptual group in which there was severe impairment on all neuropsychological tests. The fourth group (*n*=24), described as a visual-perceptual subtype, was selectively impaired on non-language perceptual tests. The final subtype (*n*=12) showed no impairments on any neuropsychological test and demonstrated average to superior performance on all cognitive tests. They were classified as the unexpected group. Groups 1, 3, and 4 demonstrated a high proportion of soft neurological signs. Since 40% of the children showed no linguistic deficiencies, Satz and Morris (1981) contest Vellutino's verbal-processing hypothesis and caution against a unitary language deficit model of reading disabled children. Nevertheless, the major criticisms of this study are its lack of formal linguistic measures and limited use of neuropsychological tests. Hence, it is possible that linguistic difficulties of a more subtle nature went unnoticed in the perceptual subtypes.

Satz and his colleagues (Fletcher et al., 1981; Fletcher & Satz, 1980; Satz et al., 1978; Satz & Sparrow, 1970) have attempted to integrate the notion of subtypes into a developmental model of learning disabilities. This model assumes that performance differences between disabled and non-disabled readers represent variations in the acquisition process (Fletcher, 1981). More specifically, reading disabilities are hypothesized as reflecting a lag in brain maturation which differentially delays the acquisition of perceptual skills in younger children and linguistic skills in older children. Those with early sensory-perceptual deficits are thought to catch up on these skills and then lag on conceptual-linguistic abilities which have a slower and later ontogenetic development. Thus, neurological maturation continues in the developing reader, evidenced in part by resolution of soft neurological signs (Satz & Fletcher, 1980) and by developmental changes in performance on neuropsychological and cognitive tasks (Fletcher & Satz, 1980; Rourke, 1975, 1976). At present, the theory is unclear as to whether lags in development of conceptual-linguistic skills in older children reflect a transitory or more permanent defect (Satz et al., 1978). However, because rate of development eventually diminishes over time, failure to become proficient in reading skills before the onset of stability in adolescence may result in a more permanent defect. The findings of numerous studies indicate that children continue to have reading problems and problems associated with deficient academic achievement in later life (Peter & Spreen, 1979; Rourke & Orr, 1977; Satz et al., 1978; Trites & Fiedorowicz, 1976).

The major support for Satz's model comes from longitudinal research (Fletcher & Satz, 1980; Morris, Blashfield, & Satz, 1986; Satz et al., 1978), from theoretical models of reading acquisition (Fletcher, 1981; Gibson & Levin, 1975), and from developmental models of language (Palermo & Molfese, 1972). Palermo and Molfese's (1972) review of language development through the Piagetian stages may have relevance for Foulkes' hypothesized relationship between growing language competence and dreaming. They report shifts in language acquisition marked by instability in linguistic development at ages 5-8 and 10-15. These are transition points from preoperational thought to concrete operations in the first instance, and from concrete to formal in the second. They are followed by more sophisticated levels of linguistic functioning during the stage of concrete and formal operations.

There are several criticisms of Satz and colleagues' studies (Satz & Fletcher, 1980; Vellutino, 1979b) and limitations to their model. Few studies in support of this hypothesis have directly manipulated the age variable; rather, they have been cross-sectional. Perhaps a more serious criticism is that the test batteries typically administered to children in these studies have employed few thorough and detailed measures of linguistic functioning. Satz's model must also more explicitly account for the child's sophisticated use of language by age four (Vellutino, 1979b). In addition, it is evident that impairments in some disabled readers may be more compatible with a deficit model (Satz & Morris, 1981).

A summary of studies investigating subtypes of reading disabled children is given in Table 1. A recent volume on subtype analysis in learning disabled children (Rourke, 1985) indicates there have been no major additions to the subtypes presented. The statistical approaches to reading disability subtypes have extended the knowledge documented by clinical-inferential methods. Whereas the latter approach basically postulated three divisions, i.e., a language group, a visual-perceptual group, and a mixed group, the more fine-grained analysis of the former approach has detailed specific patterns of cognitive deficits within these divisions and at times transcended them altogether. Nevertheless, further research is needed to clarify and more accurately define the qualitative differences in readers within and across subtypes as well as account for developmental changes and potential interactions between reading and non-reading skills. Thus, studies are needed which integrate achievement, cognitive, and neuropsychological measures rather than primarily

TABLE 1: A SELECTIVE REVIEW OF STUDIES REPORTING READING DISABILITY SUBTYPES

Authors	No. of Reading Disabled Subjects	Method of Data Analysis
Kinsbourne & Warrington (1966)	13	Clinical Inferential
Denckla (1972)	52	Clinical Inferential
Naidoo (1972)	98	Clinical Inferential
Boder (1973)	107	Clinical Inferential
Mattis et al. (1975)	82	Clinical Inferential
Mattis et al. (1979)	400	Clinical Inferential
Pirozzolo (1979)	156	Clinical Inferential
Doehring & Hoshko (1977)	34	Statistical Analysis
Petraskas & Rourke (1979)	133	Statistical Analysis
Satz & Morris (1981)	87	Statistical Analysis
Doehring et al. (1981)	87	Statistical Analysis

Authors	Reading Disabled Subtypes & % of Children Classified In Each Subtype		Total % of Children Classified	Nature of Assessment
Kinsbourne & Warrington (1966)	Subtype with depressed verbal & delayed speech comprehension & vocabulary			WISC-R
	Subtype with poor performance score & delayed arithmetic & constructive abilities			
Denckla (1972)	Specific language disturbance		30%	Clinical Neuropsychological Assessment
	Visuo-spatial disturbance			
	Dyscontrol			
Naidoo (1972)	Linguistic difficulties	31%	37%	Neuropsychological & Reading Assessment
	Visual-spatial perceptual difficulites	6%		
Boder (1973)	Dysphonetic group	67%	100%	Reading Skills & Academic Assessment
	Dyseidetic group	10%		
	Mixed dysphonetic & dyseidetic	23%		
Mattis et al. (1975)	Language disorder	39%	90%	Language, Speech, Motor, & Perceptual Tasks
	Articulatory & graphomotor dyscoordination	37%		
	Visual-spatial perceptual	16%		

Authors	Reading Disabled Subtypes & % of Children Classified In Each Subtype		Total % of Children Classified	Nature of Assessment
Mattis et al. (1979)	Language disorder.	63%	78%	Language, Speech, Motor, & Perceptual Tasks
	Articulatory & graphomotor dyscoordination	10%		
	Visual-spatial perceptual	5%		
Pirozzolo (1979)	Auditory-linguistic			Neuropsychological, Academic, & Reading Assessment
	Visual-spatial			
Doehring & Hoshko (1977)	Oral reading deficit (Type o)	35%	91%	Reading Assessment
	Phonetic deficit	32%		
	Intersensory integration	24%		
Petraskas & Rourke (1979)	Language disorder	30%	50%	Neuropsychological, Academic, & Reading Assessment
	Neurologic dysfunction	19%		
	Articulomotor	9%		
Satz & Morris (1981)	Global language impairment	31%	100%	Neuropsychological, Academic, & Reading Assessment
	Language	16%		
	Mixed global language & perceptual	11%		
	Visual-perceptual-motor	28%		
	Unexpected	14%		
Doehring et al. (1981)	Linguistic deficit	38%	81%	Neuropsychological, Academic, & Reading Assessment
	Phonetic deficit	25%		
	Intersensory integration	18%		

relying on only one of the above. It is also evident that a proportion of the reading disabled population experiences difficulties in a number of processing modes and may have eluded classification altogether. As the relationship between reading, language, and cognition becomes more detailed, it is likely that more subtle classifications of reading disorders will emerge (Doehring et al., 1981).

The development of reading skills, and the associated problems encountered by disabled readers in acquiring these skills, have also been examined from a simultaneous-sequential processing perspective. Recently, Kaufmann and Kaufmann (1983a, 1983b) have advanced an assessment battery for children founded on this theoretical orientation as developed and researched in neuropsychology and cognitive psychology. Generally, these authors contend that,

"Successful peformance in complex tasks such as reading, spelling, and mathematics appears to require the ability to analyze, integrate, and synthesize verbal and visual-spatial information both sequentially (element by element) and simultaneously (as wholes). Weaknesses in either simultaneous or sequential processing can inhibit development in one or more important skills comprising the academic areas (Kaufmann & Kaufmann, 1983a, p.242)."

Support for this model comes both from investigations of the normal reading process and studies with reading disabled children. In terms of the former area, reading as a complex process "requires the integrative functioning of several cortical areas as units of the brain and involves the simultaneous and sequential processing of information (Kaufmann & Kaufmann, 1983a, p.243)." It includes the capacities to decode, gain lexical access, and organize the text. To simplify, sequential processing seems to be necessary for the development of decoding skills, whereas lexical access and text organization may depend more on simultaneous processing (Cummins & Das, 1977; Kirby, 1980). Simultaneous processing has also been implicated in the process of reading comprehension both directly (Cummins & Das, 1977; McLeod, 1978) and indirectly (Wilson, 1979; Gardner, 1981; Dean & Kulhavy, 1981). Interestingly, Rourke (1981) has proposed a neuropsychological model of differential hemispheric involvement in the process of reading which has parallels with the sequential-simultaneous one. He suggests initial involvement of the right hemisphere when reading is encountered as a novel task, followed by a more salient contribution from the left hemisphere (with reciprocal right hemisphere influence) as decoding skills become automated. Finally, at the level of reading comprehension, the left hemisphere would participate in the routine functions of reading, allowing the right hemisphere to extract meanings from the text.

The sequential-simultaneous processing model has also received confirmation from studies of reading disabled children. As a subject population, disabled readers have demonstrated problems in perceiving sequences (Bakker, 1967; Kaufmann, 1980) and on cognitive tasks which require sequential processing (Rugel, 1974; Kaufmann, 1979). Also, some poor readers' problems in text organization, whether verbal (Clay & Imlach, 1971) or non-verbal (Levin, 1973), suggest inefficient simultaneous processing (Kaufmann & Kaufmann, 1983a). In regards to the literature on reading disabled subtypes presented earlier, Boder and Doehring report sequential deficits in their largest subtype populations, while Boder also found simultaneous processing deficits to be characteristic of 10% of her reading disabled sample. Finally, two preliminary studies utilizing the Kaufmann Assessment Battery for Children (K-ABC) (Kaufmann & Kaufmann, 1983a) suggest a relationship between sequential and simultaneous processing deficits and reading disabled children. Hooper and Hynd (1982), employing Boder and Jarrico's (1982) method for diagnosing reading disabled children, found the sequential processing scales effective in discriminating reading disabled children from normal children. In addition, McRae (1981) found a significant relationship between scores on the simultaneous processing scale in dyslexics with deficits in reading comprehension. Hooper and Hynd (1986), in a sample of 117 normal and dyslexic children aged 8-12 years, supported their earlier findings and concluded that the K-ABC Sequential Processing Scale was useful for identifying children with specific reading disabilities.

In summary, a review of the research regarding reading disabled children indicates that such children comprise a heterogeneous diagnostic category characterized by differential deficits in various aspects of cognitive functioning. The cognitive impairments found in these children are based on studies characterized by differences in methodology, subject populations, test measures, selection criteria, and theoretical orientation. Consequently, the data can be examined from many perspectives, and conclusions from these investigations should be considered tentative. In general, the literature on reading disability subtypes indicates that a large proportion of disabled readers exhibit problems in verbal-linguistic functioning and a smaller proportion in visual-perceptual functioning (but, this in no way accounts for all reading disabled children). From the process orientation advocated by some investigators, research suggests that a large percentage of reading disabled children show inefficiencies in sequential processing and a smaller percentage in simultaneous processing.

In conjunction with the literature on cognition and dreaming, these conclusions suggest that reading disabled children would be an appropriate subject population in which to investigate aspects of cognitive functioning believed to be integral to dream formation. Specifically, some dream theorists have hypothesized sequential processing of a verbal-linguistic nature as being related to dream generation. Consequently, because a large proportion of reading disabled children have deficits in sequential processing, their ability to construct age-appropriate dreams may be affected. The purpose of the present investigation is to test this possibility. This study will focus directly on the relationship between sequential processing and dreaming. This processing orientation has been chosen rather than the dimension of verbal-linguistic functioning for practical and theoretical reasons. Practically, a recently developed assessment battery for children (K-ABC - see Appendix 1) provides a well-standardized measure for effectively discriminating children with sequential processing difficulties. Theoretically, the process orientation may be beneficial in focusing on problems in cognitive dream research, such as the uncertain relationship among certain aspects of cognitive functioning in creating the dream. This is demonstrated in Foulkes' work by the shifting relationships among analytic, verbal-linguistic, and figural abilities. Finally, using the process orientation may serve as a better control for the confound of descriptive ability in dream reporting, as language skills and sequential-simultaneous processing abilities were assessed separately.

STUDY SYNOPSIS

The general purpose of this study is to investigate the role of specific cognitive abilities and overall conceptual development in REM dreaming. The foregoing literature reviewed indicates that sequential processing abilities and overall level of conceptual development have been considered as integral to dream formation. Furthermore, these areas of cognitive functioning may be especially relevant to qualitative developments which occur in dreaming at approximately the time that concrete-operational thought becomes evident. However, sequential processing skills have not been directly manipulated to observe whether there have been any associated differences in REM dreaming. The research reviewed regarding the existence of impairments in cognitive functioning among reading disabled children indicates that it is both practicable and possible to identify a group characterized by sequential processing deficits. The present study, therefore, examined the relationship between cognitive abilities and dream formation during the concrete-operational stage of cognitive development. More specifically, dream reports from normal subjects and those from a group of reading disabled children who had sequential processing deficits were compared.

HYPOTHESES

Note. See Methodology for definition of terms.

Group Differences

1. It is hypothesized that there would be no differences between reading disabled and normal subjects' dreams on measures of Recall Rate, Active Self-Representation, Dream Affect, and Visual Dream Imagery.

   A relationship has been suggested from previous research (Foulkes, 1982b) between the child's cognitive stage of development and REM Recall Rate, Active Self-Representation, Dream Affect, and Visual Dream Imagery. Since all subjects will be concrete-operational, no differences on these dependent variables are expected.

2. It is hypothesized that reading disabled subjects will exhibit significantly poorer performance on Word Count, and temporal sequence variables: Temporal Units, Setting Extensity, Character Extensity, Character Discontinuity, and Global Discontinuity.

As reading disabled children usually exhibit sequential processing impairments, it is suggested that these deficits will result in difficulty sustaining longer dream sequences and sustaining the characters and settings which comprise them. Therefore, their dream sequences should be shorter than those of normal subjects. Dream reports from reading disabled subjects should contain fewer temporal units, and a lesser number of temporal units scored for the same settings and characters. Furthermore, the disruption of developing dream sequences due to sequential difficulties should result in a higher proportion of character changes, and global changes in characters and settings. As a result of the above, dream reports from reading disabled children are expected to contain significantly fewer words.

3. It is hypothesized that reading disabled subjects will exhibit significantly poorer performance on unit composition variables: Self Density, Other Density, and Total Density. Therefore, they will exhibit lower self participation and character participation on a unit-to-unit basis.

Although not directly addressed in previous research, it is possible that dream reports of greater length are typically more complex in structure and richer in content. This may be especially true with children, as development of dreaming towards adult levels is associated with increases in report length (Foulkes, 1982b). Consequently, it is hypothesized that reading disabled subjects should produce dreams that are not only shorter in narrative sequence, but less rich in the composition of units comprising the sequence. Secondly, a relationship between reading disabilities and language development is becoming well established, and some dream researchers postulate that language processes underlie more sophisticated dream formation. It could be argued, then, that reading disabled subjects with less well-developed language will produce dreams that are simpler.

Correlational Analyses

1. A previous investigation (Foulkes, 1982b) of REM dreaming in children seven to nine years of age reported positive correlations between percentage of REM dream recall and performance on the Block Design subtest of the WISC-R. The frequency of active participation by a self character was associated with higher Full Scale and Verbal Scale scores on the WISC-R. It is predicted that these relationships will be replicated with control subjects in this study. Positive and significant correlations are hypothesized between Block Design and REM recall, as well as with Active

Self-Representation and Full Scale and Vocabulary scores on the WISC-R (Short-Form).

2. It is believed that children's sequential processing capabilities will directly influence their ability to sustain a dream sequence. A group difference is hypothesized on temporal sequence variables due to reading disabled children's deficiencies in this area of cognitive functioning. Consequently, positive correlations are predicted in both groups between measures of sequential processing and temporal sequence variables (K-ABC Sequential Scale and its subtests with number of Temporal Units, Setting Extensity, Character Extensity, Character Discontinuity, and Global Discontinuity).

METHODOLOGY

Subjects

Subjects were 24 boys, 8-10 years of age. Fourteen of these boys were normal subjects ($\underline{M}$= 8.9 ± .70 years) who fell within the normal range of intellectual and academic functioning and were free from psychological, learning, and medical disorders. The remaining 10 children presented specific reading disabilities (criteria for which are defined in the Procedures section). The reading disabled children ($\underline{M}$= 9.1 ± .48 years) were within the normal range of intellectual functioning and were free from emotional problems, sensory impairments, gross brain damage or physical handicaps which could have affected their performance on reading measures. In addition, the 24 children had not emigrated from a non-english- or non-french-speaking country within the last five years. Reading disabled subjects were recruited from two major school boards in the Ottawa area and from the Children's Hospital of Eastern Ontario (CHEO). All of these children had been identified as having reading difficulties and were receiving remedial assistance. The normal subjects were obtained from advertisements placed in local newspapers and universities. All subjects and their parents were given a full explanation of the experimental procedures and informed consent was obtained prior to participation in the study. Upon completion of the experimental protocol, subjects were paid $100.00 for participating in the investigation.

Procedure

Testing and Selection Procedure

A series of tests was administered to allocate subjects to the experimental group and to assess specific aspects of cognitive functioning hypothesized as being relevant to dream capability. The details of test administration and subject selection are presented below and in Tables 2 and 3. A brief summary of the related research, standardization, and rationale underlying the use of each test measure appears in Appendix 1. Test administration was conducted by a doctoral student in clinical psychology and a research assistant. Both had received supervised training administering psychological tests to exceptional children.

Initially, children referred to the study because of reading difficulties were administered a short form of the WISC-R (Kaufmann, 1976) and an adaption of the Imaginative Narrative Test (Foulkes, 1984). The short form of the WISC-R provided a measure of intellectual functioning and thus controlled

TABLE 2: SELECTION PROCEDURE FOR READING DISABLED SUBJECTS

1. SCREENING PHASE

Test Administered	Inclusion Criteria
WISC-R (Short-Form)	Estimated Full Scale I.Q. $\geq$ 85
Imaginative Narrative Test	No Formal Criteria

2. FIRST TESTING PHASE

KAUFMANN ASSESSMENT BATTERY

K-ABC Achievement Scales: Reading/Decoding	Age 8 -Standard Score $>$ 12 Points Below Mean Standard Score of Mental Processing Scales; $p < .05$
	Age 9 -Standard Score $>$ 13 Points Below Mean Standard Score of Mental Processing Scales; $p < .05$

K-ABC Achievement Scales: Reading/Comprehension	Age 8 -Standard Scores $\geq$ 12 Points Below Mean Standard Score of Mental Processing Scale; $p < .05$
	Age 9 -Standard Score $\geq$ 13 Points Below Mean Standard Score of Mental Processing Scale; $p < .05$
K-ABC Mental Processing Scales	Ages 8 and 9 -Sequential Scale Standard Score $\geq$ 12 Points Below Simultaneous Scale Standard Score; $p < .05$

3. SECOND TESTING PHASE

Test of Language Development (TOLD)	No Criteria
Concept Assessment Kit- Conservation	No Criteria
Raven's Colored Progressive Matrices	No Criteria

TABLE 3: SELECTION PROCEDURE FOR NORMAL SUBJECTS

1. SCREENING PHASE

Test Administered	Inclusion Criteria
WISC-R (Short-Form)	Estimated Full Scale I.Q. $\geq$ 85
Imaginative Narrative Test	No Formal Criteria

2. FIRST TESTING PHASE

KAUFMANN ASSESSMENT BATTERY

Mental Processing Scales	Ages 8 and 9 -Mental Processing Composite Standard Score $\geq$ 85 -Difference Between Standard Scores of Sequential-Simultaneous Scales $<$ 12

K-ABC Achievement Scale	Ages 8 and 9 -Achievement Scale Standard Score $\geq$ 85 -Difference Between Standard Scores of Mental Processing and Achievement Scales $<$ 10 -No Significant Differences

3. SECOND TESTING PHASE

Test of Language Development (TOLD)	No Criteria
Concept Assessment Kit- Conservation	No Criteria
Raven's Colored Progressive Matrices	No Criteria

for this factor in subject selection (inclusion criterion was an estimate of full-scale I.Q. $\geq$ 85). The Imaginative Narrative Test was given to assess waking narrative ability. Following these procedures, children were administered the Kaufmann Assessment Battery for Children (K-ABC; Kaufmann & Kaufmann, 1983b) to determine whether they met the criteria for allocation to the experimental group. Subjects assigned to this group were diagnosed as having a specific reading disability and an impairment in sequential processing. The criteria for determining the existence of a specific reading disability and an impairment in sequential processing were as follows: 1) a standard score on each of the two reading achievement subtests significantly different ($p<.05$) from the mean standard score of all mental processing subtests (i.e., the Mental Processing Composite). The Mental Processing Composite is derived from the standard scores of each subtest comprising the Sequential and Simultaneous Scales. At ages eight and nine, significance at the .05 level between each of the reading subtests and the Mental Processing Composite represents a differential of 12 and 13 points, respectively; 2) a significant difference ($p<.05$) between Sequential and Simultaneous Global Scale standard scores with lower scores on the Sequential Scale. At both age levels this is a split of 12 points. Thus, reading disabled children with a Global Sequential Scale standard score at least 12 points lower than their Simultaneous score were assigned to the experimental group. The criterion values were taken from the K-ABC Interpretive Manual (Kaufmann & Kaufmann, 1983a). A total of 20 children were screened to yield 12 qualifying subjects.

Following this process, a second stage of testing was undertaken to assess language functioning and overall level of cognitive maturation in qualifying children. The Test of Language Development - Intermediate Version (TOLD-I; Newcomer & Hammill, 1977) and the Concept Assessment Kit - Conservation (Goldschmid & Bentler, 1968) were used to evaluate language development and conceptual development, respectively. Raven's Colored Progressive Matrices (CPM) were also given at this stage of testing to provide an additional measure of non-verbal reasoning.

There were no formal inclusion criteria in this testing phase since the relationships between these test measures and the dependent variables were studied solely from a correlational perspective.

Candidates for the normal group were administered the same tests in the identical order as the reading disabled children. Thus, they were screened on the short form of the WISC-R and the Imaginative Narrative Test to evaluate intellectual functioning and waking narrative abilities. Next, sequential and simultaneous processing and achievement were examined by the K-ABC. Finally, the TOLD-I and tests of conceptual development (Concept Assessment Kit - Conservation), and non-verbal reasoning (CPM) were given in the second stage of testing. A total of 26 children were screened to yield 15 qualifying normal subjects. Administration of inventories in the initial screening and two stages of testing required approximately five hours per subject.

The battery of tests administered, which included measures of conceptual development, language development, and sequential and simultaneous processing, was designed to measure aspects of cognitive functioning thought to underlie the production and formal characteristics of REM dreaming. At a more detailed level, a number of these tests measure cognitive processes which are components of these cognitive abilities, such as syntactic processing in language functioning or visual and spatial analysis and synthesis in simultaneous processing. Also, as noted previously, the use of a measure of waking narrative ability was employed to help interpret the role of this factor in dream reporting in context of the range of abilities assessed. Therefore, the fairly extensive testing of the children in this study was designed to allow investigation of the relationship between the overall cognitive functions assessed, their component processes, and dream development.

Polygraphic Recordings

Sleep patterns were recorded from all children for six consecutive nights using standardized electrode placements and recording procedures (Rechtschaften & Kales, 1968). Specifically, recordings of electroencephalographic (EEG) activity were taken from monopolar central (C4/A1 - C3/A2) derivations, eye movements (electrooculogram, EOG) were recorded from bipolar horizontal and vertical placements, and muscle activity (electromyogram, EMG) from bipolar facial placements. Polygraphic data were recorded on paper write-out and stored on magnetic tape. The amplifier bandwidth was 3-35 Hz for EEG recordings and 10-100 Hz for EMG recordings. EOG activity was monitored using direct coupling. Nights one to four were part of a project investigating normative sleep parameters in reading disabled children and data from these nights are not reported. These nights of baseline sleep recordings prior to content arousal nights also served as adaption nights. The final two nights were the content arousal nights.

Content Awakenings

During laboratory nights five and six, subjects were awakened from REM sleep to elicit information regarding mental activity occurring immediately prior to arousal. The awakenings were made by one experimenter calling the subject's name over an intercom system until acknowledgement was obtained. At this point, a second experimenter, who was blind with respect to the subject's group membership and the polygraphic tracings associated with the arousal, then entered the room and followed an interview format to obtain information about the presence and characteristics of immediately preceding mental activity. The content awakening procedure was explained to all subjects and rehearsed each night prior to sleep. Subjects were encouraged to request clarification of any aspect of the procedure which remained unclear and it was emphasized that they may or may not have something to report. On average there were five content awakenings per night. The first awakening occurred approximately five minutes into the second REM period and in the presence of eye movements. Each subsequent arousal was made approximately 10 minutes into the REM period and in the presence of eye movements.

The following interview format taken, with minor changes, from Foulkes (1984), was employed in the study.

1. What was going through your mind before I woke you up?
   (if there is a response)

2. What else can you remember?

   (repeated until reply is negative)

3. Could you see what was happening? Was it something you could picture?

   If No...

3a. How did you know what was happening?

   If Yes...

3b. What specifically could you see?

   ... anything else?

3c. Could you see the (person, object focused on) moving, or was it more like looking at a picture that didn't move or change?

4. Were you in this dream? (If yes) Where were you and what were you doing?

5. Were there other people in the dream? (If yes) Where were they and what were they doing?

6. (If more than one temporal unit has been reported) Tell me the order of what happened in the dream, what

happened first, then next...

7. (If it is not obvious whether there was a change of setting in the dream)
Did the dream change at any time to a different place?

8. Did you have any feelings in the dream? Were you sad or happy, calm or worried, mad or excited, anything like that during the dream?

9. Can you remember anything else?

10. Ok, thank you. You may go back to sleep now. (On the final awakening; "That is the last time I'm going to wake you up and ask you about your dreams. You may sleep until morning now.")

If there is a negative reply following the initial question the protocol proceeds as follows...

2. Would you think for just a minute and see if you can remember anything?

If positive, the protocol will begin with question (2) in the first instance, if not...

3. Would you say that something was going through your mind but you forgot it, or do you think there was nothing at all?

Sleep-Stage Scoring

Coded polygraphic data for the entire night were scored for sleep stage (verification of REM stage) using accepted criteria (Rechtschaffen & Kales, 1968). These ratings were done independently by two investigators on 30 second epochs with high reliability (>.90) based on epoch by epoch comparisons.

Content Reports - Scoring System

All REM interviews were tape recorded for later transcription. Following transcription the reports were coded and then evaluated independently on a number of measures by two judges blind with respect to subject, experimental group, and night. The definition of what constituted a dream was adapted from Foulkes and Shepherd's Scoring System for Children's Dreams (1970). The judges scored the REM dream reports using the following measures:

1) Rating Scales. Rating scales were employed primarily to document formal characteristics of REM reports. The scales were based on Foulkes' more recent refinements (Kerr et al.,

1982) of his earlier scoring system for children's dreams (Foulkes & Shepherd, 1970). Frequency data for three of the dependent variables were derived directly from the rating scales. The dependent variables and the corresponding scales from which the data were tabulated are given below:

Recall Rate	Rating Scale
	a) no dream
	b) dream forgotten
	c) dream reported

Dream Self-Representation	Rating Scale
	a) none
	b) passive
	c) active

Visual Dream Imagery	Rating Scale
	a) none
	b) static
	c) kinematic

Frequency data were tabulated for each category in a particular rating scale. A higher score on a rating measure denoted a greater percentage of higher alphabetic coefficients. With respect to the hypotheses, then, the "active role" category signified a more advanced form of dream Self-Representation than the "passive" category.

2) Foulkes and Schmidt's Sequence and Composition Scoring System (Foulkes & Schmidt, 1983). The procedure for scoring the 10 variables measuring the formal and representational properties of the children's dreams was derived from the above system. For these analyses, judges scored the dream reports for "temporal" or "activity" units, setting, and characters (self and others). A Temporal Unit was defined as "consisting of whatever activities could have occurred synchronously and were not described by the subject as having occurred successively" (Foulkes & Schmidt, 1983, p.268): It was scored whenever: (a) a character performed an activity that could not, in waking life, be synchronous with his previous activity; (b) a character responded to another character or event; or, (c) there was a topical change in vaguely recalled conversation (Foulkes & Schmidt, 1983, p.268). For each Temporal Unit that was assigned, judges were instructed to score, when present in the report, the Setting and Characters (self and others). Thus, the Characters and

Settings were scored on a unit to unit basis. Once dream reports were scored for these indices, calculations were carried out to yield values for the dream variables. The dependent measures assessed the temporal organization and richness of composition of the activity units. Temporal organization or sequence was examined in terms of the extensiveness and continuity of settings and characters. Richness of composition reflected the density of Characters per Temporal Unit, the percentage of Temporal Units where a Self Character had been scored by the judges, as well as the percentage of Temporal Units without a scored Setting, or Setting and Character. A listing of these variables appears in the Analysis of Data section.

3) Foulkes' Scoring System For Children's Dreams (Foulkes & Shepherd, 1970). The remaining two dependent variables in the study were scored using aspects of this system. Word Count (Var.2) was scored in accordance with the guidelines established by Foulkes and Shepherd for counting words which actually pertain to the dream experience. The frequency data for the Dream Affect variable were obtained from the feeling content-analysis category in their system and are illustrated below.

	Dreamer	Other	Either
Feelings			
afraid, anxious, worried	-	-	-
angry, mad, hostile	-	-	-
sad, unhappy, disappointed	-	-	-
happy, pleased	-	-	-
surprised, startled	-	-	-
excited in unspecified way	-	-	-
confused, unsettled	-	-	-
any	-	-	-

To score the dream measures, the judges were provided with score sheets and written guidelines which contained examples from dream reports. A copy of this information appears in Appendices 2 and 3. The judges, two students completing Master's diplomas in clinical psychology, trained on 30 content-reports from a previous study of adolescent boys (12-15 years of age) prior to scoring the data from this study. The judges met with the experimenter after scoring each set of 10 dreams to discuss any difficulties in rating or interpretation of the dream reports and to resolve their scoring differences. Following this procedure the raters coded 217 dream reports for the eight dream variables: Recall Rate, Self-Representation, Visual Imagery, Affect, Temporal Units, Characters (self and others), Setting

Self-Representation per Temporal Unit. The inter-judge reliabilities computed for the eight dream measures from these reports are listed in Table 4. The reliabilities for Recall Rate, Visual Imagery, Self-Representation, and Affect were determined by taking the percentage of reports where judges agreed on the specific category for each rating scale. The calculations to determine inter-judge reliabilities for Temporal Units, Setting, and Characters were more complex and followed the procedure outlined by Foulkes and Schmidt (1983). Reliability for Temporal Units was achieved by taking two times the number of units and successions scored in common over the total number of units and successions scored by the two judges. Successions refer to the temporal or sequential organization of units. Thus, the formula for computing reliability takes into account both the judges' ability to agree on what constitutes a Temporal Unit, as well as their capacity to concur on the sequential development of activity in the dream from one Temporal Unit to the next. Setting reliability was defined as the percentage of Temporal Units on which judges independently agreed. The computation of Setting reliability was confined to those Temporal Units where judges agreed on the nature of activity taking place. Character reliability was determined by taking the ratio of twice the incidence of common character

TABLE 4: INTER-RATER RELIABILITIES OF DREAM VARIABLES

Dream Variable

Rating Scales	Inter-Rater Agreement
REM Recall Rate (All Dreams)	98%
REM Recall Rate (> 1 Temporal Unit)	91%
Active Self-Representation	97%
Visual Imagery	96%
Dream Affect	97%
Temporal Sequence and Unit Composition Measures	
Temporal Units (Within 1 Temporal Unit)	82%
Setting Reliability	90%
Character Reliability	83%
Self Density Reliability	96%
Word Count	78%

ascription to activity units over the total number of character ascriptions made by both judges to activity units. The reliability of scoring Self-Representation on a unit to unit basis was calculated by using the percentage of units on which judges independently agreed on either active or passive Self-Representation. Finally, inter-rater reliability for Word Count was defined as the percentage of reports for which judges were within 15% of their respective estimations of the total number of words in a report.

Waking Narrative Reports - Scoring System

All Imaginal and Personal narratives were tape recorded for later transcription. Following transcription and coding, Imaginal narratives were scored for Word Count and the temporal sequence and richness of composition variables. The Personal narratives were scored solely for Word Count and number of Temporal Units. The narrative reports were evaluated independently by the two judges blind with respect to subject and group membership. With the exception of Self Density, the ratings and their inter-judge reliabilities were done following the same guidelines used for the dream reports. For Self Density in the waking narrative reports, reliability was calculated by determining the percentage of units on which judges independently agreed. The Self Character was in an active role.

This was believed to be a more relevant variable as a Self Character was automatically placed in the narrative by virtue of the instructions. The reliability coefficients for waking narrative variables are listed in Table 5. Due to technical difficulties and non-compliance from several children, waking narrative data were collected from nine normal subjects and seven reading disabled children.

Analysis of Data

The data on which the analysis of the dependent variables is based were ordinal in character. As a result, they did not meet the assumptions of continuity and underlying normality necessary for a parametric analysis. Consequently, the inferential analysis in this study involved non-parametric statistical tests to compare group differences. A secondary descriptive analysis involving correlations was also used to examine the relationship between various pairs of variables, independent of group membership.

The following constraints were placed on the data for analyses of temporal sequence and unit composition dream variables (Var.6-16): 1) all reports one Temporal Unit in length were excluded from analyses. This conformed to the procedure

TABLE 5: INTER-RATER RELIABILITIES OF WAKING NARRATIVE VARIABLES

	Imaginative Narratives	Personal Narratives
Word Count Reliability	91%	86%
Temporal Unit Reliability (Within 1 Temporal Unit)	70%	79%
Setting Reliability	74%	
Character Reliability	87%	
Self Density Reliability (Active Role)	86%	

taken by Foulkes and Schmidt (1983) to ensure that all reports demonstrated temporal sequence; 2) four REM dream reports, two from each night, were randomly selected from every subject. This controlled for subject bias with respect to temporal sequence; and, 3) scores for the dream measures from the four content awakenings were summed to yield a total score for each dependent variable from every subject. Dream data from one normal subject and two reading disabled children were eliminated due to a lack of recalled dreams. For the two reading disabled children, recall of at least two dreams occurred on only one of the two nights when arousals were made. The normal subject was deleted due to technical failure to record his REM reports on night two.

The result of the above procedure was a data set of 96 dream reports (40-RD, 56-Normal) from the 203 (88-RD, 115-Normal) scored for content by the judges from these 24 subjects. The data analyses of temporal sequence and unit composition variables, therefore, were based on a subset of REM dream reports, whereas analyses for dream variables derived from rating scales (Var.1-5) involved the entire sample of 203 dream reports. It was not necessary to apply the constraints on the latter dream measures because they were expressed as a percentage or proportion of the total number of dreams. On the other hand, temporal sequence and unit composition dream variables were expressed as a sum across dreams and this score per subject would be directly affected by the number of dreams included in the total. The variables considered in the non-parametric analyses for group differences were:

Recall Rate (Var.1): frequency data denoting the percentage of dreams reported upon awakening from a REM period.

Recall Rate (Var.2): frequency data denoting the percentage of dreams which were reported upon awakening from a REM period (that were at least two Temporal Units in length).

Active Self-Representation (Var.3): frequency data (percentage) derived from a rating scale recording the number of dreams in which a "self" character is present in an active role.

Dream Affect (Var.4): frequency data (percentage) derived from the affect content analysis category of Foulkes' scoring system for children's dreams denoting the absence or presence and quality of affect.

Visual Dream Imagery (Var.5): frequency data derived from a rating scale recording the absence or presence and quality of visual dream imagery.

Word Count (Var.6): a whole number signifying the length of the dream report.

Temporal Units (Var.7): a whole number recording the total number of Temporal Units in a dream report.

Setting Extensity (Var.8): the mean number of Temporal Units for which a setting, once introduced, persisted.

Character Extensity (Var.9): the mean number of Temporal Units for which a non-self character, once introduced, persisted.

Character Discontinuity (Var.10): the number of Temporal Units with some character change from the previous unit divided by the total number of Temporal Units minus one.

Global Discontinuity (Var.11): the number of units with some character change and a setting change from the previous Temporal Unit, divided by the total number of Temporal Units minus one.

Self Density (Var.12): the proportion of Temporal Units for which a self-character is scored.

Other Density (Var.13): the mean number of non-self characters per activity unit.

Total Density (Var.14): Variables 12 and 13 summed.

Setting Inarticulation (Var.15): the percentage of units without a scored setting.

Global Inarticulation (Var.16): the percentage of units without a scored setting and any scored character.

Group Differences

The Wilcoxon Two-Sample Test (Marascuilo & McSweeney, 1977) was used to examine differences (two-tailed) in pooled

Recall Rate (i.e., night one and night two combined) for all dreams (Var.1), for dreams greater than one Temporal Unit in length (Var.2), and for the remaining variables derived from rating scales (Var.3-5). Comparisons between normal and reading disabled children for group differences (one-tailed) on all other dependent variables were made using the Kruskal-Wallis Test (Marascuilo and McSweeney, 1977), a non-parametric one-way analysis of variance. A series of t-tests compared reading disabled and normal children's performance on the waking cognitive measures. The Bonferroni correction procedure for multiple comparisons (Marascuilo & Levine, 1983) was applied to t-test analyses and the adjusted critical value was $z=2.68; p<.05$.

Correlational Analyses

Dream Content and Waking Narrative Analyses

A major supplementary analysis related subject age and performance on cognitive test measures with scores on dream variables. In this analysis, scaled scores from the cognitive test measures were used to control for increases in subjects' performance which may have occurred due to increases in age. In previous research, raw scores from cognitive tests (Foulkes, 1982b) have been used and therefore a similar analysis was conducted for comparative purposes. The Spearman-Rank correlation was used to relate age and cognitive test scores with frequency dream variables based on rating scales (Var.1-5). Pearson-Product-Moment correlation coefficients were computed between the cognitive test measures and remaining dream variables (Var.6-14). A total of 165 Spearman-Rank and 365 Pearson-Product-Moment correlations were computed. The Pearson-Product-Moment statistic was used to examine the relationship between subject age, cognitive test scores, and waking narrative variables from Personal (Var.6-7) and Imaginal (Var.6-14) narratives. A total of 66 and 297 correlations were calculated for Personal and Imaginal Narratives, respectively. A two-tailed level of significance was applied to all correlations except in instances where directional predictions had been made. The Bonferroni correction procedure for multiple comparisons (Marascuilo, & Levine, 1983) was considered as a procedure to adjust for spurious statistical significance resulting from the number of correlations calculated. However, using this method the significance level was inflated to such an extreme degree that all significant correlations were eliminated. The non-adjusted significant correlations in this study are reported because they may reflect important waking dream relationships for the children investigated and because the Bonferroni formula, strictly speaking, was not developed, for correlational analyses. It is realized that the relationships obtained must be taken in context with the number of correlations computed.

RESULTS

Waking Cognitive Measures

Waking measures of intelligence and cognitive development for reading disabled and normal children are listed in Tables 6 and 7. As a group, normal subjects scored in the normal to superior range on the short-form of the WISC-R and the Mental Processing Composite of the K-ABC. The mean score fell within the high average range on both measures. On the K-ABC, the mean difference between Sequential and Simultaneous Scale scores in the normal group was minimal. Their performance on achievement measures, including reading subtests, was in the high average range. The mean score on the Full Scale of the TOLD-I was also in the high average range. All normal subjects were found to be functioning at the concrete-operational stage of thought as measured by the Concept-Assessment Kit - Conservation.

The reading disabled group scored in the average to superior range on the WISC-R, and in the average range on the Mental Processing Composite of the K-ABC. The mean score fell within the average range on both measures. The difference in reading disabled children's performance on the Sequential and Simultan-

TABLE 6: MEAN SCORES OF THE NORMAL AND READING DISABLED GROUPS ON CRITERION TEST MEASURES

Test Measure		N	RD	Mean Difference	Significance Level
1. WISC-R					
	M	115.1	107.3	7.8	NS
	SD	8.69	13.0		
2. K-ABC					
Sequential Scale	M	110.5	85.9	24.6	$p < .05^{*}$
	SD	9.22	5.62		
Simultaneous Scale	M	112.8	108.3	4.5	NS
	SD	8.56	5.54		
Mental Processing Composite	M	113.6	99.1	14.5	$p < .05^{**}$
	SD	9.84	6.26		
Reading Decoding	M	113.8	85.9	27.9	$p < .05^{*}$
	SD	11.96	5.54		
Reading Comprehension	M	116.7	85.5	31.2	$p < .05^{*}$
	SD	11.08	8.12		

Note. N= Normal Group, RD= Reading Disabled Group for this and subsequent Tables and Figures.

* - one-tailed test, df=22

** - two-tailed test, df=22

TABLE 7: MEAN SCORES OF THE NORMAL AND READING DISABLED GROUPS ON MEASURES OF LANGUAGE FUNCTIONING AND CONCEPTUAL DEVELOPMENT

Test Measure		N	RD	Mean Difference	Significance Level
1. Test of Language Development					
Spoken Language Quotient	M	109.8	90.1	19.7	$p < .05$**
	SD	8.73	12.41		
Speaking Quotient	M	112.0	89.2	22.8	$p < .05$**
	SD	11.91	15.64		
Listening Quotient	M	105.1	94.6	10.5	$p < .05$**
	SD	7.93	9.25		
Semantic Quotient	M	110.7	96.7	14.0	$p < .05$**
	SD	8.14	10.62		
Syntax Quotient	M	108.9	85.7	23.2	$p < .05$**
	SD	10.75	15.7		
2. Concept Kit-Conservation	M	11.7	11.8	0.1	NS
	SD	0.5	0.63		
3. Raven's Progressive Matrices	M	30.0	26.7	3.3	NS
	SD	5.4	4.1		

** - two-tailed test, df=22

eous Processing Scales of the K-ABC was 22 points, significant at $p<.01$ (see Table 8). Their mean scores on Reading Comprehension (K-ABC) and Reading Decoding (K-ABC) were below average, and significantly lower than performance on the Mental Processing Composite (K-ABC; $p<.05$). The mean achievement scores on the two remaining subtests were average. Reading disabled children scored in the average range on the TOLD-I (Speaking Quotient - Full Scale), and all children were at the concrete-operational stage of thought.

A comparison of test scores indicates that reading disabled children were impaired relative to normal subjects on the K-ABC Sequential Processing Scale ($t(22)=7.47; p<.05$), K-ABC Reading Decoding ($t(22)=6.83; p<.05$), and K-ABC Reading Comprehension Scale ($t(22)=8.28; p<.05$). Although average, their performance on the TOLD-I was significantly inferior to that of normal subjects ($t(22)=4.60; p<.05$). The reading disabled group's mean scores on K-ABC Simultaneous Processing Scale subtests, as well as on Block Design and Picture Arrangement from the Performance Scale of the WISC-R, were relatively equivalent to those of normals. In terms of overall intellectual functioning, the reading disabled children were in the average range on the WISC-R and K-ABC, and were not significantly different from normal subjects on the former measure. The difference between groups on the latter test, i.e., Mental Processing Composite (K-ABC)

TABLE 8: PERFORMANCE OF THE NORMAL AND READING DISABLED GROUPS ON THE K-ABC - RESULTS ACCORDING TO SELECTION CRITERIA

Group		Test Measure		Mean Difference	Significance Level
		K-ABC Sequential	K-ABC Simultaneous		
N	M	110.5	112.8	2.3	NS
	SD	9.22	8.56		
RD	M	108.3	85.9	22.4	$p < .01$
	SD	5.54	5.62		
		Reading Decoding	Full Scale		
N	M	113.8	113.6	0.3	NS
	SD	11.96	9.84		
RD	M	85.9	99.1	13.2	$p < .05$
	SD	5.54	6.26		
		Reading Comprehension	Full Scale		
N	M	116.7	113.6	3.2	NS
	SD	11.08	9.84		
RD	M	85.5	99.1	13.6	$p < .05$
	SD	8.12	6.26		

($t(22)=4.08; p<.05$), may be accounted for by the stronger performance of the normal children on the Sequential Processing Scale. In the reading disabled group, the pattern of relatively high Simultaneous Scale scores, low Sequential Scale scores, and low scores on the two reading subtests, are consistent with research on the K-ABC with children previously diagnosed as reading disabled (Hooper & Hynd, 1982). Furthermore, while not "language-impaired", the significantly poorer performance of reading disabled children compared to normals on the TOLD-I supports previous research (Wong & Roadhouse, 1978; Newcomer & Maggee, 1977). The individual and pooled results of cognitive test measures are summarized in Appendices 4a and 4b.

Dream Reports - Descriptive Features

A total of 245 awakenings were made and 79.3% of these (n=195) resulted in dream reports. The pooled rates of recall over two consecutive nights were 76.2% and 84.3% for the normal and experimental groups, respectively. The rate of recall on nights one and two were 76.3% and 73.0% for the normal group, and 76.5% and 93.0% for the reading disabled children.

Seventy percent of the REM arousals (n=142) resulted in reports which contained at least two Temporal Units of content. The pooled rates of recall for the two nights were 64.5% for for normal subjects and 74.3% for experimental subjects. The rate of recall on nights one and two were 64.3% and 64.6% for the normal group and 66.2% and 84.0% for reading disabled children. Recall Rate data for all dreams and those at least two Temporal Units in length are presented in Figures 1a and 1b.

For the entire sample of dreams recalled, more than one-half from both the normal group (58%) and the experimental group (67%) contained references to a self character who actively participated in the dream. Almost all content reports from normal subjects (92%) and reading disabled children (93%) were characterized by Kinematic Visual Imagery. Reading disabled children reported experiencing affect in 47% of their dreams, whereas the comparable value for normal subjects was 23%. These data are summarized in Table 9 along with the mean values of the temporal sequence and richness of composition indices. This Table demonstrates that the sub-sample of dreams (> 1 Temporal Unit) on which analyses of temporal sequence and richness of composition variables were based, was representative of the complete data set.

Figure 1a: NORMAL (N;n=14) AND READING DISABLED GROUP (RD;n=10) DREAM RECALL RATES (ALL DREAMS) FOR NIGHTS INDIVIDUALLY AND COMBINED

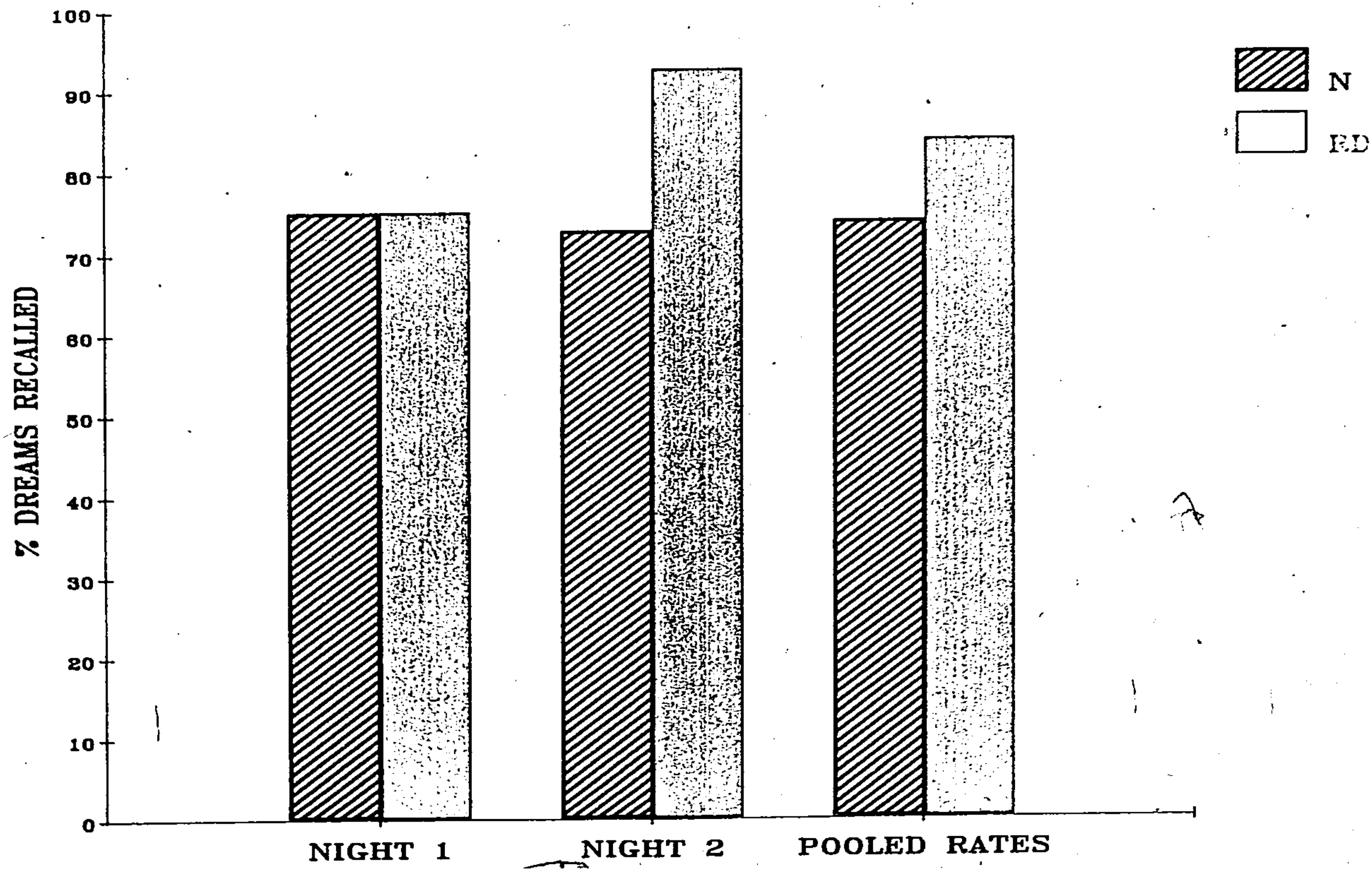

Figure 1b: NORMAL (N;n=14) AND READING DISABLED GROUP (RD;n=10) RECALL RATES FOR DREAM REPORTS OF >1 TEMPORAL UNIT FOR NIGHTS INDIVIDUALLY AND COMBINED

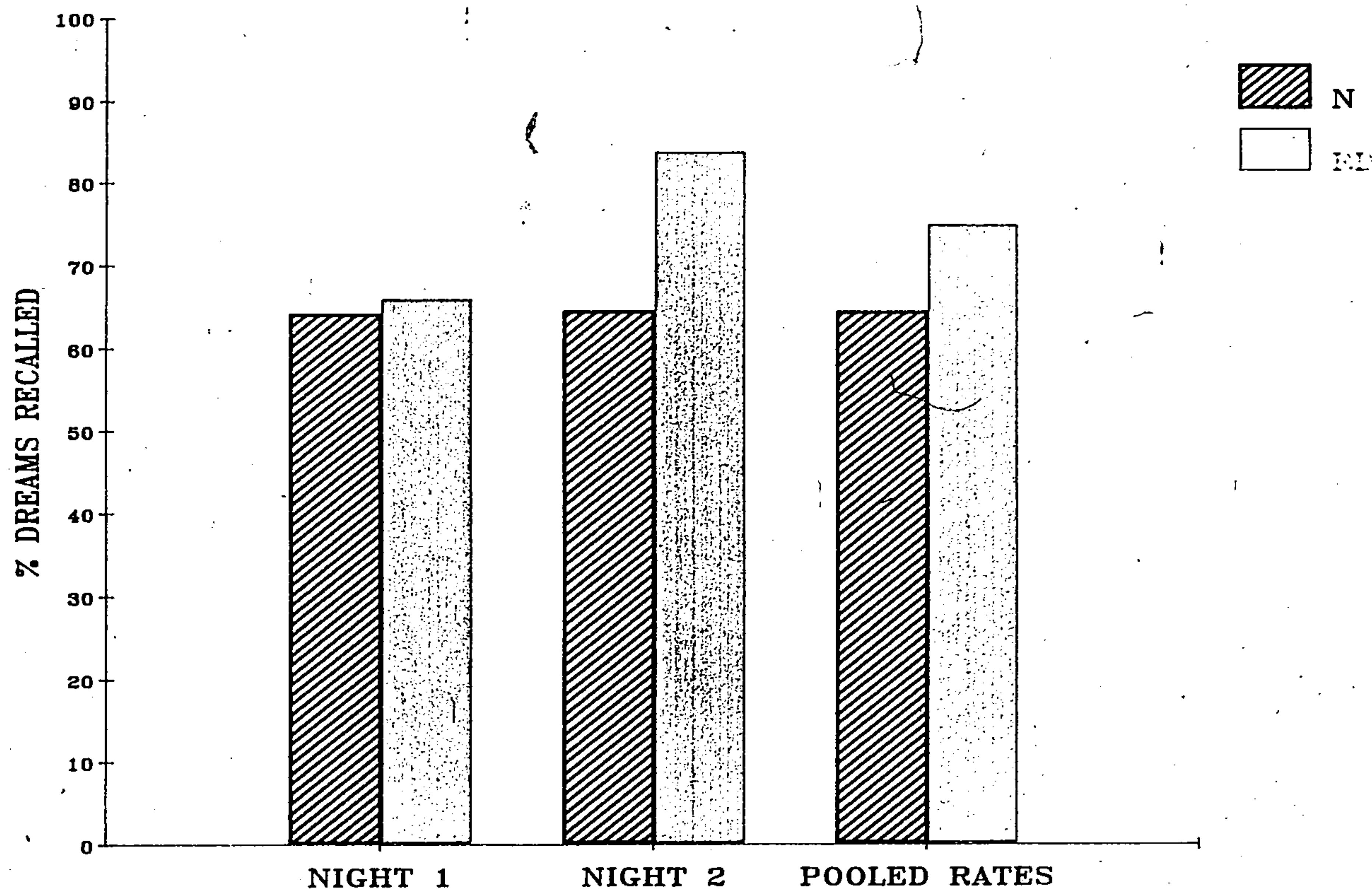

TABLE 9: MEAN VALUES OF DREAM REPORT VARIABLES FOR NORMAL AND READING DISABLED CHILDREN FOR ANALYZED DATA FROM SUBSAMPLE AND OVERALL SAMPLE OF DREAMS COLLECTED

		N		RD	
		Sample n=56 Dreams	Total n=115 Dreams	Sample n=40 Dreams	Total n=88 Dreams
Active Self-Representation	%		.58		.67
Visual Imagery	%		.92		.93
Affect	%		.23		.47
Temporal Units	M	5.02	5.32	3.92	4.26
Setting Extensity	M	2.76	2.82	2.58	2.72
Character Extensity	M	2.37	2.44	2.39	2.86
Character Discontinuity	M	.35	.30	.32	.30
Global Discontinuity	M	.13	.15	.14	.15
Self Density	M	.65	.66	.73	.64
Other Density	M	2.24	2.07	1.99	2.09
Total Density	M	2.9	2.73	2.72	2.73
Word Count	M	62.4	70.1	41.7	48.7

Dream Reports - Group Differences

Of the fourteen dream variables analyzed, the normal and experimental groups were significantly different on measures of Temporal Units ($Z=2.03; p<.05$), Word Count ($Z=2.98; p<.05$), and Self Density ($Z=-2.36; p<.05$). Specifically, relative to reports from the reading disabled subjects, dream reports from the normal group contained significantly more Temporal Units, were described with significantly more words, and showed a lower proportion of Temporal Units where a self character was scored. The results of all analyses for group differences appear in Table 10. The individual and pooled results of dream data can be found in Appendices 5a and 5b.

Dream Reports - Correlational Analyses

Significant Spearman-Rank and Pearson-Product-Moment correlations between waking measures and dream variables are listed in Tables 11 and 12. All correlations were two-tailed except where noted. The following description relates significant correlations to the areas of cognitive functioning assessed for both groups (see Table 13).

TABLE 10: RESULTS OF ANALYSES FOR GROUP DIFFERENCES ON DREAM VARIABLES

Dream Variable	Statistical Test	Statistic	Significance Level
Recall Rate (All Dreams)	Wilcoxon	$z=-1.27$	NS
Recall Rate (>1 Temporal Unit)	Wilcoxon	$z=-1.65$	NS
Active Self Representation	Wilcoxon	$z=-.97$	NS
Visual Imagery	Wilcoxon	$z=-.40$	NS
Dream Affect	Wilcoxon	$z=-1.95$	NS
Temporal Units	Kruskal-Wallis	$z=2.03$	$p<.05$ *
Setting Extensity	Kruskal-Wallis	$z=0.47$	NS
Character Extensity	Kruskal-Wallis	$z=0.94$	NS
Character Discontinuity	Kruskal-Wallis	$z=0.50$	NS
Global Discontinuity	Kruskal-Wallis	$z=1.64$	NS
Self Density	Kruskal-Wallis	$z=-2.36$	$p<.01$ *
Other Density	Kruskal-Wallis	$z=0.84$	NS
Total Density	Kruskal-Wallis	$z=0.76$	NS
Word Count	Kruskal-Wallis	$z=2.98$	$p<.01$ *

* one-tailed test

TABLE 11: SIGNIFICANT CORRELATIONS (SPEARMAN-RANK) BETWEEN WAKING MEASURES (AGE AND COGNITIVE TESTS) AND DREAM RATING SCALES IN NORMAL AND READING DISABLED GROUPS

Dream Variable	Corr.	Age/Test Measure	Cognitive Domain
1. Recall Rate (All Dreams)			
N	.56*	Word Order (TOLD-I)	Expressive Language
	.51*	Arithmetic (WISC-R)	Numerical Reasoning
RD	.66*	Spatial Memory (K-ABC)	Simultaneous Processing
	-.70*	Matrix Analogies (K-ABC)	Simultaneous Processing
2. Recall Rate (>1 Temporal Unit)			
N	-.54*	Listening Quotient (TOLD-I)	Receptive Language
RD	-.70*	Number Recall (K-ABC)	Sequential Processing
	.68*	Spatial Memory (K-ABC)	Simultaneous Processing

Dream Variable	Corr.	Age/Test Measure	Cognitive Domain
3. Active Self-Representation			
N	.78**	Full Scale (WISC-R)	General I.Q.
	-.69**	Generals (TOLD-I)	Receptive Language
	.60*	Vocabulary (WISC-R)	Verbal Concept Formation
	.55*	Spatial Memory (K-ABC)	Simultaneous Processing
RD	-.68*	Reading Comprehension (K-ABC)	Language/Achievement
	.66*	Sequential Scale (K-ABC)	Sequential Processing
	.64*	Age	
4. Affect			
RD	-.84**	Semantic Quotient (TOLD-I)	Receptive Language
	-.68*	Reading Comprehension (K-ABC)	Language/Achievement
	-.64*	Characteristics (TOLD-I)	Receptive Language

* $p < .05$

** $p < .01$

Note. All correlations were two-tailed except those between Active Self-Representation, Full Scale (WISC-R) and Vocabulary (WISC-R).

TABLE 12: SIGNIFICANT CORRELATIONS (PEARSON-PRODUCT-MOMENT) BETWEEN WAKING MEASURES (AGE AND COGNITIVE MEASURES) AND DREAM TEMPORAL AND COMPLEXITY VARIABLES

Dream Variable	Corr.	Age/Test Measure	Cognitive Domain
1. Word Count			
N	.55*	Word Order (TOLD-I)	Expressive Language
2. Temporal Units			
N	-.58*	Sentence Combining (TOLD-I)	Expressive Language
	.56*	Vocabulary (WISC-R)	Verbal Concept Formation
3. Setting Extensity			
RD	.82**	Spatial Memory (K-ABC)	Simultaneous Processing
N	-.60*	Sentence Combining (TOLD-I)	Expressive Language
4. Character Discontinuity			
N	-.56*	Arithmetic (WISC-R)	Numerical Reasoning

Dream Variable	Corr.	Age/Test Measure	Cognitive Domain
RD	-.65*	Spatial Memory (K-ABC)	Simultaneous Processing
	-.82**	Age	
5. Global Discontinuity			
N	-.63*	Word Order (TOLD-I)	Expressive Language
RD	.69*	Vocabulary (WISC-R)	Verbal Concept Formation
	.89**	Triangles (K-ABC)	Simultaneous Processing
6. Self Density			
N	.65*	Full Scale (WISC-R)	General I.Q.
	.61*	Vocabulary (WISC-R)	Verbal Concept Formation
	-.61*	Age	
	.57*	Characteristics (TOLD-I)	Receptive Language
RD	-.77**	Vocabulary (WISC-R)	Verbal Concept Formation
	-.69*	Reading Decoding (K-ABC)	Language/ Achievement
	-.68*	Reading Comprehension (K-ABC)	Language/ Achievement

Dream Variable	Corr.	Age/Test Measure	Cognitive Domain
RD	.64*	Age	
7. Other Density			
RD	.72*	Matrix Analogies (K-ABC)	Simultaneous Processing
	.70*	Arithmetic (K-ABC)	Numerical Reasoning

* $p < .05$

** $p < .01$

__Note__. All correlations were two-tailed (RD;df=8;C;df=12)

TABLE 13: SIGNIFICANT CORRELATIONS - DREAM VARIABLES AND AREAS OF COGNITIVE FUNCTIONING

Dream Variable	I.Q.	Memory	Seq.	Sim.	Language	Achievement	Age
1. Recall Rate (All Dreams)							
N					.56*	.51*	
RD		.66*		-.70*			
2. Recall Rate (>1 Temporal Unit)							
N					-.54*		
RD		-.70* .68*					
3. Word Count							
N					.55*		
4. Active Self-Representation							
N	.78**	.55*			-.69** .60*		

Dream Variable	I.Q.	memory	Seq.	Sim.	Language	Achievement	Age
4. Active Self-Representation							
RD			.66*			-.68*	.64*
5. Affect							
RD					-.84**	-.68*	
					-.64*		
6. Temporal Units							
N					.56*		
					-.58*		
7. Setting Extensity							
N					-.60*		
RD		.82**					
8. Character Discontinuity							
N						-.56*	
RD		-.65*					-.82**

Dream Variable	I.Q.	Memory	Seq.	Sim.	Language	Achievement	Age
9. Global Discontinuity							
N					-.63*		
RD				.89**	.69*		
10. Self Density							
N	.65*				.61*		-.61*
					.57*		
RD					-.77**	-.69*	.64*
						-.68*	
11. Other Density							
RD				.72*		.70*	

* $p < .05$

** $p < .01$

Rating Scales

Recall Rate, Active Self-Representation, Visual Imagery, and Affect

The recall of all dreams in the normal group was significantly related to performance on the Arithmetic subtest (WISC-R; $r=.51; p<.05$) and to Word Order (TOLD-I; $r=.56; p<.05$), a measure of expressive language which involves syntax, memory, and sequential processing. Recall of REM dreams greater than one Temporal Unit was negatively correlated ~~with~~ an index of receptive language, Listening Quotient (TOLD-I; $r=-.54; p<.05$). In reading disabled children, the frequency of REM recall (all dreams) was significantly associated with a subtest of short-term memory, Spatial Memory (K-ABC; $r=.66; p<.05$), and negatively correlated with Matrix Analogies (K-ABC; $r=-.70; p<.05$), a measure of non-verbal reasoning. The ability to recall REM dreams more than one Temporal Unit in length was also related to visual-spatial memory skills, (Spatial Memory (K-ABC); $r=.68; p<.05$) but negatively correlated with a subtest of auditory short-term memory, Number Recall (K-ABC; $r=-.70; p<.05$).

In the normal group, the frequency of Active Self-Representation was correlated with overall intellectual functioning (Full Scale, WISC-R; $r=.78$; $p<.01$) and with a test of verbal concept formation (Vocabulary, WISC-R; $r=.60$; $p<.05$), and negatively associated with a subtest of receptive language (Generals, TOLD-I; $r=-.69$; $p<.05$). Additionally, Spatial Memory was moderately correlated with Active Self-Representation in normals (K-ABC; $r=.55$; p .05). In reading disabled children, reports of active participation by a self character were correlated with age ($r=.64$; $p<.05$), increased aptitude on sequential processing tasks (Sequential Scale, K-ABC; $r=.66$; $p<.05$), and negatively related to Reading Comprehension (K-ABC; $r=-.68$; $p<.05$).

The Dream Affect Scale was negatively correlated with Reading Comprehension ($r=-.68$; $p<.05$), and two measures of receptive language functioning in the reading disabled group, i.e., the Semantic Quotient (TOLD-I; $r=-.84$; $p<.01$) and the Characteristics subtest ($r=-.64$; $p<.05$). There were no significant correlations between Dream Affect and test variables in normal subjects.

Temporal Sequence and Richness of Composition Variables

Word Count and Temporal Units

The number of words used by normal subjects to report their dreams was moderately correlated with Word Order (TOLD-I; $r=.55; p<.05$). The number of Temporal (activity) Units contained in their dream narratives was negatively related to scores on a subtest of expressive language (Sentence Combining; $r=-.58$; $p<.05$), but correlated positively with increased word knowledge and verbal concept formation skills (Vocabulary, WISC-R; $r=.56$; $p<.05$). There were no significant correlations between cognitive tests and Word Count or number of Temporal Units in the reading disabled group. However, these dream variables were significantly interrelated in the normal ($r=.62; p<.05$) and reading disabled groups ($r=.73; p<.05$).

Setting Extensity, Character Extensity, Character Discontinuity, and Global Discontinuity

In reading disabled children, the number of Temporal Units for which a dream setting persisted, i.e., Setting Extensity, was significantly correlated with Spatial Memory (K-ABC; $r=.82$;

$p < .01$). Changes in characters during a temporal sequence, i.e., Character Discontinuity, were negatively correlated with scores on the Spatial Memory subtest (K-ABC; $r = -.65$; $p < .05$) and with Age ($r = -.82$; $p < .01$). The proportion of changes in both characters and settings, namely Global Discontinuity, was associated with scores on Vocabulary (WISC-R; $r = .69$; $p < .05$), and Triangles (K-ABC; $r = .89$; $p < .01$) -- a measure of visual-spatial analysis and synthesis. It is interesting to note that Spatial Memory (K-ABC) is significantly and positively correlated in the reading disabled group with number of dreams recalled and extensiveness of settings reported, and is negatively related to character changes. On this measure of short-term memory via simultaneous processing, subjects are required to recall the locations of pictures arranged randomly on a page.

In normal subjects, Setting Extensity was negatively correlated with Sentence Combining (TOLD-I; $r = -.60$; $p < .05$), a subtest of expressive language. Character Discontinuity was negatively correlated with Arithmetic (WISC-R; $r = -.56$; $p < .05$), while Global Discontinuity was negatively associated with performance on Word Order (TOLD-I; $r = -.63$; $p < .05$). Overall, higher scores on the Word Order subtest in normal children were related to more frequent dream recall, dream reports longer in Temporal Unit length, and a lower proportion of global changes in the dream's settings and character(s). On this subtest, children were asked to construct a grammatically correct sentence from words presented in random order. Thus, this measure of expressive language development emphasizes the ability to properly sequence words and phrases.

Self-Density and Other Density

In the reading disabled group, the proportion of Temporal Units where a self character was reported increased with age (r=.64;p<.05) and was negatively correlated with scores on Vocabulary (r=-.77;p<.01) and the two reading subtests, Reading Decoding (K-ABC;r=-.69;p<.05), and Reading Comprehension (r=-.68;p<.05). The proportion of Self-Density in dream reports was higher in normal subjects with higher scores on a test of intellectual functioning, (Full Scale, WISC-R, r=.65;p<.05), and on subtests of verbal concept formation and word knowledge, namely, Vocabulary (WISC-R;r=.61;p<.05) and Characteristics (TOLD-I;r=.57;p<.05). Age was negatively related to Self-Density (r=-.61;p<.05). In the normal group, Active Self-Representation and Self-Density best correlated with the Full Scale of the WISC-R, and secondly with the Vocabulary subtest. In reading disabled children the mean number of non-self characters per Temporal Unit, i.e., Other Density, was associated with performance on Matrix Analogies (K-ABC;r=.72;p<.05) and the Arithmetic subtest of the K-ABC (Achievement Scale; $r=.70$; $p<.05$). A complete list of non-significant Spearman-Rank and Pearson-Product-Moment correlations among age and cognitive tests, and the dream variables can be found in Appendices 6a, 6b, 7a, and 7b. The results of the correlational analysis among cognitive tests and dream variables using raw scores can be found in Appendices 8a, 8b, 9a, and 9b.

Narrative Reports - Descriptive Features

The mean values and standard deviations for all dependent narrative variables appear in Table 14. The variability in the scores for Word Count and number of Temporal Units for the Imaginative-Narrative Test is quite pronounced in both groups. However, this variability is greatest in the reading disabled group where substantially higher scores from two subjects inflated the mean values for the above variables. When the data from these two subjects are excluded from analyses, the mean values for reading disabled children more closely approximate those of normal subjects for Word Count (normal=128.7; reading disabled=132.3) and number of Temporal Units (normal=9.06; reading disabled=9.8).

TABLE 14: MEAN SCORES FOR WORD COUNT, TEMPORAL SEQUENCE, AND UNIT COMPOSITION VARIABLES in WAKING NARRATIVE REPORTS

		N		RD	
		Imaginative	Personal	Imaginative	Personal
Word Count	M	128.7	131.2	199.2	128.4
	SD	112.0	37.4	183.0	42.8
Temporal Units	M	9.06	17.7	16.2	17.0
	SD	4.62	4.6	14.9	3.0
Setting Extensity	M	3.93		4.0	
	SD	2.71		2.40	
Character Extensity	M	4.38		5.17	
	SD	2.26		4.64	
Character Discontinuity	M	0.21		0.22	
	SD	0.12		0.14	
Global Discontinuity	M	0.03		0.02	
	SD	0.04		0.02	
Self Density (Active Role)	M	0.70		0.70	
	SD	0.20		0.16	
Other Density	M	1.39		0.88	
	SD	0.82		0.53	

Narrative Reports - Correlational Analysis

Significant Pearson-Product-Moment correlations between age, cognitive tests, and imaginative narrative variables are listed in Table 15. Significant correlations between test measures and personal narrative variables are found in Table 16. The description below relates these correlations to areas of cognitive development assessed in normal and reading disabled children (see Table 17).

Imaginative Narratives - Temporal Sequence and Richness of Composition Variables

Word Count and Number of Temporal Units

In the normal group, the number of words describing a reality-based story and a fantasy-based story was significantly correlated with language development (Grammatic Comprehension subtest, TOLD-I; $r=.93$; $p<.01$) and Speaking Quotient (i.e., Full Scale, TOLD-I; $r=.66$; $p<.05$). The Syntax Quotient (TOLD-I; $r=.64$; $p<.06$) and Generals subtest (TOLD-I; $r=.64$; $p<.06$) -- measures of receptive and expressive language, respectively -- approached significance. Correlations in this group between Word Count in

TABLE 15: SIGNIFICANT CORRELATIONS (PEARSON-PRODUCT-MOMENT) BETWEEN IMAGINATIVE NARRATIVE VARIABLES AND COGNITIVE TEST MEASURES

		Correlation	Age/Test Measure	Cognitive Domain
1. Word Count				
		.93**	Grammatic Comprehension (TOLD-I)	Expressive/ Receptive Language
	N	.75*	Photo Series (K-ABC)	Simultaneous Processing
		.66*	Full Scale (TOLD-I)	Language
2. Temporal Units				
	RD	.87**	Characteristics (TOLD-I)	Receptive Language
		.84*	Listening Quotient (TOLD-I)	Receptive Language
		.77*	Semantic Quotient (TOLD-I)	Receptive Language
3. Setting Extensity				
	N	.68*	Generals (TOLD-I)	Receptive Language

	Correlation	Age/Test Measure	Cognitive Domain
3. Setting Extensity (Continued)			
RD	-.84**	Arithmetic (WISC-R)	Numerical Reasoning
	-.78*	Reading Comprehension (K-ABC)	Language/ Achievement
4. Character Extensity			
N	-.69*	Word Order (K-ABC)	Sequential Processing
	-.80**	Spatial Memory (K-ABC)	Simultaneous Processing
RD	-.75*	Mental Processing Composite (K-ABC)	Intellectual Development
5. Character Discontinuity			
N	.84**	Age	
RD	.95**	Sequential Scale (K-ABC)	Sequential Processing
	.87**	Raven's Colored Progressive Matrices	Non-Verbal Reasoning
6. Self Density (Active Role)			
N	-.85**	Gestalt Closure (K-ABC)	Simultaneous Processing

	Correlation	Age/Test Measure	Cognitive Domain
7. Other Density			
N	.78*	Arithmetic (WISC-R)	Numerical Reasoning
	.78*	Concept-Kit Conservation	Conceptual Development
	-.66*	Characteristics (TOLD-I)	Receptive Language

* $p < .05$

** $p < .01$

Note. All correlations were two-tailed (RD:df=5;C:df=7)

TABLE 16: SIGNIFICANT CORRELATIONS (PEARSON-PRODUCT-MOMENT) BETWEEN PERSONAL NARRATIVE VARIABLES AND COGNITIVE TEST MEASURES

	Correlation	Age/Test Measure	Cognitive Domain
1. Word Count			
N	.67*	Semantic Quotient (TOLD-I)	Receptive Language
RD	-.83*	Age	
	.81**	Riddles (K-ABC)	Achievement/ Language
	.75*	Vocabulary (WISC-R)	Verbal Concept Formation
	.75*	Triangles (K-ABC)	Simultaneous Processing
2. Temporal Units			
RD	.88**	Generals (TOLD-I)	Receptive Language
	.86*	Vocabulary (WISC-R)	Verbal Concept Formation
	.80*	Simultaneous Scale (K-ABC)	Simultaneous Processing
	.78*	Riddles (K-ABC)	Achievement/ Language Concept

* $p < .05$

** $p < .01$

Note. All correlations were two-tailed (RD:df=5;C:df=7)

TABLE 17: SIGNIFICANT CORRELATIONS - WAKING NARRATIVE VARIABLES AND AREAS OF COGNITIVE FUNCTIONING

Imaginative Narratives

Waking Narrative Variable	I.Q.	Memory	Seq.	Sim.	Language	Achievement	Age
1. Word Count							
N				.75*	.93**		
					.66*		
2. Temporal Units							
RD					.87**		
					.84*		
					.77*		
3. Setting Extensity							
N					.68*		
RD					-.78*	-.84**	
4. Character Extensity							
N			-.69*	-.80**			
RD	-.75*						
5. Character Discontinuity							
N							.84**
RD			.95**	.87**			

Imaginative Narratives

Waking Narrative Variable	I.Q.	Memory	Seq.	Sim.	Language	Achievement	Age
6. Self Density (Active Role)							
N				-.85*			
7. Other Density							
N	.78*				-.66*	.78*	

Personal Narratives

Waking Narrative Variable	I.Q.	Memory	Seq.	Sim.	Language	Achievement	Age
1. Word Count							
N					.67*		
RD				.75*	.75*	.81**	-.83*
2. Temporal Units							
RD				.80*	.88**	.78*	
					.86*		

* $p < .05$

** $p < .01$

waking narrative reports and tests of language abilities were stronger than those associating the number of words in dream reports with language. Word Count was also correlated with a measure of simultaneous processing involving a number of skills, including seriation, perceptual organization and planning, and analysis and synthesis of part-whole relationships, i.e., Photo Series (K-ABC;r=.75;$p<.05$). The relationship between Word Count and language abilities did not persist in analyses of the number of Temporal Units scored from the number of words in a waking narrative report. In fact, there were no significant correlations between this variable and cognitive test measures in normal children.

In the reading disabled group, no significant correlations were obtained between indices of cognitive functioning and the number of words in an imaginative narrative report (i.e., Word Count). However, the number of Temporal Units contained in an imaginative narrative was positively related to scores on three measures of receptive language, Characteristics (TOLD-I) (r=.87; $p<.01$), Listening Quotient (TOLD-I) (r=.84;$p<.05$), and Semantic Quotient (TOLD-I) (r=.77;$p<.05$). These results are in contrast with comparisons between tests of cognitive abilities and number of Temporal Units contained in a dream report, where no significant relationships emerged.

Setting Extensity, Character Extensity, Character Discontinuity, and Global Discontinuity

In normal children, the number of Temporal Units for which a narrative setting persisted, i.e., Setting Extensity, was significantly correlated with Generals (TOLD-I) (r=.68;p<.05), a subtest requiring receptive language skills. Character Extensity was negatively associated with scores on subtests of auditory sequential short-term memory, Word Order (K-ABC) (r=-.69;p<.05), and visual-spatial short-term memory, Spatial Memory (K-ABC) (r=-.80;p<.01). The proportion of character changes in a narrative report, i.e., Character Discontinuity, was significantly correlated with Age (r=.84;p<.01) in the normal group.

In reading disabled subjects, Setting Extensity was negatively associated with Arithmetic (WISC-R) (r=-.84;p<.01) and Reading Comprehension (K-ABC) (r=-.78;p<.01), while Character Extensity was negatively correlated with the Mental Processing Composite of the K-ABC (r=-.75;p<.05). The incidence of Character Discontinuity in imaginative narrative reports was strongly related to K-ABC Sequential Scale scores (r=.95;p<.01) and performance on the Raven's Colored Progressive Matrices (r=.87;p<.01). There were no significant correlations between age, cognitive test measures, and Global Discontinuity in narrative reports from either the normal or reading disabled subjects.

Self Density (Active Role) and Other Density

In normal children's imaginative narratives, the proportion of Temporal Units where an active self character was scored correlated negatively with Gestalt Closure (K-ABC) ($\underline{r}$=-.85; $\underline{p}$<.01), a measure of simultaneous processing. Other Density was positively related to scores on Arithmetic (WISC-R) ($\underline{r}$=.78; $\underline{p}$<.05), Concept - Kit Conservation ($\underline{r}$=.78;$\underline{p}$<.05), and negatively related to Characteristics (TOLD-I) ($\underline{r}$=-.66;$\underline{p}$<.05).

Personal Narratives

Word Count and Temporal Units

The Personal Narrative Test asked subjects to remember, describe, and then organize sequentially their previous night's experience in the sleep laboratory. This was a more structured task than the Imaginative Narrative Test where subjects created their own stories given a basic situation. On the Personal Narrative Test, the number of words used by normal subjects to describe their experiences correlated significantly with the Semantic Quotient (TOLD-I, $r=.67; p<.05$), a measure of receptive language skill. In the reading disabled group, Word Count was related negatively to Age ($r=-.83; p<.05$) and positively with performance on Triangles (K-ABC, $r=.75; p<.05$), Vocabulary (WISC-R, $r=.76; p<.05$), and Riddles (K-ABC, $r=.85; p<.05$), a test of achievement which also involves verbal concept formation and verbal comprehension. Interestingly, these multiple correlations between Word Count and cognitive measures are in contrast to the analysis of this variable in dream reports of the reading disabled where no significant relationships emerged.

A pattern of relationships similar to that found with Word Count was noted between Temporal Units and cognitive test correlates in reading disabled children. Temporal Units were also positively related to achievement, verbal concept formation and language skills, and simultaneous processing. These correlations were somewhat stronger and included scores on Generals (TOLD-I; $r=.88; p<.01$), Vocabulary (WISC-R; $r=.86; p<.05$), and the Simultaneous Processing Scale ($r=.80; p<.05$). Non-significant correlations between age, cognitive tests, and waking narrative variables for each group are listed in Appendices 10a and 10b.

DISCUSSION

Dreaming has only recently been investigated from a cognitive-psychological perspective and consequently there is a paucity of research attempting to map interrelationships between cognitive functioning and qualitative aspects of nocturnal mentation. Within this literature, moreover, there has been controversy regarding which cognitive abilities are critical to dream-generation and dream-recall. The present study, designed to examine relationships between cognitive skills and dream formation in normal and reading disabled children, differs from previous research by investigating formal properties of REM dreams in a population with specific cognitive impairments, i.e., deficits in the sequential processing of information.

At the outset, it is appropriate to identify and evaluate potential sources of experimental variability in this investigation. One such variable is the subject's adaption to the sleep laboratory and recording equipment. Prior to their nighttime involvement, subjects became familiar with the laboratory setting, personnel, and procedures through extensive psychological testing and daytime electrophysiological recordings. Dream content retrieval nights followed four nights of baseline sleep, and as a result, subjects were well-adapted to the experimental methods and procedures specific to sleeping overnight in the laboratory. On the basis of conversations with the children and their parents, it can be concluded that the children enjoyed the initial novelty of the situation, the interpersonal contact with the experimenters, and the opportunity to earn a substantial monetary reward for their commitment. The children were generally cooperative and compliant throughout the investigation and only one child withdrew before completing the necessary study protocol.

Interviewing techniques and confabulation by subjects are also viewed as factors which may compromise the validity and reliability of dream reports. The interviewer in this investigation remained the same for twenty-two of the twenty-four children and was initially familiarized with the interview format on two pilot subjects. His interviewing style is best described as a balance between a non-directive and directive approach, and this did not consciously change during the course of the study. One important decision which faced the interviewer was dealing with instances where children quickly responded that they did not remember any dream. In such instances efforts were made to ensure, as much as possible, that the child was alert, to attempt to facilitate thoughtful reflection, but not to probe so far as to provoke confabulation (Foulkes, 1982b). The children were also instructed that it was not necessary that they remember a dream on each awakening. Although the possibility of confabulation cannot be excluded, it is noteworthy that waking narratives -- where children exercised their confabulatory talents -- and dream reports differed substantially on measures of Word Count and Temporal Units in both groups.

The ratio of statistical analyses to number of subjects must also be considered when interpreting results. It is acknowledged that numerous statistical analyses were performed in this study on a relatively small sample of subjects. In this area of research there are a number of practical and financial difficulties inherent in the process of data acquisition which limit sample size. However, the number of subjects in this investigation is equal to or greater than that of published studies in this area. In general, the pattern of results will be emphasized and this pattern suggests the significant findings were not spurious.

The results of this investigation provide additional normative data regarding REM dreaming for children seven to nine years of age. They also extend earlier findings which examined the relationship between cognition and dreaming in children. The major research to date in this area is Foulkes' longitudinal study (Foulkes, 1982b) with boys and girls aged 3-15 years. The two studies are comparable in that both utilized content arousals in the laboratory with a standardized interview format, investigated REM dreaming in boys during the stage of concrete-operational thought, and assessed a number of areas of cognitive development. As well, there are several differences worth noting. One major difference is that whereas the present study is cross-sectional and involves boys from a specific age range, Foulkes' investigation was a longitudinal study of boys and girls. Fourteen of the twenty-one subjects (seven boys;seven girls; seven to nine years old) in the latter study were investigated at two previous age levels and therefore had acquired dream reporting experience. An additional seven "novice" girls (seven to nine years old) were added to contrast the longitudinal and cross-sectional paradigms. Further, in the present investigation subjects were awakened approximately five times from REM sleep per evening over two consecutive nights. Foulkes' study made REM, non-REM, and sleep onset awakenings over nine non-consecutive nights. A total of 15 REM arousals occurred during this period, with a maximum of three on some nights. Also, the boys in the present study (_M_=8.9 years) were somewhat older than the boys and girls in Foulkes' sample (_M_=8.0 years). In addition, the analysis correlating cognitive measures with dream variables was based on raw scores whereas scaled scores were used in the present research. It should be noted that an additional analysis using raw scores in this study did not yield a substantially different pattern of results. These and other differences will be elaborated upon as the findings from the two studies are discussed.

Dream Variables: Recall Rate and Word Count

Recall Rate and Word Count have been viewed as two distinct empirical indices of REM dreaming/reporting skill in children (Foulkes, 1982b). A comparison of normal children from the present study and Foulkes' longitudinal study showed that subjects in the present study recalled a substantially higher number of REM dreams (present study-74.2%; Foulkes-48%). A number of factors, including subject characteristics, experimental design, motivational state, age and stage of cognitive development, and number and timing of REM arousals may explain this difference. In a cross-sectional study with two consecutive nights of data collection in children of comparable ages, a 75% recall rate was achieved (Foulkes, Pivik, Steadman, Spear, & Symonds, 1967). This figure very closely approximates the present results. Foulkes (1982b) reported a higher incidence of REM recall in veteran boys relative to veteran girls (55% vs. 33%), as well as with novice girls relative to veteran girls (54% vs. 33%). Consequently, higher rates of recall have been reported in cross-sectional studies, and at times, with male subjects. Foulkes (1982b) has suggested that novelty and higher states of anticipation or anxiety in novice subjects, and decreased motivation in veteran children may, in part, account for varying recall rates with the two experimental designs. In terms of age and cognitive development, boys in the present study were older than those in Foulkes' (1982b) longitudinal sample (approximately eight years nine months versus seven years eight months, respectively) and perhaps somewhat more advanced conceptually. A ceiling level was reached by almost all children in the normal group on a Piagetian task, and they appeared to have incorporated the principles of operational reasoning. In contrast, children in Foulkes' investigation were described as in the "late transition" to concrete-operational thought and only a few had fully consolidated this achievement. It is noteworthy that in that study, the 9-11 year-old fully concrete-operational sample produced a median recall rate of 86% (four extremely low recallers were excluded). Finally, the children in the present study were also awakened on consecutive nights, and more frequently in the latter half of the night when one would expect greater recall.

In summary, the recall rate of normal children in this study was almost identical to a previous investigation (Foulkes et al., 1967) and greater than that obtained in Foulkes' longitudinal study. The percentage of awakenings which elicited dream content in our sample approximates adult levels (Dement

& Kleitman, 1957b; Foulkes, 1966).

A second variable traditionally associated with growth in REM dreaming/reporting skill has been Word Count. The mean REM report length of the normal group was 70 words. This is similar to the average dream report obtained in the longitudinal study sample for same-age children ($\underline{M}$=72; Foulkes, 1982a). Although the mean word count is not given, the median length for girls (70 words) is higher than for boys (48 words). Consequently, REM dream reports from boys in the present study appear to be somewhat longer. The more advanced level of cognitive maturation in these subjects may account in part for this difference. Foulkes (1982b) reported that relatively longer reports were collected from children characterized by higher rates of cognitive maturation, greater waking narrative complexity, and more use of figural creativity. In the present investigation, the inclusion of a question in the night-time interview asking subjects to sequentially organize and describe their dream experience following a spontaneous report may have increased report length by triggering additional mnemonic elements and/or descriptive features. The moderate correlation in the control group between Word Count and Word Order, a subtest of expressive language which involves memory and sequencing, suggests this may have been a contributing factor.

In the normal group, Recall Rate (all dreams) and Word Count were positively but not significantly correlated (r=.46). Foulkes (1982b) reported similar findings for same-aged children. He suggested that for children seven to nine years of age, Recall Rate was perhaps more representative of qualitative developments in REM dreaming while Word Count reflected increases in reporting skills which required attention, memory, and language. The two indices were thought to stabilize around 9-11 years of age and then to jointly reflect some common factor of dream formation. Interestingly, Recall Rate and Word Count were significantly correlated in normal subjects in this study when dreams greater than one Temporal Unit were analyzed (r=.66;p<.01). The exclusion of dream reports consisting of only one Temporal Unit heightened this correlation. Age and conceptual level of the normal children may also have been contributing factors. The frequency of REM dream recall and number of words contained in a dream report were significantly associated (r=.55;p<.05) in the 9-11 year old group in Foulkes' longitudinal research, and their frequency of REM recall and report length were comparable with the normal group in the present investigation. In making these comparisons, it should be kept in mind that Foulkes (1982b) did not distinguish between dreams greater than or less than one Temporal Unit.

In the normal group, Recall Rate (all dreams) and Word Count were significantly associated with Word Order (TOLD-I). As mentioned, this language subtest is a measure of syntactic development which assesses a child's ability to properly sequence words and phrases. Recall Rate additionally correlated with Arithmetic (WISC-R), a subtest of numerical reasoning abilities. Both aforementioned cognitive tests require sustained attention and the use of auditory short-term memory while symbolic operations are performed on information.

These results suggest that the ability to recall and describe a dream experience in normal children may involve reasoning and expressive language skills. The correlation between these two traditional measures of dream development, i.e., Recall Rate and Word Count, and syntactic abilities may provide support for Foulkes' (1982a) model of REM dreaming emphasizing syntactic thematic planning in dream construction. Alternatively, data associating expressive language skills with these dream variables, particularly Word Count, may be viewed as evidence that apparent advancements in REM dreaming in children are primarily related to more sophisticated dream reporting skills. However, the lack of pervasive correlations between measures of language functioning and Recall Rate and Word Count may indicate that syntactic processes are relevant to dream formation rather than dream description per se. Finally, the application of symbolic operations, either mathematical or linguistic, is common to cognitive measures significantly correlated with Recall Rate. Collectively, these correlations support the theoretical trend toward examining logical relations in dream formation (Foulkes, 1978, 1982b, 1985; Haskell, 1986a, 1986b).

Unlike a previous report in seven to nine year old children (Foulkes, 1982b), Recall Rate was not related to scores on Block Design (WISC-R). Again, the somewhat older and more advanced level of cognitive development of this sample may explain this difference. Foulkes (1982b) did not find a correlation between Recall Rate and Block Design in 9-11 year olds, nor did Pivik et al. (1982) in a sample of six early adolescent boys of superior to very superior intelligence.

When one considers recall of REM scenarios greater than one Temporal Unit the above noted relationships are no longer obtained. It is possible that recall of brief and more extended dream sequences involves different cognitive skills. There is evidence that high and low dream recallers may differ in cognitive abilities. In a study by Butler and Watson (1985), Block Design (WAIS), Mental Control and Digit Span subtests of the Wechsler Memory Scale, and a test of visualization were significantly related to dream recall. Moreover, subjects who were high on Block Design (WISC-R) reported significantly more dreams than subjects low on this measure. Moffit (1982) found that high and low recallers could be separated with respect to the degree of alertness upon awakening and inter-hemispheric activation.

To review, frequency and length of dream reports were positively related for dreams greater than one Temporal Unit in length, and this finding appears consistent with results of somewhat older children (Foulkes, 1982b). With qualitative progression in cognitive development, the relationship between these variables appears to stabilize and dream recall frequency is increased and dream reports lengthen. Dream recall seems to be positively associated with reasoning and expressive language, while Word Count correlated with the same measure of expressive language.

A comparison of Recall Rate and Word Count from normal and reading disabled children confirms and clarifies aspects of this relationship, but complicates others. As hypothesized, there were no significant differences in rate of recall between reading disabled children and normal controls. There are a number of possible explanations for this finding. Foulkes (1982b) suggested that increases in dream recall toward adult levels is a cognitive-structural achievement dependent upon accession to the concrete-operational stage of development. All reading disabled children had attained the concrete-operational level and were, therefore, theoretically capable of increased dream recall. Furthermore, a number of theorists have implicated simultaneous processing capabilities in REM dreaming (Bakan, 1978; Hunt, 1982; Palombo, 1978a, 1978b), and Foulkes (1982b, 1985) has suggested that good performance on tests of visual-spatial analysis and synthesis reflecting simultaneous processing capabilities, such as Block Design, are positively correlated with the ability to generate dreams. With the exception of somewhat lower scores on Raven's Colored Progressive Matrices and the K-ABC Matrix Analogies, reading disabled children's scores on simultaneous processing tasks were comparable to normals.

Although it is not possible to delineate the relative contributions of conceptual and simultaneous processing factors to dream generation and recall, the correlations provide some indication of specific abilities which may have been important in the reading disabled group. For the entire sample of REM reports, recall correlated positively with a spatial memory task (r=.66) from the Simultaneous Processing Scale (K-ABC) but negatively with a measure of analogical thinking (r=-.70). As recall involved more extensive REM scenarios, performance on Spatial Memory remained important (r=.68), and a negative correlation with a subtest of short-term auditory memory emerged. One interpretation of this pattern of correlations for Recall Rate is that dream retrieval may be substantially determined by reading disabled subjects' ability to rely on visual-spatial short-term memory skills. The simultaneous processing components of the Spatial Memory task, i.e., the perceptual organization and integration of stimuli, may be important in this respect. The positive correlation between Recall Rate and visual-spatial memory in conjunction with a negative correlation with auditory short-term memory, suggests that the cognitive strengths and weaknesses of the reading disabled group may have influenced how they remembered and/or produced REM dreams as these children often have deficits in auditory short-term memory.

Reading disabled children described their dreams with significantly fewer words than normal children. This difference is consistent with the hypothesis that reading disabled children would show significantly lower performance on Word Count. Their deficit in sequential processing and/or less developed language abilities may have accounted for this finding. The rationale for the hypothesis was that sequential processing impairments would result in dream sequences of fewer Temporal Units and therefore dreams described in fewer words. As will be examined in greater detail, the reading disabled dream reports did contain significantly fewer Temporal Units. Nevertheless, one must consider whether this significant difference is more related to less developed language and hence dream reporting skills in reading disabled subjects. Although linguistic competence may play a role in the length of dream reports, the data suggest it is not the determining factor. First, Word Count for REM dreams was not extensively correlated with language measures in either group. Second, the reading disabled children were not inferior to normal subjects when Word Count was examined in the Waking Imaginative and Personal Narratives. There were, however, comparatively stronger correlations between language tests and Word Count for the waking narratives in both groups. Third, as noted, the reading disabled group's dream reports were comprised of significantly fewer Temporal Units and this variable attempts to control for linguistic advantage. The significant difference for Word Count may be explained by the difference in Temporal Units, and these two variables are strongly associated (r=.73). Finally, Recall Rate and Word Count are not significantly related in the reading disabled group and the former index may be more representative of dream development in these children (the Recall Rate of this group was relatively higher than normal subjects on the second night; it is unclear why this was so).

The significant difference in the length of dream reports between reading disabled and normal subjects highlights a major controversy in the literature, namely whether increases in Word Count or Recall Rate are evidence for qualitative changes in dream formation or by-products of developing retrieval/reporting skills. Data from the present investigation do not resolve this controversy. Sequencing and some expressive language skills appear to be related to these variables in both groups. Short-term memory processes are clearly correlated with Recall Rate in reading disabled children, while reasoning abilities are positively associated with this measure in normal subjects. These variables appear to be related not only to advancements in REM dream generation and reporting skills, but also to the cognitive capabilities of the dreamer, requirements of the task, and amount of material recalled.

Rating Scales: Active Self-Representation, Visual Kinematic Imagery, And Affect

Dream reports from the normal group were characterized by very high percentages of Visual Kinematic Imagery, a majority of which involved Active Self-Representation and little Affect. Although the ratings are not strictly comparable with previous studies, the above characteristics are generally consistent with those reported by Foulkes (1982b) for normal children in this age range. The incidence of Affect was somewhat lower in the present study (23%) when compared with boys seven to nine years of age in Foulkes' longitudinal sample (40%).

A comparison of REM reports from normal and reading disabled children showed no significant differences in Active Self-Representation, Visual Kinematic Imagery, or Affect, thereby confirming the hypothesized group similarities for these variables. Foulkes has suggested that active participation of the self character in the dream and the presence of Visual Kinematic Imagery are dependent upon concrete-operational reasoning (Foulkes, 1982b), but that affect may appear later in the developmental sequence (Foulkes, 1982c). Accordingly, since all children in the present study were concrete-operational but possibly not developmentally advanced for expression of dream affect, these results are consonant with Foulkes' suggestions (1982b, 1982c). Furthermore, in view of the absence of differences in simultaneous processing, including performance on the Block Design subtest, the children's level of cognitive maturation and simultaneous processing skills could be responsible for their capacity to recall a high percentage of REM dreams with Kinematic Visual Imagery and Active Self-Representation.

It is not possible to conclude from the data how conceptual and simultaneous processing factors influenced performance on

Active Self-Representation, Visual Imagery, and Affect. Like the correlations between Recall Rate and Word Count, those between cognitive test measures and these dependent measures varied across groups as a function of dream variables. This was generally true for characteristics of REM mentation examined in the study. The results of the correlational analyses indicated that: 1) a number of cognitive abilities contributed to subjects' performance on the dream variables; 2) different abilities were related to different aspects of REM mentation; 3) the processes of dream generation, dream-retrieval, and dream-description were affected by the cognitive strengths and weaknesses which characterized the normal and reading disabled groups; and, 4) the cognitive deficits of the reading disabled group interacted with the cognitive task requirements of the nighttime interviews. These points will be elaborated as the findings are discussed.

In terms of conceptual functioning, the Piagetian measure was not significantly correlated with any of the dream rating scales. This is not surprising since, with the exception of two subjects from each group who did very well on the test, all children reached a ceiling level of performance. In normal children of this age range Foulkes (1982b) also reported an absence of significant correlations between a number of Laurendeau-Pinard Scales of Piagetian conceptual development and REM recall, active self-participation, and frequency of dreams recalled with visual imagery. In addition to the conservation task used in the present study, children's scores on the intelligence scales may provide indications of their conceptual skills. In a review of studies examining the relationship between traditional intelligence measures such as the WISC-R and Piagetian scales, Sattler (1982) reported that correlations were consistently positive and moderate in magnitude. It has been suggested that a general intelligence factor is common to both types of scales (Humphrey & Parsons, 1979). The frequency of Active Self-Representation was fairly highly correlated with normal subjects' scores on the short-form of the WISC-R (r=.78) and secondarily with Vocabulary (r=.60), a subtest of verbal concept formation generally considered to be a good indicator of intellectual ability. Foulkes reported moderate relationships between active participation and Full Scale (r=.49), as well as verbal scale (r=.46), I.Q. scores in same-aged children. He administered more of the battery and perhaps when a wider range of abilities is assessed the relationships decrease. This may account for the lack of significant correlation between the K-ABC Full Scale score and recall rate in this study. Nevertheless, in both studies the frequency of active participation is most positively related to a measure of general intellectual functioning and secondarily to tests of verbal abilities. A moderate correlation has also been reported between active participation and verbal I.Q. scores (WISC-R) in boys aged 12-15 (Foulkes, 1982b). In the reading disabled group, Active Self-Representation was related to performance on the Sequential Processing Scale ($\underline{r}$=.66) and age ($\underline{r}$=.64). Since these children's scores on the Sequential Scale increased and theoretically approximated normal subjects' K-ABC Full Scale quotient, the incidence of Active Self-Representation also increased. The positive relationship with age may be related to progressions in cognitive development not discerned by the test measures.

There is some evidence, then, from correlational data in both groups as well as from previous research, to suggest that children's (seven to nine years) level of intellectual functioning is related to their capacity to represent themselves actively in REM scenarios. However, probably as a result of deficits in sequential processing and poorer language skills, the reading disabled group in this study scored somewhat lower on the WISC-R (short-form) and significantly lower on the K-ABC (Mental Processing Composite), yet there were no group differences in the frequency of Active Self-Representation in dream reports. Further, Pivik et al. (1982) did not find greater percentages of active self-participation or REM recall in adolescent boys of superior to very superior intelligence. Although the study by Pivik et al. was with a smaller sample of children from an older age group, the results do not contradict those of this investigation. As mentioned, current research indicates that conceptual advancements associated with concrete-operational thought most likely make a major contribution to the incorporation of an active self character into the formal structure of REM dreams. The frequency of active participation may be moderately related to overall intellectual ability and therefore children who fall within a fairly wide range of intelligence will not differ substantially on the above variable. As well, there may be qualitative aspects of dreamer participation influenced by a general intellectual factor which is not measurable with a frequency scale. Also, the relationships between Active Self-Representation and intelligence may vary developmentally. At present, it is not possible to delineate the common areas of cognitive functioning assessed by Piagetian scales and traditional tests which may be important to the development of Active Self-Representation in dreams. It is possible that higher-order conceptual factors interact with sequential, simultaneous (visual-spatial), and language abilities (Reitan & Wolfson, 1985). Conceptual skills may be especially important for specific stages of dream generation and qualitative aspects of REM mentation. Additionally, the frequency of Active Self-Representation was also moderately related to a measure of spatial memory in the normal but not the reading disabled group. Short-term spatial memory skills have not been assessed in previous research, and the relationship with Active Self-Representation is a new finding.

Dream Variables: Temporal Sequence and Unit Composition

A unique characteristic of this investigation is the analysis of dream reports by temporal sequence and richness of composition measures in children, particularly a group of children who have specific deficits in cognitive functioning. The most outstanding finding in this regard is that the dream reports from normal and reading disabled children were quite similar when examined along these dimensions. The absence of widespread differences for these variables is generally not supportive of the hypotheses that reading disabled children would report less thematically continuous and rich dream narratives.

The dream reports from normal children did contain a significantly greater number of Temporal Units than those from reading disabled subjects -- a finding which confirms the hypothesis for this variable. This result could be explained by the reading disabled group's impairment in sequential processing which would hinder their ability to sustain longer dreams. Alternatively, the presence of shorter REM dream sequences may be related to reading disabled subjects' less well developed language skills. Dream reports which contained a greater number of Temporal Units in normal subjects were associated with higher scores on the Vocabulary (WISC-R) subtest ($\underline{r}$=0.56), a measure of verbal concept formation. There was a significant difference between reading disabled and control subjects on Word Count (i.e., reading disabled children described their dreams in fewer words), and Word Count and number of Temporal Units were significantly related in both groups. Nevertheless, as mentioned, there are several indications that group differences in language functioning cannot entirely account for the group differences in Temporal Units and Word Count. The mean Word Count and number of Temporal Units in the waking narrative reports of reading disabled children were not lower than these measures in normal subjects. These variables in the waking narratives were correlated with language measures in both groups. Specifically, the number of Temporal Units contained in reading disabled children's waking narratives was consistently related to language skills, while the number of Temporal Units in dream reports was not. Therefore, it seems that language functioning was associated with waking narrative production, and waking narratives from reading disabled children were not inferior to those of normal subjects. The waking tasks did not involve the sequential organization of verbal information nor the visual/verbal translation to the extent that dream reports did. These requirements may have contributed to the group differences since reading disabled children are generally deficient in these areas. Interestingly, a recent study comparing narrative speech in reading disabled and normal 10-12 year old boys, (Davenport, Yinglish, Fein, Galin, & Johnstone, 1986) found that reading disabled subjects' narrative speech samples contained communication units shorter in length and a higher percentage of words extraneous to the speakers' intended meaning. A communication unit was defined as an independent clause and its modifiers. According to the authors, these findings suggested that reading disabled children were less skillful than same-aged peers at expressing their ideas with clarity and precision. In view of these results, one must consider whether deficits in dream production and waking narrative speech production emerge from cognitive impairments in reading disabled children or whether possible speech difficulties have adversely affected the dream reporting skills of these children and contributed substantially to our findings. The narrative speech difficulties found in Davenport et. al.'s reading disabled subjects relate most directly to the presence of shorter dream reports in our reading disabled children, that is, the hypothesized deficiencies in narrative speech may have been a factor in the lower Word Counts. The relationship between Davenport et. al.'s findings and our group difference in number of Temporal Units is more unclear at this time, especially since number of communication units in reading disabled subjects' narrative speech) was not a dependent measure in their study. Finally, their results suggest that Word Count and number of Temporal Units may not have been variables sensitive enough to detect differences between reading disabled and normal subjects' waking narratives.

The differential effect of sequential and linguistic factors on observed differences in number of Temporal Units and number of words contained in subjects' dream reports remains problematic. An analysis of spontaneous versus elaborated REM recall in this study, and a better understanding of the relationship between Temporal Units and Word Count would perhaps begin to tease out the contribution of these factors. The presence of fewer Temporal Units in dream reports from reading disabled children could also relate to their difficulties with short-term auditory memory. However, this appears unlikely. Although there were no correlations between number of Temporal Units and tests of cognitive functioning in the reading disabled group, dream recall, as well as dream recall where settings and characters persisted over a greater number of Temporal Units, were associated with spatial and not auditory memory.

Temporal Sequence: Setting and Character Extensity, and Character and Global Discontinuity

Contrary to expectation, dream reports from reading disabled children were not comprised of less extensive sequences of the same character or setting, nor more frequent changes in characters or characters and settings. These findings are difficult to interpret because the difference between groups in number of Temporal Units seems to be one which did not affect the narrative elaboration of the REM dream in terms of setting, character, or global development. The hypothesis that conceptual skills may be most relevant to creating and maintaining thematic organization in dreams may partially account for these findings (Foulkes, 1985). Reading disabled children were equivalent to normals in level of cognitive maturation and on most measures of non-verbal concept formation. Moreover, it is possible that their sequential processing deficits were not disruptive to dream formation at the level of thematic planning, but rather at the (related) level of the moment-to-moment elaboration of the dream narrative. Unfortunately, this does not explain why the overall continuity of activity in the dream was affected while the continuity of settings and characters were not.

As noted, positive correlations of Spatial Memory (K-ABC) with Setting Extensity (r=.82) and Character Extensity (r=.51), and a negative relationship with Character Discontinuity (r=-.65), suggest these memory skills were related to the extensiveness of material recalled in the reading disabled group. The relationships between Global Discontinuity and cognitive test measures in this group are more difficult to interpret. Global Discontinuity is believed to measure thematic shifts in the dream via changes in both character(s) and setting. Foulkes (1985) reports that Temporal Unit data in adults show that narrative development is typically maintained in REM dreams, i.e., when changes occur from one Temporal Unit to the next, the setting, character(s), or both usually remain constant, and therefore the incidence of Global Discontinuity is low. This dream variable was positively correlated with verbal concept formation abilities (Vocabulary, WISC-R) and strongly related to scores on a test of visual-spatial analysis and synthesis (Triangles, K-ABC) in reading disabled children. Previous research has reported that these cognitive skills in normal children are associated with advancements in dream capabilities indexed by increases in Self-Representation and Recall Rate. These are accompanied by longer and more complex narrative sequences. Therefore, it is puzzling why these cognitive skills would show the positive relationship to global changes in the thematic continuity of

REM dreams in reading disabled subjects. If Global Discontinuities in reading disabled children's dream sequences were often followed by the persistence of REM mentation, one may speculate that the deconstructive and reconstructive processes necessary for performance on Triangles (K-ABC) are related to the ability to link different thematic segments of the dream while preserving its overall continuity. In normal children, Global Discontinuity was negatively related to scores on Word Order. This is consistent with the subtest's positive association with Word Count -- a general indicator of narrative continuity.

Unit Composition: Self Density, Other Density, and Total Density

The dream reports from reading disabled children were characterized by a higher incidence of self-representation on a temporal unit-to-unit basis. There were no group differences in the number of non-self characters per Temporal Unit, nor in Total Density, i.e., when Self Density and Other Density were combined. These results do not confirm the hypotheses that dream reports from normal children would be richer in terms of self and character participation, and the higher proportion of Self Density in the reading disabled group is contrary to expectation. The rationale for the hypotheses for unit composition variables were two-fold. It was expected that longer dream sequences would be associated with richer narrative development, and because reading disabled subjects would produce shorter sequences, the composition of the narratives would be less complex. Although, based on unit composition measures, the sequences of dream activity were shorter in reading disabled subjects, they were not less complex. The second rationale was that reading disabled subjects' performance on unit composition variables would be significantly lower due to less well developed language abilities. One interpretation of our findings suggests that performance on unit composition variables was not primarily related to children's sequential processing or language abilities. Correlations between these variables in both groups generally support this interpretation and suggest that conceptual and simultaneous processing capabilities were primarily related to unit composition measures. In the normal group, Self Density was positively related to general intellectual functioning and a measure of verbal concept formation. In the reading disabled group, Self Density was negatively associated with reading achievement and word knowledge, while Other Density correlated positively with measures of analogical thinking and numerical problem solving. It is also possible that limitations of the definition of temporal sequence and unit composition variables restricted the ability to measure narrative richness and complexity. Perhaps dream sequences from normal subjects were more complex and this was reflected by their longer sequences of dream activity.

The finding of a greater proportion of units scored with a self-character in the reading disabled group appears to have been an artifact of the sampling procedure (c.f. Methodology) which reduced the number of dream reports used in the analysis for group differences. When the entire sample of REM dreams is considered, the proportion of units scored with a self-character is almost identical in normal (.66) and reading disabled children (.64), and is in fact slightly higher in the former group.

A comparison of temporal sequence and unit composition variables between this sample and a study of 23 young adults is informative (Foulkes & Schmidt, 1983, see Appendix 11). The pattern is consonant with Foulkes' (1982b) observation that dreams of seven to nine year old children are, by and large, indistinguishable from those of adults in formal structure, and generally begin to approximate those of adults in many respects. For example, in terms of temporal sequence, the dream reports from children were somewhat shorter, as were the persistence of characters and settings. Measures of sequential changes for characters, as well as settings and characters, were almost identical. With respect to unit richness, Self Density was somewhat higher in adults, while Other Density was slightly higher in children. The latter finding may be a result of the uncertainty scoring this variable in the present study. Since the exact number of characters was not ascertained, this figure was approximated by the judges and it may have been over-estimated.

A comparison of temporal sequence and unit composition variables between normal children's dream reports and waking narrative reports is also of interest even though the comparisons must remain tentative given the variability in the data and the absence of statistical analyses. As mentioned, normal subjects' waking narratives were comprised of a substantially greater number of Temporal Units. Several factors may have contributed to this result. The degree of alertness and ability to engage in task-oriented behavior were most likely enhanced when children generated their waking narratives. Additionally, volitional control over cognitive processes, i.e., retrieval and elaboration of scripts related to the narrative structure provided by the experimenter, language skills such as waking verbosity, and personality factors such as introversion/extroversion, may have affected waking narrative data. Finally, the state-dependent differences in cortical activation and cognitive processing between waking and dreaming provided distinct contexts for dream generation and waking narrative generation.

Although less striking, there were some discrepancies between normal subjects' waking narratives and dream reports on measures of Setting Extensity, Character Extensity, Character Discontinuity, and Global Discontinuity. The pattern of these results indicated that normal children's waking narratives contained settings and characters which persisted for a greater number of Temporal Units and changed less frequently. Nevertheless, these differences between waking narratives and dream reports were not great. It is possible that the frames of thematic development in terms of characters and settings were not radically different in the two conditions despite longer temporal sequences in waking narrative reports. Interestingly, settings persisted for a greater number of Temporal Units in normal subjects for the reality-based imaginative narrative where a setting was provided by the experimenter, than in the fantasy-based story which did not give an explicit setting. Normal children's scores on Setting Extensity for the fantasy-based story approximated Setting Extensity in dream reports. These results suggest there may be differences in children's waking narratives which may be related in part to the structure of the task. It is possible that waking narratives may be elicited from children which will differ in their resemblance to dream reports. A more detailed investigation of the relationships between waking narrative generation and dreaming in children may prove beneficial.

The relationships between waking narrative variables and measures of cognitive functioning were different than those with dream variables in both groups. This may indicate that different cognitive abilities contribute to dream formation and waking narrative generation. The number of words and Temporal Units in children's waking narratives was more closely associated with measures of language development. For example, the number of Temporal Units contained in reading disabled subjects' imaginative narratives was consistently related to tests of receptive language, particularly those requiring semantic skills, whereas this variable did not yield any significant correlations in dream reports. In normal children, there was a trend associating Word Count in waking narratives with receptive language skills, and the number of words in dream reports with expressive language abilities. It is possible that semantic development in normal and reading disabled children is more relevant to their success in generating waking narratives. These results may provide some support for Foulkes' (1982a) emphasis on syntactic rather than semantic intentionality in dream formation.

The correlations between cognitive measures and the remaining temporal sequence and unit composition variables are difficult to interpret as they do not show a distinct pattern. This may be due to the fact that these variables have been designed to evaluate dream development and therefore may not adequately assess waking narrative development. In reading disabled children, spatial memory processes were associated with Temporal Unit extensity and continuity in dreams but not in waking narratives. Also, Character Extensity in normal subjects' waking reports correlated negatively with tests of spatial and auditory short-term memory. These findings perhaps demonstrate that memory processes mediated dream reporting to a greater degree than narrative reporting. Interestingly, Character Discontinuity was strongly associated with sequential processing skills in reading disabled children. The proportion of Character Discontinuity was relatively low in waking narrative reports, and this relationship may suggest that children with higher sequential processing scores were able to maintain overall thematic unity in their narratives despite character changes.

SUMMARY and CONCLUSIONS

The purpose of this research was to investigate the relationship between cognitive functioning and dream development in children. The formal and representational properites of dream reports collected from normal children, and in most respects from the reading disabled group, are similar to those reported in previous research with children in this age range. The developmental markers suggested from previous research (Foulkes, 1982b) of increases in REM recall, Active Self-Representation and Visual Kinematic Imagery were present in reading disabled children. The advances in REM dream report length (and activity units), relative to normals, were not. With the exception of number of Temporal Units, a comparison of temporal sequence and unit composition measures in this study with those from an investigation in adults illustrates that these characteristics of REM dreaming in both groups are developing toward, but have not yet reached, adult levels. The differences observed between the control and experimental groups were predictable and consistent with the cognitive deficits in the reading disabled group. The aforementioned trends in the data suggest that cognitive development and dream development are indeed related. However, it is noteworthy that the REM reports from the two populations were similar in many respects despite the cognitive impairments in the reading disabled group.

A second purpose of the study was to attempt to determine what aspects of cognitive functioning were most relevant to dream generation. In this regard, the results of this study are not conclusive. The absence of dramatic variations in REM dreaming between normal and reading disabled children indicates sequential processing skills are not likely central to dream generation. They do, nonetheless, appear to be related to children's ability to sustain a dream sequence and more severe sequential impairments may have produced greater differences and had more disruptive effects on dream formation. However, the reading disabled children were seriously deficient in this area and to find a group with greater deficits would most likely entail involvement of other cognitive domains and a more complicated picture clinically.

The relative equivalence of normal and reading disabled children's simultaneous processing skills may have been a factor contributing to the absence of group differences. However, although simultaneous processes are probably involved with REM dreaming, this notion cannot readily be related to the view that REM dreaming is primarily a right-hemisphere function (cf. Introduction). The right-hemisphere approach has not explicitly defined what cognitive abilities would be related to REM dreaming and few relationships emerged between measures of simultaneous processing and characteristics of REM mentation in normal children in this investigation. Interestingly, there were relatively strong indications that visual-spatial memory played an important role in reading disabled children's recall of REM dreams. As well, simultaneous processing was related to the richness of dream narratives in this group (i.e., Other and Total Density). One may speculate, particularly in the case of dream recall, that reading disabled children's relative strength in simultaneous processing compensated for their weaknesses in other areas of cognitive functioning.

The hypothesis that conceptual/reasoning skills are fundamentally associated with dream capability (Foulkes, 1982b, 1985) offers a plausible explanation for similarities observed between reading disabled and normal subjects' REM dreams. The significant positive correlations of Active Self-Representation and Self Density with Full Scale (WISC-R) and Vocabulary, as well as those between Arithmetic and Recall Rate (all dreams) in normal children lend support to this idea. It may be that conceptual skills are expressed through, but remain partially independent of, verbal and non-verbal processes, and that if gross conceptual deficiencies are not present perhaps no major deficits in dream formation will occur. Recently, Schanfeld, Pearlman, and Greenberg (1985) reported a high frequency of dreaming in stroke patients who suffered severe disturbance in either waking visual-spatial or language functions. Unfortunately, information regarding the patients' level of intellectual functioning and/or problem solving abilities was not reported, and therefore, it is difficult to determine the influence of these skills on their ability to recall dreams. In general, the role of both verbal and non-verbal conceptual abilities in dream generation awaits further clarification and investigation.

The relationship between language development and dream formation remains problematic. The reading disabled children exhibited significantly less well developed language skills yet their performance was equivalent to normal subjects on the majority of dream measures. Consequently, the results do not clearly support the hypothesis that the verbal system plays a major role in dream formation (Foulkes, 1978, 1982a). Nonetheless, the children were not language impaired despite scoring significantly lower than normal subjects on tests of language development. Also, a measure of verbal concept formation was correlated with a number of dream variables in normal subjects, as was a test of syntactic development. Finally, it has been argued that language abilities and their effects on dream reporting skills were not the determining factor in subjects' performance on dream variables, nor in the differences between groups. However, it remains unclear how language functioning differentially contributes to dream formation, dream retrieval, and dream description.

There are a number of future directions for research suggested by the present investigation. In the present study, subjects could be divided into high and low recallers and the data re-examined to determine if any test measures differentiate the two groups. An analysis of the spontaneous versus elaborated recall in reading disabled and normal groups could give some indication as to how much interview questions requiring sequential organization of the dream experience affected each group's Temporal Unit and Word Count scores. Generally, it could be beneficial to determine whether any cognitive abilities would differentiate children who recall a high percentage versus a low percentage of REM dreams.

The role of simultaneous and conceptual factors in dream formation needs to be examined further. The present study investigated the relationship between cognitive abilities and dream formation by studying reading disabled children with sequential processing difficulties. As discussed in the Introduction, reading disabled children comprise a heterogeneous group of children characterized by differential deficits in cognitive functioning. Future dream research may benefit from studying additional reading disability subtypes, i.e., children with deficiencies in simultaneous processing.

However, given the small percentage of children in this category, a relatively large clinical sample of subjects will have to be available to provide an adequate sample of children of this type.

Children with learning disabilities in other academic areas also exhibit specific patterns of cognitive strengths and weaknesses. The relationship between cognitive processes and dream formation may be investigated in these children. For example, Strang and Rourke (1983) reported on a group of children with arithmetic difficulties who exhibited poor visual-perceptual organizational skills, non-verbal concept formation and problem solving abilities, yet excellent language-related skills of the rote variety.

As in the present study, it would be important for future research to comprehensively assess children's cognitive functioning and clearly delineate their areas of strengths and weakness. It may be useful to evaluate conceptual functioning in more detail by including cognitive tests which provide a better assessment of higher order problem solving and metacognitive abilities than that provided by traditional intelligence measures. A more thorough assessment of this dimension of cognitive functioning would be important given the current emphasis in dream research (Foulkes, 1985) on narrative planning and organization, and the monitoring and modification of on-going symbolic activity in dreams. An evaluation of children's capacity to manipulate mental imagery would also be useful.

Finally, more information is needed regarding the similarities and differences between waking narrative generation and dream formation. As mentioned, waking narratives may differ from dream reports along a number of dimensions which are not clearly understood. For example, children's waking narratives may be comprised of longer thematic sequences and these sequences may change less frequently. Perhaps future tasks requiring subjects to generate stories or describe stimuli may systematically manipulate variables such as visual versus non-visual stimuli, open-ended versus highly structured instructions, and/or fantasy-based versus reality-based settings. A more thorough understanding of the relationships between dreaming and waking narrative generation may help clarify the role of language in dream construction and dream description.

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APPENDIX 1: TEST INVENTORIES - RATIONALE, RESEARCH, AND STANDARDIZATION

Screening Phase

Weschler Intelligence Scale For Children - Revised - (WISC-R) (Weschler, 1974)

The WISC-R represents one of the three intelligence scales designed by David Weschler. It is modeled after his conviction that intelligence is a multi-determined and multi-faceted global entity (Salvia & Ysselke, 1981) which contributes to and is part of the total personality (Sattler, 1974). This brief summary of the WISC-R will focus on a description of the test, standardization, and research related to children with learning difficulties in areas such as reading.

The WISC-R was standardized on 2,000 children from 6.5 to 16.5 years of age. All data gathered since its inception indicate the WISC-R is reliable, satisfactorily valid, and adequately norm-referenced for heterogeneous populations (Quattrochi & Sherrers, 1980). The proposed study utilized a short-form of the WISC-R as developed by Kaufmann (1976). In general, short-forms correlate highly with Full Scale I.Q.

(Frank, 1983), and are believed to be an efficient and reliable alternative when time constraints suggest that giving the entire battery would be impractical. The major caution, understandably, is that short-forms should never be used to make educational decisions concerning a child.

The short-form employed in the study was standardized on a population of 2,200 children, with 100 boys and 100 girls being represented at each age level between 6.5 and 16.5 years of age. Split-half reliability ranged from .89 to .93, and test-retest reliability matched that of Weschler's original scale. The subtests chosen for this short-form version were Arithmetic-Vocabulary for the Verbal Scale, and Picture Arrangement-Block Design for the Performance Scale. These dyads correlated .92 with the Verbal Scale, and .89 with the Performance Scale, respectively. The four subtests employed in the short-form are described briefly below.

Verbal Scale

Arithmetic- This subtest assesses the ability to apply arithmetic operations to solve problems. It is thought to measure reasoning ability, concentration, and attention.

Vocabulary- Assesses the individual's ability to define words and is often considered as an excellent measure of g. It may involve several cognitive functions such as concept formation, language development, and memory.

Performance Scale

Block Design- In this subtest the individual must manipulate blocks to construct and reproduce the visual stimulus design in front of him. It is considered to be a good measure of visual-perceptual organization and visual-spatial analysis and synthesis. The entire process is thought to require abstract conceptual ability.

Picture Arrangement- This subtest involves putting pictures in sequence to construct a logical story and is believed to involve a number of skills such as non-verbal reasoning, sequencing, planning ability, and visual organization.

In the last 10 years, the WISC-R (or WISC) has become one of the most widely used inventories for identifying learning disabled children (Henry & Whittman, 1981). An enormous amount of research has been devoted towards explicating the internal structure of the WISC-R and finding a characteristic WISC-R profile for learning disabled children (Dudley-Marling, Kaufmann

& Tarver, 1981). These studies can be divided into three main areas; factor-analytic investigations, Bannantyne re-categorization of subtests into four groupings, and interpreting profiles based on interscale-intrascale scatter (Kaufmann, 1981). Briefly, factor-analytic studies indicate the presence of three main factors in the WISC-R: Verbal Comprehension (Information, Similarities, Vocabulary, Comprehension, and to a lesser degree Arithmetic), Perceptual Organization (all Performance Scales except Coding), and Freedom From Distractibility (Arithmetic, Digit Span, and Coding). Several investigations point to the importance of the Freedom From Distractibility factor in diverse learning disabled groups (Ackerman, Dykman, & Peters, 1976; Kaufmann, 1979). However, more research is needed to clarify more precisely what these factors mean from a theoretical and clinical standpoint (Kaufmann, 1981).

Bannantyne (1971, 1974) re-categorized Weschler subtests into four categories: Verbal-Conceptualization (Similarities, Vocabulary, Comprehension), Spatial (Picture Completion, Block Design, Object Assembly), Sequencing (Arithmetic, Digit Span, Coding), and Acquired Knowledge (Information, Arithmetic, Vocabulary). This has become more popular, with some reservations, than the three factor system. Initially, a characteristic profile was believed to be found for reading disabled and learning disabled children in which spatial > conceptual > sequencing scores (Clarizio & Bernard, 1981; Rugel, 1974; Smith, Colemn, Dokecki, & Davis, 1977). However, this pattern has also been reported with juvenile deliquents, emotionally handicapped, and non-impaired referrals (Clarizio & Bernard, 1981; Groff & Hubbie, 1981; Thompson, 1981) and has not always been found with learning disabled subjects (Thompson, 1981; Vance & Singer, 1979). In addition, although mean differences have been found for groups, the characteristic pattern has been displayed by few individuals. In short, Bannantyne's groupings appear relevant for understanding a child's processing strengths and weaknesses but should not be used for diagnosing children as learning or reading disabled (Kaufmann, 1981).

Finally, it has been generally believed that learning disabled children were characterized by significant Verbal-Performance Scale discrepancies and large subtest scatter on the WISC-R in relation to normal children. However, extensive reviews on this topic state strongly that these claims are unwarranted, and suggest caution when interpreting WISC-R profiles from this viewpoint.

In summary, the WISC-R is considered to be a reliable and sufficiently valid measure of intelligence. In this study, a norm-referenced, well-standardized short-form was used primarily to control for this factor in subject selection. Additionally, the inclusion of Block Design in this abridged version enabled comparisons with this measure and dream capability.

Imaginative Narrative Test

(adapted from Foulkes, 1984)

The Imaginative Narrative Test used in the study provided a concrete measure of waking imaginative narrative generation. It consisted of presenting the child with two kinds of hypothetical situations and asking him to tell a story about himself. The two hypothetical situations employed were:

1) "Suppose that you went to eat at a new restaurant -- one that just opened up. Tell me a story about what might happen there."

2) "Suppose that you could fly like a bird can. Tell me a story about what might happen then."

As a measure of waking imaginative generation, the protocols were analyzed in a manner similar to the dream reports. That is, they were scored for Word Count and for the majority of temporal sequence and unit composition variables used in the analyses of dream reports. This allowed for an evaluation of the length and narrative qualities of the waking narratives, as well as for a comparison between waking narratives and dream reports on these dimensions.

Personal Narrative Test

(adapted from Foulkes, 1984)

This test was part of the three phases of testing but was administered as the subject was being oriented to the nighttime dream reporting task. It proceeded in the following manner. Following the attachment of EEG electrodes and general preparation for sleep, the child (at bedside) was shown the cassette recorder on which nighttime interviews were recorded. At this time, the experimenter informally asked the child if he could answer a few questions so that they could play back the tape and confirm that the recorder was functioning properly. On each occaision the experimenter asked the child, "Have you ever been in the laboratory before?", and following his confirmation, "Could you tell me about it?" The child was encouraged to explore the topic thoroughly by the experimenter through the use of non-directive inquiries such as "What else can you remember about the last time you were here?" Once the child was finished, he was asked to recount the order in which he thought the events he described took place (this question was part of the nighttime dream interviews, cf. p.86). The personal narratives obtained from these informal interviews were examined for Word Count and number of Temporal Units.

The rationale for the Personal Narrative Test were several. First, it acted as an appropriate method for orienting the subjects toward nighttime dream interviews. Second, it provided an informal assessment of the child's discursive linguistic organization in a context similar to the experimental task. Third, the test gave a measure of the child's ability to recall events independently known to the experimenter. Consequently, data obtained from the test may have helped indicate whether dream report "failures" could be more parsimoniously accounted for by the production, or the retrieval hypothesis.

First Testing Phase

Kaufmann Assessment Battery For Children (K-ABC) (Kaufmann and Kaufmann, 1983a,b)

The K-ABC is a standardized, norm-referenced, individually administered measure of intelligence and achievement. The multi-test battery gives standard scores (*M*=100, *SD*=15) in four areas of mental functioning: Sequential Processing, Simultaneous Processing, Mental Processing Composite (sequential plus simultaneous), and Achievement. Administration of the entire test battery takes approximately 75-85 minutes for children seven years of age and above. This brief summary of the K-ABC will concentrate on a short description of the scales and their rationale, standardization, and research related to children with reading disabilities.

The K-ABC defines intelligence on the basis of an individual's style for solving problems and processing information. The Sequential and Simultaneous Processing Scales represent two styles of mental processing that have been identified, researched, and developed predominantly in the areas of cognitive psychology and neuropsychology. In general, sequential processing involves analysis of information based on its details and features, whereas simultaneous processing focuses on "the more global properties of patterns" (Kaufmann & Kaufmann, 1983a, p.2). Thus, the Sequential Processing Scale presents the individual with problems which have to be solved by arranging the input in serial order, where each idea has a linear and temporal relation to the preceding one. The Simultaneous Processing Scale involves tasks which are more spatial, analogic, or organizational in character where the solution is dependent on integrating and synthesizing information simultaneously. These scales do not offer pure measures of each processing strategy. Rather, they involve primarily one mode of processing while containing elements of the other as well. Also, the Sequential and Simultaneous Processing Scales have intentionally been developed to minimize the role of language and verbal skills for competent performance. The subtests which comprise these scales are briefly described below (descriptions taken from the test manual).

Sequential Processing Scale

Hand Movements - This subtest has been adapted from a clinical task designed by Luria to assess motor functions as part of a neuropsychological evaluation. It involves an individual's ability to perform a skilled motor movement with three consecutive components via his fist-edge palm.

Number Recall - This subtest requires that the individual repeat a series of digits (numbers) spoken by the examiner. It ha been adapted from the Digit Span subtest of the WISC-R, a well-researched and proven measure of sequential processing.

Word Order - This subtest measures the child's ability to point to the silhouette of common objects in the same order as presented by the examiner. It involves many skills, among which are auditory-visual integration, auditory-motor memory, and retention without rehearsal.

Simultaneous Processing Scale

Gestalt Closure - This subtest measures intellectual ability within the visual-vocal channel of communication and has been derived from various Gestalt completion tasks. It measures several skills, among which are perceptual closure, perceptual inference, and conversion of abstract stimuli into a concrete object.

Triangles - This subtest measures the child's capacity to assemble several identical rubber triangles to match a picture or abstract design. It has been adapted from the Block Design of the WISC-R.

Matrix Analogies - This subtest measures the child's ability to select a picture or design which best completes a 2 x 2 analog. This task has been adapted from Raven's Colored Progressive Matrices (Raven, 1965).

Spatial Memory - This subtest involves the ability to recall the locations of pictures arranged randomly on a page.

Photo Series - This subtest measures the child's ability to organize a randomly placed array of photographs illustrating an event and then order them in their proper sequence. It is an adaptation from the Picture Arrangement subtest of the WISC-R.

In sum, there are eight Mental Processing subtests, three Sequential and five Simultaneous.

The Achievement Scale of the K-ABC test battery has been developed to assess "factual knowledge and skills usually acquired in a school setting or through alertness to the environment" (Kaufmann & Kaufmann, 1983a, p.33). As such, it purports to be a reliable measure of achievement in five areas of functioning: reading, arithmetic, general information, early language development, and language concepts. In general, the Achievement subtests are extremely verbal requiring a considerable amount of verbal comprehension and expression. As measures of achievement, they are not to be equated with mental processing ability, intelligence level, or potential. Four of the five Achievement subtests were used in this study and they are very briefly described below.

Arithmetic - This subtest measures a child's skill at identifying numbers, counting, computing, and demonstrating understanding of mathematical concepts.

Riddles - Measures a child's ability to infer the name of a concrete or abstract verbal concept when given several of its characteristics.

Reading/Decoding - This subtest involves the child's ability to identify letters and to read and pronounce words.

Reading/Understanding - Measures the child's capacity to demonstrate reading comprehension by acting out commands that are given in sentences.

The K-ABC battery was standardized on a nationwide sample of 2000 children; 100 children being represented for each six month interval in the ages 2.5 through 12.5. The sample was stratified on the variables of sex, parental education, race or ethnic group, geographic region, community size, and educational placement. The exceptional population contribution was 138 children of all ages to the sample, with populations of speech-impaired, learning disabled, mentally retarded, emotionally disturbed, and gifted children being represented. Also, an additional 496 black children and 119 white children were tested to obtain sociocultural norms.

The average split-half reliability coefficients for the Mental Processing and Achievement Scales range from .89 to .97

in school age children. The majority of subtests in these categories have coefficients in the .80's. Kaufmann and Kaufmann (1983b) suggest that in excess of 40 correlational studies in normal and exceptional samples on existing tests of intelligence, achievement, visual-motor, neurological language, and cognitive abilities provide support for the construct, predictive, and concurrent validity of the K-ABC. These include factor-analytic analysis and correlational comparisons with Das, Kirby, and Jarman's (1975, 1979) tests of simultaneous and successive processing.

The publication of the K-ABC met with controversy, particularly with respect to its validity and theoretical suppositions (Kaufmann, 1984). Nevertheless, more recent studies have supported the construct validity of the instrument (Klanderman, Devine, & Moller, 1985; Klanderman, Perney, & Kroeschell, 1985), began to establish its utility with a variety of patient populations (Snyder, Leark, & Allison, 1983; Miller & Reynolds, 1984; Hooper, 1985; Inglis & Lawson, 1986), and found some corroboration for a hemispheric model for interpreting K-ABC Sequential and Simultaneous Processing scores (Morris & Bigler, 1987).

As mentioned previously (cf. p.67), research utilizing the K-ABC in reading disabled populations has been carried out. In general, these results suggest that a number of children with reading disabilities have difficulty on sequential tasks, while a smaller proportion show evidence of simultaneous processing deficits.

In summary, information presently available indicates that the K-ABC is a theoretically sound, well-researched, standardized measure of certain aspects of cognitive functioning and achievement. In terms of the proposed study, its major strength is its ability to measure and delineate specific cognitive processing skills which have been hypothesized as important in REM dream construction. Its major weakness is its, as yet, unproven credibility in research and clinical settings.

Second Testing Phase

Language Development

Test of Language Development - Intermediate Version (TOLD-I) (Hammill & Newcomer, 1982)

The TOLD-I is an extension of the Test of Language Development (TOLD), perhaps the most highly standardized comprehensive language test for children (Wallace & Larson, 1978). The TOLD-I inventory measures syntactic and semantic aspects of expressive and receptive language. There are five subtests in the battery: Characteristics (semantic-receptive), Generals (semantic-receptive), Grammatic Comprehension (syntax-receptive), Sentence Combining (syntax-expressive), and Word Ordering (syntax-expressive). A very brief description of each subtest is given below.

Sentence Combining - The child must form one compound or complex sentence from two or more simple sentences said by the experimenter.

Characteristics - This test requires that the child determine the validity or truth of simple statements that are spoken by the experimenter. For example, the child must decide whether statements such as " all trees are oak" and "all cows are brown" are true or false.

Word Ordering - The examiner says a series of randomly ordered words and asks the child to reorder them to form a complete correct sentence. For example, your is name what, can be reordered to construct the sentence "What is your name?"

Generals - On this test the child must tell how three words spoken by the examiner are all alike. For example, if the examiner were to say "Venus, Mars, and Pluto", the child might say "They are all gods".

Grammatic Comprehension - This test measures the child's ability to recognize incorrect grammar in spoken sentences. Ten correct sentences are interspersed throughout the 40 scorable items to serve as foils.

In general, each subtest encompasses a linguistic system (listening or speaking) and a linguistic feature (semantic or syntactic). The subtests are grouped in accordance with common features or systems to yield the following composite scores: Syntax Quotient (Sentence Combining + Word Order + Grammatic Comprehension), Semantics (Characteristics + Generals), Speaking (Sentence Combining + Word Order + Generals), Listening (Characteristics + Grammatic Comprehension), and Total Spoken Language (Sentence Combining + Word Order + Grammatic Comprehension + Characteristics + Generals).

The TOLD-I normative data is based on tests administered to 871 children. Assessments of reliability and validity on the test are extensive and well-documented. The TOLD-I was designed for children from 8-6 to 12-11 years and takes approximately 35-40 minutes to administer.

Wong and Roadhouse (1978) and Newcomer and Maggee (1977) administered the TOLD to reading disabled subjects and found they scored significantly lower on all measures than normal subjects (overall, in the low average range). Newcomer et al. state that although, as a group, the reading disabled were not "language impaired", a significant proportion of them did score below the normal mean on oral language tasks. It is conceivable, then, that a selective group of reading disabled children will fall below the normal range in language functioning as measured by the TOLD-I.

In summary, the TOLD-I is one of the best comprehensive language measures commercially available and was used in this study to evaluate children in terms of language skills.

Conceptual Development

Conceptual Assessment Kit - Conservation

(Goldschmid and Bentler, 1968)

The development of scales of cognitive ability originating from Piagetian theory is a relatively new phenomenon (Clarizio, 1982). At the present time, most of these scales are experimental in form and not yet commercially available. The conservation measures of Goldschmid and Bentler have been designed to provide standard, normatively-adequate tests of Piaget's concept of "conservation". Piaget has stated that the ability to conserve signals the onset of concrete-operations (Piaget & Inhelder, 1971) and therefore assessment of this ability is directly relevant to the child's classification as pre-operational or operational. The Conceptual Assessment Kit was employed in the study to assess this ability and to provide an index of overall conceptual development. It has been used in this respect by other investigators (e.g., Maman, 1981; Krebs & Gillmore, 1982).

Children were administered Form B of the Conservation Kit which assessed conservation abilities for six concepts: two-dimensional space, number, substance, continuous quantity, weight, and discontinuous quantity. In general, the child was presented with two identical objects, followed by specific transformations performed on one by the examiner, and then a series of questions asking the child to explain their similarity or difference (Clarizio, 1982). Subsequently, the child was given a chance to explain his answer and was scored on the basis of principles such as invariance, reversibility, or compensation. The child was given a total score and classified as operational or pre-operational on the particular task.

The Concept Assessment Kit was standardized on a sample of 560 boys and girls between the ages of four and eight, chosen from schools, daycare centers, and Head Start programs in the Los Angeles area (Clarizio, 1982). It was administered to a fairly wide range of socioeconomic groups, although lower middle-class subjects seem to be overrepresented. The "Kit" was standardized and designed for children between the ages of four and seven but has been used with older subject populations.

Goldschmid and Bentler's test measure has been lauded for its attempt at standardizing and operationally defining Piagetian concepts and also severely criticized on psychometric and theoretical grounds (Ayers, 1972; Devries & Kohlberg, 1969; Hall & Mery, 1969). The major thrust of these criticisms suggests that the test is limited in its ability to measure conservation and is inadequate as an estimate of conceptual development. The authors add that their reservations concern not only the present instrument, but basically all Piagetian measurement procedures. As with other tests in the field, the Concept Assessment Kit is viewed as being at the experimental stage.

Despite the test's shortcomings and inadequate norms for the present sample, the Concept Assessment Kit appeared to be the most appropriate , reliable, and time-efficient measure available for obtaining some indication of overall conceptual development. However, its obvious restrictions necessitate caution with interpretation of its results.

Additionally, both Piagetian and traditional I.Q. scales were used in the study. Generally, research indicates a fair degree of overlap between Piagetian scales and traditional measures of I.Q. (Clarizio, 1982). There is conflicting evidence, however, concerning the degree of commonality between the two types of measures. Several studies reviewed by Sattler (1982) report positive and moderate correlations between Piagetian and traditional I.Q. scales in infant, pre-school, and school-aged populations. Further research in both normal and clinical populations is needed to carefully delineate the relationship between these types of instruments. Also, the commercial market must await the development of Piagetian scales to strengthen the validity and reliability of present observations.

APPENDIX 2: SHEET USED BY JUDGES FOR SCORING DREAM VARIABLES

Dream Variables: Rating Scales   Code ....

Check appropriate box

1. Recall Rate		
a) No dream	---	
b) Dream forgotten	---	
c) Dream reported	---	
2. Self-Representation		
a) None	---	
b) Passive	---	
c) Active role	---	
3. Visual Imagery		
a) None	---	
b) Static	---	
c) Kinematic	---	
4. Affect	Dreamer	Other
a) Afraid	---	---
b) Angry, mad	---	---
c) Sad, unhappy, disappointed	---	---
d) Happy, pleased	---	---
e) Excited	---	---
f) Confused, unsettled	---	---
g) Other	---	---
h) None	---	---

Characters

Temporal Unit No.	Self Specificity P=passive A=active	Other (1) specify who	Other (2)	Other (,2)	Setting S=same D=different
1.	---	---	---	---	---
2.	---	---	---	---	---
3.	---	---	---	---	---
4.	---	---	---	---	---
5.	---	---	---	---	---
6.	---	---	---	---	---
7.	---	---	---	---	---
8.	---	---	---	---	---
9.	---	---	---	---	---
10.	---	---	---	---	---

APPENDIX 3: GUIDELINES FOR SCORING REM DREAM REPORTS

Note. Adapted from Foulkes and Shepherds' (1974) scoring system for children's dreams. In general, three examples of each scoring distinction were given. Where appropriate, one will be presented here.

A) Rating Scales: The dreams were first scored for a number of variables using "checklist" rating scales. These variables are:

Var.1 - Recall Rate: Simply whether a dream was or was not reported, or forgotten. The appropriate box was checked:

a) no dream

b) dream forgotten

c) dream reported

Var.2 - Self-Representation: This variable pertained to whether or not a self character was present in the dream, and if so, did he assume a passive or active role. Again, the appropriate box was checked:

a) none (no self character)

b) passive (represented but passive)

c) active (represented and active in the dream)

Examples of each category are given below:

A) None (No Self-Representation): No self character was reported as being present in the dream.

E: What were you dreaming about?

S: There was this boy in Africa and he had a parrot, a mouse, and a lion, and he told the man to do something. I don't know what it was and he didn't do it. And then he went back and he died and all he had was this lion ... and he set up a pit and the elephant came and fell in. The pit was too little and the elephant got out.

B) Passive: A self character was reported as being in the dream but does not assume an active role. This category included dreams where the subject reported himself to be in the dream but just observing or watching, or involved in an indirect or circumscribed manner.

E: What was going through your mind before I called you?

S: It was in the park and kids were playing soccer.

E: Were you in the dream?

S: I was just watching the game.

E: So you were there but just watching?

S: Yeah.

C) Active: The subject was reported to be in the dream and actively participated.

E: What was going through your mind before you woke up?

S: We were riding along in the car and Daddy got mad at me. And he tried to kill me and Mommy. But after awhile he changed his mind and we got home. He knew that he was going to try to kill me and Mommy. I took all the knives and hid them.

Note. If a Self Character was not reported as being in the dream then automatically the passive/active distinction was not scored.

Ultimately, the passive/active distinction was a qualitative one. It was possible for the Self Character to "do something" in the dream yet remain on the perimeter of the overall dream scenario. In most instances, however, the distinction was clear-cut.

Var.3 - Visual Imagery: This variable referred to the presence or absence of visual imagery, and whether, if present, it was static or kinematic (movement). The judge checked the appropriate box.

a) none

b) static

c) kinematic

Examples of the three categories are:

A) None: This occurred when the child reported a dream and upon questioning stated he was only thinking it and that he saw nothing.

E: Can you remember anything else?

S: That's all I can remember.

E: When you say thinking was it like seeing pictures of something or just like thinking about it?

S: Just thinking about it.

B) Static

E: What were you dreaming about before I woke you?

S: I was asleep beside a coke machine.

C) Kinematic

E: What was going through your mind before I called your name?

S: There were these monsters that had a whole bunch of people that were slaves and I was one of them. One of the monster guards was kind of nice and kind of bad at the same time. Everytime we tried to escape, they shot the house and burned it up with people in it and so that happened to a few people.

Var.4 - Dream Affect: The scale scored whether or not a child reported having a feeling or whether other characters had feelings in the dream. The child indicated the presence of feelings, either by directly naming them, or saying "I was feeling like ..." That is, it must have been explicitly stated and not inferred from the content. Inferences, if any, were noted on a side sheet. The scorer checked the appropriate box.

	Dreamer	Other
a) afraid, anxious		
b) angry, mad		
c) sad, unhappy, disappointed		
d) happy, pleased		
e) excited		
f) confused, unsettled		
g) other (name it)		
h) none		

Var.5 - Temporal Units: The Temporal Unit was the basic unit of action in the dream. It consisted of whatever activities could occur synchronously and were not described by the subjects as occurring successively.

Rules For Assigning New Temporal Units

A) A character performed an activity that could not in waking life be synchronous with his previous activity.
B) A character responded to another character or event.
C) There was a topical change in conversation.

Note. A conversation was one Temporal Unit until a topical change or event (e.g., one of the participants gets mad and an argument takes place).

Scoring Temporal Units

At the same time the judges were scoring Temporal Units, the following variables were also recorded for each Temporal Unit.
1) Characters: It was noted which characters were present for each unit. If a self character was scored, the judge designated whether they were in an active or passive role. Non-self characters were also scored and described.
2) Setting: The setting was scored for each Temporal Unit. After the initial setting was scored, the judge noted whether the subsequent setting was the same or different from the previous one. The basic definition of a setting was any place where any dream event occurred or where any character was located (e.g.,

brushing teeth in the bathroom then taking a shower in the bathroom consists of two Temporal Units in the same setting; brushing teeth in the bathroom and then watching t.v. in the bedroom are two Temporal Units in two different settings).

Var.6 - Word Count: Count of all words in sentences or phrases in which the subject described something that had occurred just before waking. This excludes:

1) Ah's, uhm's, well, I was dreamiing.
2) Repeated words and corrected words.
3) Commentary on the experience.
4) Commentary on the report.
5) Commentary on the status of the subject.

Examples for exclusion categories were given but are not presented here.

APPENDIX 4A: INDIVIDUAL AND POOLED RESULTS OF INTELLIGENCE AND COGNITIVE MEASURES: NORMAL SUBJECTS

Test		WISC-R				
		Arithmetic	Vocabulary	Picture Arrangement	Block Design	Full Scale I.Q.
Name	Age					
R.H.	10.25	12	16	13	12	116
D.H.	9.58	8	10	10	12	100
J.M.	9.58	13	13	16	12	115
J.T.	9.08	14	18	11	13	118
R.D.	8.92	14	9	7	12	103
J.C.	7.92	13	17	11	13	118
D.B.	8.25	10	14	13	14	118
Z.B.	8.08	8	17	15	13	121
S.R.	9.58	10	13	13	11	111
R.G.	9.00	10	11	12	13	110
R.D.	8.50	13	15	17	19	137
M.W.	8.92	10	12	14	15	118
J.F.	8.08	10	16	13	11	111
P.B.	8.50	12	14	16	11	116
<u>M</u>	8.9	11.2	13.9	12.9	12.9	115.1
<u>SD</u>	.70	2.04	2.75	2.67	2.09	8.69

Test Kaufmann Assessment Battery For Children (K-ABC)

Sequential

Name	Hand Move-ments	Number Recall	Word Order	Sequential Scale Score
R.H.	15	13	14	126
D.H.	13	8	9	100
J.M.	9	11	11	102
J.T.	12	15	12	119
R.D.	9	10	10	98
J.C.	9	12	11	104
D.B.	12	10	11	106
Z.B.	11	15	15	124
S.R.	13	9	12	108
R.G.	15	11	15	124
R.D.	14	10	11	110
M.W.	13	10	12	110
J.F.	12	10	13	110
P.B.	11	10	12	106
<u>M</u>	12	11	12	110.5
<u>SD</u>	2.03	2.07	1.75	9.22

Test Kaufmann Assessment Battery For Children (K-ABC)

Simultaneous

Name	Gestalt Closure	Triangles	Matrix Analogies	Spatial Memory	Photo Series	Simultaneous Scale Score
R.H.	15	12	16	11	11	121
D.H.	10	11	12	9	16	111
J.M.	6	13	15	12	10	108
J.T.	15	13	15	10	13	123
R.D.	12	12	12	10	10	108
J.C.	5	10	14	10	10	98
D.B.	11	13	10	11	10	106
Z.B.	9	16	16	14	11	123
S.R.	15	12	10	8	12	109
R.G.	9	16	15	12	15	124
R.D.	13	15	11	13	11	117
M.W.	13	13	13	10	16	121
J.F.	13	11	9	9	10	102
P.B.	15	11	11	9	10	108
<u>M</u>	11.5	12.7	12.8	10.6	11.8	112.8
<u>SD</u>	3.32	1.85	2.39	1.69	2.29	8.56

Test Kaufmann Assessment Battery For Children (K-ABC)

		Achievement			
	Mental Processing Composite (Full Scale)	Arithmetic	Riddles	Reading Decoding	Reading Compre-hension
Name					
R.H.	127	116	117	118	127
D.H.	107	121	124	118	134
J.M.	106	125	113	102	110
J.T.	125	137	138	137	132
R.D.	104	108	96	93	108
J.C.	100	118	110	120	116
D.B.	107	106	116	117	124
Z.B.	127	114	126	124	124
S.R.	110	94	120	123	120
R.G.	128	104	108	108	101
R.D.	117	125	104	123	106
M.W.	119	116	119	108	121
J.F.	106	124	115	98	111
P.B.	108	106	113	105	111
M	113.6	115.3	115.6	113.8	116.7
SD	9.84	11.0	29.3	11.96	11.08

Test   Test of Language Development - Intermediate (TOLD-I)

Name	Sentence Combining	Character-istics	Word Order	Generals	Grammatic Comprehension
R.H.	12	12	17	13	10
D.H.	15	9	12	17	9
J.M.	14	8	10	13	12
J.T.	17	12	12	16	15
R.D.	9	12	8	12	9
J.C.	10	11	10	11	12
D.B.	13	13	3	13	10
Z.B.	15	12	11	12	10
S.R.	12	8	10	13	10
R.G.	14	8	11	13	13
R.D.	11	9	9	9	10
M.W.	15	13	9	13	13
J.F.	9	12	9	11	11
P.B.	13	12	9	13	9
<u>M</u>	12.8	10.8	10.0	12.8	10.9
<u>SD</u>	2.42	1.92	2.98	1.96	1.81

Test	Test of Language Development - Intermediate (TOLD-I)				
	Listening Quotient	Speaking Quotient	Semantic Quotient	Syntax Quotient	Spoken Language Quotient
Name					
R.H.	106	126	115	119	119
D.H.	94	130	118	113	116
J.M.	100	115	103	113	109
J.T.	121	132	124	130	130
R.D.	103	99	113	93	101
J.C.	109	102	106	104	105
D.B.	109	98	118	91	103
Z.B.	106	117	112	113	113
S.R.	94	111	103	104	104
R.G.	103	117	103	117	112
R.D.	97	98	97	113	97
M.W.	118	115	118	115	117
J.F.	109	98	109	98	103
P.B.	103	111	115	102	108
<u>M</u>	105.1	112.0	110.7	108.9	109.8
<u>SD</u>	7.93	11.91	8.14	10.75	8.73

Test	Raven's Colored Progressive Matrices	Concept Kit - Conservation
Name		
R.H.	34	12
D.H.	33	12
J.M.	36	12
J.T.	33	12
R.D.	32	12
J.C.	23	12
D.B.	34	11
Z.B.	29	10
S.R.	31	12
R.G.	35	12
R.D.	25	12
M.W.	33	12
J.F.	18	12
P.B.	24	12
<u>M</u>	30.0	11.8
<u>SD</u>	5.40	.58

APPENDIX 4B: INDIVIDUAL AND POOLED RESULTS OF INTELLIGENCE AND COGNITIVE MEASURES: READING DISABLED SUBJECTS

Test		WISC-R				
		Arithmetic	Vocabulary	Picture Arrangement	Block Design	Full Scale I.Q.
Name	Age					
T.H.	8.75	9	9	13	13	106
P.M.	9.67	6	10	13	14	105
P.L.	8.92	10	15	14	18	123
J.P.	9.42	11	11	12	11	107
N.W.	8.17	10	17	13	14	118
G.M.	9.50	8	10	12	13	105
J.N.	9.50	13	12	17	15	128
M.D.	8.75	6	10	14	9	98
L.C.	9.58	9	10	9	13	100
D.M.	9.10	5	8	10	7	83
<u>M</u>	9.1	8.8	11.2	12.7	12.7	107.3
<u>SD</u>	.48	2.5	2.8	2.2	3.1	13.0

Test Kaufmann Assessment Battery For Children (K-ABC)

Sequential

Name	Hand Movements	Number Recall	Word Order	Sequential Scale Score
T.H.	7	10	10	93
P.M.	9	6	11	91
P.L.	9	7	6	83
J.P.	7	7	8	83
N.W.	6	9	7	83
G.M.	7	11	7	89
J.N.	7	6	8	81
M.D.	4	10	10	87
L.C.	9	8	10	93
D.M.	6	7	15	76
<u>M</u>	7.1	8.1	9.2	85.9
<u>SD</u>	1.6	1.8	2.6	5.6

Test Kaufmann Assessment Battery For Children (K-ABC)

Simultaneous

Name	Gestalt Closure	Triangles	Matrix Analogies	Spatial Memory	Photo Series	Simultaneous Scale Score
T.H.	12	11	10	13	15	115
P.M.	12	14	9	13	10	111
P.L.	10	15	10	13	12	114
J.P.	7	12	8	14	11	102
N.W.	12	15	13	8	14	117
G.M.	6	11	12	10	13	102
J.N.	15	11	12	10	15	118
M.D.	13	11	10	10	12	108
L.C.	11	12	9	10	10	102
D.M.	11	13	8	7	7	94
M	10.9	12.5	10.1	10.8	11.9	108.3
SD	2.7	1.6	1.7	2.3	2.5	8.0

Test Kaufmann Assessment Battery For Children (K-ABC)

Name	Mental Processing Composite (Full Scale)	Achievement: Arithmetic	Riddles	Reading Decoding	Reading Compre-hension
T.H.	107	88	99	82	73
P.M.	103	90	100	80	79
P.L.	101	108	102	88	91
J.P.	93	92	105	86	90
N.W.	103	119	130	98	96
G.M.	97	124	100	85	88
J.N.	103	121	109	85	95
M.D.	100	86	101	91	88
L.C.	99	94	91	85	76
D.M.	85	75	91	79	79
<u>M</u>	99.1	99.7	102.8	85.9	85.5
<u>SD</u>	6.3	17.0	11.0	5.5	8.1

Test Test of Language Development - Intermediate (TOLD-I)

Name	Sentence Combining	Character-istics	Word Order	Generals	Grammatic Comprehension
T.H.	9	7	3	8	8
P.M.	8	9	8	10	10
P.L.	6	9	8	11	9
J.P.	9	12	9	11	9
N.W.	9	13	6	12	10
G.M.	5	9	4	9	9
J.N.	15	10	15	12	9
M.D.	5	10	3	9	2
L.C.	6	9	7	7	11
D.M.	6	11	7	9	6
<u>M</u>	7.8	9.9	7.0	9.7	8.3
<u>SD</u>	3.0	1.7	3.5	1.6	2.6

Test	Test of Language Development - Intermediate (TOLD-I)				
	Listening Quotient	Speaking Quotient	Semantic Quotient	Syntax Quotient	Spoken Language Quotient
Name					
T.H.	85	79	85	79	79
P.M.	97	97	97	91	93
P.L.	94	89	79	85	90
J.P.	103	98	109	94	100
N.W.	109	91	112	89	98
G.M.	94	74	94	74	81
J.N.	97	126	106	119	115
M.D.	76	72	97	59	71
L.C.	100	83	88	91	89
D.M.	91	83	100	76	85
<u>M</u>	94.6	89.2	96.7	85.7	90.1
<u>SD</u>	9.3	15.6	10.6	15.8	12.4

Test	Raven's Colored Progressive Matrices	Concept Kit - Conservation
Name		
T.H.	30	12
P.M.	30	12
P.L.	30	12
J.P.	25	12
N.W.	27	12
G.M.	29	12
J.N.	28	12
M.D.	19	10
L.C.	29	11
D.M.	20	12
<u>M</u>	26.7	11.7
<u>SD</u>	4.1	.67

APPENDIX 5A: INDIVIDUAL AND POOLED DATA FOR DREAM VARIABLES: NORMAL SUBJECTS

Name	Recall Rate (All Dreams)	Recall Rate (> 1 Temporal Unit)	Active Self-Representation	Visual Imagery	Affect
R.H.	90%	90%	67%	100%	11%
D.H.	90%	70%	22%	100%	33%
J.M.	88.8%	66.6%	38%	67%	38%
J.T.	90%	50.%	22%	88%	11%
R.D.	80%	70.%	38%	78%	0%
J.C.	91.6%	75.%	91%	88%	9%
D.B.	60%	50.%	67%	100%	33%
Z.B.	66.6%	55.5%	83%	100%	16%
S.R.	70%	70%	43%	100%	0%
R.G.	76.9%	69.2%	75%	89%	75%
R.D.	88.8%	88.8%	44%	100%	22%
M.W.	50%	33%	100%	100%	0%
J.F.	58.3%	50%	67%	86%	38%
P.B.	72.7%	72.7%	57%	88%	33%
<u>M</u>	76.2%	64.5%	58.1%	91.7%	22.7
<u>SD</u>	14.0	15.6	24.5	10.2	20.7

Name	Temporal Units	Setting Extensity	Character Extensity	Character Discontinuity	Global Discontinuity
R.H.	27.0	13.5	17.3	.62	0.0
D.H.	17.0	6.5	3.3	2.5	.93
J.M.	15.0	8.3	14.0	.66	.33
J.T.	20.0	10.0	12.0	1.1	.83
R.D.	21.0	13.0	15.0	.40	.40
J.C.	30.0	7.6	9.5	.96	.76
D.B.	18.0	10.8	8.0	2.2	1.8
Z.B.	21.0	10.8	5.7	2.3	.50
S.R.	21.0	14.5	15.5	.74	.25
R.G.	14.0	9.0	5.5	2.5	0.0
R.D.	26.0	15.5	9.5	2.5	1.0
M.W.	13.0	8.5	12.0	1.0	1.0
J.F.	22.0	18.5	18.0	3.5	0.0
P.B.	17.0	8.7	9.7	1.2	.75
<u>M</u>	20.1	11.1	11.1	1.6	.61
<u>SD</u>	4.9	3.4	4.6	.96	.51

Name	Self Density	Other Density	Total Density	Word Count
R.H.	3.0	10.8	13.8	454.5
D.H.	1.0	4.3	5.3	221.5
J.M.	2.0	11.3	13.3	207.0
J.T.	3.0	7.7	10.7	269.0
R.D.	3.0	9.0	12.0	236.5
J.C.	4.0	3.6	7.6	200.0
D.B.	3.0	8.0	11.0	210.5
Z.B.	4.0	8.2	12.2	274.5
S.R.	1.0	10.8	11.8	306.0
R.G.	1.2	7.4	8.6	235.5
R.D.	4.0	11.1	15.1	379.5
M.W.	3.0	14.0	17.0	108.0
J.F.	3.0	11.8	14.8	235.0
P.B.	2.0	7.9	9.9	155.5
M	2.7	8.9	11.6	249.5
SD	1.1	2.9	3.2	87.3

Note. Recall Rate (All Dreams), Recall Rate (> 1 Temporal Unit), Active Self-Representation, Visual Imagery, and Affect *n*=115 dreams.
Temporal Units, Setting Extensity, Character Extensity, Character Discontinuity, Global Discontinuity, Self Density, Other Density, Total Density, and Word Count *n*=56 dreams (cf. Methodology).

APPENDIX 5B: INDIVIDUAL AND POOLED DATA FOR DREAM VARIABLES: READING DISABLED SUBJECTS

Name	Recall Rate (All Dreams)	Recall Rate (> 1 Temporal Unit)	Active Self-Representation	Visual Imagery	Affect
T.H.	90.9%	63.6%	100%	100%	90.0%
P.L.	90.0%	90.0%	44.4%	90.0%	22.0%
G.M.	71.4%	57.0%	80.0%	100%	20.0%
N.W.	70.0%	40.0%	29.0%	86.0%	0.0%
J.N.	81.8%	81.8%	44.4%	88.0%	33.0%
J.P.	100%	100%	70.0%	90.0%	40.0%
P.M.	83.3%	83.3%	100%	90.0%	33.0%
L.C.	90.0%	80.0%	78.3%	89.0%	88.0%
M.D.	77.7%	77.7%	71.0%	100%	86.0%
D.M.	87.5%	75.0%	57.0%	100%	57.0%
M	84.3%	74.8%	67.4%	93.3%	46.9%
SD	9.3	17.1	23.6	5.8	31.8

Name	Temporal Units	Setting Extensity	Character Extensity	Character Discontinuity	Global Discontinuity
T.H.	15	13.0	7.0	1.5	.00
P.L.	14	10.5	10.0	1.5	1.5
G.M.	9	9.0	9.0	1.0	.00
N.W.	10	5.0	6.5	2.5	1.0
J.N.	19	12.5	13.5	.83	.00
J.P.	22	16.0	19.0	.42	.00
P.M.	17	12.2	8.5	.73	.40
L.C.	20	7.5	7.0	.70	.45
M.D.	20	10.0	8.3	1.5	.16
D.M.	11	7.5	7.0	2.3	.50
<u>M</u>	15.7	10.3	9.6	1.3	.40
<u>SD</u>	4.6	3.2	3.9	.69	.50

Name	Self Density	Other Density	Total Density	Word Count
T.H.	4.0	6.3	10.3	140
P.L.	1.0	8.3	9.3	163
G.M.	4.0	14.0	18.0	124
N.W.	1.0	8.3	9.3	168
J.N.	2.0	13.2	15.2	199
J.P.	4.0	4.3	8.3	188
P.M.	4.0	3.8	7.8	217
L.C.	4.0	4.6	8.6	184
M.D.	2.0	8.9	10.9	194
D.M.	3.0	7.6	10.6	96
<u>M</u>	2.9	7.9	10.8	167.1
<u>SD</u>	1.3	3.5	3.3	37.5

<u>Note</u>. Recall Rate (All Dreams), Recall Rate ($>$ 1 Temporal Unit), Active Self-Representation, Visual Imagery, and Affect n=88 dreams.
Temporal Units, Setting Extensity, Character Extensity, Character Discontinuity, Global Discontinuity, Self Density, Other Density, Total Density, and Word Count n=40 dreams (cf. Methodology).

APPENDIX 6A: NON-SIGNIFICANT CORRELATIONS (SPEARMAN-RANK) BETWEEN WAKING MEASURES (AGE AND COGNITIVE TESTS) AND DREAM RATING SCALES FOR THE NORMAL GROUP

	Recall Rate (All Dreams)	Recall Rate (> 1 Temporal Unit)	Active Self-Representation
WISC-R			
Arithmetic	-	.33	.14
Vocabulary	.09	-.03	-
Picture Arrangement	-.19	.06	.47*
Block Design	.05	.07	.48*
WISC-R (Full Scale)	.02	.13	-
K-ABC Sequential Scale			
Hand Movements	-.09	.16	-.26
Number Recall	.21	-.09	.44
Word Order	-.28	-.07	.05
Sequential Scale Score	-.04	.01	.18
K-ABC Simultaneous Scale			
Gestalt Closure	-.24	-.02	-.29
Triangles	-.12	-.07	.15

	Recall Rate (All Dreams)	Recall Rate (> 1 Temporal Unit)	Active Self-Representation
K-ABC Simultaneous Scale			
Matrix Analogies	.43*	.11	.17
Spatial Memory	.13	.13	-
Photo Series	-.09	-.29	-.41
Simultaneous Scale Score	.01	-.08	-.21
Mental Processing Composite	-.01	-.04	-.11
K-ABC Achievement Scale			
Reading Decoding	.31	.07	.19
Reading Comprehension	.04	-.25	-.03
Arithmetic	.21	-.24	.38
Riddles	-.15	-.50*	-.12
TOLD-I			
Sentence Combining	.01	-.39*	-.22
Characteristics	-.45*	-.47*	.31
Word Order	-	.42*	-.20
Generals	.16	-.26	-
Spoken Language Quotient	.17	-.30	-.19

	Recall Rate (All Dreams)	Recall Rate (> 1 Temporal Unit)	Active Self-Representation
TOLD-I			
Listening Quotient	-.31	-	.37
Grammatic Comprehension	.03	-.45*	.15
Speaking Quotient	.34	-.03	-.37
Semantic Quotient	-.20	-	-.20
Syntax Quotient	.41*	.04	-.07
Raven's Colored Progressive Matrices	.15	-.08	-.32
Concept - Kit Conservation	.20	.28	-.40
Age	.18	.19	-.51

	Visual Imagery	Affect
WISC-R		
Arithmetic	.43	-.10
Vocabulary	.38	.01
Picture Arrangement	.38	.50*

	Visual Imagery	Affect
WISC-R		
Block Design	.14	-.08
WISC-R (Full Scale)	.45*	.24
K-ABC Sequential Scale		
Hand Movements	-.17	-.11
Number Recall	.47*	-.03
Word Order	.46*	.13
Sequential Scale Score	.38	.02
K-ABC Simultaneous Scale		
Gestalt Closure	.17	.31
Triangles	.32	.14
Matrix Analogies	.07	-.03
Spatial Memory	.32	-.08
Photo Series	-.43	-.05
Simultaneous Scale Score	-.03	-.01
Mental Processing Composite	.14	.15

	Visual Imagery	Affect
K-ABC Achievement Scale		
Reading Decoding	-.07	.02
Reading Comprehension	-.45	.26
Arithmetic	-.25	.30
Riddles	-.23	-.04
TOLD-I		
Sentence Combining	-.31	.37
Characteristics	.22	.26
Word Order	-.35	-.16
Generals	-.48	.41
Spoken Language Quotient	-.24	.23
Listening Quotient	.42	.10
Grammatic Comprehension	.39	.06
Speaking Quotient	-.38	.08
Semantic Quotient	-.31	.25
Syntax Quotient	-.07	-.03
Raven's Colored Progressive Matrices	-.10	.31

	Visual Imagery	Affect
Concept - Kit Conservation	.13	.20
Age	-.30	.02

* $.05 < p < .10$

APPENDIX 6B: NON-SIGNIFICANT CORRELATIONS (SPEARMAN-RANK) BETWEEN WAKING MEASURES (AGE AND COGNITIVE TESTS) AND DREAM RATING SCALES FOR THE READING DISABLED GROUP

	Recall Rate (All Dreams)	Recall Rate (> 1 Temporal Unit)	Active Self-Representation
WISC-R			
Arithmetic	.12	.30	-.19
Vocabulary	-.25	.24	-.54
Picture Arrangement	-.27	.18	-.52
Block Design	-.15	.21	-.32
WISC-R (Full Scale)	.04	.26	-.33
K-ABC Sequential Scale			
Hand Movements	.45*	.55*	.37
Number Recall	-.26	-	.13
Word Order	.21	.01	.39
Sequential Scale Score	.18	-.14	-
K-ABC Simultaneous Scale			
Gestalt Closure	-.31	-.12	-.29
Triangles	.02	.19	-.46

	Recall Rate (All Dreams)	Recall Rate (> 1 Temporal Unit)	Active Self-Representation
K-ABC Simultaneous Scale			
Matrix Analogies	-	-.55*	-.41
Spatial Memory	-	-	.45
Photo Series	-.27	-.36	-.19
Simultaneous Scale Score	-.24	-.07	-.41
Mental Processing Composite	-.13	-.14	-.13
K-ABC Achievement Scale			
Reading Decoding	-.31	-.02	-.53
Reading Comprehension	-.45*	.10	-
Arithmetic	.29	.47	.37
Riddles	.28	.33	-.04
TOLD-I			
Sentence Combining	.24	.17	-.03
Characteristics	-.29	-.03	-.47
Word Order	.25	.52*	-.17
Generals	-.11	.21	-.58*
Spoken Language Quotient	.05	.47	-.18

	Recall Rate (All Dreams)	Recall Rate (> 1 Temporal Unit)	Active Self-Representation
TOLD-I			
Listening Quotient	-.03	.19	.02
Grammatic Comprehension	-.07	.13	.17
Speaking Quotient	.17	.55*	-.12
Semantic Quotient	-.35	-.07	-.21
Syntax Quotient	.31	-	.13
Raven's Colored Progressive Matrices	.27	.14	.28
Concept - Kit Conservation	-.19	-.05	-.20
Age	.24	.21	.64*

	Visual Imagery	Affect
WISC-R		
Arithmetic	-.24	-.44
Vocabulary	-.42	-.48
Picture Arrangement	-.35	-.21

	Visual Imagery	Affect
WISC-R		
Block Design	-.53	-.16
WISC-R (Full Scale)	-.41	-.39
K-ABC Sequential Scale		
Hand Movements	-.43	.35
Number Recall	.18	.18
Word Order	.53	.29
Sequential Scale Score	.18	.47
K-ABC Simultaneous Scale		
Gestalt Closure	.29	-.17
Triangles	-.48	.04
Matrix Analogies	-.06	-.43
Spatial Memory	-.30	.24
Photo Series	.01	-.32
Simultaneous Scale Score	-.18	-.28
Mental Processing Composite	-.06	-.03

	Visual Imagery	Affect
K-ABC Achievement Scale		
Reading Decoding	-.29	-.24
Reading Comprehension	-.29	-
Arithmetic	.13	-.63*
Riddles	-.29	-.59
TOLD-I		
Sentence Combining	.18	-.41
Characteristics	.24	-
Word Order	-.12	-.25
Generals	-.18	-.49
Spoken Language Quotient	-.06	-.61
Listening Quotient	.12	-.52
Grammatic Comprehension	.01	-.19
Speaking Quotient	-.06	-.51
Semantic Quotient	.52	-
Syntax Quotient	.06	-.35
Raven's Colored Progressive Matrices	-.41	.37

	Visual Imagery	Affect
Concept - Kit Conservation	.27	-.45
Age	.10	-.03

* $.05 < \underline{p} < .10$

APPENDIX 7A: NON-SIGNIFICANT CORRELATIONS (PEARSON-PRODUCT-MOMENT) BETWEEN WAKING MEASURES (AGE AND COGNITIVE TESTS), DREAM TEMPORAL SEQUENCE AND UNIT COMPOSITION VARIABLES FOR NORMAL GROUP

	Temporal Units	Setting Extensity	Character Extensity	Character Discontinuity
WISC-R				
Arithmetic	.35	.08	.45*	-.56*
Vocabulary	-	.23	.16	.11
Picture Arrangement	-.09	.10	-.03	.20
Block Design	.15	.08	-.29	.22
WISC-R (Full Scale)	.35	.22	-.04	.12
K-ABC Sequential Scale				
Hand Movements	-.08	.24	-.11	.35
Number Recall	.28	-.06	.01	-.15
Word Order	-.01	.22	.05	.22
Sequential Scale Score	.10	.16	-.04	.18
K-ABC Simultaneous Scale				
Gestalt Closure	.02	.49*	.42	-.07
Triangles	-.28	.04	-.38	.29

	Temporal Units	Setting Extensity	Character Extensity	Character Discontinuity
K-ABC Simultaneous Scale				
Matrix Analogies	.02	-.45*	-.17	-.34
Spatial Memory	.05	-.04	-.35	.22
Photo Series	-.52*	-.42	-.43	.13
Simultaneous Scale Score	-.27	-.09	-.23	.02
Mental Processing Composite	-.11	.03	-.15	.10
K-ABC Achievement Scale				
Reading Decoding	.33	-.12	-.31	.01
Reading Comprehension	.04	-.27	-.18	-.02
Arithmetic	.18	-.03	.07	.15
Riddles	-.15	-.22	-.13	.05
TOLD-I				
Sentence Combining	-	-	-.49*	-.04
Characteristics	.12	.08	.18	-.06
Word Order	.27	-.04	.16	-.21
Generals	-.48*	- -	-.27	-.16
Spoken Language Quotient	-.26	-.44	-.10	-.21

	Temporal Units	Setting Extensity	Character Extensity	Character Discontinuity
TOLD-I				
Listening Quotient	-.06	-.11	.17	-.11
Grammatic Comprehension	-.20	-.24	.05	-.09
Speaking Quotient	-.27	-.47*	-.21	-.20
Semantic Quotient	-.27	-.34	-.06	-.17
Syntax Quotient	-.09	-.28	-.15	-.09
Raven's Colored Progressive Matrices	-.50	-.45	-.17	-.42
Concept - Kit Conservation	.01	-.22	-.37*	.03
Age	-.23	.12	.25	-.47*

	Global Discontinuity	Self Density	Other Density	Total Density
WISC-R				
Arithmetic	-.04	-.31	.06	.23
Vocabulary	.02	–	-.03	.15
Picture Arrangement	.08	.15	.44	.45*

	Global Discontinuity	Self Density	Other Density	Total Density
WISC-R				
Block Design	.49*	.51*	.20	.35
WISC-R (Full Scale)	.31	–	.29	.47*
K-ABC Sequential Scale				
Hand Movements	-.11	-.26	.24	.09
Number Recall	-.16	.52*	-.10	.07
Word Order	-.52*	.11	.23	.19
Sequential Scale Score	-.36	.17	.14	.13
K-ABC Simultaneous Scale				
Gestalt Closure	-.03	-.11	.45	.32
Triangles	-.03	.13	.22	.21
Matrix Analogies	-.29	.16	-.16	-.07
Spatial Memory	.04	.48*	.07	.23
Photo Series	.05	-.46*	-.04	-.20
Simultaneous Scale Score	-.13	.01	.24	.19
Mental Processing Composite	-.24	.08	.22	.18

	Global Discontinuity	Self Density	Other Density	Total Density
K-ABC Achievement Scale				
Reading Decoding	.32	.18	-.29	-.27
Reading Comprehension	.34	-.03	-.21	-.23
Arithmetic	.08	.41	.01	.22
Riddles	.14	-.09	-.09	-.15
TOLD-I				
Sentence Combining	.26	-.26*	-.09	-.17
Characteristics	.34	–	.10	.27
Word Order	–	-.12	-.03	-.07
Generals	.13	-.59*	-.34	-.49
Spoken Language Quotient	-.07	-.14	-.10	-.13
Listening Quotient	.21	.48*	.14	.30
Grammatic Comprehension	-.06	.08	.09	.15
Speaking Quotient	-.18	-.39	-.17	-.28
Semantic Quotient	.33	-.01	-.18	-.16
Syntax Quotient	-.20	-.05	.04	.03
Raven's Colored Progressive Matrices	.09	-.40	.04	-.07

	Global Discontinuity	Self Density	Other Density	Total Density
Concept - Kit Conservation	-.26	-.38	.12	.05
Age	-.34	-	.21	.01

* $.05 < \underline{p} < .10$

APPENDIX 7B: NON-SIGNIFICANT CORRELATIONS (PEARSON-PRODUCT-MOMENT) BETWEEN WAKING MEASURES (AGE AND COGNITIVE TESTS), DREAM TEMPORAL SEQUENCE AND UNIT COMPOSITION VARIABLES FOR READING DISABLED GROUP

	Temporal Units	Setting Extensity	Character Extensity	Character Discontinuity
WISC-R				
Arithmetic	.20	.30	.56*	-.34
Vocabulary	-.22	-.29	.06	.31
Picture Arrangement	.14	.37	.31	-.07
Block Design	-.06	.10	.07	-.23
WISC-R (Full Scale)	.06	.20	.33	-.17
K-ABC Sequential Scale				
Hand Movements	.07	.16	.05	-.48
Number Recall	-.37	-.30	-.41	.25
Word Order	.02	-.12	-.34	.23
Sequential Scale Score	.21	.12	-.30	-.45
K-ABC Simultaneous Scale				
Gestalt Closure	.24	-.12	-.31	.25
Triangles	-.36	-.37	-.21	.43

	Temporal Units	Setting Extensity	Character Extensity	Character Discontinuity
K-ABC Simultaneous Scale				
Matrix Analogies	-.45	-.38	-.21	.27
Spatial Memory	.49	-	.51	-
Photo Series	-.04	.18	.09	-.04
Simultaneous Scale Score	.04	.13	-.03	.06
Mental Processing Composite	.12	.13	-.19	-.15
K-ABC Achievement Scale				
Reading Decoding	-.10	-.41	-.04	.36
Reading Comprehension	-.08	-.06	.44	.11
Arithmetic	-.33	-.18	.13	-.07
Riddles	-.23	-.20	.10	.34
TOLD-I				
Sentence Combining	.27	.39	.44	-.20
Characteristics	-.06	-.27	.31	.33
Word Order	.34	.30	.56*	-.35
Generals	.02	.27	.58*	.01
Spoken Language Quotient	.21	.22	.55*	-.26

	Temporal Units	Setting Extensity	Character Extensity	Character Discontinuity
TOLD-I				
Listening Quotient	-.12	-.16	.26	-.09
Grammatic Comprehension	-.10	-.01	.11	-.32
Speaking Quotient	.33	.37	.55	-.31
Semantic Quotient	.06	-.02	.38	.10
Syntax Quotient	.29	.29	.47	-.39
Raven's Colored Progressive Matrices	-.11	.16	-.02	-.38
Concept - Kit Conservation	-.33	.31	.23	.30
Age	.39	.42	.39	-

	Global Discontinuity	Self Density	Other Density	Total Density
WISC-R				
Arithmetic	-.03	-.22	.33	.25
Vocabulary	-	-	.16	-.11
Picture Arrangement	-.04	-.52	.49	.30

	Global Discontinuity	Self Density	Other Density	Total Density
WISC-R				
Block Design	.46	-.31	.15	.03
WISC-R (Full Scale)	.28	-.51	.35	.16
K-ABC Sequential Scale				
Hand Movements	.32	.27	-.34	-.24
Number Recall	-.23	.10	.32	.36
Word Order	-.24	.37	-.37	-.26
Sequential Scale Score	-.27	.54	-.29	-.12
K-ABC Simultaneous Scale				
Gestalt Closure	.05	-.42	.02	-.18
Triangles	-	-.50	-.32	-.50
Matrix Analogies	.10	-.49	-	.57*
Spatial Memory	-.09	.32	-.41	-.34
Photo Series	-.16	-.28	.48	.35
Simultaneous Scale Score	.23	-.51	.18	-.05
Mental Processing Composite	.05	-.18	.05	-.07

	Global Discontinuity	Self Density	Other Density	Total Density
K-ABC Achievement Scale				
Reading Decoding	.39	–	.21	-.03
Reading Comprehension	.25	–	.54*	.35
Arithmetic	.13	-.37	–	.62
Riddles	.27	-.60*	.22*	.01
TOLD-I				
Sentence Combining	-.26	-.15	.18	.10
Characteristics	.20	-.40	-.01	-.11
Word Order	.02	-.20	.14	.09
Generals	.24	-.57	.29	.11
Spoken Language Quotient	.05	-.21	.09	.04
Listening Quotient	.29	-.05	-.15	-.14
Grammatic Comprehension	.21	.21	-.17	-.09
Speaking Quotient	-.06	-.21	.13	.05
Semantic Quotient	-.28	-.12	.10	.08
Syntax Quotient	-.03	-.06	.05	.03
Raven's Colored Progressive Matrices	.16	.18	-.03	.02

	Global Discontinuity	Self Density	Other Density	Total Density
Concept - Kit Conservation	-.03	-.30	.34	.22
Age	-.44	-	-.05	.23

* $.05 < p < .10$

APPENDIX 8a: CORRELATIONS (SPEARMAN-RANK) BETWEEN COGNITIVE TEST MEASURES AND DREAM VARIABLES USING RAW SCORE DATA IN NORMAL CHILDREN

	Recall Rate (All Dreams)	Recall Rate (>1 Temporal Unit)	Active Participation	Visual Imagery	Affect
WISC-R					
Arithmetic	.42	.27	-.22	.14	.08
Vocabulary	.02	-.04	.46*	.32	.17
Picture Arrangement	-.30	.02	.24	.31	.55*
Block Design	.21	.01	.13	-.14	.03
K-ABC Sequential					
Hand Movements	.06	.10	-.46	-.31	-.10
Number Recall	.26	.02	.32	.48**	.05
Word Order	-.33	-.24	-.12	.46	.38
K-ABC Simultaneous					
Grammatic Comprehension	-.30	-.30	-.42	.07	.24
Triangles	-.11	-.14	.15	.25	.04
Matrices	.38	-.04	-.02	-.07	.01
Spatial Memory	-.12	-.29	.12	.11	-.04

	Recall Rate (All Dreams)	Recall Rate (>1 Temporal Unit)	Active Participation	Visual Imagery	Affect
K-ABC Simultaneous					
Photo Series	-.01	-.21	-.15	-.42	-.11
K-ABC Achievement					
Reading Decoding	.15	-.03	-.11	-.24	.16
Reading Comprehension	-.07	-.33	-.17	-.45	.42
Arithmetic	.32	-.14	.07	-.28	-.21
Riddles	-.04	-.37	-.34	-.38	.42
TOLD-I					
Sentence Combining	.10	-.30	-.25	-.38	.29
Characteristics	-.31	-.34	.28	.17	.29
Word Order	.55*	.19	-.29	-.38	-.08
Generals	.23	-.07	-.56*	-.42	.38
Grammatic Completion	.26	-.12	.07	.31	.07

* $p < .05$

** $.05 < p < .10$

APPENDIX 8b: CORRELATIONS (SPEARMAN- RANK) BETWEEN COGNITIVE TEST MEASURES AND DREAM VARIABLES USING RAW SCORE DATA IN READING DISABLED CHILDREN

	Recall Rate (All Dreams)	Recall Rate (>1 Temporal Unit)	Active Participation	Visual Imagery	Affect
WISC-R					
Arithmetic	.38	.46	.06	-.23	-.21
Vocabulary	.13	.32	-.45	-.47	-.39
Picture Arrangement	-.03	.09	-.38	-.29	-.11
Block Design	.21	.32	.01	-.41	-.04
K-ABC Sequential					
Hand Movements	.47	.62	.33	-.42	.23
Number Recall	-.30	-.52	.39	.37	.11
Word Order	.51	.39	.61*	.36	.29
K-ABC Simultaneous					
Grammatic Comprehension	.14	.18	-.14	.24	.13
Triangles	.05	.07	-.44	-.54	.11
Matrices	-.27	-.32	-.30	-.12	-.39
Spatial Memory	.81*	.74*	.42	-.35	.33

	Recall Rate (All Dreams)	Recall Rate (>1 Temporal Unit)	Active Participa-tion	Visual Imagery	Affect
K-ABC Simultaneous					
Photo Series	.10	-.09	-.22	.01	-.37
K-ABC Achievement					
Reading Decoding	-.12	.17	.17	.36	-.59
Reading Comprehension	-.19	.18	-.20	-.18	-.65*
Arithmetic	-.10	.07	-.24	-.29	-.48
Riddles	-.11	-.08	-.32	-.06	-.70*
TOLD-I					
Sentence Combining	.60	.31	.11	.23	-.30
Characteristics	-.11	.04	-.27	.41	-.73*
Word Order	.31	.66	-.17	-.29	-.28
Generals	-.20	.07	-.64*	-.30	-.61
Grammatic Completion	.20	.24	.48	.12	.12

* $\underline{p} < .05$

** $.05 < \underline{p} < .10$

APPENDIX 9a: CORRELATIONS (PEARSON-PRODUCT-MOMENT) BETWEEN COGNITIVE TEST MEASURES AND DREAM VARIABLES USING RAW SCORE DATA IN NORMAL CHILDREN

	Temporal Units	Setting Extensity	Character Extensity	Character Discontinuity
WISC-R				
Arithmetic	.14	.06	.49**	-.66*
Vocabulary	.44	.17	.33	-.19
Picture Arrangement	-.19	.10	.08	.07
Block Design	.01	-.09	-.25	.08
K-ABC Sequential				
Hand Movements	-.33	.15	-.21	.35
Number Recall	.24	-.03	.05	-.17
Word Order	-.34	.14	-.01	.16
K-ABC Simultaneous				
Grammatic Comprehension	-.37	.33	.13	.10
Triangles	-.27	.07	-.13	.01
Matrices	-.20	-.62	-.30	-.37
Spatial Memory	-.38	-.14	-.31	.16
Photo Series	-.32	-.23	-.54	.30

	Temporal Units	Setting Extensity	Character Extensity	Character Discontinuity
K-ABC Achievement				
Reading Decoding	.16	-.16	-.18	-.19
Reading Comprehension	-.08	-.19	-.01	-.21
Arithmetic	-.02	-.13	.16	-.16
Riddles	-.23	-.22	-.01	-.13
TOLD-I				
Sentence Combining	-.38	-.52	-.36	-.14
Characteristics	.14	.02	.18	-.08
Word Order	.07	-.25	-.04	-.20
Generals	-.26	-.32	-.11	-.25
Grammatic Completion	-.11	-.17	.13	-.10

	Global Discontinuity	Self Density	Other Density	Total Density	Word Count
WISC-R					
Arithmetic	-.22	-.08	.21	.23	.38
Vocabulary	-.16	.31	.11	.19	.58*
Picture Arrangement	-.03	-.08	.54*	.48**	.21
Block Design	.36	.19	.24	.29	.29
K-ABC Sequential					
Hand Movements	-.04	-.49**	.24	.01	.28
Number Recall	-.24	.39	-.05	.06	.40
Word Order	-.38	-.12	.35	.22	-.01
K-ABC Simultaneous					
Grammatic Comprehension	.14	-.29	.38	.20	-.03
Triangles	-.07	.05	.41	.37	.39
Matrices	-.24	-.09	-.20	-.18	.01
Spatial Memory	.16	.04	.18	.23	-.07
Photo Series	.22	-.12	.05	-.01	.05

	Global Discontinuity	Self Density	Other Density	Total Density	Word Count
K-ABC Achievement					
Reading Decoding	.17	-.12	-.14	-.20	.52**
Reading Comprehension	.20	-.25	.04	-.05	.29
Arithmetic	-.09	-.04	.12	.17	.29
Riddles	-.01	-.34	.03	-.11	.17
TOLD-I					
Sentence Combining	.10	-.30	-.06	-.16	.09
Characteristics	.31	.46	.02	.17	-.11
Word Order	-.60	-.24	-.17	-.25	.25
Generals	.09	-.48**	-.08	-.21	.27
Grammatic Completion	-.11	.09	.16	.21	-.10

* $p < .05$

** $.05 < p < .10$

APPENDIX 9b: CORRELATIONS (PEARSON-PRODUCT-MOMENT) BETWEEN COGNITIVE TEST MEASURES AND DREAM VARIABLES USING RAW SCORE DATA IN READING DISABLED CHILDREN

	Temporal Units	Setting Extensity	Character Extensity	Character Discontinuity
WISC-R				
Arithmetic	.20	.30	.56	-.34
Vocabulary	-.22	-.29	.06	.31
Picture Arrangement	.14	.37	.31	-.07
Block Design	-.06	.10	.07	-.23
K-ABC Sequential				
Hand Movements	.08	.16	.05	-.48
Number Recall	-.37	-.30	-.41	.25
Word Order	.02	-.12	-.34	.23
K-ABC Simultaneous				
Grammatic Comprehension	.24	-.12	-.31	.25
Triangles	-.36	-.37	-.21	.43
Matrices	-.45	-.38	-.21	.27
Spatial Memory	.49	.82	.51	-.65
Photo Series	-.04	.18	.09	-.04

	Temporal Units	Setting Extensity	Character Extensity	Character Discontinuity
K-ABC Achievement				
Reading Decoding	-.10	-.41	-.04	.36
Reading Comprehension	-.08	-.06	.44	.11
Arithmetic	-.33	-.18	.13	-.07
Riddles	-.23	-.20	.10	.34
TOLD-I				
Sentence Combining	.27	.37	.44	-.20
Characteristics	-.06	-.27	.31	.33
Word Order	.34	.29	.56	-.35
Generals	.02	.27	.58	.01
Grammatic Completion	-.10	-.01	.11	-.32

	Global Discontinuity	Self Density	Other Density	Total Density	Word Count
WISC-R					
Arithmetic	-.03	-.22	.33	.25	.27
Vocabulary	.69	-.77	.16	-.11	.26
Picture Arrangement	-.04	-.52	.49	.30	.43
Block Design	.46	-.32	.15	.03	.36
K-ABC Sequential					
Hand Movements	.32	.28	-.34	-.24	.21
Number Recall	-.23	.10	.33	.36	.40
Word Order	-.24	.37	-.37	-.26	-.30
K-ABC Simultaneous					
Grammatic Comprehension	.05	-.42	.02	-.18	.38
Triangles	.89	-.50	-.32	-.50	.05
Matrices	.10	-.49	.72	.57	.02
Spatial Memory	-.09	.32	-.41	-.34	.44
Photo Series	-.16	-.28	.48	.35	.21

	Global Discontinuity	Self Density	Other Density	Total Density	Word Count
K-ABC Achievement					
Reading Decoding	.39	-.69	.21	-.03	.24
Reading Comprehension	.25	-.70	.54	.35	.24
Arithmetic	.14	-.37	.70	.62	.10
Riddles	.27	-.60	.22	.01	.26
TOLD-I					
Sentence Combining	-.26	-.15	.18	.10	.38
Characteristics	.20	-.40	-.01	-.11	.06
Word Order	.02	-.20	.14	.09	.40
Generals	.24	-.57**	.29	.11	.33
Grammatic Completion	.21	.21	-.18	-.09	.16

* $\underline{p} < .05$

** $.05 < \underline{p} < .10$

APPENDIX 10A: NON-SIGNIFICANT CORRELATIONS (PEARSON-PRODUCT-MOMENT) BETWEEN WAKING MEASURES (AGE AND COGNITIVE TESTS) AND WAKING NARRATIVE REPORTS FOR THE NORMAL GROUP

	Imaginative Narratives			
	Word Count	Temporal Units	Setting Extensity	Character Extensity
WISC-R				
Arithmetic	.46	.21	.38	.38
Vocabulary	.39	-.35	-.24	-.47
Picture Arrangement	-.63	.01	-.45	-.28
Block Design	-.18	-.17	-.17	-.27
WISC-R (Full Scale)	-.26	-.25	-.26	-.36
K-ABC Sequential Scale				
Hand Movements	-.08	-.05	-.05	-.12
Number Recall	.41	-.25	-.11	-.53
Word Order	-.11	-.18	-.52	-
Sequential Scale Score	.16	-.23	-.29	-.64
K-ABC Simultaneous Scale				
Gestalt Closure	.15	-.25	.33	.38
Triangles	-.10	-.16	-.27	-.62

	Imaginative Narratives			
	Word Count	Temporal Units	Setting Extensity	Character Extensity
K-ABC Simultaneous Scale				
Matrix Analogies	.29	.05	-.11	-.53
Spatial Memory	-.27	-.14	-.54	-
Photo Series	-	.09	.59*	.22
Simultaneous Scale Score	.28	-.21	-.03	-.50
Mental Processing Composite	.24	-.23	-.30	-.14
K-ABC Achievement Scale				
Reading Decoding	.44	-.24	.44	-.03
Reading Comprehension	.45	-.28	.36	-.09
Arithmetic	.53	.13	-.17	-.22
Riddles	-	-.17	.42	.05
TOLD-I				
Sentence Combining	.48	-.27	.45	-.01
Characteristics	-.17	-	-.26	-.30
Word Order	.32	.30	-.13	-.32
Generals	.64	-.10	-	.40
Spoken Language Quotient	.66	-.12	.30	-.06

	Imaginative Narratives			
	Word Count	Temporal Units	Setting Extensity	Character Extensity
TOLD-I				
Listening Quotient	.51	-.42	.10	-.05
Grammatic Comprehension	-	.24	.44	.25
Speaking Quotient	.59	.05	.32	-.07
Semantic Quotient	.29	-.56	.25	.05
Syntax Quotient	.64	.18	.16	-.19
Raven's Colored Progressive Matrices	.31	.17	.47	.04
Concept - Kit Conservation	.35	.49	.37	.64
Age	.40	.61	.43	.25

	Imaginative Narratives			
	Character Discontinuity	Global Discontinuity	Self Density	Other Density
WISC-R				
Arithmetic	.49	-.14	-.30	.78
Vocabulary	-.28	.17	-.10	-.35

	Imaginative Narratives			
	Character Discontinuity	Global Discontinuity	Self Density	Other Density
WISC-R				
Picture Arrangement	-.43	-.62	.20	.10
Block Design	-.32	-.48	.23	.05
WISC-R (Full Scale)	-.43	-.56	.17	.04
K-ABC Sequential Scale				
Hand Movements	.17	.44	-.57	-.10
Number Recall	-.09	-.12	.23	-.28
Word Order	-.30	.31	-.08	-.66*
Sequential Scale Score	-.08	.23	-.14	-.46
K-ABC Simultaneous Scale				
Gestalt Closure	.15	.51	-	.20
Triangles	-.52	-.57	-	-.27
Matrix Analogies	.19	-.23	.27	-.07
Spatial Memory	-.39	-.64	.63	-.37
Photo Series	.15	.27	-.07	.36
Simultaneous Scale Score	-.08	.01	-.02	-.25

Imaginative Narratives

	Character Discontinuity	Global Discontinuity	Self Density	Other Density
K-ABC Simultaneous Scale				
Mental Processing Composite	-.08	.01	-.02	-.25
K-ABC Achievement Scale				
Reading Decoding	-.01	-.09	.14	.08
Reading Comprehension	.32	.19	.05	-.27
Arithmetic	.01	-.04	.06	.18
Riddles	.11	.20	.12	-.06
TOLD-I				
Sentence Combining	.09	-.47	.43	.15
Characteristics	-.17	.01	-.23	-.66
Word Order	.30	.39	-.39	.10
Generals	.54	.08	-.02	.23
Spoken Language Quotient	.35	.12	-.10	.08
Listening Quotient	.08	.09	-.06	-.22
Grammatic Comprehension	.29	.13	.17	.40

Imaginative Narratives

	Character Discontinuity	Global Discontinuity	Self Density	Other Density
TOLD-I				
Speaking Quotient	.41	.09	-.09	.20
Semantic Quotient	.23	.05	-.16	-.28
Syntax Quotient	.20	-.01	-.02	.35
Raven's Colored Progressive Matrices	.65*	-.27	.43	.17
Concept - Kit Conservation	.55	.42	-.65	-
Age	-	.30	-.21	.53

Personal Narratives

	Word Count	Temporal Units
WISC-R		
Arithmetic	-.12	.27
Vocabulary	-.22	-.13
Picture Arrangement	-.27	-.17
Block Design	-.40	-.30
WISC-R (Full Scale)	-.41	-.28

	Personal Narratives	
	Word Count	Temporal Units
K-ABC Sequential Scale		
Hand Movements	-.07	-.18
Number Recall	-.14	-.13
Word Order	-.10	-.31
Sequential Scale Score	-.14	-.27
K-ABC Simultaneous Scale		
Gestalt Closure	.24	.28
Triangles	-.47	-.56
Matrix Analogies	-.17	-.17
Spatial Memory	-.39	-.42
Photo Series	-.25	-.25
Simultaneous Scale Score	-.27	-.29
Mental Processing Composite	-.23	-.30
K-ABC Achievement Scale		
Reading Decoding	-.11	-.20
Reading Comprehension	.35	.14

Personal Narratives

	Word Count	Temporal Units
K-ABC Achievement Scale		
Arithmetic	-.49	-.13
Riddles	.11	.06
TOLD-I		
Sentence Combining	.17	.20
Characteristics	.57	.53
Word Order	-.31	-.28
Generals	.48	.49
Spoken Language Quotient	.13	.21
Listening Quotient	.25	.39
Grammatic Comprehension	-.26	-.01
Speaking Quotient	.03	.07
Semantic Quotient	-	.65
Syntax Quotient	-.43	-.25
Raven's Colored Progressive Matrices	.23	.08
Concept - Kit Conservation	-.10	.19

	Personal Narratives	
	Word Count	Temporal Units
Age	-.04	-.07

* $.05 < p < .10$

APPENDIX 10B: NON-SIGNIFICANT CORRELATIONS (PEARSON-PRODUCT-MOMENT) BETWEEN WAKING MEASURES (AGE AND COGNITIVE TESTS) AND WAKING NARRATIVE REPORTS FOR THE READING DISABLED GROUP

	Imaginative Narratives			
	Word Count	Temporal Units	Setting Extensity	Character Extensity
WISC-R				
Arithmetic	.46	.18	-	-.03
Vocabulary	.76	.24	-.37	-.45
Picture Arrangement	.09	.59	-.41	-.53
Block Design	.23	.55	-.28	-.74
WISC-R (Full Scale)	.29	-.09	-.55	-.53
K-ABC Sequential Scale				
Hand Movements	-.18	.04	.20	-.46
Number Recall	-.01	-.34	-.15	-.08
Word Order	.60	-.49	.65	.34
Sequential Scale Score	-.08	-.20	.33	-.38
K-ABC Simultaneous Scale				
Gestalt Closure	.43	.53	.20	-.45
Triangles	.75	.49	.36	-.37

	Imaginative Narratives			
	Word Count	Temporal Units	Setting Extensity	Character Extensity
K-ABC Simultaneous Scale				
Matrix Analogies	.38	.35	-.27	-.62
Spatial Memory	-.27	.12	-.16	.09
Photo Series	.23	.53	-.57	-.45
Simultaneous Scale Score	.55	-	-.19	-.69
Mental Processing Composite	.42	.58	-.04	-
K-ABC Achievement Scale				
Reading Decoding	.74	.49	-.41	-.23
Reading Comprehension	.36	.25	-	-.18
Arithmetic	.14	.32	-.50	-.54
Riddles	-.06	.56	-.25	-.24
TOLD-I				
Sentence Combining	.14	.56	-.33	-.05
Characteristics	.60	.46	-.19	.52
Word Order	-.12	.44	-.35	-.01
Generals	.35	.18	-.56	-.14
Spoken Language Quotient	.22	.69	-.40	-.01

	Imaginative Narratives			
	Word Count	Temporal Units	Setting Extensity	Character Extensity
TOLD-I				
Listening Quotient	.74	.68	-.18	.12
Grammatic Comprehension	.40	.49	-.05	-.44
Speaking Quotient	.06	.55	-.28	-.08
Semantic Quotient	.35	.26	-.05	.46
Syntax Quotient	.09	.59	-.35	-.10
Raven's Colored Progressive Matrices	.06	.25	-.06	-.71
Concept - Kit Conservation	.15	.44	-.33	-.36
Age	.35	-.59	.11	.18

	Imaginative Narratives			
	Character Discontinuity	Global Discontinuity	Self Density	Other Density
WISC-R				
Arithmetic	-.11	.03	-.28	.11
Vocabulary	.20	.09	.12	-.20

	Imaginative Narratives			
	Character Discontinuity	Global Discontinuity	Self Density	Other Density
WISC-R				
Picture Arrangement	.15	-.17	-.59	.08
Block Design	.61	-.10	-.31	-.02
WISC-R (Full Scale)	.30	-.05	-.39	.06
K-ABC Sequential Scale				
Hand Movements	.64	-.45	-.27	-.47
Number Recall	.35	-.20	.17	.61
Word Order	-.49	-.03	.19	-.28
Sequential Scale Score	.08	.35	-.62	.59
K-ABC Simultaneous Scale				
Gestalt Closure	-.26	-.15	-.30	-.32
Triangles	.19	.22	.43	-.64
Matrix Analogies	.33	-.31	-.30	.49
Spatial Memory	.45	.49	-.31	-.05
Photo Series	.32	-.10	-.47	.46
Simultaneous Scale Score	.35	.05	-.44	-.02

	Imaginative Narratives			
	Character Discontinuity	Global Discontinuity	Self Density	Other Density
K-ABC Simultaneous Scale				
Mental Processing Composite	.64	.13	-.61	.22
K-ABC Achievement Scale				
Reading Decoding	.12	.16	.14	.05
Reading Comprehension	-.02	-.06	-.10	.15
Arithmetic	.42	-.29	-.36	.54
Riddles	.10	.32	-.16	.16
TOLD-I				
Sentence Combining	-.31	.10	-.60	.10
Characteristics	-.55	.46	.29	-.11
Word Order	-.39	-.06	-.45	-.18
Generals	-.13	.19	-.30	-.20
Spoken Language Quotient	-.30	.21	-.52	-.01
Listening Quotient	.05	.68	-.17	.16
Grammatic Comprehension	.73	.49	-.61	.39

	Imaginative Narratives			
	Character Discontinuity	Global Discontinuity	Self Density	Other Density
TOLD-I				
Speaking Quotient	-.27	.11	-.58	-.06
Semantic Quotient	-.42	.50	-.29	.33
Syntax Quotient	-.20	.12	-.62	.03
Raven's Colored Progressive Matrices	-	.04	-.56	.31
Concept - Kit Conservation	.68	.34	-.59	.42
Age	.18	.01	-.57	.36

	Personal Narratives	
	Word Count	Temporal Units
WISC-R		
Arithmetic	.15	.18
Vocabulary	-.32	.24
Picture Arrangement	-.28	-.30
Block Design	-.42	-.34
WISC-R (Full Scale)	-.23	-.09

	Personal Narratives	
	Word Count	Temporal Units
K-ABC Sequential Scale		
Hand Movements	-.16	-.49
Number Recall	-.09	.13
Word Order	.03	-.07
Sequential Scale Score	.08	-.07
K-ABC Simultaneous Scale		
Gestalt Closure	-.47	-.21
Triangles	-.38	.11
Matrix Analogies	-.48	-.06
Spatial Memory	.46	.02
Photo Series	-.17	.03
Simultaneous Scale Score	-.39	-.08
Mental Processing Composite	-.33	-.12
K-ABC Achievement Scale		
Reading Decoding	-.13	.49
Reading Comprehension	-.06	.25

	Personal Narratives	
	Word Count	Temporal Units
K-ABC Achievement Scale		
Arithmetic	-.32	-.12
Riddles	-.06	.56
TOLD-I		
Sentence Combining	.11	.48
Characteristics	.39	-
Word Order	.06	-.16
Generals	.06	.18
Spoken Language Quotient	.17	.21
Listening Quotient	.35	-
Grammatic Comprehension	.06	.23
Speaking Quotient	.09	-.01
Semantic Quotient	.51	-
Syntax Quotient	.11	.03
Raven's Colored Progressive Matrices	-.27	-.32
Concept - Kit Conservation	.13	.12

Personal Narratives

	Word Count	Temporal Units
Age	.35	-.38

* $.05 < \underline{p} < .10$

APPENDIX 11: TEMPORAL SEQUENCE AND UNIT COMPOSITION VARIABLES-COMPARISON OF NORMAL, READING DISABLED, AND ADULTS

	Normal n=56 Dreams	RD n=40 Dreams	Foulkes Adults (1983) n=23 Dreams
Temporal Units	5.02	3.92	7.17
Setting Extensity	2.76	2.58	3.38
Character Extensity	2.37	2.39	3.4
Character Discontinuity	.35	.32	.31
Global Discontinuity	.13	.14	.13
Self Density	.65	.73	.95
Other Density	2.24	1.99	1.42
Total Density	2.9	2.72	2.37