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Conscious Mind, Sleeping Brain

Perspectives on Lucid Dreaming

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Individual Differences Associated with Lucid Dreaming

THOMAS J. SNYDER and JAYNE GACKENBACH

Lucid dreaming has been said to be within the capability of all individuals (LaBerge, 1985). Based on analyses of the incidence of this dream experience among university students and among persons with an expressed interest in dreaming, a majority have reported experiencing at least one lucid dream during their lifetime, and about 20% have reported experiencing lucid dreams with relative frequency. Our goal in this chapter is to describe and to integrate what has been learned through research about individuals who experience lucid dreams. To this end we will present data derived from the study of four separable but not unrelated functional domains for which subject differences associated with lucid dreaming, or lucidity, have been found. These functional domains are (1) oculomotor/equilibratory; (2) visual/imaginal; (3) intellectual/creative, and (4) personal/interpersonal. The extent of individual differences in lucid dreaming and the methods by which these differences have been investigated will also be discussed. Because methodology is an integral part of research into individual differences, methodological considerations will first be presented.

METHODOLOGY

There are two general methodological considerations that pertain to individual differences associated with lucid dreaming. The first is conceptual and is related to the definition of lucid dreaming, the extent to which subjects understand that definition, and the measurement of lucidity. The second is procedural

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and has to do with the research designs by which individual differences in lucidity have been investigated as well as with subject factors that, if not taken into account, can obscure these differences. In Tables 1 and 2 can be found the methodological details of many of the studies referred to in this chapter.

In the study of individual differences in lucid dreaming, it has been useful to identify and rank persons according to the prevalence and frequency of their lucidity. Such classification has been accomplished through various self-report measures and is based on the belief that lucidity is best conceptualized as a function of act frequency, an approach that has been utilized by Buss and Craik (1983) to conceptualize individual differences in personality. Gackenbach (1978), for example, has classified subjects according to their frequency of lucidity as frequent lucid dreamers (> one/month), infrequent lucid dreamers (< one/month), or nonlucid dreamers and has then compared these groups for an assortment of behavioral characteristics. Because classification of subjects into dreamer groups has usually been based on subject self-report of lucidity frequency, there are two questions that must be addressed if such a classification scheme is to be used. First, how can researchers be confident that subjects who self-report lucidity have, in fact, experienced lucid dreaming? Second, how comparable are the different means that have been used to assess lucidity?

As our research into the differential psychology of lucid dreamers was pursued, it quickly became apparent that potential subjects often misunderstood the nature of lucid dreams (Gackenbach, 1986). Confusion with morning-after dream recall was frequently encountered, and we consequently formulated a process by which it could be verified that persons who reported lucidity had indeed experienced lucidity, that is, demonstrated "content" validity. Verification was accomplished by gathering from all potential subjects a very recent or especially salient dream transcript that ostensibly exemplified a lucid dream. Persons were instructed to be certain to include information about how they, in fact, knew they were dreaming lucidly. A recognition phrase, such as "then I realized it was only a dream," was judged as evidence of verification. Illustrative of the "hit rate" with this verification process is a mass testing of 707 university students of whom 344 were disqualified because their dream transcripts were judged to include dreams that were questionably lucid, partially lucid, or clearly not lucid (Gackenbach, Sachau, & Rokes, 1982; Gackenbach, 1980).

Although a verification process addresses the issue of the quality of self-reported lucid dreams, the classification of persons according to the frequency of lucid dreaming raises the issue of concurrent validity, that is, to what extent is the frequency of self-reported lucidity related to other indexes of lucid dreaming? Two indexes of lucidity other than self-report have been studied—signaled lucidity in the sleep laboratory and lucidity recorded in dream diaries. As in the general dream recall literature (Cartwright, 1978), correlations between the different indexes of dreaming, in this case lucid dreaming, have been found to be

variable. Gackenbach (1978), for high dream recall adults, compared self-reported lucidity with dream diary lucidity and found that persons who reported that they frequently dreamed lucidly recorded more lucid dreams than did persons who reported infrequently or never experiencing lucidity. Though these three groups did not differ with regard to the total number of dreams reported, frequent lucid dreamers were found to record more information per dream, that is, to demonstrate greater dream recall than infrequents and nonlucids.

In a more recent study with self-selected adult subjects, Gackenbach, Curren, LaBerge, Davidson, and Maxwell (1983) have found significant positive correlations between self-reported estimates of lucidity and dream diary frequency of lucidity (males $r = .79$, females $r = .55$). Similarly, Kueny (1985), using self-selected adults for whom dream recall and verification of understanding were controlled, has reported a significant positive correlation between one self-report estimate of lucidity and frequency of lucidity in a dream diary ($r = .54$). The results from these studies enable us to conclude that, for self-selected adults, the relationship between self-report estimates of lucid frequency and dream diary lucid frequency is clearly positive, provided dream recall and verification are controlled for. In contrast, among randomly selected university students, Gackenbach, Curren, and Cutler (1983) obtained equivocal results when they compared lucid frequency as measured with three self-report scales to that reported in dream diaries. Using extent of dream recall as a covariate, significant positive correlations that ranged from .20 to .60 were found; however, reanalysis after subjects were screened for verification of understanding revealed that only one self-report scale correlated positively with dream frequency.

Kueny (1985) is the only investigator who has examined the relationship between self-report, dream diary, and laboratory-signaled estimates of lucidity frequency. For a small sample of adults ($N = 16$), she has reported that neither self-report nor dream diary frequencies were predictive of the frequency of signal-verified lucid dreams in the laboratory, though, as previously stated, self-report and dream diary estimates were found to be significantly correlated ($r = .54$). Despite the absence of a significant correlation between self-report indexes and sleep laboratory lucid dreaming in Kueny's data, it should be kept in mind that in most (LaBerge, 1985; Fenwick *et al.*, 1984; Ogilvie, Hunt, Kushniruk, & Newman, 1983) but not all (Dane, 1984) sleep laboratory studies of lucidity, subjects who have been selected according to self-reported lucidity have successfully signaled the lucidity process.

In addition to these issues involving the validity of subject reports of lucidity, there are a number of procedural considerations that must be taken into account in order to study individual differences in lucid dreaming ability. Several subject characteristics (dream recall efficiency, sex) and sampling procedures (random, self-selected) have already been referred to. The confounding nature of general dream recall with self-reported lucidity frequency has been noted by many investigators (Belicki, Hunt, & Belicki, 1978; Gackenbach, 1978;

Table 1. Methodological Comparisons of Lucid Dreaming Frequency Estimates and Controls for Selected Individual Difference Studies

Reference	Lucid dreaming frequency estimate	Controls[a]		
		Understanding verification	Dream recall	Other
Belicki & Hunt, 1978	Self-report frequency	No[b]	No[c]	
Blackmore, 1984	Self-report frequency	No	No	
Gackenbach, 1978	(1) Dream diary. (2) Self-report frequency	No[b]	No	
Gackenbach, 1980	Self-report frequency	Yes	Self-report frequency	
Gackenbach, 1983	Self-report frequency	Yes	Self-report frequency	Social desirability
Gackenbach, 1984a	Self-report frequency	Yes	Self-report frequency	Social desirability Self-report religiosity Self-report creativity
Gackenbach, 1984b	Self-report frequency	Yes	Self-report frequency	Social desirability
Gackenbach, 1985a	Self-report frequency	Yes	Self-report frequency	Handedness Related physical
Gackenbach, 1986	Study 1: Self-report frequency	No[b]	No	
	Study 2: Self-report frequency	Yes	No	
Gackenbach, Curren, LaBerge, Davidson, & Maxwell, 1983	(1) Dream diary. (2) Self-report frequency	Yes	(1) Dream diary; (2) Self-report frequency	Social desirability, educational attainment and sex-role identity (as appropriate)
Gackenbach & Hammons, 1983	Self-report frequency	No	No	
Gackenbach, Heilman, Boyt, & LaBerge, 1985	Study 1: Self-report frequency	No	No	
	Study 2: Self-report frequency	Yes	No	
	Study 3: Self-report frequency	Yes	Self-report frequency	Handedness
Gackenbach, Snyder, Rokes, & Sachau, 1986	Self-report frequency	Yes	Self-report frequency	Handedness, related physical problems, eye-movement direction

Gackenbach, Sachau, Rokes, & Snyder, 1986	Self-report frequency	Yes	Self-report frequency	Handedness Related physical
Gackenbach, Snyder, & Esbeck, 1981	Self-report frequency	Yes	Self-report frequency	Handedness
Gackenbach, Snyder, McKelvey, McWilliams, George, & Rodenelli, 1981	Self-report frequency	Yes	No	
Gackenbach, Snyder, & Vognsen, 1981	(1) Dream diary. (2) Self-report frequency	Yes	Self-report frequency	Handedness
Hearne, 1978	Ch. 15: Self-report frequency	No	No	
	Ch. 16: Self-report frequency	No	No	
Hearne, 1983	Self-report frequency	No	No	
Kueny, 1985	(1) Signal verified in sleep lab. (2) Dream diary. (3) Self-report frequency	Yes	(1) Dream diary; (2) Self-report frequency	Motivation to learn to dream lucidly
LaBerge & Gackenbach, 1982	(1) Dream diary. (2) Self-report frequency	Yes	Self-report frequency	
Reed, 1977	Dream diary	No[b]	No	
Snyder & Gackenbach, 1981	Self-report frequency	No	No	Consistency in right or left handedness

[a]Although information may have been obtained on these variables, it is only indicated as present if it was used as control in either experimental design or statistical evaluation.
[b]Due to the nature of the sample or procedures, it is unlikely that the degree of confusion over what is a lucid dream, often found, was present here.
[c]Although recall was not used as a control, lucid-nonlucid differences in dream diary dream recall were found.

Table 2. Methodological Comparisons of Type of Subject, Procedure, and Statistical Analyses for Selected Individual Difference Studies

Reference	Type of subject: Sex/*N*	Type of subject: Sample	Procedure	Major type of statistical analyses
Belicki & Hunt, 1978	*N*=58	Canadian college students	Personally administered questionnaire	*t*-test
Blackmore, 1984	*N*=314	English adults	Mail survey with untimed questionnaire	Chi-square
Gackenbach, 1978	*M*=22 *F*=68	Adults highly interested in dreams	Mail survey with both timed and untimed scales. Several years earlier other scales filled out and month-long dream diary kept.	Factor analysis followed by one-way analyses of variance on factor scores.
Gackenbach, 1980	*M*=186[a] *F*=174	Students at a midwestern university	Administration of a packet of questionnaires to groups.	Analysis of variance
Gackenbach, 1983	*M*=47[a] *F*=117	Students at a midwestern university	Administration of a packet of questionnaires to groups.	Partial correlation
Gackenbach, 1984a	*M*=51[a] *F*=84	Students at a midwestern university	Administration of timed and untimed questionnaires to groups	Partial correlation
Gackenbach, 1984b	*M*=17 *F*=22	Students at a midwestern university	Administration of a packet of questionnaires in one group	Partial correlation
Gackenbach, 1985a	*M*=40 *F*=40	Students at a midwestern university	10 trials of eye dominance; administration of eye-movement questions from behind subject and scored from videotape	Analysis of covariance
Gackenbach, 1986	*M*=22 *F*=68	Adults with high dream interest	Mail survey with timed scales	Factor analysis followed by one-way analysis of variance on factor scores
	M=34 *F*=92	Students at eastern college	Administered scales in groups	Analysis of variance

Gackenbach, Curren, LaBerge, Davidson, & Maxwell, 1983	$M=81$ $F=102$	Adults responding to magazine articles on lucid dreaming	Mail survey with both timed and untimed scales and 7- to 10-day dream diary	Partial correlation
Gackenbach & Hammons, 1983	$M=59$ $F=93$	Students at a midwestern university	Group administered timed and untimed tests	Analysis of variance
Gackenbach, Heilman, Boyt, & LaBerge, 1985	$M=22$ $F=68$	Adults with high dream interest	Mail survey on timed test	Analysis of variance
	$M=40$ $F=41$	Students at an eastern college	Experimenter-administered scale	Analysis of variance
	$M=54$ $F=53$	Students at a midwestern university	Experimenter-administered scale and task	Analysis of covariance
Gackenbach, Snyder, Rokes, & Sachau, 1986	$M=24$ $F=24$	Students at a midwestern university	Caloric irrigation to measure electronystagmography response	Analyses of covariance
Gackenbach, Sachau, Rokes, & Snyder, 1986	$M=72$ $F=72$	Students at a midwestern university	Balance beam and stabilometer performance under different visual conditions	Analyses of covariance
Gackenbach, Snyder, & Esbeck, 1981	$M=57$ $F=58$	Students at a midwestern university	Performance on a visual maze	Analysis of covariance
Gackenbach, Snyder, McKelvey, McWilliams, George, & Rodenelli, 1981	$M=45^a$ $F=45$	Students at an eastern college	Admin. of paper-and-pencil and performance-based perceptual tasks	Analysis of variance
Gackenbach, Snyder, & Vognsen, 1981	$M=58$ $F=60$	Students at a midwestern university	Performance on a tactile maze, trail-making task and form board	Analysis of covariance
Hearne, 1978	$M=24^a$ $F=24$	Students at an English university	Individually administered questionnaires	Correlation
	$M=10$ $F=10$	Students at an English university	Individually administered questionnaire and task	*t*-test

(continued)

Table 2. (Continued)

Reference	Type of subject: Sex/N	Type of subject: Sample	Procedure	Major type of statistical analyses
Hearne, 1983	$M=63$ $F=16$	English adults with high lucidity interest	Mail survey with untimed questionnaire	Descriptive
Kueny, 1985	$M=13$[a] $F=27$	West Coast adults with high lucidity interest	Group-administered hypnotic induction and other timed and untimed scales	Partial correlation
LaBerge & Gackenbach, 1982	$N=23$	Students at a West Coast university	Administration of untimed questionnaire to a group	Partial correlation
Reed, 1977	$N=300$	English adults with high dream interest	Mail survey of month-long dream diary	Chi-square
Snyder & Gackenbach, 1981	$F=48$	Students at an eastern college	Sequence manual tapping	Analysis of variance

[a]Number of males and females varied with this figure as a maximum for each task/questionnaire.

Gackenbach, Heilman, Boyt, & LaBerge, 1985; Gackenbach, Sachau, & Rokes, 1982; Gackenbach & Schilling, 1983; Hearne, 1978; Palmer, 1974). Use of dream recall as a covariate with lucid frequency, preferably with parallel estimates of both, for example, self-reported or dream diary counts for both, is essential. Other covariates will be needed according to the types of evaluation techniques employed. Personality measures that can be biased in terms of social desirability may require measures of social desirability as controls (Crowne & Marlowe, 1961), whereas cognitive measures may need to be covaried with relevant variables like extent of education in order to assure accurate statements about individual and group differences. Because the studies reported in the remainder of this chapter differ in the extent to which these methodological controls have been incorporated, these studies should not be viewed comparably. Methodological incongruances will be pointed out as relevant.

LUCID DREAMING INCIDENCE

The incidence of lucid dreaming has been measured in terms of prevalence (how many people have ever had at least one lucid dream) and frequency (how often does an individual experience lucid dreams). The prevalence of lucid dreaming among students (Palmer, 1974; LaBerge, 1985; Gackenbach, Snyder, Rokes, & Sachau, 1986) and adults (Palmer, 1974; Kohr, 1980; Blackmore, 1983, 1984; Gackenbach, Curren, LaBerge, Davidson, and Maxwell, 1983) is reported in seven surveys. For adults, estimates have ranged from 100% (Gackenbach, Curren, LaBerge, Davidson, & Maxwell, 1983) to 47% (Blackmore, 1983, 1984). This variability can be attributed to differences in sampling procedures. Kohr (1980), Gackenbach (1978), and Gackenbach and associates (Curren, LaBerge, Davidson, & Maxwell, 1983), who reported percentages of 70, 76, and 100, respectively, surveyed highly motivated adults with an expressed interest in dreaming. Palmer (1974) and Blackmore (1983, 1984), who reported that 55% and 47%, respectively, of the persons they surveyed stated they have had at least one lucid dream during their lifetime, randomly selected subjects from an alphabetized public record. It may be notable that Palmer and Blackmore did not verify their subjects' understanding of lucidity.

The prevalence of lucid dreaming among university students is similarly variable according to the sampling and validation procedures utilized. LaBerge (1985) has reported a 77% prevalence for students enrolled in a sleep and dreams class (i.e., nonrandom) with verified understanding of lucidity. Palmer (1974), for a randomly selected but nonverified sample of students, found a prevalence of 71.5%. If random sampling and verification of understanding as judged by independent raters is used, then a more conservative estimate of prevalence, 57.5%, has been obtained (Gackenbach, Snyder *et al.*, 1986).

The frequency of lucid dreaming as a measure of incidence has been evaluated either through self-reported ratings or through the percentage of lucid

dreams in dream diaries compiled in the laboratory or at home. To date, too few dream laboratory subjects have been studied in order to derive meaningful estimates of frequency from this source. Only self-report and at-home dream diary estimates are therefore reported. As for estimates of the prevalence of lucid dreaming, estimates of frequency will vary according to sample characteristics and validation procedures.

Self-report estimates of the frequency with which individuals dream lucidly have been reported for groups of adults and students. Gackenbach (1978) and associates (1987) have estimated that about 15% of adults surveyed dream lucidly more than once per month (13.5% and 16%, respectively), whereas 20.75% of students have been found to report this frequency (Gackenbach *et al.*, 1987). Palmer (1974), using a random but nonverified sample, estimated that 28.5% of adults experience lucidity more than once a month, whereas Kohr's (1980) nonverified and nonrandom sample showed 21% experienced dreams more than monthly. For persons who self-report dreaming lucidly less often, that is, once or more in their lifetimes but less than once a month, estimates have varied from 36.55% to 60%. Gackenbach, Snyder *et al.* (1986) found that 36.55% of a randomly selected and verified student sample were classifiable as infrequent lucid dreamers; Palmer (1974) has reported a similar value (41%) for his random sample. Gackenbach's (1978) high estimate of 60% was found for self-selected adults for whom verification of lucidity understanding was not procured.

When the frequency of lucid dreaming is estimated by counting the number of lucid dreams in a dream diary, values relatively comparable to those obtained through self-report ratings have been found. For adults with decided interests in dreaming and for whom it had been verified that they understood the concept of lucidity, 13% of dreams in a log maintained for 7 to 10 days were judged to be lucid (Gackenbach, Curren *et al.*, 1983). This same frequency has been reported for randomly selected and concept-verified university students who recorded dreams on a weekly basis for a 16-week period (Gackenbach, Curren, & Cutler, 1983).

In conclusion, conservative estimates of the incidence of lucid dreaming indicate that about 58% of the population have experienced a lucid dream at least once in their lifetime and that some 21% report such dreams more often (one or more per month). Additionally, about 13% of dreams recorded in dream diaries are likely to be lucid. The remainder of this chapter will be a review of what has been learned about the behavioral and personal characteristics of persons who do or do not dream lucidly.

OCULOMOTOR/EQUILIBRATORY DIFFERENCES

Oculomotor activities are a complex set of diverse movements subserved by cortical and subcortical structures involved in cognitive, sensoriperceptual, visu-

opractic, equilibratory, and affective functions. They include reflexive and nonreflexive movements, are signals of neural processing during sleep and wakefulness, and *in toto* are a window through which the afferent and efferent worlds of a person can be viewed. LaBerge (1985) has described the importance of eye movements for studying subject awareness of the lucid process in the sleep laboratory. Our concern, and that of others, has been whether eye movements might be indirectly used to view individual differences associated with the dream process, especially with lucidity. This concern has been engendered by consideration of the content of lucid dreams, by how lucidity events are experienced, and by the fact that eye movements have been useful for studying the cognitive and personal characteristics of persons during wakefulness. Our concern has also derived from the hypothesis that lucid dreaming is an organismic response, a response that is typical of some persons but not others because of psychophysiological differences between these persons. To what extent lucidity is an emergent process, that is, one that can be developed in any individual, is a question open to empirical investigation. Claims have been made that lucid dreaming is a unique process, that it can be exhilirating and uplifting, that it is an experience that can be clinically useful, that it affords a path to spirituality, greater self-awareness, and higher consciousness, and that it is a step in a hierarchy of out-of-body experiences. We believe that these claims can also be investigated scientifically. Hendricks and Cartwright (1978) have asked: "Are there stable individual differences in the cognitive style of the night as there are in waking mental activity?" (p. 292). They have answered in the affirmative. Our subsequent question: Is lucid dreaming a particular cognitive style of the night that is associated with stable individual differences in waking mental activity? The study of eye movements and postural orientation have provided some data for answering this question—also in the affirmative.

Two variations of eye movements have been studied with reference to lucid dreaming. Gackenbach, Snyder, Rokes, & Sachau (1986) have investigated differences in nystagmoid movements during rest and following vestibular stimulation of lucid and nonlucid dreamers, whereas these same investigators (Gackenbach, 1985a) have studied differences between dreamer groups for conjugate lateral eye movements during reflective mentation. In response to directions to look leftward, rightward, or forward with eyes opened or closed, a procedure that is used to establish baselines for nystagmographic analyses, frequent lucid dreamers have been shown to demonstrate leftward eye movement preference as measured by the average amplitude per beat on electronystagmographic (ENG) records; nonlucid dreamers and infrequent lucid dreamers were found to exhibit no directional preference (Gackenbach, Snyder *et al.*, 1986). This result, which is based on recordings of 16 lucid, 16 infrequently lucid, and 16 nonlucid dreamers, half of each sex and all prescreened for handedness, balance-related disorders, oculomotor/noncorrectable visual disturbances, and an understanding of lucidity, is suggestive that lucid dreamers may have

asymmetrical activation of the brain, whereas nonlucid dreamers and persons who seldom experience lucid dreams tend to demonstrate bilaterally symmetrical activation in this circumstance.

In recent years, differential activation of the right and left sides of the brain, sometimes referred to as brainedness, or hemisphericity, has received much attention (sometimes too much!) and has been related to a host of organismic variables. Bakan (1971) has proposed that consistently directed conjugate lateral eye movements are indicative of disproportionate activation of the hemisphere contralateral to the direction of eye movements. Persons with a tendency to move their eyes leftward, that is, left movers, would accordingly tend to be subject to greater activation of the right hemisphere. Because we have found that lucid dreamers during a baseline nystagmographic procedure are left movers whereas other dreamer types are not, we have begun to investigate how this difference varies according to subject characteristics and experimental conditions. There is already an extensive literature in which ocular movements have been related to individual differences in cognitive processing, affect, and personal attributes. Most of this literature, which has been reviewed by Ehrlichman and Weinberger (1978), Gur and Gur (1980), and Owens and Limber (1983), among others, deals with the conjugate lateral eye movements that occur as a person reflects on questions asked of him or her. Although there is controversy about the usefulness of conjugate lateral eye movements for studying individual differences, controversy in part engendered by methodological differences and by the probability that these eye movements derive from more than one level of brain activation, such movements have been directly related to dreamer characteristics, for example, dream recall (Van Nuys, 1984), and indirectly to a set of personal characteristics associated with lucid dreamers. Persons who shift their gaze leftward following questioning have been shown to be sensitive to hypnotic susceptibility (Bakan, 1969; Dewitt & Averill, 1976; Gur & Gur, 1974), to clear mental imagery (Bakan, 1969), to daydreaming (Meskin & Singer, 1974), to high verbal abilities (Bakan, 1971), and to interference on the Stroop Test (Kaban & Shotland, 1969). Persons who experience lucid dreaming have been found to have these same sensitivities (Dane, 1984; Hearne, 1978; Gackenbach, Snyder, McKelvey, McWilliams, George, & Rodenelli, 1981; Gackenbach, Curren, LaBerge, Davidson, & Maxwell, 1983).

Convergent associations between the characteristics of lucid dreamers and those found for left movers would predict that persons who frequently experience lucid dreams should tend to direct their eyes leftward in response to questioning. However, because the direction of conjugate lateral eye movements of a person involved in reflective mentation can differ according to whether questions are asked by an examiner facing a person or by an examiner behind a person, this predicted leftward movement of lucid dreamers could vary according to circumstances. Lateral eye movements in response to inquiries by a confronting examiner probably are an intrapersonal response pattern with an affective component. These lateral eye movements can be modulated by the types of questions asked,

for example, those that necessitate visualization rather than linguistic processing, and can be superceded if a confronting examiner is not present and eye movements are recorded inobtrusively. Some of the confusion over the validity of eye movements for making inferences about brain activity is due to the fact that the moderating effects of question type and examiner location have not been controlled or accounted for. To do so may allow for a more precise understanding of the cognitive-style dimensions encompassed by lateral eye movements. When university students who report frequently lucid dreaming ($n = 40$) have been compared to those who are nonlucid dreamers ($n = 40$) for the direction of gaze in response to a set of prototypic questions, it has been found that the videotaped eye-movement pattern of the nonlucids was bidirectional, whereas that for the lucid group was biased to the right (Gackenbach, 1985a). We are now in the process of comparing this result with eye-movement patterns evoked by confrontive examination. Inasmuch as some eye movements are an endogenous response pattern characteristic of an individual, that is, have the properties of a trait, whereas others in part derive from exogeneous factors like the type of question a person is asked to process, we would expect, according to our hypothesis that a proclivity for lucid dreaming is an organismic response pattern, that frequently lucids display a leftward eye-movement bias to confrontive questioning but not to nonconfrontive questioning. To date, our results with regard to this variant of eye movements are promising but inconclusive. Less ambiguous and more revealing have been the findings of a study in which the eye movements of lucid and nonlucid dreamers in response to caloric stimulation have been compared.

Gackenbach *et al.* (1982) and Gackenbach, Snyder *et al.* (1986) using bithermal caloric irrigation of the tympanic membranes, a procedure that is used clinically to induce nystagmus via stimulation of the vestibular system (McCabe & Ryu, 1979), have found frequent lucid dreamers to be more responsive to caloric irrigation than persons who never dream lucidly. This greater responsivity was manifest for two graphic measures of nystagmus (amplitude per beat and speed in the slow phase) and for three measures that imply diminished vestibular integrity (dysrhymthmia, directional preponderance, and canal paresis). It was also found that the onset and duration of self-reported vertigo in response to caloric irrigation differed for these dreamer groups in the same direction. Calorically induced nystagmic eye movements have particular relevance to dreaming because they are believed to be generated by a neural system that also subserves REM. McCarly and Hobson (1979) have proposed that intense vestibular activation of this system can be reflected in dream experiences, especially with regard to sensations of spinning and floating. These types of movement sensations have been specifically related to lucidity (Green, 1968; LaBerge, 1985) and Gackenbach, Sachau *et al.* (1986) and Gackenbach, Snyder *et al.* (1986) have proposed that the vestibular system of lucid dreamers is uniquely subject to intense activation during sleep, an activation that in part explains the saliency that the self-observations of pleasurable motility have in

lucidity. Divergent validation of this proposal is afforded by the negative correlation between lucid frequency and the prevalence of signs of vestibular dysfunction (Gackenbach, Snyder *et al.*, 1986) and by the aversive motion experiences reported for persons with known vestibular dysfunctions (Doneshka & Kehaiyov, 1978; Eisinger & Schilder, 1929).

The vestibular system is a multimodal one in which receptors in the eyes, skin, and joints, in addition to those in the vestibular apparatus, play an essential role in orientation and balance. Evidence that lucidity might involve a balance or postual component first became apparent to us through the factor analysis of the content of collected lucid dreams (Gackenbach, 1978). We subsequently undertook studies in which three manifestations of equilibratory functioning were investigated: (1) static balance, (2) dynamic balance, and (3) vestibular responsiveness to caloric irrigation. Because the field dependence–field independence construct was an individual difference variable known to be related to spatial orientation, we reasoned that measures of this cognitive-style construct could also be helpful for understanding the lucid process. The static balance of persons grouped according to their frequency of lucid dreaming was assessed with a stabilometer, whereas dynamic balance was assessed with a balance beam. Both tasks were performed under conditions of light, darkness, and distorted visual fields. After controlling for dream recall, body weight, balance-related dysfunctions, and the validity of lucidity, Gackenbach *et al.* (1982, 1986) determined that lucid dreamers spent more time in balance on a stabilometer than did infrequently lucid or nonlucid dreamers but that dreamer types did not differ for the speed and accuracy with which they walked a balance beam. Static balance is distinguished from dynamic balance by the latter's requiring translocation. One interpretation of the finding that lucidity may be related to static balance but not dynamic balance is that static balance more closely simulates the physical conditions of the dream state, one in which no physical displacement in space is objectively determinable. An alternative interpretation is that use of a balance beam precluded detection of differences because walking a balance beam is an easier task than maintaining stabilometer balance. Theoretically, we prefer the former interpretation, but methodologically we are not justified in our preference.

In relation to studies in which balance, orientation, and lucid dreaming have been investigated electronystagmographically and with the use of stabilometer and balance beam, is a positive association that has been found between field independence and the frequency of dreaming lucidly, an association that we have found particularly semiotic for viewing the lucid process from an holistic, organismic perspective. Witkin and his many collaborators over the past 30 years have sought to understand the basis for the perception of the upright. This perception has been attributed to apprehension through vision, coordinated with apprehension through the vestibular, tactile, and kinesthetic senses, that is, with reference to the visual field around us and with reference to the direction of gravity (Witkin & Goodenough, 1981). Initial research with the Body Adjust-

ment Test (BAT), the Rod and Frame Test (RFT), and the Rotating Room Test (RRT) indicated that, across these three situations, subjects tended to be self-consistent with regard to degree of reliance on the external visual field or on their own body for perception of the upright. As Witkin has pointed out (Witkin & Goodenough, 1981), primary reliance on the external field (field dependence) or on the body (field independence) could be advantageous under some circumstances but not others. For example, in the RFT, reliance on cues from the body leads to relatively accurate adjustments of the rod to the gravitational vertical, whereas in the RRT, reliance on bodily cues leads to relatively inaccurate adjustments. As research into field dependence/independence progressed, this construct was extended beyond its initial confines, first to be conceived as a perceptual-analytical ability that pervades an individual's perceptual functioning, then to include elements of intellectual functioning, then to encompass personality characteristics like self-control and body concept, and finally to incorporate the social behavior of individuals. Integral to this elaboration into a psychological differentiation construct have been results from numerous studies with the Embedded Figures Test (EFT) in which subjects were asked to differentiate components in a complex visual field. In our own laboratory, we have used the EFT and the RFT as measures of spatial-visualization functions and with reference to the broader confines of psychological differentiation. This latter construct is presumed in a wealth of diverse studies that are potentially applicable to lucid dreaming, including those involving body image, psychopathology, visual imagery, hemispheric specialization, impulse control, sensory deprivation, social conformity, reactions to stress, and cross-cultural comparisons (Witkin, Goodenough, & Oltman, 1979).

With specific reference to dreaming, Witkin (Witkin, Dyk, Faterson, Goodenough, & Karp, 1962) has proposed that field-independent persons would demonstrate greater frequency of dream recall than persons who were more field-dependent. He has also noted that Linton (personal communication to Witkin) has found evidence that nightmares of falling are more common among field-dependent than among field-independent persons (Witkin *et al.*, 1962). Furthermore, more active participation in the dream experience has been attributed to field independents, whereas field-dependent subjects have been found to be more passive observers (Hendricks & Cartwright, 1978; Witkin *et al.*, 1962). Based on the results of our studies with caloric stimulation and the stabilometer, studies in which lucid dreamers have been found to be more reliant on cues from their own body than nonlucids for maintaining orientation, we would expect individuals who dream lucidly to be relatively field independent. Results with the Embedded Figures Test (EFT) have confirmed this expectation for males and females (Gackenbach *et al.*, 1985); results with the Rod and Frame Test (RFT) have clearly supported such a relationship for males and to a lesser degree for female lucid dreamers. As will be discussed later, sex differences among lucid dreamers are not uncommon. Whether these differences are attributable to variations in lucidity

ability or to task-related sex differences is unclear. For example, it is well known that male adults tend to be more field-independent than females on the RFT (e.g., Witkin *et al.*, 1962). It is therefore not surprising that group differences for dreamer types would be more evident for males than females for the RFT.

Three additional studies of dreamer types have been done in our laboratory that are relevant to the issue of individual differences in bodily orientation. The first also demonstrates a sex difference. Kinesthetic feedback is an important component of the body's system for maintaining equilibrium and orientation. We have found that male lucid dreamers perform more accurately for the reproduction of arm placements without visual feedback than do nonlucid males; females manifested no differential performance on this measure of kinesthetic sensitivity when grouped according to dreamer type (Gackenbach, Snyder, McKelvey *et al.*, 1981). Another study in which kinesthetically related differences have been demonstrated for lucids and nonlucids implements a dual task paradigm (Snyder & Gackenbach, 1981). In this experiment, female subjects were asked to sequentially tap a set of four telegraph keys during silence and concurrent with recitation of a nursery rhyme. This type of task is especially interesting because it has been used as a measure of hemispheric specialization (Kinsbourne & Hicks, 1978), an area of research that has also been pursued with regard to field dependence–independence. In the study by Snyder and Gackenbach (1981), both right- and left-handed female lucid dreamers were found to evince greater hemispheric specialization than did nonlucid dreamers, that is, they gave evidence of more interference during concurrent tasks. Witkins *et al.* (1979) have proposed that greater specialization in the psychological domain, in other words, greater psychological differentiation as characterized by field independence, will be linked to greater specialization in the neurophysiological domain. According to the Snyder and Gackenbach (1981) results and those from studies in which lateralized eye movements have been investigated, lucid dreaming ability may be associated with a greater degree of disproportionate hemispheric activation. Because frequent lucid dreaming is also associated with field independence, indirect evidence for an interrelationship between lucid dreaming ability, degree of brain lateralization, and field independence is apparent. It should be noted that Witkin *et al.* (1979) emphasize degree of lateralization with regard to types of processing in the two hemispheres; they do not propose that field independence will be related to the preferred or prepotent use of one hemisphere versus the other across all tasks.

The final study that is relevant to our discussion of individual differences among lucid dreamers for functions that involve spatial orientation is one in which university students classified as frequent or infrequent lucid dreamers or nonlucids were compared on a set of tactual measures that included a pencil maze and a Sequin form board (Gackenbach, Snyder, & Vognsen, 1981). Analyses done with dream recall as the covariate for right-handers time to completion and errors made on the pencil maze over eight trials, four with each hand, revealed

no differences among dreamer types for time and a marginal ($p < .06$) interaction for errors between dreamer type and the direction of errors made (right vs. left). These results do not clearly indicate differences in tactual maze performance for lucid and nonlucid dreamers. Comparable analyses of times to completion in placing geometric forms in a board without visual feedback also indicated no differences; however, analyses of the drawings by subjects done after these forms had been placed with the preferred, nonpreferred, and both hands, a procedure that is part of the Halstead-Reitan Tactual Performance Test, did reveal that lucid dreamers more accurately located shapes than did nonlucids ($p < .04$), though groups did not differ in terms of the number of shapes recalled. This measured difference is suggestive that lucid dreamers are able to better recall haptically learned spatial relationships than are persons who are not lucid dreamers. Because a comparable measure of recall was not obtained for the pencil maze, we cannot say whether this difference generalizes beyond form board performance.

Conclusions

Based on the results of the different studies reviewed in this section, studies in which various aspects of balance, bodily orientation, and personal style have been investigated, it can be concluded that lucid dreaming ability is related to the efficient use of one's own body as a referent during the experience of changes in orientation. On one level of interpretation, this can be said to demonstrate that lucidity is related to field independence, a statement that is substantiated by direct measures of the field dependence–independence construct. On a higher level of inference would be the statement that lucidity is also related to the broad construct of psychological differentiation. We could therefore expect to find evidence of this relationship on an organismic level as well as on a systemic level. There is also suggestive evidence that lucid dreaming ability and psychological differentiation involve a higher degree of intrahemispheric specialization, that is, neurophysiological differentation.

VISUAL/IMAGINAL DIFFERENCES

Evidence to date from studies of eye movements, kinesthesis, caloric stimulation of the vestibular apparatus, and field dependence/independence supports a functional role for the vestibular system during the experience of lucid dreaming. This role is not surprising, given the known relationships between sleeping, dreaming, eye movements, the vestibular apparatus, and the rotational movements reported for lucidity. Because dream mentation experientially involves visual imagery, as do other types of waking experiences that have been related to

lucidity, for example, out-of-body experiences, it is of interest to determine if lucid dreamers differ from nonlucids for susceptibility to experiencing certain types of imagery. It is also of interest to determine if differences between lucids and nonlucids can be demonstrated for visual-perceptual tasks performed during the waken state. Because Shepard (1984) has established that imagery and perception appear to have similar mechanisms, information for both phenomena will be interrelated. The forms of imagery that will be considered include spontaneous waking images as experienced in hallucinations, daydreams, hypnogogery, and psychic experiences. Some qualitative aspects of waking imagery like vividness and control will also be reviewed relative to lucid dreaming. In addition to the information already presented for differences between lucid and nonlucid dreamers on the Rod-and-Frame and Embedded Figures tests, both of which entail visualization, results will be presented from a series of studies in which the performance of dreamer types on visual-perceptual tasks was compared. Measures of mental rotation, perceptual completion, visual maze learning, and susceptibility to visual illusion were included in these studies.

Spontaneous Waking Imagery

Lucid dreaming in relation to the imagery that is experienced in hallucinations, daydreams, hypnogogery, and psychic phenomena has not been thoroughly investigated. However, we would expect some interrelationship between lucidity and these waking imaginal experiences for several reasons. Because lucidity is by definition characterized by self-awareness during the dream process, an awareness that is typically attributed to a waken state, the imagery experienced in the lucid dream may have features in common with the imagery that can be induced by various means in persons who are not asleep. Siegel (1977) has described a number of conditions in which hallucinatory waking imagery occurs, including falling asleep, waking up, insulin hypoglycemia, the delirium of fever, epilepsy, psychotic episodes, advanced syphilis, sensory deprivation, photostimulation, crystal gazing, migrane headaches, dizziness, and various drug intoxications. To this list could be added meditation and hypnosis (Tart, 1972, 1975) as well as other altered states of consciousness. The descriptions of persons experiencing visual imagery during these different conditions appear to follow a common pattern with an initial stage in which four types of simple form constants, for example, spirals, are described. This is followed by a second stage in which the images become more complex and incorporate people, objects, and recognizable scenes, some of which represented improbable experientially derived images such as aerial perspectives (Siegel, 1977). Included in these subject descriptions of complex images were some that are congruent with the descriptions of lucid experiences, and one could consequently hypothesize that persons who do frequently experience lucid dreams more often experience other forms of spontaneous waking imagery than do nonlucid dreamers.

Hypnogogic imagery with reference to lucidity has been reported on by Hearne (1978, 1983) and Gackenbach (1978), though none of these studies may be generalizable because of inadequate controls. Hearne (1978) has found for women only that the frequency of experiencing dream lucidity is positively correlated with the frequency of experiencing hypnogogic images. In a more recent but selective study, he has reported that 82% of lucid dreamers experience images and 77% experience sounds while falling asleep (Hearne, 1983). The similarity between hypnogogic imagery and lucid dream imagery has been investigated by Gackenbach (1978). She found that adult high dream recallers perceived hypnogogic images as more similar to nonlucid than lucid imagery; however, for persons who did view lucid and hypnogogic imagery as similar, it was likely that their lucidity would be initiated by dreamlike or incongruent elements. As for hypnogogic imagery, the relationship between hallucinatory imagery and lucid imagery is equivocal. Hearne (1978) has found no relationship between the frequency of dreaming lucidly and the frequency of a body–schema hallucination, whereas Blackmore (1983) has reported a positive association between the quantity and quality of lucidity with waking hallucinations. In turn, the frequency of daydreams has been positively correlated with lucid frequency for males, but no relationship has been found for the vividness of daydreams and lucidity (Hearne, 1978) or for the emotionality and realism of daydreams and lucidity (Gackenbach, 1978).

In two investigations of self-reported experiences of PK and lucidity, no relationships have emerged (Gackenbach, 1978; Kohr, 1980), nor have there been consistent findings interrelating lucidity with seeing apparitions, with experiences and beliefs about survival of bodily death, or with having a near-death experience. Hearne (1978) and Gackenbach (1978) reported no relationship between lucidity and apparitional sightings, whereas Kohr (1980) has reported that lucid dreaming is positively correlated with such sightings. Among persons grouped according to whether or not they have had a near-death experience as a deep, moving personal episode, Kohr (1982) has described an experiencing group that reported a greater frequency of unusual dream states like lucidity, a higher incidence of dreaming in color, and greater multimodal dreaming than did a nonexperiencing group and a group for which death had come close but with ambiguous poignancy. Relatedly, Greyson (1982) notes that

> I have already asked about the occurrence of lucid dreams in one questionnaire (a shortened version of John Palmer's Survey of Psychic Experiences) administered to self-selected members of the International Association for Near-Death Studies (IANDS). Among the "controls" (i.e., IANDS members who have not had NDEs), 83 out of 155 respondents (54%) reported having had lucid dreams, which is roughly what Palmer found among his sample from the general population. Among near-death experiencers, 13 out of 62 respondents (21%) reported having had lucid dreams *prior* to their NDEs, and 33 (53%) reportedly had lucid dreams *since* their NDEs. Thus, a fairly low percentage of near-death experiencers had lucid dreams before their NDEs, while after the NDE, this percentage rises to the level among the IANDS controls and the population Palmer sampled. (p. 6)

Unlike the vividness of imagery, control of imagery has not been shown to relate to lucid dreaming. Blackmore (1982) and Gackenbach, Prill, and Westrom (1983), both using Gordon's Control of Imagery Questionnaire (Richardson, 1969), found no relationship, as did Hearne (1978, 1983) using several imagery questions invoking control. In unreported data (Gackenbach, 1984a), we have detected a marginally significant positive association between these two variables, but clearly the bulk of evidence argues against a very meaningful association. In summary, the frequency of experiencing dream lucidity can be said to be related to the frequency with which two forms of spontaneous waking imagery (sleep transition hallucinations and waking hallucinations) are experienced. Daydreaming and imagery vividness also appear to be associated with lucidity frequency.

The performance of persons classified according to lucid dreaming frequency has already been shown to differ for two perceptual measures of visualization, the Rod-and-Frame Test (RFT) and the Embedded Figures Test (EFT); according to Gackenbach *et al.*, (1985), lucid dreamers rely less on the immediate visual field than do nonlucid dreamers. Because of suspected differences between dreamer types in their susceptibility to experiencing certain types of waking imagery (sleep transition hallucinations and waking hallucinations), a series of other studies of visualization comparisons between lucids and nonlucids have been undertaken. As Ley (1983) has pointed out, imagery is integral to the performance of many visuospatial tasks, including some for which sex differences have variably been reported (Harris, 1978). Before presenting our results, we would emphasize that visualization is a very general process that can undoubtedly be influenced by many experimental and personal variables. It is also but one part of an integrated organismic system.

Because personal accounts of lucid dreams have included imagery of rotational movements (Green, 1968; LaBerge, 1985), we have studied the abilities of lucid dreamers on mental rotation tasks. For a simple two-dimensional mental rotation task (Golden, Hemmeke, & Purisch, 1979), Gackenbach and associates, after controlling for dream recall, have found that lucidity frequency is unrelated to level of performance (Gackenbach, Curren, LaBerge, Davidson, & Maxwell, 1983; Gackenbach, Prill, & Westrom, 1983). However, for a more difficult two-dimensional rotation task (Hakstain & Cattell, 1975) as well as for a three-dimensional task (Vandenberg & Kuse, 1978), female lucid dreamers have been shown to perform better than nonlucid females. Interestingly, for a select sample of males performing these same tasks, a negative relationship between lucid dreaming frequency and level of performance was found.

The fact that lucid dreaming ability has been found to be related to higher level visuospatial performance is mirrored in a study in which the visualization of persons who have had out-of-body experiences (OBE) has been investigated (Cook & Irwin, 1983). Although OBEers and non-OBEers were not found to differ on a measure of visual imagery (Richardson's Necker Cube Fluctuations

Task), they were found to differ on a more complex, Piagetianlike visuospatial task that required the allocentric localization of three-dimensional block sketches within a simulated room. This task could also be interpreted as one that measures field independence. Because a relationship between lucid dreaming and OBEs has long been purported (Green, 1968; Irwin, 1985), it is particularly interesting with regard to this study that the occurrence of an OBE was not found to depend on an individual's skills in vividness and controllability of waking visual imagery. A comparable lack of dependence on visual vividness and controllability has been reported for lucid dreaming (Gackenbach, 1978; Gackenbach, Prill, & Westrom, 1983; Hearne, 1978).

If lucid dreaming ability is specifically related to higher level visualization skills that involve spatial orientation, evidence for which is discernable in the results obtained for dreamer types on figural rotational tasks and field-dependence/independence tasks, then we would expect no differences to be found between lucid and nonlucid dreamers on a visual perceptual task with minimal spatial demands. This hypothesis has not been tested extensively; however, no differences for dreamer types have been found for Mueller-Lyer illusion and Necker Cube tasks and for a perceptual completion task (Gackenbach *et al.*, 1981). This last finding also serves to illustrate the need for controlling relevant variables when analyzing individual differences. In a study done by Gackenbach *et al.* (Gackenbach, Curren, LaBerge, Davidson, & Maxwell, 1983), in which the Perceptual Completion subscale of the Comprehensive Ability Battery (Hakstain & Cattell, 1975) was administered to adults highly interested in lucid dreaming, it was found that the performance of females was positively correlated with lucidity frequency ($r = .45$). Dream recall and extent of education were controlled for in this study, as was lucidity verification. In a subsequent administration of this same measure (Gackenbach, 1984a) to college students, an opposite result was obtained after controlling for dream recall, college GPA, and lucidity verification. Lucidity ability was found to be negatively correlated with perceptual completion ($r = -.29$) among university women. For both studies, there was no relationship between perceptual completion scores and lucidity for males. At this time, the inconsistency between these two studies for females is viewed as due to different sample characteristics. Cross-validation with this task and other visual perceptual tasks, however, is needed to confirm that visualization differences between lucids and nonlucids are not demonstrable for tasks with limited spatial demands.

Additional support for a visuospatial functional difference between lucid and nonlucid dreamers is afforded by the performance of dreamer types on a visual "stepping stone" maze used by Milner (1965) and Newcombe and Russell (1969) to study the effects of lateralized brain damage on visouspatial learning. In these studies, persons who had incurred right hemisphere lesions were found to perform poorer than persons with left hemisphere lesions or controls. Unlike Porteus Mazes, variants of which are included in the Wechsler Scales of

Children's Intelligence, the visual mazes used by Milner (1965) and by Newcombe and Russell (1969) and us do not provide ongoing visual feedback as to the path already followed. Rather, self-generated auditory feedback occurs in the form of a click or buzzer whenever a deviation from the correct path takes place. Subjects are therefore required to initially discover the correct path by trial and error and subsequently to reproduce their correct movements over multiple trials. Visual imagery for movement through space is a part of this process:

> The subject's task is to discover this series of points [stepping stones] and to remember their order and direction so that he can select them correctly; in other words, he is asked to follow the imaginary path (Barker, 1931, p. 282).

When university students who were grouped according to lucid dreaming frequency were administered a version of a visual maze, persons who experience lucid dreams more than once per month were found to perform differently than those who reported never or infrequently experiencing lucid dreams (Gackenbach, Snyder, & Esbeck, 1981). This difference was manifest in terms of speed of performance, with frequent lucid dreamers completing a predetermined number of trials (four per hand) more slowly than "infrequents" and "nevers" ($p < .04$). A marginal difference ($p < .06$) was also found for errors made, once more with frequents doing poorer than other dreamer types. Unlike for the tactual form board task (Gackenbach, Snyder, & Vognsen, 1981) in which lucid dreamers were determined to more accurately recall the respective spatial location of different shapes, analyses of drawings of the maze path following eight trials did not indicate better recall for lucids versus nonlucids. These findings do not support the hypothesis that lucid dreamers can use imagery more effectively than others when performing a set number of trials on a visual maze of this type. They do, however, support the existence of differences between persons classified according to lucid dreaming ability, differences that parallel those already described for other visual tasks that rely to varying degress on external visual referrents, that is, field dependence or independence.

Conclusions

Several tentative conclusions can be reached based on the information presented in this section. First, lucid dreaming frequency appears to be positively associated with the frequency with which sleep transition hallucinations, waking hallucinations, and daydreaming are experienced. An enhanced vividness of imagery across several sense modalities (auditory, tactile/kinesthetic, olfactory/gustatory) also appears to be positively related to lucidity frequency. Performance on visualization tasks with limited spatial demands has not been useful for discriminating between lucid and nonlucid dreamers, nor has performance on a visual maze for which a visual field is delineated. However, as the visualization

Beliefs about survival have also been investigated as they relate to the lucid dreaming experience. Palmer (1974) found a positive relationship, whereas Blackmore (1983) found no relationship. Irwin, in Chapter 15 in this book, has summarized the empirical relationship between OBEs and lucidity as being consistent but weak.

> Where the relationship was at its strongest, less than 12% of the variance between the two variables is explained. The meta-analysis of the 10 results also puts the combined effect size at . . . .20 only. Thus, whereas the association between the occurrence of the two experiences is statistically significant and a fairly reliable finding, it is of meager predictive value.

Induced Waking Imagery

In addition to the data that have been collected about the shared frequencies of lucid dreaming and types of spontaneous waking imagery, there is a body of information in which the quality of images has been related to lucidity, especially with regard to the vividness and control of imagery. Hearne (1978) found no relationship between lucid dreaming and three vividness questionnaire items, whereas Blackmore (1982) has reported no differences between lucid and nonlucid dreamers for Bett's vividness of imagery scores (Richardson, 1969). In contrast, Gackenbach, Prill, and Westrom (1983) did find that when dream recall and social desirability were controlled and an understanding of lucidity was verified (cautions not taken by Hearne, 1978, or Blackmore, 1982), males who reported frequently dreaming lucidly also reported more vivid tactile images according to responses on the Bett's Inventory. In unpublished follow-up data from our laboratory, both male and female students showed a positive relationship between lucidity frequency and the Auditory and Tactile subscales of the Bett's, provided dream recall, social desirability, and lucidity verification were controlled. Suggestive evidence of a sex difference for vividness and lucidity was also found for the Kinesthetic (females) and smell (male) subscales (Gackenbach, 1984a).

Kueny (1985), taking into account dream recall, motivation for lucidity, and verification of lucid dreaming, has also found a positive association between lucidity and items designed to sample the vividness of imagery in the tactile, olfactory, kinesthetic, and gustatory modalities. Hearne (1983), too, has stated that the majority of his lucid dreamers report moderate-to-clear vividness for visual and auditory imagery tasks. Finally, Blackmore (1983) has obtained a significant positive correlation between lucidity and the vividness of visual imagery. In sum, when moderator variables are taken into account, there is consistent evidence that self-reported imagery vividness is positively correlated with an ability to dream lucidly—a correlation that is demonstrable for males and females.

tasks increase in spatial complexity and/or there is less need to rely on visual field referents for successful performance, lucid dreamers become distinguishable from persons who do not dream lucidly. These findings are compatible with those reported in the section on oculomotor/equalibratory differences and fit into the stage pattern of imagery described by Siegel (1977). Visualization or imagery *per se* can therefore be said to not be essential for understanding the lucid process. Rather, selective nonvisual imagery in combination with internally oriented perspectives would appear to be keys for opening the portal to lucidity.

INTELLECTUAL/CREATIVE DIFFERENCES

Many of the differences between dreamer types that have been presented thus far can be said to primarily involve perceptual abilities rather than abilities that are largely intellectual. In this section the results from studies of individual differences of cognitive functioning, as apparent in measures of intelligence and creativity, will be reviewed. If lucid dreaming ability has manifestations on an organismic level, then we would expect to find evidence of lucidity differences in the cognitive as well as perceptual domains. Witkin and associates (Witkin *et al.*, 1962) have followed a similar rationale with regard to the field-dependence/independence construct. Because their construct was found to be useful for characterizing a person's problem-solving activities and perception, Witkin referred to self-consistent ways of experiencing as cognitive styles. Within this broader framework, field-dependence/independence was once said to represent the perceptual component of experience, with an analytical-global dichotomy being delinenated in order to describe differences across intellectual and perceptual abilities. As already demonstrated, frequent lucid dreamers tend to be field independent rather than field dependent. Field independence as a cognitive style entails psychological differentiation in which a person tends to approach problems or situations by experiential restructuring rather than dealing with them as a given whole. If psychological differentiation is related to a tendency to dream lucidly, then we would expect to find differences between lucid and nonlucid dreamers consistent with those described by Witkin. We might also be in a position to better understand the experience of lucid dreaming as an active restructuring of the dream experience in which the "unconsciousness" of dreaming and the "consciousness" of waking is comingled.

Early investigations of intellecutal functioning of persons who were field-dependent and/or independent revealed that field independence might be associated with superior general intelligence (Witkin *et al.*, 1962). Subsequent research has shown that this superiority may be limited to performance on spatial-visualization types of intellectual tasks (Witkins *et al.*, 1979) and is unrelated to verbal ability (Witkin & Goodenough, 1981). If the relationship which we have postulated between lucid dreaming and the cognitive restructuring of field inde-

pendence is a reliable one, we would expect differences between lucid and nonlucid dreamers to be apparent for some measures of intellectual functioning but not others. Specifically, lucid dreamers should do better than nonlucids for self-oriented nonverbal types of intellectual tasks. The data to date are inconclusive with regard to this hypothesis, in part because of poor experimental designs. Hearne (1978) and Gackenbach, Snyder, McKelvey *et al.* (1981), respectively, have found no difference between dreamer types for solving Raven's Advanced Progressive Matrices or the pyramid puzzle, both of which are measures of visually based problem-solving ability. However, neither study controlled for lucid vertification, and Hearne did not control for dream recall. In another study in which dream recall also was not taken into account (Gackenbach, 1986), lucid male adults and students were found to differ from nonlucids on a measure of verbal intelligence included in Cattell's Sixteen Personality Factor Questionnaire (16PF; 1969); lucid dreaming frequency, as would be expected, correlated negatively with Factor B scores. In a study in which dream recall, education, and sex role identification were accounted for, Gackenbach, Curren, LaBerge, Davidson, and Maxwell (1983) found that high lucid dreaming frequency among women was associated with high verbal and numerical abilities as measured with the Comprehensive Abilities Battery (CAB; Hakstain & Cattell, 1975); male frequent lucids scored comparably lower than male nonlucids for numerical abilities. This study, unfortunately, was exclusively a mail survey accomplished with self-selected adults with an expressed interest in lucid dreaming. More representative but unreported data (Gackenbach, 1984a) from our laboratory for the CAB administered to university students and analyzed with regard to dream recall and grade point average do indicate no differences for male or female dreamer types for the Verbal and Numerical CAB subscales. Although this last finding is as hypothesized, it is clear that more adequately controlled and more comprehensive studies of intellectual differences between dreamer types remain to be done before any conclusions can be reached.

Studies of lucid dreaming frequency in relation to the cognition of creative activities have been few in number but more substantive than those in which measures of intelligence have been employed. Relatedly, creativity with regard to field dependence/independence has been examined by a number of investigators (Bloomberg, 1971, 1976; Leftcourt & Telegdi, 1971; Noppe & Gallagher, 1977; Ohrmacht & McMorris, 1971; Spotts & Mackler, 1976). As for intelligence, different cognitive styles could be expected to involve their own forms of creative thought (Forisha, 1978). The same is to be expected for dreamer types, an expectation that has been met on the basis of three studies from our laboratory. Gackenbach and Hammons (1983), using the Remote Association Test (RAT), a measure of verbal reasoning, have found no differences in performance relative to lucid dreaming frequency. This finding was replicated by Gackenbach, Curren *et al.* (1983) for men, whereas frequent lucid dreaming women were found to show some evidence of higher verbal (RAT) and nonver-

bal (Torrance Non-verbal) creativity. In an unreported follow-up to these studies (Gackenbach, 1984a), male lucids were again determined to be no more creative than male nonlucids, but female dreamer types were determined to differ on two of four Torrance (Torrance, 1972) measures of nonverbal creativity. These findings are consistent in indicating that female lucid dreamers differ from their nonlucid counterparts in terms of their success at solving some types of nonverbal tasks. The results for males indicate no differential abilities. With reference to lucidity, much research is needed for both the intellectual and creative dimensions of cognition.

PERSONAL/INTERPERSONAL DIFFERENCES

In keeping with our contention that lucid dreaming ability involves multiple functional systems working in concert on an organismic level, we would expect to find that persons who frequently experience lucid dreams self-consistently differ from other persons on personal and interpersonal dimensions as well as on the equilibratory, perceptual, and cognitive dimensions already discussed. The personal and interpersonal characteristics of lucid dreamers studied to date include the demographic variables of gender, race, age, and family status, and the personality variables of risk taking, self-perception, anxiety, sex-role identity, and extroversion. Because individual differences for personal/interpersonal behaviors and attitudes have been demonstrated for the psychological differentiation construct of field dependence/independence, we will also review these demonstrated differences in order to relate them to hypothesized differences for dreamer types.

Demographic Differences

Demographic studies with regard to gender, age, birth order, and family status have been carried out by several researchers. Although not entirely consistent, these studies, if properly designed (Gackenbach, 1985b), have generally indicated no differences in lucid dreaming frequency according to gender (Blackmore, 1982; Gackenbach, 1978. 1980, 1983, 1984b, 1986, Gackenbach, Curen, LaBerge, Davidson, & Maxwell, 1983; Hearne, 1978; Palmer, 1974) but demonstrable differences according to age, birth order, and family variables. Overall, younger persons have been determined to dream lucidly more often than older persons (Blackmore, 1983; Gackenbach, 1980; Kueny, 1985; Palmer, 1974). Whether a cohort effect is operative for this age-related difference has not been studied, though Gackenbach (1978) has shown that among adult women with an expressed interest in dreaming, older women reported a higher frequency of lucidity than did younger women. Regarding birth order, Gackenbach *et al.*

have reported that firstborns report a higher incidence of lucid dreaming than later borns. In that same study, as well as in Palmer (1974), single adults have reported more frequently dreaming lucidly than married persons, though Gackenbach (1978) has also found no difference for another sample. Finally, with regard to deaths of family members, paternal and sibling deaths were statistically unrelated to the frequency of lucidity, but maternal deaths have been found to favor its frequency (Gackenbach, 1978).

Cultural differences in lucid dreaming frequency have not been systematically studied. Palmer (1974) has examined race differences in Virginia and found that 76% of blacks reported having had a lucid dream experience, whereas only 53% of whites reported such an experience. In the same study, Palmer reported that occupation and family income variables did not appear to affect lucid dreaming frequency. Educational levels have also not been found to influence the frequency of lucidity in quasi-normal (Palmer, 1974) or well-educated (Gackenbach, 1978; Gackenbach, Curren, LaBerge, Davidson, & Maxwell, 1983) samples. Regarding cultural factors, it may be notable that Gackenbach (1978) has reported, for an adult sample, differences between lucids and nonlucids for interests in Yoga:

> Frequent lucid dreamers . . . are much less likely to be involved in Yoga than members of the other two groups (infrequents and nevers).. . . In addition, nonlucid dreamers were slightly more likely to be involved with followers of Eastern gurus. Although frequent lucid dreamers may not be interested in Yoga, they are slightly more likely to be involved in Silva Mind Control than infrequent or non-lucid subjects. (pp. 176–177).

Administration of the Eastern and Western Scale (Gilgen & Cho, 1979) to university students has suggested an association between lucid frequency and east–west values for females only. Overall, these results provide suggestive evidence of racial differences in lucid dreaming frequency, no evidence that socioeconomic status influences lucidity frequency, and contradictory evidence of an association between an interest in non-Western ideologies and lucid dreaming. Although gender does not appear to influence the frequency with which a person dreams lucidly, being younger, firstborn, and unmarried may influence the likelihood of experiencing lucidity. Better controlled, longitudinal studies are needed, however, before we can be confident of these findings.

Personality Differences

In addition to the study of these demographic variables, there have been several studies of the personality characteristics of lucid and nonlucid dreamers. Because many of these same characteristics have been studied with reference to psychological differentiation, we will first review the personality differences between field-dependent and field-independent persons before discussing dif-

ferences between dreamer types. The cognitive styles of field dependence/independence, which are now defined as "contrasting tendencies to rely primarily on external referents or on the self in psychological functioning" (Witkin *et al.*, 1979, p. 1131), have been studied with reference to three dimensions of personal attributes: (1) one's body concept, (2) one's sense of identity, and (3) one's use of controls and defenses in dealing with impulses and potentially disturbing experiences. The body concept of field-independent persons has been said to be an impression of the body as having definite boundaries with the parts within as discrete yet interrelated. In view of the self-reference of field independents to visuopatial, kinesthetic, cutaneous, and vestibular cues, it is not unexpected that they would develop a more articulated body concept than less egocentrically oriented persons. This is especially true when one considers the measures that have been employed to study both body articulation (e.g., human figure drawings and self-perceptual tests like Thurstone's Hands Test) and body boundary (e.g., 2-point discrimination and tactile localization). Relatedly, but of probably more meaning for understanding the personal attributes of lucid dreamers, is the imputed relationship between field independence and a sense of separate identity. Whereas field-dependent persons tend to have an interpersonal orientation that enhances their social interactions with others, field independents are said to function more autonomously and to have an impersonal orientation (Witkin *et al.*, 1979). This dichotomy appears to be comparable to that described by Gardner (1981) for persons who differ in terms of their interpersonal versus intrapersonal abilities. We would expect that these differently oriented people would also vary with regard to their ideation and their manner of dealing with impulses and psychological conflict. Such differences have been established for field-dependent/independent persons, for example, field independents have been shown to rely on specialized defenses like isolation, intellectualization, and projection, whereas field dependents have tended to use global defenses like denial and repression (Witkin *et al.*, 1979).

Inasmuch as lucid dreaming ability is associated with field independence for the personal/interpersonal domain, we could expect that persons who frequently dream lucidly would evince differences from nonlucids along the three dimensions of personal attributes studied with regard to cognitive styles. We have already discussed lucid frequency in relation to self-image, or one's body concept, as measured for tactile/kinesthetic localization. Frequent lucid dreamers have most accurately drawn the relative location of form board figures previously placed without visual feedback. They have also more accurately duplicated visually unobserved angular displacements of their arms than have nonlucid dreamers. No studies have been done in which human figure drawings of lucid and nonlucid dreamers have been compared for differences in body articulation, but we are now analyzing data derived from the administration of a variant of Thurstone's Hands Test and a test of left–right orientation for upright and inverted figures to determine if differences will be demonstrable for these self-perceptual tasks that Witkin and others have used as measures of body articulation. Although we are now

unable to state that lucid dreamers have a more articulated body concept than other persons, evidence does support a more distinct awareness of body boundary among lucid dreamers than among others.

With regard to an individual's sense of identity and personal and social manifestations of that sense of identity, there has been a set of studies carried out with dreamer types in which risk taking, self-perception, sex-role identity, extroversion, and anxiety have been assessed.

Risk Taking

Risk taking was originally conceived by Dane (personal communication, 1980) as related to lucidity. He developed eight items that described situations of either internal (e.g., develop your telephatic powers) or external (e.g., taking skydiving classes) risk and found that frequently lucid individuals expressed an interest in these potentially risky situations. Gackenbach (1980) administered Dane's scale to 707 students during a mass testing at a midwestern university and found that when dream recall and understanding were controlled, there was no dreamer difference for the external risk items. However, frequently lucid individuals reported themselves as significantly more interested in internally risky situations than their infrequently lucid or nonlucid counterparts.

In a follow-up with adults (Gackenbach, Curren, LaBerge, Davidson, & Maxwell, 1983) and with the additional control of social desirability, both internal and external risks were significantly correlated with lucidity frequency for females only. In a subsequent study (data unpublished; Gackenbach, 1984a), two traditional measures of risk proclivity were administered with Dane's scale—the Choice Dilemma Questionnaire (CDQ; Stoner, 1961) and the Sensation Seeking Scale (SSS; Zuckerman, 1979). High scores on the latter are defined by Zuckermann, Bone, Neary, Mengelsdorff, and Bustman (1972) as characterizing "a person who needs varied, novel, and complex sensations and experiences to maintain an optimal level of arousal" (p. 308). The CDQ was developed by Stoner (1961) to measure the "risky shift" phenomenon, or the finding that groups make riskier decisions than individuals. Among college students, the CDQ and the Dane scale were significantly positively correlated to the SSS, whereas the CDQ and Dane scale were unrelated. For the association between lucid dreaming frequency and these measures of risk taking, we found nothing for the Dane scale and a negative correlation for the SSS most evident for males but significant across sex. In contrast, the CDQ correlated positively across sex with lucid frequency. The SSS finding was replicated in males but not females in the final study in this sequence (data unpublished; Gackenbach, 1984b). Using the same design, scores on the external subscale of the Dane also showed a significant negative correlation for males with lucidity frequency. However, the SSS and Dane scale were not significantly correlated.

Although the three measures used in these studies all claim to measure risk,

the interelationship between scales is moderate. Where significant correlations did occur, risk taking was positively associated with lucidity frequency for the Dane scale and for the CDQ, but for the SSS the inverse was found. This somewhat contradictory finding can be explained by making a distinction between internal and external risks. The Dane scale has both Internal and External Risk subscales and the CDQ clearly deals with external risk (i.e., all the items describe hypothetical situations involving other people and not the subject). As for the SSS, although there are a few items that deal with internal risk (i.e., "I have tried marijuana or would like to"), that is, experiencing or exploring inside the self as opposed to outside the self, the vast majority are external risk items. With this distinction in mind. except for the adult women in Gackenbach *et al.* (1983a) and the CDQ results, the rest of the significant findings (and the direction of the nonsignificant findings) are consistent in indicating that lucid dreaming is associated with a preference for internal risk and avoidance of external risk. Regarding the inconsistency of the CDQ research, Cartwright (1971) has noted that "the assumption that CDQ scores measure a unitary disposition to take risks is no longer tenable" (p. 375). The negative finding for adult women (Gackenbach, Curren, LaBerge, Davidson, & Maxwell, 1983) may, in turn, be accounted for by the fact that this sample reported themselves as being significantly more interested in externally risky situations than did the student samples used. As Goldenberg (1979) and Nussdorf (1975) point out, the traditional sex difference for risk taking favoring males is attenuated by sex-role identity. The adult women in the previously mentioned Gackenbach *et al.* study were found to be significantly less feminine than the women in the normative data provided by Spence and Helmreich (1978).

Sex-Role Identity

Integral to a person's self-concept is one's sex-role identity, or the extent to which one exhibits characteristics typically attributed to men or women. For example, men have typically been found to be less attentive to social cues, to favor solitude, to be less open about feelings, and to display greater internal locus of control in comparison to females. Sporros, Stam, Radtke, and Nightingale (1980) have reported that femininity, especially among men, is associated with enhanced dream recall. Gackenbach *et al.* (1985), on the other hand, have reported that field independence, a stereotypically masculine cognitive style (Witkin & Goodenough, 1981) is characteristic of frequent lucid dreamers. Although others have found a positive association between field independence and masculinity (Hulfish, 1978; Rosenberg, 1976), this support has diminished in recent years (Chatterjea & Bhaskar, 1980). Gackenbach (1978), however, has reported that a factor labeled *masculinity* was positively and moderately corre-

lated with a factor defined by the frequency of lucid dreams experientially associated with the hypnogogic and hypnapompic states.

In order to directly compare lucidity frequency and sex-role identity, Gackenbach, Curren, LaBerge, Davidson, and Maxwell (1983) administered the Personal Attributes Questionnaire (PAQ) of Spence and Helmreich (1978) to adults with an expressed interest in dreaming. After controlling for dream recall, understanding of lucidity, and social desirability, it was determined that masculinity was positively related to lucid frequency for men and marginally for women. A positive relationship was also found between femininity and lucid frequency for men but none for women. Finally, Kueny (1985), using the Femininity subscale of the California Psychological Inventory (CPI), found a positive relationship for males and females between femininity and the number of lucid dreams signal-verified in the sleep laboratory but no relationship between femininity and several self-report and dream log indexes of lucid frequency.

In summary, there is evidence that both masculinity and femininity are related to lucidity. This evidence is consistent with the reconceptualizations of sex-role identity as a multidimensional trait rather than a monolithic one (Bem, 1974; Constantinople, 1973). We would therefore suggest that frequent lucid dreamers tend toward an androgenous sex-role identity. Some data in support of this suggestion are afforded by Gackenbach, Curren, LaBerge, Davidson, and Maxwell (1983), a study in which subjects were assigned to one of four sex-role identities: (1) androgynous (high masculine, high feminine); (2) masculine (high masculine, low feminine); (3) feminine (low masculine, high feminine); or (4) undifferentiated (low masculine, low feminine), according to Spence, Helmreich, and Stapp's (1975) median split method. Regardless of lucid dreaming frequency, women proved to be equally classified in the four identities; however, 49.1% of the frequently lucid males were androgynous—a difference that resulted in a significant chi-square value.

Self-Perception

Lucid dreaming history as it relates to self-perception, self-monitoring, and self-consciousness is relevant both to risk taking and sex-role identity and to studies of the personal and interpersonal characteristics of field-dependent and independent individuals. Our research has indicated that frequent lucid dreamers tend to be persons who are willing to take internal risks but who avoid external risks. In other words, their reference for risk is themselves. Sex-role characteristics that have been associated with high lucidity incidence, primarily for males but for some masculinely oriented females, also have favored intrapersonal rather than interpersonal abilities, including less self-disclosure, being less attentive to social cues, having an internal locus of control, favoring solitude,

and being less socially conforming. Witkin has spoken of a field-independent person as being more differentiated than others, by which he meant that there is a greater self-nonself segregation than for field-dependent persons who display a greater connectedness between self and others. Because self-awareness of dreaming during the dream process is the defining characteristic of lucid dreaming, knowledge of the role that the self plays in this dream experience may be essential for an understanding of lucidity.

Belicki, Hunt, and Belicki (1978), taking into account neither dream recall nor lucidity verification, did not find that lucid dreaming history was related to typical, ideal, or private self-perception. In several, more recent studies, it has been found that lucidity is not positively related to an interpersonal orientation. Kueny (1985), taking into account dream recall, lucidity verification, and motivation to dream lucidly, reported that several indexes of lucidity were uncorrelated with a Self-Control (freedom from impulsivity and self-centeredness) measure derived from the California Psychological Inventory and marginally correlated with a Good Impression (concern for how others react to them) measure. Gackenbach (1978), using the Self-Sentiment Control (Q3) factor from the Sixteen Personality Factor Questionnaire (Cattell, 1969), also found no positive association between this measure and several indexes of lucidity. High scorers on Q3 are controlled and socially precise, whereas low scorers follow their own urges and are careless of social protocol. The Self-Consciousness Inventory (SCI), of Fenigstein, Scheier, and Buss (1975), has been used in three studies of lucid dreamer characteristics. The SCI is a measure of the extent to which persons habitually reflect upon themselves and includes two major components of self-consciousness—private self-consciousness and public self-consciousness. Private self-consciousness involves habitual attendance to one's thoughts, motives, and feelings, whereas public self-consciousness involves concern for social appearance and the impressions one makes on others. According to our hypothesis that persons who frequently dream lucidly tend toward an intrapersonal orientation whereas others tend toward a more interpersonal orientation, we could expect that lucid dreaming frequency would be positively associated with private self-consciousness but not public self-consciousness. In a pilot study, in which LaBerge and Gackenbach (1982) administered the SCI to students enrolled in a dreams class, both males and females who scored high for private self-consciousness self-reported frequently dreaming lucidly. In a follow-up study (Gackenbach, Curren, LaBerge, Davison, & Maxwell, 1983), the SCI was administered to adults, and multiple stepwise regression analyses done separately for males and females showed that private self-consciousness was the single best predictor of lucid frequency among males. Kueny (1985), also working with adults, some of whom attempted to signal lucidity in the sleep laboratory, found a significant negative relationship between private self-consciousness and the number of signal-verified lucid dreams. In one sense, Kueny's results with the SCI contradict the results of

Gackenbach and her associates. It is possible, however, that lucidity signaled in the sleep laboratory is an interpersonal act that is not comparable to self-reported or diary-recorded lucid frequency.

Extraversion and Anxiety

In the study by Kueny (1985) in which two CPI Class II scales (Self-Control and Good Impression) were found to have low correlations with lucid frequency, one of the Class I scales, Social Presence, was determined to be negatively correlated with the frequency of signal-verified lucid dreams in the sleep laboratory. According to Gough (1968), Class I scales pertain to "interpersonal effectiveness, style, and adequacy." These Class I scales, excluding Sense of Well-Being, have also loaded highly on a factor (Factor 2; Megargee, 1972) sometimes designated a measure of extraversion. We have proposed that frequent lucid dreamers tend toward an intrapersonal orientation. We would therefore expect them to tend toward introversion rather than extraversion, and we would emphasize that introversion, in turn, has been related to level of arousal (Corcoran, 1981). In addition to the finding by Kueny, which was obtained with few subjects and was accounted for principally by males, there are two studies in which lucidity frequency has been related to the dimension of introversion-extraversion. Hearne (1978), administering the Eysenck Personality Inventory (EPI), found no differences between lucid and nonlucid dreamers for the dimension of extraversion. Gackenbach (1978), using Form C of the 16 PF and scoring it for the second-order factor of Extraversion, did find that Extraversion loaded on two factor-analytic variables ("Masculinity" and "Joining") that were moderately and positively correlated with a lucid dream factor associated with hypnagogic and hypnapompic states. In a subsequent reanalysis of this adult data and other student data, Gackenbach (1986) reports a marginally significant correlation between extraversion and self-report lucid frequency for students but no relationship for adults. Finally, in an unpublished study (Gackenbach, 1984a), the Self-Monitoring Scale (Snyder, 1974), including a subscale purported to measure extraversion, was administered to students for whom dream recall, social desirability, and lucid verification were controlled. No relationship between lucid frequency and extraversion emerged. In general, these different studies do indicate that lucid frequency is not positively associated with various measures of extraversion.

Over the years, a body of literature has accumulated in support of arousal differences for persons who differ along the introversion–extraversion dimension. Introverts have been said to maintain a higher level of arousal than extraverts due to constitutionally determined properties of the central and autonomic nervous systems (Eysenck, 1982), though there is uncertainty about the locus of the arousal difference between introverts and extraverts and these differences

appear to vary with the time of day (Corcoran, 1981). It is interesting to speculate that lucid dreaming, which involves a high level of arousal during sleep, occurs in individuals who tend toward introversion. We might also expect that these individuals while awake might be more susceptible to stress than less aroused individuals, that is, nonlucid dreamers. To date, six studies have been carried out in order to assess the relationship between susceptibility to anxiety and lucid dreaming frequency. The results from these studies are inconsistent, though procedural and sampling differences may account for this inconsistency. Gackenbach (1978) and Gackenbach (1986) used the 16 PF, Gackenbach, Curren, LaBerge, Davidson, and Maxwell (1983) and Kueny (1985) used the social anxiety subscale of the Self-Consciousness Inventory (SCI), and two unpublished studies (Gackenbach, 1980; LaBerge & Gackenbach, 1982) used the Zuckerman Affect-Adjective Checklist and the SCI, respectively, to derive measures of anxiety. Although high anxiety has been found to be associated with high lucid frequency for males, the converse has been found for females if all the data are combined and weighted according to methodological differences. We are not sure why this gender difference has been found but do believe that this issue merits further study. We also plan to investigate if persons who dream lucidly differ from others with regard to how they deal with stress, for example, with regard to the use of specialized versus global defense mechanisms when faced with actual or potential conflict situations.

IN REVIEW

The studies that we have marched before you in this chapter have not always been in step, and some are attired in rather shabby scientific uniforms. This state of affairs can largely be attributed to the recency of scientific inquiry about lucid dreaming. At times, we ourselves have groped in the dark trying to make this dream process more understandable. Our investigations have consequently been vitiated by imprecision and false steps. Nonetheless, we do believe that there is an emerging conceptualization of the lucid dreamer within the ranks of the studies in which individual differences have been investigated. In this emerging conceptualization, lucid dreaming is viewed as typically experienced by some individuals but not others. Evidence has been presented that supports that individuals who do frequently dream lucidly tend to rely primarily on the self in psychological functioning rather than on external referents. Manifestations of this intrapersonal orientation have been found for different domains of psychological functioning, including the reflexive, perceptual, cognitive, and personal. As a group, persons with a propensity to dream lucidly can be described as sensitive to tactile/kinesthetic and vestibular cues, as less reliant on an external visual field, as relatively field-independent, as having a well-delineated body boundary, as being androgenous in sex role and open to internal but not external

risks, as being more self- rather than socially oriented, and as tending toward introversion and a relatively high level of arousal. The data reviewed would also lead us to believe that the lucid experience is a cognitive style of the night in which nonvisual imagery plays an essential role. To what extent the characteristics described for lucid dreamers as a group are applicable to persons of different age, gender, race, and experiential background remains to be demonstrated. Only now is the quality and quantity of empirical evidence beginning to amass so that the individual characteristics associated with lucid dreaming can be seen in full review.

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