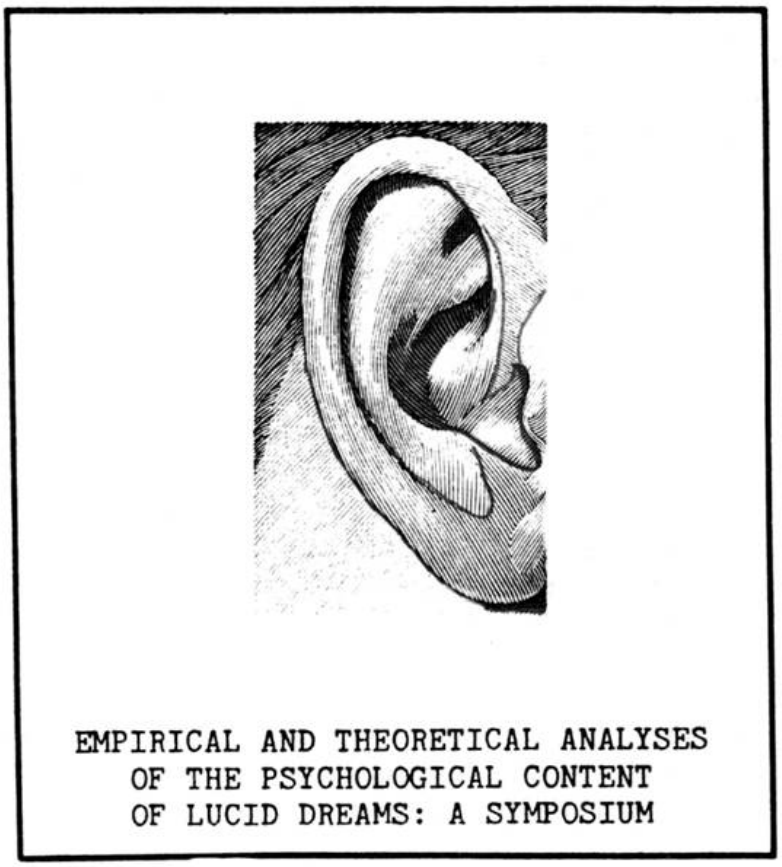

Kinesthetic Imagery as a Quality of Lucid Awareness: Descriptive and Experimental Case Studies

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Note: This is a revision of the paper presented at the lucidity symposium. It contains numerous conceptual clarifications and a discussion of some results collected subsequent to the symposium.

Throughout this symposium there has been substantial agreement that lucid dreaming can be defined as 'an awareness of dreaming while dreaming'. This defini-tion may be adequate in a general sense, but to facilitate research into specific questions about lucid dream formation, a more specific statement is required.

Some investigators have used more specific descrip-tions of lucid 'awareness', usually with reference to some quality of the dreamer's feelings or sensations during the dream. For example, Hunt (this panel) refers to a special sense of 'freedom or excitement' or an 'attitude of detachment'. Others have em-phasized the sense of control

accompanying lucidity. In a similar way, I am attempting to specify how 'awareness of dreaming' may be conceptualized, in part, as a feeling process of kinesthetic origin. More specifically, awareness during dreaming - like awareness during many waking states - frequently refers to a particular class of sensations, namely, the kinesthetic sensations of' bodily orientation and movement. Qualitative changes in the nature of kines-thetic sensations will, in this view, be accompanied by qualitative changes in the nature of dream 'awareness' referring to these sensations. By using examples of kinesthetic imagery provided by participants in this mornings' panel discussion on experiential significance of lucid dreaming, as well as findings from my own studies of REM dream formation, I will try to illustrate how kinesthetic imagery is a central feature of the lucid dream experience which may, at times, constitute lucid 'awareness' itself.

Definition of Kinesthetic Imagery

Kinesthetic imagery, whether embedded in waking or dreaming imagery sequences, is a derivative of kines-thetic sensation. Kinesthetic sensation, in turn, is a property of an interactive network of afferent pathways providing moment-to-moment information about bodily orientation and movement. Afferent pathways subserving kinesthetic sensation include, for example, facial feedback systems signaling emotional expres-sion (e.g., Tomkins, 1982), muscular proprioceptors signaling features of body and limb movement (e.g., McCloskey, 1978), and vestibular and cervical reflex arcs signaling balance, posture, and eye and head movements. These kinesthetic sensations apparently comprise the affective, bodily substrate of ordinary waking self-awareness (e.g., Shapiro, 1985) and of moments of heightened self-awareness or affective insight (Kuiken, Carey & Nielsen, 1986). I propose further that imaginal derivatives of kinesthetic sensation comprise the affective substrate of self-involvement and awareness during dreaming, i.e., that normal and lucid dreaming are sensory events anchored in bodily felt imagery.

Kinesthetic imagery, then is characterized by the reproduction of waking bodily experience. In its most mundane form, kinesthetic imagery is nothing more than this, i.e., a veridical reproduction of some invariant waking kinesthetic sensation of the body at rest or in motion. Such mundane kinesthetic imagery includes the imagined sensations that form the typically unnoticed 'backdrop' of normal dreaming, e.g., sensations of embodiment, posture, orientation, balance, gravity, inertia, object contact, rhythm, acceleration, body and limb movement, facial movement, tendency to move-ment, gesture, and emotional expression.

However, kinesthetic imagery can frequently 'assume an extraordinary aspect; it can become a creative exten-sion of normal, waking kinesthetic sensation. Extraordinary kinesthetic imagery includes the bizarre imagined sensations that so frequently appear in the 'foreground' of lucid and other exceptional types of dreams, e.g., sensations of disembodiment, disorienta-tion, imbalance, inversion, loss of gravity or object contact,

paralysis, ineffectuality, suffocation, vibration, rotation, revolution, bodily distortion, bodily metamorphosis, exaggerated gesture, and atypi-cal emotional expression. The frequent association of such extraordinary imagery with lucid dreaming is not accidental. I am suggesting that such creative exten-sions of normal kinesthetic sensation may enable the occurrence of some equally extraordinary states of self 'awareness' during dreaming.

Examples of Kinesthetic Imagery in Lucid Dreaming

Some excellent examples of extraordinary kinesthetic imagery occurring during dream lucidity were provided by participants in the experiential panel. Beverly, for example, indicated that a criterion test of 'awareness of dreaming' is whether she is able to feel herself floating or flying. Others noted that illusory sensations of flying and of the body seeming to pass through solid objects are common lucid themes. Kenneth often determines he is conscious in his dreams when he can feel his bodily states; the most excep-tional example is of a whirling vortex sensation which evolves into a felt vibration. Stephen indicated that sensations of spinning and falling backwards are crucial in maintaining his awareness. Andrew referred to a feeling of rotating 180 degrees in his bed, sitting, and engaging in an inner struggle. Patrick described lucidity that follows a 'stereo out-of-body' experience in which he repeatedly feels himself pulled backwards, spun around, and so on. Debra added that awareness frequently includes tangible sensations of object contact in the dream.

Such examples are frequent in the lucid dreams literature. For instance, empirical analyses have shown that lucid dreams contain significantly wore kinesthesia themes (Gackenbach & Schillig, 1983) and balance themes (Gackenbach, in press) than non-lucid dreams. Similarly, a close examination of lucid dream collections (e.g., Moers-messmer, 1929; Gregory, 1984) confirms that the first moment of 'awareness' in many lucid dreams is preceded by or concurrent with some form of extraordinary kinesthetic imagery. Even when kinesthetic imagery is not reported to be present in such dreams, this may be due to difficulties in recognizing, recalling and describing kinesthetic attributes of the imagery. As mentioned above, kinesthetic imagery is frequently subtle or taken for granted (e.g., posture, orientation, balance) and, in comparison with visual imagery is not easily remembered (Posner, 1967). There may, in fact, exist cultural constraints which hinder the recall or con-ceptualization of kinesthetic images (Lerner, 1967; Schactel, 1959). Thus, unless controlled introspec-tive reporting of the kinesthetic features of lucid dreaming occurs immediately after awakening, these features may be overlooked, forgotten, masked or distorted in the dream report.

Implications for Research

If kinesthetic imagery, is indeed, a central feature of lucid dreaming, one implication for experimental research is that the domain of lucid experiences may be broader than the 'awareness of dreaming' criterion allows. For example, the Old Hag or

intruder dream, which occurs in up to 25% of the population in some regions (Hufford, 1982), consists of both intense kinesthetic imagery (e.g., paralysis, pressure on the chest, felt presences near the bed) and a type of false awakening typically associated with lucid dream-ing (e.g., a sense of being awake and present in the bedroom). Out-of-body dreams are another example of this juxtaposition of extraordinary kinesthetic im-agery with self-awareness. Thus, including Old Hag, out-of-body, and other related phenomena in the category of lucid dreams considerably broadens the size and general psychological importance of this category.

A second implication of this more specific definition of lucidity is that kinesthetic imagery parameters may be used to define dimensions of awareness in mundane dream reports. It is my personal impression that many everyday dreams - and especially those accompanied by salient kinesthetic sensations (e.g., dreams of ex-pressive dancing, intense emotion, physical exertion, or chase by a villain) - also contain qualities of indefinable 'awareness'. A detailed phenomenology of kinesthetic imagery could provide a means of identify-ing and defining such qualities.

A third implication of the kinesthetic imagery hypothesis presented here is that training in the 'skill' of lucid dreaming may involve alterations in the person's awareness and utilization of kinesthetic sensation. If there is, indeed, a therapeutic benefit in learning how to dream lucidly it may be due, in part, to a concomitant development of functions dependant upon kinesthetic sensation, such as a heightened ability to attend to 'inner' sensations, a heightened ability to generate and creatively apply kinesthetic images, improved balance and motor coor-dination, integration of body image, etcetera.

Experimental Inductions of Kinesthetic Imagery

Experimental inductions of extraordinary kinesthetic imagery during REM sleep contribute to an understand-ing of the processes of lucid dream formation. As I have described elsewhere (Nielsen, Kuiken & Rindlisbacher, 1985), when muscular kinesthesia in the lower limbs is increased during REM sleep, sub-sequently recalled dream reports contain significantly more kinesthetic imagery, especially kinesthetic imagery of the stimulated limb. Frequently, this imagery depicts hyperactive, repetitive or precise movement (e.g., acrobatic skiing, repetitive limping, manipulating objects with the feet). The experimen-tally altered imagery is replete with scenes in which the dreamer's balance is threatened (e.g., standing backwards on a high ladder, walking near a precipitous drop), disrupted (e.g., falling to the ground, teeter-ing on the dance floor), or augmented (e.g., pirouetting on a staircase, leaping from a shaky boat). Body imagery transformations are also frequent (e.g., obese/anorexic characters, face and limb distortions), as are various atypical or unusual body postures (e.g., chronic supine position, bodily lean-ing, bodily inversion). Abbreviated examples of some of these themes are presented in Table 1.

None of our first four participants undergoing kines-thetic stimulation were asked to attempt to dream lucidly, and none of them spontaneously reported doing so, as defined by the more conservative 'awareness of dreaming' criterion. However, using a more liberal definition of lucidity which includes the occurrence of kinesthetic imagery, three of our four participants were lucid to some degree. Specifically, these three participants reported variations of the Old Hag dream: one participant reported paralysis, orientation to the laboratory, extreme panic, and some dream control; another reported paralysis, orientation to the laboratory, fear, felt presence of an intruder in the bed, and breathing on the neck and back; another reported orientation to the laboratory, presence of an intruder in the bed, and intense sexual arousal. Moreover, all four participants in this experiment spontaneously reported that their experimentally altered dreams were qualitatively different, novel and bizarre when compared with their everyday dreams.

Table 1

Abbreviated Examples of Some Qualities of Kinesthetic Imagery Induced in Dreams With Right Leg Stimulation

Hyperactivity: I am skiing in our back alley. I go faster and faster, turning and fishtailing.

Repetitiveness: I limp on my right leg down a hallway. I turn and limp down another hallway. I do this several times, then I stop and look at myself in a mirror.

Precision: I reach out with my right leg from the bed and take the door with my toes. I push the door shut.

Balance Uncertainly: I am climbing down a precarious ladder. The rungs are too far apart and I am not sure I can step down to the next one.

Imbalance/Vertigo: I stumble into a house and fall onto my back. I am writhing around on my back at the foot of some stairs.

Balance Augmentation: I am standing in the prow of a shaky boat as it turns slowly in the water. When we near shore, I leap onto the dock.

Body Image Transfer: I reach down to touch my leg, but it is not where I expect it to be. It is floating off the floor somehow.

Postural Inversion: I am upside down being dragged down the hall by my leg. My body is straight up in the air and my head and neck on the floor.

Postural Leaning: We are driving along a river high on an embankment and at an angle. I am leaning sharply toward my right side and staring down into the dry river bed.

Lateropulsion: A bright light is emanating from the kitchen floor. As I try to cross the floor, a strong gravity from the light pulls me down and to my right side. I can barely resist it.

Anteropulsion: The experimenter is pulling on the electrode wires from the other room. My head is pulled backwards into the wall. I am irritated.

Circularvection: I climb a staircase two stairs at a time. At the top I leap in the air, pirouette, and land on my right foot.

In an experiment with two experienced and one inex-perienced lucid dreamers (conducted subsequent to this symposium), pre-sleep suggestions were given to both signal with eye movements and become ‘aware’ in the dream when the kinesthetic stimulus was applied. These suggestions led to signaling and reported ‘awareness of dreaming’ as well as vivid kinesthetic imagery in all three participants. This effect ap-peared after one night of exposure with the two experienced lucid dreamers, and after three nights of exposure with the inexperienced lucid dreamer. The lucid dreams varied in content from a mundane ‘awareness’ of orientation in the dream scene following a vigorous kinesthetic imagery sequence in two cases, to a more extraordinary ‘awareness’ of flying acrobatically and in an inverted position in one case. These findings strongly suggest that dreams accom-panied by ‘awareness of dreaming’ and dreams accompanied by extraordinary kinesthetic imagery are produced by similar mechanisms of kinesthetic excitation. They may differ only in the terminology chosen by the dreamer to verbally conceptualize his or her experience to an expectant experimenter.

Neurocognitive Processes in Lucid Dreaming

The results of this preliminary experiment implicate at least two groups of neural processes in the produc-tion of lucid dreaming:

(1) AFFERENT SENSORY PATHWAYS. Presumably, kinesthetic sensation normally affects some architectural processes of kinesthetic image formation during dream-ing despite the fact that there occurs both phasic and tonic inhibition of kinesthetic sensation during sleep (atonia). There is widespread reference to REM ‘paralysis’, but neurological studies have shown the afferent neural processes are only partially muted, not completely eliminated, during REM (e.g., Gucer, 1978). The demonstration of partial H-ref1ex damping during REM sleep given earlier in this symposium is a good example of this point. Disturbances in this diffuse system of afferent muting is likely respon-sible for the vivid kinesthetic images of bodily immobility and ineffectuality in nightmares and in the dreams of narcoleptics (cf. Liddon, 1967).

(2) CENTRAL VESTIBULAR NUCLEI. The high frequency of occurrence of balance themes in our experimental dreams implicates vestibular processes in the formation of kinesthetic lucid dream imagery. It is likely that the unilateral peripheral stimulus we administered during REM sleep disrupted a normally balanced input to the central vestibular nuclei, thereby creating illusory imbalance and instability in the dream structure. This explanation assumes that the central vestibular nuclei, perhaps by affiliation with the peripheral vestibular labyrinths, normally serve some orientational, stabilizing role in dream imagery formation. This is an assumption consistent with evidence that the lateral and descending vestibular nuclei are crucial mediators of phasic dreaming sleep (Pompeiano, 197k).

Neurocognitive Processes In Waking Kinesthetic Sensation

The definition of kinesthetic imagery under discussion further suggests that there is a continuity between, on the one hand, pathways associated with kinesthetic imagery formation and 'awareness' during dreaming and, on the other, the pathways associated with kinesthetic sensation and 'awareness' during waking. First, many of the extraordinary dream themes induced in our study are similar to the kinesthetic illusions which can be induced during wakefulness by experimentally altering the kinesthetic inflow from particular muscle groups. For example, illusions of falling forward or swan diving can be induced with bilateral vibration of
Achilles tendon; illusions of spinning can be induced with unilateral vibration of gluteus muscles, and so on (Lackner & Levine, 1979).

Second, there is some evidence that patients with lesions of the vestibular system experience frequent illusory body movement, such as hyperactivity, rota-tion, or vertigo, both while awake and while dreaming (Eisinger & Shilder, 1929). Perhaps not surprisingly, these patients report dreams containing many of the same themes found in our sample of experimentally-induced kinesthetic dreams. That is, both patients and experimental participants exhibited a variety of dreamed 'symptoms' attributable to disruption of the afferent sensory pathways and central vestibular nuclei (see Table 2). Some of the themes from our collection are rather striking parallels of vestibular dysfunction. For example, the nausea and vomiting dreamed by one experimental participant during kines-thetic stimulation resemble the symptoms of motion sickness. Similarly, the snow, fog and sensations of cold in other dreams may be varieties of the 'cold sweat' sensations associated with labyrinth stimulation. The similarities in kinesthetic content between the dreams of these two groups and the dreams of lucid dreamers should also be apparent. In Table 2, for example, it can be seen that the themes of falling, turning or spinning, and being pulled back-wards were all explicitly mentioned by the lucid dreamers as central to their sense of 'awareness'.

Finally, the waking-dreaming continuity hypothesis is consistent with recent experiments demonstrating an association between waking vestibular skills and dream lucidity. Frequency of lucid dreaming is greater among individuals who perform well on a waking balance platform task (Gackenbach et al, 1982) and who show less post-rotational disorientation (Hunt, this panel).

Table 2

Similarities in the Themes of Dreams Reported By Patients With Labyrinth Lesions (1) And Persons Receiving Kinesthetic Stimulation During REM Sleep (2)

1.	2.
Patient sinks down into the snow.	Person pushes a carriage through deep snow.
Patient is pulled backwards.	Person is pulled backwards by electrodes on her head.
A boy leans over a railing and falls.	Some friends lean over a railing; a man appears and falls over it.
Some horses fall down a hill.	A farmer wrestles a horse to the ground on a hill.
Patient is sitting in a train.	Person is sitting in a train.
Patient feels nausea.	Person feels nausea and vomits.
Patient's bed rises in the air.	Person's bed sinks down to the floor.
Standing near an abyss, patient staggers.	Approaching some stairs, person falls to the ground.
Patient is near a steep slope.	Person is on a steep hill.
	Person descends a steep ladder.
Patient dances on a spiral staircase.	Person climbs stairs two at a time, pirouettes at the top.
Patient sees a thick, gray fog and feels a terrible cold.	Person sees a while cloud and fog on a river and feels cold.

1. Eisinger & Schilder (1929)
2. Nielsen, Kuiken & Rindlisbacher (1985)

Conclusion

Together, the descriptive and experimental data reviewed underscore the role of kinesthetic imagery in dream 'awareness'. They suggest that extraordinary kinesthetic imagery is frequently the focus of many lucid dreams and that careful phenomenological assess-ments may reveal previously overlooked kinesthetic correlates of lucid dreaming. The data further demonstrate that kinesthetic stimulation administered during dreaming fairly dramatically alters the form of dreams, inducing them to manifest one or more of the various typical themes associated with lucid dreaming. These themes, in turn, are evidence for the existence of certain neural systems which may be involved in the generation and maintenance of lucid dreaming. These systems may be the same afferent sensory pathways and central vestibular nuclei necessary for the generation and maintenance of oriented, stable, and structured kinesthetic self awareness during wakefulness.

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