In: Parasomnia Dreaming
Editor: James Frederic Pagel
ISBN: 978-1-53617-815-9

Chapter 9

New Neuroimaging Technologies and Online Methods for Dream Content Analysis Make It Possible to Study Dreaming in Non-Disruptive and Low-Budget Ways in Sleep Medicine Clinics

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Abstract

After presenting an overview of information on the neural basis for dreaming, the gradual cognitive development of dreaming in children, and the quantitative findings on dream content collected in laboratory and non-

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laboratory settings, this chapter suggests ways in which sleep medicine clinics could engage in low-cost, completely objective, mostly automated dream research without interfering with normal clinical routines. The process would begin by adding a few simple questions about the patient's personal dream history to the intake questionnaire, which could be answered in writing, or by use of a voice recorder in a private space. The intake questionnaire first of all might lead to studies of the way in which lesions or major traumas effect the neurocognitive basis of dreaming. The intake questionnaire also might ask patients to write down the Most Recent Dream they can recall, a method that leads to samples similar to representative samples collected through two-week dream diaries. The Most Recent Dream method has been used successfully with pre-adolescents and adolescents in middle schools in four different countries, and with older adolescents in high schools, as well as with adults. Similarly, Most Recent Dreams could be collected at each follow-up visit, and would be useful in comparing diagnostic groups or patients put on new medications. Finally, the intake questionnaire might ask new patients to indicate if they have ever kept a dream journal containing 50 or more dream reports for a period of 30 or more days—and if so, when and for how long. Dream journals provide an excellent context for pre-and-post studies of medications as well as for general content analyses. Once the dream reports collected by means of the Most Recent Dream method, or from a dream journal, are digitized, the use of the keyword search program on dreambank.net, which includes numerous word strings of proven value, would solve the need for fast and reliable content analyses. The coding system and spreadsheet available on dreamresearch.net also could be used to supplement the results from keyword searches. Within this framework, a wide range of studies would be possible in addition to those mentioned earlier, such as studies of patients with extremely high or extremely low dream recall, or in studies of unique individual cases of potential theoretical significance in specifying the neural network for dreaming, including those rare but invaluable patients who say they have lost dreaming or have never dreamt.

INTRODUCTION: THE WHERE, WHEN, HOW, AND WHAT OF DREAMING

The numerous discoveries about dreaming and dream content that followed in the 35 years after the discovery of the REM/NREM sleep cycle in the 1950s, which often have been replicated, put dream research on a solid foundation for the first time. In addition to revealing the generally realistic nature of dream content, its consistency over time, and its continuity with waking person concerns, it revealed more cross-cultural similarities in dream content than cultural differences (e.g., Domhoff, 1996, 2003, 2018; Foulkes, 1985; Snyder, 1970). The new discoveries included the unexpected laboratory finding that dreaming is a gradual cognitive achievement that develops slowly between the ages of 5 and 12 (Foulkes, 1982, 1999; Foulkes, Hollifield, Bradley, Terry, & Sullivan, 1991). In the 1990s, these findings gradually were encompassed within the context of findings on the neural substrate that subserves dreaming, based on converging evidence from neuroimaging and lesion studies, which revealed that the neural substrate that subserves dreaming is far more circumscribed than previously imagined (Braun et al., 1997; Domhoff, 1996; Foulkes, 1999; Maquet et al., 1996; Nofzinger, Mintun, Wiseman, Kupfer, & Moore, 1997; Solms, 1997).

In the second decade of the twenty-first century, this new understanding of dreaming was extended by the realization that the neural substrate that supports dreaming is a portion of the waking default network, which supports imagination, daydreaming, creativity, mind-wandering and other forms of self-generated, spontaneous thought during waking life. More specifically, dreaming is based on highly activated neural substrates located in *portions* of the default network, including its dorsomedial prefrontal subsystem, its medial temporal subsystem, the lingual gyrus, and the caudate nucleus (Domhoff, 2011a; Domhoff & Fox, 2015; Eichenlaub, Bertrand, & Ruby, 2014; Fox, Nijeboer, Solomonova, Domhoff, & Christoff, 2013).

The two subsystems referred to in the previous paragraph, the dorsal medial prefrontal cortex and the posterior cingulate cortex, carry out slightly different imaginative tasks in waking life while at the same time working together in a harmoniously fashion. The dorsal medial prefrontal cortex system, which includes the dorsal medial prefrontal cortex, the temporoparietal junction, the lateral temporal cortex, and the temporal pole of the temporal lobe, is preferentially activated by instructions to think about the person's present situation or present mental state ("present self"). The medial temporal lobe system, which includes the ventral medial prefrontal cortex, posterior inferior parietal lobule, retrosplenial cortex, parahippocampal cortex, and hippocampal formation, is preferentially activated by thinking about personal situations and decisions in the future ("future self") (Andrews-Hanna, Reidler, Sepulcre, Poulin, & Buckner, 2010, pp. 554, 559). These results were supported and augmented in a later meta-analytic study (Andrews-Hanna, Smallwood, & Spreng, 2014).

Although the default network is normally constrained during waking by the frontoparietal control network, the dorsal attentional network, and the salience network, those three networks are significantly deactivated when dreaming occurs. Thus, dreaming is enabled by a relatively unconstrained and highly activated portion of the default network. Within this context, it is also now known that only brain lesions within the default network can lead to the loss or alteration of dreaming, and that only electrical brain stimulation in the medial temporal lobe, which is part of the default network, can lead to a sense of dreaming, or of recalling a dream (Bischof & Basset, 2004; Curot et al., 2018; Domhoff, 2018; Poza & Marti-Masso, 2006; Solms, 1997).

The inclusion of networks for mental imagery within the default network is crucial because vivid mental imagery is one of the striking characteristics of dreams (Moulton & Kosslyn, 2011, p. 98). In addition, there are overlaps between the default network and the social brain, with one comprehensive synthesis concluding that parts of the social brain are the "social-affective part" of the default network (Amft, Bzdok, Laird, Fox, & Schilbach, 2015). Then, too, the wide range of thoughts related to the past, present, and future that can arise during drifting waking thought and dreaming may be possible because there is a "striking overlap between the cortical network that mediates contextual associative thinking" and the default network (Bar, 2011, p. 17, including Figure 2.3). In addition, the inclusion of language areas in the temporal lobes within the default network is consistent with the frequency and specificity of language use in dreams (Foulkes et al., 1993; Meier, 1993). Finally, the fact that the medial prefrontal cortex, a key hub in the self-system, is part of the default network may help account for the highly personal focus of most dream content (e.g., Amft et al., 2015; D'Argembeau et al., 2012; Di & Biswal, 2014; Heatherton, 2010; Jenkins & Mitchell, 2011). One such study found that focal lesions to the medial prefrontal cortex reduce self-referential processing of stimuli, which indicates that this brain region is "important for self-referential processing and the neural representation of self" (Philippi, Duff, Denburg, Tranel, & Rudrauf, 2012, p. 475).

At the cognitive level, dreaming appears to be based on the process of simulation, a form of off-line thinking in which people imagine themselves as being in a hypothetical scenario and exploring possible outcomes (Buckner, Andrews-Hanna, & Schacter, 2008; Schacter, Addis, & Buckner, 2008). Moreover, dreaming is an enhanced form of simulation, called "embodied simulation," in which people experience themselves as being in hypothetical scenarios that include a vivid sensory environment, interpersonal interactions, and emotions (Domhoff, 2019; Gibbs, 2006)}. The defining feature of dreaming is therefore the sense of being a participant in (or observer of) an ongoing real event, which sometimes is thought of as a real experience for several seconds or minutes after awakening.

As a result of the realistic feelings that often accompany dreaming, dreams have parallels with theatrical plays because the dreamer and the other characters are usually engaged in one or another activity or social interaction within a setting, or series of settings, and sometimes express thoughts or emotions. In a study based on a normative non-lab sample containing 991 dream reports from young women and men, 86.9% of the dream reports included a social interaction or shared social activity, 6.7% included the dreamer seeing, hearing, or thinking about another dream character, 2.2% included only the dreamer and at least one animal, and 4.3% included only the dreamer engaging in an activity (Domhoff & Schneider, 2018, p. 10 Table 3, for a summary of the findings).

Dreaming may therefore be best defined as a simulated subjective experience in which dreamers experience themselves as embodied participants in (or embodied observers of) an event, almost always involving characters, activities, and/or social interactions. This sense of experiential involvement in an event is what distinguishes dreaming from other forms of thinking during sleep, such as isolated imagery or repetitive thoughts, as well as distinguishing dreaming from mind-wandering, whether the mind-wandering occurs during NREM 2 or as part of waking thought when not engaged in a focused task. This point is reinforced by the fact that dreams can last as long as 15-30 minutes, are experienced as “real” while they are happening, and are often remembered upon awakening, at least temporarily, as an actual experience.

In addition, it can be stated that dreaming occurs spontaneously if and only if the following six specific conditions exist. There is:

1) a mature neural substrate that can support the cognitive process of dreaming, a qualification that allows for neural development in childhood;
2) an intact neural substrate that can support the cognitive process of dreaming, which takes into account the loss of dreaming due to specific brain lesions;
3) an adequate level of cortical activation, which is provided by subcortical ascending pathways and crucial regions in the hypothalamus;
4) an occlusion of external stimuli, which likely involves the posterior thalamus;
5) a cognitively mature imagination system, which allows for childhood cognitive development, a necessity that is indicated by the virtual lack of dreaming in preschoolers, by the low frequency, complexity, and emotionality until ages 9-11, and its lack of adultlike content until ages 11-13;
6) a loss of conscious self-control, which may be neurologically mediated by the decoupling of the frontoparietal, dorsal attentional, and salience networks from the functional subsystems of the default network that remain activated during dreaming.

Based on these understandings, it is possible to envision a neurocognitive framework for thinking about dreams that could be tested and augmented as part of the routine practices with a sleep medicine clinic, with a focus on both group studies and unique individual cases of the kind that sometimes have greatly advanced the understanding of waking thought (e.g., Phineas Gage and H.M.).

If such a view were to be supported, it could lead to a neurocognitive approach to dreaming that includes all three of the “distinct but interdependent levels” that are the hallmarks of all theorizing in cognitive neuropsychology: the underlying neural substrate, the cognitive processes it supports, and the output or behavioral level, which means “verbal reports” in the case of dreaming (Ochsner & Kosslyn, 2014, p. 2).

The examples of possible dream studies in a sleep medicine clinic in the next two sections of this chapter assume that the primary mission of sleep medicine clinics is to help people with sleep problems, and that there can be no changes in normal clinical routines. The examples also assume that the studies have to be unobtrusive and low in cost. Moreover, these examples are not exhaustive, nor necessarily relevant to the interests of practitioners in specific sleep clinics. They are meant to stimulate ideas.

NEUROCOGNITIVE STUDIES OF DREAMS IN A SLEEP MEDICINE CLINIC

Based on both tantalizing findings in past studies and new possibilities that have arisen with the increase in waking neuroimaging findings that may provide new leads for the study of dreaming, this section provides examples of how participants in such studies could be located among patients that arrive to sleep medicine clinics, as well as technologies that might make these studies feasible.

The process of finding patients that might be usefully studied could begin with questions that concern any changes in their dreaming over the past year, with the goal of finding patients who may have started to have nightmares during the sleep-onset process, started to have nightmares during sleep, started to dream excessively, stopped dreaming, or who no longer see visual imagery during dreaming. In studying such patients, there are predictions, based on past lesion findings, that could be made as to the specific neural changes that might be found through neuropsychological examinations and neuroimaging studies (Bischof & Basset, 2004; Domhoff, 2018, Chapter 5, for a summary; Poza & Marti-Masso, 2006; Solms, 1997, for all past studies through the mid-1990s as well as his own original findings).

Questions concerning changes in dreaming also might be useful in locating patients who started having frequent nightmares in relation to an extreme trauma. There is some evidence, which needs further development, that patients with frequent nightmares, including those who are victims of PTSD, have abnormally activated brains during sleep; at least one of these studies implicates the threat-detection system that has key hubs in one region of the amygdala (e.g., Ebdlahad et al., 2013; Germain, Jeffrey, Salvatore, Herringa, & Mammen, 2013; Marquis, Paquette, Blanchette-Carrière, Dumel, & Nielsen, 2017; Mysliwiec et al., 2014; Simor, Horváth, Ujma, Gombos, & Bódizs, 2013). It seems likely that the normal neural substrate that supports dreaming is expanded in nightmare sufferers.

Finally, it would be very worthwhile to have a question that could find the rare few people who say they never have dreamt. A complete study of a few non-dreamers might prove to be very valuable in understanding dreaming. The potential for such studies is seen in an earlier study in a sleep medicine clinic, which began with a question included on the intake questionnaire over a five-year period (Pagel, 2003). The researcher found 16 patients that reported they had never dreamt; they repeated this claim in a follow-up telephone interview, which led to the estimate that 0.38 percent of the total patient population consisted of people who never had dreamt. (Pagel, 2003, p. 238). They were then studied during one-night visits to the clinic, in which none of them reported a dream from a total of 36 REM sleep awakenings. There were no differences between these non-dreaming patients and a control group of rare dreamers, who did recall a few dreams from REM sleep awakenings, on standard polysomnographic, clinical, and demographic variables.

However, there could be no thought at that time of carrying out neuroimaging studies because the default network had just been discovered and was barely known outside the small group that studied it in the late 1990s, according to two first-hand accounts (Buckner, 2012; Raichle, 2009). The first major publications on it occurred just after the turn of the century

(Gusnard, Akbudak, Shulman, & Raichle, 2001; Raichle et al., 2001). In addition, the possible basis of dreaming in portions of the default network was not discussed until 10 years later (Domhoff, 2011b; Pace-Schott, 2011).

Without the information that a highly active default network during waking was linked to mind-wandering and daydreaming, it was not possible to refer these patients for neuroimaging studies. Nor would it have seemed feasible at that time to ask these non-dreamers about their daytime mental imagery, which might have helped to link dreaming to a lack of waking visual spatial skills, or by an inability to generate any mental imagery. Such a possibility in the case of visual mental imagery had been noticed on the basis of very low dream recall from REM awakenings in two average-IQ preadolescent boys in a longitudinal study of children and adolescents ages 3-15 that included waking tests of visual-spatial skills (Foulkes, 1982, pp. 181, 225-226). Similar findings also were found for a few of the respondents in a study focused on adult non-dreamers, who were recruited through newspaper advertisements; however, the sample was too small to be more than intriguing and was soon lost from sight (Butler & Watson, 1985).

The range of studies of the cognitive process of dreaming and the neural substrate that supports dreaming that are possible might be widened if a sleep medicine clinic has a working relationship with units for the treatment of specific disorders, such as OCD, panic disorders, or PTSD. Perhaps just as valuable, if not more so, although not necessary, it might be useful for some clinics if they could refer sleep patients for neuropsychological assessments that might reveal focal brain injuries that would make it possible to shed new light on dream disorders, such as the loss of visual dreaming, excessive dreaming, a sudden increase in nightmares, or the complete loss of dreaming.

Neuroimaging studies of dreaming may become even more feasible with the increasing availability of the lower-cost neuroimaging technology called functional Near Infrared Spectroscopy (fNIRS), which in its portable form involves a device \ about the size of a large microwave. It readily used by easily placing a “swimming cap” on the patient’s head, which is similar to an EEG cap. Not only is fNIRS less expensive to purchase ($100-200,000), it does not require the presence of a technological expert (Cui, Bray, Bryant, Glover, & Reiss, 2011). Neuroimaging studies based on the use of fNIRS could become even less costly if clinics were in larger units that already have fNIRS machines that are only used during the day.

Beyond the cost advantages, fNIRS is in many ways superior to fMRI, even though it does not reach into subcortical regions. It is portable, tolerates motion well, and can be utilized at the person's home (e.g., Balconi & Molteni, 2016; Bulgarelli et al., 2018; Cui et al., 2011; McKendrick, Parasuraman, & Ayaz, 2015). It is used by some neurocognitive researchers to study adults while they are walking and to study the prefrontal cortex in infants while sitting in their mother's laps (Grossmann, 2013; Hamaker & Wichers, 2017). Equally important, fNIRS already has been used to detect the default network studies not focused on dreams (Durantin, Dehais, & Delorme, 2015; Harrivel, Weissman, Noll, & Peltier, 2013; Sasai et al., 2012). It has been used in studying sleep in at least one instance, but the participants were taking an afternoon nap while sitting in a chair, so if it remains to be seen how well it might work in a bedroom at night (Nguyen et al., 2018). Finally, fNIRS works readily with other measuring technologies, including high-density EEG (Pan, Borragán, & Peigneux, 2019).

Circling back to the issue of the rare few people who are non-dreamers (Pagel, 2003), it might be that an ideal study of them would involve the placement of a portable fNIRS device in their bedrooms at home, which could be further supplemented by adding a program to an iPhone that would signal researchers to call the sleepers and have them report what was going through their minds at the time of the call.

STUDIES OF DREAM CONTENT COLLECTED IN A SLEEP MEDICINE CLINIC

With or without studies focused on dreaming as a neurocognitive process, it would be possible to do excellent studies of dream content in a sleep medicine clinic. First of all, such studies could focus on large samples of dream reports, which could be collected through the Most Recent Dream Method. In previous studies, the Most Recent Dream method (hereafter called the MRD method) involved asking students in classrooms and adults at meetings or conferences if they would voluntarily and anonymously write down the most recent dream they remember. The MRD form emphasizes the dream may have been recalled earlier that day, a few days before the request, or in the previous week or month, but it should be the most recent one they recall. To prime for recency, potential participants were asked to write down the date of the dream before they wrote out the dream report, which usually takes anywhere from five to 15 minutes with adults. Potential participants were told that they could choose not to participate; those who choose not to do so were told on the form that they could write what they wished to on the form and then not turn it in, or simply sit quietly and read. (An example of the form that is used appears in Appendix X, and a pdf of the form can be download from DreamResearch.net at https://dreams.ucsc.edu/Forms/most_recent_dreams.html).

The MRD method has been used to study normative samples of college students in Iran, Japan, South Africa, the United States, and Wales, as well as the elderly in Switzerland and animal rights activists in the United States (Domhoff, 1996, p. 67; Domhoff, Nishigawa, & Brubaker, 2004; Lewis, 2008; Malcolm-Smith & Solms, 2004; Malcolm-Smith, Solms, Turnbull, & Tredoux, 2008; Mazandarani, Aguilar-Vafaie, & Domhoff, 2013; Strauch, 2003; Tartz & Krippner, 2017). It also has proven to be useful with preadolescents as young as the fifth grade (ages 10-11) in Spain, Italy, and Greece as well as the United States (Avila-White, Schneider, & Domhoff, 1999; Crugnola, Maggiolini, Caprin, Martini, & Giudici, 2008; Karagianni, Papadopoulou, Kallini, Dadatsi, & Abatzoglou, 2013; Oberst, Charles, & Chamarro, 2005; Saline, 1999).

In addition to collecting a MRD each time a patient arrives to the clinic, it would be useful to ask patients on the intake questionnaire or during an intake interview if they have ever kept, or are keeping, a dream journal for a period of 30 or more days that contains 50 or more reports-- and if so, when and for how long. Such dream journals, rare though they indeed are, could be invaluable in pre-and-post studies of individuals who are suffered a brain injury or a psychological trauma, and for studies of the effects of new medications on dream content. (Based on surveys in classrooms and informal surveys of audiences at talks, this author estimates that about 1-3% of people from ages 16 through adulthood have kept a dream journal at least once for 30 days or more).

Dream journals are kept by a diverse set of individuals in many parts of the world for their own widely separate reasons, which very rarely have anything to do with psychotherapy or an interest in any dream theory (e.g., Bell & Hall, 1971; Domhoff, 2018, Chapter 4; Hall & Lind, 1970; Smith & Hall, 1964). In the case of dream research in a sleep medicine clinic, dream journals are ideal as baselines for pre-post studies with unique patients or patients who are about to be put on new medication. (A pilot study that provides a good example of the possibilities for such studies is summarized at the end of this section.) Even without the possibility of studying the effects of medications with a person who has kept a dream journal, there is much to be learned from any dream journal that is identified and offered for study.

The dream series contained in dream journals are a form of unobtrusive, nonreactive archival data, uninfluenced by the demand characteristics, expectancy effects, or social desirability factors that can arise as subtle confounds in experimental settings using either humans or other animals (e.g., Kihlstrom, 2002; Rosenthal & Ambady, 1995). #2113; Harari, 2016 #2618; Webb, 2000 #2639}. They are not case studies, at least in the usual clinical sense of that term, because their quantitative nature makes them directly comparable, and they can be compared with norms. In those regards, the quantitative studies of dream journals are more akin to personality tests such as the MMPI or the items used in the test associated with the Five-Factor Model.

Quantitative studies of about two dozen dream series using the HVdC (1966) coding categories have revealed that the main characters, avocations, and personal preoccupations expressed in the dream reports are consistent over months, years or decades (Domhoff, 1996, Chapter 7; 2018, Chapters 3-4). Moreover, dream series provide a good opportunity for studies examining the degree to which the conceptions and concerns found in dream reports through quantitative content analyses also might be present in waking thought. This search for continuities between dreaming and waking thought can be studied by asking participants to confirm or reject a series of inferences based on blind quantitative analyses of a dream series, in which the dream researcher knows little or nothing about the dreamer at the outset. These inferences are based on comparisons of the results with normative samples to find high or low frequencies, percentages, and ratios. This strategy is possible because studies of both group data and dream journals have shown that the frequency of the appearance of an element in dream reports is related to the intensity of a waking personal concern (Domhoff, 1996, Chapter 8; 2018, Chapters 3-4; Hall & Van de Castle, 1966, pp. 13-14).

Studies of roughly a dozen dream series based on this strategy have shown that there is usually considerable continuity between the frequency with which specific people and avocations appear in a dream series and the intensity of waking personal concerns about those people and avocations, thereby replicating the general finding that frequencies in dream series reveal the intensity in concerns in waking life (Domhoff, 1996, Chapter 8; 2018, Chapters 3-4, for summaries).

As to how to analyze the dream reports, whether they are collected through the MRD method or from individual dream journals. there are two methods. The first and oldest one is based on a time-tested and frequently used coding system, which contains 10 general categories and numerous subcategories, rests on the nominal (categorical) level of measurement, has high reliability, includes normative baseline findings for both women and men, and is available to all dream researchers on DreamResearch.net (Hall & Van de Castle, 1966). It includes a spreadsheet (DreamSAT) for analyzing the codings, and provides p values and effect sizes, and a correction formula for multiple tests of the same pair of samples. The results provided by DreamSAT are displayed in either tables or bar graphs called h-profiles. The one drawback for use in low-budget studies in an applied context is that it is labor-intensive.

The second method, and the one more likely to be used in a clinical setting, at least for preliminary studies, is based on word, phrase, and word-string searches that are facilitated by an online platform for dream researchers that is accessible at DreamBank.net (www.dreambank.net). It can be used to analyze any set of digitized dream reports, which can be stored in a password-protected private space, which is accessible only to the researchers who collected the dream reports. The findings from the searches, which appear within a space of several seconds, are automatically analyzed using programs built into the website (see Domhoff & Schneider, 2008; 2020, for accounts of the capabilities built into DreamBank.net).

DreamBank.net also contains 25,000+ dream reports in English and 5,000+ in German, which were collected in a variety of lab and non-lab settings (but never from the Internet). Specific sets or series in this large collection can be used as normative baselines for purposes of some studies. Using DreamBank.net as a starting point or model, it also might be feasible for a sleep medicine clinic, or several sleep medicine clinics, to develop a common data-analysis unit specific to their own needs and goals. Relevant software could be borrowed from DreamBank.net, and the expert who created DereamBank.net, Adam Schneider, could be consulted (http://adamschneider.net/adam.html).

The creation of word strings, whether they are generic, and can be used with any set of dream reports, or individually tailored for the study of individual dream journals, carry out all four steps of a quantitative content analysis in a matter of seconds or minutes. The word strings entered into the search program define the category's breadth and limits exactly. Since the same results are guaranteed each time the sample is searched, the categories have perfect reliability. The search engine also provides instant frequency counts. It also creates analyses in the form of percentages. The fourth step of any content analysis, a comparison with a normative or control group, can be carried out by applying any given word string to the dream reports from the women or men that were used in creating the Hall and Van de Castle (1966) normative findings, or by making use of a relevant dream series that is available on DreamBank.net. (Hereafter the Hall and Van de Castle (1966) coding system will be called HVdC).

Generic word strings concern topics that are likely to be relevant in the lives of most individuals and at the same time are described in a relatively circumscribed number of words that are commonly used by most people.

Examples include word strings for sensory terms, pet animals (e.g., dogs and cats), and religion. For the purposes of research in a sleep medicine clinic, the generic emotion word strings are far more relevant. They are comprehensive, are based on words that reflect the five emotion categories in the HVdC system, and provide reasonably similar results to those provided by a labor-intensive coding for emotions using the HVdC categories. They have been used in several studies (Domhoff, 2018, Chapters 3-4, for summaries).

A good example of the usefulness of an individually tailored word string can be found in a study of 2,022 dream reports from a college student (Domhoff, 2018, pp. 42-45). This dream series also was studied using the generic word string for emotions mentioned in the previous paragraph as well as with selected HVdC coding categories. The convergent results are summarized briefly in a chapter on dream series (Domhoff, 2018, pp. 93-95). The dream series itself can be found on DreamBank.net under the pseudonym “Kenneth,” along with most of the other dream series that have been studied in the past.

More recently, a study using individually tailored word strings, created separately for two different dream journals from young women, one containing 4,329 dream reports, the other containing 664 dream reports, showed that there is both consistency and continuity in dream content from ages 13-14 to the mid-20s (Domhoff & Schneider, 2020). (These two dream series are available on DreamBank.net under the pseudonyms “Izzy” and “Jasmine”).

A CONTENT ANALYSIS BASED ON GROUP DATA FROM PSYCHIATRIC PATIENTS

Two types of studies, as briefly mentioned earlier, would be possible using MRD’s First, it would be possible to do studies of patients with specific diagnoses, such as panic disorder, chronic anxiety disorders, OCD, sleep-onset disorders, or PTSD. Second, sleep medicine clinics that provide medications to patients who visit regularly for check-ups or prescription renewals would be good candidates for well-controlled studies. In either case, or in the case of studies that might attempt to determine which kinds of medications work with which kinds of patients, the patients would be asked to provide an MRD upon their initial arrival to the clinic, and then to provide and MRD on each subsequent visit. If 125 patients eventually provided at least original in-take and last-visit dream reports, but hopefully with reports from intermediate visits as well, it would be possible to carry out studies of changes in dream content over time to determine the effects of the medication on dream content, and perhaps to determine if any changes are correlated with waking tests or patient ratings on a well-being scale. In particular, it might be expected that the medications would reduce aggressive interactions, increase friendly interactions, and lead to a decrease in negative emotions in dream content.

There have, in fact, been few solid studies of the dreams of patients with one or another diagnosis, as numerous review articles have shown down through the decades (Domhoff, 1996, pp. 184-189; Kramer, 2010; Skancke, Holsen, & Schredl, 2014). Nor have there been any studies leading to consensus on the effects of medications on dream content, a topic that is reviewed further in the context of the subsection on the analysis of individual dream journals.

One of the few rigorous studies of differences among various types of psychiatric patients, published 54 years ago, demonstrates what might be possible with group data collected via MRDs. It showed that the various patient groups all included less characters who were named as friends and less friendly interactions. (These two categories differ because friends do not always have friendly interactions with the dreamer, and friendly interactions can happen with family members and strangers as well as friends.) The study was based on 211 dream reports collected from 50 male patients, who were grouped into four diagnostic categories: five patients who were both schizophrenic and alcoholic, 20 patients who were schizophrenic, 15 patients who were alcoholics, and 10 patients with a variety of other diagnoses.

Using the HVdC coding system, the four sets of dream reports were compared with each other and with the HVdC male norms for characters, social interactions, success and failure, misfortune and good fortune, and eating and drinking. Surprisingly, there were very few differences among the groups or with the male norms (Hall, 1966). However, there was one potentially useful difference between the dream reports of the 50 patients as a whole and the male norms: lower percentages and ratios having to do with friends and friendly interactions. Specifically, the patients' friends percent (all friends divided by all characters), F/C index (the total number of friendly interactions divided by the total number of characters, and percentage of dreams with at least one friendly interaction were below the male norms. Since most of these differences are slightly larger for the 105 dreams reports from schizophrenics, Table 1 compares the findings from their dreams with the male norms on the six indicators related to aggression and friendliness.

A DRUG STUDY BASED ON A DREAM JOURNAL

As in the case of past studies of people with different psychiatric diagnoses, which have added up to very little, so, too, the past studies of the effects of medications on dream content have been mixed at best (Armitage, Rochlen, Fitch, Trivedi, & Rush, 1995; Roth, Kramer, & Salis, 1979). One of the few systematic studies of the effects of a medication that detected any differences involved a relatively short series of dream reports from a young college woman suffering from a variety of symptoms. Since the study involves only one participant and has fewer than the 125 dream reports for each condition that would be ideal in terms of sample size, it is best viewed as a pilot study.

The student had written down 33 dream reports in her first year of college as part of the therapy she was receiving from the campus counseling center for anxiety and mild depression. After abandoning the therapy because she did not feel it was helping her, during her junior year she saw a psychiatrist and was placed on the SSRI sertraline (Zoloft), with her dosage gradually increasing from 25 to 100 milligrams before her light-headedness and panic attacks subsided. A year later, she recorded 40 dreams while still taking Zoloft for possible use in a research project in a psychology course. Based on the pre-medication and on-medication dream series, Kirschner (1999) discovered that the second set of dream reports greatly differed from the first set on several HVdC content indicators. In particular, she moved further above the norms on the friends percent and the F/C index, and closer to the norms on the A/F% (all aggressions divided by all aggressions + friendliness), the A/C index (all aggressions divided by the total number of characters), and the percentage of dreams with at least one aggressive interaction (Domhoff, 2015, pp. 75-72 and Table 6.2 for a summary of the main results; Kirschner, 1999, for the original study).

Although this particular study, and most previous studies of dream journals, have been carried out using the HVdC coding system, it is also possible to do studies using the generic work strings that work with any sample of dream reports, as discussed at the outset of this section.

CONCLUSION

As the overview of the scientific literature at the outset of this chapter suggests, there is now a solid foundation for future dream research because much is known about the where, when, how, and what of dreaming. However, there is even more that is not known at the same time as the number of dream researchers is dwindling, and only three or four of them have access to sleep-dream labs or neuroimaging technology. Ironically, dream researchers may have worked themselves out of government and foundation financial support by showing that dreaming is more frequent, regular, and mundane than had been imagined in the past, and therefore unlikely to be of major help in solving the problems of psychosis, as often claimed in the past, or in providing deep insights into people's darkest secrets, as also often asserted in the past.

Not only are there fewer dream researchers, but it may be that many future advances might be more possible in clinical settings, including sleep medicine clinics. More needs to be known about PTSD nightmares and about nightmare sufferers in general, which in both cases may involve expansions or disruptions of the neural substrate that normally supports the relatively mundane process of dreaming, with 96-99% of dreams never remembered by most people, and the few that are remembered soon forgotten.

Similarly, there are people who have trouble falling asleep, and more needs to be known about the role of the default network and/or overly vivid dreaming in creating this disorder in one or more stages of the eight-stage sleep onset process. The role of overly activated default networks and/or dreams may be a factor in one or more of the types of insomnia, a topic that has not been discussed in this chapter.

Over and beyond the role of dreaming and nightmares in various parasomnias, there is also the possibility of new general discoveries via very atypical patients, such as those who turn out of have previously undetected brain lesions, or a lack of visual imagery, or developmental irregularities at the level of cognition. And once again, there are the elusive non-dreamers, and the lure of what might be revealed about the basis of dreaming, or about its adaptive function, by studying them with comprehensive cognitive, neuropsychological, and neuroimaging assessments.

The search for the Phineas Gage or H.M. of dreaming is just beginning.

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