
NEW APPROACHES IN THE EMPIRICAL STUDY OF DREAMS

Kelly Bulkeley

Introduction

Since the beginning of recorded history, humans have been seeking to understand the empirical patterns of meaning in their dreams. By “empirical,” we are speaking here of patterns that can be observed and identified in evidence that is available to everyone for review. There are many possible dimensions of meaning in dreams, but not all of them are available to everyone in this empirical sense. Some of these dimensions can only be accessed by the dreamer. Some only emerge from theoretical frameworks. And some require a detailed knowledge of the dreamer’s cultural and historical context to fully understand. There may be valid and valuable insights gained from each of these approaches, but they each have the drawback of being difficult to communicate, test, and verify. The task is finding a way to convey the basic findings of modern dream research to people who might know nothing about it, and indeed who might be skeptical that dreams have any actual significance at all. How can we provide clear, easily accessible empirical evidence in favor of the meaningfulness of dreaming? Answering this question is a central challenge for dream researchers in the twenty-first century.

This paper offers one possible answer to that question, in the form of a new technological resource, the Sleep and Dream Database (SDDb) and its suite of tools for pursuing a genuinely empirical study of the meaningful patterns of dreaming. The paper will show how using the

tools of the SDDb, specifically the survey analysis and word search functions, can provide anyone with the resources to explore large collections of dreams, analyze them in different ways, and develop one's own ideas and interpretations that can easily be tested, refined, and shared with others. To be clear, even more sophisticated dream analysis systems exist now and will be developed in the future. The goal of this paper is not to treat the SDDb as a singular phenomenon, but rather to use its tools as a means of providing readers with an initial orientation to the new world of dream discovery that has opened up thanks to these kinds of technologies. The paper will close with reflections on the interplay of dreaming and technology.

Background

Several other researchers have been working in this direction for more than a century and the present paper builds on their methods, findings, and insights. Perhaps the earliest empirical dream researcher in the modern sense was Mary Whiton Calkins, whose 1893 paper "Statistics of Dreams" provided a detailed analysis of the most easily observable features of two dream series, one from herself and the other from one of her colleagues.¹ Others who pursued the analysis of large collections of systematically gathered dreams include the anthropologist Dorothy Eggan, who studied the dreams of the Hopi native people of the American Southwest;² the psychologist Calvin Hall, who along with Robert Van de Castle created a widely-used coding system for the quantitative analysis of dreaming;³ and the social psychologist G. William Domhoff, who with his colleague Adam Schneider, have carried Hall's work into the digital resource of Dreambank.net.⁴ The SDDb

¹ Mary Calkins, "Statistics of Dreams," *The American Journal of Psychology* 5 (1893): 311–343.

² Dorothy Eggan, "The Manifest Content of Dreams: A Challenge to Social Science," *American Anthropologist* 54 (1952): 469–485, <https://doi.org/10.1525/aa.1952.54.4.02a00020>; Dorothy Eggan, "Dream Analysis," in *Studying Personality Cross-Culturally*, ed. Bert Kaplan (Evanston: Row, Peterson and Co., 1961), 551–557.

³ Calvin Hall and Robert Van de Castle, *The Content Analysis of Dreams* (New York: Appleton-Century-Crofts, 1966).

⁴ George William Domhoff, *Finding Meaning in Dreams: A Quantitative Approach* (New York: Plenum, 1996); Inge Strauch and Barbara Meir, *The Scientific Study of Dreams: Neural*

derives much of its inspiration and guidance from the efforts of Domhoff and Schneider with the Dreambank. Also deserving mention in this realm are Inge Strauch and Barbara Meir, Ernest Hartmann, Harry Hunt, Rosalind Cartwright, Michael Schredl, James Pagel, Sophie Schwartz and Pierre Maquet, and Han and colleagues, all of whom have developed innovative methods of identifying empirical patterns and themes in dreams.⁵

Not high on this list are Sigmund Freud and Carl Jung, the two giants of modern dream psychology.⁶ Freud did not dismiss empirical dream research per se (in the *Interpretation of Dreams*, he refers favorably to Calkins), but he built his ideas primarily on the foundations of clinical and cultural research data. Jung actively affirmed the value of studying dreams in a series to highlight the recurrent images, conflicts, and motifs. However, other than his examination of the dream series of Wolfgang Pauli, a famous physicist who came to him for treatment, Jung did not pursue this insight about the empirical patterns of dream content in any active way. And even in his study of Pauli's dreams, Jung focuses on the exploration of archetypal symbolism, which can be compelling but does not include any quantitative analyses that might help to ground and clarify the qualitative interpretations. Freud and

Networks, Cognitive Development, and Content Analysis (Washington: American Psychological Association, 2003).

⁵ Han et. al., "The cognitive social network in dreams: Transitivity, assortativity, and giant component proportion are monotonic," *Cognitive Science* 40, no. 3 (2016): 671–696, <https://doi.org/10.1111/cogs.12244>; Ernest Hartmann, *Dreams and Nightmares: The Origin and Meaning of Dreams* (New York: Basic Books, 2000); Harry Hunt, *The Multiplicity of Dreams: Memory, Imagination, and Consciousness* (New Haven: Yale University Press, 1989); James Pagel, *The Limits of Dream: A Scientific Exploration of the Mind/Brain Interface* (New York: Academic Press, 2010); Michael Schredl, "Dream Recall: Models and Empirical Data," in *The New Science of Dreaming*, Vol. II, eds. Patrick McNamara and Deirdre Barrett (Westport: Praeger, 2007), 79–114; Sophie Schwartz and Pierre Maquet, "Sleep imaging and the neuro-psychological assessment of dreams," *Trends in Cognitive Sciences* 6, no. 1 (January 2002): 23–30, [https://doi.org/10.1016/S1364-6613\(00\)01818-0](https://doi.org/10.1016/S1364-6613(00)01818-0); Inge Strauch and Barbara Meir, *In Search of Dreams: Results of Experimental Dream Research* (Albany, New York: State University of New York Press, 1996); Rosalind Cartwright, *The 24-Hour Mind: The Role of Sleep and Dreaming in Our Emotional Lives* (New York: Oxford University Press, 2010).

⁶ Sigmund Freud, *The Interpretation of Dreams*, trans. James Strachey (New York: Avon Books, 1965); Carl Jung, *Children's Dreams: Notes from the Seminar Given in 1936–1940*, trans. Ernst Falzeder and Tony Woolfson (Princeton: Princeton University Press, 2008).

Jung's general theories of dreaming are always worth keeping in mind, and perhaps in future developments of the technologies discussed here, it will be possible to integrate their ideas into a kind of hybrid or "centaur" model of dream interpretation. We will return to this topic in the conclusion.

Overview of the SDDb

The Sleep and Dream Database (SDDb) is a digital archive designed to promote an empirical, hands-on approach to dream research. The SDDb enables users to apply the basic tools of data analysis to identify meaningful dimensions of dreaming experience. The goal of the SDDb is not to replace other modes of dream interpretation, but rather to complement and enrich them with new insights into the recurrent patterns of dream content. Anyone who studies dreams, from whatever perspective and for whatever purpose, can benefit from knowing more about these basic patterns. As noted above, the SDDb is not the only online resource for this kind of approach to the study of dreams. The Dreambank.net website run by G. William Domhoff and Adam Schneider also has a large online collection of dream reports gathered by various researchers that can be searched and analyzed in many ways. The future will likely witness the development of many other online databases with valuable collections of dream material. The focus here is on the SDDb, but the following discussion highlights important methodological principles that apply to all forms of digitally-enhanced dream research.

The SDDb currently contains more than 30,000 dream reports of various types from a wide range of people. Some of the reports come from individuals who have kept a dream journal for many years. Some of the reports come from participants in surveys and questionnaires. Some come from studies by other researchers who have generously shared their data with me. The SDDb also includes dream reports from anthropological studies, historical texts, literary sources, and media interviews. (The database does not, however, contain dream reports that users have entered directly through an online portal. That feature awaits future development.)

In addition to dream reports, the SDDb also includes the answers given by survey participants to a variety of questions about their sleep and dreaming, for example how often they remember their dreams, how often they experience insomnia, have they ever had a dream of flying or lucid dreaming, etc. The data also includes people's responses to various demographic questions about their gender, age, race/ethnicity, education, religious practices, political beliefs, etc.

This combination of a large number of narrative dream reports plus a large amount of quantitative survey data makes the SDDb an especially deep and varied resource for the study of dreaming.

The SDDb offers two basic functions for exploring this material. One, "Survey Analysis," enables you to compare answers to questions posed on a survey or questionnaire. For example, you can create a statistical table to compare the dream recall frequencies of people from different age groups, or the insomnia frequencies of people with different political views, or the occurrence of lucid dreams among men and women.

The other function, "Word Searching," enables you to sift through large numbers of dreams for particular words and phrases. You can search the dreams by choosing your own word strings, or you can use the built-in word search templates to search for typical categories of dream content. This function allows you, for example, to search a set of dreams for all references to water, or colors, or emotions, or the names of famous people or places.

Methodology

The development of the SDDb began in the early 2000s in consultation with G. William Domhoff and Adam Schneider, who helped me understand how to use their Dreambank.net website. With their encouragement, I started designing a new, complementary database that would 1) include both dream reports and survey data, 2) allow for the easy use of built-in word search templates, and 3) have enough flexibility to enable a wide range of searches and analyses. In 2009 I worked with Kurt Bollacker, a software designer and engineer from San Francisco with expertise in digital archiving practices, to build the

first version of the database. In 2014, I began working with Graybox, a web technology company in Portland, to expand the scope of the SDDb and improve its user interface. A major upgrade of the database was completed by Graybox in the spring of 2020. Since then, the team behind the Elsewhere.to dream journaling app has been managing the database and helping to prepare for another upgrade, which is scheduled to come online in early 2024.

The word search function of the SDDb has many advantages as a mode of dream research: speed, transparency, replicability, flexibility, and the power to analyze very large quantities of material. The process is fairly easy to learn and sites like the SDDb and Dreambank.net provide free and open access for users to engage in their own study projects aided by these new digital tools.

This approach has several disadvantages, too. They include deemphasizing the qualitative aspects of dreaming, overemphasizing the measurability of dream content, and leaving open the key question of how to connect the numerical frequencies of word usage to the waking life concerns of the dreamer.

These disadvantages can be diminished by using quantitative analysis as one method among others in a multidisciplinary approach to dreams. There is no reason in principle why word search methods cannot work in coordination with other methods using qualitative insights and evaluations. Indeed, I would argue the future prosperity of dream research depends on developing better interdisciplinary models for integrating the results of multiple methods of study. The users of the SDDb can help make progress in creating these models.

To address the challenge of how to connect the word usage frequencies with relevant aspects of the dreamer's life, two principles should be kept in mind. These principles suggest paths for exploring the potentially meaningful connections between the dream and the individual's waking situation.

One principle is the *continuity hypothesis*: the relative frequency with which something appears in a person's dream could be a reflection of its importance as a meaningful concern in the person's waking life. In other words, the more often something (a character, setting, or activity) shows up in dreams, the more emotionally important it's likely to

be in waking life. To be clear, the continuity does not need to be literal or physical; it's more what people care and think about in their waking lives. As an example, one of the dream series in the SDDb comes from "Bea," a young woman whose anxious, sad dreams were continuous not with her actual life, which was quite safe at the time, but with her worries about possible bad things that might happen to her family or to the students in her care as a dormitory resident assistant.

The other principle is the *discontinuity hypothesis*: infrequent and anomalous elements of dream content can be spontaneous expressions of playful imagination, occurring at any point in life but especially in times of crisis, change, or transition. Something that appears very rarely and is dramatically discontinuous with typical patterns of dream content can reflect the mind's concerted effort to go beyond what is to imagine what *might be*.

A Closer Look: Survey Analysis

The Survey Analysis function allows you to compare the answers that different groups of people give to questions about their sleep and dreams. This tool lets you create statistical tables that focus on whatever demographic variables you want to study.

The SDDb currently includes results from twelve different surveys that I designed and commissioned to study sleep and dream patterns among contemporary Americans. (The number of surveys in the SDDb and the layout of the menus will likely change in the future, but the basic analytical process will remain the same for users.) The field research for these surveys was conducted by a number of different opinion research companies (Zogby Interactive, Harris Interactive, and YouGov), all but one of which administered the surveys online (one, via Quinlan Greenberg Rosner, was performed by random-digit telephone dialing).

More surveys will be added to the database, but this initial collection includes responses from more than 30,000 participants. All of the surveys include responses to questions about demographics (age, gender, region of residence, etc.) along with questions about sleep and dreams (the frequency of insomnia, dream recall, sharing dreams with others, etc.). Most of the surveys also include questions asking for a narrative

report of a dream (e.g., a lucid dream, a nightmare, or a highly memorable dream), and many of the surveys include demographic questions about religion and politics.

Here is an example of the kind of inquiry that can be easily performed using the SDDb. (Note: future upgrades of the database may change some of the labels and analytic sequences described in this paper, but the basic processes will remain the same.) Let's start with the two most important variables that have been studied in relation to dream recall, namely gender and age. How do a person's gender and age correlate with the frequency of their dream recall? We can gain helpful empirical insights into that question through the following analyses.

First, we choose one of the surveys available for study in the Survey Analysis page's menu. Several surveys could serve as examples; let's look at the 2015 Demographic Survey, which includes responses from 2,303 participants.

Then we choose the questions of comparison. If we make a table comparing people's answers to questions of gender and dream recall, we find that women remember slightly more dreams than men. Summarizing the results and rounding to the nearest whole number, 56% of the women remembered a dream once a week or more often, compared to 52% of the men who remembered their dreams this often.

Next, we will try a new analysis with the same survey, comparing people's age to their dream recall. For this analysis, we use the variable "Age Group D," which divides the participants into three age groupings (18-34, 35-54, and 55+). The results show that younger people remember dreams much more frequently than older people. For the youngest age group, 64% reported remembering their dreams once a week or more, while 54% of the middle age group and 49% of the oldest age group said they remembered their dreams this often.

The SDDb enables users to pursue the analysis further than this. We might wonder whether men and women remember their dreams with similar frequencies at the same ages? Do young men remember more dreams than old men, and young women more than old women?

This kind of analysis can be performed by using the constraints feature. After choosing to make a table comparing the questions for Age

Group D and dream recall, we can add a constraint by selecting the gender question and choosing either male or female participants. By doing this, we filter the analysis so we only see the results for that specific subset of participants. Starting with the males as a constraint, we find that the 18-34 group does not have significantly more dream recall than the 55+ group (55% vs. 51%). But when we use the females as a constraint, the results differ more dramatically, with 69% of the 18-34 group remembering their dreams once a week or more, while only 47% of the 55+ remembered their dreams that often.

These results can be taken as evidence that men's dream recall frequency is more consistent over the life span, and women's recall frequency is more variable, with an especially high rate in early life and a considerable drop-off thereafter.

This example has shown that with nothing more than a few computer clicks, we are able to identify an intriguing pattern in dream recall frequencies among men and women of different ages. We have to be careful, however, because even though a sizable number of people participated in this survey, their answers may not be representative of all of humankind, so we should not overgeneralize about the significance of such results. I believe it is vital to remain humble in this kind of research, in recognition of the wide variability of dreaming experience among the general human population.

To determine whether this pattern is only true of the participants in this survey or applies to other people as well, we could try a similar search process using other surveys in the SDDb. We could also look at age and gender variations in relation to other demographic categories like race/ethnicity, education, income, religious activities, and political views. There may be other variables at play that need to be considered before reaching any settled conclusions.

The Survey Analysis function can be applied to the study of a wide range of topics, with the capacity for even more finely-grained investigations. For example, if you wanted to compare the dream recall frequencies of younger versus older women, all of whom who graduated from four-year colleges, describe themselves as politically conservative, and live in the American south, you could create a table using those variables and constraints and learn that 67% of the younger women with

all these attributes remember their dreams once a week or more, while only 14% of the older women remember their dreams that frequently.

Of course, using more constraints in an analysis leads to a smaller number of participants who fit the criteria, making the statistical frequencies of the results shakier and more subject to chance. (In the comparison above, there were only 6 women in the younger group and 7 in the older group.) Here, as elsewhere, caution and modesty are advised when drawing appropriate conclusions from the results of your analyses.

A Closer Look: Word Searching

The Word Searching function has even greater range and flexibility than the Survey Analysis function. This function enables you to sift through large numbers of dream reports for particular words and phrases. The SDDb automatically calculates the percentage of dreams in which the selected word or phrase appears at least once. This percentage allows users to compare patterns of word usage in various kinds of dreams from various kinds of people.

The Word Searching process begins with the selection of a source of dream reports. The SDDb contains reports from many different sources, including personal journals, questionnaires, psychology experiments, anthropological studies, and media interviews, among others. The first choice to make when using this function is which dreams to explore. As a simple introductory demonstration, let's just select "All Surveys," which will draw on all the sources in the SDDb. Next we choose a filter, which is optional but allows for more focused results. Again, to keep it simple, we can choose "males" from the filter menu for the "gender" question.

Next is a choice of the type of dream report to be searched. The dreams in the SDDb have been provided in response to several kinds of questions. Examples include: What is your most recent dream? What is your most memorable dream? What is your worst nightmare? Have you ever had a visitation dream (in which someone who is dead appears as if alive)? Each different type of dream has special qualities and is worthy of detailed study, which the SDDb makes relatively easy to do. For this

initial search, we can select “Most Recent Dream” as the type of dream text.

The next step is an important one, regarding the length of the dream reports to be searched. The SDDb allows users to set a minimum and maximum word length for the dream reports to be searched. For most kinds of study, this feature is highly recommended. Some of the responses in the SDDb are not dreams *per se* – they may be people saying “I don’t know,” or “Can’t remember,” or sometimes colorful rebukes for my audacity in asking the question! Rather than removing those responses, I usually screen them out by choosing a minimum word length, usually 10 or 25 words. This means the search will not include many genuine dream reports of shorter length. For some studies, that might be a drawback; not in ours, which I’m setting at a minimum length of 25 words and a maximum of 300 words.

Then comes the last step, choosing the word or words to search for in the set of dreams we have just defined. The easiest way to get interesting results is to use the SDDb templates for word searching. The 2.0 version has 40 categories of content grouped into eight classes of dream content:

- Perception
 - Vision
 - Hearing
 - Touch
 - Smell/Taste
 - Colors
- Emotion
 - Fear
 - Anger
 - Sadness
 - Wonder/Confusion
 - Happiness
- Cognition
 - Thought
 - Speech
 - Reading & Writing
- Natural Elements

- Fire
- Air
- Water
- Earth
- Movement
 - Walking & Running
 - Flying
 - Falling
 - Death
- Characters
 - Family
 - Animals
 - Fantastic Beings
 - Male References
 - Female References
- Social Interactions
 - Friendliness
 - Physical Aggression
 - Sexual
- Culture
 - Architecture
 - Food & Drink
 - Clothing
 - Work & Money
 - Technology & Science
 - School
 - Transportation
 - Sports
 - Religion
 - Art
 - Weapons

Each of the 40 categories comprises dozens of words relating to that topic. These categories are not drawn from a generic coding scheme unrelated to dream research, but have been developed over time as a direct continuation of the system of the empirical study of dream content devised by Calvin Hall and Robert Van de Castle and refined by

G. William Domhoff and Adam Schneider.⁷ In this way, the SDDb templates provide an approach to digital dream research that is backward-compatible with pre-digital methods of study. I believe this is a key methodological principle: as we move into the technologically enhanced future of studying dreams, we should make sure we can integrate new findings with the hard-won knowledge of the past.

An Illustration: The Emotion of Fear

From the 2.0 template menu, let's select one of the emotions, the category "Fear," and hit the "Search" button. In the version of the database available as I write, the results page shows 1,667 dream reports that fit the search criteria (from males in all sources, in the most recent dream texts of 25–300 words in length), of which 266 have at least one reference to a word in the "Fear" category, a total of 16%.

The left column on the Results page shows the frequency of usage for each of the words in the category. In this case, the four most used words in these dreams were scared, afraid, fear, and frightened. In the right column are the dream reports themselves, with the word(s) from the selected category highlighted.

To be clear, these results show *every* use of the words in the selected category. The results may include references to fear that have nothing to do with the dreamer's emotional state. The results may include uses of the term that are metaphorical, or fictional, or incidental. (If desired, users can perform an additional screening process to remove dream reports from the search that are judged to be irrelevant to the primary search.)

For a general inquiry like this one, we can take the unfiltered results as a rough measure of the incidence of fear in men's dreams. To take the process a step further, we can perform the same search while changing the filter from "male" to "female." Here, the results page shows that out

⁷ Hall and Van de Castle, *The Content Analysis of Dreams*; George William Domhoff and Adam Schneider, "Studying Dream Content Using the Archive and Search Engine on Dream-Bank.net," *Consciousness and Cognition* 17 (2008): 1238–1247, <https://doi.org/10.1016/j.con-cog.2008.06.010>.

of the 1,984 dream reports that fit the search criteria (from females in all sources, in the most recent dream texts of 25–300 words in length), 437 have at least one reference to a word in the “Fear” category, a total of 22%. The four most used words from the category were scared, afraid, upset, and fear.

These findings can be taken as evidence suggesting that women’s dreams have considerably more references to fear than men’s dreams. However, as with all studies using the tools of the SDDb, care is needed in the interpretation of the results of any given word search. Many more studies would have to be performed, and other research findings consulted, before making a firm statement about a broad topic like fear in men’s and women’s dreams.

The findings of one search often lead to new questions requiring new searches. For instance, we can extend this line of inquiry by asking if the gender difference in fear references also appears in children’s dreams. The SDDb includes a set of dreams gathered from children aged 8 to 18 via an online survey administered by Harris Interactive in 2011. The participants were asked to describe their “most memorable” dreams, which are different from the most recent dreams in favoring unusual and emotionally intense types of dream content. The comparison is not perfect, but in this inquiry, we are exploring a general trend and we can refine the analysis at later stages if desired.

Using the same search parameters (reports of 25–300 words in length), the results show that for the boys, 37 of the 205 dream reports, or 18%, contained at least one reference to fear, with the four most used words being scared, nervous, afraid, and scare. For the girls, 80 of the 372 dreams, or 22%, contained at least one reference to fear, with the four most used words being scared, terrified, afraid, and fear. This is still a difference, though not as big as with the most recent adult dreams.

An Illustration: Nan’s Journal

This line of investigation could continue from this point in any of several different directions. But let’s turn to a different kind of word search strategy, one that can yield more personally relevant kinds of insights. The SDDb includes several lengthy series of dreams from in-

dividuals who recorded their dreams on a regular basis for an extended period of time, in some cases covering many years. The study of the patterns in these dream reports can often lead to the discovery (guided by the continuity and discontinuity hypotheses) of meaningful connections between the dreams and the individual's waking life concerns.

To illustrate how this kind of search process works, let's select "Nan Journal 2001–2002" from the menu. Clicking the search button at this point will show all 26 dream reports in her series, which range in length from 12 to 397 words, with a median length of 116 (meaning that half the dreams are longer than, and half the dreams are shorter than, 116 words). This is one of the shortest series in the SDDb, but it is a good one for quickly illustrating what can be learned using word search methods.

Nan (not her real name) kept a journal of her dreams for the six months she spent in a hospital following a near-fatal car crash. You would not know this from the dreams themselves, which never refer directly to the crash. This highlights a crucial finding of dream research: the patterns of dream content reflect people's waking *concerns*, not necessarily their waking activities or behavior. She did not dream about the car crash, but about the emotional and interpersonal implications of the crash.

In Nan's case, her dreams indicate that she definitely did feel strong concerns at this time, in a mostly negative direction. Of her 26 dreams, 8 of them (31%) have at least one reference to fear. There are also five references to death (19%), six to physical aggression (23%), and none to happiness. These frequencies accurately reflect the frightened and vulnerable quality of Nan's feelings in waking life.

Looking more closely at the characters in her dreams, a man named Phil appears in 6 of the dreams (23%), more than any other character in the series. Following the continuity hypothesis, we can infer that Phil is a person of great concern to her, and this turns out to be true. Phil is Nan's ex-husband. She divorced him ten years earlier, after which she started an independent career as an art teacher. After the accident, she recuperated in a hospital ward with several other women, all much older than her and all of whom had severe mobility problems. The sad plight of these women stoked Nan's fears and raised the darkest concern

in her life: she might have to return to Phil and become reliant on him again. Her dreams accurately reflected her strongly negative feelings about the possibility of Phil becoming more of a presence in her waking life again.

Nan's waking life interests in art are also reflected in her dreams, and one dream in particular had an especially strong psychological impact on her. This dream features a magical paintbrush painting a beautiful rainbow pattern on the walls of her childhood home. It is the only dream in the series with so many colors, the only one with a magical object, and one of only two dreams in which something is described as "beautiful." Following the discontinuity hypothesis, we can infer that an unusually creative and playful dream like this would prompt Nan to think beyond what *is* to imagine what *might be*, and that does seem to have been the case. She told me that she regarded this dream as a reassuring sign of hope and healing in her long, dark road to physical and mental recovery. Like the first green shoots of spring, Nan's "bizarre" dream of the magical paintbrush heralded the eventual return of color, beauty, and creative vitality to her waking life.

Other series in the SDDb have many more dreams covering much longer periods of time. As a general principle, the longer the series of dreams, the stronger the results of analyzing those dreams. Although even a short series like Nan's can yield valuable findings, the potential for meaningful insights and discoveries is greatest with a long series of dreams.

The Role of Baselines

Regardless of the length of the series, the analysis will be limited to the given individual's dreams. For example, in Nan's dreams discussed above, five of her twenty-six dreams, or 19%, included a reference to death. In light of her recent and nearly fatal automobile accident, it makes psychological sense that Nan's dreams would include references to death. But what can we say about that figure of 19%? Among people in general, is that a high or a low frequency of references to death in dreams, or about average?

If we only have the individual's dreams to analyze, there is no way to answer such a question. What is required is a means of comparison with other people's dreams that have also been analyzed in the exact same manner. For many years, dream researchers have used the Hall and Van de Castle (HVDC) Norm Dreams in this way, as a tool for comparing the empirical patterns of content in one person's dreams with the patterns of a large group of people. In recent years, the SDDb has provided a set of Baseline Dreams that include the HVDC Norm Dreams plus several thousand additional dreams from a wider and more diverse range of people. The SDDb provides the ability to compare the word search results of any set of dreams with the Baselines. Thus, we can quickly determine that Nan's frequency of death-related dreams, 19%, is indeed unusually high, as only 6% of the Baseline Dreams include at least one reference to death.

As this example suggests, the findings of word search analyses can often be prefigured by close reading and qualitative analysis. The claim here is not that word search methods reveal radically new dimensions of dreaming (although that may be the case someday). Rather, the claim in this paper is that word search methods, in tandem with a comparative resource like the Baselines, can provide results that are fast, reliable, easily shared, and easily verified. If properly used, this approach can support and enhance other methods of dream research by giving them a stronger empirical foundation than they would otherwise have. Returning to Nan's case once more, we can recognize the prominence of death by reading through the texts of her dreams, but the word search results, enhanced by the comparison with the Baselines, make that unusual feature of her dreams more distinct for others to observe and appreciate. You can now confidently assert that Nan's dreams have an unusually high proportion of dreams referring to death, not just because you personally read the dreams and believe this, but because an empirical method of dream analysis found it to be true. Nobody needs to take your word for it. If anyone doubts your claims, you can show them how to perform the same word search analysis in the SDDb, which will lead them to the same results.

The current version of the SDDb Baseline Dreams includes more than five thousand dreams, gathered by researchers using systematic methods. The dreamers do not represent a perfect sample of human-

ity, but they do reflect various kinds of diversity, including age, gender, nationality, educational background, and time of dreaming (from the 1940s to 2000s). Future versions of the Baselines will continue to expand in size and diversity, and it can be expected that other measuring systems will emerge, too. This will be a positive development as long as the new systems maintain a capacity for “backward compatibility,” meaning a relationship with previous approaches to the empirical study of dreams. The SDDb Baselines, for example, are designed in such a way that many of the findings can easily be compared with the results of older, pre-digital-era research studies. In this way, the valuable findings of previous researchers are not lost in the rush of new technologies. By combining the best findings of the past with the best empirical research tools of the present, we will stimulate the greatest advances in the future understanding of human dreaming.

Notable Findings

Even at this stage of the research, several basic findings can be shared. Future research will surely revise these propositions, but the empirical evidence so far points strongly in the following directions.

- Perception: Vision is the most frequently mentioned sense in dreams; hearing and touch are mentioned much less often, and smell and taste are relatively rare.
- Color: White, black, and red are the most frequently mentioned colors.
- Gravity: Falling dreams outnumber flying dreams.
- Emotions: Fear is the most frequently mentioned emotion, more than happiness, sadness, or anger.
- Friendly social interactions are more frequent than physically aggressive social interactions.
- Gender: Male characters and pronouns are mentioned more frequently than female characters and pronouns.
- Women’s dreams: Compared to men, women’s dreams have more references to fear, family, and friendliness.
- Men’s dreams: Compared to women, men’s dreams have more references to physical aggression, transportation, and money/work.

These findings derive from the SDDb Baselines and their use with numerous collections of dreams. There are exceptions to all of the above findings, but the overall trends seem quite strong and widespread across diverse populations. To be clear, this approach does not directly answer the question of whether these tendencies of dream content reflect innate features of the human brain/mind system or if they stem from the social and cultural influences of a specific historical moment. We do not know if nature or nurture plays a bigger role in shaping these oneiric patterns. Both factors clearly have an impact on dreaming, and yet we cannot say for sure how they interact in the context of particular dreams.

Blind Analysis

This may seem like a boundary situation for digital dream research, which thrives on the analysis of large collections but becomes unwieldy when applied to individual dreams. However, what appears as a limitation actually marks one of the greatest opportunities for innovative research in this field. The word search method, enhanced by the Baselines, provides an unprecedented ability to identify the most common themes and patterns in a set of dreams. By the same token, this method also provides the ability to identify the most unusual dreams in the set, the dreams that most dramatically deviate from the average contents of the other dreams. The ability to measure in precise terms what makes extraordinary dreams so extraordinary is a boon for qualitative research on anomalies and singularities in dreaming, e.g. using Jung's concept of "big dreams." Here again, the word search method adds a high degree of empirical support and statistical precision to findings that may have been originally generated through close reading or clinical practice. Back to Nan: she identified one of her dreams as having special meaning and healing power for her, a dream she titled "Ziggy Paints My Room." Interestingly, a word search analysis shows that this dream is unique in her series in having chromatic colors, positive emotions, and a magical object. This illustrates the larger point about the two different but complementary ways in which word search results can be used: to identify large-scale patterns, and to observe unusual and unique phenomena.

A series of experiments I conducted with G. William Domhoff explored these twin uses of the word search method. The experiments involved what we called “blind analysis,” meaning an analysis that proceeded purely on the basis of statistical patterns in the dream reports, without any additional input from the dreamer and without even reading the narrative texts of the dreams. The process generally had the following steps. Domhoff would approach me with a new series of dreams from someone unknown to me. After establishing a mutual agreement with the dreamer, Domhoff sent me the dream reports, which I immediately uploaded into the SDDb. Once there, I performed a word search analysis using a template of forty categories of content and compared the results to the Baselines. In this way, I was able to identify several kinds of recurrent patterns and themes. I could also identify several specific, measurable ways in which the dreams differed from the Baselines. Drawing these observations together, I prepared a list of inferences about the dreamer’s waking life concerns and activities. For example, if the person had an unusually high frequency of animals in their dreams, I would infer that animals are important in their waking life. If their dreams had no references to school, I would infer that they are not currently a student or teacher. After compiling this list, I sent the inferences to Domhoff, who forwarded them to the dreamer. The dreamer was then invited to respond to the inferences, confirming or disconfirming them and adding any relevant context. Domhoff sent me the responses, and at this point the veil of anonymity was lifted and we had an open discussion about the dreams, their empirical patterns of meaning, and the accuracy of the inferences.

Recently I reviewed the results of fifteen of these blind analysis experiments, conducted over several years, not all of which have been published yet. A more complete meta-analysis of the results will be forthcoming, but at this stage, it can be reported that a total of 167 inferences were made in the fifteen studies, and the dreamers confirmed 143 (86%) of them as accurate, 11 (7%) as partly accurate, and 13 (8%) as inaccurate. Several points can be noted about these results. One, the high accuracy rate is not due to my personal skill as a dream interpreter, but to the empirical patterns revealed by the word search analysis. All I did was translate the most significant statistical results

into specific inferences. Two, in many of the studies, it was the incorrect inferences that provided the most helpful insights about improving the word search method. Learning which inferences failed in one study enabled us to avoid making similar mistakes in subsequent studies. And three, in light of the value of *incorrect* inferences, the high accuracy rate should perhaps not be seen as a badge of honor but as a sign that the inferences are insufficiently bold and innovative. Making *more* mistakes might be the best way to tease out new dimensions of meaning.

Strongest Signals of Meaning

Several of the inferences revolved around specific areas of the dreamer's waking life, some of which are obvious in their relevance, while others are more subtle in how they relate to the individual's daily concerns and activities. The relatively high accuracy of these inferences justifies an attempt to provide a more generalized framework in which to categorize and interpret these findings. This provisional framework inevitably includes my own qualitative reflections on the dreams, which means that it will be shaped according to my personal and professional biases. However, the framework can still be grounded in empirical research and revisable in the light of new findings, so these factors need not become insurmountable obstacles to objective knowledge.

If, using a metaphor from data science, we think of dream content in terms of a varying ratio of signal and noise, the following are the three strongest signals of meaning as revealed by the blind analysis studies: The Self, Relationships, and Culture.

The category of Self, as I am using it here, includes the accurate inferences involving gender (male or female; little research has been done on people with non-binary gender identities); professional or public identity, such as student, musician, or journalist; concerns about health, both physical and mental; personality characteristics such as sociability and emotional expressiveness; and concerns about death and dying. These self-oriented dream themes can be interpreted as elements of the individual's basic psychological nature and ongoing experience.

The category of Relationships includes some of the strongest signals of meaning yet identified using the blind analysis method. In other

words, the word search results combined with the Baselines enable an especially clear view of the dreamer's most important relationships in waking life. References in dreams to family members and friends can be remarkably accurate indicators of their personal significance for the dreamer. To be clear, the relationship can be positive or negative, and the person can be present or far away; what matters is their emotional connection. The same is true of animals. To put it crudely but accurately, cat people tend to dream more of cats, and dog people tend to dream more of dogs.

The category of Culture includes a broad array of references to the collective world. The aspects of culture that seem to make the most discernible impact on dream content are reading and writing, school, sports, artistic interests, and religious/spiritual interests. For each of these topics, the Baseline frequencies are relatively low. It seems that among the general population, people do not often dream of art, for example, or reading and writing. This is helpful for empirically-minded researchers, because it suggests that when a dream series has a relatively high frequency on one of these cultural topics, there is likely to be a genuine connection with something important and meaningful in the dreamer's waking life. Hence the accuracy of many of the inferences in my blind analysis studies that focused on the dreamer's cultural concerns and activities.

Future Horizons

The future for research in this realm will be limited only by the investigators' imaginations—and by the consensus on ethical guidelines for digitally-enhanced dream research, which does not yet exist but must be developed soon. Some of the applications of these technologies could be turned toward abusive ends, and at a minimum, the research community should state its shared principles about the ethical issues at stake in this area of rapidly advancing knowledge. The goal is not to impose a top-down regime of morality, but rather to heighten everyone's awareness of both the benefits and the dangers emerging here. Anything that can reveal so much accurate psychological information about a person is worthy of a) great excitement and further

exploration, and also b) great caution and attention to personal privacy and dignity.

With this heightened ethical sensitivity in mind, the following topics for future research can be offered as having especially great potential for new insight and understanding. All of these involve the application of currently available resources toward a focused area of inquiry.

1. The general categories of Self, Relationships, and Culture can each be studied in more detail, with larger and more diverse groups of dreamers. The blind analysis experiments described above are suggestive but not exhaustive. There are certainly more, and perhaps many more, signals of empirical meaning in dreams. Tools of big data analysis are making it more feasible than ever to identify these signals. Especially if we can develop our analytical technologies with truly cross-cultural capacities, our empirical knowledge about the nature and functions of dreaming will become much stronger.
2. An especially promising area for new research involves the practical application of these technologies in the treatment of people with various kinds of mental and physical maladies. As a resource in caregiving and healing practice, dreams have several advantages: they are free, plentiful, universally accessible, and now quite easy to analyze for useful psychological information. New technologies of dream analysis can be developed into therapeutic allies, providing fast and accurate insights that are directly related to the client's unique experiences and emotional concerns.
3. The strong signals involving religion and spirituality are especially suggestive. For many people, religion and spirituality refer to a realm of special meaning, truth, and existential self-understanding. This adds significance to the empirical finding that dream content accurately reflects people's concerns in this area. Further research can build on this finding by exploring a) the types of dream content that seem most associated with religion and spirituality, b) the types of dreamers who seem most likely to experience such dreams, and c) the cultural/historical contexts in which such dreams seem most likely to occur.

4. All of the studies mentioned above will be enhanced by the development of new Baselines with an even larger and more diverse collection of systematically gathered dreams. The current Baselines available in the SDDb are useful, but new research will be able to determine the basic frequencies of common types of dream content with even more precision. Looking ahead, we can anticipate that, once a certain number of dreams have been gathered—let’s call them the Ultra-Baselines—the same stable set of basic frequencies will always appear, and adding more dreams to the analysis will not change the frequencies. For instance, if the number of dreams required for a stable set of Baselines turns out to be 10,000, it means that for all numbers higher than this, the basic frequencies of dream content will remain the same. This is an empirical question that new research will presumably be able to answer.
5. In the realm of art and entertainment, the empirical findings presented here could provide the deep architectural blueprint for the development of a virtual reality (VR) dream world. The frequencies of dream content from the Baselines can be seen as constituting a detailed portrait of what an “average” dream space might look and feel like. Such a portrait could be a valuable resource for developers and engineers interested in creating VR simulations of dreaming. The value could be both positive and negative, suggesting elements to include to make a VR dream space feel more authentically dream-like (e.g., more family and friends, falling, and friendliness) and elements to avoid because they tend not to be qualities of genuine dreaming experience (e.g., bright colors, magical creatures).

Conclusion

Those of us who study dreams are fortunate to be working in the field today. All the elements are coming together to create a prosperous future for empirically-grounded dream research. These elements include the increasing availability of powerful tools of analysis, large collections of dream data, and a century’s worth of psychological theorizing to pro-

vide testable hypotheses. The tools will surely become stronger and the dream collections larger, but a challenge will be expanding the range of hypotheses beyond modern Western psychology to include ideas about dreams from other cultures and periods of history. This might seem to lead in non-empirical, non-scientific directions, but the opposite is actually the case. I would emphasize the cardinal fact, supported by both historical and scientific research, that dreaming is a pan-species experience of humankind. We are a dreaming species. As such, an empirical approach to the study of dreaming can hardly limit itself *a priori* to the ideas of one culture during one period of history. The future study of dreaming will grow more vigorously to the extent that it seeks detailed empirical testing of *all* conceptions of how dreams are formed, what functions they serve, and how to interpret their meanings.

B i b l i o g r a p h y

- Calkins, Mary. "Statistics of Dreams." *The American Journal of Psychology* 5 (1893): 311–343.
- Cartwright, Rosalind. *The 24-Hour Mind: The Role of Sleep and Dreaming in Our Emotional Lives*. New York: Oxford University Press, 2010.
- Domhoff, George William, and Adam Schneider. "Studying Dream Content Using the Archive and Search Engine on DreamBank.net." *Consciousness and Cognition* 17 (2008): 1238–1247. <https://doi.org/10.1016/j.concog.2008.06.010>.
- Domhoff, G. William. *Finding Meaning in Dreams: A Quantitative Approach*. New York: Plenum, 1996.
- Eggan, Dorothy. "Dream Analysis." In *Studying Personality Cross-Culturally*, edited by Bert Kaplan, 551–557. Evanston: Row, Peterson and Co., 1961.
- Eggan, Dorothy. "The Manifest Content of Dreams: A Challenge to Social Science." *American Anthropologist* 54 (1952): 469–485. <https://doi.org/10.1525/aa.1952.54.4.02a00020>.
- Freud, Sigmund. *The Interpretation of Dreams*. Translated by James Strachey. New York: Avon Books, 1965.
- Hall, Calvin, and Robert Van de Castle. *The Content Analysis of Dreams*. New York: Appleton-Century-Crofts, 1966.
- Han, Hye Joo, Richard Schweickert, Zhuangzhuang Xi, and Charles Viau-Quesnel. "The cognitive social network in dreams: Transitivity, assortativity, and

giant component proportion are monotonic.” *Cognitive Science* 40, no. 3 (2016): 671–696. <https://doi.org/10.1111/cogs.12244>.

Hartmann, Ernest. *Dreams and Nightmares: The Origin and Meaning of Dreams*. New York: Basic Books, 2000.

Hunt, Harry. *The Multiplicity of Dreams: Memory, Imagination, and Consciousness*. New Haven: Yale University Press, 1989.

Jung, Carl. *Children's Dreams: Notes from the Seminar Given in 1936–1940*. Translated by Ernst Falzeder and Tony Woolfson. Princeton: Princeton University Press, 2008.

Pagel, James. *The Limits of Dream: A Scientific Exploration of the Mind/Brain Interface*. New York: Academic Press, 2010.

Schredl, Michael. “Dream Recall: Models and Empirical Data.” In *The New Science of Dreaming*, Vol. II, edited by Patrick McNamara and Deirdre Barrett, 79–114. Westport: Praeger, 2007.

Schwartz, Sophie, and Pierre Maquet. “Sleep imaging and the neuro-psychological assessment of dreams.” *Trends in Cognitive Sciences* 6, no. 1 (Jan. 2002): 23–30. [https://doi.org/10.1016/S1364-6613\(00\)01818-0](https://doi.org/10.1016/S1364-6613(00)01818-0).

Strauch, Inge, and Barbara Meir. *In Search of Dreams: Results of Experimental Dream Research*. Albany, New York: State University of New York Press, 1996.

Strauch, Inge, and Barbara Meir. *The Scientific Study of Dreams: Neural Networks, Cognitive Development, and Content Analysis*. Washington: American Psychological Association, 2003.