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Publication Patterns in Dream Research: Trends in the Medical and Psychological Literatures

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The annual rate of journal publications is a pertinent index of a scientific field's prosperity. In the present study, annual publication rates were calculated for the field of dream research using both medical (Index Medicus, MEDLINE) and psychological (PsychINFO) reference databases. A composite profile from the medical database spanning 111 years revealed very similar changes in publishing levels following the release of Freud's (1958/1900) The Interpretation of Dreams *and the publication in* Science *of Aserinsky and Kleitman's (1953) article on dreaming and "rapid, jerky eye movements." In both cases, the peak year occurred about 15 years after release of the work, and the peak was followed by a precipitous 3-year drop and then a slow and yet variable decline. In the more recent case, the peak level (reached in 1969) dropped (during 1970-1972) by about half and has continued a slow decline to the present day. As is the case with basic sleep research, this level of activity does not keep pace with either (1) global growth in scientific publishing or (2) growth in related sleep disciplines, particularly, sleep disorders and chronobiology. The psychological database confirms many features of the medical database profile—but is advanced by 1 year, i.e., a publishing peak in 1968, a drop from 1969-1971, and a slow decline until 1980. In this case, however, 1981 marks the beginning of a period of renewed growth that has endured to the present. This divergence between the two publishing profiles may reflect the field's shift from psychophysiological to cognitive and dream analytic approaches since the early 1980s.*

For many years, the health of dreaming research has been in doubt (cf. Foulkes, 1996). On the one hand, the number of laboratories and researchers dedicated to problems of dreaming has been in steady decline, while related disciplines such as sleep medicine and chronobiology appear to enjoy steady annual growth. On the other hand, research on dreaming remains visible in the research community, as

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indicated by the recent establishment of a special section on the study of dreams within the American Sleep Disorders Association and by the continuing prosperity of the journal *Dreaming*. The present special issue on the psychobiology of dreaming itself speaks to a continuing interest in scientific examination of dream phenomena.

How, then, are we to accurately gauge the health of the scientific enterprise of dream research? How do we measure its current progress and anticipate future trends? Among the markers of activity within a field of study (e.g., number of researchers or laboratories, size of annual budgets, number of citations by peers), one of the simplest to use is the annual number of research publications. There exist several databases containing information on annual publishing activity. One of these, published for most of the 20th century as the Index Medicus and now known principally as MEDLINE, has maintained systematic records on the publication of dream research for over a century. Another, PsychINFO, is more limited in scope but has kept digital records of references on dream research since 1967.

MEDICAL VS. PSYCHOLOGICAL RESEARCH DATABASES

Medical research. For publication within the medical sciences, citations in the Index Medicus and MEDLINE databases were consulted. These are presently owned by the National Library of Medicine (NLM), although management of the Index Medicus has changed hands several times (see Kunz, 1979, for a review). Thus, a variety of indices had to be consulted (see Table 1) to obtain an unbroken record dating back to 1885. All citations listed under the heading of "Dreams" for 1885-1996 were counted. For publications prior to 1966, relevant pages of the appropriate version of Index Medicus were tallied manually. For more recent publications, starting in 1966 (the year the database was first automated into the MEDLINE system) citations were accessed using Ovid software and the search term "explode *Dreams." The latter term includes publications for which dreams is a valid keyword and excludes publications that only mention dreaming in the summary. Ovid was also used with this database to calculate (1) productivity estimates for the areas of *basic sleep*, *sleep disorders*, and *chronobiology*, and (2) annual estimates of *total scientific publishing* for the period 1966-1996.

Psychological research. For estimates of publications in journals of interest primarily to psychological scientists, citations from the PsychINFO database were tallied from 1967 to 1996. PsychINFO is a database owned by the American Psychological Association that includes all records from the printed *Psychological Abstracts* as well as from *Dissertation Abstracts International* and other sources. It was accessed using the Ovid software program. Since PsychINFO catalogues dream-related publications by any of 5 keywords (*dreaming, REM dreams, dream analysis, dream content, nightmares*), all of the latter were included in deriving the publishing estimates. Counts were limited to journal articles only. It is important to note that PsychINFO also references journals relevant to medicine, psychiatry, nursing, pharmacology, physiology, etc.; so the overlap between this database and MEDLINE is not negligible.

Table 1. Components of the National Library of Medicine Database Consulted for Calculation of Publishing Estimates

The Index Medicus	Vols.	Years
Index Medicus (Series 1)	1-21	1879-1899
Bibliographia Medica Index Medicus	1-3	1900-1902
Index Medicus (Series 2)	1-18	1903-1920
Quarterly Cumulative Index (QCI)	1-12	1916-1926
Quarterly Cumulative Index Medicus (QCIM)	1-36	1927-1959
Cumulated Index Medicus (CIM)	1-5	1960-1964
Index Medicus (IM+CIM)	6-28	1965-1985
MEDLINE	12/2/1998	1966-1996

DIFFERENT PUBLISHING TRENDS IN THE TWO LITERATURES

Medical science. Over a 111-year span, 2904 dream research publications were identified (M = 25.9 ± 22.6/yr). During 1967-1996, the average annual rate was 53.2 ± 15.3. Figure 1 clearly shows that an episode of increased publishing began in 1910 (likely as a delayed response to the appearance in 1900 of Freud's *The Interpretation of Dreams*), peaked in 1914, and then dropped dramatically in the three following years. Publishing during the next three decades was variable, but generally it decreased in relation to the previous high in 1914.

With publication in 1953 of Aserinsky and Kleitman's paper on dreaming and "rapid, jerky eye movements," publishing began another rapid increase. Again, the peak of publishing activity was 16 years after appearance of the paper, i.e., in 1969. The level then dropped precipitously during the following 3 years. From 1972 to the present, publication activity has remained relatively stable, with a slight decline, but has maintained a volume that is almost four times greater than pre-1953 levels. Specifically, the mean number of publications for the 25-year interval 1971-1996 (47.6 ± 6.4) was almost four times that for the 25-year interval 1931-1956 (12.2 ± 6.3). However, the variances of these two intervals are virtually identical, indicating a greater stability in the more recent mean. The more recent episode of publishing activity is also strikingly similar to that following Freud in the relative degree of increase defining the peak years. A ratio calculating the proportional increase *prior to* vs. *following* release of the key manuscripts (i.e., *mean (release year to peak year) / mean (10-year period prior to release year)*) was only slightly lower for Freud's dream book (3.0) than it was for Aserinsky and Kleitman's dream paper (4.3).

There are some indications, however, that the relative stability of medically-oriented dream research in recent times is in fact a *decrease* relative to changes within medical science publishing more generally. The solid line in Figure 1 indi-

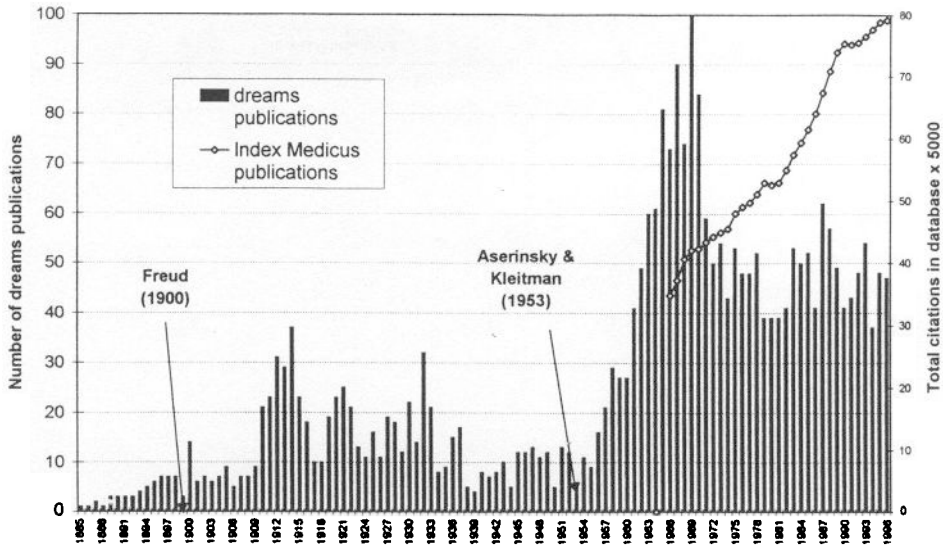

Fig. 1. Annual number of dreams publications in the Index Medicus 1885-1996. The histogram displays the annual number of journal publications under the topic 'dreams' in the Index Medicus. Data are derived from a number of different sources (listed in Table 1) which together form a 111-year unbroken record of medical research. Periods of increased publishing incited by the release of Freud's (1900) dream book and Aserinsky and Kleitman's (1953) *Science* paper are described in the text.

cates that the total volume of publications listed yearly in MEDLINE increased in a near-linear fashion from 1966 to the present. With the exception of 2 years during this period (1980 and 1991), there was a net increase each year (M = 2.79 ± 2.2%). The recent publishing plateau for dreaming may thus represent a decline relative to global linear growth in medical scientific publishing.

This possibility is supported by comparisons of the dream publishing trends with trends in the related disciplines of basic sleep, sleep disorders, and chronobiology, each of which was also profoundly affected by the publication of Aserinsky and Kleitman's paper. As shown in Figure 2, all three of these disciplines have enjoyed a steady increase in publications since 1966. When plotted as proportions of increase relative to 1966, it is clear that for both sleep disorders ($y = 34.44x - 172.2$, $R^2 = 0.91$) and chronobiology ($y = 14.24x + 76.7$, $R^2 = 0.94$) publications are increasing at rates greater than those of medical science as a whole ($y = 4.37x + 90.1$, $R^2 = 0.97$); basic sleep research is increasing, but at a rate less than the overall index ($y = 2.23x + 118.5$, $R^2 = 0.76$). Dream research shows a slight *decrease* in publishing activity which is described only moderately well as a linear trend ($y = -1.36x + 96.7$, $R^2 = 0.33$, $p = .001$).

Psychological science. For the 30-year span covered by PsychINFO, a total of 2467 citations was logged (M = 82.2 ± 24.9), a substantially higher per annum volume than for the equivalent time window in the medical database (52.3 ± 15.3) (see Figure 3). There were also 735 books and 266 dissertations logged; the former were excluded from the estimates and the latter tallied separately (Figure 3). Al-

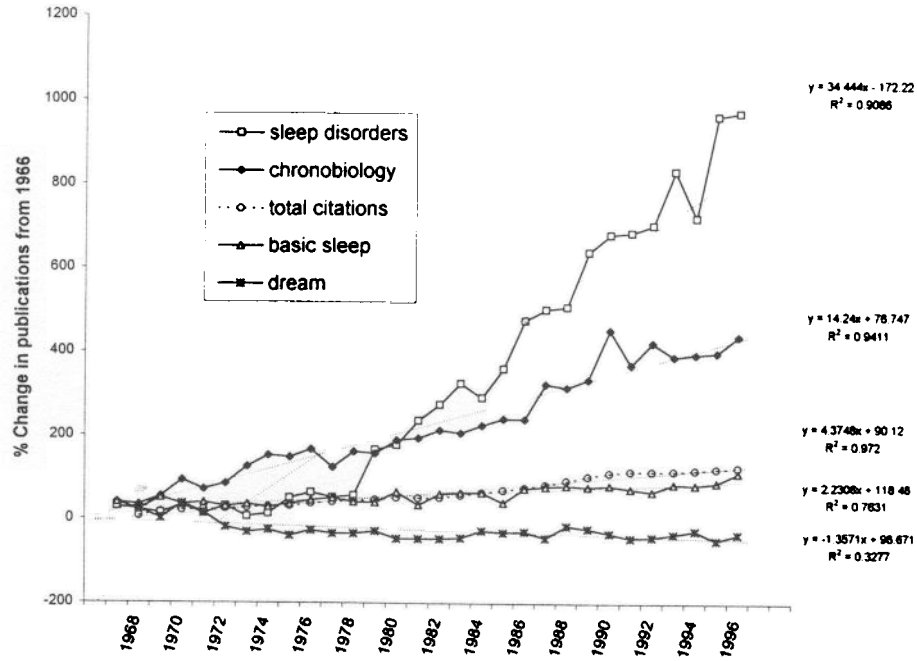

Fig. 2. Annual proportional change in number of dreams publications since 1966 for four disciplines and a global estimate of publishing in the Index Medicus. Curves depict the percent of change relative to 1966 for each discipline. Linear regression equations display the average rate of growth (x-weighting factor) and degree of fit to the observed data. The 'total citations' curve plots percent increase in total number of citations in the Index Medicus database per year; note the near-linear growth rate (R = .99). Both dream and basic sleep show growth rates inferior to the global estimate; dream research alone shows a negative growth rate.

though this database does not allow examination of the increases in publishing around the time of Aserinsky and Kleitman's (1953) paper, the peak in 1968 is largely consistent with the 1969 peak found in the MEDLINE profile, although advanced by one year. Moreover, a steep drop for the years 1969-1971 followed by a decade of slowly declining activity is parallel to the situation expressed in MEDLINE for the years 1970-1972 and beyond.

However, PsychINFO reveals a wholly *different* profile of publishing activity from that of MEDLINE for the years 1980-1996 (Figure 4). Whereas MEDLINE suggests a near-zero growth rate in published research, PsychINFO suggests a period of increased, if somewhat sporadic, growth. Regression lines of percentage change relative to 1967 show almost zero slope for MEDLINE ($y = 0.2458x + 62.5$, $R^2 = .01$, ns), and a modest increase for PsychINFO ($y = 8.0017x + 207.7$, $R^2 = .31$, $p = .025$).

Figure 5 plots the percent of change relative to 1967 in the number of dissertations on dreaming listed in *Dissertation Abstracts International* as catalogued in PsychINFO for the years 1980-1992 (1993-1995 were not yet available). This trend

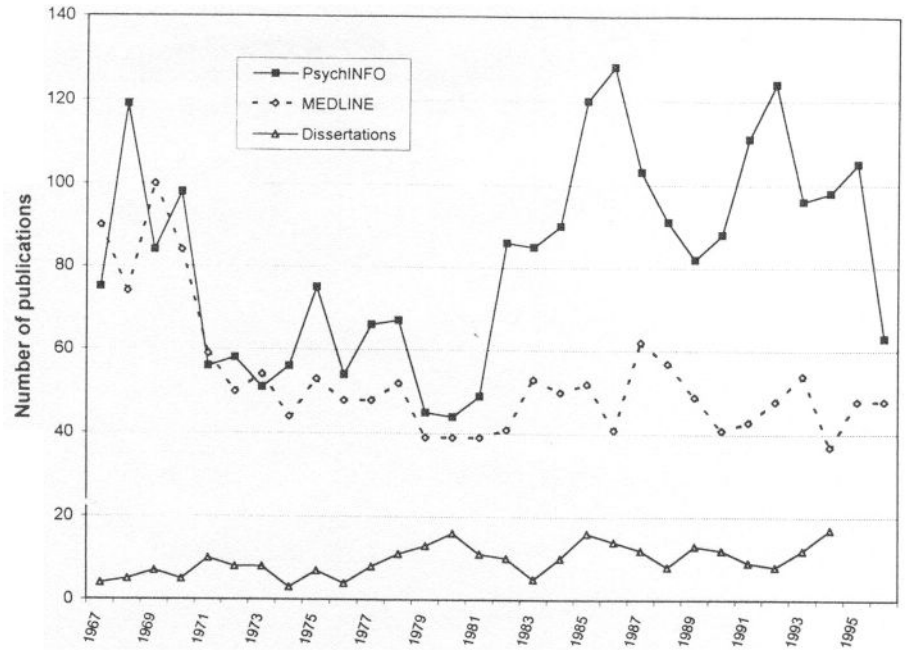

Fig. 3. Annual number of dreams publications in MEDLINE and PsychINFO databases and for PsychINFO Dissertations listings: 1967-1996. Curves display the total number of publications on dreams per year for the period covered by both automated referencing databases. Both MEDLINE and PsychINFO show the peak of publishing activity in 1968-1969 and subsequent decline up to 1980. Whereas MEDLINE indicates a continuing decline, PsychINFO shows a resurgence from the 1980s to the present. Dissertations tend to parallel the increase seen in PsychINFO. Note that the most recent data point (1996) may underestimate actual levels because of delays in cataloguing.

($y = 6.6697x + 149.22$, $R^2 = 0.32$, $p = .025$) resembles the linear growth curve of dreams publications in PsychINFO more than it does the zero-growth rate of publications in MEDLINE.

Figure 6 plots the total number of publications in PsychINFO listed under each of 4 subheadings (*Dreaming*, *Dream Analysis*, *Dream Content* and *Nightmares*) from 1972, when these became standard categories, to the present. Although all four areas demonstrate some periods of resurgence during the last 2 decades, *Dream Analysis* clearly exhibits this tendency to the greatest degree.

THE DECLINE OF MEDICAL DREAM RESEARCH

Freud's great influence on dream research is often appreciated (see *Dreaming*, 1994, 4(1), whole issue) but rarely quantified. The present finding of rapid growth in publishing 10-15 years after release of *The Interpretation of Dreams* can be construed as one quantitative index of this influence. There was a delay of almost 10 years before Freud's influence became manifest, but it appears to have endured

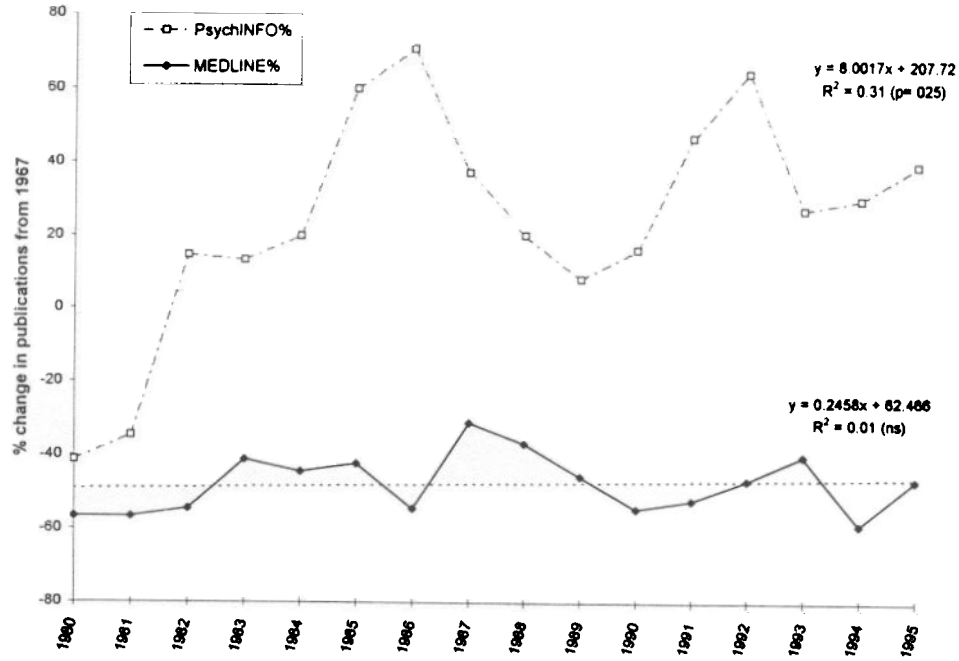

Fig. 4. Annual proportional change in number of dreams publications for PsychINFO and MEDLINE databases. Curves depict the percent of change relative to 1967 for the two databases. Linear regression equations display the average rate of growth (x-weighting factor) and degree of fit to the observed data. MEDLINE indicates a negligible rate of growth whereas PsychINFO indicates a continuing moderate rate of growth that is only poorly described by a linear regression.

well beyond the 15-year peak. That a second, similarly structured, period of growth can be identified for the later publication of Aserinsky and Kleitman's paper in *Science* attests to the non-random nature of this phenomenon. Also, since the Index was under relatively stable management for the period in which Freud's influence was most strongly felt (i.e., 1903-1920), we can be reasonably confident about the accuracy of these observations.

The impact on dream research of Aserinsky and Kleitman's work paralleled that of Freud's, albeit on a larger scale. The three most apparent parallels are: (1) both works led to a period of sustained growth that peaked about 15 years after release; (2) for both works, growth rates relative to 'baseline' or pre-release levels were similar (Freud's work led to a 3-fold increase, Aserinsky and Kleitman's to a 4-fold increase); (3) both periods of growth were terminated by a rapid 3-year decline followed by an extended period of variable levels of publishing. The significance of these parallels remains uncertain. Apart from the obvious possibility that they are due to chance, one explanation is that the recurrent pattern reflects an inherent intractability in the scientific study of dreaming. Twice in history scientists have mounted a concerted effort to bring the intrigue of dreaming into the mainstream of scientific inquiry; twice, seemingly, they have failed.

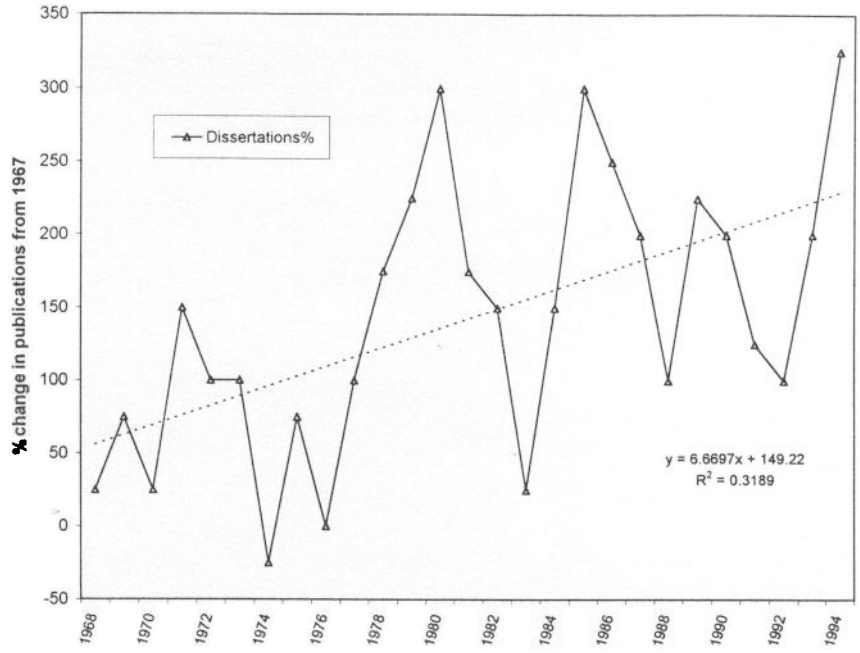

Fig. 5. Annual proportional change in number of dissertations on dreaming. The curve depicts the percent of change relative to 1967 for PsychINFO listings of works on dreaming in Dissertations Abstracts International. The growth rate is similar to that seen in the PsychINFO profile for dreams publications and is poorly described by a linear regression.

Another possibility is that the pattern observed here is typical of scientific change. Some scholars (e.g., Price, 1963) have described growth in science as a sequence consisting of a period of exponential growth, an inevitable period of saturation, and then breakdown/restraint and either escalation or fluctuation in the area. Although this pattern may describe dreaming research fairly well, it does not describe other areas influenced by Aserinsky and Kleitman's findings: sleep disorders and chronobiology. These areas have shown little evidence of decline to the present day, suggesting that Price's structural principal does not apply equally well in all scientific domains. By implication, developments within the area of dream studies per se may be required to explain the present observations.

The publishing peaks identified in both MEDLINE (in 1969) and PsychINFO (in 1968) are consistent with Foulkes' (1996) historical account of dream research. He judged 1964-1965 to be the all-time high point for US government support of dream research. Since the typical delay between inception of a project and its public availability through an abstracting source is about 4 years (Garvey, Lin & Carnot, 1970), the observed peaks at 1968 and 1969 in the abstract databases correspond well with Foulkes' estimates. Moreover, the diminution in published dream research up to 1980, which is apparent in both the medical and psychological databases, is consistent with Foulkes' (1996) claim that by 1980 psychophysiological dream research had become moribund. The solutions to basic problems of dreaming that

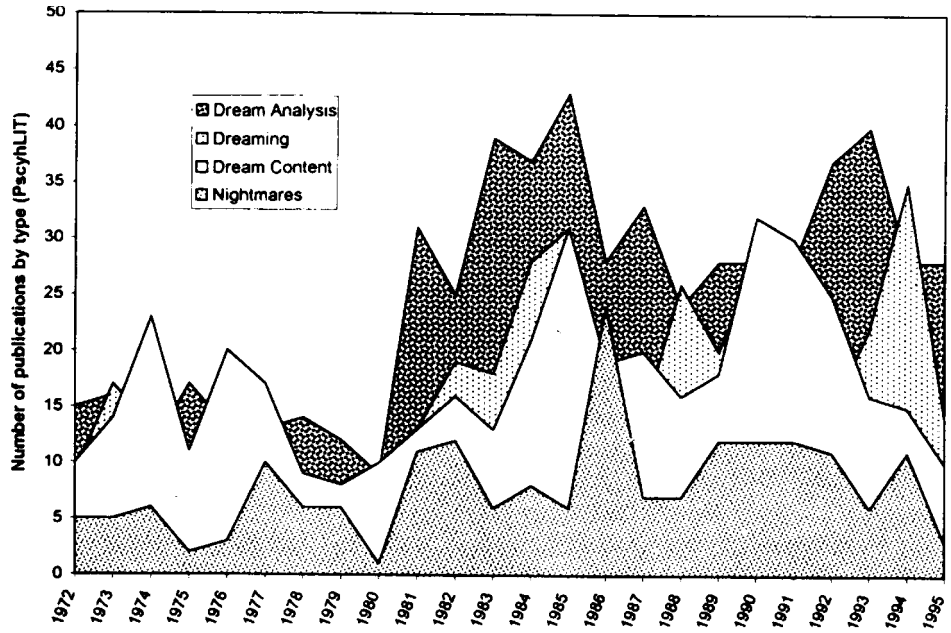

Fig. 6. Annual number of dreams publications in PsychINFO by subcategory: 1972-1995. The area curves show the annual number of PsychINFO listings for 4 subcategories of dreaming research publications: *Dream Analysis* publications are most responsible for the growth in publications in this database over the last two decades.

were promised but not fulfilled by physiological measurement of REM sleep may have been sufficient motive for many researchers to abandon the field.

On the other hand, that a similar, although less extreme, growth curve describes the situation in basic sleep research during this period suggests that *a more general influence may have been at work.* Basic sleep research demonstrated the flattest growth curve of all the other areas sampled. It resembles the growth curve of dream research more than those of chronobiology or sleep disorders in that it falls slightly below the projected estimate of growth for medical science in general. These trends are generally consistent with other publication estimates (Ware, 1988; Webb, 1991) indicating a decline during 1968-1988 in basic sleep research and an increase in sleep disorders research. Webb found that the decline in basic research was specific to some specialties (e.g., neurophysiology, biochemistry, phylogeny), but not others (e.g., pharmacology, instrumentation).

Thus, a more general influence on both dreaming and basic sleep research may have been the rapid ascent of clinical sleep medicine in North America (see Dement, 1990), which may have inadvertently drained the limited pool of expertise in basic sleep and dreaming research laboratories. Consequently, there were—and are—fewer researchers available to undertake basic research programs and perhaps even fewer funds to support the researchers who pursue these endeavors.

A RENAISSANCE IN COGNITIVE DREAM RESEARCH?

Comparisons between the MEDLINE and PsychINFO publishing estimates suggest that the recent slow decline in dream research publishing may be limited to biomedically-oriented studies. The psychological literature *does* confirm the impression from MEDLINE that there was a peak of activity in the late 1960s, a rapid decrease in the first few years of the 1970s, and then a period of variable decline. However, it diverges from MEDLINE in showing a clear resurgence of publishing in the 1980s—a resurgence that continues to the present day. This is a substantial difference; the volume of publications in PsychINFO during many of these years is at a level about twice that for MEDLINE. And, the peak levels for PsychINFO (in 1986 and 1992) surpass even the highest point of the MEDLINE profile (in 1969). The measure of completed dissertations reveals that the number of new Ph.D.s working on dreaming has more or less kept pace with this psychological renaissance in publishing.

Foulkes (1996) has isolated one obvious factor that may explain the observed divergence between the medical and psychological literatures, i.e., that in the early 1980s dream researchers began to turn their attention to more cognitively-oriented paradigms. However, it should be noted that other approaches to studying dreams have also grown in importance during the last two decades. PsychINFO indicates that studies under the heading *Dream Analysis* account for a large portion of this research. These primarily include publications dealing with dreams in the context of psychoanalytic and neo-psychoanalytic casework, group and individual therapy, counseling, and psychosomatics. Much of this research is applied or applied/clinical in nature, but it may well be underrepresented in the medical index. If so, much of the new research may reflect the same exodus towards clinically-relevant research described above for basic sleep research. Still other areas with a less clinical focus have grown in visibility in recent years; among these are studies of (1) personality and dreaming, (2) the phenomenology of dreaming, (3) dreams and literature, (4) lucid dreaming, and (5) anthropological, ethnographic, and cross-cultural investigations. The birth of the Association for the Study of Dreams in 1984 also played a role in stimulating growth among alternative approaches to dream research, as did the founding, in 1991, of its multi-disciplinary journal *Dreaming* (as of this writing, *Dreaming* accounts for 113 of the 597 dream research articles listed in PsychINFO from 1991-1996, or almost 19% of the total volume for these years. None of this work is listed in MEDLINE).

RELIABILITY OF THE INDEX MEDICUS

There are without question many factors affecting the consistency of the Index Medicus system that should temper any interpretation of the present findings (see Kunz, 1979, for a concise history of the Index). Survival of the Index for over a century—through shifting financial allegiances and two nation-consuming world wars—was due in no small measure to the successful interventions of a number of far-sighted benefactors and administrators. The Index changed hands several times

over the years—even ending up under the directorship of some French physicians for a time (1900-1902). Some of these changes are listed in Table 1. Despite turnovers in management, however, the principal production methods of the Index—entries typewritten and manually filed—did not change for over 83 years (Crawford, 1979).

Thus, although reliability of the Index may be doubted at points, such doubts are not serious enough to obscure the trends emerging from the present analyses. At many junctures, the observed trends even run counter to the restructuring that characterized the Index at the time. For example, the number of *new* journal titles cited in the Index for the years in which Freud's influence was most clearly in evidence (1910-1920) *decreased* dramatically relative to the preceding decade (Humphreys & McCutcheon, 1994). A second, more recent, example is that the number of titles cited by the Index *dropped* markedly from 1966-1967 and then remained relatively steady from 1967-1973 (Humphreys & McCutcheon, 1994)—precisely the period during which we observed a marked *increase* followed by a marked *decrease* in dream publishing. The fluctuations in dream research publishing appear to have been relatively independent of vagaries in growth and management of the Index itself.

CONCLUSION: THE PRESENT SPECIAL ISSUE

Analyses of publishing trends in the world's principal medical and psychological databases reveal shifting currents in dream research over the last century as a function of major scientific advances. Medically-oriented dream research has not kept pace with its sibling sleep disorders and chronobiology disciplines even though it has maintained a relatively stable volume of publications. However, in more recent years, other forms of research appear to have replaced or complemented medically-oriented research. Some of this work appears to be psychological—perhaps specifically cognitive—in nature, although much of it may be clinical/applied in focus despite its under-representation in the Index Medicus. In the present special issue of *Dreaming,* we have clear evidence that some of today's psychobiological researchers are directing their interests toward problems that combine psychobiological expertise with questions pertaining to clinical populations. Four of the contributions (Godbout, Bergeron, Stip, & Mottron; Rochlen, Hoffman, & Armitage; Schredl; Zadra & Nielsen) are concerned with the characteristics of laboratory-elicited dream reports and their physiological markers in the clinical populations of Asperger's syndrome, depression, narcolepsy, and sleep terrors, respectively. Fukuda, Ogilvie, and Takeuchi are concerned with sleep paralysis, a symptom of the sleep disorders narcolepsy and familial sleep paralysis that is increasingly examined in non-pathological populations. Mahowald, Woods, and Schenck propose a framework within which the hallucinations of a variety of psychiatric and neurological conditions may be reconciled with new discoveries in dreaming and state overlap disorders.

These contributions are perhaps a sign of the continuing evolution of dream science, an indication that dream research is rediscovering itself as a discipline with

historically distinct roots but with expanding opportunities for complementing the blossoming field of sleep medicine.

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