
An Empirical Analysis of Trends in Psychology

Richard W. Robins
Samuel D. Gosling and Kenneth H. Craik

University of California, Davis
University of California, Berkeley

The present research examined trends in the prominence of 4 widely recognized schools in scientific psychology: psychoanalysis, behaviorism, cognitive psychology, and neuroscience. The results, which replicated across 3 measures of prominence, showed the following trends: (a) psychoanalytic research has been virtually ignored by mainstream scientific psychology over the past several decades; (b) behavioral psychology has declined in prominence and gave way to the ascension of cognitive psychology during the 1970s; (c) cognitive psychology has sustained a steady upward trajectory and continues to be the most prominent school; and (d) neuroscience has seen only a modest increase in prominence in mainstream psychology, despite evidence for its conspicuous growth in general. The authors use these findings as a springboard for discussing different views of scientific prominence and conclude that psychologists should evaluate trends in the field empirically, not intuitively.

Since the birth of scientific psychology more than a century ago, many schools have risen and fallen from prominence. Much has changed since Heider (1933) described the early days of the field in terms of “seven psychologies.” Which, if any, of the schools currently competing for intellectual influence and institutional power is most prominent?

One popular contention is that the cognitive perspective now dominates scientific psychology, having prevailed over psychoanalysis and behaviorism (e.g., Baars, 1986; Gardner, 1985; Hunt, 1993; Sperry, 1988). For example, Sperry (1988) claimed that a shift from the behaviorist to the cognitive perspective is “widely recognized and well-documented . . . and appears to constitute a true shift of paradigm” (p. 608). In contrast, others have argued that no such cognitive revolution has occurred: “The repeated declaration of a revolution may be more a reflection of the enthusiasm many cognitive psychologists have for their subdiscipline than of actual events” (Friman, Allen, Kerwin, & Larzelere, 1993, p. 662). Similarly, Leahey (1991) suggested that “cognitive scientists believe in a revolution because it provides them with an origin myth, an account of their beginnings that helps legitimize their practice of science,” but he bluntly states, “there was no revolution” (p. 362). Others have come to the defense of the behaviorist school: “Although I have conducted no study, prepared no

in-depth interview, nor even any shallow survey of opinions, I do contend that behavioral analysis is alive and kicking and that I for one knew it all along” (Salzinger, 1994, p. 816). Pierce (1996) agrees that “behaviorism is not dead . . . the field of behavior analysis continues to thrive and progress, even in the absence of its mentor B. F. Skinner” (p. 461). Finally, and most recently, some have argued that the neuroscientific perspective is flourishing (e.g., Churchland, 1998)—indeed, the 1990s have been designated the “Decade of the Brain” by congressional resolution. There are even concerns (and for some, hopes) that the field of psychology will ultimately be reduced to a subfield of neuroscience (Bechtel, 1988).

Similar polemics pervade all fields, and although they may stimulate lively conversation, they are rarely informative and often misguided. Unfortunately, scientists often make consequential decisions—about allocating funding, hiring faculty, and so on—based on their personal views of what is “hot” in their field. Such decisions profoundly shape the direction taken by a science, and we believe they should be guided by empirical research rather than by mere speculation.

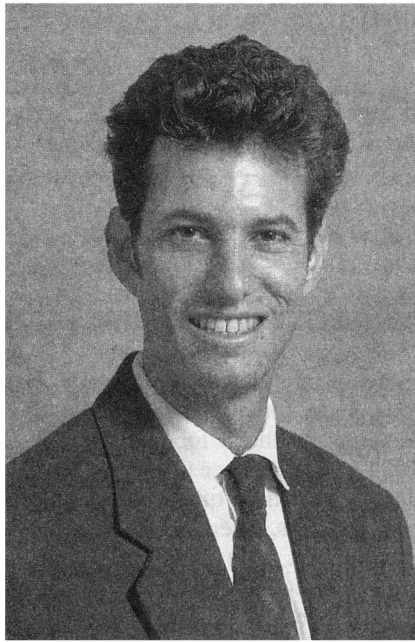
The present research focused on trends in the prominence of four of the most influential and widely recognized schools within psychology: psychoanalysis, behaviorism, cognitive psychology, and neuroscience. Prominence is a difficult construct to measure, and we therefore examined three indexes of prominence within mainstream scientific psychology. Our first index was based on an analysis of the subject matter of articles published in four “flagship” psychology publications. These flagship publications (e.g., *American Psychologist*) cut across subdisciplines and are read by a broad range of psychologists. The flagship pub-

Editor's note. William Bevan served as action editor for this article.

Author's note. Richard W. Robins, Department of Psychology, University of California, Davis; Samuel D. Gosling and Kenneth H. Craik, Department of Psychology, University of California, Berkeley.

This research was funded by a faculty research grant (University of California, Davis), a University of California graduate fellowship, and National Institute of Mental Health Grant MH-49255. We thank Oliver P. John for comments on an earlier version of this article.

Correspondence concerning this article should be addressed to Richard W. Robins, Department of Psychology, University of California, Davis, CA 95616-8686. Electronic mail may be sent to rwrubins@ucdavis.edu.



Richard W. Robins

lications serve dual roles in the field: They reflect current trends, and they define an agenda for the future. Thus, a school's prominence in the flagship publications can serve as an indicator of its prominence in mainstream scientific psychology. For example, if neuroscience has been increasing in scientific prominence, we would expect to find an increase in articles on neuroscience topics appearing in the flagship publications.

Our second index of scientific prominence was based on an analysis of the subject matter of dissertations. Compared to the flagship publications, dissertations may provide a better gauge of cutting edge research that is attracting the attention of young scientists in the field. Thus, an analysis of the subject matter of dissertations may detect emerging trends earlier than an analysis of the flagship publications, which may reflect more established scientific perspectives.

Our third index of prominence focused more directly on the scientific products of each of the four schools. Specifically, we examined how frequently articles published in each school's subdisciplinary journals were cited by the four flagship publications. By determining how many times an article is cited and who cites it, citation analyses provide a valuable empirical gauge of the level of attention an article has received (Garfield, 1979; Robins & Craik, 1993). Because many journals are associated with particular schools (e.g., cognitive psychologists tend to publish in cognitive journals and not in psychoanalytic journals), we can examine the scientific prominence of a school by determining how frequently journals within that school are cited in the flagship publications. If a school is increasing in prominence, one would expect to find an increase in citations of articles published in its subdisciplinary journals. Thus, we measured scientific promi-

nence by the number of times the flagship publications cited articles published in the top journals in psychoanalysis, behaviorism, cognitive psychology, and neuroscience.

Together, these three indexes of scientific prominence allowed us to determine which of the four schools are currently prominent and what specific trends can be identified over the past several decades. By including three measures and searching for convergence across measures, we hoped to ensure the generalizability of the findings. To the extent that all three indexes point to the same trends, we can be confident that the findings do not depend on the particular method used to measure prominence.

Method

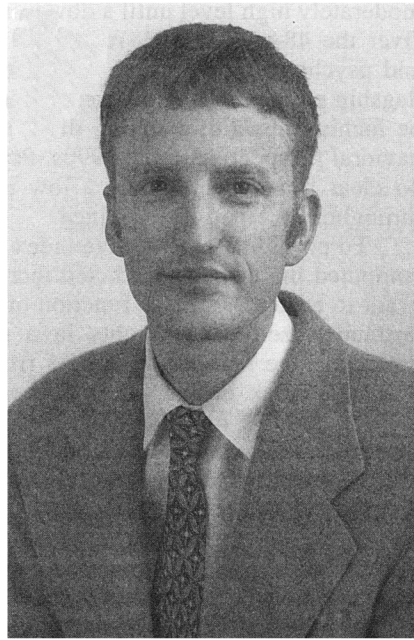
Selection of Flagship Psychology Publications

The *American Psychologist*, *Annual Review of Psychology*, *Psychological Bulletin*, and *Psychological Review* were selected as flagship publications because they aim to publish articles representing the entire field of psychology and because they were the most frequently cited of all psychology journals published throughout the period examined (*Social Sciences Citation Index: Journal Citation Reports [SSCI: JCR]*, 1977–1996).

Subject-Matter Index of Psychology's Flagship Publications

We used the psycINFO data base (which lists all articles published in psychology or related journals) to measure the proportion of articles relevant to each school that appeared in the flagship publications. PsycINFO permits keyword searches that retrieve all articles containing a specified word stem in one of four locations: article title, abstract, subject index, and keyword phrases listed by the authors. For example, a search based on *psychoanal#* will retrieve all articles that include words beginning with this stem, such as *psychoanalysis* and *psychoanalytic*. Thus, *psychoanal#* was used to represent psychoanalysis, *cognit#* was selected to represent cognitive psychology, and *neuropsy#* and *neurosci#* were selected to represent neuroscience. It was more complicated to identify keywords for behaviorism because the stems *behav#* and *behavior#* are too generic. Instead, we used the keywords *reinforc#* and *conditioning* to identify articles within the behaviorist school. It is important to bear in mind that the keywords we selected may not be equivalent in terms of representing their respective schools. For example, the keyword *cognit#* may capture more articles from the cognitive school than the keyword *psychoanal#* captures from the psychoanalytic school. Therefore, mean differences among the schools may reflect, in part, differences in the keywords chosen to represent each school and should be interpreted cautiously. Thus, our keyword analyses focus primarily on *trends* over time.

For each school, we calculated the percentage of articles published in the four flagship publications that included one or more of the keywords selected to represent



Samuel D. Gosling

that school.¹ This index was computed annually from 1950 (the earliest date when all four flagship publications existed) through 1997 (the most recent data available). Trends in scientific prominence were obtained by plotting these values over time.

Subject-Matter Index of Psychology Dissertations

For our second index of prominence, we measured which topics were occupying the attention of the next generation of researchers, that is, individuals writing their dissertations. Specifically, we examined the subject matter of doctoral dissertations listed in the psycINFO data base from 1967 to 1994 (the most recent data available).² We computed the index by calculating the percentage of dissertations that included at least one of the keywords previously selected to represent each school.

Citation Index of Flagship Publications

To replicate our findings using a non-keyword index of prominence, we examined trends in the degree to which the flagship publications cited articles published in the leading journals from each school. Findings from this analysis cannot be attributed to the particular selection of keywords.

Our first step was to select representative journals for each school. It was important that these journals publish research specific to the particular school. Thus, some highly influential journals were not appropriate because they span multiple schools (e.g., *Journal of Personality and Social Psychology*). For the behavioral, cognitive, and psychoanalytic schools, we used Friman et al.'s (1993) criteria to select the top four journals in each school based on citation impact rankings (the number of times a journal has been cited divided by the number of articles it has pub-

lished over a two-year period) and evaluations of influence and importance by experts (journal editors).

We used a similar procedure to identify the top neuroscience journals in psychology. However, because the field of neuroscience consists of a broad range of disciplines outside psychology (e.g., neurochemistry), many top neuroscience journals (e.g., *Neuron*) publish little of relevance to psychologists, and high citation rates do not necessarily reflect prominence by psychology. Therefore, we used ratings of prominence by neuroscientists working within psychology departments. First, six neuroscientists independently nominated a pool of 20 relevant journals. The nominated journals were then rated by an independent group of eight neuroscientists (seven professors and one postdoctoral fellow from three major research universities). Judges rated each journal's overall "influence and importance" and "relevance and centrality to psychology" on 5-point scales. The ratings showed substantial interjudge agreement and formed reliable composites (coefficient $\alpha = .87$ for influence and importance and .91 for relevance and centrality). After omitting journals that our judges did not consider relevant to psychology (i.e., those with mean ratings below 2.5), we selected the 4 rated as most influential for the analyses.³

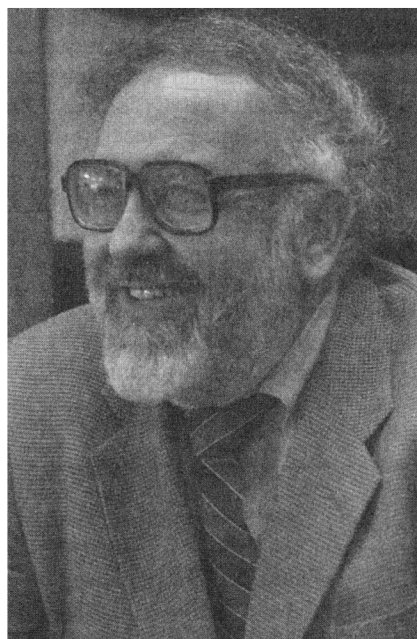
The 16 journals included in our analyses (the top 4 from each school) are shown in Table 1. The scientific prominence of each journal was gauged by the degree to which the articles it published were cited in the flagship publications. Specifically, we computed the total number of times per year the flagship publications cited articles published in each subdisciplinary journal.⁴ We then summed

¹ Our keyword analyses do not detect all of the articles related to each school. For example, the keyword *cognit#* does not detect all cognitive articles because even articles that are central to the cognitive perspective may not have *cognit#* in their title, list of keywords, or abstract. Moreover, as we have noted previously (Robins & Craik, 1994), the four broad schools of thought do not exhaust the research perspectives found in psychology. Thus, for example, articles from an evolutionary, behavioral genetic, or social constructionist perspective are unlikely to include any of our keywords. Finally, our keyword indexes may not identify psychological research that is centered on specific content domains (e.g., self-esteem, emotion regulation) or applied issues (e.g., industrial psychology, sports psychology). Given these points, we would not expect our keywords to capture the full range of articles published in the flagship publications.

² Dissertations in the psycINFO historical database (i.e., prior to 1967) used a different indexing policy that did not include any subject terms. Thus, the two periods are not comparable because keyword searches in the historical database detect far fewer dissertations than keywords searches from 1967 to the present.

³ One problem with this set of journals was that three of the four journals were founded after the beginning of our citation analysis (two in 1978 and one in 1981). However, the three journals started early in the period examined, and their debuts did not appear to influence the trends substantially. Nonetheless, neuroscience citation trends in the late 1970s and early 1980s should be interpreted cautiously.

⁴ To keep the number of cited journals under control, *SSCI: JCR* does not list every single journal cited by a publication. Instead, they adopt the following algorithm. Cited journals are limited to a maximum of 100, or to the number of journals that account for 85% of the total citations; journals that are cited less than six times are not printed unless this would leave a list of fewer than six cited journals. In practice, this algorithm



Kenneth H. Craik

these citation rates across the 4 journals associated with each school to obtain an index of the prominence of the psychoanalytic, behavioral, cognitive, and neuroscientific schools. This index was computed annually from 1977 through 1996 (the years *SSCI: JCR* was available).⁵

Results

Keyword Analysis 1: Subject Matter of Psychology's Flagship Publications

Figure 1 shows trends in the four schools from 1950 to 1997 based on the keyword analysis of the flagship publications. The plotted values are the percentage of articles associated with the keywords that represent each school. Averaged over the entire period, articles concerning cognitive psychology ($M = 9.7\%$, $SD = 5.9$) appeared most frequently in the flagship publications, followed by behavioral articles ($M = 5.8\%$, $SD = 2.7$), with psychoanalytic articles ($M = 1.3\%$, $SD = 1.5$) and neuroscientific articles ($M = 1.1\%$, $SD = 1.3$) relatively infrequent throughout the period examined.

In terms of trends over time, articles relevant to cognitive psychology have appeared with increasing frequency in the flagship publications. The increase began around 1960, soon after the 1956 symposium on information theory that some see as the birth of the cognitive revolution (Gardner, 1985). In contrast to the cognitive perspective, articles relevant to behavioral psychology have been decreasing. Behavioral articles sustained a

means that our analyses could miss some citations by the flagship publications to the subdisciplinary journals. However, we can be certain that the journals we missed would account for only a tiny proportion of journals cited by the flagship publications.

moderately high level until a downturn in the late 1970s. Over the 48-year period, relatively few neuroscientific and psychoanalytic articles have been published in the flagship publications. However, neuroscience appears to be inching upward, reaching the same level as the behavioral perspective in the 1990s. Psychoanalysis shows no clear trend, maintaining a low and level trajectory throughout the period examined.

To provide a quantitative index of these trends, we computed the average predicted increase in articles relevant to each school as a function of year (based on the unstandardized beta weights in a regression analysis predicting the number of articles from year). This provides an index of the rate of change in a raw score metric. Over the past 48 years, the percentage of cognitive articles has risen by about 0.39 ($p < .01$) percentage points per year, whereas the percentage of behavioral articles has declined by about 0.13 ($p < .01$) percentage points per year. Although these effects may appear small, they represent annual changes that accumulate over almost half a century. Thus, the percentage of flagship articles devoted to cognitive psychology has more than quintupled from an annual average of 3% between 1950 and 1952 to an annual average of 17% between 1995 and 1997. Behavioral psychology, on the other hand, has declined over the same period from an annual average of 6% between 1950 and 1952 to half of this value, or 3%, between 1995 and 1997. The trends for neuroscience ($\beta = 0.05$, $p < .01$) and psychoanalysis ($\beta = -0.01$, *ns*) were much weaker.

Keyword Analysis 2: Subject Matter of Psychology Dissertations

The findings from the analysis of dissertations are very similar to those from the analysis of the flagship publications. Figure 2 shows trends in the four schools from 1967 to 1994 based on a keyword analysis of dissertations. The plotted values are the percentage of dissertations listed in the psycINFO database that include keywords representing each school. Overall, dissertations concerning cognitive psychology ($M = 8.9\%$, $SD = 1.3$) appeared most frequently, followed by behavioral ($M = 4.3\%$, $SD = 3.5$) dissertations; again, psychoanalytic ($M = 0.5\%$, $SD = 0.2$) and neuroscience ($M = 0.6\%$, $SD = 0.4$) dissertations were almost nonexistent throughout the period examined.

⁵ There was one extreme outlier in the citation data. The November 1992 issue of the *American Psychologist* included hundreds of citations to the four behavioral journals. For example, the *Journal of Experimental Analysis of Behavior* was cited 143 times in that issue, more than 10 standard deviations above average (e.g., there were only 5 citations to the *Journal of Experimental Analysis of Behavior* in all 11 other issues of the *American Psychologist* published in 1992). There is a simple explanation for this deviant pattern: The November issue was a special issue commemorating B. F. Skinner upon his death. Thus, the unusually high citation level does not reflect a surge of attention toward behavioral psychology in November 1992. Therefore, we replaced the outlier value from the November issue with the mean value for the other 11 months of 1992.

Table 1
Leading Journals From Each School

Journal	1996 citation impact	Year first published
Psychoanalytic		
<i>International Journal of Psychoanalysis</i>	0.95	1920
<i>Psychoanalytic Quarterly</i>	0.88	1932
<i>Journal of the American Psychoanalytic Association</i>	1.22	1953
<i>Contemporary Psychoanalysis</i>	0.35	1964
Behavioral		
<i>Journal of Experimental Analysis of Behavior</i>	1.24	1958
<i>Behaviour Research and Therapy</i>	2.14	1963
<i>Journal of Applied Behavior Analysis</i>	2.04	1968
<i>Behaviour Therapy</i>	2.49	1970
Cognitive		
<i>Cognitive Psychology</i>	2.90	1970
<i>Cognition</i>	2.57	1972
<i>Memory and Cognition</i>	1.80	1973
<i>Journal of Experimental Psychology: Learning, Memory, and Cognition</i>	2.56	1975
Neuroscientific		
<i>Journal of Neurophysiology</i>	3.83	1938
<i>Annual Review of Neuroscience</i>	33.63	1978
<i>Trends in Neurosciences</i>	17.76	1978
<i>Journal of Neuroscience</i>	7.96	1981

Note. The citation impact of a journal is a measure of the frequency with which the average article in that journal has been cited in a particular year. Citation impact is computed by dividing the number of all current citations to a journal over the past two years by the total number of articles published in that journal over those two years.

In terms of trends over time, the percentage of dissertations with cognitive keywords has increased by 0.08 ($p < .01$) percentage points per year over the 28-year period, while the percentage of dissertations with behavioral keywords has decreased at a rate of 0.40 ($p < .01$) percentage points per year. Most of the increase in cognitive-related dissertations took place in the early 1970s, after which it essentially plateaued and sustained a high level. This extended plateau has the effect of attenuating the rate of change over time for cognitive dissertations. In contrast, the proportion of behavioral dissertations has continually declined across the period examined. Consistent with the findings from the flagship publications, the trends for neuroscience and psychoanalysis were weak, increasing by 0.04 ($p < .01$) and 0.02 ($p < .01$) percentage points per year, respectively.

Citation Analysis: Which Journals Do the Flagship Publications Cite?

The findings from the citation analysis replicated the two keyword analyses. Figure 3 shows annual citation rates from 1977 to 1996, separately for journals from each school. The plotted values are the total number of citations by articles in the four flagship publications to articles published in the four leading journals in each school. Averaged over 20 years, the flagship publications cited articles from cognitive journals most often ($M = 294$, $SD = 170$), followed by behavioral journals ($M = 138$,

$SD = 82$) and neuroscience journals ($M = 43$, $SD = 24$). Citations to articles published in psychoanalytic journals were minimal or nonexistent throughout the entire period examined ($M = 2$, $SD = 4$).⁶

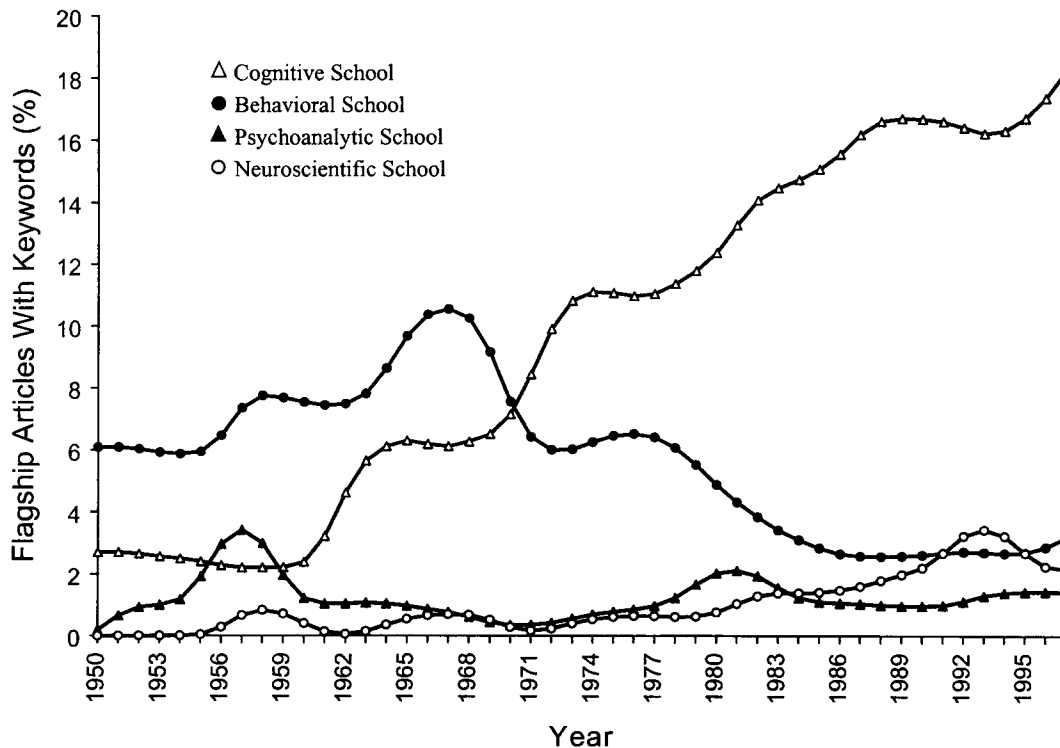
Over the past 20 years, there has been a gradual increase in citations to cognitive journals and a decrease in citations to behavioral journals. More specifically, Figure 3 shows a surge of attention to cognitive journals in the late 1980s and early 1990s, and a downturn in citations to behavioral journals beginning in 1979. Citations to cognitive journals increased from an annual average of 144 between 1977 and 1979 to an average of 520 between 1994 and 1996, while citations over the same period to behavioral journals decreased from 254 to 109. There were no trends for neuroscience or psychoanalytic journals, with the latter remaining close to zero throughout the 20-year period.

Again, these trends can be expressed in terms of unstandardized beta weights. Over the past 20 years, cita-

⁶ It is possible that mean differences in citations reflect variations among the schools in the total number of articles published in their respective journals. For example, perhaps cognitive journals published more articles than neuroscience journals. To control for this, we computed a second citation index based on citations per article; specifically, we divided the average annual total number of citations received by the journals in each subdiscipline by the average number of articles these journals published each year. The trends replicated for this adjusted citation index.

Figure 1

Percentage of Articles Published in the Flagship Publications That Include Keywords Relevant to the Cognitive, Behavioral, Psychoanalytic, and Neuroscience Schools



Note. A smoothing function was used to transform the raw data.

tions to cognitive articles have increased by about 21 per year ($p < .01$), whereas citations to behavioral articles have declined by about 6 per year ($p < .05$). Citations to neuroscience articles have increased by 0.7 per year (ns), and citations to psychoanalytic articles have increased by 0.02 per year (ns).

Together the three indexes of prominence paint a picture of the history of scientific psychology. Overall, the findings seem to reflect the achieved decline of psychoanalysis, the observed decline of behavioral psychology, the observed ascent of cognitive psychology, and perhaps, the starting position for neuroscientific psychology's rise to prominence. These findings are further supported by the founding dates of the four journals from each school (see Table 1). The psychoanalytic journals had the earliest founding dates ($Mdn = 1943$), followed by the behavioral journals ($Mdn = 1965$), the cognitive journals ($Mdn = 1973$), and most recently the neuroscience journals ($Mdn = 1978$).

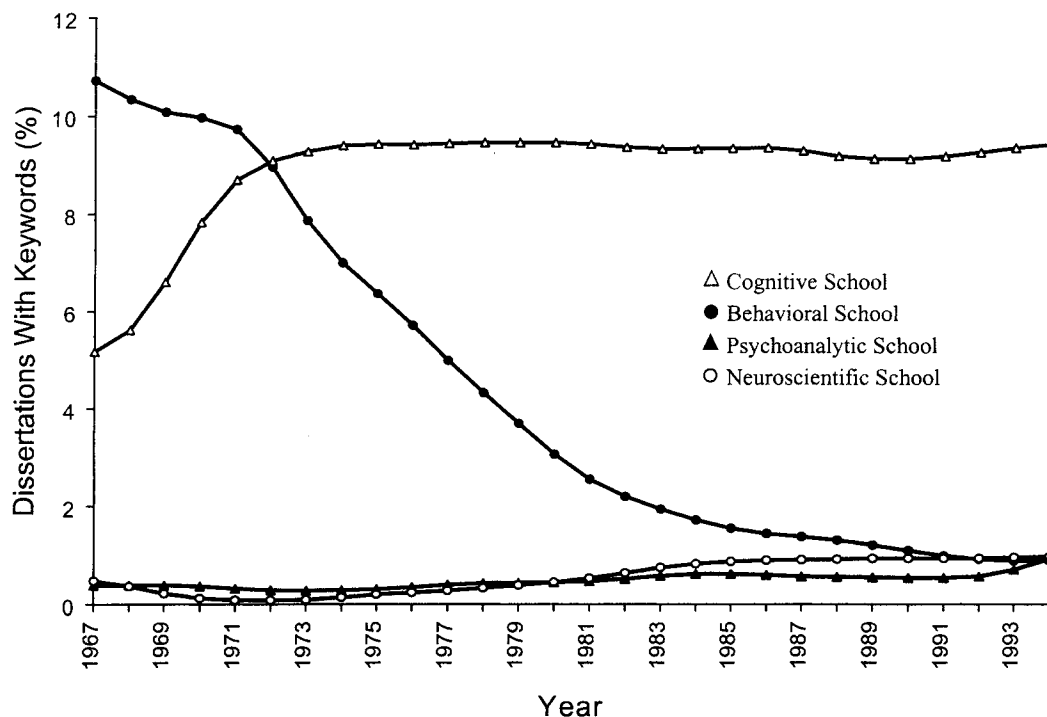
Supplemental Analyses: Searching for Evidence for the Rise of Neuroscience

We were surprised that none of the three indexes showed evidence of a strong rise in the neuroscientific perspective

within psychology. Intrigued by this counterintuitive finding (and spurred by some of our colleagues' disbelief), we searched for further evidence of neuroscience's prominence. First, we tested whether any of the four flagship publications showed a clear increase in attention to neuroscience. None of the flagship publications showed particularly strong trends for either the keyword or citation indexes of prominence. The *Annual Review of Psychology* showed the strongest increase for the keyword index (about one fifth of a percent per year) and *Psychological Review* showed the strongest increase for the citation index (less than one citation per year). Second, we considered the possibility that neuroscience journals may be attending to research in mainstream psychology even though the flagship publications have been largely neglecting research in neuroscience. However, when we tested this idea using the most recent citation data (1996), we found that the top four neuroscience journals cited the flagship publications only 56 times (in contrast, the four cognitive journals cited the flagship publications 733 times). This suggests that neuroscience is not strongly connected with mainstream scientific psychology through reciprocal citations. Third, we expanded the keyword analyses to include a broader range of keywords (e.g., *brain*, *fMRI*, *MRI*, *PET*). Again, we

Figure 2

Percentage of Dissertations That Include Keywords Relevant to the Cognitive, Behavioral, Psychoanalytic, and Neuroscientific Schools



Note. A smoothing function was used to transform the raw data.

found no strong upward trend for either the flagship or dissertation indexes. Fourth, we considered the possibility that our top four neuroscience journals were not sufficiently relevant to mainstream psychological science. To address this possibility, we reselected the top four neuroscience journals using a more stringent relevance criteria (a mean relevance rating greater than 3.0). This shift in relevance criteria excluded the *Journal of Neurophysiology*, which was replaced by *Behavioral Neuroscience*. This procedure strengthened the upward trend for neuroscience to an annual increase of 5 citations per year; however, this trend is still substantially weaker than the cognitive trend, which has had an annual increase of 21 citations per year. Fifth, we considered the possibility that the flagship publications were, in fact, increasing their citations to neuroscience articles, but that our analyses did not detect this increase because the cited articles were spread across the ever-increasing number of neuroscience journals. To address this possibility, instead of restricting our citation analysis to the four neuroscience journals, we examined citations to the flagship publications to any journal with *Neuro* or *Brain* in the title (e.g., *Neuropsychologia*, *Brain Research*). Although the total number of citations was obviously substantially higher, we again found only a minor upward trend. In summary, our supplemental analyses do show

some signs that the neuroscience perspective is growing in psychology. However, taken as a set, the analyses lead us to conclude that the growth of neuroscience within mainstream psychology is weak when compared with the rise of cognitive psychology.

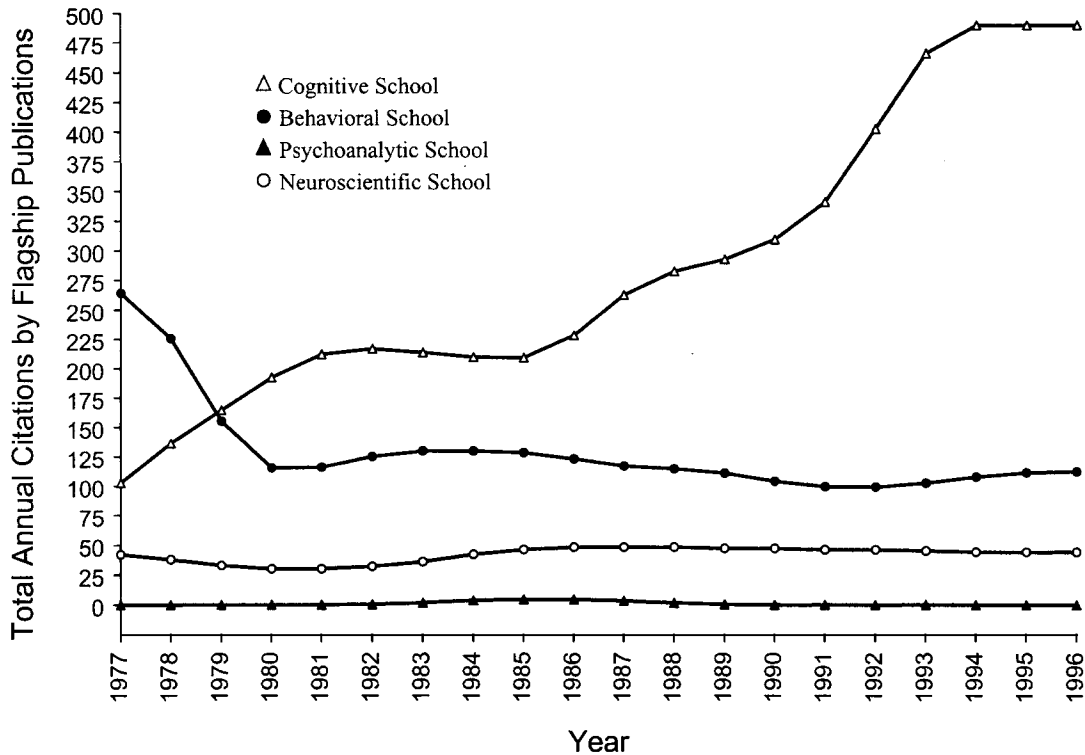
Discussion

The present study examined trends in the prominence of four influential schools in psychology. The replicability of the results across three independent measures of scientific prominence supports the generalizability of our findings, as well as the construct validity of all three measures of prominence. Although each index has limitations, the convergence of the findings across measures provides strong evidence for the trends we report. The analysis of dissertation trends shows that the findings cannot be attributed to a reliance on the four flagship publications as a gauge of prominence, and the analysis of citation patterns shows that the findings cannot be attributed to problems associated with the keyword-search methodology. Thus, to question the trends we report, the validity of all three measures would have to be disputed.

Overall, the results of our analyses suggest four major conclusions. First, mainstream scientific psychology has paid little attention to research published in the preeminent

Figure 3

Total Number of Citations per Year by the Four Flagship Publications to Articles Published in the Cognitive, Behavioral, Psychoanalytic, and Neuroscientific Journals



Note. A smoothing function was used to transform the raw data.

psychoanalytic journals over the past two decades. Moreover, there have been relatively few psychoanalytic dissertations or psychoanalytic flagship articles over the past several decades. Clearly, many of Freud's basic ideas have become incorporated into psychology's intellectual foundations and continue to influence research in the field (Kihlstrom, 1994; Westen, 1998). However, work appearing in contemporary psychoanalytic journals does not seem to be assimilated directly into the mainstream of scientific psychology. Rather, psychoanalysis seems to be a relatively self-contained camp, perhaps interacting more directly with research in psychiatry and with scholarship in the humanities and other social sciences (Friman et al., 1993; Robins & Craik, 1994).⁷

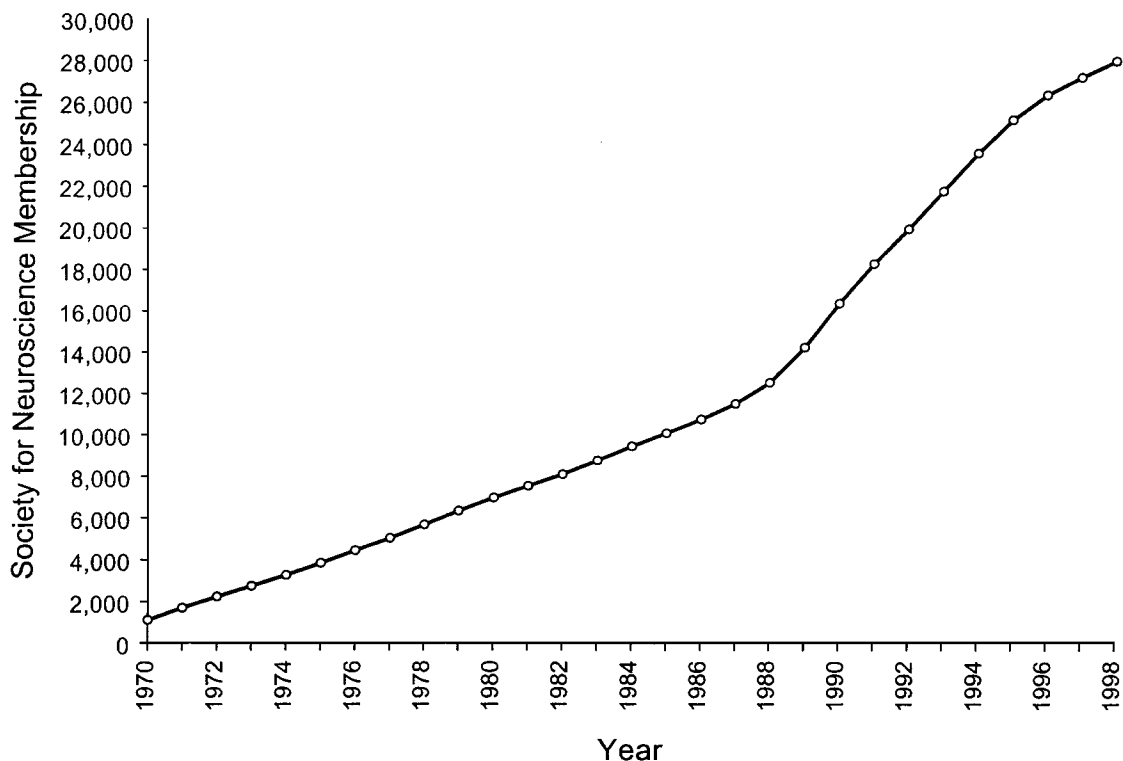
Second, despite claims to the contrary (e.g., Friman et al., 1993; Pierce, 1996; Salzinger, 1994), behavioral psychology has been on the decline in scientific psychology. Thus, our findings furnish hard evidence to substantiate what has become academic lore: Sometime during the 1970s, the prominence of behavioral psychology gave way to the ascension of cognitive psychology. This picture of contemporary psychology contrasts sharply with the view that behavioral psychology has maintained a high profile

throughout the 1980s (e.g., Friman et al., 1993). However, as is the case for psychoanalysis, behavioral concepts and methods continue to be widely used by researchers, as well as clinicians, to describe and study human behavior.

Third, cognitive psychology has overtaken behavioral psychology as the most prominent of the four schools. Different indexes place the ascension at different times, but all three show a rise in prominence. How can we explain the cognitive school's rise to prominence? Although there are certainly many factors (e.g., Gardner, 1985), the computer revolution has probably had a major impact on the prominence of cognitive psychology. Computers provided scientists with a new metaphor for conceptualizing how the mind works, one based on information processing and associated concepts of storage, retrieval, computational operations, and so on. Perhaps equally important, comput-

⁷ Friman et al. (1993) analyzed citations to psychoanalytic journals by all publications in the arts, humanities, social sciences, and sciences. Thus, this analysis gauged prominence across the general intellectual community rather than prominence within mainstream scientific psychology (Robins & Craik, 1994). Using this method, Friman et al. found a steady rate of citations to psychoanalytic journals from 1979 to 1988.

Figure 4
Annual Membership in the Society for Neuroscience



Note. A smoothing function was used to transform the raw data.

ers paved the way for the development of new methods for measuring mental processes (e.g., highly controlled presentation of visual and auditory stimuli). However, the cognitive school's dramatic rise in prominence shows some sign of abating—two of the indexes show its trajectory leveling off. It remains to be seen whether this plateau represents a temporary pause in growth, a zenith in the cognitive school's rise to prominence, or the beginning of a future decline.

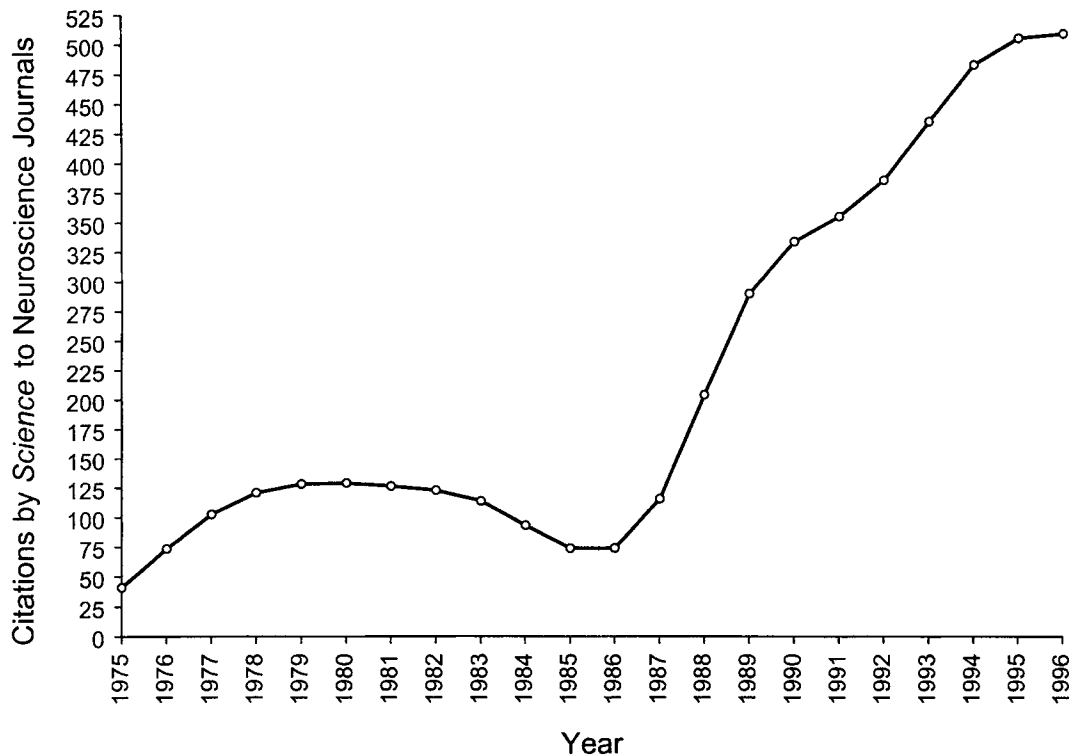
Fourth, none of the three indexes showed a substantial increase in the prominence of the neuroscience perspective within mainstream psychology. Moreover, a number of supplementary analyses also failed to detect a strong trend for neuroscience. At the same time, however, the widespread belief in the growth of the field of neuroscience is not mistaken. As shown in Figure 4, membership in the Society for Neuroscience has increased dramatically since it was founded in 1970. Similarly, neuroscience journals have been multiplying rapidly over the past decade. For example, the journal *Nature* recently created a new journal, *Nature Neuroscience*, based on the belief that "neuroscience is one of the great intellectual frontiers of science, and that [neuroscience] is likely to see rapid growth in the coming years" (*Nature*, 1997). Indeed many neuroscience journals are receiving a great deal of attention from science

as a whole. The four neuroscience journals examined in the present study are among the most frequently cited of all scientific journals when citations by both psychology and nonpsychology sources are considered (see the citation impact values in Table 1). In fact, the *Annual Review of Neuroscience* and *Trends in Neurosciences* have citation rates comparable with the journal *Science*. Moreover, when we examined citations by *Science* to the four core neuroscience journals, we found further evidence for the prominence of neuroscience. As shown in Figure 5, *Science* articles have dramatically increased their citations to the four neuroscience journals, with the upsurge beginning in the late 1980s. (In contrast, *Science* articles rarely cited journals from the cognitive, behavioral, and psychoanalytic schools.)

Given the conspicuous growth of neuroscience, how can we account for the findings of the present study? One possibility is that our three indicators of scientific prominence have a lag time, and they will detect an increase in the prominence of neuroscience within psychology over the next several years. Future research should explore other indicators that might already be pointing in this direction (e.g., research and training grants, hiring trends). Another possibility is that neuroscience will continue to grow but not within mainstream psychology. At this point, neuro-

Figure 5

Total Number of Citations per Year by the Journal *Science* to the Leading Neuroscience Journals



Note. A smoothing function was used to transform the raw data.

science may be located more centrally in the biological sciences than in psychology and in some ways may already constitute its own independent scientific discipline.

In our opinion, psychology should not let neuroscience slip away, perhaps taking with it a host of topics formerly studied by psychologists. Many areas of psychological research (e.g., attention, memory, emotion) appear to be increasingly oriented toward understanding the relevant neural mechanisms, but scientists studying these topics have thus far remained centrally located within psychology. The integration of the neuroscientific perspective within psychology cannot be taken for granted. Just as Plomin (1997) has urged psychologists not to lose DNA to the molecular geneticists, Squire (1997) has recently called on psychologists to take active steps to strengthen links between psychology and neuroscience. Even those who advocate the goal of reducing psychology to neuroscience have argued that “neuroscience needs psychology because it needs to know what the system does” (Churchland, 1986, p. 373). Alternatively, some researchers and philosophers have questioned whether higher level sciences like psychology and lower level sciences like neuroscience can “offer any useful guidance to each other” (Bechtel, 1988, p. 78) and have suggested that psychology and neuroscience

“must simply pursue their own problems in their own way” (p. 78). As Laird Cermak, the current editor of *Neuropsychology*, has pointed out, “neuropsychology is a discipline for which the boundaries are still being defined—it is still inventing itself (“Cermak Sees,” 1996). We anticipate that the next few years will see many border disputes between psychology and other disciplines to determine the extent to which neuroscientists see psychology as their primary academic home. E. O. Wilson (1998) has even suggested that psychology (as well as other social sciences) may be at a critical juncture that will determine whether it degenerates into a postmodernist free-for-all or evolves into a fully fledged natural science. Although we would not cast psychology’s prospects in terms of these two extremes, we do believe that psychologists must work harder to integrate neuroscience into the field.

What Is Scientific Prominence?

How should these trends be interpreted? Our intent was not to trace the history of ideas in modern psychology (e.g., Kendler, 1987) but rather to focus specifically on an empirical analysis of trends in prominence. We have defined prominence as the degree to which the mainstream of the field pays attention to a school’s scientific products (e.g.,

research findings and theories). Thus, a school's prominence could be seen as a reflection of its scientific merit. For example, Lakatos (1970) argued that a school becomes "progressive" when it yields new predictions that lead to empirical successes; Lakatos believed that "empirical evidence is the final arbiter among competing research programs" (Gholson & Barker, 1985, p. 757). This view suggests that cognitive psychology has attained prominence through successful scientific discoveries and through its ability to account for phenomena deemed central to the field. In contrast, Latour's (1987) constructionist view of scientific activity suggests that scientific information is disseminated to the field through communication networks that determine what becomes attended to and widely known. From Latour's perspective, cognitive psychology may have become prominent because its scientific products were effectively publicized to the rest of the field. Finally, scientific prominence could be seen as simply mirroring fad and fashion in the field (Christensen-Szalanski & Beach, 1984). In this view, the rise in the prominence of cognitive psychology would constitute an ephemeral blip in the history of psychology rather than a long-term shift in the orientation of the field. Clearly, though, the fact that the cognitive perspective has sustained its prominence for more than two decades argues against this position. Thus, although we recognize there are paths other than scientific merit to achieving prominence, we believe that the robust scientific trends documented in the present study reflect more than just fad and fashion.

Perspectives on Scientific Progress

How do these trends fit into the broader context of psychology as a science? Although our empirical approach is neutral with regard to different views of scientific progress, several perspectives within the history and philosophy of science may aid in interpreting our findings. For example, Kuhn (1962, 1970) portrayed the development of a science as moving from a *preparadigmatic* stage, characterized by multiple, competing schools, to a *paradigmatic* (or *normal science*) stage, characterized by a single dominant paradigm of shared assumptions and methodologies. Once a field has attained paradigmatic status, further scientific development involves a succession of revolutions in which the dominant paradigm within the field is displaced by a new one. Interpreted within a Kuhnian perspective, our findings point to the cognitive school as the most recent in a succession of dominant paradigms. However, other forms of evidence are required before a Kuhnian revolution can be declared; Kuhn's emphasis on the socialization process within science would call for evidence that, for example, the textbooks of scientific psychology have become primarily cognitive in orientation.

A number of scholars have debated whether psychology has even reached the paradigmatic stage of science (e.g., Briskman, 1972; Leahey, 1991; Schultz, 1981; Warren, 1971; Watson, 1977). For example, Masterman (1970) argued that psychology and other social sciences may be characterized by a *multiparadigmatic* stage, which precedes the eventual emergence of a dominant paradigm.

From this perspective, the proper question is not whether cognitive psychology is a newly dominant paradigm arising from the revolutionary ashes of a prior dominant paradigm. Instead, inquiry should focus on which of the various schools is most likely to gain a transcendent status and introduce the long-awaited paradigmatic stage of scientific psychology's development. The analyses we have presented speak to this issue. Viewed within a multiparadigmatic framework, cognitive psychology may be the most likely candidate among the existing schools to move psychology to the Kuhnian stage of normal science.

In contrast to Kuhn (1962, 1970) and Masterman (1970), Lakatos's (1970) theory of scientific development allows for multiple, competing schools at any stage of a science's historical development. These schools ("research programmes" in Lakatos's, 1970, terminology) may coexist indefinitely, and there is no assumption that one school will eventually emerge as the dominant paradigm. Lakatos views scientific progress as a horse race in which competing schools progress, degenerate, get revived, and so on, depending on the ability of the school to generate new hypotheses that lead to empirical discoveries.

The Lakatosian perspective has several implications for our findings. First, it implies that the cognitive school has attained prominence because it has been a progressive research program; that is, it has yielded new hypotheses and findings. Second, it implies that the current surge in cognitive psychology need not be interpreted as a scientific revolution, but could represent a revitalization of a perspective that was progressive in the early days of psychology (e.g., Wundt and James both emphasized the role of mental activity), degenerative during the middle of the 20th century, and now revived to prominence. Similarly, the currently lower prominence of the behavioral school may be seen as only a temporary slump, leaving open the possibility that the behavioral research program may once again rise to prominence in the field. Finally, the Lakatosian view implies that the four schools can inform each other; that is, they are not strictly "incommensurable," as Kuhn (1962, 1970) would have argued. Consistent with this view, there does seem to be fruitful exchange among the various schools of psychology. For example, cognitive neuroscience represents a fusion of ideas from the cognitive and neuroscientific schools, suggesting that these two perspectives may be able to coexist fruitfully. More generally, psychology appears to be coagulating around broader scientific orientations that cut across traditional fields of study (e.g., cognitive science combines psychology, linguistics, computer science, philosophy, etc.). At the same time, psychology also seems to be dividing into increasingly specialized camps (e.g., visual attention, stereotypes, decision making), which may eventually render broad classifications such as "cognitive psychology" obsolete.

Conclusion

The present research has identified a number of noteworthy trends in the history of psychology, some of which concur with prevailing beliefs and some of which run counter to them. In the years to come, questions about the prominence

of various schools will continue to be asked by those responsible for making decisions about who to hire, what to publish, which grants to fund, and ultimately how scientists study human behavior. We do not aim to offer guidance on how the trends should be used to answer these questions (e.g., whether to support currently prominent versus emerging perspectives). However, we do propose that such deliberations should be informed by empirical investigation rather than by mere speculation.

REFERENCES

- Baars, B. J. (1986). *The cognitive revolution in psychology*. New York: Guilford.
- Bechtel, W. (1988). *Philosophy of science: An overview for cognitive science*. Hillsdale, NJ: Erlbaum.
- Briskman, L. B. (1972). Is a Kuhnian analysis applicable to psychology? *Science Studies*, 2, 87–97.
- Cermak sees big role for neuropsychology. (1996, July). *APA Monitor*, p. 12.
- Christensen-Szalanski, J. J., & Beach, L. R. (1984). The citation bias: Fad and fashion in the judgement and decision literature. *American Psychologist*, 39, 75–78.
- Churchland, P. S. (1986). *Neurophilosophy: Toward a unified science of the mind/brain*. Cambridge, MA: MIT Press/Bradford Books.
- Churchland, P. S. (1998, March). *Ten unsolved problems in neuroscience*. Paper presented at the Science of Mind Distinguished Lecture Series, University of California, Davis.
- Friman, P. C., Allen, K. D., Kerwin, M. L. E., & Larzelere, R. (1993). Changes in modern psychology: A citation analysis of the Kuhnian displacement thesis. *American Psychologist*, 48, 658–664.
- Gardner, H. (1985). *The mind's new science: A history of the cognitive revolution*. New York: Basic Books.
- Garfield, E. (1979). *Citation indexing—its theory and application in science, technology, and humanities*. New York: Wiley.
- Gholson, B., & Barker, P. (1985). Kuhn, Lakatos, and Laudan: Applications in the history of physics and psychology. *American Psychologist*, 40, 755–769.
- Heidbreder, E. (1933). *Seven psychologies*. New York: Appleton.
- Hunt, M. (1993). *The story of psychology*. New York: Doubleday.
- Kendler, H. H. (1987). *Historical foundations of modern psychology*. Philadelphia, PA: Temple University Press.
- Kihlstrom, J. F. (Ed.). (1994). Psychodynamics and social cognition: Perspectives on the representation and processing of emotionally significant information [Special issue]. *Journal of Personality*, 62(4).
- Kuhn, T. S. (1962). *The structure of scientific revolutions*. Chicago: University of Chicago Press.
- Kuhn, T. S. (1970). *The structure of scientific revolutions* (2nd ed.). Chicago: University of Chicago Press.
- Lakatos, I. (1970). Falsification and the methodology of scientific research programmes. In I. Lakatos & A. Musgrave (Eds.), *Criticism and the growth of knowledge* (pp. 91–196). Cambridge, England: Cambridge University Press.
- Latour, B. (1987). *Science in action*. Cambridge, MA: Harvard University Press.
- Leahey, T. H. (1991). *A history of modern psychology*. Englewood Cliffs, NJ: Prentice-Hall.
- Masterman, M. (1970). The nature of a paradigm. In I. Lakatos & A. Musgrave (Eds.), *Criticism and the growth of knowledge* (pp. 59–89). Cambridge, England: Cambridge University Press.
- Nature. (1997, December 23). *Nature Neuroscience: A call for papers* [Announcement posted on the World Wide Web]. Retrieved April 17, 1998 from the World Wide Web: <http://neurosci.nature.com/call.shtml>
- Pierce, W. D. (1996). Behavior analysis is alive and well. *Contemporary Psychology*, 41, 461.
- Plomin, R. (1997, May). Let's not give away DNA. *APA Monitor*, p. 30.
- Robins, R. W., & Craik, K. H. (1993). Is there a citation bias in the judgment and decision literature? *Organizational Behavior and Human Decision Processes*, 54, 225–244.
- Robins, R. W., & Craik, K. H. (1994). A more appropriate test of the Kuhnian displacement thesis. *American Psychologist*, 49, 815–816.
- Salzinger, K. (1994). The one with the most citations wins. *American Psychologist*, 49, 816.
- Schultz, D. (1981). *A history of modern psychology* (3rd ed.). New York: Academic Press.
- Social Sciences Citation Index: Journal Citation Reports*. (1977–1996). Philadelphia: Institute for Scientific Information.
- Sperry, R. W. (1988). Psychology's mentalist paradigm and the religion/science tension. *American Psychologist*, 43, 606–613.
- Squire, L. R. (1997, April). A partnership between psychology and neuroscience. *APA Monitor*, p. 29.
- Warren, N. (1971). Is a scientific revolution taking place in psychology? Doubts and reservations. *Science Studies*, 4, 407–413.
- Watson, R. I. (1977). The historical background for national trends in psychology: The United States. In J. Brozek & R. B. Evans (Eds.), *R. I. Watson's selected papers on the history of psychology* (pp. 83–94). Hanover, NH: University Press of New England.
- Westen, D. (1998). The scientific legacy of Sigmund Freud: Toward a psychodynamically informed psychological science. *Psychological Bulletin*, 124, 333–371.
- Wilson, E. O. (1998, March). Back from chaos. *Atlantic Monthly*, 281, 41–62.