

General Article

THE ANATOMY OF IMPACT: What Makes an Article Influential?

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This study presents an analysis of psychologists' implicit theories of what makes an article influential in psychology. The study opens with a review of some alternative approaches to assessing the influence of articles. Next, the article discusses alternative conceptions of influence. Then a study that assesses the factors underlying impact is described. Six factors are identified: Quality of Presentation, Theoretical Significance, Practical Significance, Substantive Interest, Methodological Interest, and Value for Future Research. These findings are then discussed in terms of the theories presented earlier.

What makes an article influential? Why do some articles have enormous impact on the field, and others practically none? As both students and professionals, all of us read articles that stay with us for the rest of our lives; other articles are forgotten (at least from active memory!) moments after being read. Similarly, certain articles stay with the field and continue to be influential years after they are published, whereas other articles seem to disappear into thin air, and seem to have virtually no impact at all.

In this article, we seek to understand psychologists' implicit theories of what makes an article influential in the field of psychology. Such implicit theories may include judgments of quality (Shadish, 1989), but may include other factors beyond quality as well. Knowing what makes an article influential is important for consumers of knowledge, who need to read, sometimes review, and often evaluate the work of other people; and it is useful for producers of knowledge, who want to ensure that their time in research is spent wisely. In our discussion of impact, we use the terms *influence* and *impact* interchangeably.

ALTERNATIVE APPROACHES TO ASSESSING IMPACT

At least two approaches might be taken to answer the question of why it is that some articles have substantial

impact on the field, whereas others have virtually none. Each of these approaches has its strengths and weaknesses. Obviously, there is no one "right approach."

Analysis of the Impact of Specific Articles

The first approach involves selecting particular articles and analyzing why they have been influential. These articles may be selected either by subjective judgment, on the one hand, or by an objective measure, such as citation count, on the other. Consider, first, the subjective approach. This approach has been taken, for example, by Hunt (1992) and Kintsch and Cacioppo (1994), who identified and reprinted classic articles in the *Journal of Experimental Psychology: General* and the *Psychological Review*, respectively. Of course, editors of anthologies of readings also reprint classics.

A subjective list of factors (Sternberg, 1993) that seem to make articles such as those chosen by Hunt, Kintsch and Cacioppo, and editors of books of readings influential includes the following: (a) the article contains one or more surprising results that nevertheless make sense in some theoretical context; (b) the results presented are of major theoretical or practical significance; (c) the ideas are new and exciting, perhaps presenting a new way of looking at an old problem; (d) the interpretation of the results is unambiguous; (e) the article integrates into a new, simpler framework data that had previously required a complex, possibly unwieldy framework; (f) the article contains a major debunking of previously held ideas; (g) the article presents an experiment with a particularly clever paradigm or experimental manipulation; and (h) the findings or theory presented are general. Abelson (1995) has also provided a list of criteria, which go under the acronym MAGIC: magnitude of effect, articulation (including parsimony and detail), generality, interestingness, and credibility.

Influential articles may also be identified objectively, as determined by, say, citations in the *Social Science Citation Index* or in textbooks on introductory psychology. The "Top 10 Hit Parade" of articles published in the

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Psychological Bulletin (Sternberg, 1992) was based on this approach. Kintsch and Cacioppo (1994) also used citation counts for their analysis of the *Psychological Review*.

In the "Top 10 Hit Parade" issue of the *Psychological Bulletin*, authors of the 10 most highly cited articles were asked to comment on what made their particular articles so influential. Some of the features that these authors listed as leading to the high impact of their own articles included having a message worth delivering and writing well (Cronbach, 1992), making links between psychological constructs and psychological methods (Fiske & Campbell, 1992), and timing publication when a topic is "hot" (Douglas, 1992).

An advantage of the citation procedure over subjective identification is that citations are a relatively objective measure for identifying those articles that have had impact according to a quantitatively operationalizable criterion. An obvious shortcoming of this procedure is that it is arguable whether citation rate should be the measure of impact.

Although there is virtually no doubt that citation rate is one measure of impact, it is probably incomplete. For example, many cognitive theorists interested in thinking would acknowledge the impact of Dewey on their work, but Dewey's impact is so general that the ideas have become part of a general canon and Dewey is rarely cited specifically. The same might be said for the influence of Donders on reaction time research, of Skinner on the experimental analysis of behavior, or of Chomsky on ideas about innate aspects of language. Moreover, some articles are highly cited during a brief period of time and then are quickly forgotten, or are cited frequently for their flaws.

Analysis of the Impact of Articles in General

A second approach, taken here, is to ask psychologists (or others) what factors, in general, make an article influential and then to analyze the results statistically by multivariate methods.

This approach has the advantage of allowing an investigator to query a large number of individuals at a time, and of directly rather than indirectly seeking to assess just what people see as leading to impact. The method also has the advantage of being quantitative. But the method reveals only people's implicit theories of impact (see Sternberg, 1985, for a discussion of implicit theories), and there is no guarantee that what people believe renders an article influential is actually what has this effect. People may have false beliefs about what leads to impact, or may simply not be aware of what factors truly make a difference. At the same time, the method does

allow one to specify what people are likely to look for when they evaluate the impact of a given article.

ALTERNATIVE CONCEPTIONS OF INFLUENCE

We are unaware of any formal theories of the influence of articles on a field. Structurally, however, we believe that there are at least two quite plausible alternatives.

One alternative is that, when all is said and done, articles are influential for holistic reasons. Separate components of influence would be difficult to extract, and even if they were extracted, they would not be meaningful in their own right. According to this view, an analysis of people's conceptions of influence would yield a large general factor, but no meaningful subsequent factors, except, perhaps, for specific ones that apply to one article or another, but not to articles considered in general. This holistic view in the domain of the influence power of articles corresponds to the theory of Spearman (1927) in the domain of the mental power of people. One general factor overshadows any number of specific factors, each of which is of relatively little importance.

A second alternative is that the components of influence can, indeed, be separated, and that multiple components are meaningful in their own right. In this view, which corresponds to a Thurstonian view of intelligence (Thurstone, 1938), multiple and possibly correlated factors can each account for substantial proportions of variation in what makes one article more influential than another. According to this alternative, then, influence can be decomposed into multiple components, each of which can be analyzed in its own right.

These two viewpoints are not necessarily contradictory. A hierarchical model might be proposed, as it has been for intelligence (see, e.g., Carroll, 1993; Cattell, 1971). In such a model, there would be both a general factor and group factors below it. But our concern here is with whether it is possible even to extract meaningful group factors at all, or whether a general factor overshadows everything else.

METHOD

The study was done in two phases. The first phase involved generation of attributes; the second, evaluation of attributes.

In the first phase, 20 psychologists were asked to list characteristics of articles that make a high impact on the field of psychology. The psychologists were asked to list as many or as few items as they wished. The list obtained was then edited for redundancies, and the remaining items were compiled into a questionnaire.

In the second phase, psychologists were asked to provide ratings of the importance of the attributes in determining whether articles have impact. The final questionnaire was sent via the U.S. mail to 500 psychologists who were chosen at random from the membership directory of the American Psychological Society. All recipients of the questionnaire held doctorates in psychology.

The chosen organization tends to attract psychologists with interests directed toward research, although strong research interests are not a prerequisite for joining. Selecting psychologists from a different organization, such as the American Psychological Association, might have resulted in a different orientation, say, more toward practice.

Of the 500 questionnaires sent out, 17 were sent back for inadequate addresses (moved with no forwarding address, inadequate address, wrong address), giving us a potential sample of 483 individuals. Of the sampled individuals, 254 (53%) returned their questionnaires. Two of the questionnaires were incomplete, leaving us a final sample of 252 individuals (52% of those originally sampled).

Respondents were asked to list their main areas of interest, and we classified these listings into seven groups: 38 respondents in clinical-counseling-abnormal-rehabilitation, 65 in cognitive-experimental, 36 in social-personality, 11 in quantitative, 39 in applied-industrial-organizational-school-educational-ecological-consumer, 27 in psychobiology-physiological-behavioral neuroscience-behavior genetics-comparative, and 34 in developmental-history. The interests of 2 were unclear from their responses.

Of the 252 respondents, 158 were male, 92 were female, and 2 could not be classified. Moreover, 37 had received doctorates in the 1990s, 78 in the 1980s, 81 in the 1970s, 43 in the 1960s, and 13 in the 1950s. Thus, there was a wide spread among the respondents in the number of years since they received the doctorate.

The questionnaire consisted of 45 statements presented in two different random orders. The instructions were as follows:

This questionnaire seeks your views on what makes an article in psychology have an impact on the field. Below you will find a set of statements. Each statement represents a possible attribute contributing to an article's having an impact. Your task is to rate each statement on a 1 to 6 scale, where 1 indicates that you do not believe that the attribute is of any real importance in determining whether an article will have impact, 6 indicates that you believe that the attribute is of extreme importance, and 2-5 represent intermediate points. In a nutshell, 1 = not at all important, 2 = slightly important, 3 = somewhat important, 4 = quite important, 5 = very important, 6 = extremely important. Please rate each item. Thank you.

RESULTS

Basic Statistics

Table 1 lists the complete set of items used as well as the mean rated value and standard deviation for each item. Items are listed in descending order of mean rated importance of the attribute.

The means show that the attributes viewed as most important in determining influence are making an obvious contribution to psychological knowledge, adding something new and substantial; presenting results that are of major theoretical significance; and presenting a useful new theory or theoretical framework. Generating new research, providing new and exciting ideas, and integrating previously unintegrated or poorly explained areas were also viewed as relatively important.

Least important among the attributes listed were including concrete examples, providing evidence that supports an existing influential psychological theory, and containing useful implications for professional practice. Presenting a general theory and having intriguing results that do not fit any existing theory were also seen as relatively unimportant.

One can see where there was most and least agreement among respondents by examining the standard deviations. These interpretations, of course, must be moderated by ceiling and floor effects at the top and bottom of the scale, respectively. However, the items with the lowest and highest standard deviations were not all at the extremes.

The most agreement was obtained on the items arguing for an obvious contribution to psychological knowledge, adding something new and substantial; providing a better explanation of existing phenomena; presenting a new viewpoint on a problem; and containing interesting generalizations, which are clearly stated, confirmed, and based on results.

The least agreement was obtained on the items arguing for the importance of the article appearing at the right moment, when people are ready to hear the message; being applicable to work in many areas of psychology; presenting results of major practical significance; and having an unbiased, impartial tone. Again, it is important to add that a different subpopulation of psychologists might have perceived things differently.

Principal-Components Analysis

Principal-components factor analysis was conducted on the complete intercorrelation matrix. A total of 11 unrotated factors had eigenvalues greater than 1 (in descending order: 8.80, 5.22, 2.56, 2.12, 1.93, 1.72, 1.48, 1.35, 1.28, 1.12, 1.05). These results suggest that a gen-

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Table 1. Basic statistics on item ratings for the impact questionnaire items

Rank	Mean	SD	Item
1	4.94	1.00	Makes an obvious contribution to psychological knowledge, adding something new and substantial
2	4.91	1.11	Presented results are of major theoretical significance
3	4.79	1.18	Presents a useful new theory or theoretical framework
4	4.70	1.15	Generates new research
5	4.57	1.18	Provides new and exciting ideas
6	4.56	1.14	Integrates many different areas of data previously thought to be unrelated or poorly explained
7	4.46	1.13	Integrates into a new, simpler framework data that had previously required a complex and possibly unwieldy framework
8	4.45	1.08	Opens up a new problem (research question) for investigation
9	4.43	1.25	Results of analysis are presented clearly and discussed carefully with tight, logical reasoning
10	4.33	1.33	The problem is clearly stated and well-conceptualized
11	4.31	1.16	Presents an unambiguous and creative interpretation of results
12	4.29	1.17	Topic is interesting and important
13	4.28	1.03	Presents a new viewpoint on a problem
14	4.28	1.26	Well-written, well-structured, and well-organized
15	4.26	1.02	Provides a better explanation of existing phenomena
16	4.25	1.10	Contains useful implications for future research studies
17	4.14	1.30	Hypotheses are clearly stated and testable
18	4.13	1.31	The writing is succinct and internally consistent
19	4.10	1.09	Contains useful recommendations for changes or modifications in accepted theoretical constructs
20	4.08	1.22	Considers different alternative interpretations of the data and then arrives at a clear final, unambiguous interpretation
21	4.05	1.29	Has a logical flow and organization of ideas
22	4.03	1.54	Appears at the right moment, when people are ready to hear the message
23	4.03	1.15	Contains useful implications for a scholarly understanding of the field
24	4.00	1.19	Contains some surprising results that make sense in some theoretical context
25	4.00	1.04	Contains interesting generalizations, which are clearly stated, confirmed, and based upon results
26	3.98	1.10	Contains useful recommendations for further research or for changing research methodology
27	3.88	1.39	Debunks an existing theory or way of thinking
28	3.87	1.12	Clarifies existing problem(s)
29	3.84	1.22	Contains useful implications for theory building
30	3.79	1.34	Captures reader's interest
31	3.74	1.45	Results are of major practical significance
32	3.72	1.37	Starts and ends strongly, attracting attention and interest from the first paragraph and ending with clear take-home message
33	3.70	1.21	Presents a new and useful test or technique
34	3.68	1.13	Demonstrates a useful experimental paradigm
35	3.48	1.18	Presents an experiment with a particularly clever paradigm or experimental manipulation
36	3.46	1.49	Is applicable to work in many areas of psychology
37	3.42	1.29	Provides evidence that fails to support an existing influential theory
38	3.40	1.39	Is clearly understandable to a broad cross-section of psychologists
39	3.17	1.45	Tone is unbiased and impartial
40	3.03	1.12	Presented findings are general ones
41	2.96	1.16	Results are intriguing but do not fit any existing theory
42	2.95	1.22	Presented theory is a general one
43	2.87	1.40	Contains useful implications for professional practice
44	2.74	1.17	Provides evidence that supports an existing influential psychological theory
45	2.32	1.26	Includes concrete examples (from everyday life, lives of famous people, etc.)

Note. Means are on a scale from 1 (low) to 6 (high).

eral-factor model would be insufficient to characterize the data. We therefore varimax-rotated from three to six factors. Promax (oblique) rotation yielded similar but less clear-cut results. After six factors, the rate of decrease in the eigenvalues became very small. All six factors were interpretable. These six factors, along with items loading .50 or over, are listed in Table 2.

Note that in the table there are two measures of the power of the factor. The first, the average scale value, is the mean of the importance ratings for the items in the factor. This mean will not necessarily correspond to the ordering of the factor, because ordering is determined by correlational structure, not by mean values. The second measure, the eigenvalue for the rotated factor, is the relative strength of the factor in accounting for variation in the (correlational) data.

We interpret the factors as follows:

- Factor I. *Quality of Presentation*. High-impact articles tend to be well written, with the problem well conceptualized and clearly stated. They are succinct and internally consistent, and have a logical flow and organization of ideas. Although this factor accounted for the most variation in the data, its statements ranked only third in importance.
- Factor II. *Theoretical Significance*. High-impact articles tend to present results of major theoretical significance, and often explain existing phenomena better than previous work did, perhaps by containing useful recommendations for changes or modifications in accepted theoretical constructs. This factor accounted for the second most variation in the data (rank of two), but its statements had the highest mean importance rating (rank of one).
- Factor III. *Practical Significance*. High-impact articles tend to contain results that have major practical significance and useful implications for professional practice, as well as ideas that are applicable to work in many areas of psychology. This factor ranked fourth in terms of accounting for variation in the data, but its statements had the lowest mean importance rating (i.e., ranked sixth).
- Factor IV. *Substantive Interest*. High-impact articles tend to capture people's attention. They are interesting, are important, and appear just at the right moment, when people are ready to hear the message they present. This factor accounted for the least variation in the data (i.e., ranked sixth), and its statements ranked fourth in importance.
- Factor V. *Methodological Interest*. High-impact articles tend to present new experimental paradigms or manipulations, or new tests and techniques of potential

interest to the field. This factor ranked fifth in accounting for variation in the data and fifth in the importance of its statements.

- Factor VI. *Value for Future Research*. High-impact articles tend to present work that has useful implications or recommendations for further research, whether methodological or substantive. This factor ranked third in accounting for variation in the data, but its statements ranked second in importance.

Obviously, no factor name perfectly captures all the ideas delineated by a factor, and no set of factors adequately captures all of the variation in the data. Here, the six rotated factors explain 49.67%, or roughly half, of the variance in the data.

The results suggest that the methodology we used was useful for capturing people's implicit theories of what characteristics are likely to result in an article's having high impact. Obviously, not all influential articles will show all of the characteristics. Furthermore, there is no guarantee that an article that possesses all six characteristics will be influential. But the factors seem to capture reasonable intuitions as to what psychologists should strive for when they seek to do work that will have an impact on the field, or what readers might look for when they seek to evaluate the potential impact of an article.

DISCUSSION

This study, like any other, has certain limitations, at least some of which we are aware of. First, the subpopulation we chose tended to emphasize research rather than practice interests. Second, what people believe in the abstract is not always what actually happens in the concrete. A further study would be desirable to evaluate actual articles for impact as well as for the six attributes we have uncovered, to see whether these attributes do in fact predict evaluations of impact. Third, the six factors listed accounted for only half the variance in the data, and certainly are not an exhaustive account of what makes an article influential. Moreover, there may be unique (idiographic) factors that apply only to single articles, and that thus would be unlikely to emerge in the type of analysis we did. But we believe, nevertheless, that useful findings have emerged from our analysis.

High-impact articles tend to have at least some common attributes. There is more than a single, general factor underlying what makes an article influential. The results suggest some of the qualities the field may select for, namely, quality of presentation, theoretical significance, practical significance, substantive interest, methodological interest, and value for future research. Thus, it seems that the field does have a set of criteria by which

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Table 2. Varimax-rotated principal components for the impact questionnaire

Scale value	Loading	Item
Factor I. Quality of Presentation (Average scale value: 4.06; eigenvalue: 6.22)		
4.05	.82	Has a logical flow and organization of ideas
4.43	.82	Results of analysis are presented clearly and discussed carefully with tight, logical reasoning
4.28	.81	Well-written, well-structured, and well-organized
4.33	.81	The problem is clearly stated and well-conceptualized
4.13	.80	The writing is succinct and internally consistent
4.14	.74	Hypotheses are clearly stated and testable
3.17	.61	Tone is unbiased and impartial
3.72	.57	Starts and ends strongly, attracting attention and interest from the first paragraph and ending with clear take-home message
4.31	.55	Presents an unambiguous and creative interpretation of results
Factor II. Theoretical Significance (Average scale value: 4.25; eigenvalue: 4.85)		
4.91	.70	Presented results are of major theoretical significance
4.79	.65	Presents a useful new theory or theoretical framework
4.56	.64	Integrates many different areas of data previously thought to be unrelated or poorly explained
4.26	.57	Provides a better explanation of existing phenomena
3.88	.57	Debunks an existing theory or way of thinking
4.46	.54	Integrates into a new, simpler framework data that had previously required a complex and possibly unwieldy framework
4.10	.52	Contains useful recommendations for changes or modifications in accepted theoretical constructs
3.03	.52	Presented findings are general ones
Factor III. Practical Significance (Average scale value: 3.16; eigenvalue: 2.72)		
3.74	.77	Results are of major practical significance
2.87	.74	Contains useful implications for professional practice
3.46	.64	Is applicable to work in many areas of psychology
3.40	.59	Is clearly understandable to a broad cross-section of psychologists
2.32	.57	Includes concrete examples (from everyday life, lives of famous people, etc.)
Factor IV. Substantive Interest (Average scale value: 4.04; eigenvalue: 2.45)		
3.79	.61	Captures reader's interest
4.29	.56	Topic is interesting and important
4.03	.50	Appears at the right moment, when people are ready to hear the message
Factor V. Methodological Interest (Average scale value: 3.72; eigenvalue: 2.70)		
3.48	.71	Presents an experiment with a particularly clever paradigm or experimental manipulation
3.70	.69	Presents a new and useful test or technique
3.68	.63	Demonstrates a useful experimental paradigm
4.00	.51	Contains some surprising results that make sense in some theoretical context
Factor VI. Value for Future Research (Average scale value: 4.21; eigenvalue: 3.41)		
4.25	.72	Contains useful implications for future research studies
3.98	.64	Contains useful recommendations for further research or for changing research methodology
4.03	.60	Contains useful implications for a scholarly understanding of the field
4.10	.56	Contains useful recommendations for changes or modifications in accepted theoretical constructs
4.70	.51	Generates new research

Note. The six rotated principal components listed account for 50% of the variance in the data and were obtained from factor-analyzing the item intercorrelation matrix. Items are listed only if their loading on a factor is .50 or greater.

it selects some articles and not others for longevity. Clearly, mere novelty is not enough. To be influential, articles have to be clearly communicated and theoretically or practically important as well. There is much more to impact than merely coming up with a novel idea.

Perhaps most important, the interest factors show the importance of the interaction between an article and the time and place in which it is published. Substantive and methodological interest are very much a function of time and place. What interests and even excites people at one time or place does not necessarily do so at another, a fact recognized in the item that notes the importance of the article's appearing "at the right moment" and of people's being "ready to hear the message." And our message today is that if one wishes to write an article with potential impact or to evaluate the impact of an already written article, it is possible to understand at least some of the factors that will contribute to the perceived impact of that article.

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