

Current Comments®

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The New 1956-1965 *Social Sciences Citation Index*. Part 1. Analysis of 1988 Research Fronts and the *Citation Classics* That Made Them Possible

Number 41

October 9, 1989

This fall ISI® is publishing the 1956-1965 *Social Sciences Citation Index*®. The new cumulation provides unique access to the social sciences literature of a crucial decade. Analysis of current research fronts demonstrates how core literature of earlier decades has continuing and lasting relevance for present and future research. Six papers from the behavioral sciences are reviewed, including *Citation Classics*® by Claude E. Shannon, Janet A. Taylor, David B. Duncan, Henry F. Kaiser, George A. Miller, and Harry F. Harlow.

Next month, ISI® will publish the 1956-1965 *Social Sciences Citation Index*® (*SSCI*®). The compilation of this 10-year cumulation is part of a continuing plan to extend coverage so as to provide the first comprehensive, multidisciplinary index of the social sciences for the postwar period. The source and citation data in this cumulation have not been covered in other print, online, or compact disc versions of the *SSCI*. In fact, no other single comprehensive print or online source for this data exists. Apart from its value to researchers, in terms of retrospective retrieval, it now provides libraries and scholars the means of bibliographic verification for these years.

Since the particular and unique advantages of these indexes have been described many times before, I will not repeat them. However, it is worth reiterating that the *SSCI* covers over 60 specialties in nine broad subject areas: business/economics, communication/information science, education, geopolitics, history, humanities, law, medicine, and psychology/behavioral sciences. The latter discipline is by no means the least, as the following report will emphasize.

Nearly 450,000 source articles and other substantive items containing over 2,500,000 citations are indexed in the new cumulation. The *SSCI* also includes additional entries relevant to the social sciences selected from non-social sciences journals covered in the *Science Citation Index*® (*SCI*®)—thus pro-

viding one-stop access to most relevant material. Searches can be extended by using the *SCI* for this period, published several years ago.

Significant Advances in the Social Sciences

Space does not permit an adequate discussion of the significant achievements that social sciences research accomplished during this decade. Some of the significant publication events reported in those years are reflected in the list of 108 highly cited papers and *Citation Classics*® that will be reported on later. In a subsequent essay, we intend to provide further indicators of the intellectual output of this decade by identifying highly cited articles and books that are, to some extent, the leading products of social sciences scholars.

The Most-Cited Papers from the 1956-1965 *SSCI*

A most-cited paper list was compiled from the 1956-1965 *SSCI* data. With 75 citations as a cut-off, 108 papers were identified (the complete list is included in the front matter for the 1956-1965 cumulation, and a complete listing of the 108, along with highly cited books, will appear in Part 2 of this essay). Psychology dominates the list—98 out of the 108 were in this field. Of these,

eight were published in psychiatry journals. About 17 percent of the psychology papers are in the subfield of personality; 11 percent concern learning and memory. Cognition and social psychology were each represented by 11 papers (about 10 percent); physiological psychology by 10 papers (9 percent); and the specialties of conditioned learning, motivation and behavior, and psychometrics were represented by 9 papers. Research methodology and statistical-quantitative psychology had six and three papers, respectively. So that readers can get a fairly accurate idea of the kinds of papers that are highly cited, a list of the top 41 articles (derived from the 108 papers mentioned earlier) appears in Table 1.

The substantial number of psychology papers should come as no surprise. A large volume are published each year. Psychology is one of the largest of the social sciences research fields, both in subdisciplines and in numbers of researchers. According to 1985 statistics from the National Science Foundation, Washington, DC, there were 52,000 psychologists as compared with 64,000 social scientists in other disciplines.¹ This means there are nearly as many psychologists as there are economists, historians, anthropologists, and other social scientists combined. The dominance of psychology articles was also reflected in our study of most-cited social sciences papers for the 1969 to 1977 period. In that report, 77 of the 100 most-cited works were in psychology.²

The 1988 Research Fronts

An additional measure of the continuing influence of research from this decade can be found in 1988 research fronts. These fronts can be observed by noting systematically the earlier works cited by contemporary authors. These cited papers and books are described as core to the research fronts they identify. Table 2 shows those fronts for which at least one paper in the most-cited list is core.

Claude E. Shannon's Information Theory

For example, #88-7967, "Information entropy, systems science, and channel capacity" is defined completely by two classic pa-

pers of Claude E. Shannon,^{3,4} formerly of Bell Telephone Laboratories, Murray Hill, New Jersey, and now at the Department of Electrical Engineering, Massachusetts Institute of Technology, Cambridge. Shannon's work on the mathematical theory of communication has been widely discussed and included in encyclopedias⁵—among them *Van Nostrand's Scientific Encyclopedia*.

Although many early writers had grappled with the problems of information transmission, and had recognized its statistical nature, the consolidation and extension of these concepts into a complete and cohesive theory of communication is quite properly attributed to Shannon. His original paper in 1948 is a remarkable document that has survived the tests of time and become a genuine classic whose relevance is increasingly impressive as the years pass. Although information theory has become more precise and more complete in the past 25 years, no fundamental concepts of major importance have been added to or significantly altered from those originally proposed by Shannon.⁶

In the years 1956 to 1965, Shannon's works^{3,4} were cited in social sciences journals over 180 times. Since then, these papers have accumulated over 730 citations through 1988. Their impact was even greater in the physical and theoretical sciences. In the 1945-1988 *SCI*, Shannon's classic works have been explicitly referenced in over 2,200 publications.

The other research fronts in the table are identified by a combination of older and more recent *Citation Classics* or core papers. An extensive discussion of Table 2 is not possible here, but it is important to note that were we to have made a comparable analysis of the research fronts of each year of the decade in question, there would be a very different listing. Many of the research fronts were just emerging in those days. Table 2 emphasizes the current relevancy of the core literature published during the 1956-1965 decade.

The Five Most-Cited Papers

In addition to Shannon's highly cited work, five other most-cited papers in the new *SSCI* cumulation have been selected for

Table 1: The papers most frequently cited in the 1956-1965 SSCI® cumulation, alphabetized by first author. Numbers following the bibliographic entry indicate the 1988 SCF®/SSCI® research fronts for which these are core publications. A=number of 1956-1965 citations. Asterisks (*) indicate that the article was the subject of a *Citation Classic®* commentary. The issue, year, and edition of CC® in which the commentary appeared follow the bibliographic reference. Daggers indicate that the paper has been previously identified in our essay on the 100 most-cited articles in the SSCI. (See reference 2.) It should be noted that despite every reasonable effort to unify citations to the same article, incomplete or incorrect references and difficulty in identifying all possible reference abbreviations can introduce errors in computing the number of times articles are cited.

A	Bibliographic Data
127	Barron F. An ego-strength scale which predicts response to psychotherapy. <i>J. Consult. Psychol.</i> 17:327-33, 1953.
183	† Bateson G, Jackson D D, Haley J & Weakland J. Toward a theory of schizophrenia. <i>Behav. Sci.</i> 1:251-64, 1956.
139	Bexton W H, Heron W & Scott T H. Effects of decreased variation in the sensory environment. <i>Can. J. Psychol.—Rev. Can. Psychol.</i> 8:70-6, 1954.
115	*† Campbell D T & Fiske D W. Convergent and discriminant validation by the multitrait-multimethod matrix. <i>Psychol. Bull.</i> 56:81-105, 1959. (14/87/A&H, S&BS)
116	Castaneda A, McCandless B R & Palermo D S. The children's form of the manifest anxiety scale. <i>Child Develop.</i> 27:317-26, 1956.
130	Couch A & Keniston K. Yeasayers and naysayers: agreeing response set as a personality variable. <i>J. Abnormal Soc. Psychol.</i> 60:151-74, 1960.
140	Cronbach L J. Further evidence on response sets and test design. <i>Educ. Psychol. Meas.</i> 10:3-31, 1950.
113	Cronbach L J. Processes affecting scores on "understanding of others" and "assumed similarity." <i>Psychol. Bull.</i> 52:177-93, 1955. 88-1035
130	Cronbach L J. Response sets and test validity. <i>Educ. Psychol. Meas.</i> 6:475-94, 1946.
125	Cronbach L J & Gleser G C. Assessing similarity between profiles. <i>Psychol. Bull.</i> 50:456-73, 1953.
161	† Cronbach L J & Meehl P E. Construct validity in psychological tests. <i>Psychol. Bull.</i> 52:281-302, 1955.
125	Crutchfield R S. Conformity and character. <i>Amer. Psychol.</i> 10:191-8, 1955.
210	*† Duncan D B. Multiple range and multiple <i>F</i> tests. <i>Biometrics</i> 11:1-42, 1955. (4/77)
120	Erikson E H. The problem of ego identity. <i>J. Amer. Psychoanal. Assn.</i> 4:56-121, 1956.
119	Estes W K. Toward a statistical theory of learning. <i>Psychol. Rev.</i> 57:94-107, 1950.
175	Glaze J A. The association value of non-sense syllables. <i>J. Genet. Psychol.</i> 35:255-69, 1928.
116	Goldstein K & Scheerer M. Abstract and concrete behavior: an experimental study with special tests. <i>Psychol. Monogr.</i> 53:1-151, 1941.
147	Grant D A. Analysis-of-variance tests in the analysis and comparison of curves. <i>Psychol. Bull.</i> 53:141-54, 1956.
120	* Greenspoon J. The reinforcing effect of two spoken sounds on the frequency of two responses. <i>Amer. J. Psychol.</i> 68:409-16, 1955. (21/82/S&BS)
184	* Harlow H F. The formation of learning sets. <i>Psychol. Rev.</i> 56:51-65, 1949. (6/80/S&BS)
156	Hartmann H. Comments on the psychoanalytic theory of the ego. <i>Psychoanal. Stud. Child</i> 5:74-96, 1950.
138	Hartmann H, Kris E & Loewenstein R M. Comments on the formation of psychic structure. <i>Psychoanal. Stud. Child</i> 2:11-38, 1946.
174	*† Hebb D O. Drives and the CNS (conceptual nervous system). <i>Psychol. Rev.</i> 62:243-54, 1955. 88-1166 (14/79/S&BS)
111	Jacobson E. The self and the object world: vicissitudes of their infantile cathexes and their influence on ideational and affective development. <i>Psychoanal. Stud. Child</i> 9:75-127, 1954.
203	*† Kaiser H F. The varimax criterion for analytic rotation in factor analysis. <i>Psychometrika</i> 23:187-200, 1958. (24/79/S&BS)
138	Kohler W & Wallach H. Figural after-effects: an investigation of visual processes. <i>Proc. Amer. Phil. Soc.</i> 88:269-357, 1944.
158	Krasner L. Studies of the conditioning of verbal behavior. <i>Psychol. Bull.</i> 55:148-70, 1958.
133	*† Mandler G & Sarason S B. A study of anxiety and learning. <i>J. Abnormal Soc. Psychol.</i> 47:166-73, 1952. (44/78)
127	* Mann H B & Whitney D R. On a test of whether one of two random variables is stochastically larger than the other. <i>Ann. Math. Statist.</i> 18:50-60, 1947. (48/79/PC&ES)
195	† Miller G A. The magical number seven, plus or minus two: some limits on our capacity for processing information. <i>Psychol. Rev.</i> 63:81-97, 1956.
108	* Moruzzi G & Magoun H W. Brain stem reticular formation and activation of the EEG. <i>Electroencephalogr. Clin. Neuro.</i> 1:455-73, 1949. (40/81/LS)
145	Noble C E. An analysis of meaning. <i>Psychol. Rev.</i> 59:421-30, 1952.
126	† Osgood C E. The nature and measurement of meaning. <i>Psychol. Bull.</i> 49:197-237, 1952.

- 108 Osgood C E & Tannenbaum P H. The principle of congruity in the prediction of attitude change. *Psychol. Rev.* 62:42-55, 1955.
- 115 Skinner B F. Teaching machines. *Science* 128:969-77, 1958.
- 171 Spitz R A. Hospitalism: an inquiry into the genesis of psychiatric conditions in early childhood. *Psychoanal. Stud. Child* 1:53-74, 1945. 88-5830
- 132 †Stevens S S. On the psychophysical law. *Psychol. Rev.* 64:153-81, 1957. 88-2938
- 131 Taylor J A. Drive theory and manifest anxiety. *Psychol. Bull.* 53:303-20, 1956.
- 536 †Taylor J A. A personality scale of manifest anxiety. *J. Abnormal Soc. Psychol.* 48:285-90, 1953.
- 133 Taylor J A. The relationship of anxiety to the conditioned eyelid response. *J. Exp. Psychol.* 41:81-92, 1951.
- 121 †Wechsler H. Toward neutral principles of constitutional law. *Harvard Law Rev.* 73:1-35, 1959. 88-1612

discussion below. Some are review papers; others are methods papers—on, for example, scales and instruments of measure. The fact that most of the citations to these papers have occurred since 1965 indicates the lasting relevance and importance of these works.

Three of the authors involved have published *Citation Classic* commentaries. Indeed, among the 108 most-cited social sciences papers from 1956 to 1965, authors of 17 have published *Citation Classics*. It is impossible, given this limited space, to do justice to the breadth of research contained in these *Citation Classic* papers. In general, however, these commentaries reflect new theories on aspects of human behavior, the application of statistics to experimental test results on human behavior, and the development of new methods of investigation into human behavior.

Janet A. Taylor/Personality Scale

The paper most cited in the 1956-1965 *SSCI* is by Janet A. Taylor (now Janet Spence), then at Northwestern University, Evanston, Illinois, and now at the Department of Psychology, University of Texas, Austin, entitled "A personality scale of manifest anxiety." In that decade alone, it was explicitly referenced in 536 publications. The paper, which discusses a written test that was developed and revised for selecting subjects for experiments in human motivation, has accumulated 1,767 citations through 1988. In her paper, Taylor comments on the scale's usefulness:

A series of recent studies [at the time]...has shown that performance in a number of experimental situations, rang-

ing from simple conditioning and reaction time to a "therapy" situation involving experimentally induced stress, is related to the level of anxiety as revealed on a test of manifest anxiety.... Since the scale has proved to be such a useful device in the selection of subjects for experimental purposes, a description of the construction of the test and the normative data that have been accumulated in connection with it may be of interest to other investigators in the field of human motivation.⁷

David B. Duncan/Multiple Range Tests

The second most-cited paper, entitled "Multiple range and multiple *F* tests," details a statistical method for determining the homogeneity of a set of a given number of values in an analysis of variance in a population. Authored by David B. Duncan, then at Virginia Polytechnic Institute and State University, Blacksburg, and now professor emeritus, Biostatistics Department, Johns Hopkins University, Baltimore, this paper was cited 210 times from 1956 to 1965, but, in the subsequent 23 years, it has been cited in over 500 research articles. Duncan published a *Citation Classic* commentary on this paper in 1977.

The 1955 DMR [Duncan multiple range] rule was a modified version of my earlier...multiple *F* rule. Both of these rules ranked in conservatism and power between the less conservative 1935...Fisher LSD [least-significant-difference] rule and the more conservative 1939 Newman MR rule. By using *F* tests, the DMF rule could be used to test comparisons...as well as pairwise differences. However, the multiple use of *F* tests was more cumbersome than that of range tests, and the [1951] DMF rule received much less attention.⁸

Table 2: The 1988 ISI® research fronts that include at least one of the papers most cited in the 1956-1965 SSCJ® cumulation as core documents. A =total number of core documents. B=total number of citing papers published in 1988.

Number	Name	A	B
88-0673	Organizational conflict, social projection, and dynamics of opinion formation	12	202
88-0676	Personality styles, dispositional prediction of behavior, social judgment, trait-state distinction, and motivational models	10	202
88-0821	Music perception, successive incentive contrast, reinforcer in instrumental learning, motivational model, and comparative psychology of intelligence	31	260
88-1035	Performance ratings, female job applicants, professional women, employment interview, gender role bias, and hiring decisions	20	201
88-1166	Strategic management, job design, participation at work, false feedback, and conduct of organizational behavior	20	283
88-1612	Legal scholarship, constitutional adjudication, <i>Bowers v. Hardwick</i> , and federal judiciary	19	190
88-2689	Paradoxical sleep, subjective insomnia, and long ultradian EEG components in daytime arousal	18	217
88-2938	Respiratory muscles, social judgment, response alternatives, ad context, and sensory matching	11	132
88-3190	Social differentiation in intergroup cooperation, peer status of children, and group identification	26	234
88-4097	Employee participation, subordinate performance in management groups, sport leadership, organizational innovation, goal setting, and occupational psychology	5	51
88-4422	Social desirability, gender differences, and Sulliman scale	2	59
88-5830	Short slowly growing children, childhood malnutrition, psychosocial dwarfism, and failure-to-thrive infants	5	52
88-7422	Dispositional prediction of behavior, computer-based test interpretations, and cutting scopes	2	41
88-7605	Severely mentally retarded children, reliability of a maladaptive behavior scale, and staff-client interaction in small community houses	2	19
88-7967	Information entropy, systems science, and channel capacity	2	94

Henry F. Kaiser/*The Varimax Criterion*

The third most-cited paper, "The varimax criterion for analytic rotation in factor analysis," was written by Henry F. Kaiser, then at the University of Illinois, Urbana, and now at the Department of Education, University of California, Berkeley. This measuring tool in statistical analysis determines a factor matrix, representing uncorrelated factors, where the variance of the squared loading of a column of the factor matrix is maximized and summed over columns. This statistical methodology paper was cited "only" 203 times from 1956 to 1965, but through 1988 it had received over 1,300 explicit citations. In his *Citation Classic* commentary, Kaiser comments that

[the varimax idea's] widespread use comes primarily from its almost always giving "nice" results from the viewpoint of scientific interpretability. In succeeding years I have tried to improve varimax, without success.... Varimax has been a tough act to follow. It was my first paper, and none of the more than 100 papers I have written subsequently has had nearly the impact.⁹

George A. Miller/*Information Processing in Humans*

Cited 195 times in the new 10-year SSCJ cumulation, and number four on our most-cited list, the review paper "The magical number seven, plus or minus two: some limits on our capacity for processing information" deals with experiments on the human capacity to transmit information, the theory behind the observed phenomena, and the personal experiences of the author, George A. Miller, then at Harvard University, Cambridge, and now at the Department of Psychology, Princeton University, New Jersey. According to sociologist Robert K. Merton, Columbia University, New York, this was one of the most important papers of the decade.¹⁰

Miller shows that many human characteristics—our abilities to distinguish magnitudes in taste, hearing, even the use of sounds in speech—center on the number seven, "plus or minus two." With nearly 2,000 citations through 1988, it still impacts directly on the study of absolute judgment, the span of immediate memory, and human "recoding" (the breaking down of complex

sequences of information into simpler, easier-to-remember groups).

Harry F. Harlow/Learning Set Theory

Of the top five, three of the papers are methods papers dealing with psychometrics. The other two, including the fifth most cited, deal with experiments in psychology. "The formation of learning sets," written by Harry F. Harlow, then at the University of Wisconsin, Madison, and now at the Department of Psychology, University of Arizona, Tucson, was referenced in 184 publications in the 1956-1965 period. Through 1988, there have been 520 additional explicit references to this *Citation Classic*. Examining how primates learn, the paper puts forth the concept of "learning sets." According to the theory, the original learning on any kind of problem is a slow, belabored process; however, when many problems of a single type are solved, learning becomes immediate and insightful. In his *Citation Classic* commentary, Harlow writes:

The learning set theory studies were designed to show that there were no real discrepancies between the trial and error learning theory and Gestalt learning theory. When an animal learns a new kind of problem, he solves it according to a behaviorist learning theory model by slow

painful plodding trial and error. However, if he has experience with a large number of problems of a single type or class the trial and error is replaced by the Gestalt learning theory model so that the individual problems are eventually solved insightfully.... I believe my paper has been widely cited because the learning sets describe the mechanisms by which complex learning problems are mastered by primate animals.¹¹

The Value of a Retrospective Cumulation

Our previous *SSCI* cumulations have proved to be valuable reference and research tools. Cumulations can save considerable time and effort, particularly in tracking down and verifying references to older papers. The cumulations also provide consolidated, year-by-year citations to the hundreds of thousands of books and articles cited in this multidisciplinary index. Like its 5-year predecessors, this 10-year cumulation provides unique access to the history of the social sciences for a remarkable decade.

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My thanks to Peter Pesavento and Eric Thurschwell for their help in the preparation of this essay.

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