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"Current Comments"

Social Sciences Citation Index Clusters

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If you were asked to identify the hundred most 'active' areas of research in the social sciences, how would you go about it? Indeed, I think the average scientist would find it difficult to name more than a dozen. But the question is really unfair without some criterion of 'active research.' Activity might be based on number of people involved, number or total value or grants, number of organizations represented, number of papers published on the subject, or numbers of citations.

Some time ago I describe the methodology of co-citation analysis,[1] which ISI® has used to identify active areas of scientific research. Henry Small, Beta Starchild, and Louis Holmes of ISI, with help from Professor Belver Griffith of Drexel University, have used this algorithmic technique to produce some fascinating data about research in the social sciences.[2] Using ISI's *Social Sciences Citation Index*® (*SSCI*®) tape files they were able to identify several hundred active areas of research. Each area is represented by a group of frequently cited papers or books. They form a 'cluster' because each has been co-cited, along with one or more other publications in the group, by subsequent publications.

In addition to identifying individual clusters, the method also shows linkages between clusters. This relationship between clusters can be displayed in 'cluster maps.' An example is shown in Figure 1. The make-up of a cluster, and its relation to others in such maps, is determined by statistical thresholds established for inclusion of cited documents.

My purpose here is simply to list about 100 areas of research in the social sciences that we have identified with this technique. The existence of these foci of research interest will certainly not surprise knowledgeable specialists. I do believe, however, that the size of the fields--in terms of citing publications--will be most interesting even to experts.

Figure 2 is a list of 100 clusters ranked by the frequency with which all members of the cluster were cited in the 1974 *SSCI*. The figure in the 'citing' column is the number of articles that cited papers in the cluster. The 'cited' figure is the number of publications that define the cluster. These cited articles will have been published in earlier years.

For further illustration, Figure 3 lists the 17 cited papers that compose the cluster on depressive disorders (item 64 in the list of Figure 2). In Figure 4, a

map of this cluster shows the 'strength' of the linkage between each cited paper. The larger the number on the lines connecting the citations, the closer one would like to place the relevant boxes, or the thicker one would like to make the linkage lines, to indicate the strength of association.

On the other hand, the ranking by 'citing' frequency sometimes separates fields which are in fact quite closely related. Thus, *Personal Space* (item 22 in Figure 2) and *Personal Space, Man-Made Environments* (item 44) are obviously related. Yet they are distinct clusters because of differences of cited papers among the members of each cluster. Notice also the large differences in the number of citing and cited items in each case.

At ISI we use co-citation analysis and cluster identification for a variety of purposes. A principal use is in construction of *ASCA*® profiles. Using each item in the cluster as a cited-reference question, they become rather efficient 'descriptors' in the profile, so that we can selectively disseminate the information on each topic selected.

Since research in many areas moves swiftly and often changes emphasis and direction, profiles must be modified frequently. As the research front moves forward, citation patterns change. Corresponding changes in terminology may or may not occur as well. In some cases, the 'cited-reference' terms may be much more stable than the terminology. In others, a new term may be highly efficient as a retrieval key for some time. For unexplainable reasons, some phenomena are quickly and unambiguously named, eponymically or otherwise. Other concepts will show a confusion of terminology and be describable with certainty only by constant reference to primordial or other major papers on the subject.

The titles of the clusters listed in Figure 2 have been created from a scanning of terminology used in the titles of the citing works. Thus, in cluster 15, *Biofeedback Training*, 318 citing papers were involved. In their titles the term *biofeedback* clearly predominates as a description of the phenomenon. This particular cluster will be examined in much greater detail in the near future. Detailed listings of this type of cluster information will one day be incorporated in ISI's *Atlas of Science*.

In closing, may I point out to my colleagues in information science that these procedures are, in fact, automatic classification in the strictest sense. Classification purists, with rare exceptions, have been unable to grasp the practical significance of citation analysis for library and other classification needs. But to my knowledge, no other extant system exploits the *self-organizing* capabilities of published literature in a manner required to classify it as truly 'automatic' classification.

1. Garfield E. ISI is studying the structure of science through co-citation analysis. *Current Contents*® No. 7, 13 February 1974, p. 5-10.
2. Small H & Griffith B C. The structure of scientific literatures. I. Identifying and graphing specialties. *Science Studies* 4:17-40, 1974.

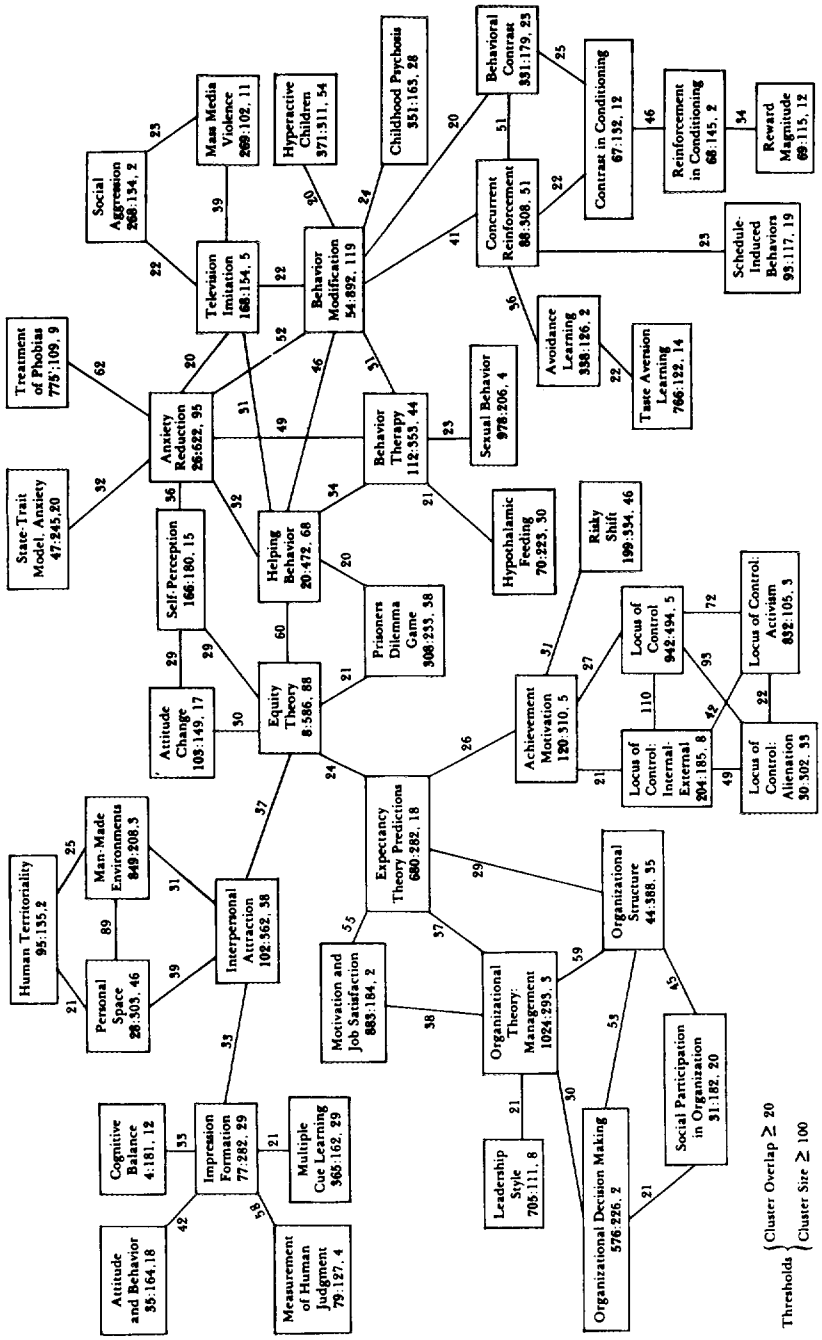

Figure 1. 1974 *Social Sciences Citation Index* Cluster Map

Figure 2. List of 100 *SSCI* Clusters. The clusters are ordered by number of papers citing the clustered papers. **A** = item number. **B** = number of citing papers. **C** = number of cited papers in the cluster. **D** = cluster title.

A	B	C	D
1.	892	119	Behavior modification as psychotherapy
2.	753	106	Human information processing: memory search
3.	622	95	Desensitization in reduction of anxiety
4.	586	88	Equity theory: status consistency
5.	551	92	Hemispheric Differences in cerebral function.
6.	494	5	Locus of control
7.	472	68	Helping behavior
8.	444	106	Pharmacology of affective disorders: depression
9.	443	2	Linguistics
10.	412	72	Stimulus orientation in perception
11.	388	35	Organizational structure
12.	362	38	Interpersonal attraction
13.	353	44	Behavior therapy in obesity, homosexuality, and drug addiction
14.	334	46	Risky shift
15.	318	52	Biofeedback training
16.	312	36	Sentence memory
17.	311	54	Hyperactive children
18.	311	15	Free recall
19.	311	3	Imagery in learning
20.	310	5	Achievement Motivation
21.	308	51	Concurrent schedules of reinforcement
22.	303	46	Personal space
23.	302	33	Locus of control and alienation
24.	293	3	Organizational theory: management
25.	282	30	Urban planning: residential location models
26.	282	29	Impression formation
27.	282	18	Expectancy theory prediction
28.	278	40	Cognitive development: Piaget's concept of conservation
29.	272	28	Semantic memory
30.	271	22	Equal protection
31.	270	31	Judicial process
32.	259	29	Portfolio choice
33.	257	38	Change components of adult development
34.	257	2	Cognitive style and personality
35.	249	22	Memory: repetition effects
36.	246	39	Overinclusive thinking in schizophrenia
37.	245	20	State-trait model of anxiety
38.	233	38	Cooperation and competition: prisoners dilemma game
39.	226	2	Organizational decision making
40.	223	30	Hypothalamic feeding mechanisms
41.	212	21	Labeling and deviance
42.	210	8	Proactive interference in short-term memory
43.	208	13	Psychoanalytic theory
44.	208	3	Personal space: man-made environments
45.	206	4	Sexual behavior
46.	204	24	Use of health-care services
47.	202	21	Effects of organization on recognition memory
48.	202	14	Political conflict

Figure 2. List of 100 *SSCI* Clusters. (con't)

A	B	C	D
49.	197	4	Cognitive complexity
50.	196	4	Multidimensional scaling
51.	190	10	Family planning
52.	189	32	Psychological correlates of marijuana use
53.	185	8	Internal-external locus of control
54.	184	22	Social mobility
55.	184	2	Motivation and job satisfaction
56.	182	20	Social participation: organizational environment
57.	181	12	Cognitive balance
58.	181	4	Clustering in free recall
59.	180	15	Self-perception
60.	180	9	Teacher expectations and pupil performance
61.	179	23	Behavioral contrast
62.	176	27	Alcoholism
63.	176	2	Counselor empathy learning
64.	173	17	Depressive disorders
65.	171	3	Short-term visual memory
66.	169	3	Politics
67.	167	10	Monetary theory
68.	164	18	Attitude and Behavior
69.	163	28	Childhood psychosis
70.	162	29	Multiple cue probability learning
71.	160	17	Scientific literature
72.	157	16	Hypnotic susceptibility
73.	154	5	Imitation and television
74.	153	19	Civil commitment of mentally ill: suicide risk
75.	151	12	Social choice theory
76.	149	17	Attitude change
77.	145	2	Partial reinforcement in conditioning
78.	140	19	Infant attachment behavior
79.	140	18	Bereavement
80.	139	16	Short-term memory
81.	135	20	Sleep
82.	135	2	Human aggression and territoriality
83.	134	19	Investment
84.	134	12	Factor analysis
85.	134	2	Social aggression
86.	133	2	Education
87.	132	15	Children's associative learning
88.	132	12	Contrast effects in conditioning
89.	131	2	Depression
90.	130	16	Prognosis in schizophrenia
91.	130	11	Paired associate learning: retroactive inhibition
92.	129	11	Self disclosure
93.	128	16	Inflation and unemployment
94.	127	4	Measurement of human judgment
95.	126	2	Avoidance learning
96.	125	7	Retrieval cues
97.	125	7	Political socialization
98.	124	5	Resource allocation and liability
99.	123	14	Psychiatric sociology
100.	123	8	Childhood language acquisition

Figure 3. Papers Comprising the 1974 *SSCI* Co-Citation Cluster on Depressive Disorders (Cluster #64).

1. **Carney M W P, Roth M & Garside R F.** The diagnosis of depressive syndromes and the prediction of ECT response. *Brit J. Psychiatry* 111:659-74, 1965.
2. **Everitt B S, Gourlay A J & Kendell R E.** An attempt at validation of traditional psychiatric syndromes by cluster analysis. *Brit J. Psychiatry* 119:399-412, 1971.
3. **Eysenck H J.** The classification of depressive illnesses. *Brit. J. Psychiatry* 117:241-50, 1970.
4. **Greenblatt M, Grosser G H & Wechsler H.** Differential response of hospitalized depressed patients to somatic therapy. *Amer. J. Psychiatry* 120:935-43, 1964.
5. **Hollister L E & Overall J E.** Reflections on the specificity of action of antidepressants. *Psychosomatics* 6:361-65, 1965.
6. **Hollister L E, Overall J E, Shelton J, Pennington V, Kimbell I & Johnson M.** Drug therapy of depression; amitriptyline, perphenazine, and their combination in different syndromes. *Arch. Gen Psychiatry* 17:486-93, 1967.
7. **Kendell R E.** *The classification of depressive illnesses.* London: Oxford Univ. Press, 1968, 102 pp.
8. **Kiloh L G, Ball J R B & Garside R F.** Prognostic factors in treatment of depressive states with imipramine. *Brit. Med. J.* 2:225, 1962.
9. **Kiloh L G & Garside R F.** The independence of neurotic depression and endogenous depression. *Brit. J. Psychiatry* 109:451-63, 1963.
10. **Klerman G L & Cole J O.** Clinical pharmacology of imipramine and related antidepressant compounds. *Pharmacol. Rev.* 17:101-41, 1964.
11. **Overall J E, Hollister L E, Meyer F, Kimbell I Jr. & Shelton J.** Imipramine and thioridazine in depressed and schizophrenic patients; are there specific antidepressant drugs? *J. Amer. Med. Assoc.* 189:605-08, 1964.
12. **Overall J E, Hollister L E, Johnson M & Pennington V.** Nosology of depression and differential response to drugs. *J. Amer. Med. Assoc.* 195:946-48, 1966.
13. **Paykell E S, Klerman G L & Prusoff B A.** Treatment setting and clinical depression. *Arch. Gen. Psychiatry* 22:11-21, 1970.
14. **Paykell E S.** Classification of depressed patients; a cluster analysis derived grouping. *Brit. J. Psychiatry* 118:275-88, 1971.
15. **Paykell E S, Weisman M, Prusoff B A & Tonks C M.** Dimensions of social adjustment in depressed women. *J. Nerv. Ment. Dis.* 152:158-72, 1971.
16. **Raskin A, Schulterbrandt J, Reatig N & McKeon J J.** Replication of factors of psychopathology in interview, ward behavior and self-report ratings of hospitalized depressives. *J. Nerv. Ment. Dis.* 148:87-98, 1969.
17. **Raskin A, Schulterbrandt J G, Reatig N & McKeon J J.** Differential response to chlorpromazine, imipramine, and placebo; a study of subgroups of hospitalized depressed patients. *Arch. Gen. Psychiatry* 23:164-73, 1970.

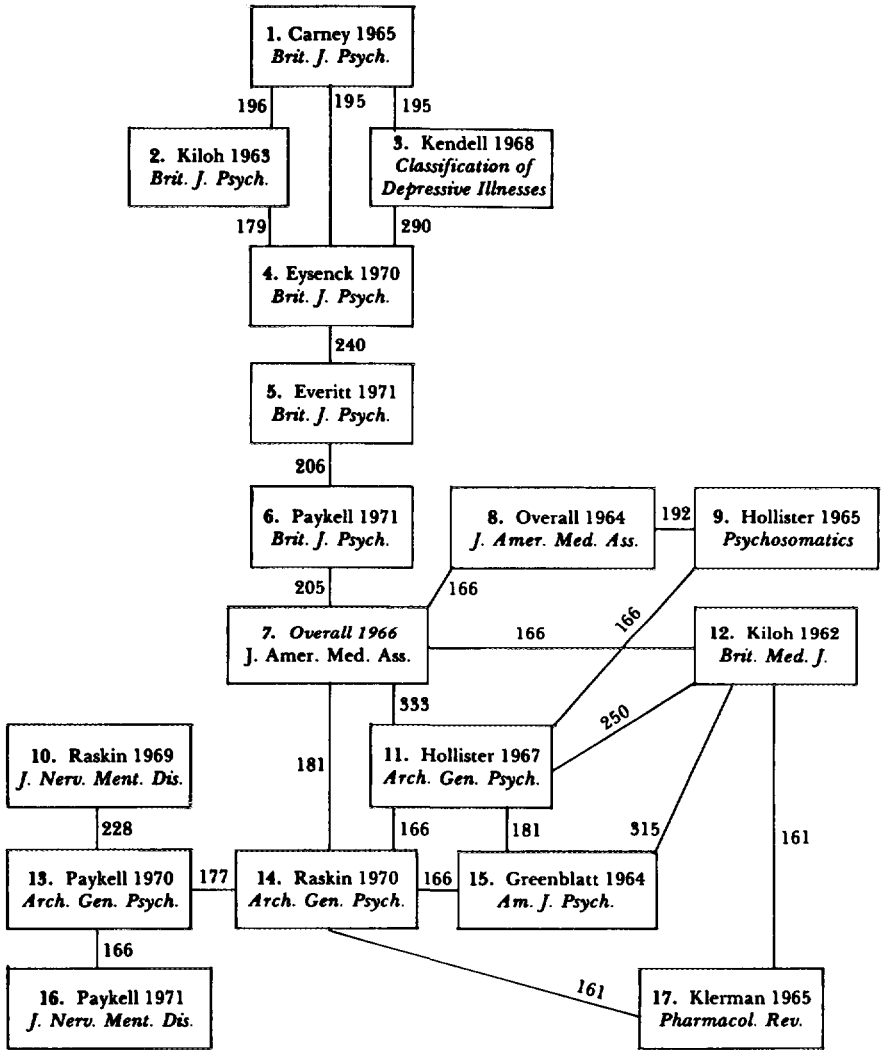

Figure 4. Cluster Map on Depressive Disorders.