

THE SIGNIFICANCE OF THE BIBLIOMETRIC METHODOLOGY TO THE STUDIES OF THE HISTORY OF PSYCHOLOGY

HELIO CARPINTERO

JOSE M. PEIRO

Departamento de Psicología General
Universidad de Valencia

Psychology as a science has depassed its centennial year. In a hundred years it has managed to reach a position of pre-eminence among the human and natural sciences.

During its century of existence the effectiveness of psychological knowledge has become evident. Along with, and even more important than, its theoretical dimension, a whole series of techniques have been employed, lending force to psychology's social appeal.

But the variety of applications which psychology has is precisely what clouds a bit its condition as a strict science. Connected during a large part of its existence to pragmatism, there have been times when the validity of its theoretical explanation has been accepted, only in terms of the practical effectiveness of the results achieved.

Without discussing the question of its ultimate theoretical nature, it might prove interesting to take a look at its institutional and historical dimensions. For it happens that a whole series of facets of scientists's work become completely clear only when a series of strictly social variables or factors are

*PROF. DR. HELIO CARPINTERO: Departamento de Psicología General. Facultad de Filosofía y Ciencias de la Educación. Universidad de Valencia.

taken into consideration. The forms of research and of teaching, the way in which prestige and pre-eminence are established, the effective paths of information flow, and many other variables that belong to the real world make possible a new understanding of scientific knowledge from its historical horizon.

A few years ago CRONBACH (1957) wrote: "Today no one can know all of psychology". More recently WOLMAN has said: "Contemporary psychology is no longer a single discipline. The common denominator is the study of behavior but the word behavior is as complex as the word life...Perhaps the most significant element that links the various psychological disciplines together is the philosophical and methodological foundation" (WOLMAN, 1973).

So, it is obviously necessary to find a valid image for psychology with all its complexity.

THE DIMENSIONS OF THE SCIENCE

The image of a science complicates several dimensions, and this is also true in the case of psychology. At least it is possible to differentiate between sciences as a body of knowledge, sciences as a social institution, and science as the thing scientists do (ZIMAN, 1968).

The intellectual side of any science is just one of several facets. Psychology is not made up of a series of theories that follow and substitute for one another. The sociology of science has also shown the complexity and weight of the relationships among researchers, the norms by which they are ruled, and the economic, cultural and political dependences which bear upon scientific research.

The problem consists of finding a unifying principle for all these facets (ZIMAN, 1968). In trying to suggest an integrating model for the understanding of science, we propose, as a simple hypothesis, to consider science itself as an organization. In so doing, our intention is to establish the bases of a coherent view of the qualitative, theoretical and conceptual dimensions of science and the quantitative, material and social ones. This hypothesis lets us assume the existence of relationship between all these aspects within the organizational unity.

SCIENCE AS AN ORGANIZATION

The complexity and variety of science is obvious. But we are also aware of science as a whole content defined by certain limits.

In science we are dealing with a unity, or a consensus of knowledge about reality (ZIMAN, 1968). Science contains a system of aims. It intends to discover the regularities and laws of processes and phenomena. There are also the human and social values that the scientists try to achieve in themselves. SKLAIR systematizes them as follows: the search for knowledge, the search

for domination over nature and for man's well being, and the search for personal profit of scientists (SKLAIR, 1977).

As in other organizations, we find here a division of labour. There is specialization of knowledge, plurality of schools, diversification of tasks and functions in research teams. It is generally accepted that science is universal knowledge free from racial or national differences. It crystalizes in the form of successive paradigms, open to anybody and maintained by groups of practitioners, according to Kuhn's classical point of view. Therefore, the publication of ideas is an essential moment in investigation; the moment which "makes possible the process of correction and evaluation, and perhaps the assent of the relevant scientific community" (PRICE, 1978).

It is also important the well-known methodological unity, specially in the areas of natural sciences, organized around the hypothetic-deductive method. But we must also think in another direction. Connected with the question of unity we find in organizations authority or a system of leadership. The same occurs in science. COLE and COLE have suggested that one important function of great scientists is precisely to maintain the consensus within a research field. Without these leaders "a modern science probably could not function at all" (COLE and COLE, 1973); even though at times this whole power structure has been a brake to scientific revolutions.

Public recognition of pre-eminence and authority have been studied in recent years (MERTON, ZUCKERMAN). It seems that authority is directly related to scientific quality and based on scientific achievement. In many cases, it can be detected a whole group which supports and actively backs up research: master and pupil relationships or the groups we could consider as "Invisible Colleges" of selected scientists represent collective phenomena of scientific leadership (PRICE, 1963).

Another important notes in the organization of science are its relative autonomy and independence (MERTON, 1977). There is also, as in any organization, a process of selection, formation and incorporation of members; they get in this way not only certain skills or ideas, but also habits of reflection, a panoramic view of the areas of investigation toward which they are orientated, and a whole mentality. As TOULMIN says, the conceptual apprenticeship in a science is "comparable to the initiation into a social institution" (TOULMIN, 1977).

Communication is another characteristic of any organization, and there are here many forms and channels for the flow of information between different groups and members.

Finally, science has to be considered as an organization within the wider network of a social structure. Science offers society certain results, ideas, or knowledge that are incorporated into a social dynamics (BERRIEN, 1976); sometimes this leads to the transformation of uses, norms, traditions and social mentality. In any case it suffices to say that society is by now science's client and user. It remains to be seen what kind of relationship will predominate

in the future.

All this emphasizes that it is possible by analogy to interpret science as an organization and offers us a way for an examination and analysis of its organizational dimensions.

And in order to clarify the role of certain variables in the production of knowledge, that is the real aim of science, we need to clarify some important points:

- 1.- The productivity of the different authors, institutions, countries, that show a large amount of variability.
- 2.- The groups or teams of research, their heads, the relations, and changes upon time; that is the collaborative side of scientific work.
- 3.- The process of communication and dissemination of information at its various levels, especially the formal and published one.
- 4.- The eminence of certain researches and also of certain works, that have obtained more recognition within a given field.

WRITTEN DOCUMENTS AND THE HISTORY OF SCIENCE

When we want to get an historical image of psychology in accordance with the model we have presented, which integrates intellectual aspects and social dimensions, there are many factors that must be considered.

It is possible to consider the weight that the various levels of institutionalization bear on scientific progress (BEN-DAVID and COLLINS, 1966; FERNBERGER, 1928), the master-pupil relationships (BORING and BORING, 1948), the development of technology and the successive appearance of the new laboratories (PEIRO and CARPINTERO, 1978) or the influence of personal variables such as age (LEHMAN, 1953) and other biographical data (PEREZ-DELGADO, PEIRO and CARPINTERO, 1981). But together with these lines of historical investigation, the analysis of scientific literature, as the result of social and conceptual factors, in which a social form and a theoretical background converge, permits us an objective, quantitative and rigorous approach to the study of the concrete and historical reality of a science, in our case psychology.

It becomes necessary in such a case to determine the indicators which have to be considered in trying to establish the productivity, collaboration and pre-eminence that we have recognized as fundamental in the organizational analysis of the history of a science (ELKANA, et al., 1978). And, for such a study, bibliometric techniques prove to be quite appropriate.

GARFIELD and his collaborators give us an convenient starting point: "Bibliometry can be defined as the quantification of the bibliographical information capable of being analyzed" (GARFIELD and colls., 1978).

One element of this information -the names of authors on the studies- bears an immediate relation to the "members" of the scientific organization, the researchers. Their quantification makes it possible to determine the author's productivity, number of papers per time unit. The identifying elements as sex, institution, academic degree, professional position, and other similar aspects let us pinpoint exactly who are the working scientists. Also the signatures show collaboration -joint authorship- and this can be used to detect working groups and "invisible colleges" (PRICE and BEAVER, 1966).

Another kind of analysis is based on studying the titles of the papers and this brings us closer to the research topics.

References constitute a third field of study. One must bear in mind that references constitute the intellectual base on which science is built and through them it becomes visible not only school's preferences, but also thematic affinities.

SCIENTIFIC PRODUCTIVITY

It has been generally found in studies on the productivity of scientists a distribution that shows a small group of enormously productive people along the side of a huge group which apparently takes very little part in research. It is LOTKA's model of distribution, which PRICE has applied to some quantitative dimensions of science, among these, the productivity of authors (PRICE, 1963).

We have repeatedly found very considerable differences in the productivity of authors. In a series of studies we have made on some American and Spanish psychology journals, together with a small group of highly productive authors we found a large number who have written only one article for the whole period under study. For example, in the *American Journal of Psychology (A.J.P.)* (1887-1945) we find one author who has published no less than 107 signed articles as against 950 authors who have only one signed article for the same period (CARPINTERO and PEIRO, 1979; 1980; CARPINTERO, et al., 1983).

It is easy to see that in a study on the history of psychology it is very important to identify the highly productive authors in certain epochs and areas. In the case of *A.J.P.* the 5 most productive authors between 1887 and 1945 were: E.B. TITCHENER (107 articles), M.F. WASHBURN (76); K.M. DALLENBACH (72); E.G. BORING (49) and E.C. SANFORD (43). All of them have, at one time or another, been editors of this journal and are very well known figures in American Psychology.

When productivity is considered from the point of view of institutions, these great differences are found again. When we studied in the *A.J.P.* the distribution of articles according to their institutional origin we found that 25 per cent came from Cornell, another 25 per cent from Clark, Vassar, Harvard, Wisconsin, Bryn Mawr and Columbia; the third 25 per cent was spread out among 17 centers, and the rest, among 224 institutions.

In the same way, when we studied the journal with the longest tradition in the Spanish psychology, the *Revista de Psicología General y Aplicada (R.P.G.A.)* between 1946 and 1970, we found 509 authors with only one article and, at the other extreme, one single author with 55 studies. In this publication the most productive authors for the period under study were Jose GERMAIN, director for many years of *R.P.G.A.* (55 studies), Mariano YELA (39), and José Luis PINILLOS (33); these latter two authors are today tenured professors at the University of Madrid and members of the *R.P.G.A.* editorial staff (PASTOR-CARBALLO and CARPINTERO, 1980).

The problem of productivity has to be viewed within certain limitations. Productivity has often been related with eminence and this has resulted in correlations ranged between .60 and .78 (DENNIS, 1954, COLE and COLE, 1973, ENDLER, 1978). On the other hand, productivity has to be considered in connection with publishing mechanisms, which may or may not exist, such as editorial groups and political or social censorship. Also, it must be understood within a wider framework of the researchers' motivations, which may be influenced by the "publish or perish" rule, or may be free of all compulsion and open to an unlimited perfectionism: ZUCKERMAN has observed the change in the productivity of the Nobel Prize winners. But the possession of the Nobel Prize represents an important change in the role of the researcher within the scientific community (ZUCKERMAN, 1977), that is, within the scientific organization. In short, productivity is an indicator which helps us in detecting certain relevant aspects of author's contribution to scientific progress.

SCIENTIFIC COLLABORATION

Collaboration between scientists consists of exchanging information, writing and publishing studies together, master-pupil relationship, and the use of the work done by others for one's own work.

For this reason, one must pay attention to a series of indicators in order to detect collaboration relationships: direct exchange, academic relationship, bibliographical references and joint authorship of papers.

Using the last indicator in accordance with the methodology suggested by PRICE and BEAVER (1966) it is possible to determine collaboration nuclei in several fields of psychology. The hypothesis is that the authors who do their research and publish the results together maintain close relationship, and become related with the collaborators of their collaborators. In this way groups are

built which are often considered "Invisible Colleges".

If we group together the authors according to the methodology we have mentioned, we find non-collaborating authors, and authors who belong to groups with 2 or more members.

The knowledge of the big groups permits us a more organized image of a scientific field. For example, in studying the collaboration in the *A.J.P.* we find an invisible college around E.B. TITCHENER with 375 authors who have published 690 articles. The most productive authors -WASHBURN, DALLENBACH, SANFORD and BORING- belong to it along with other well known personalities: PILLSBURY, BENTLEY, GUILFORD, HELSON and others. These, in turn, are heads of minor groups. In this way, this "college" produces nearly a third of the articles published in the journal, and constitutes an intellectual unit whose deep meaning needs to be studied in greater detail and taking into account other theoretical aspects.

We have also found relevant groups in psychometrics (PEIRO and RIVAS, 1981), behavior modification (CARPINTERO and PEIRO, 1980), or Spanish psychological journals (PEIRO and CARPINTERO, 1980), that help us understand certain aspects of those fields.

STUDY OF REFERENCES

In this bibliometric approach it is important to assess the echo or impact that some authors or studies have in the research community because of their quality. When a study is recognized as relevant in its field, even when its relevance comes from the refutations it provokes, it achieves high visibility which, in a way, is the measure of its impact in the community. This can be determined quantitatively by the number of bibliographical references made to it. References seem to be a good indicator of the eminence of works, authors, journals and institutions. There are limitations to its use as ENDLER and colls. have pointed out. They say that there is no difference between positive and negative references; large cultural zones are also badly represented for linguistic reasons; at times, self-references disturb the evaluation; and, finally sometimes the most important works and authors aren't mentioned explicitly and aren't detectable with this methodology. In spite of all this it has an undeniable usefulness in historical research on psychology.

And so in the *A.J.P.* it has been possible to identify, by analyzing the references, the authors and works that have had the greatest impact in the journal in certain periods. For example, between 1887-1914 the two most visible works in the *A.J.P.* were *Grünzüge der physiologische Psychologie* by W. WUNDT and *Principles of Psychology* by W. JAMES, the first with 63 references and the second with 50. In Spanish publications we have been able to see the different visibility of foreign and native authors, according to the type of publication. In the *R.P.G.A.* (1946-1957), the most cited author was Ch.S. MYERS, followed by C. MINKOWSKA, H.J. EYSENCK,

A.R. LURIA, SAINT AUGUSTIN and S. FREUD.

With this methodology it is possible to determine the presence of certain author's works, specially the classical ones, in one or several journals, or fields.

It is also possible to evaluate the impact or visibility of journals. And finally from the references one can find thematic affinities and try to produce maps of a given scientific field which would be of great interpretative and heuristic value in the field of historiography (GARFIELD, 1978).

STUDIES ON PSYCHOLOGICAL SUBJECTS

The importance of specialized journals and repertories in disseminating scientific information on psychology, as *Psychological Index*, *L'Année Psychologique*, first, and *Psychological Abstracts*, *Contemporary Psychology*, *Annual Review of Psychology* latter, has posed the problems of their organization by subject matters. This classification depends on more or less subjective criteria, often demands the inclusion of one article in various categories, and the classification is usually too inflexible to permit new research specialities. The study of the most important bibliographic classifications by subject matters lets us see the course taken by psychological research. A study on the *Psychological Abstracts* from 1927 to now discloses several general shifts in classification which indicate periods of important changes in psychology.

The first classification scheme, which remained in effect from 1927-1936 could be interpreted as representing the structuralist point of view. The second one (1937-1946) reflects the dominant S-R orientation with some categories from gestalt and from psychoanalytic traditions. After 1947 a series of reorganizations occurred which ended in a new system which can be characterized as S-O-R (Stimulus, organism, response).

In 1960 the categories show a variety of adjectives (clinical, developmental, etc.) with the term "Psychology", and that seems to be an academic and eclectic classification.

Since 1974 a new attempt has being made to introduce the cognitivist point of view and the experimental aspects of research in some of the categories.

All these changes indicate the growth and progress of contemporary scientific investigation in psychology, detected through objective means (TORTOSA, 1980).

To conclude: the application of bibliometric and sociometric techniques for the measuring and quantification of scientific literature through objective indicators has made it possible to study important dimensions of the history of psychology. Social and intellectual or theoretical aspects of a science are very closely related, and we accepted as a working hypothesis the idea of a science as an organization in order to understand that relationship.

It is possible to establish through bibliometric methods where the research front of a speciality is. The measurement of productivity of authors,

also of institutions, journals and so on, gives the historian a rough, but clear idea of the men and centers that made the most frequent contributions in an area of research. Productive authors must be compared with eminent authors, and these, in turn, can be detected by several methods, but in a very interesting way, through citation analysis. Important men in science are cited many more times than average authors, and their impact could be evaluated through the citations they receive in different periods.

Another traditional problem for the historian of psychology has been the determination of schools or systems inside his science. An objective approach to that question can be made through the study of collaborative work, since the emerging groups of joint authors, a sort of "Invisible Colleges", are normally connected by common interest in research.

Finally, bibliometric methods also permit through content analysis and bibliographic indexing the study of the evolution or subject matters in psychology, as we have tried to show here.

The bibliometric approach seems very helpful for the historian of a science. It never will eliminate more comprehensive and qualitative methodologies, but it offers information and heuristic hypothesis to be proved in more detailed studies.

RESUMEN

Desde una perspectiva que considera a la ciencia como una organización, se analiza la importancia y el sentido del método bibliométrico para clarificar el papel de ciertas variables relevantes en la evolución de una ciencia: productividad diferencial, grupos de investigación, eminencia reconocida de obras y autores, y procesos de comunicación y diseminación de la información.

La evidencia empírica presentada apoya la utilidad de esta metodología en investigaciones de historia de la psicología.

SUMMARY

The authors offer an evaluation of the importance and significance of bibliometric methodology as a tool for the historiography of science. This methodology clarifies the role of certain important variables dealing with the organizational dimensions of a scientific field: differential productivity, working groups, impact and visibility of authors and works and communication networks.

The some empirical evidence is presented giving support to the usefulness of this methodology is for the historian of psychology.

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