



## Information retrieval in psychology

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# Information Retrieval in Psychology: Implications of a Case Study

Birger Hjørland

**ABSTRACT.** Information retrieval is an important but generally neglected part of the research method in psychology. On the basis of a case study, which consists of an examination of the search strategy in a Swedish dissertation, the problems of searching are overviewed, with regard to both the selection of sources, and the construction of the search profile. Attention is given to subject faceting in psychology. A model used by *Psychological Abstracts* in building on the concepts of experimental variables is replaced by a facet model developed on the basis of the Bliss Classification System. This model is illustrated using the above-mentioned dissertation as an example, and it is shown that the model can help in formulating search questions in psychology. Also discussed are problems that concern the use of abstracts or full texts in the selection of documents. In addition, attention is given to the question of types of research in psychology that can benefit from computer-based retrieval methods.

This article is an attempt to advance information retrieval in psychology by highlighting some important illustrated by an analysis of the literature search in a recent Swedish dissertation (Welwert, 1984). The dissertation contains a detailed account of the literature search that forms the basis of the study's conclusions. This case

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study will be drawn upon heavily in order to avoid purely theoretical or speculative statements.

### **THE VISIBILITY OF THE LITERATURE SEARCH**

One must first ask why a scientific work so seldom includes a detailed account of the method used for the literature search. The impression is that this has become more common with the increased popularity of computer-based searches, because it is fairly easy to specify the databases and search profiles that have been used; that is, an important reason for the absence of such accounts is that it is difficult for a researcher to give a methodical description of the search that has been undertaken. This corresponds to the findings of many user investigations (among others the American Psychological Association's "Project on Scientific Information Exchange in Psychology," 1963-1969), which show that informal and unsystematic search behavior plays a dominant role.

As an information scientist, one must maintain the view that a literature search is a component of the research method—and a rather significant one at that. Even though the procedure of the method used in the literature search can only be described with difficulty, and even though it lacks the prestige associated with other scientific methods (e.g., statistical analysis), it is so widespread and so fundamentally decisive in the research results obtained that progress in this area can potentially make research more efficient. Exploration of the problems connected with literature searches or information retrieval should therefore be given high priority. That it is not can be attributed to, among other things, the difficulty experienced in articulating that which is close-at-hand and obvious and examining it in a meaningful way.

It is hoped that this article can contribute to promoting the necessary change in the perception of information retrieval and literature work in psychology. At the same time, it should be added that certain signs indicate a breakthrough is on its way. It is becoming more and more common for researchers to interest themselves in the possibilities of meta-analysis, research surveys, citation analysis, and so on (see, for example, Glass et al., 1981; Light and Pillemer, 1984; and Rosenthal, 1984).

## **SOURCES FOR THE RELEVANT LITERATURE**

The above-mentioned dissertation is a Swedish psychological treatise, which takes upon itself the task of referring to comparative research in learning, in which material is presented visually versus auditively, and it attempts to draw conclusions based on this material. Or stated more colloquially, it is an attempt to chart when a verbal presentation of the material works well and when a visual presentation (most often reading) proves to be the most efficient means of learning.

In his dissertation, Welwert mentions fourteen different sources that were searched: from Swedish report series to retrospective bibliographies to modern bibliographical databases. These sources will be briefly presented and commented on below.

### ***Nordic Sources***

Welwert begins with the Swedish sources. He describes how he searched five different sources, with very meagre results (four reports in all). These five sources are: (1) Skolverstyrelsens (The School Board's) yearly surveys, (2) Surveys of work in the behavioral sciences, issued by the State Council of Social Science Research, (3) Bjersted's annual bibliographical surveys, (4) "various universities' own collocations," and (5) the Swedish report series found in the library at the teachers college in Malmo.

One can make several comments on the selection of these sources. First, it is puzzling that, relatively speaking, Welwert makes so much out of the Swedish sources and has not, on the other hand, used the corresponding Danish and Norwegian ones. The statement of the problem is not of a nature that can explain his favoring the Swedish speech area, and, as we shall see below, he makes a great deal out of more distant speech areas.

Second, he keeps exclusively within the types of bibliographies known as subject bibliographies and does not include, example, the Swedish national bibliography of books or the bibliography of journal articles. As the subject bibliographies in Swedish psychology are of a very limited range, one would find it natural to complement them with other types of sources.

Third, within the area of Swedish psychological bibliography,

Welwert should have known that the Norwegian Pedagogical Study Collection in Oslo has issued an index of Scandinavian (including Swedish) psychological and pedagogical articles with brief subject entries (a project that has now been transferred to the so called PEPSY-database). There is also a "hidden" annual bibliography of Swedish research in psychology in the journal *Nordisk Psykologi* (*Nordic Psychology*), that goes back to 1948—admittedly listed in alphabetic order according to author with no subject entries, but usable nonetheless.

Finally, given the level of work under discussion here, there is something unfortunate in the author's contenting himself with drawing on local libraries (a common phenomenon) and not examining the possibilities the Swedish main library in psychology and pedagogy (located in Stockholm) has to offer.

We must therefore conclude that the bibliographical apparatus in the Nordic countries is inadequate and that even the elements that are available are not used sufficiently because they are too complicated and easy to overlook. There is a clear need for solid guidance to subject bibliographies when it comes to Nordic literature on psychology.

### **Other Manual Sources**

With regard to material outside the Nordic countries, Welwert relies primarily on bibliographic databases, but he also lists the following sources:<sup>1</sup> (6) *Listening Bibliography*, (7) *Erziehungswissenschaftliche Hochschulschriften*, (8) *Pädagogischer Jahresbericht*, (12) *Psychological Abstracts* for the period up until the database was introduced, and (14) written inquiries to six Spanish universities. Despite the fact that these manual sources include a few of the most central ones, they are, speaking from the point of view of search strategy, rather arbitrary. A few of the works that have been overlooked are: *British Educational Index* and *Wilson's Education Index*, the *Bulletin Signalétique* (two sections, one for education and one for psychology) for the period up until the data-

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1. These numbers correspond to the order in which Welwert lists his references. As they are ordered a bit differently here, certain gaps appear.

base was introduced and bibliographies of Russian research in *Voprosy Psichologii* (Welwert includes Russian and Chinese references in his treatise and keeps statistics on the incidence of literature in different languages).

Indeed, many other relevant sources are also available, for example, *Dambauer's* yearly bibliography of German psychology, which from a professional bibliographic point of view is a model, and various psychological bibliographies, such as the *Indian Psychological Abstracts*.

The sources that have been mentioned so far have all been bibliographies. It is apparent, however, that important handbooks and encyclopedias often contribute valuable information that cannot be found in bibliographies. For example, Welwert would probably have benefited from becoming familiar with works like the *Handbook of Research On Teaching*, *Handbuch der Psychologie* and the various editions of Woodworth's *Experimental Psychology*.

As noted earlier, Welwert's procedure documents the need for a clear overview of available search possibilities. A number of works exist that attempt to provide such overviews, but they are either outdated or seriously limited in various ways. One of the better ones is McInnis's *Research Guide for Psychology* (1982), but it only covers English language material. It is also rather difficult for a researcher to utilize a work of this nature without the assistance of a specialist trained in information work in psychology.

### **Databases**

Welwert emphasized primarily the usefulness of scanning bibliographical databases. He went through: (9) *Dissertation Abstracts* 1861-1980, (10) *ERIC* (Educational Resources Information Center) 1966-1980, (11) *Psychological Abstracts* 1967-1980, and (13) *Pascal* (corresponds to *Bulletin Signalétique*, 1972-1980).

This information retrieval process encompasses far more than what is normally undertaken by researchers, and in view of the amount of work entailed in examining the transcripts from these four databases (*ERIC* alone yields 1200 references), it of course may seem harsh to suggest that even more databases should have been scanned. Nevertheless, that is the author's opinion. At the

same time, the search profile should have been narrower in order to have produced fewer references, in particular from ERIC.

It is felt that a scanning of the LLBA (*Linguistics and Language Behavior Abstracts*) and of the SSCI (*Social Sciences Citation Index*) would have generated additional references, and that various other indexes could have been included, for example, the *British Educational Index*, which can be found on Blaise; the German *Psyndex* system; possibly monographic databases, such as LC-MARC, and so on. One cannot help thinking about the kind of advice Welwert received concerning the selection of databases. It can be seen from the search profile annexed in his book that the search was performed by Kungliga Tekniska Högskolan (the Royal Polytechnic University) in Stockholm. Perhaps it is simply a case of their searching the databases at their disposal on their own computer? The selection of databases also seems to indicate that the principle at play is: what is closest at hand is most used and no attempt is made to exhaust all possibilities.

Even though it is likely that use of particularly LLBA and SSCI would have produced some relevant references, it is not just because of this omission that Welwert's selection of sources is challengeable. It is more a question of a prevalent tendency to favor the use of electronic bibliographies over that of printed ones. This is an understandable reaction in view of the laborious paperwork connected with using printed sources of information, and it illustrates the importance libraries place on getting as many of their works as possible registered in a database.

In respect to Welwert, the computer-based search yielded 79 relevant research reports, while the manual search yielded an additional 47. Finally, combing the references in these reports resulted in finding 82 more. All told, Welwert succeeded in identifying 208 relevant research reports. The question is whether the relation between the 79 references from the computer-based search and the 47 from the manual search reflects the true relation between the possibilities of these two types of search process. This is doubtful. It is clear that the difference between these two figures can be attributed to the fact that the manual search is not, relatively speaking, very well considered. Welwert, however, does not share this latter opinion. He thinks that a manual search provides such good possibilities

for double-checking (in that relevant references are cited in the reports that have already been obtained) that older works are not likely to be overlooked. But given what is known about the way in which researchers cite — for example also about language barriers — it is a bit too much to assume that all the relevant research has been cited in the mass of research that has been picked up in Welwert's search. On the other hand, the chain search resulted in finding 82 reports and proved to surpass both the manual and the databased bibliographical searches. Again, a typical example of why so many researchers exploit this method, at the cost of a more systematic literature search. In most cases, it is simply the most cost-effective method.

If only one comment were to be made concerning the selection of databases, it is that the most important databases are commercial ones (as are even the so called "nonprofit" databases such as PsycINFO), each interested in appearing as the principal source of information in a given field. Instead of clearly delimiting coverage and dividing the indexing between them, there occurs a massive overlapping and a rather arbitrary division of, for example, more peripheral subject and speech areas. The searcher is therefore left without sufficient opportunity for a truly methodical strategy for choosing databases. The only way to alleviate this situation is to let the search be undertaken by the people most experienced with the given databases and to produce as many reviews and analyses of existing databases as possible and then convey the findings in these to the users.

Welwert's selection of sources for his literature search points to a need for a far more active effort on the part of information and library specialists. It is not sufficient for libraries to purchase the appropriate means of information retrieval and to enumerate these in long lists. Their strengths and weaknesses must also be adequately elucidated. It is necessary moreover, to describe precisely the function of the individual sources of information and to show to what degree one source of information makes another one superfluous or reduces the need for it within one or more well-defined areas (such as language, manner of publication, etc.). Finally, the literature search must preferably be described as a chain of decision-making elements, and this chain must not be utopically long in relation to the time limitations of the typical research project. This



author has made a suggestion for such a model (Hjørland, 1980), until now available only in Danish.

### **THE SEARCH PROFILE: TERMINOLOGY AND SUBJECT FACETING**

As an annex, Welwert includes on page 233 of his dissertation the search profile that was used in the databased literature search (see Annex 2). The search profile is also discussed in the text itself, where Welwert maintains that the profile is so broad that no relevant reports could have been omitted.

The profile consists of three logical groups of terms: (a) terms concerning listening or reading comprehension (all the documents with these terms are printed out); (b) terms for auditory perception and for reading (documents with these terms are only printed out if they also contain the terms from group [c]), and (c) which comprises one word, the truncated form of comprehension, *comprehen\**.

To reiterate, many objections can be made concerning the search profile. First, it appears as though this one search profile has been used for all four databases. It would be unfortunate of course if this were actually the case. That the search profile only contains English terms and that one of the databases is predominantly French, speaks for itself. But even within the same language (English), it would only be expedient in a few cases to formulate the profile identically for different banks. It is precisely this kind of solution that leads either to the printing out of too much from some databases that is irrelevant or too little that is relevant from others. What is clear is that the individual database's uniqueness and particular demands have not been taken into consideration. Theoretically, the search strategy one selects can be so broad that it will yield anything, regardless of the individual database; such strategies are often used with questions on which there is very little available literature — but here the case is the exact opposite.

Another complaint about this search profile is that it pins everything on one term, *comprehen\**. One can see that this is dangerous just from the fact that if Welwert's own dissertation were coded, one would not be able to find it again through a title search under

this term. Welwert uses the Swedish word *jämförande*, that is, "comparative" research. It is of course quite likely that one could have identified many pertinent documents by combining the term *comparative* with *auditive* and *visual*.

If in addition these two interrelated aspects of the subject, the auditive and the visual, are considered, a marked imbalance emerges. With regard to the auditive, both the term *auditive* and *listening* are used. On the other hand, the term *visual* itself is not used; only terms for the type of visual perception called reading. The author has fallen between two stools. He must either write a dissertation solely about reading compared to listening, or he must include other forms of visual perception, such as iconic comprehension. Judging from the dissertation's subtitle, he did the latter, but the search profile only encompasses the terms for reading. Apart from this inconsistency, one could also mention other search terms that might have improved the search result. For example, it might have been worthwhile to search under the term *modality* (or *sense modality*) combined with such other terms as learning, text processing or word processing (as used by Rickheit et al., 1987). Moreover, *non literate*, combined with, for example, *comprehension*, would have increased the probability of finding all relevant studies.

Welwert's search strategy indicates that he has used the thesauri that are available for PsycINFO and ERIC—his use of compound terms, such as *listening comprehen\** suggest this. However, the author is far too tied to these thesauri. At any rate, experience reveals that one can often achieve better results by combining a descriptor search with a free text search than by basing it on controlled terms alone. This view is common among experienced information workers.

As seen, the task of establishing a search profile comprises not only the "selection" of search terms, as it is not just a question of a "selection" process, but to a large degree a term-producing process. Within this process, terminological considerations and the logic of the search profile itself affect each other in such a way that the one problem cannot be solved independently of the other.

The question is whether a heuristic method can be indicated to produce and order terms for a search profile? The method encountered in psychology that comes closest to that stems from *Psycho-*

*logical Abstracts*, which requests its users to fill in a form (see Annex 4) and answer, among others, the following questions: Which descriptors are relevant for the dependent variable(s)? Which descriptors are relevant for the independent variable(s) and which descriptors are relevant for the population variable(s)? It is felt, however, that this model is not very useful. Inspired by the second edition of Bliss's *Bibliographical Classification*, the author has created an alternative model consisting of eight facets. It is considered that this is a rather strong model, and even though it is outside the scope of this article to provide a complete introduction to this model, in the next chapter it will be examined in its application to Welwert's subject.

### **SUBJECT FACETING AND EXPERIMENTAL VARIABLES**

If we look at the dissertation, we can say that it deals with how learning or comprehension is influenced respectively by an auditive and a visual presentation of the learning material. In other words, it demonstrates how learning is dependent on the means of presentation. In traditional experimental research, learning and perception are described as dependent variables, whereas the means of presentation are described as independent variables. The age, sex, education, etc., of the subjects of the study are described as the population variable. As mentioned above, it is the view of *Psychological Abstracts* that such variable thinking can be used as a means of constructing search profiles. The search profile for Welwert's dissertation does not quite fit this pattern. This is connected to the fact that one search term can cover dependent, as well as independent, variables. In terms of search technique, *listening comprehension* and *reading comprehension* are perceived as one term and thus cover both variables. (One can say that *Psychological Abstracts* is in conflict with itself in that it could have avoided these composite terms, but that is another problem and cannot be dealt with here.) Second, Welwert does not find cause for restricting his investigation to any particular population. For these two reasons, Welwert's search profile deviates from the three types of variable. However, it can be said that the search profile is not too different from this

variable model, as there is some conformity between the research tradition to which Welwert belongs and the one that was the prototype for the way in which *Psychological Abstracts* constructed its forms.

The point is that what, for example, Klaus Holzkamp (1983, p. 522 ff.) has criticized as "variable psychology" is passé (or at any rate less dominant) as a paradigm in psychological research. The question of whether to use the variable paradigm as a model for drawing up the search profile is twofold: (1) Is this an appropriate model for research that belongs to the "variable paradigm" itself? If yes (2) is it also an appropriate model for research that falls outside this paradigm? It appears that the variable model is in any case a less efficient one; but rather than demonstrating that, this article will concentrate on the alternative facet model.

### ***The Facet Model Exemplified***

This alternative facet model will be illustrated by applying it to Welwert's dissertation. The model implies that every psychological subject should be analyzed from eight mandatory viewpoints or facets: the research method applied; the theoretical frame of reference; common facets such as time, form and place; the psychological processes involved; psychobiological aspects; individual characteristics such as sex, age and personality traits; social and cultural conditions; and, finally, the aim of application.

*Facet 1: Research methods.* One can say that Welwert's research method is first and foremost a secondary analysis of existing studies in the field. Relevant subject headings could be "secondary analysis," "literature survey," "meta review," and so on.

*Facet 2: Theoretical orientation.* One could say that Welwert's dissertation is in a certain sense atheoretical or "theory agnostic." It is closest to the behavioral school of thought that compares dependent and independent variables without having any conception of the, for example, biological or social context. One relevant subject heading might therefore be "behaviorism."

*Facet 3: Time, place and form.* One can say that Welwert's study covers the period 1890-1980 internationally and that the form is a

printed dissertation. These three aspects should be covered by descriptors.

*Facet 4: Psychological processes.* As already mentioned, Welwert's work concerns auditive and visual perceptual processes and should be indexed under both categories.

*Facet 5: Psychobiology.* Welwert does not touch on the neuropsychological mechanisms of the processes under study, just as he does not deal with the development of auditive and visual signal systems in the animal kingdom. He could have done so, and when conducting a literature search it is relevant to be able to specify both the positive and the negative possibility. As psychobiology is a mandatory facet, a stand must be taken, and one can envision two solutions with regard to subject headings: either (1) that the missing psychobiological descriptors are evidence of the fact that the document does not deal with this area, or (2) the descriptors being used are defined in such a way that they exclude this area (for example, one could decide that all documents that do not deal with animal psychology or phylogenesis must be described by the term *human*).

*Facet 6: Individuals and personality.* Since Welwert does not narrow his interest to a definite age group, for example 7-12-year olds, it is not necessary to indicate age-specific subject headings. But as he is explicitly interested in how the use of reading versus listening varies with age, a descriptor indicating this must be given. The fact of the matter is that in *Psychological Abstracts* one finds descriptors that delimit age, as well as ones for age-comparative studies ("Age Differences"). The latter should be mentioned in this case. Similar examples could be given with regard to psychological terms concerning personality.

*Facet 7: Social and cultural conditions.* Again, what is most characteristic is what Welwert does not do. He does not include the question of the role and function of listening and reading in different cultural or social milieus, and the influence this can have on the way in which an individual acquires reading versus listening skills for various tasks. Carrying out an efficient literature search is contingent on whether the indexing explicitly indicates that these conditions have not been elucidated.

*Facet 8: Sphere of application.* Welwert's work can be relevant in many contexts, for example, in pedagogy, communication and influence. Descriptors explicitly accounting for this are more significant than would seem at first glance. Often those conducting the literature search find themselves in a situation where they cannot precisely define all the relevant delimitation variables. Under these circumstances, one can often identify the sphere of application to which the studies may appertain, and if the literature can be retrieved using this facet the probability of achieving a good research result will therefore be increased. In psychology it is often the case that other facets are too abstract and delimit the literature in a less expedient way than does the sphere of application facet.

This presentation of Welwert's subject using the facet model shows that this model is valuable as an aid in producing and sorting relevant terms for the search profile. It is thus a good tool for library work. Perhaps one can go a step farther and claim that it is also a good heuristic method to clarify the way in which the problem of the research itself is formulated, and that efficient mastery of this model might have allowed Welwert to include more facets in his problem formulation than was the case.

### **THE SELECTION PROCESS**

Annex 1 shows the data from Welwert's literature search. It can be seen there that as a result of his computer search in the ERIC system, 1200 references emerged. He selected them based on titles, abstracts, etc. and ordered on that basis, 155 reports from the library, of which only 20 proved in the end to be relevant. The precision is quite low for a literature search (1.7%). This coincides with the general reputation of the ERIC-system, as well as this author's personal experience with it. Before drawing conclusions that are too far-reaching, however, one must take various circumstances into account; for example, whether the search profile was especially ill suited to this system, whether the ERIC-system is geared to the questions posed (or whether its forte lies in other areas), etc. The fact that the other systems generally perform much better can, however, be interpreted as an indication of poor subject indexing and

information selection in the ERIC-system. In Table 1 the corresponding figures for the other systems are presented as a comparison.

It is evident from Welwert's account that he experienced significant difficulties in determining, based on the transcripts, which studies were relevant. This concurs with the observation that scientific abstracts usually are constructed in too general a manner. The user's return can be just as nominal as the information a consumer receives from reading a list of ingredients on a package of processed food (see Herrell, 1979).

Welwert states further that even though there were considerable difficulties in selecting literature using these references, he did not encounter problems in choosing among the documents in full text. This apparently has to do with the chosen subject. Problems of a fundamental nature tend to expand, so that in the end what one finds relevant is something completely different from what one deemed relevant at the start. Thus, in research that undergoes a conceptual

Table 1:

Retrieval and precision rates in four databases.

Name of database:	Documents:	Relevant:	Precision rate:
:	retrieved:	documents:	:
ERIC	1200:	20 :	1.7 % :
Psychological Abstracts	383:	44 :	11.5 % :
Dissertation Abstracts	814:	27 :	3.3 % :
Pascal	93:	7 :	7.5 % :

development, the researcher experiences difficulties in selecting the literature using full texts as the basis upon which choices are made.

### **CONNECTION BETWEEN THE FORMULATION OF THE PROBLEM AND THE POSSIBILITY OF A SYSTEMATIC LITERATURE SEARCH**

That the dissertation under discussion here has dealt with the literature search in a more thorough way than usual is naturally connected to the fact that one of its primary aims is to summarize earlier research in the same field. As mentioned above, this type of research is becoming more and more common—which is not surprising, given the rapid proliferation of the literature. Strictly speaking, of course, all researchers ought to evaluate carefully existing knowledge about a subject, and the reader ought to be able to assume that a thorough and explicit literature search has been undertaken.

One can go a step further and ask whether a correspondingly systematic literature search would have been possible if the formulation of the problem had to a lesser degree been phrased in relation to “variable psychology.” To be even more difficult, one could ask whether only the most superficial and unreflective problem formulations can be translated into a search profile. The answer is both yes and no. In principle, there is no limit to how advanced the indexing can be, and at the same time a description of a subject is not final but a setting of priorities of important aspects of documents, based on suppositions about the needs of the research and the users. The simpler the level on which this indexing is made, the fewer—and the more simplistic—the problem formulations that can, with some luck, be translated into a search profile. That is why it is not quite coincidental that Welwert’s formulation of the problem led to a profitable computer-based literature search, whereas other dissertations do not have a corresponding need. However, it is typically the case that information pertaining to certain aspects of a scientific work must be retrieved from other sources, whereas certain subquestions can usually be isolated and transformed to a computer search. Furthermore, most scientific works build on just a few



central sources, and one can advantageously trace the further development of these through the use of citation indexes.

It is thus concluded that all scientific research could greatly benefit from a so-called systematic literature search, but given the state of search systems as these exist today, their role in the conceptual and theoretical sides of research is minimal. If the means of information retrieval are to function better, the quality of indexing must be considerably improved. And it is held that this development must be based on a facet model similar to the one presented here.

Until now psychologists have been very little occupied with research efforts directed toward formal classification systems and taxonomies with the aim of improving information retrieval in psychology. McGrath and Altman (1966) and Rice (1978) are exceptions, but they have only been occupied with a subdiscipline in psychology (small group research), and their works have had no practical consequences on indexing or retrieval. An important distinction between their approach and the facet model presented in this paper is that they are only occupying themselves with the classifying of empirical data, whereas the facet model classifies literature. The hypothesis, that it is sufficient to classify data, is related to the positivist tradition in psychology. If it is accepted that empirical data are subject to interpretation, then it is not sufficient to index data; one must also index theories.

This article will be concluded with a problem formulation that is of great importance both to psychology and to other social sciences. It has to do with the possibility of transcending the researcher's theoretical point of departure. By way of introduction, attention will be drawn to another example. In 1984, Karen Vibeke Mortensen (KVM) defended her dissertation on children's drawings. The dissertation was praised as a solid piece of work, but Søren Kjörup (1985) wrote in his review that although the dissertation represented a reasonable contribution to the psychological tradition to which it belonged, this tradition is quite problematic; he thinks it is rather shocking that one can be a psychologist of pictorial representation without having any knowledge of modern pictorial theory and without taking a position with regard to Gombrich.

It is not the purpose here to determine whether Kjörup's criticism is justified (which KVM refuted, during a conversation with this

author, as she does not consider Gombrich relevant). It is part of scientific research that different points of view exist concerning the value of different theoretical lines of thought. This is particularly the case in psychology with its many schools of thought. Therefore, this criticism points to a very regrettable situation: if a researcher conducts a computer-based literature search about children's drawings in, for example, *Psychological Abstracts*, he/she is not referred to literature that will enable him/her to trace Gombrich or the "modern theory of pictorial representation."

There are two good reasons for this, the most important one being that that kind of literature has only a modest chance of being included in *Psychological Abstracts*. As far as is known, *Psychological Abstracts* has misunderstood scientific norms as it accepts a great amount of literature falling within the traditional paradigms and has been hesitant with regard to new or alternative paradigms — especially from the human sciences as compared to those from the natural sciences. Second, even though one might find relevant references in *Psychological Abstracts* about this particular theory of pictorial representation, it is improbable that they would emerge in a search for children's drawings or that they would be particularly visible. This is connected to the indexing practice, criticized above, where "variable psychology" is the ideal. If indexing documents according to theory were stressed — as in the facet model — it would be possible to a far greater extent than at present to uncover the existing theoretical approaches to a given problem formulation.

Welwert's dissertation is another example of this. He conducted a rather extensive literature search but did not retrieve the essential literature that could have dissipated some of the stagnation prevalent in this field. It seems as though it is difficult to draw conclusions that are sufficiently general, despite countless studies. One result is found for one population, and another for another population; the same applies when the text content, etc., is varied. It is not that the research is not valuable. It is, to the contrary, highly valuable.

The question is simply whether the research strategy is sufficiently economical; that is, whether useful conclusions can be reached, quickly and cheaply, within this relatively theory-agnostic tradition. From completely different sources, attention has been

drawn to the fact that psycholinguistics works with theories about how acoustic and visual input of words is processed and represented in the psychic system. In Annex 3, a figure is presented that illustrates this. It is believed that this kind of theoretical research has a better chance of delineating the underlying mechanisms that determine whether reading or listening represents the most efficient form of learning and communicating.

Only two examples have been given here, but these, it is contended, represent an incredibly widespread problem, one that it is of the greatest scientific interest to solve on a high level. Various things must be done to achieve such a solution. In this article, an attempt has been made to outline what library and information scientists ought to contribute in this connection. It is evident that this implies a much closer cooperation between psychologists and information scientists, and that persons responsible for the psychological information system must have a combined knowledge of both psychology and information science on a very high level.

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ANNEX 1. Specification of data from retrieval and collection of research reports.  
(Translated from Swedish by the present author.)

Database searched	Number of retrieved references.	No. of ordered documents	Number of relevant documents
ERIC (1966-1980)	1200	155	20
Psychological Abstracts (1967-80)	383	100	44
Dissertation Abstracts (1861-1980)	814	85	27
Pascal (1972-80)	93	20	7
<b>Total</b>	<b>2490</b>	<b>360</b>	<b>98</b>
Duplicates			-19
Number of unique and relevant documents found by computer based information retrieval			79
Number of documents found by manual literature search		126	47
Number of documents found in the reference lists in obtained reports:		118	82
<b>Total number of reports</b>		<b>604</b>	<b>208</b>

Country of publication:

Language of research reports:

English 187 reports  
 German 13 reports  
 Swedish 4 reports  
 Chinese 2 reports  
 Russian 1 report  
 French 1 report

USA 179 reports  
 Great Britain 6 reports  
 Canada 2 reports  
 Germany 13 reports  
 Sweden 4 reports  
 China 2 reports  
 Russia 1 report  
 Belgium 1 report

**Total 208 reports**

**208 reports**

## ANNEX 2. The search profile used by computer based information retrieval.

```

Name           : KTHML01                               Page 01
Data Base     : Base      Version 01

* Rank        : 70      Modification date:79-11-01
Max.refs     : 0000    Creation data   :79-11-01

* Read       : IDC

* Write      : IDC

* Comments   : READING AND LISTENING COMPREHENSION

* Logic      : 10 * A + B*C

  GRP  NO   TYP  TYPNO  WGT   CUM   TERM
*  A   01   TIK   0.5   +02   * LISTENING COMPREHEN*
*  A   02   TIK   0.5   +02   * READING COMPREHEN*

*  B   01   TIK   0.5   +02   * AUDITORY PERCEPT*
*  B   02   TIK   0.5   +02   * AUDITORY DISCRIM*
*  B   03   TIK   0.5   +02   * READING *
*  B   04   TIK   0.5   +02   * READING ABILIT*
*  B   05   TIK   0.5   +02   * READING SKILL*
*  B   06   TIK   0.5   +02   * SILENT READING*
*  B   07   TIK   0.5   +02   * READING PROCES*
*  B   08   TIK   0.5   +02   * ORAL READ*

*  C   01   TIK   0.5   +02   * COMPREHEN*

TOTAL NO. OF TERMS: 0011

```

ANNEX 3. Graphic representation of the psychological processes by which visual and acoustical analysis of a word are carried out (from *Handbuch der Lexikologie*, 1985, p. 291).

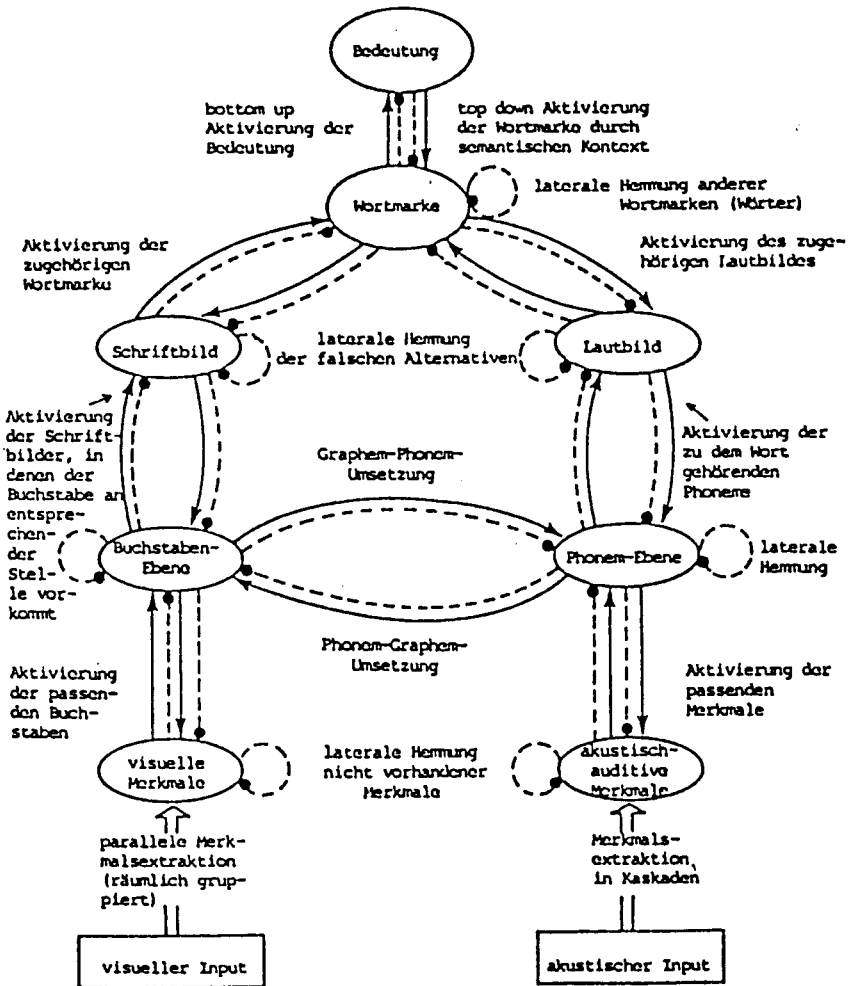


Abb. 2: Graphische Voranschaulichung der Prozesse, die bei der visuellen bzw. akustischen Analyse eines Wortes ablaufen. In der linken Bildhälfte sind alle aufsteigenden, in der rechten alle absteigenden Aktivierungen benannt. Finden sowohl aktivierende (—>) als auch aktivierende (--->) Prozesse statt, so sind stets nur die aktivierenden benannt. Für die hemmenden Prozesse ist in diesem Fall analog zu lesen: 'Hemmung der nicht zugehörigen (passenden, etc.) Einheiten'.

ANNEX 3 (continued)

English translation of German text in Annex 3:

<A Psycholinguistic model of the processing of forms of words.>

Die Repräsentation und Verarbeitung von Wortformen-The representation and processing of forms of words.

Bedeutung=meaning

bottom up Aktivierung der Bedeutung=bottom up activating of the meaning

top down Aktivierung der Wortmarke durch semantischen Kontext=top down activating of marks of words through semantic context.

Wortmarke=mark of a word/(characteristic features of a word)

laterale Hemmung anderer Wortmarken (Wörter)= lateral inhibition of other marks of words (words).

Aktivierung der zugehörigen Wörtmarke=activating the belonging mark of word.

Aktivierung des zugehörigen Lautbildes=activating the belonging acoustic image

Schriftbild=visual picture of the text/word.

Laterale Hemmung der falschen Alternativen=Lateral inhibition of the false alternative.

Lautbild=acoustic image

Aktivierung der Schriftbilder, in denen der Buchstabe an entsprechen der Stelle vorkommt=activating of the visual picture of the word, in which the letters are at corresponding places.

Aktivierung der zu dem Wort gehörenden Phoneme=activating the phonemes belonging to the word.

Graphem-Phonem-Umsetzung=grapheme-phoneme-conversion

Buchstaben-Ebene=level of letter

Phonem-Ebene=level of phoneme

laterale Hemmung=lateral inhibition

Phonem-Graphem-Umsetzung=phoneme-grapheme-conversion

Aktivierung der passenden Buchstaben=activating the adequate letter



## ANNEX 3 (continued)

Aktivierung der passenden Merkmale=activating the adequate mark

visuelle Merkmale=visual mark

laterale Hemmung nicht vorhandener Merkmale=lateral inhibition of marks not at hand

akustisch-auditive Merkmale=acoustic-auditive marks

parallele Merkmalsextraktion (räumlich gruppiert)=parallel extraction of marks (spatial grouped).

Merkmals-extraktion in Kaskaden=extraction of marks in cascades

visueller Input=visual input


akustischer Input=acoustic input

text under figure:

"Figure 2:

Graphical illustration of the processes by which the visual respectively acoustical analysis of a word takes place. In the left half of the picture are all the upgoing processes named, in the right half of the picture are all the downgoing processes named. If both inhibition (-----) and activating (\_\_\_\_\_) processes take place, then only the activating processes are named. As to the inhibiting processes these should be read as follows: "Inhibition of units which do not belong (e.g. are not adequate)."

# PASAR Request Form

<p style="text-align: center;"><b>Psychological Abstracts Information Service</b></p> <p style="text-align: center;">                   American Psychological Association                  1200 Seventeenth Street, N.W.                  Washington, D.C. 20036                  (202) 833-7600             </p>	<p style="text-align: center;">FOR OFFICE USE ONLY</p> <p>Search Request No. _____                  Search Time _____                  Date Received _____                  Date Sent _____                  APA Invoice No. _____</p>
<p>Address to which response should be mailed:</p> <p>Mr. _____                  Ms. _____</p> <p>NAME _____</p> <p>ORGANIZATION _____</p> <p>STREET _____</p> <p>CITY _____ STATE _____ ZIP CODE _____</p> <p>AREA CODE AND TELEPHONE NO. _____</p>	<p><input type="checkbox"/> Attached is my institutional purchase order # _____</p> <p><input type="checkbox"/> Please bill me personally at the address indicated. I agree to assume responsibility for charges resulting from this PASAR search request.</p> <p>AUTHORIZED SIGNATURE _____ DATE _____</p>
<p>PLEASE READ GUIDELINES BEFORE COMPLETING THE REQUEST FORM — PLEASE TYPE OR PRINT</p>	
<p>1. Narrative statement of search topic:</p>	<p>3. Descriptor(s) relevant to independent variable(s):</p>
<p>2. Descriptor(s) relevant to dependent variable(s):</p>	

**ANNEX 4.** Formula from *Psychological Abstracts (1982)* in which the users are asked, among other things, to specify the descriptor(s) relevant to dependent variable(s), to independent variable(s) and to the population. This formula is not used any longer, but an alternative to the three kinds of variables has yet to be introduced as an aid in designing the search profile.

## ANNEX 4 (continued)

4. Relevant citations and/or authors:
5. Population: (Caution should be exercised in order not to limit unnecessarily the range of references to be retrieved.) _____ humans _____ adolescents _____ animals _____ infants _____ adults _____ specific animal(s) _____ children _____ aged _____ special characteristics (e.g., alcoholics, kindergarten students) _____ _____ _____
6. Search qualifications:
a. Time span: (Data base contains PA entries from 1967 to present.) From _____ To _____
b. Language: _____ English _____ foreign _____ specific foreign
c. Document type: _____ articles and reports _____ dissertations _____ books _____ book reviews
7. Sorting requirements: <input type="checkbox"/> Author sort <input type="checkbox"/> Year sort
8. Intended use of search results:
9. Size of retrieval:
a. If necessary, limit retrieval by changing the following search specifications:
b. If necessary, extend retrieval by changing the following search specifications:

Please do not remove. Photocopy may be used or write to PASAR at address above.

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