
Changing Values in the Published Literature with Time

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ABSTRACT

THIS ARTICLE EXAMINES THE multidimensionality of print materials in order to discuss utility versus value of print materials as they age. Studies of changing uses of print materials over time have shown a bias on the part of researchers in favor of the hypothesis of obsolescence, although studies have failed to conclusively support that hypothesis. Based on issues raised in previously conducted obsolescence studies, this article presents a schema of parameters (superordinate classes of contextual variables) that affect all studies of changing uses of print materials over time. Recent studies have concentrated on the age-date relationship rather than on other parameters (especially the "use" and "users" parameters) or they have relegated concern about these parameters to other researchers. This article argues that only by incorporating what can be learned about all the parameters of the seamless web of co-occurring events surrounding the changing uses of print materials will researchers and librarians be able to make use of the quantitative data on the declining numbers of uses of print materials.

INTRODUCTION

We've kept stored knowledge like holy relics and fewer people believe in relics all the time. I once had the pleasure of breaking bread with Mortimer Adler...Dan Boorstin had asked him what he thought the Library of Congress should save, and he replied that the secret was to burn everything older than fifty years and keep burning as time went on. So long as you kept the last fifty year's worth of nonfiction—he

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excluded belles-lettres—he claimed you'd always have what you needed. Why? Because every profession carries along what matters in its new books and junks the myths and the mistakes of the earlier generations. (Goodrum, 1987, pp. 76-77)

The conventional wisdom that print materials decline in both use and usefulness with age is shared not just by librarians-turned-mystery-writers but also by many researchers and librarians. In the jargon of library and information science, this phenomenon is called *obsolescence*. This term has traditionally been used to refer to the hypothesis that the pattern of use of print materials over time will show a predictable and observable decline in use with age (Line & Sandison, 1974, p. 283; Stinson & Lancaster, 1987, p. 65; Motylev, 1981).

The body of literature which has tested the obsolescence hypothesis has grown to considerable size over the past several decades, but the pattern of research has seldom deviated from the exploration of a single easily measured criterion—i.e., the number of uses of the items studied. Yet researchers have not reached a consensus about the validity of the obsolescence hypothesis. They have not agreed on the mathematical model that best represents obsolescence (Stinson & Lancaster, 1987; Avramescu, 1979; Motylev, 1981; Egghe & Rao, 1992). When research results have failed to show the expected measurable decline in use, researchers have suggested a variety of mitigating factors (usually contextual variables) that they believe are responsible for skewing results.

The lack of consensus among researchers about fundamental questions related to obsolescence studies suggests that another kind of exploration of the changing uses of print materials over time is needed. What has traditionally been assumed to be evidence of obsolescence in the literature of library and information science may be more productively understood in terms of *changing relationships* among dynamic populations of users and their uses of printed materials, the population of published materials available, and the period of time under study.

A RATIONALE FOR A NEW APPROACH

The nature of printed books or journals may have much to do with their changing uses over time. Toffler (1970) has noted accurately that few objects have a single easily definable function; printed materials are no exception. Like the elephant encountered by a group of blind men, books or other publications can seem to have different identities depending on the dimension which one chooses to examine. It is proposed here that books, journals, and other published materials have three dimensions. They exist simultaneously: (1) as artifacts of human knowledge production, (2) as conveyors of information,

and (3) as recorded statements of an author or authors at a particular point in time.

The first dimension of books or other published materials has to do with their existence as artifacts of human knowledge production. Books have always possessed a cultural significance beyond, and sometimes unrelated to, the information which they contain. Cressy (1986), for example, has documented uses of books in previous centuries as magical talismans, aids to divination, devices for social display, symbols, or totems. The use of books as a visible display which provides evidence of erudition is not unknown in contemporary American society.

The rare book trade is evidence that, along the dimension of *artifact*, books tend to appreciate with age, assuming a decrease in numbers of similar existing items in usable condition. From this perspective, a publication may be said to be obsolescent when its physical condition deteriorates to the point that it is rendered unusable. At that point, its value as a rare commodity is greatly diminished if not lost completely.

The second dimension of published materials, that of *conveyor* (or *container*) of information, is the dimension most frequently examined in the library obsolescence literature and in the literature of particular disciplines. It is a truism that many publications become less frequently used with the passage of time. They "age" or "decay" or "obsolesce," in the language of library and information science researchers, because they contain information that clearly has been superseded by works which sandwich the important parts of previous works between a literature review and some new information. Obsolescence researchers see this side of the print-materials "elephant" when they examine published works. Librarians struggle to make weeding and off-site storage decisions about works because they view them along this dimension. To casual observers, the decline in use of older works superseded by newer ones is sufficient evidence of the validity of the obsolescence hypothesis.

Most print materials decline in numbers of uses over time along the second dimension. Obvious examples include phone books, almanacs, or state or federal government yearbooks in daily use; policy statements, regulations, or legislation that is periodically revised and upon which individuals must base their actions; new editions of textbooks or syntheses of the literature in a discipline; or published accounts, in the research literature or trade press, that add new information to public knowledge of a contemporary theory, process, or event. Issues of knowledge obliteration and replacement, although beyond the scope of this article, are relevant to these kinds of second dimension uses. In each case, the need for the latest information

on a particular topic reduces dramatically the value of the older publication for certain popular kinds of uses.

The third dimension of print publications, that of a *statement by an author at a particular point in time*, suggests roles for published materials that clearly change over time, especially for scholarly purposes but is not limited to these purposes. West (1991) has described such books as "finds at an archaeological site" (p. 13). The *Warren Commission Report*, the Surgeon General's first official statement on the health hazards of smoking, published assessments on the current state of calculus instruction in secondary education—recorded statements on these topics possess a particularly cogent and time-bound third dimension. While one may not want to go so far as to agree with Eugene Ionesco that: "Only the ephemeral is of lasting value" (Clinton, 1981, p. 84), the time-bound characteristic which constitutes the third dimension of published works is, paradoxically, the quality which guarantees their lasting value—these statements constitute the historical record.

Over time, the primary sources of the historical record are used for a variety of purposes not intended by the original authors. These changing uses are instances of *utility* (expressed in numbers of uses, which may decrease) juxtaposed against *value* (expressed in the importance of individual uses, which may increase). Obsolescence researchers have traditionally been interested in the utility factor rather than the value factor. Those who use older print materials for changing purposes include ordinary people; lawyers, researchers, policymakers, and legislators; and, of course, historians. It is this research or evidentiary dimension that confounds the librarian's task in discarding older materials or relegating them to less accessible storage in all kinds of libraries.

From early research studies of declining numbers of uses over time (Gosnell, 1944) to contemporary studies (Christianson & Hayes, 1991), the obsolescence hypothesis has carried with it an underlying assumption that declining use with age is accompanied by a decline in value of the aging materials. Obsolescence (the phenomenon of successively fewer numbers of uses over a period of time) is frequently cited as a factor in discarding or weeding library collections of less valued items (Ettelt, 1991). The existence of three dimensions of print materials, however, suggests that the one-dimensional view of changing uses over time—e.g., a view which examines only numbers of uses, citations, or circulations, and equates that with value—is inadequate for all but the most narrow purposes.

Some examples may help clarify the phenomenon of utility versus value over time. As stated earlier, viewed along the third dimension, the number of uses of earlier works superseded by later ones may

decline as time passes, but the social value of individual uses may increase dramatically. As citations to supporting evidence or proof, individual uses may have economic or social cost and/or benefits for society far greater than could have been expected at the time of publication (legislation based in part on references to a 30-year body of research related to effects of high quality programs for preschool children is one example (see Berrueta-Clement et al., 1984). Another example is taken from *The Washington Post*, October 18, 1990:

Since 1930, more than 100 studies have purported to show that the painful, potentially fatal disorder of ulcerative colitis was caused by psychological factors. In a recent review of the original studies published in the *American Journal of Psychiatry*, a team of researchers re-examined the original 100 studies often cited in literature reviews and found most of them so seriously flawed as to be useless. New avenues of treatment will now be made available to those suffering from this disorder.

Such uses of aging print materials, taking place during what might be expected to be a period of only occasional uses or citations to these works, clearly possess the power to have a great impact on the lives of particular groups or individuals. Other examples of uses of published materials that may be of extreme social importance but are not related to the original intent of the publication are indicated in Figure 1.

All printed works possess the three dimensions of print materials discussed here. Yet research studies on changing patterns of use of library materials over time have concentrated primarily on the age-use or age-date relationship as related to second-dimension uses. Shifting groups of users and the changing social value of different kinds of uses over time, primarily a function of the third dimension, have received relatively little attention.

THE CONVENTIONAL WISDOM OF OBSOLESCENCE

Line and Sandison (1974), who provided the classic discussion of the issues related to the study of changes in the use of documents over time, were careful to distinguish between changing uses of materials (the observed phenomenon) and obsolescence (one hypothesis which has been used to explain the phenomenon of changing uses of documents over time). Yet few obsolescence researchers have chosen to use the phrase "changing uses of materials"; indeed, over the last few decades, the term *obsolescence* has come to refer to much of the body of research which examines changing uses.

This body of research has developed its own characteristics and jargon. The language of library obsolescence literature is characterized by terminology and metaphors that tend to link inevitable organic

Categories of published materials	Original uses (second dimension use)	Later uses (third dimension use)
Telephone books, city directories	To assist in making telephone calls or sending letters to current residents.	Genealogy studies; tracing missing persons; evidence of legal residence at a particular point in time.
Almanacs, yearbooks, calendars	To provide date-bound information on weather, customs, and events.	Legal evidence of time and date of sunrise, sunset, days of the week, or holidays in a particular year.
Conference programs	To let conference attendees know about the timetable of events at a meeting.	Contributes to assessment of historical trends in a discipline by analyzing the topics of presentations.
Case law as reported in <i>The Law Reporter</i>	To determine the outcome of a particular case in a court of law.	Establishes precedent for deciding similar cases in courts at the same jurisdictional level.
Fictional writings	To tell a story for contemporary readers' enjoyment or learning.	Evidence of local customs and traditions at a particular time; evidence of attitudes and ideas popular in a given era; indications of word and the evolving nature of language.
Legislation	To provide guidelines for current practice in some legally regulated activity.	Contributes to meaning of current legislation through legislative histories.

Figure 1. Publications and their uses at the time of publication and uses later in time

("aging," "decay") or scientific phenomena (a "half-life" analogous to the half-life of radioactive materials) to the phenomenon of changing uses of published materials over time. Use of such terminology grants artificial legitimacy to the assumptions of obsolescence. Kuch (1982) has argued that the traditional library and information science concept of obsolescence is one of those ideas that has taken on a life of its own. He believes it has become part of a grand assumption accepted by most researchers about change in the state of knowledge which he calls a *thema*—"a belief deeply and often unquestioningly held that has an influence in determining, for an individual scientist, what problems he will find interesting, what position he will take on the work of colleagues, and what types of hypotheses he will tend to frame" (p. 69). Kuch describes *themata* as beliefs capable of being expressed in objective terms, often widely

shared (or assumed) among researchers, and "often adhered to with an emotional commitment much beyond that common to ordinary working hypotheses" (p. 69). Gapen and Milner (1981) support the view that the obsolescence hypothesis has become an accepted part of the conventional wisdom, or the common sense folklore, of library and information science. As is true of many common sense beliefs, the widely held assumptions about obsolescence have obscured the complexity of the phenomenon and proved particularly resistant to change.

PARAMETERS OF OBSOLESCENCE

Research related to the conventional wisdom represented by the obsolescence hypothesis generally ignores not only the multidimensional nature of print materials discussed in the first section of this article (in particular, the social value of individual uses), but also the importance of contextual and other factors that impinge on changing uses over time. Many such factors already have been identified by obsolescence researchers. These factors are clustered here into classes of characteristics that make up what will be called the "parameters of obsolescence."

The term *parameter* is used to indicate a superordinate category of contextual variables which applies to all situations in which the age-use relationship is considered (much of this organizational scheme and many definitions of terms were adapted from Katz [1973, p. viii]). Each parameter, which is assumed to remain approximately constant during the course of a single study, consists of a class of largely contextual phenomena which have an impact on the observable changes in publication use over time in every study. The salient feature of this proposed scheme is that, in agreement with Line and Sandison (1974, p. 284), obsolescence, or decline in use with age, is not assumed to be the cause of changing uses in the life cycle of print materials.

The parameters described here are most easily observed in obsolescence studies conducted in libraries (an easily definable kind of "setting"). Every study of changing uses over time, however, is subject to the impact of each parameter, even though the particulars of the class of descriptive characteristics defined within the parameter may vary from study to study. For example, every library must have patrons (e.g., every library possesses the "user" parameter), but the patrons of a public library differ in measurable ways in their information needs or patterns of use of print materials from patrons of a university library. As another example, in every study, a group of related materials is examined, but the materials may range from the journal literature on human genetics (Stinson & Lancaster, 1985) or the music literature (Diodato & Smith, 1993), to the books borrowed

through a major university interlibrary loan operation (Rouse & Rouse, 1979).

A review of research studies on obsolescence suggests a number of factors that are recognized as having a significant impact on the changing-use-with-age phenomenon. Unlike some factors, such as growth of the collection, most of these mitigating factors are contextual variables for which correction may not be possible in a study. Their identification by researchers provides a cumulative body of evidence of the inadequacy of solely quantitative measures of the changing use of print materials. Line (1970), for example, defined several factors related to the probability that an item would be consulted in a library (p. 186). Researchers have cited Line's (1970) work and the mitigating factors suggested by their peers in an attempt to explain why data showing changing uses with age of print materials have sometimes deviated from the expected exponential decline in use over time.

The parameters or superordinate classes of largely contextual variables suggested here include: (1) the knowledge base under study; (2) the print materials studied; (3) the uses for which the materials are sought, cited, or used; (4) the users of the materials; (5) the setting; and (6) the time period studied. This listing is not intended to be exhaustive but merely to suggest variables within each parameter that have been identified by obsolescence researchers.

Parameter Descriptions

The Knowledge Base. The discipline chosen for study (Gosnell, 1944; Bottle & Gong, 1987; Heisey, 1987) is universally recognized as a key variable affecting the aging factor in citation studies of obsolescence. Few obsolescence studies have been cross-disciplinary or included all disciplines (exceptions include Rouse & Rouse, 1979; Nakamoto, 1988; Rothenberg, 1992). Other significant variables related to the knowledge base which have been suggested as impinging on the rate of obsolescence include the age of the discipline (Marton, 1985), the stability of the domain studied (Burton & Kebler, 1960), and the rate of acceleration of knowledge increase in a domain (Motylev, 1981).

Queiroz and Lancaster (1981) also cited rapid literature growth as a reasonable hypothesis about any subject field during its early development phase, and suggested that, as a literature matures and begins to scatter, its rate of obsolescence will be slower (p. 217). Marton agreed (1985), arguing that disciplinary aging differences are highest in the early years, and that, as a discipline ages, differences among disciplines gradually decrease, tending toward equalization of the rate of aging (p. 152). Gosnell (1944) suggested that the size of the subject area studied was significant (p. 119). He believed that larger

subject areas tend to have a lower rate of obsolescence than smaller, more volatile subject areas (but admitted exceptions like philosophy and music, which are small but which age slowly). Finally, knowledge replacement is a factor in changing uses of materials.

The Print Materials Studied. Just as the literature of each domain may exhibit a unique pattern of declining use with age, the aging characteristics of, for example, the journals within a discipline can be expected to vary from those of other print materials in the same domain (Wallace, 1987, p. 44). The materials selected for study (Chen, 1972) are thus another major parameter of obsolescence studies. Some researchers have suggested that key variables within this parameter include the ephemeral or classical nature of the information in the article, or the theoretical or practical nature of the information (Burton & Kebler, 1960). Cawkell (1976) argued that the impact of individual articles is ignored in synchronous studies of obsolescence and that "enduring articles" and "very important papers" (which he was able to identify in retrospect) show no decline in citations with time (p. 53). The "immediacy factor" suggests that the decrease in citation means not that older articles garner fewer citations, but that newer articles receive extra citations (discussed in Marton, 1985, p. 153).

Line (1970) suggested that the likelihood of an item being consulted in a library was partly dependent on the number of papers in a consulted volume (p. 186). The country of origin and/or the language of the article (Motylev, 1989; Gupta, 1984) are key factors related to the intellectual accessibility of specific materials and may affect the aging of certain literatures. Griffith et al. (1979) suggested that journals studied may be of two kinds: "archival journals" (which age slowly) or "research front journals" (which age rapidly [Marton, 1985, p. 146]).

Users. The use and users of information are sometimes difficult to treat separately; nonetheless, this author believes they require separate consideration. Key variables already identified by researchers include the type of user (Voigt, 1979; Beheshti, 1989; Duncan, 1979; Katz, 1986; Sani, 1984). Sani (1984) and others have suggested that users may vary in their uses of materials at different times and therefore cannot be considered a constant over time. Line (1970) suggested that the number of readers and the number of items consulted per reader are significant (p. 186).

Uses. The use to which information will be put, like the users-of-information variable, constitutes an under-researched but important contextual class of characteristics. Several researchers have claimed

that intended use is a significant variable that impinges on changing uses of materials over time, and that intended use may vary even by the same users (Bottle & Gong, 1987; Sani, 1984; Katz, 1986). Sandison (1974) suggested that whether the use constitutes a "basic" search or an "updating" use or search may make a difference in the age of the materials sought out and used. Duncan (1979) attempted "to introduce the concept of a 'user-time profile'" (p. 5) intended to predict information needs of researchers at different points in a research project.

Other researchers have explored related ideas. For example, Katz (1986) suggested that the classic distinction between clinicians and researchers has consequences for the kinds and ages of materials used. Bottle and Gong (1987) defined seven "content typologies" (p. 60) in biochemical literature intended to describe the major types of use to which the information contained in a paper may be put by the researcher, and then examined the importance of age of the information attributed to the different content typologies by researchers. They arrived at the conclusion that classifying citations into these content typologies may be theoretically the best means of providing some insight into changing uses with the aging of materials.

The Setting. The setting, which may be thought of as both place- and domain-specific, is another major parameter. The kind of library (Sandison, 1975) and characteristics of the library itself (Brookes, 1970; Line & Sandison, 1974) are significant. As an example, Sandison suggests differences between an American teaching and research institution and a library which engages in interlibrary lending for the whole of Britain. McGrath (1978) suggests that in a university library, variability in circulation of books by subject area is partly dependent on the academic program (p. 17).

A number of administrative and philosophical factors are relevant in obsolescence studies set in specific libraries. In times of lean budgets, for example, collections may be built in selective areas and cooperative collection development with other nearby libraries may be practiced. These local practices have unpredictable consequences for the results of obsolescence studies in particular libraries. In addition, many researchers have asserted that density of use or the amount of shelf space occupied in a library by print materials has impact on obsolescence studies based on the results of circulation or use studies (Sandison, 1971; Stinson & Lancaster, 1985).

In citation studies, the number of available items to be used or cited or the rate of growth of the literature are key factors in

understanding the “setting” in which materials are cited (Line, 1970; Sandison, 1974, p. 172; Stinson & Lancaster, 1985). Healey and Cox (1978) and Line (1970) suggested that bibliographic accessibility (the number of citations to an item in indexes or databases) and physical accessibility (ease of identification in library catalogs and proximity to the library entrance, time to retrieve it from reserve, use by other readers, and so on), can also be significant. Mueller (1965) also found that inaccessibility of older works (stored in a basement workroom) or “enhanced accessibility” of new books featured in a “new title” bin were significant factors in whether these materials were used or borrowed, independent of age (pp. 170-71). These studies suggest questions about the impact of intellectual accessibility (or inaccessibility) of publications due to inadequate indexing in databases or in languages other than English in various domains.

The Time Span. A cursory examination of obsolescence studies suggests that data from longitudinal studies frequently reveal declining use with age along the expected exponential decline in use in some disciplines, while short-term studies frequently indicate anomalous results. Parker (1982) suggests that whether the time span in question is affected by the “ephemeral factor” or the “residual factor” is related to such results (the former causes a faster decline in the earlier years, while the latter gradually assumes predominance and, after thirty to thirty-five years, it alone remains (Parker, 1982, pp. 131-32). Many researchers have suggested that print materials in some fields—humanities (Heisey, 1988), music (Longyear, 1977), or physics (Line, 1974) —may not obsolesce at all. Others exploring the same fields, such as Diodato and Smith’s (1993) recent exploration of obsolescence of the music literature, showed different results when different techniques of analysis were applied.

Figure 2 is a schematic representation of how a matrix can be generated from the parameters of obsolescence proposed earlier. The matrix is intended to help organize what is known about the parameters and to suggest areas in which additional research is needed in order to better understand the changing uses of print materials over time. It is also intended to indicate the seamless web of interrelated and co-occurring events that affect changing uses of print materials over time.

Looking first at each cell in the diagonal of the matrix marked *A*, *B*, *C*, *D*, *E*, and *F*, it is clear that to understand the phenomenon of changing uses over time, researchers need considerable knowledge about the variables within that parameter. For example, it is necessary

Parameters	A. Knowledge Base	B. Publi- cations	C. Uses	D. Users	E. Setting	F. Time Span
A. Characteristics of the knowledge base	A	A → B				
B. Characteristics of publications studied	B → A	B	B → C			
C. Characteristics of uses		C → B	C	C → D		
D. Characteristics of users				D	D → E	
E. Characteristics of the setting				E → B	E	
F. Time span						F

Figure 2. Schematic representation of parameters of obsolescence

to understand the pattern of growth or splintering of the knowledge base in the discipline being studied, or the likely borrowing patterns of faculty, undergraduate, and graduate students in the large research university setting.

The parameters schematically portrayed here contribute to a view that literature aging is a major reason for decreasing use of print materials over time, but they also suggest that changing numbers of uses may co-occur with other processes that affect the dynamics of using print books and journals over time. The existence of superordinate classes of contextual variables suggests that an understanding of the co-occurring events within each parameter may help explain why, for example, large-scale citation or reference studies frequently yield different results from large-scale studies done in specific library settings (Rothenberg, 1992). In a large-scale reference or citation study, the unique qualities of individual library settings are corrected because the study is cross-institutional. Even so, it must be stressed that the "setting" parameter remains a central cluster of variables in cross-institutional citation studies, although the variables in cross-institutional studies have to do with varying degrees of bibliographic, physical, and intellectual access to a body of literature.

Research findings in most fields are generally expected to suggest relationships among co-occurring events rather than indicating cause

and effect. If questions concerning the cause or effect of changing uses are unlikely to be answered by research studies related to obsolescence, and the relationships suggested in the matrix are those among co-occurring events, it may be useful to speculate on some possible relationships that have seldom been explored by library and information science researchers.

For example, looking at row *D* in figure 2, questions emerge about the effects of setting variables, particularly in libraries, on user behavior ($D \rightarrow E$) that have, to date, seldom been explored. Among the questions that could be addressed: Is there a difference in borrowing patterns in libraries with closed stacks compared to libraries with open stacks? Do online public access catalogs that are searchable from many different locations tend to neutralize the effects of displays, or of inaccessible storage, on borrowing patterns? Would most patrons rather use older materials which are locally available than request newer items through interlibrary loan or is the reverse true?

CONCLUSION

This discussion has explored the three dimensions of print materials in order to shed light on the issue of utility versus value of print materials as they age. The multidimensionality of print materials described in this article supports the notion that there are several important parameters that traditional studies of obsolescence, which have concentrated on the "materials," "knowledge base," or "time span" parameters, have largely ignored or considered beyond the province of obsolescence research. Yet only by viewing these parameters as helping to define a seamless web of interrelated and co-occurring events will libraries be able to make use of data on declining numbers of uses for making decisions about storing or discarding library materials.

This discussion should not be interpreted as concluding that all libraries need to keep all older materials immediately available to users. West (1991) has described the phenomenon of wholesale "dispersals" of library materials as a "cultural catastrophe which could do irreparable damage to our nation's literary heritage" (p. 8) as brought about by the growth of a semiliterate society that has come to depend on video images for information. Rather than accepting this extreme view, this article is intended to suggest that a less simplistic research paradigm, one that acknowledges the multiple dimensions of print materials and addresses all the parameters of changing uses of print materials, needs to be taken into consideration in order to make weeding and storage decisions.

Studies of changing uses of print materials over time reveal an affinity on the part of researchers for what Kuch (1982) has termed

the *thema* of obsolescence, which has served to oversimplify the issues involved. This bias has contributed to a conventional wisdom that obfuscates the complexity of the phenomenon of changing uses of print materials over time.

As in other instances where matrices have been applied (Katz, 1973), the major purpose of setting out a matrix of the parameters of obsolescence is to emphasize the complexity of the phenomenon. Most studies to date have focused on the "materials" or "knowledge base" or "time span" parameters. The point here is not to deny the importance of questions related to these well researched parameters, but rather to emphasize that analyzing changing uses of print materials in any given context requires understanding the relative influence and the co-occurrence of certain variables within the other parameters.

This article is not the first to suggest that major problems related to the study of changing uses of print materials over time remain to be solved. Motylev (1981), among others, has effectively set out several of the major methodological and conceptual problems of obsolescence research. Studies of changing uses of print materials over time need more sophisticated analysis than conclusions reached through frequency counts. Identifying the seamless web of parameters of the changing uses of print materials is a useful step toward developing new methods of analysis.

REFERENCES

- Avramescu, A. (1979). Actuality and obsolescence of scientific literature. *Journal of the American Society for Information Science*, 30(5), 296-303.
- Beheshti, J. (1989). A cross-sectional study of the use of library books by undergraduate students. *Information Processing & Management*, 25(6), 727-735.
- Berrueta-Clement, J. R.; Schweinhart, L. J.; Barnett, W. S.; Epstein, A. S.; & Weikart, D. P. (1984). *Changed lives: The effects of the Perry Preschool Program on youths through age 19*. Ypsilanti, MI: High/Scope Educational Research Foundation.
- Bottle, R. T., & Gong, Y. T. (1987). A bibliometric study on the ageing and content typology relationship of the biochemical literature. *Journal of Information Science: Principles & Practice*, 13(1), 59-63.
- Brookes, B. C. (1970). The growth, utility, and obsolescence of scientific periodical literature. *Journal of Documentation*, 26(4), 283-294.
- Burton, R. E., & Kebler, R. W. (1960). The "half-life" of some scientific and technical literatures. *American Documentation*, 11(1), 18-22.
- Cawkell, A. E. (1976). Citations, obsolescence, enduring articles, and multiple authorships. *Journal of Documentation*, 32(1), 53-58.
- Chen, C. C. (1972). The use patterns of physics journals in a large academic research library. *Journal of the American Society for Information Science*, 23(4), 254-270.
- Christianson, E., & Hayes, S. (1991). On account: Depreciation of library collections: Terminology of the debate. *Bottom Line*, 5(3), 35-37.
- Clinton, A. (1981). *Printed ephemera: Collection organisation and access*. London, England: Clive Bingley.
- Cressy, D. (1986). Books as totems in seventeenth century England and New England. *Journal of Library History: Philosophy and Comparative Librarianship*, 21(1), 92-106.

- Diodato, V., & Smith, F. (1993). Obsolescence of music literature. *Journal of the American Society for Information Science*, 44(2), 101-112.
- Duncan, E. B. (1979). Growth and decay in information and their relationship to user needs. *CRUS News*, (7), 5-6.
- Egghe, L., & Rao, I. K. R. (1992). Citation age data and the obsolescence function: Fits and explanations. *Information Processing & Management*, 28(2), 201-217.
- Ettelt, H. (1991). When can you weed an unused book? *Information Reports and Bibliographies*, 20(2), 24-25.
- Gapen, D. K., & Milner, S. P. (1981). Obsolescence. *Library Trends*, 30(1), 107-124.
- Goodrum, C. (1987). *The best cellar*. New York: St. Martin's Press.
- Gosnell, C. F. (1944). Obsolescence of books in college libraries. *College & Research Libraries*, 5(2), 115-125.
- Griffith, B. C.; Servi, P. N.; Anker, A. L.; & Drott, M. C. (1979). The aging of scientific literature: A citation analysis. *Journal of Documentation*, 35(3), 179-196.
- Gupta, D. K. (1984). Periodical literature of exploration geophysics: Obsolescence factors and patterns. *Library Science with a Slant to Documentation*, 21(4), 205-226.
- Healey, J. S., & Cox, C. M. (1978). Research and the *Readers' Guide*: An investigation into the research use of periodicals indexed in the *Readers' Guide to Periodical Literature*. *Serials Librarian*, 3(2), 179-190.
- Heisey, T. M. (1987). *Paradigm agreement and reference concentration: A study of reference obsolescence and dispersion in the literature of the Dead Sea Scrolls*. Doctoral dissertation, Rutgers University.
- Heisey, T. M. (1988). Paradigm agreement and literature obsolescence: A comparative study in the literature of the Dead Sea Scrolls. *Journal of Documentation*, 44(4), 285-301.
- Katz, L. G. (1973). Foreword: Early childhood education: Toward a definition. In *Early childhood education: An ERIC bibliography* (pp. vii-xiv). New York: Macmillan Information, a division of Macmillan Publishing Co., Inc.
- Katz, L. G. (1986). *Professionalism, child development, and dissemination: Three papers*. Urbana, IL: University of Illinois, ERIC Clearinghouse on Elementary and Early Childhood Education.
- Kuch, T. D. C. (1982). Thematic analysis in information science: The example of "literature obsolescence." *Journal of the American Society for Information Science*, 33(2), 69-75.
- Line, M. B. (1970). The "half-life" of periodical literature: Apparent and real obsolescence. *Journal of Documentation*, 26(1), 46-54.
- Line, M. B. (1974). Does physics literature obsolesce? A study of variation of citation frequency with time for individual journal articles in physics. *BLL Review*, 2(3), 84-91.
- Line, M. B., & Sandison, A. (1974). "Obsolescence" and changes in the use of literature with time. *Journal of Documentation*, 30(3), 283-350.
- Longyear, R. M. (1977). Article citations and "obsolescence" in musicological journals. *Notes: Quarterly Journal of the Music Library Association*, 33(3), 563-571.
- Marton, J. (1985). Obsolescence or immediacy? Evidence supporting Price's hypothesis. *Scientometrics*, 7(3-6), 145-153.
- McGrath, W. E. (1978). Relationships between hard/soft, pure/applied, and life/nonlife disciplines and subject book use in a university library. *Information Processing & Management*, 14(1), 17-28.
- Motylev, V. M. (1981). Study into the stochastic process of change in the literature citation pattern and possible approaches to literature obsolescence estimation. *International Forum on Information and Documentation*, 6(2), 3-12.
- Motylev, V. M. (1989). The main problem of studying literature aging. *Scientometrics*, 15(1-2), 97-109.
- Mueller, E. (1965). Are new books read more than old ones? *Library Quarterly*, 35(3), 166-172.
- Nakamoto, H. (1988). Synchronous and diachronous citation distributions. In L. Egghe & R. Rousseau (Eds.), *Informetrics 87/88* (Select proceedings of the First International Conference on bibliometrics and theoretical aspects of information

- retrieval, Diepenbeek, Belgium, 25-28 August 1987) (pp. 157-163). Amsterdam: Elsevier Science Publishers.
- Parker, R. H. (1982). Bibliometric models for management of an information store. II. Use as a function of age of material. *Journal of the American Society for Information Science*, 33(3), 129-133.
- Price, D. J. de S. (1970). Citation measures of hard science, soft science, technology, and nonscience. In C. E. Nelson & D. K. Nelson (Eds.), *Communication among scientists and engineers* (pp. 3-22). Lexington, MA: Heath Lexington.
- Queiroz, G. G. de, & Lancaster, F. W. (1981). Growth, dispersion and obsolescence of the literature: A case study in thermoluminescent dosimetry. *Journal of Research Communication Studies*, 2(4), 203-217.
- Rothenberg, D. (1992). *Synchronous and diachronous methods in the measurement of obsolescence in library circulation studies*. Unpublished manuscript.
- Rouse, S. H., & Rouse, W. B. (1979). Analysis of monograph obsolescence at two levels of an interlibrary loan network. *Information Processing & Management*, 15(5), 219-225.
- Rovner, S. (1990). Patient's mental state isn't cause of ulcerative colitis (Health Section). *Washington Post*, October 16, p. 5.
- Sandison, A. (1971). The use of older literature and its obsolescence. *Journal of Documentation*, 27(3), 184-199.
- Sandison, A. (1974). Densities of use, and absence of obsolescence, in physics journals at MIT. *Journal of the American Society for Information Science*, (May-June), 172-178.
- Sani, R. B. (1984). *Literature sources in elementary and early childhood education*. Unpublished doctoral dissertation, University of Illinois at Urbana-Champaign.
- Stinson, E. R., & Lancaster, F. W. (1985). Synchronous versus diachronous methods in the measurement of obsolescence by citation studies. *Journal of Information Science: Principles & Practice*, 13(2), 65-74.
- Toffler, A. (1970). *Future shock*. New York: Random House.
- Voigt, M. J. (1979). Circulation studies cannot reflect research use. *Journal of Academic Librarianship*, 5(2), 66.
- Wallace, D. P. (1987). A solution in search of a problem: Bibliometrics & libraries. *Library Journal*, 112(8), 43-47.
- West, W. J. (1991). *The strange rise of semi-literate England: The dissolution of the libraries*. London, England: Duckworth.