Research Notes
Reference Service and Bounded Rationality: Helping Students with Research
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In university library reference service librarians often get ambiguous questions to which they try to give appropriate answers. Because of limitations on resources, time, mental capability for information processing, and other factors, the decision-making process involved in answering a reference question becomes bounded by the rationality of these constraints. Entering into this process is the ambiguous nature of good and acceptable answers according to students. This paper is based on Herbert Simon's ideas on bounded rationality and fuzzy sets as discussed by L. A. Zadeh.

he quality of reference service has been a concern of librarians for many years. Carefully crafted studies can help practicing librarians improve services and help administrators in allocating funds and justifying budget requests to university administration. To that end, there has been a preference for objective studies. In examining the accuracy of reference service, Kenneth Crews has given an overview of existing studies.[1] In calling for further studies to examine the effects of using more variables, it may become possible to predict more accurately the quality of service.[2] However, another recent study by Jo Bell Whitlatch has raised questions about the scope of existing studies such as those based on unobtrusive testing.[3] She says

unobtrusive testing seems too narrowly focused to measure the range of reference services and cautions librarians not to let available methodology dictate the types of evaluation. Whitlatch urges introspection of reference librarians about the reference process so that they may examine and identify variables that help explain quality service while they wait for more sophisticated studies that use a greater variety of evaluation methods.[4]

One area that merits closer examination involves the assumptions of reference service. An existing premise is that there is a single correct answer for a reference question. The quality of reference service as measured by unobtrusive testing studies, for example, is based on the supposed accuracy of the answer. However, there may be multiple

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answers that are acceptable and equally accurate. In order to measure the quality of reference service, one must find out what to measure and how to measure. Part of the *what* involves a better understanding of the process of decision making involved in how to answer reference questions. It is only when the process (doing reference) is improved that the final product (the answer) can be improved. Some of the variables in the process that may influence the quality of reference service are explored below.

THE REFERENCE SETTING

One of the jobs for a reference librarian at an academic library is to help students find information for their course work. This may be as simple as finding the mailing address in Washington, D.C., of United States Senators from Illinois or as complex as finding research materials for a paper on variables that influence the success of United States exports in South America. The former case is a clearly defined question for which only one answer will suffice. In the latter case, several factors influence the decisions as to what constitutes usable materials. Relevant materials may span several disciplines such as economics, political science, and history. They may also be written in Spanish or Portuguese and assume an understanding of local cultures and practices in specific countries such as Argentina or Brazil. Other factors include ambiguous understanding of terms such as *success*. Thus, relevancy of many of the variables is problematic.

ISSUES OF RATIONALITY

Herbert Simon has used the phrase *bounded rationality* to describe the limitations on rationality.[5] In explaining his ideas through playing chess, he said that a player never really considers every possible move before choosing the next one. Given the time and human capacity, it is simply not possible, especially if one tries to extrapolate to future moves. A beginning player may only see a few moves and choose on that basis. A more experienced player may not consider many more moves, but in the process may visualize several moves ahead based on the pattern of the pieces on the board. Instead of looking at individual pieces, such a player looks at the makeup of the board after successive moves. The choice is not based on all possible moves but only on a subset of possible moves being considered. The choice will then be a *satisficing*—a Scottish term meaning "good enough"—move.[6] Thus the alternative chosen is satisfactory based on the limited rationality of the player.

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In the lecture delivered when he accepted the Nobel Prize in Economic Science in 1978, Simon further postulated that the satisficing decision is based on the aspiration level of the decision maker, given the limitations on rationality.[7] It is not that one should not aspire to a higher level. But in a given circumstance, librarians, limited by their rationality such as constraints of time and memory, provide answers that are sufficiently good in those instances for them and the students.

Librarians often must make decisions based on incomplete information about issues that are not well understood. Robert Taylor describes this as one person (the librarian) trying to find out what another (the patron) wants to know but cannot describe precisely.[8] According to the classic understanding of rationality in decision making, one would consider all possibilities, calculate the cost of using each choice and the benefits to be gained in each case, and then choose the best one. Calculations of cost and benefit should be taken in a broader sense to mean more than expenditures of money and time, and knowledge gained in this instance. Benefits should also include understanding the process through which knowledge and experience are increased and broadening of one's knowledge base so that these gains may be used later.

However, there are many limitations on rationality. Foremost are the limitations on the resources at a given library and the time available for searching for relevant materials. One must also keep in mind that not all relevant materials are usable for a particular student. Those materials that assume a solid understanding of the basics in a field or that use advanced research methodology or statistics are not useful to the freshman though they may be helpful to the graduate student.[9] Nor is it possible to calculate accurately the cost associated with making some of the choices together with the return on making those choices since one's mental capability is limited. It is hard to predict whether the value of the information that one finds will outweigh the time and energy spent tracking it down; nor is it possible to know the existence of all relevant materials that have been published or even all materials at one's own library. Thus, one has incomplete knowledge of not only available information but alternative methods of access.

Sometimes, when librarians and students don't understand each other, it becomes a process of expanding the bounds of rationality until the librarian's fuzzy set of satisfactory answers and the student's fuzzy set of acceptable answers overlap.

Reference librarians answer their interpretation of the question based on a context bounded by their knowledge and experiences. Similar to the chess example above, an experienced reference librarian does not consider each journal index as a separate item but may consider classes of indexes as patterns to answer certain types of questions. The number of items or chunks that can be remembered is relatively constant among inexperienced persons and experts.[10] A student may attribute one title to a chunk whereas an experienced librarian may attribute a group name representing many related titles to one chunk. Thus, instead of considering *Education Index, Current Index to Journals in Education* and *Resources in Education* as three distinct titles, librarians may take them as one chunk to answer questions dealing with education.

This also means that a satisficing answer to a freshman may not be good enough for a graduate student working on a thesis. It is possible for two students in the same class to need two different satisfactory answers. In one instance involving the author, for example, one student asked for material on the yearly percentage increase in a certain category of the population. All that could readily be found at the time were yearly totals. That was minimally satisfactory for the author because the end product involved performing some calculations, whereas the actual percentages are available in other sources. But to that student, the answer was good enough. He sat down with his calculator and did the necessary work to arrive at the percentages. For another student working on the same assignment, that was not good enough because he could not visualize the process. This is knowledge gained from talking to the student. The "good enough" answers cover a whole range of alternatives whose quality is situation-dependent. It also becomes obvious that there is a whole set of acceptable answers for students. As with good chess players, librarians see patterns in information that may not be apparent to a student. With an understanding of the infrastructure of information, librarians act on patterns that students may not be able to follow. In order to arrive at an appropriate answer, sometimes librarians need to negotiate with the student.

To summarize, the student does not go through all possible ways to phrase a question rationally nor does the librarian rationally pick the best answer. In the reference process, the two participants try to elucidate their frameworks and try to merge the two. A successful answer is when the two come to a common understanding. In the example above involving population increase, the author was able to explain the process of calculation

to the second student, which took far less time than it would have taken to trace the necessary steps in locating the actual percentages.

FUZZY SETS

It is apparent from the scenario examined above that there is not a single answer nor a precise number of correct answers. The number of "good enough" answers really depends on the rationality of an individual.[11] At this time it is appropriate to bring up the concept of fuzzy sets introduced by Zadeh.[12] Fuzzy sets are those sets with ambiguous criteria of membership. In a normal or crisp set, the membership is bivalent. One element is either a member of the set or not. For example, if the set is comprised of students registered for a particular class, then any student who is registered is a member of the set, and any student who is not does not belong to that set. When a student asks for factual information such as addresses of state senators from Illinois, only those addresses would be satisfactory, although sources used may vary for different librarians. However, when the set is comprised of tall librarians, without an accompanying definition of tall, then membership becomes problematic, depending on the understanding of the observer. In this case, membership may range from "0" to "1" on a continuum with "0" meaning not in and "1" meaning in, depending on the likelihood of a librarian being considered tall. This is the nature of the question when a student needs to find background information leading to the passage of the Civil Rights Act of 1964. There is no crisp set of documents or sources that will address the question because students will approach the question with a set of assumptions based on their previous knowledge and feelings. There is only a set of satisficing materials that will help in answering the question. Again, the set of relevant documents for one person may not be the same as the set of relevant documents for another person. As Bart Kosko said, "The world is gray but sci-

ence is black and white."[13] Thus, relevance in the real world is gray and depends on the individual case when we do not know the user's assumptions.

Similar examples may be a set of useful or extremely useful information sources to address a need. The word *extremely* in the above example is what Zadeh calls a linguistic hedge.[14] The degree to which it enhances the accompanying adjective depends on interpretation of the person using it. In this sense, "good enough" may range from minimally useful to a perfect fit to the reference question. As illustrated above in the reference setting, reference librarians are dealing with a set consisting of the range of satisfactory answers that can be offered by a librarian, and a set of acceptable solutions according to a student. It is only when these two fuzzy sets—bounded by their respective rationalities—intersect that there is a mutually satisfactory solution to the problem.

CONCLUSION

The examples presented above constitute a brief look at problems encountered in helping students do research. In most cases, reference librarians know what the students want and can help them find the information. Sometimes, when librarians and students don't understand each other, it becomes a process of expanding the bounds of rationality until the librarian's fuzzy set of satisfactory answers and the student's fuzzy set of acceptable answers overlap. Then there is a solution. We must realize that, depending on the reference question, there may be more than one answer considered satisficing. The usefulness of the answer also depends on the rationality of the student.

ISSUES FOR FURTHER RESEARCH

In examining the quality of reference service, it is not enough to improve the accuracy in measuring the measurable with the basic assumption that there is a best or only answer. In view of the salience of bounded rationality in decision making, it seems advisable that librarians approach measurements care-

fully in evaluating the quality of reference service. It is the process that must be better understood in order to improve the quality of services. Data for further research can be gathered through field observation, recordings of reference negotiations on audiotape or videotape, and focused interviews of librarians and patrons. The data may then be analyzed to generate grounded theories to better understand the process. With better understanding, librarians may find more relevant variables that can be measured.

REFERENCES AND NOTES

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9. See my letter to the editor "'Useful' Isn't Always 'Usable'," *Library Journal* 115 (July 1990): 8 and "Bibliographic Instruction and the Scholarship of Integration," *Research Strategies* 11 (Spring 1993): 66–72 for a discussion of usefulness versus usability.
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11. See Taylor, "Question Negotiation," especially pp.187–88. Even though this study deals with special libraries where users are more critical of and want more substantive answers, the process of negotiation between the librarian and the user brings out ambiguities and assumptions that must be filtered to reach an acceptable answer.
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