Article

Using Concept Mapping to Enhance the Research Interview

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Abstract
In this paper the authors report the use of concept mapping as a means of summarizing interview transcripts in the study of the information-seeking behavior of employees in an organization. Concept mapping differs from traditional methods of textual coding for interview analysis by making underlying cognitive structures transparent and giving a focus to the sets of propositions by which individuals construct meaning. Concept map structure correlates with the perceived richness of interview data. They provide quick summaries of the interview quality and may help to identify topics for further probing to elicit new information. In this study rich interviews provide complex concept map structures, whereas less successful interviews provide simpler, spoke structures. Issues in using concept maps with research interviews are discussed, including use as a retrospective interview probe, as a check on evidence saturation, as a form of data display or as a form of creative coding.

Keywords: interviewing, visualization, knowledge structures, concept maps

Introduction

The mapping metaphor has spawned the development of a number of techniques that have been used to elucidate and assess understanding of complex topics (e.g., Eppler, 2006). Some approaches have been quite free form, giving respondents more room for creativity in their responses. However, the resulting range of data forms can mean that it is impossible to talk of typical concept maps, making it difficult to isolate common features across a data set (Fox, McCormick, Proctor & Carmichael, 2007). To avoid this, the maps described here were drawn according to the organizing principles used in Novak's concept maps. Concept mapping is a product of research over the past 25 years or so that has been spearheaded by Novak and his colleagues (Novak, 1998; Novak & Cañas, 2006).

Concept mapping builds explicitly on Ausubel's (2000) assimilation theory of meaningful learning and fits well with constructivist learning perspectives (Trowbridge & Wandersee, 1998). It provides a tool to support reflection, helping to transform implicit associations to make explicit linkages (Fisher, 2000). The technique was originally developed as a way of providing a semigraphic summary of the complex data gained from interviews (Novak & Musonda, 1991), but the parallels between the qualitative description of concept maps and interpretation of interview data have never been explicitly drawn. In a particular development of the method, however, Kinchin, Hay, and Adams (2000) have shown how it can be used to gauge the cognitive structures that the mapper holds in mind to describe a particular topic.

The analysis of concept maps can reveal typologies of gross knowledge structures indicative of different patterns of understanding (Hay & Kinchin, 2006). Through this approach we do not attempt to measure change in quantitative ways (through change in concept richness or link quality, for example) as has been done elsewhere, nor it is it an attempt to validate change in terms of "correctness" or predetermined learning outcomes. Instead, it shares an epistemological approach with Jarvis (2006) and suggests that meaningful change is any that gives greater potential for the exposition of personal interpretations of a subject. This is the mainstay of the approach described here, but in this work the concept mapping method has been used not to collect data directly but to reduce interview transcript data to structural summaries of knowledge (information held) and understanding (the way in which knowledge is structured and individual concepts connected to each other).

Application of concept mapping
to analysis of the research interview

The objectives of the work described in this paper were to explore the scope to use concept maps constructed by the interviewer to enrich the interpretation of information collected during the interview. We also expose limitations in the research interview as a means of delving into the respondent's understanding of a research question (in this case, their conceptions of their own information behavior at work). We then suggest how research interview schedule design might be strengthened by examining the results of constructing concept maps from research interview transcripts.

The opening questions from a set of 19 previously completed interview transcripts (based on tape-recorded interviews) were chosen for analysis by constructing retrospective concept maps from the replies. A further five questions (not considered here) had been used to ask about other aspects of information use. These questions were not chosen for interpretation as concept maps because they were insufficiently open ended to make this approach appropriate.

These key informant interviews were conducted early in 2006 with senior staff of a national ecological organization as the first part of a review of the organization's information support requirements. The aim had been to build up as rich a picture as possible of organizational information use and of how people viewed their own information-seeking and use behavior within the broader organizational context.

In the featured segment of the interviews, respondents were asked whether obtaining information from outside the organization was a significant part of their current work. If this was the case, what sort of information were they required to find? We also wanted to know how they obtained information and from what sources. We asked whether they made any direct or indirect use of information and library services provided by the organization, and if so, which of these services and how frequently.

The intention in choosing these interview transcripts was to construct concept maps for each interview respondent to assess whether it is possible to retrospectively create adequate concept maps on the basis of open-ended qualitative research interviews. We would then start to see whether and to what extent the concept mapping approach adds to the interviewer's understanding of the respondents' use of information in context and which elements of the concept map approach are readily replicated through traditional qualitative research interviews and which are not. Finally, we wanted to know whether there is potential for using the idea of concept maps to guide the design of research interview schedules.

Concept mapping

Concept maps are essentially graphical tools for organizing and representing knowledge. They are constructed from concepts (shown in boxes in the concept maps below), grouped into propositions linked by statements of relationships. Following Novak and Cañas (2006), we define *concept* as a perceived regularity in events or objects, or records of events or objects, and *propositions* as statements about some object or event in the universe, either naturally occurring or constructed. Propositions contain two or more concepts, usually connected using linking words or phrases to form a meaningful statement. Connecting lines are always read down the page unless an arrowhead indicates that it should be read in the opposite direction (in cases of possible ambiguity, an arrowhead is added). The approach to constructing the concept maps followed the guidelines put forward by Novak (1998) and Novak and Cañas (2006).

Concept maps can be drawn by hand or on a computer, either using specialist software or using the drawing tools in more general applications. Those shown here were all drawn using the drawing options in Microsoft PowerPoint. The concepts are first identified (i.e., the main ideas covered within the interview) and then the way in which the interviewee links those concepts is identified and used to build a structure in which to arrange the concepts. In this way the map grows and the overall structure emerges.

Concept maps and interviews

Concept mapping has powerful utility for the demonstration of understanding. It can be used to display individual knowledge structures for comparison at different stages in the learning process. The characteristics of concept maps that have made them a popular tool for the promotion and assessment of learning (e.g. Nesbit & Adesope, 2006) also make them a helpful tool in the armory of the qualitative researcher. In particular, concept maps are excellent tools for eliciting

	SPOKE	CHAIN	NETWORK
Structure			
Hierarchy	single level	as many levels as concepts (but often these are unjustified)	several justified levels
Additions	additions to the central concept does not interfere with others	cannot cope with additions near the beginning of the sequence	additions and deletions have varying effects as 'other routes' are often available through the map
Deletions	generally have no effect on the overall structure unless the central (organising) concept is deleted (which leads to complete collapse)	disrupt the sequence below the deletion	
Links	often simple	often compound (making sense only when the map is read as a whole)	often rich and complex showing deep understanding
General	these structures indicate 'learning readiness' they are flexible and amenable to change in the course of learning	these structures are 'active' they are common to enterprise or to clinical practice where specific sets of actions must be carried out in sequence	these structures are 'scholarly' they often include alternative view-points and even contradictory ideas

Figure 1. Characteristics of the three main morphological types of concept map (after Hay, Kinchin, & Lygo-Baker, 2008; copyright to authors)

information and foregrounding key points from the background noise that is often included within interview transcripts. Concept maps can support quantitative and qualitative analysis, helping to highlight relationships and patterns within the data.

Because concept mapping depends on a structured approach to recording information, the authors have chosen to apply this approach using data collected through structured research interviews. The common ground here is that both concept mapping and interviewing are used to seek to understand the complexities of the research question by focusing on how the participants in a situation conceptualize that situation. To this end, we have adopted the definition of the structured research interview, advanced by Brenner, Brown and Canter (1985) as a "conversation conducted to gather research-relevant information" (p. 148). The main steps in this form of interviewing, again as offered by Brenner, Brown & Canter are

1. *ask the question* (at "slow normal" speed and in a neutral tone but with emphasis on certain words to help the respondent understand the question),
2. *listen to the reply*,
3. ensure that the respondent *answers in full* by using nondirective probes or prompts,
4. record the answers, and
5. *feed back complex replies* (to make sure that the interviewer has understood them and to prompt further comment).

This general approach to structured research interviewing has been widely adopted in the library and information field.[1]

In earlier studies, extensive examination of concept maps produced by students and teachers of all ages (from primary school pupils to postgraduate researchers) has shown that their structures can be broadly described as spokes (where all subordinate concepts link directly to the key idea, but not to each other), chains (where the concepts are arranged in a linear sequence), and nets (where multiple links exist between concepts at all levels in the concept map) (Kinchin, Hay, & Adams ., 2000). Consideration of the significance of these three major knowledge structures has resulted in the description of various attributes linked to the structural types (Kinchin & Hay, 2007), and to the ways in which they develop (Hay, 2007).

These structural types and developmental pathways indicate which of the concepts within the concept map are considered to be most important to the understanding held by the concept map's author, and the depth of understanding that links the individual elements. In general terms, spokes are often indicators of rote learning; chains often indicate a goal-orientated disposition, whereas highly integrated networks provide evidence of a deep understanding that could be applied to new situations. A concept map can illustrate aspects of all three of these structures. The three knowledge structures (spoke, chain, and net) are supported by the three phases of knowledge development, described by Pedrosa de Jesus et al. (2006) as (a) an acquisition phase, (b) a specialization phase, and (c) an integration phase. However, a simple linear progression from one phase to the next cannot be assumed. The phases can be employed simultaneously across different regions of a particular knowledge structure (Hay, 2007) and so cannot be usefully considered in isolation from each other. Mapping of knowledge structures can indicate which of these developmental phases is employed by the mapper/interviewee across different parts of the knowledge structure and as such can open a "window into the mind" (Shavelson, Ruiz-Primo & Wiley., 2005).

**Reconstituting research interview evidence
as retrospective concept maps**

The interview transcripts were translated into retrospective concept maps by the original interviewer, as having the closest involvement with the interview content apart from the respondent. This is termed retrospective as the concept mapping was undertaken after the interview data were gathered rather than as part of the interview procedure. There is clearly a subjective aspect to any reinterpretation of other people's responses, but the concepts were always sufficiently clear to make for ready delineation of a concept map and the links were almost always sufficiently explicit to provide the necessary detail.

As an independent check, another information researcher constructed four concept maps using the same evidence (and based on the more complex responses). Apart from minor differences in labeling of concepts and three variations in links, the concept maps constructed by the interviewer and by the other information researcher were remarkably similar. The choice of information-

seeking and use as the focus of this work may have helped because many of the respondents thought of this area in terms of contacts and relationships. Other potential mapping areas are likely to require greater understanding by the interpreter of the complex problem or subject area under consideration and hence may give more scope for variant interpretations.

One procedural difficulty encountered in interpreting responses was that the researcher had already built up a picture of the organizational infrastructure prior to and during the course of the interviews. How much of this background could be added to the concept map without distorting the picture as provided by the respondent? It was decided that, where it could reasonably be deduced that the respondent was assuming that the interviewer understood part of the context, this element could be included. For example, if a respondent talked about the organization's press cuttings service when answering the question about use of information and library services (ILS) provided by the organization, the fact that this service was provided by ILS was included in the concept map. However, if the cuttings service was mentioned in answer to the more general question about information sources the link was not shown (unless the respondent made that link in the reply). Interestingly, we discovered in the course of interviews that two of the respondents were unaware of who provided their press cuttings service.

Reviewing the concept maps

Responses as nets

What did these concept maps look like? Five of the sets of responses readily translated into nets, as illustrated in Figure 1.

This concept map clearly places land management at the heart of the map in which the other concepts are arranged in a network around the periphery. The concept map reflects a number of points made during the interview, which are summarized here from field notes to show the basis from which this concept map was constructed:

> The respondent works closely with key partners and looks for information on their Internet sites. She obtains core documents through other organisations, the Internet and by speaking to partners. She has list of c.50 key partners; and is working on relations with new partners . . . She relies particularly on information on the organisation's Intranet to keep up to date. The library has good links to the main family of organisations. She used the library regularly when she was based at the head office; not now that she works from [elsewhere]. She has access to on-line mapping systems via the organisation's geographical team.

(This summary is necessarily a heavily edited paraphrase of a 10-minute segment from a 42-minute interview.)

The concept map clearly indicates the main elements in the Quality Manager's information world and the relationships between them. In this instance, the concept map could, with minor modifications, also be used to show the relative importance of each of these elements for the quality manager in her work, although ranked responses were not explicitly sought during these interviews.

Another net is shown in Figure 2, followed by a summary of the interview (conducted with a recreation strategy program manager) to show what information was used in constructing the concept map:
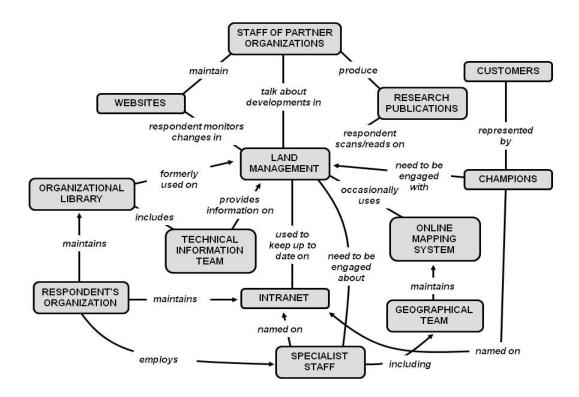
Figure 2. Net representation based on replies from the quality manager

This respondent finds a lot of information by e-mail or word of mouth and then follows it up (e.g., through web sites, as well as through meetings and networking. He uses the organization's network, which is about sharing information nationally with other interested parties, including documents, leaflets, conference information, and training, mostly by e-mail. He also uses the network to pass on information and uses other networks. Information comes directly to him, and he forwards or circulates it if relevant. His department often commissions consultants to do literature searches when setting up contracts and they typically use websites, academic institutions, and the internal library services. These provide the context for the contracted research.

Apart from indirect use by consultants, he uses the organization's library directly to refer to own publications, past minutes, and policies. It is essential that it is there, even though he uses it only occasionally. He uses the picture library quite often though it does not always come up with the goods as pictures need to be up to date.

He uses weekly press cuttings service for current awareness, and occasionally follows these up. He used to get a review of new relevant journals and often used to follow that up. He found the review very useful, but hasn't seen it for a couple of years and is not sure if it is still going. He also uses the library to order publications and provides copies of his own publications for the library to share, but does not often come down to browse the information himself.
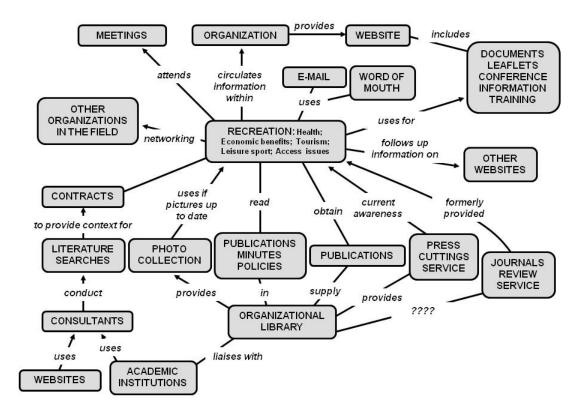
Figure 3: Net representation based on replies from program manager

Responses as chains

Three of the interview transcripts were transmuted into what could best be described as chains. One of these, based on an interview with an operational manager who relied heavily on external information to do the job, is shown in Figure 4.

This respondent appears to see the job as managing a government information production line, where clarity about information sources and flows is paramount. A chain representation of the relationship between key providers and recipients of information seems appropriate.

The other two interviews presented a less straightforward series of steps, as illustrated by the one in Figure 5.

Here the research manager described his information behavior in relatively simple terms, but it seems likely that a more complex picture could have been obtained (in this and some other cases) through closer questioning. The limitations of retrospective analysis are exposed here: Is the respondent demonstrating a relatively unsophisticated grasp of the issues or simplifying the picture in order to help the interviewer?
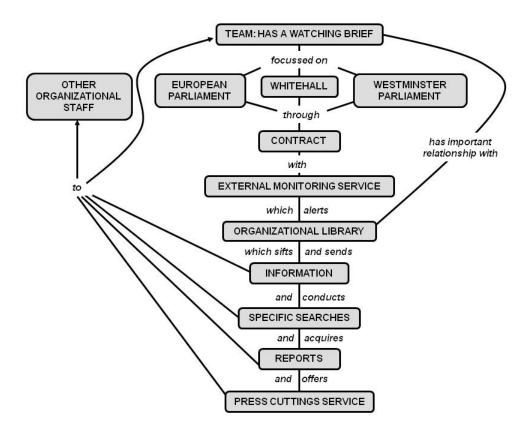
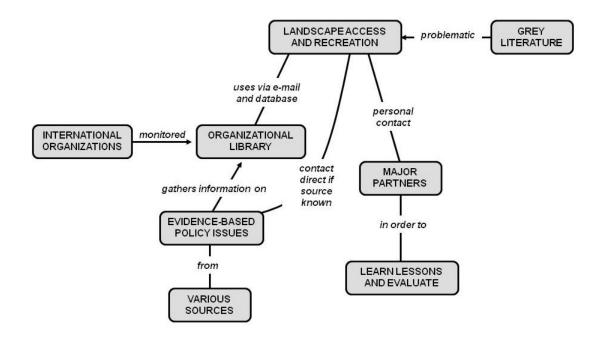*Figure 4: Chain representation based on replies from operational manager*

Figure 5. Representation based on replies from program manager

In general, a chain response was not particularly likely to emerge from the interviews analyzed because the respondents were not asked to describe the order in which they conducted information searches, nor were they specifically asked to say how often they used particular sources (although a few respondents did both). By contrast, the critical incident interviews with operational managers and advisers conducted at a later stage in the review, encouraged reporting in chain form. There, respondents were asked to think of a specific instance when they sought information from outside the organization and to recount it as a critical incident. This line of questioning sometimes resulted in step by step descriptions. For example, an ecologist described the steps she had taken or was planning in preparing to write a book on "settlement, population and archaeology" in an uplands area, resulting in the clear chain shown in Figure 6.

It seems highly likely that, if asked to describe the quest again when she has written the book, a more complex net will emerge.

Responses as spokes

Two of the key informant interviews resulted in slightly elaborated spoke diagrams as shown in Figures 7a and 7b: These two interviews were identified as unsuccessful by the interviewers at the time as neither provided much in the way of useful or illuminating information for the review.
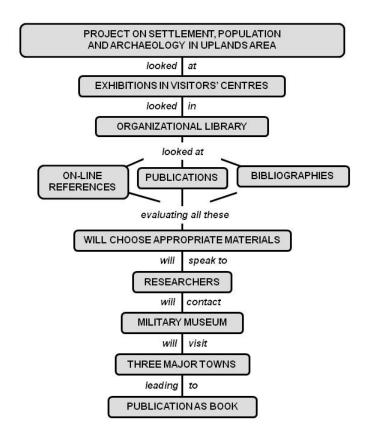

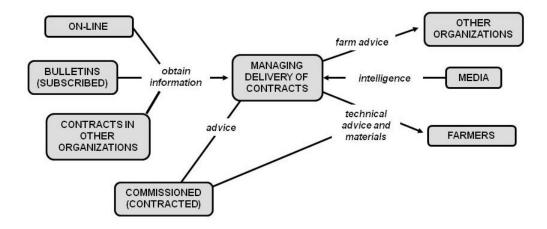*Figure 6. Chain representation based on the replies from the ecologist*

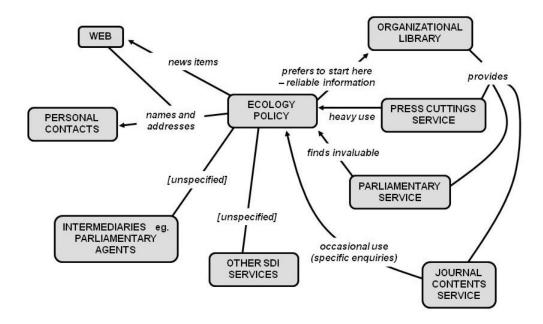*Figure 7a. Spoke representation based on the replies from head of the External Advice Unit*

Figure 7b. Spoke representation based on replies from head of the director's office.

Responses as nascent nets

The remaining four transcripts gave rise to what might be described as nascent nets, showing understanding of key elements in information seeking, but without much detail. Again it seems likely that some of these respondents were either deliberately simplifying the picture for the interviewers or that they had not fully engaged in describing their own information world

If the respondents were simplifying the picture for the interviewer, this behavior parallels that of many teachers when teaching students. A typical teaching strategy is to reduce the complex area under consideration to chains which are then presented to students (as exemplified in curriculum planning documents, which usually adopt this format). However, presentation of such chains of information tends to decontextualize the information so that links with the broader field can be obscured. The student needs to see how the chains of information emerged from the wider networks of understanding if she or h is to appreciate the connection between the two (Kinchin, Cabot, & Hay, 2008).

When this approach is adopted by respondents in research interviews, the consequences are similar to those resulting from "chain teaching" to students. The interviewer is left to try to reconstitute what has been conveyed into nets, without having all the requisite information. The advantage for the interviewer however is that interviews are usually conducted in series so that it is normally possible to fit chains of information into an overarching concept map.

An example of this type of concept map is shown as Figure 8.

In one case, the respondent had taken on a short term intensive role in preparing a parliamentary bill on behalf of the organization and this is reflected in the concept map (Figure 8).

It is likely that this respondent will have reverted to more complex information-related behavior once the task was complete.
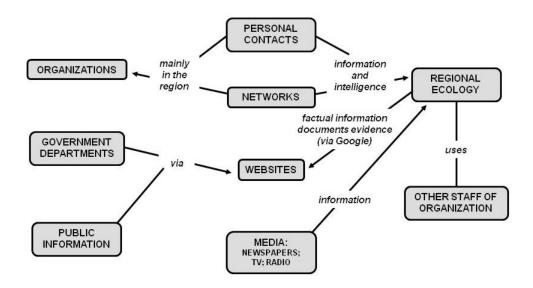

Figure 8. Nascent net representation based on replies from the regional director
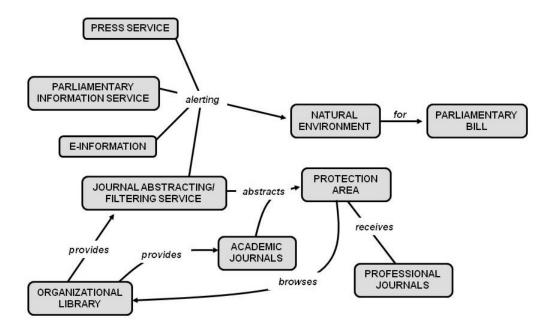
Figure 9. Nascent net based on replies from chief advisor

Reviewing the concept maps: general comment

The conversion of interview replies into concept maps proved particularly interesting at the extremes of perceived success and failure in both modes of representation. The three interviews that had at the time been regarded (and noted) by the interviewers as really useful in illuminating the organizational communication picture (and, usually also in relation to the ideas emerging in replies to the other five questions not considered here) all translated into nets. On the two occasions where the interviewers felt that the respondent made little contribution to the overall picture, the concept map was in spoke form. There were also two interesting instances where the respondent appeared to engage with information communication as an issue during the interview (possibly for the first time) so that the resulting concept map began in spoke form and then became more complex.

Using concept maps with research interviews

It is evident from this limited study that concept maps can be used in a number of ways to enhance the research interview process and the subsequent data analysis and interpretation or as an adjunct to the research interview. Some of the potential uses are outlined below.

Use as a retrospective interview probe

Where a significant part of a research interview is concerned with the respondent's conceptualization of a problem or issue, it should be possible to construct concept maps from the interviews (much as described above). Such concept maps could be used as a way of re-presenting information gathered during research interviews to the interview respondents to stimulate further (or deeper) responses and to correct any areas of misunderstanding.

Use as a check on evidence saturation

An overarching concept map could be constructed from all the interview replies during a research project, or during a specific phase of interviewing, to provide a consolidated view of what is being learnt. This type of concept map is likely to be particularly useful if one or more research questions have been clearly formulated for the work. If this approach is adopted the concept map will also serve as a useful signal of interview saturation. The interview process will cease to be productive at the point where interviews are not yielding additional concepts or links.

Use as a form of data display

Where does concept mapping fit into the process of making sense of qualitative research information? A traditional view of qualitative data coding, as exemplified by Miles and Huberman (1994), presents coding as a subprocess in which data are reduced to manageable proportions by being categorized for retrieval. This process involves breaking down data into themes and clusters. The next subphase in this process is labeled in this version as "display," which entails organizing the compressed assembly of information into diagrammatic, pictorial, or visual form to show what the data imply. Concept maps or an overarching concept map can readily be used in this way.

Use as a form of creative coding

Strauss (1987) has taken a more radical view of qualitative data analysis that has the effect of "promoting" activities such as concept mapping to the coding stage of the process and enhancing that role. In this view, the priority is no longer data compression; instead emphasis is placed on expanding the conceptual framework by raising further questions and opening up enquiry. Commenting on this reconceptualization of coding, Coffey and Atkinson (1996) have claimed:

> In essence, Strauss's approach encourages us to go beyond the essentially summarising approach to coding . . . his general approach exhorts us to expand on rather than to reduce the data, to take categories and exhaust their full analytic potential . . . to use codings and categories to think with and not remain anchored in the data alone. The process of coding is about asking oneself questions about the data. These questions help to develop lines of speculation and hypothesis formation. (p. 49)

It is clear that in this view of coding, concept maps can do more than merely present summaries of data. By translating data into diagrammatic form and emphasizing links and relationships, concept maps can play an important part in raising questions about the data.

To illustrate this point, using data and concept maps presented earlier, concept maps could be used to raise questions about the ad hoc and relatively passive nature of much information-seeking and the apparent over-reliance on other people's websites as a representation of their total efforts.

Use to improve interview schedule design

A useful aspect of concept mapping is that it focuses on the specific conceptual views of individuals. Since the structured research interview is often used, inter alia, to probe people's perceptions of situations, concept maps could be used as a preliminary stage before interviewing (to test out and explore potential areas for interview, using key informants; semistructured interviews are often used for this purpose at the beginning of a research project). Translating

interview replies into concept maps might also help to show areas where adequate information is not being consistently collected or where respondents appear to be simplifying replies, as discussed earlier.

These sorts of findings have obvious implications for more effective design of interview schedules: How can structured interviews be conducted to help respondents to share their understanding of the subject area in net form, especially when interviewing senior managers or other people with an overview of policy and operational issues? Would interviews focused on concept maps completed by the respondent be more effective for evidence-gathering in some circumstances?

The relative strengths and weaknesses of the structured interview and the respondent-constructed concept map is an area ripe for further exploration. We are currently comparing the two approaches in interviews focused on postgraduate student experience of completing their doctoral research, but there is scope for further comparative work in many other contexts where the structured research interview is habitually used.

Limitations of concept mapping

As with any tool, retrospective construction of concept maps based on interviews is unlikely to be universally useful. Some of the circumstances in which this approach is unlikely to work well are

1. when the interview is not focused on concepts and relationships (hence the decision to discard responses to later, more circumscribed questions in the interviews considered here),
2. when respondents do not describe concepts and relationship clearly (although this should happen only rarely if the interviewer is competent),
3. when it appears that the concepts and relationships have been deliberately misrepresented by the respondent,
4. if the interpreter has insufficient understanding of the world of the respondent or of the topic under discussion, and/or
5. if a pattern is prescribed through the questioning.

Some of these limitations could be addressed by ensuring that any concept maps produced are shared with the respondents as a stimulus to amplification and clarification.

Conclusion and way forward

What is described here is a preliminary exploration of a potentially fruitful area. This small study has shown that concept mapping could usefully enhance the research interview as an evidence-gathering tool and also as an interpretation tool.

Further work in this exploration will be, firstly, to apply concept mapping to research data collected through research interviews on a larger scale. This is necessary in order to clarify the procedures required to apply this approach retrospectively and to re-present data effectively (whether to stimulate interview respondents or to undertake creative coding, as described earlier). Second, we intend to explore and evaluate the procedures entailed in administering concept maps with respondents, whether as part of a traditional research interview or as an independent research evidence-gathering activity (including such issues as how to effectively conduct and record the conversation with each respondent).

Notes

1. The approach was used, for example, in the three series of research methods courses offered in the United Kingdom by the Library and Information Research Group 2001-2004.

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