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Published in:
Library and Information Science Research

DOI:
10.1016/S0740-8188(02)00166-4

Publication date:
2003

Citation for published version (APA):
Yeoman, A., Cooper, J., Armstrong, C., Fenton, R., Lonsdale, R., Spink, S., Urquhart, C., Thomas, R., Barker, A., & Light, A. (2003). Critical incident technique and explicitation interviewing in studies of information behavior. *Library and Information Science Research*, *25*(1), 63-88. https://doi.org/10.1016/S0740-8188(02)00166-4

Critical incident technique and explicitation interviewing in studies of information behavior

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Abstract

This article discusses two related techniques, critical incident technique and explicitation, used in a variety of social science research settings, and critically reviews their application to studies of information behavior. The current application of both techniques is compared to Flanagan's early guidelines on the critical incident technique and is discussed in relation to recent experience in the use of (1) the critical incident technique in the JUSTEIS and VIVOS projects, and (2) explicitation in projects concerned with text entering on interactive Web sites. JUSTEIS is identifying trends, and reasons for those trends, in the uptake and use of electronic information services in higher education in the UK, and the article examines experience gained over the first two cycles, 1999/2000, and 2000/2001. VIVOS evaluated virtual health library services. Comparison of the experiences gained on the various projects suggests that critical incident methods could usefully be extended and enriched by some explicitation methods, to elicit the degree of evocation required for current and future studies of Internet use.

Introduction

The critical incident technique (CIT), which developed from work in the US Army Air Forces Aviation Psychology Program by Flanagan (1954), is regarded as flexible set of principles, to be modified for the situation under study. Explicitation, on the other hand, is relatively unknown beyond its country of origin (France).

The CIT was originally used to assess performance in professional practice, and recent examples of such usage include the performance of health professionals (e.g., the prescribing decisions of doctors (Bradley, 1992) and the quality of care for cancer patients (Bjorklund, 1999)). More complex sets of behavioral intentions can be examined, such as the factors which affect patient compliance (Stromberg et al., 1999), customer perceptions and reaction across a range of service industries (de Ruyter, Wetzels, & van Birgelen, 1999), and the quality of nursing care (Redfern & Norman, 1999). Other applications include supported reflection for student learning (Naidu & Oliver, 1999). The aim in health services research is often a better understanding of the interaction between patient and professional, and therefore the behaviors (patient or professional) which appear to lead to effective care outcomes. Similarly, the studies that examine service quality in the area of hospitality research or other service industries, are generally concerned with the dimensions of service quality and identification of the key factors that affect customers' positive and negative perceptions.

Flanagan advocated five steps: (1) determine the general aim of the activity; (2) develop plans and specifications for collecting factual incidents regarding the activity; (3) collect the data (either through interview or written up by the observer); (4) analyze, as objectively as possible, and (5) interpret and report on the requirements, particularly those which make a significant contribution to the activity. According to these steps, studies of quality of care, or quality of service can be categorized as:

- General aims. These require a care or service episode, which may be discrete, or what Strauss et al. (1985) term a more extended 'trajectory of care' for chronic

conditions, for example. These situations are nevertheless bounded, with some purposes, agreed by the customers or clients and the service providers, and therefore they fall within Flanagan's specification. Some studies include all stakeholders, others concentrate on provider or user, and one, unusually, considered the impact of other customers on the service experience (Grove & Fisk, 1997).

- Plans and specifications. Flanagan indicates that, for direct observation of behavior, observers should be familiar with the activity, the groups whose behavior is being studied can be specified, and that the behaviors can be categorized, or some criteria developed. Health services researchers are frequently from the same profession as the group studied, but in other organization studies, researchers are more likely to be academic social scientists than business professionals.
- Observational and retrospective data collection. Flanagan implies that observational data collection is preferable, although retrospective data collection of incidents fresh in the mind of the study subjects is acceptable, providing informed consent procedures assure the participants that they are not being singled out, and that their anonymity is assured. Flanagan notes (without reference to the specific studies) that slight changes in the question can produce substantial differences in the responses. He suggests that proper piloting is necessary with checking of the interpretation of the question and instructions. The question should have a brief specification of the type of behavior relevant, and subjects should be restricted to recall of certain incidents, such as the most recent.

In the actual interview the subject should be allowed to do most of the talking to permit an unbiased account.

- Variations on data collection. Flanagan also mentions 1) group interviews (recent examples include Jackson and Stevenson (2000) and Liefooghe and Olafsson (1999)), and 2) questionnaires.
- Scope of studies. Most recent studies examine between 50-100 incidents, although more complex activities may require several thousand incidents. Few studies can afford the latter level of research effort, and very few studies exceed 300 incidents for analysis. Each research subject usually contributes one or two incidents, though Janson and Becker (1998) use three per subject. As far as piloting is concerned, several studies do not detail how this was achieved, and more emphasis seems to be put on the data analysis, whether through content analysis, phenomenonological approaches (Chell, 1998; Johnson & Fauske, 2000) or grounded theory. In several healthcare studies (Luker et al., 2000; Redfern & Norman, 1999) the emphasis is on delineation of the positive and negative quality indicators. A similar emphasis is evident in some educational studies (e.g., good and bad supervisory behaviors (Curtis et al., 1998)) and business research (e.g., attribution of positive and negative tourism experiences (Jackson, White, & Schmierer, 1996)). The depth of detail that can be provided by the subject appears important (Kemppainen, 2000).
- Data analysis. This includes the frame of reference, or what the underlying purpose or purposes might be, the formulation of categories (acknowledged to be a subjective process), and general behaviors (the appropriate level of specificity).

Several of the studies (e.g., Callan, 1998) could be viewed as extended pilot studies to refine the research methods, and define provisional classification of categories. Several studies (Runeson et al., 2001; Vettor & Kosinski, 2000; von Post, 1998) describe the research approach as the analysis of "stories" of care. In others, the quality of the dilemma itself is of interest, as in the study of prescribing of analgesics in primary care (Bendtsen et al., 1999). The organizational behavior studies often use a quantitative approach, to study the components of a transaction (O'Driscoll & Cooper, 1996), or citizenship behavior (Skarlicki & Latham, 1995).

- Interpreting and reporting, with full acknowledgement of limitations (e.g., researcher bias, and groups not representative). Typically, the difficulty is one common to many qualitative research studies, that of coder inter-reliability, a problem acknowledged by Perry (1997) and addressed by Kemppainen et al., (2001).

The preponderance of critical incident studies in the health services research area is notable. Bradley (1992) suggests that the perennial popularity of anecdotes in medicine is related to the fact that they make interesting stories, and that as "stories" they offer insights to a social anthropologist about the social and conceptual world inhabited by the group. Some of the studies, as indicated above, capitalize on this approach to understanding the nature of care. More particularly, perhaps, in spite of the bandwagon of evidence-based practice, the continuing popularity of the case report, the medical case presentation or the nursing care study as a format for disseminating knowledge, suggests

that health professionals structure their knowledge according to story schemata (Urquhart, 1998), or illness scripts (Schmidt et al., 1990). Health-related incidents and stories are perhaps more memorable to all concerned than a visit to a supermarket.

The critical incident technique relies on recall of an actual event. In contrast, vignettes (Urquhart, 1999) may be used to examine the likely behavior of subjects in certain situations. The technique is useful when it is likely that attitudes or behavior would be less likely to be revealed using a direct approach. Subjects may be unwilling to be truthful when the situation is controversial.

Explicitation

The explicitation data collection technique (Vermersch, 1994) has some similarities with the retrospective data collection use in the critical incident technique. What emerges from studying explicitation is a thorough and specific set of guidelines that are largely compatible with the goals of Flanagan and others, but which, in emphasizing how data are gathered and in providing theoretical grounding for why this should be so, also offers an interesting tool for examining purposes in gathering qualitative data on information seeking and use.

Vermersch (1994) developed the explicitation method of data collection, taking the qualitative retrospective interview as his starting point in understanding and supporting a range of pedagogical tasks that had been regarded as impenetrable. For instance, it has been used to explain the basis of mathematics to students by giving them access to their

own thinking processes, and also to model the behavior of successful chefs (Vermersch & Maurel, 1997). The system is now used in the French education system to provide insight into learning processes for both the interviewer and the interviewee. It has also developed a role in more formal social science as a means of data collection. Its use outside France and with the goal of interrogating information seeking and human-computer interaction (HCI) is only just beginning (Light & Wakeman, 2001).

The explicitation method

The technique offers a verbalization of activity ('la verbalisation de l'action', Vermersch, 1994, p.17). It draws on Piaget's theory of how experience is processed into reflection, seeking to help people progress from pre-reflected to reflected experience and from experience as it was lived to experience which is 'represented' and 'verbalized' ('vécu représenté', 'vécu verbalisé' (Vermersch, 1994, p. 80)). To accomplish this, interviewees enter a state of evocation, so that they are "reliving" an example of the activity under investigation. As they are pressed to give details and thus explore the experience, they may provide insights both for themselves and the interviewers.

The ability of the interviewer to establish and maintain a state of evocation in the interviewee is essential to the success of the explicitation interview. It is this state that makes the detailed account, and the reflection that accompanies it, possible. An evocative state is not an unusual state, but has particular characteristics and, without understanding, recognizing and knowing how to inspire this state, a researcher cannot proceed. Evocation relies heavily on the observation that the start of recollection about an event,

such as going upstairs, may hinge on a specific sensory memory such as smelling polish or seeing the black strip on the edge of each stair. To summarize, the state of evocation is familiar to most of us, if not from personal experience, then from watching others glaze over as they remember something by staring into the space as they replay the sensory memories of the event.

When an interviewee is focusing on a previous event in this way, as they answer a stream of detailed questions, the kind of account given is qualitatively different from that which might be volunteered on another occasion (see Vermersch, 1994, pp. 176-181 for a summary of the technique's validation). Not only is a fine-grained description of the activity made possible, but the language used to describe it is less tailored for its audience than normal accounts tend to be (Antaki, 1988). The account tends to be a description rich in emotional color and the detail of associations that are not strictly relevant to the action being described. Because the chronology of the event is being experienced anew, rather than just retold, there is little of the post-hoc rationalization that often accompanies retrospective accounts (Ericsson & Simon, 1984, 1993).

The first stage of conducting an explicitation interview is to agree on a contract between participants. Interviewees are asked whether they accept being interviewed in depth about an event. The interview is contingent on this agreement, which can be referred to at any time during the interview, should it be useful to do so. The contract is important in securing cooperation from the interviewee, given the rigors of the method.

Then, interviewers encourage interviewees to evoke a particular episode involving the activity under investigation, so that the episode can be described in detail. If the episode is part of a series of similar events, then one (the first, the last or the most memorable) is chosen for analysis. The adoption of a single occasion is essential for evocation. It encourages remembered detail, rather than assumptions drawn from a pre-digested conglomerate of memories.

The interviewee is helped to recollect a particular episode by sensorial questioning:

> *Just put yourself back into the situation. Don't tell me a story, just put yourself back into the situation and tell me exactly what you did. Was it morning or afternoon?*
>
> It would have been afternoon.
>
> *And where were you?*
>
> I was in the lab. It was at that terminal there.
>
> *And was it a hot afternoon? Was it a cold afternoon?*
>
> Um, not so I noticed either way. *[excerpt from RG's account of using a Web site, 1999]*

Certain cues, such as the gaze of the interviewees, reveal whether they are in evocation or not. It is helpful if the interviewer does not sit directly opposite the interviewees as this interferes with the ability of the interviewees to stare into space, returning their gaze to the other person and their thoughts to the present. Sometimes evocation is not sustained throughout an interview, but the purpose is to foster an environment in which evocation is dominant.

To maintain focus on a single episode, the interviewee is steered away from any generalizations and comments, such as: “Whenever I….” If they offer an opinion, it is clarified whether they thought it at the time or are relating it as part of an explanation now, and, if the latter, it is politely dismissed. The intention is to stimulate an account that, usually chronologically, describes the event as if the interviewee were conducting it again, rather than an account designed for the listener.

Even with the interviewee in a state of evocation, questioning guides the interview. Often, extracting the most relevant information, or just to maintain a flow, requires prompting, which may involve echoing, specifying “When you say you did X, what did you do?” or clarifying “I want to understand. You said X. Have I understood? Was it like this?” It never takes the form of a closed or leading question. The interviewers avoid introducing their own presuppositions about the possible form or content: for instance, by using “what did you see, or hear, or think, or whatever?” rather than “what did you see?”. Inaccurate assumptions about *how* a person thinks tend to be more disruptive to the state of evocation than inappropriate assumptions about *what* is being thought.

Such recollection takes time. However, relevant and non-intrusive interruption and probing are necessary at some points in the accounts, as it is unusual for interviewees to volunteer the fine detail required without help. Interjections while interviewees are talking can actually assist recall for some new detail. During evocation, it is not annoying

or alarming to be interrupted, and the interviewers may challenge every utterance to get a more detailed and precise account in areas of interest.

Nonetheless, there are many ways of interrupting evocation through intervention by pulling the interviewees out of their track of thinking. A common failing is to invite the interviewee into a judgmental mode, which demands interpretation rather than recall. To avoid this, there is no use of questions starting “why,” which brings on rationalizations and justifications, or language that encourages judgmental conditions, such as abstracts, complex language, and language unfamiliar to the interviewee. Using “but” is also treacherous as it implies criticism. If a reason for an answer is sought, then careful questioning using “how” and “what” covers the same ground as “why” in a different way “How did you know that X?” or “What were you thinking at the moment when X?”

If comparisons are needed, which intrinsically involve judgments, these can be approached without direct recourse to questioning. Comparable conditions can be handled in an evocative way and considered later.

Sometimes interviewees interrupt themselves with a sudden failure to recall. If this is in response to a question, the question might need rephrasing or asking again later. Generally, some reassurance is necessary if this happens: “No problem, just tell me which type of impressions come back” or “It doesn’t matter. Just tell me what you can remember.” On some occasions, summarizing what has gone before allows interviewees to resume their position and continue.

Another technique for deepening an interviewee's response is to use modalities in questioning. These concepts, a way of describing how thoughts are represented internally, are taken from neuro-linguistic programming (Bandler & Grinder, 1979), which claims that most people will use a dominant modality for recalling a particular event, such as a visual, audible, or kinesthetic sense. Modalities can be identified through listening to the language use of the interviewee and through watching gesture, as, for instance, grasping during recounting is indicative of a kinesthetic approach. Once the dominant modality has been recognized, it can be exploited to deepen recall.

Within these parameters, considerable flexibility is written into the guidelines and interviewers are free to try whatever might work with an individual to produce evocation, since this is the basis of data collection. It will be apparent, though, that the interviewee's experience is paramount, and researchers may only explore aspects of interest to them by probing in relevant places, giving focus, without direction.

Examples of explicitation

Two examples illustrate the insights that can be gained into cognitive processes. The first is an example of ideas given access by the kind of questioning:

> *And then I had a wicked thought. I thought "I wonder if I could look at anybody else's [entered data]." (laughs) {…} At one level I thought I didn't think anything, but I remember thinking, um, "It would be nice to just, sort of, be naughty", if you like, "and have a look at other things" but then I thought "Well, they probably*

know who's looked at what so" and I just can't be bothered thinking that someone else might know where I'd been. Life's too complicated. [excerpt from PG's account of having entered text into a Web site, 1999]

In the next example, an interviewee explains how she thinks in chunks when she meets a routine situation, so that the thought is more *referred to* than *developed* on the particular occasion of entering text into a Web site asked about:

I tend to experience my thoughts as a kind of block that I know about, so I already know what the thought is [that I'm telling you about], it's this thought about "Bloody hell it's another registration, password, security, will I get the mail message, blah". And that's like a procedure, it's kind of like I know what it is so I'm in this structure that is this thought very briefly, then I'm into another structure which is the second thought, which is "Oh god, we're getting back in…" like paragraphs, yeah. [extract from CS's account of Web site registration, 1999]

These extracts demonstrate the potential of the technique for investigating introspective processes. A by-product of using the technique is a number of interviewees commenting on how they surprised themselves with recalling thoughts of which they had not been fully aware of thinking at the time; further, they were surprised by the level of detail that returned to them in attempting to describe their activities.

Explicitation and Flanagan's five vital steps

For purposes of comparison with the critical incident technique, Flanagan's five vital steps are now used to explore the scope of the explicitation method:

- General aims. Any event, phenomenon, activity, or process can be investigated using the technique, but participants in an explicitation study only give an account of one instance of experience. This agreement forms part of the contract made with interviewees, and interviewers may remind interviewees of this in the interview if the interviewer suspects a more general perspective is being adopted.
- Plans and specifications. There is, unlike the CIT, no obligation that the interviewer be someone familiar with the activity described. Emphasis is placed on the careful training of the interviewer in the technique, to ensure thoroughness, and also on the purpose of the inquiry, which will determine where probing takes place. The interviews are recorded, both to capture data and to allow a review of the interviewers' integrity.
- Data collection. This takes place retrospectively through individual interview and, though the chosen incident need not have been recent, it is often solicited as "the last instance of." The technique is designed to aid recall and overcomes some concerns about retrospective interviewing (Ericsson & Simon, 1984). The method is unstructured and focused, but undirected. Interviewers encourage participants to talk and use various means of probing to secure an account of necessary focus and detail. Flanagan's concern that piloting takes place is less relevant here as no standard structure is followed, but this again highlights the importance of practice, and close collaboration between interviewers, in the preparation of a

study. Sample sizes can vary from one to hundreds, but, since analysis of this quantity of data is laborious, samples tend to be small.

- Data analysis. This depends upon the task in hand: raising awareness of cognitive processes has been achieved by a short post-interview discussion between interviewer and interviewee (Vermersch, 1994). For social science purposes, the richness of the accounts makes discourse analysis (Edwards & Hardman, 1993; Potter & Wetherell, 1987) a useful tool (used in Light & Wakeman, 2001). The method is compatible with many types of investigation providing the sample collected is suitable.
- Interpreting and reporting. All Flanagan's strictures about care in reporting limitations of course apply here. The technique is described as part of making the methodology transparent, with sections of accounts quoted in full to allow readers to arrive at informed conclusions.

Review of the use of critical incident technique in studies of information seeking and use

CIT information behavior studies frequently occur in the health sector. Like an early small-scale study (e.g., Northup et al., 1983) many of these examine the motivations for information seeking, urgency of the request, type of information required, sources used, and reasons for selecting those sources.

[Table 1]

Larger scale studies include a National Library of Medicine study of the use of MEDLINE (Lindberg et al., 1993; Wilson, Starr-Schneidkraut & Cooper, 1989) among 552 health professionals (mostly physicians), who were asked in telephone interviews to describe recent MEDLINE searches that were especially helpful (or not) with their work. A CIT study of information seeking by general (family) practitioners (GPs) used a questionnaire with a multiple choice format (Timpka, Ekstrom, & Bjurulf, 1989). A later study (Timpka & Arborelius, 1990), among 12 GPs, used video-recordings to examine clinical decision making dilemmas in more depth. Pettigrew (1996), on the other hand, used the in-depth critical incident survey first, as exploratory field work for a larger qualitative research study. Other library and information science researchers use the CIT similarly, as one technique in a repertoire of qualitative techniques, to develop theory (e.g., Sonnenwald & Pierce, 2000, Yeoman et al., 2001a).

The CIT encourages participants to tell their story. The situations that are explored are those that are memorable and that are more likely to be faithfully recalled, although there is no guarantee that this will be the case. What the CIT is less equipped to do, is to explore those situations in which there was no decision to act, or where the user was unaware of the information need or suppressing (consciously or unconsciously) the perception of the information need as a soluble problem. Providers of information services have justifiably viewed the problem of unexpressed gaps as something that can only be tackled through a better understanding of the expressed gaps. Information use studies (of the expressed gaps) are presumed to indicate the possible extent and nature of unmet needs. There may, however, be great disparity between met and unmet needs, both

in quantity and quality. Covell, Uman, and Manning (1985) demonstrated that, although physicians reported that they needed information about once a week, interviews after each patient visit revealed that physicians did formulate questions at a much higher rate (around two questions for every three patients seen). Whether satisfying these unmet needs would serve a useful purpose is, of course, debatable. The physicians may have already made the decision to be extremely selective as a cost-effective approach to information seeking. It may therefore be more useful, from the service provider perspective, to examine existing patterns of information needs and use, although that may provide limited indications of future possibilities and shifts in patterns.

Most CIT studies of information behavior focus on the individual user as a free agent with choices on whether to use an information service or not. Lamb & Kling (in press) argue that a perspective that considers the social actor may be more valid when considering how the organizational context actually shapes use of online information, when use is an expectation of routine practice. Only one CIT study (Radford, 1996) was found to be concerned with the interaction of user and information professional, unlike other social sciences studies, many of which focus on client-professional interaction.

Use of the CIT in value and impact studies

The CIT has been developed in different ways for various studies of the effectiveness, value and impact of service provision. Unlike the market research literature, most of these studies do not attempt to determine the dimensions of an information service encounter in terms of what was good or bad, but more often the aim is to determine the

outcome of information use, and hence, by implication, the value ascribed to the service providing the information. Examples of this approach include Urquhart & Hepworth (1995a, b, c) who used the CIT to examine the pattern of information need and use among medical staff in the UK, thus providing the context to the assessment of the value of information to clinical decision making. The methods included a questionnaire survey, which, unusually, among CIT studies, involved sending out a questionnaire once a week for four weeks (consecutively) to the study subjects. The reasons for this approach were partly practical (the format formed a type of reminder system), partly methodological (to assess underlying patterns of information behavior). Other similar examples include a study of general (family) practitioners by Wood, Palmer, and Wright (1996), and the assessment of the value of information to UK nursing continuing education (Davies et al., 1997; Urquhart & Davies, 1997), which included use of vignettes (Urquhart, 1999, 2001) to elicit more details about likely information behavior and information-seeking strategies (or lack of them) among nursing staff. Saracevic and Kantor (1997 a, b) used the CIT in a study of the value of research libraries in the USA.

JUSTEIS project aims and objectives

The JUSTEIS project (Armstrong et al., 2000, 2001)[1] examined, over a number of cycles, trends in the uptake and use of electronic information services (EIS). The project covered a range of higher education institutions in the UK, worked across all discipline clusters, and included academic staff, and undergraduate and postgraduate students. Emphasis was placed on investigation of the motivational factors for individuals within their own academic settings. Each sample for the first two cycles included over 35 departments, from at least 25 higher education institutions across the UK. A cluster sampling approach ensured that different types of discipline and higher education institution (by size, research emphasis, and date of foundation) were included. The JUSTEIS project team aimed to develop a reliable monitoring framework, complementing work done by another project team (JUBILEE project) (Banwell, Gannon-Leary, & Childs, 2000; Banwell & Gannon-Leary, 2001).

JUSTEIS methods

The survey instruments for JUSTEIS incorporated critical incident and critical success factors elements. The intention was to elicit from the research subjects a memorable

[1] Commissioned by the Joint Information Systems Committee (JISC) (for UK Higher Education institutions) to provide a periodic survey of the uptake and use EIS in higher education in the UK, with a view to bridging the gap between the perceptions and the reality of user behavior. The work undertaken by a team based at the University of Wales Aberystwyth (UK) included examination of resource access and purchasing intentions of higher education institutions for EIS.

recent information-seeking event, which had involved the use of a computer. Further conversation was intended to elicit some of the personal (work and leisure) priorities which influenced subjects' use of electronic information services, and gain a picture of their use of particular information services. Original plans to rely on interviews alone were amended to include use of e-mail or postal questionnaires[2].

JUSTEIS limitations

When comparing the questionnaire results with the analysis of the interviews it rapidly became apparent in the first cycle that the responses were different, and the differences could not be attributed solely to the fact that some minor changes had been made to the questions asked, for example, concerning the categories of purposes. Respondents to the questionnaire survey, despite instructions supplied, had answered the questionnaire in general terms, giving details about what they usually did, often checking several purposes, and disparate EIS, rather than detailing what happened on one particular incident. This was confirmed by comparison of the responses to questions about the degree of success obtained and whether the search was typical. There was a significant ($p<0.05$) difference between the interviewees and the questionnaire survey respondents in both the claimed degree of success obtained, and the familiarity of the type of search. More simply, respondents seemed to be prompted to recall different types of information searches when they were talking to interviewers than when completing questionnaires.

[2] Widely varying response rates among institutions, particularly to the e-mail and postal questionnaire, probably biased the findings in the first cycle.

JUSTEIS – definition of a 'critical incident'

It was impossible to find out directly why questionnaire respondents had chosen to respond in the way many did, but it was possible to review how the interviewees had viewed determination of a critical incident.

Sometimes it is difficult for some interviewees to disentangle the story of one occasion, when there is a choice of several recent searches or uses of EIS.

> *[Interviewer: Right, I'm going to stop you there. I want you to think of a particular instance when you were looking for something specifically, as opposed to just browsing around.] ...OK! (Silence) [Interviewer: What did you do last week?]... I do this all the time so it gets confused! I went shopping for sprint spikes... is that a better example? [undergraduate student, Cycle Two site 46]*

Abad-Garcia, Gonzalez-Teruel and Sanjuan-Nebot (1999) also point out the problem of deciding what the physicians they were studying chose as critical incidents. In their setting the interviewers were (as Flanagan's guidelines suggest) familiar with the setting, but familiarity and professional constraints may have led physician interviewees to choose a salient, though not necessarily recent, clinical incident (as they had been instructed to do). The interviewees in JUSTEIS sometimes seemed to have suffered from the problem of separating out a discrete searching incident.

The range of leisure and domestic purposes for EIS use was notable, and the value of the interview is that a more realistic picture of EIS use for routine lifestyle usage can be extracted from the interviewee, when they may not view the use of EIS for such purposes legitimate when completing the questionnaire.

> *Right, OK. Does playing silly games count? That was the last thing I did! One of my friends invited me to a silly game where there's a load of cows and you have to click on them to milk them and see how fast you can do it [undergraduate student, Cycle Two site 46]*

Findings from both the questionnaire survey and the interviews confirmed the popularity of e-mail and the Internet, to the extent, perhaps, that these are simply viewed as part of the normal routine. Information seeking is not necessarily purposive, and is often interspersed with browsing.

> *No, I do this for most of my assignments...I go and look up on the Internet for other resources...you know, besides books all the time...it's something alternative to do as well...No, it isn't always work...my Dad has a racehorse in training and I can look up under that to see the form and everything...what else...just things like holidays and things like that [undergraduate student, Cycle One, site 35]*

> *I just tend to hit the search engines. They are pretty good. [undergradua*te *student, Cycle One, site 17]*

Searching strategies used by students were not limited to use of electronic information services. In the interviews the students were often relaxed about acknowledging

ignorance of some of the finer (and less fine) points of their searching techniques, and appeared happy to talk about some of their problems. The following extract shows, in abbreviated form, the steps taken by a student to obtain information for a final year project.

> *First of all I used BIDS, can't remember what that stands for, searching the databases. What I was searching for was quite hard to find anyway, so I tried MEDLINE...*
>
> *...and then tried just putting it on Yahoo! or something like that...Yahoo was better than the other two...*
>
> *I went to my supervisor and went "Can't find anything" and then he basically told me to use manual sources...I tried looking it up in the Chemical Abstracts, but I didn't really get very far...because I didn't understand how to use it...*
>
> *I tried asking the LIS staff, the lady who like deals with life and health sciences wasn't there so I was stuck...*
>
> *and then I've written to the drug company who told me to write to the German arm of the company...I used e-mail for that...I ended up ringing them up... in pigeon-German speaking to them and then sent two e-mails, [be]cause it was easier and cheaper than ringing them [undergraduate student, Cycle One, site 11]*

Such accounts were exceptional, and most information searching had neither been so extensive, nor had required so many steps. The following account by one student

indicated a considerable amount of learning by trial and error, and some anxiety about the use of the Internet.

> *Um, I was looking for, firstly for a Web address ...um and secondly for the spelling of someone's name...um, and I tried typing in what I thought was the Web address, um uh...at the computer's university network and then it gave me sort of five options that were all within the university so I realized that, that wasn't a good idea, so then I asked someone else and she suggested I try Yahoo.com...um and then I typed in again what I thought the Web address was and found the Web site, and then having found the Web site that I wanted, I was able to tell my friend about it and found the spelling of the names that I needed [Interviewer: Did you experience any problems while you were doing this?]... Um, only that I went about it in the wrong way... I don't use the Web for my studies... I can get information I need, enough of what I need in the library, and I find the Web can be quite frustrating [undergraduate student, Cycle Two site 55]*

Findings from both Cycles indicated that the Internet (search engine use) was the first – and often last – resort of many students when seeking information. Although it was of concern to the interviewers to find out which services students had used, and the routes taken, it was apparent talking with some of the students that Internet use was seamless in the sense that students did not differentiate between specific services, and found it difficult to identify what they had used. From the point of view of the JUSTEIS research team, concerned with detecting trends in the use and uptake of more formal library and information services, the blurring of boundaries of information provision on the Internet

means that there was often some “unpicking” to be done when discussing what has happened on a search.

Problems of integrating CIT interviews and questionnaires

The variations between the questionnaire and interview responses concerning particular EIS used for the critical incident seem to reflect Flanagan’s observation that subtle changes in the wording of the question can produce large changes in response. If respondents are unclear about their own classification and description of EIS, then it is vital that interviews form a substantial component of any survey work, to clarify the terminology used by users to describe particular EIS. It would be unwise to place much faith on the reliability of the questionnaire survey instrument as a means of accurately gauging use of particular EIS for a particular incident, or which EIS are used regularly, when the interpretation of the EIS is doubtful, apart from some categories (such as e-mail and Online Public Access Catalogue (OPAC)) which can be assumed to be understood.

The interview methodology (i.e., the use of CIT and critical success factors) appears successful in eliciting the details required of the purposes of one information search, sources used, the prompts behind the search and the influence of other people (e.g., peers or academic tutor advice) on the search strategies used. As respondents enlarge on their priorities, particular problems, their attitudes and perceptions become apparent. The most productive route to access student subjects is via academic staff contacts in the selected department, though care must be taken to ensure that the students who come forward are, if possible, randomly selected, and that all year groups are included for any one

department. One of the benefits of the CIT for studies of information behavior is the possibility of profiling groups of users (e.g., Abad-Garcia, Gonzalez-Teruel & Sanjuan-Nebot, 1999; Davies et. al., 1997, Urquhart & Hepworth, 1995a, b; Urquhart et al., 1997). It would be easy to bias the sample, if only the enthusiasts for EIS volunteer as contact staff and their classes are those where EIS is embedded into the teaching. This is particularly the case when one of the aspects of interest in the research is the relationship between tutor/staff advice and student use of EIS. The trends that JUSTEIS is investigating in uptake and use of EIS could then look unrealistically optimistic.

Adapting the CIT to an evaluation project (VIVOS – The Value and Impact of Virtual Outreach Services)

The Value and Impact of Virtual Outreach Services (VIVOS) project[3] (Yeoman et al., 2001a, b), used the CIT in its evaluation of outreach services in health libraries. The VIVOS research team worked closely with librarians at the seven research sites. Indeed, participation by library staff was actively encouraged with the additional aim of developing their research skills. The VIVOS definition of virtual outreach services was fairly broad, covering any service that enabled healthcare professionals to access information without physically coming into library premises. Five initiatives were selected for participation in the full study with data from two further sites collected separately.

[3] The project was conducted by the Department of Information and Library Studies, the University of Wales Aberystwyth over a one-year period February 2000 to January 2001. Funding was received from Resource, the Council for Museums Archives and Libraries.

The CIT was used as one of the evaluation techniques, to supplement the interview or questionnaire questions which were concerned with specific evaluation topics at each site, for example the effectiveness of training programs. There could be no guarantee that a randomly selected recipient of training had used the service recently after training. However, it was felt important to gain insights into information behavior when the interview subject had little or no experience of using the service, as well as when they did. Ideally, both the users and non-users might have been presented with the critical incident questions, to check whether there were differences between the groups. In practice, the need to keep the schedules brief, coupled with the need to answer practical questions of interest to the sites, often meant that the critical incident questions were directed more at the infrequent users.

Semi-structured interviews took place at all five of the original sites. Interview schedules were supplemented by the use of either vignettes (Urquhart, 1999) or the CIT. At some sites postal questionnaires were distributed in addition to, or instead of, the interviews. In the VIVOS study the CIT was used to explore (1) the nature of service use by users, and (2) the alternative strategies used by non-users.

The technique is well-suited to such questions because it encouraged respondents to give real-life examples of recent information needs. All of the libraries participating in the study wanted to discover not simply the extent to which their outreach services were being used but also how they were being used and, moreover, whether the services have an impact on clinical decision making. Evaluating impact on decision making is

notoriously difficult to achieve (Urquhart & Hepworth, 1996) and the VIVOS team found that interviewees often struggled to answer a direct question such as: “Has using [service X] had any impact on your clinical decisions or actions?” Participants also expressed different interpretations of what constituted clinical decisions or actions, as opposed to background knowledge and education.

The technique had the added advantage of broadening the discussion beyond the initial focus of the interview (reflecting observations by Nicholas, 1996, p. 43). Since most of the outreach services being evaluated were electronic, some interviewees concentrated very much on computers when talking about their information-seeking behavior. Reflecting on a recent critical incident often led them to reveal their motivations, the problems, the use of informal sources, and the uncertain outcomes of information use:

- *Fairly recently I wanted to pull a document, a government document about cataract extraction with regard to some new developments from the acute trust which would affect community nurses working out in the field. ...We were supposed to be having a talk with the consultant and one of the nurses at the hospital who wanted to come to the practice to discuss issues with regard to cataract extraction and we felt it was probably related to this document. So we were trying to actually research, do a little bit of our own research before they came. On that occasion I went to see the practice manager and we tried together to access the document but couldn’t. We couldn't access it properly I think we got the first sheet, the first page and then I rang* [librarian] *and he accessed it and sent it...[Interviewer: usefulness of document in future?] Probably not. We've had the meeting about cataracts and…it was more to do*

with a sort of pathway of care really for certain patients and how it would affect us. [Community Nurse]

Unlike the JUSTEIS project findings, interviewees in VIVOS tended to be more satisfied than questionnaire respondents, although there was some dissatisfaction over the number of irrelevant references uncovered, or the suspicion that more relevant information might be available elsewhere on a specialized topic. The questionnaire respondents were equally likely to respond "partially successful" or "successful," but the majority indicated that the type of search was a typical search for them. Interviewees indicated that the degree of success is a subjective estimate and requires learning about realistic expectations, for a MEDLINE search or Internet search.

The observation that the JUSTEIS interviewees were more likely to report unsuccessful searches than the JUSTEIS questionnaire respondents, whereas the VIVOS interviewees were, apparently, more content than the VIVOS questionnaire respondents might be attributed to the differences in material being retrieved, the way success was construed in a different context, or simply an artifact of the comparatively small sample size in VIVOS.

Explicitation: Text-entering project

The explicitation technique was used in a study (Light & Wakeman, 2001) of the mental processes of experienced users when performing the types of Web-based task required on dynamic pages. The study examined how people responded to entering text into

interactive components on Web sites, such as comment boxes, search fields and order forms. The explicitation technique was used to describe: (1) thoughts went through the minds of the users as they approached and started the task of entering text into Web sites; and (2) how these thoughts compared with thoughts when using other parts of the site. Since thoughts can only be accessed in mediated form, the thinking under investigation was construed as a series of mental activities stimulated by – but not necessarily directly related to – the experiences users had with Web sites. Descriptions of these mental activities could then be collected. It was decided to collect users' accounts of what they did and thought during the period of conducting their task, whether it was closely associated or not with the business of using the Web site. These accounts were then analyzed to reveal interviewees' interpretations of the activities associated with moving around the site, reading and entering text.

The study required a fine degree of granularity in the accounts of people's thinking if it was to yield any useful data for comparison within and across interviews. Pilot studies had found that collecting the accounts concurrently with use of the Web sites was not satisfactory, as the thoroughness of describing the thoughts and feelings being experienced distracted users from the task that was being conducted[4].

The adoption of the explicitation interviewing technique to overcome this problem immediately exposed a new methodological issue. In some pilot studies a common task was set for interviewees so that experimental conditions would enable direct comparisons

to be made between accounts. But the unusual quantity and quality of the information gathered using the explicitation method revealed a weakness with the assumptions made in setting a controlled task. Explicitation produced an account that was far richer in personal motivation and reflection, whereas in the controlled study such comment may have been seen to breach the co-operative conversational principle of being relevant (Levinson, 1987). Borlund (2000) examined the validity of set tasks in information retrieval studies, and her observations are similar, although she concluded that the task simulation will work best if the situation is one with which test subjects can identify, and one which is of intrinsic interest to them, as well as providing them with enough scope for imagination. Similarly, Urquhart (1999) concluded that vignettes, which were likely to be close to the experience of the interviewee, were likely to be more successful in eliciting a detailed response than those which were more distant. This, of course, can be more a matter of luck than judgment unless the researcher happens to have a good deal of background knowledge of the interviewee's situation. In the text-entering project, explicitation, with the users' own accounts of their experience, provided the depth of detail required to detect any changes in behavior as users progressed through interaction with the website.

Obviously, such extra information is useful in this context to alert the researcher to the inappropriateness of the kind of task set. Pilot studies revealed that users' personal motivations for using Web sites would be needed if the accounts were to provide meaningful data about users' perceptions. Consequently, experimental conditions that

[4] Noted also in a review of information retrieval processing which included a critique of 'thinking aloud'

would have allowed simple comparison between users' accounts had to be abandoned. Instead, participants in the main study were not manipulated to perform a particular task at a specific time, but asked to give an account of the last time they had entered text into a Web site of their choice. The interviews became closer to fieldwork. This provided far richer data and made discussion of the relation of behavior to purpose possible, though initially it seemed to thwart the original intention to compare accounts.

Twenty 'experienced' (as defined by Graphics, Visualization & Usability Center, 1998) Web users were interviewed, being asked to describe as fully as possible the last occasion upon which they had entered any text into a Web site. Participants were picked, through a brief semi-structured interview, as those who used the Web as part of their everyday life, so that unfamiliarity with the medium would not affect the data collected. Participant demographics reflected Web demographics (Graphics, Visualization & Usability Center, 1998), with the exception that all interviewees were European English speakers. Interviews lasted on average just more than half an hour and dealt with between one minute and ten minutes of behavior.

Explicitation data analysis

Analysis was concerned with variations within accounts, and patterns between accounts, looking for signs of relationships. These did not have to be straightforward statements from interviewees – indeed, interviewees had been given no idea which details were of interest, so that their accounts would not be prepared with the research agenda in mind.

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experiments) (Keen & Armstrong, 1980, p. 36).

Because discourse analysis (Potter & Wetherell, 1987) was being used, another researcher – who had not been present at the interviews – was asked to examine the transcripts for signs of leading questions from the interviewer and, subsequently, three colleagues including the interviewer looked at the findings to draw independent conclusions, which agreed. In general, the interviews showed that users responded differently at the point where they began to enter text into Web sites from behavior with other parts of the site; and that there were generalizable patterns between accounts about where changes in perception occurred.

There was an awareness of the interface as an object:

> *Yes. Ok. Uh, as I recall there was a big blob of color in the middle. Uh, I can't remember what was underneath, but the pointer changed to a hand, yeah, and so I didn't bother reading the rest at the bottom. [excerpt from AC's account of using a Web site, 1999]*

When starting to think about entering text, perceptions of the interface as inanimate began to change:

> *[Interviewer: Any images come to mind?]*
>
> *… Kind of designers, designers, a group, I don't know why. It's more a sense of people having designed that ... Yeah, I had, no, I had. I had more this impression of bizarre, this stuff, it's not done well: this box comes too late. [excerpt from BL's account of using search on a Web site, 1999]*

The accounts also revealed that interviewees changed the pronoun they were using for describing the site, from “it” to a mixture of “it” and “they” as they switched from talking about moving through the site, looking at it or reading, to talking about entering text into fields.

> *Because, you know, they’ve got to - what do you call it? - check your, this was a debit card so it has to actually go and check whether your funds are available, validate your card. [excerpt from LB’s account of entering financial details into a booking form on a Web site, 1999]*

There were also explanations of feelings, and the problems of presenting oneself in communications with the Web site:

> *[Interviewer: So any more thoughts or feelings as you went through this bit?] ...I think I was rather pleased actually. You know you kind of get it so that you think Oh great, yeah ... excellent! [excerpt from JL’s account of receiving a confirmation after entering travel details into a form on a Web site, 1999]*

> *I also remember thinking that, I think I put myself down as ‘scientist’, and I remember thinking ‘Well, what am I? Should I be put down as ‘student’ or what would I like to be known as?’ {…} I remember thinking ‘What-‘ {…} ‘how, what, how would I be categorized according to them?’ Does it matter, do I care? [excerpt from JF’s account of entering occupation into a registration form on a Web site, 1999]*

The use of the technique allowed the researchers in the study described to collect examples showing that, in going about their business, these interviewees were aware of two levels of interaction, one with the interface, the other with shadowy figures beyond the interface. Based on previous experience and the results of pilot testing, the researchers concluded that much of what was discovered, through analysis of the data gathered, would not have been available without use of the explicitation technique.

Conclusion

Explicitation has developed along parallel tracks to some of the critical incident studies, but there is a far stronger emphasis on the processes required for evocation to encourage full recall. What explicitation offers is an approach which might disentangle some of the deeper seated perceptions from the information user. The approach appears to encourage a better recall of the episode and some of the steps taken. The particular difficulties encountered in the JUSTEIS project suggests that the explicitation technique might be applied to overcome particular problems when information services seem to be seamlessly provided to the user. The difference between books, journals and CD-ROMs in the physical sense is obvious to the user. In the electronic world, such differences are less apparent. What is needed for studies of electronic information use, for studies of the use of the digital library, is a way of understanding how and why users navigate and make the choices that they do. One limitation is that a text-entering operation may have a defined sequence or story, unlike the type of Internet searching where the user is browsing and flitting from one source to the next.

While evocation might be beyond the scope of some large scale information behavior studies, important lessons from explicitation could be learnt by those wishing to employ the CIT for studies of information behavior. First, there are lessons from the methods used to encourage recall, by trying to get interviewees to remember what else they were doing, how they felt at the time. Second, explicitation encourages a lack of judgment on the part of the interviewer and the interviewee. Despite the best intentions of the research team in both JUSTEIS and VIVOS, interviewees often apologized for their lack of use of certain information services. Explicitation techniques might help full recall of the detail, by helping interviewees acknowledge the problems and feelings freely without the distraction of rationalizing actions.

Future studies of information behavior will undoubtedly focus on use of the Internet and use of intranets. To find out just how users navigate the Web to assist in particular information searches, or browse for information, will require some effort on the part of the interviewer and the interviewee to recall the episode in depth. In the physical world, getting up to pick a reference book from the shelf or ferreting among a pile of personal journals is a very tangible experience. These markers do not exist when searching at a computer. Critical incident interviewing will require enriching with explicitation to help provide the detail of the episode.

Acknowledgements

The authors thank the Joint Information Systems Committee of the Higher Education Funding Councils for their support of JUSTEIS, and Resource (formerly the Library and

Information Commission) for their funding of VIVOS. The authors also wish to thank the JISC Scientific Adviser Professor Jenny Rowley for her support on the JUSTEIS project, and the School of Cognitive and Computer Sciences at the University of Sussex for their support for the text-entering project. Other members of the research team who contributed to the work of JUSTEIS and VIVOS include Rebecca Phillips, Jean Everitt, Elizabeth McDermott, Helen Morris, and Alyson Tyler.

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Table 1: Critical incident studies of information behavior (1983-2001)

Study details	Sample	Purpose	Methods	Outcomes
Northup et al. (1983)	299 respondents (medical students and staff stratified sample, 60% response rate), 293 problems in total	Identification of characteristics of clinical information searching	Short (5-15 minute) telephone interview	Distribution of information problems by specialty, disease, and type of resources used.
Wilson, Starr-Schneidkraut & Cooper (1989) Lindberg et al. (1993)	552 respondents (health professionals, mostly doctors, 48% response rate) 1158 searches	Impact of information obtained from MEDLINE on clinical problem solving	30 minute interview concerning effective and ineffective MEDLINE searches, content analysis	Generation of hierarchical classifications of impact on clinical problem solving, and on outcomes of professional activities. List of reasons for using MEDLINE.
Timpka. Ekstrom & Bjurulf (1989)	186 general practitioners in Sweden	Investigation of decision making habits concerning information and searching	Questionnaires combining a multiple choice and CI questionnaire (87% response overall)	Identification of solved and 'unresolved dilemmas', reasons for, and sources used, time spent searching
Timpka & Arborelius (1990)	12 general practitioners, 46 consultations, 262 'dilemmas'	Modeling of ill-structured complex dilemmas	Review of video-recording of consultation, phenomenological analysis	Development of knowledge needs for decision support, based on types of dilemmas identified
Hripcsak & Clayton (1994)	Comments (126) sent over a period of 26 months from health care providers to clinical information services staff	Effectiveness of alerting messages	CI technique used for analysis of comments	Improvement of medical logic modules for a clinical event monitor
Urquhart & Hepworth (1995a; b) (Value project)	196 medical staff respondents, at 11 sites (individual response 69%, response by number of possible questionnaires returned 46%)	Examination of patterns of information need and use among hospital medical staff and general practitioners (background to impact assessment study)	One page questionnaires sent once a week, for four weeks. Selected follow-up interviews (43)	Identification of purposes of information need, sources used, sources used for certain purposes, and differences between staff groups
Pettigrew (1996)	9 community nurses	Examination of perceptions of the need for	Interviews, using a grounded theory approach, plus	Identification of information management

		community-based (social care) information	field diary and theory notebook	practices, valued characteristics of information and barriers
Wood, Palmer & Wright (1996)	27 General practitioners (part of a larger study)	Information seeking for patient care	Interviews	Impact of information on clinical decision making
Radford (1996)	27 library users, 9 librarians, at 3 sites, 47 incidents	Effectiveness of the reference 'interview'	Interviews, followed by analysis to identify categories and themes, application of relational communication theory	Identification of important elements of interpersonal dynamics
Davies et al (1997) Urquhart & Davies (1997) (EVINCE project)	163 nursing staff respondents, at 5 sites (individual response 78%, response by number of possible questionnaires returned 52%)	Examination of patterns of information need and use among hospital and community nursing staff	One page questionnaires sent once a week, for four weeks. Selected follow-up interviews (48)	Identification of purposes of information need, sources used, sources used for certain purposes, and differences between staff groups
Saracevic & Kantor (1997a, b)	528 users (mostly faculty, professionals and postgraduates) from 5 research library sites	Development of a taxonomy of the value-in-use of library and information services	Interviews conducted 'post-use', immediately and some time later, analysis to provide an empirical taxonomy (user perspective, terminology), later refined	Derived taxonomy of value in use
Timpka et al. (1997)	15 hospital physicians	Study of clinical reasoning	Identification of problem situations, stimulated recall (CI), workflow graphs	Construction of an integrated method for study of clinical reasoning
Abad-Garcia, Gonzalez-Teruel & Sanjuan-Nebot (1999)	372 (456 hospital physicians, Spain, response 82%)	Examination of information behavior and effectiveness of present services	Structured interview, sometimes self-administered questionnaire	Types of information dilemmas, pattern of sources used and information-seeking behavior
D'Alessandro et al. (1998)	Sample from 345 rural physicians using telemedicine network	Identification of barriers to use of a digital health sciences library	Questionnaires distributed at professional meetings, overall response 70%	Identification of barriers (and possible solutions) to use of digital health libraries
D'Alessandro et al.	28 radiology	Baseline analysis	Recall of	Information

(1999)	residents (on-call), 198 resident interviews, 1-16 incidents each	of information needs and information-seeking behavior	questions, and analysis of type of question and sources used	system to meet patient care information needs of residents
Armstrong et al. (2000) (JUSTEIS project)	178 interviewees (121 UG/PG students, 30 academic or research staff, 27 library and information services staff), 575 questionnaires respondents (518 UG/PG students, 57 academic or research staff)	Study of the uptake and use of electronic information services in Higher Education (UK)	15-30 minute face-to-face or telephone interviews, postal and e-mail questionnaires using similar questions. Combined CI with critical success factors approach. Qualitative and quantitative analysis	Identification of types of electronic information services used, purposes of information seeking and likely sources used for particular purposes, influences on use, and barriers to use
Sonnenwald & Pierce (2000)	Command and control in simulated battlefield exercises	Information behavior in dynamic group work contexts	Document analysis, observation and CI interviews	Identification of interwoven situational awareness, dense social networks and contested collaboration
Yeoman et al. (2001a, b)	137 interviews (mostly CI based)	Information seeking-behavior in routine practice	Interview as part of a wider interview into uptake and use of training or particular services	Fuller picture of the likely barriers and opportunities associated with uptake of networked services