Assessing Q-Assessor: A Validation Study of Computer-Based Q Sorts versus Paper Sorts

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Abstract: Q methodology studies traditionally have relied on face-to-face administration to lead subjects correctly through the steps involved in the Q sort. The cost and time commitments of one-on-one supervision limit Q methodology's potential applicability to geographically scattered samples. Unsupervised paper-based techniques are less costly to administer, but can compromise study conclusions by introducing unmeasured methodological variability. Computer-based systems using the Internet can ensure accurate performance of the Q sort, administer studies to subjects anywhere, and collect results immediately and cost-effectively. Two validation studies are described for a prototype Internet-based system, Q-Assessor. In the pilot study, 6 subjects performed Q sorts via Q-Assessor. They also completed a traditionally administered paper-based sort. Q-Assessor compared favorably in the time required for participants to complete the study and for the investigator to process the results into a database as well as in subject satisfaction with and preference for the study methodology. This led to a larger-scale validation study of the computer-mediated method. Thirty subjects were given the option of completing a Q sort either online or on paper. More than half (17) selected the computer-based alternative as the more convenient method. Because 13 elected to do paper-based sorts, comparisons were allowed which showed no apparent difference in the reliability or validity between the methods.

Introduction

Q methodology measures subjective viewpoints through a complex series of steps in which study subjects rank-order statements in a precise fashion (the Q sort). Successful analysis of Q sort data depends on proper adherence to the prescribed steps (McKeown & Thomas, 1988).

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Q sorts have traditionally been conducted in conjunction with personal interviews, through which the investigator can assure that the subject followed the correct steps and constructed an accurate representation of personal feelings as reflected in the Q sort. The time and expense of these interviews (particularly when travel is required) can limit the deployment of Q methodology. Mailed packets with instructions and Q sort materials can reduce logistical obstacles, but cannot assure the subject's proper performance of the task. Recently, new computer-based technologies have been applied to the problem (Reber and Kaufman 1999; Schmolck 1999). The interactive capabilities of the World Wide Web have been applied in at least one prior prototype system — WebQ (Schmolck 1999). This system, however, implements only the Q sort portion of the process.

The work reported here grew out of the challenges encountered in planning a Q methodology study among top public relations professionals and legal counsel in corporate practice. Preliminary testing with targeted study subjects revealed that mailed paper sorts were unwieldy and confusing, but limited study resources prevented travel for personal interviews. Consequently, a new system was created that uses the communication and computational capabilities of the Internet to implement the process of conducting a Q study. This system was designed to:

1) support both an initial pre-sort (general agreement, disagreement, neutral) and the final rank-order Q sort

2) permit subjects to change their minds at any time throughout the process

3) provide subjects with visual access to all statements at all times

4) ensure that all steps in the Q sort process occur in the proper order (the subject sorts the top several "agreement" statements first, followed by bottom several "disagreement" statements, and the remainder last)

5) collect other required data elements of the study — consent forms, demographic information, reflection questions (regarding individual item placement)

6) automatically send results to the investigator via e-mail without further subject access to the data.

Q-Assessor is a prototype Internet system developed to meet these requirements. This paper reports the initial validation of this system through a comparison of its performance against standard methods based on paper sorts and interviews in a small pilot study followed by a full implementation study.

Literature Review

Q methodology, developed by William Stephenson (1953, 1968, 1994), is designed to measure subjectivity in an objective manner. Stephenson (1902 to

1989) held a Ph.D. in physics from the University of Durham, England and a Ph.D. in psychology from the University of London. He came to the University of Missouri in 1957 as distinguished research professor in journalism and professor of psychology. The methodology requires fewer respondents than do other social scientific research methods. The respondent defines personal subjectivity by ranking a series of self-referential opinion statements. The goal is to unmask deeply held opinions in such a manner that people who respond to the sort in specific ways can be identified, grouped into factors or types, and described according to similarities and differences in attitudes, motives, and desires as represented by their individual Q sorts.

> The purpose of conducting a Q study is to gain insight into an individual's point of view on any matter of social importance ... and to give these opinions structure and form. (Cropp 1996, 60)

> The major concern of Q methodology is not with how many people believe such-and-such, but with why and how they believe what they do. Thus, the central issue is from what perspective can relations best be observed. (McKeown and Thomas 1988, 45)

Q sorting is underused as a research tool in public relations practice. It holds beneficial potential to increase understanding of the preferences and opinions of audience, market, client, and public. Popovich and Popovich (1994) noted that Q methodology could be useful in strategic public relations planning. In many circumstances, it may be more useful in its ability to reveal broadly held individual attitudes than can topic-specific response rating surveys. The use of this methodology, combined with in-depth interviews, is a powerful tool that could easily be put into practice by public relations professionals.

For more than 60 years, Q methodology has been conducted in several different ways. Undoubtedly one prior innovation was in the delivery of Q sort materials via U. S. Postal Service (Van Tubergen and Olins 1979). When results from a large-scale mail delivery of 800 Q sorts were compared to those of a control group of 50 participants to whom the sort was administered "in a conventional in-person manner by a trained and experienced Q sort interviewer" (p. 55), the data gathered by the 2 techniques were highly congruent, according to the researchers.

> The in-person study might be seen as a fairly 'by-the-books' use of Q. In contrast, the mail study involved a large sample of people, requiring unconventional factor procedures and the hazards of Q sort self-administration by untrained consumers. Yet the attitude patterns and their interpretations arising in the 2 studies are essentially identical. (pp. 58-9)

Van Tubergen and Olins commended the robustness and flexibility of the method and its associated statistical methods. This suggests that the Q sorting process should also be highly adaptable to the Internet.

Computer-based data gathering has become commonplace in virtually all aspects of modern life. Formal educational testing, such as graduate school admission examinations, is conducted through interactive computer programs. Internet-based systems to collect patient healthcare information have been created and validated. In one study, Bliven, Kaufman, and Spertus (1999) found that "health-related quality of life measures can be reliably collected using software operating over the World Wide Web. Data collected in this manner are valid and of comparable quality to self-reported health related quality of life data obtained via paper survey."

Collecting data via computer-based Q sorts might be "fun" for the sorter. Singer (1994/95) noted that the use of online media is related to Stephenson's play theory.

> Many adults ... seem to view the computer as a toy for grown-ups and commonly describe their use of it as 'playing' even when they're actively seeking or retrieving information. Stephenson points to certain media as encouraging a 'pure play' attitude, with formats and layouts that encourage readers to browse, to wander, to let themselves be diverted or captivated by something new or unusual. (p. 41)
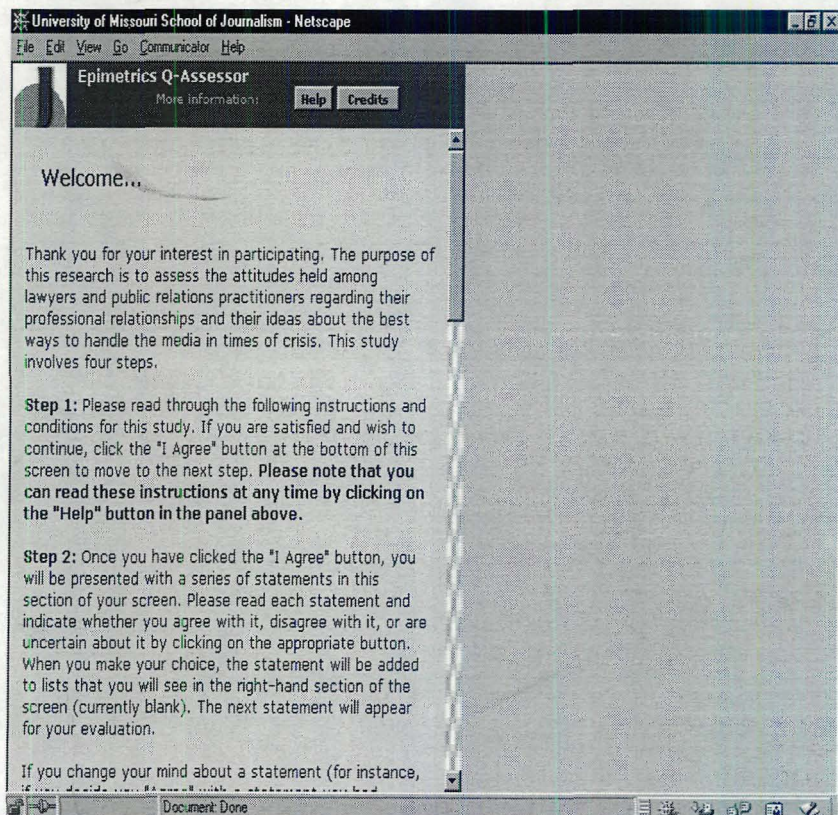
Methods

Software System for Internet Q Sorting

Q-Assessor was created as an Internet-based system to implement Q methodology's valued subject-interview process. This system was programmed using a combination of Hypertext Markup Language (HTML) and JavaScript. In order to maintain compatibility with all current-generation browsers (Netscape Navigator and Microsoft Internet Explorer, version 4 or later), only standardized features of these languages were used.

To use Q-Assessor, subjects connect to the Internet through their usual service provider and then access the Q-Assessor Internet site via a password-protected gateway. The Q-Assessor application then loads into the subject's browser and leads the subject through the following steps of the Q methodology research process:

- introduces and explains the Q methodology process (Figure 1)
- secures consent for the subject's participation (Figure 2)
- presents the first-order sort of the Q set into "Agree," "Uncertain," and "Disagree" categories (Figure 3)
- conducts the Q sort rank-ordering of each of the statements in the Q set (Figures 4 and 5)
- obtains demographic information from the subject (Figure 6)
- collects all data into an email package that is sent back to the investigator who then can import the subject's responses into any appropriate analysis package (Figure 7)
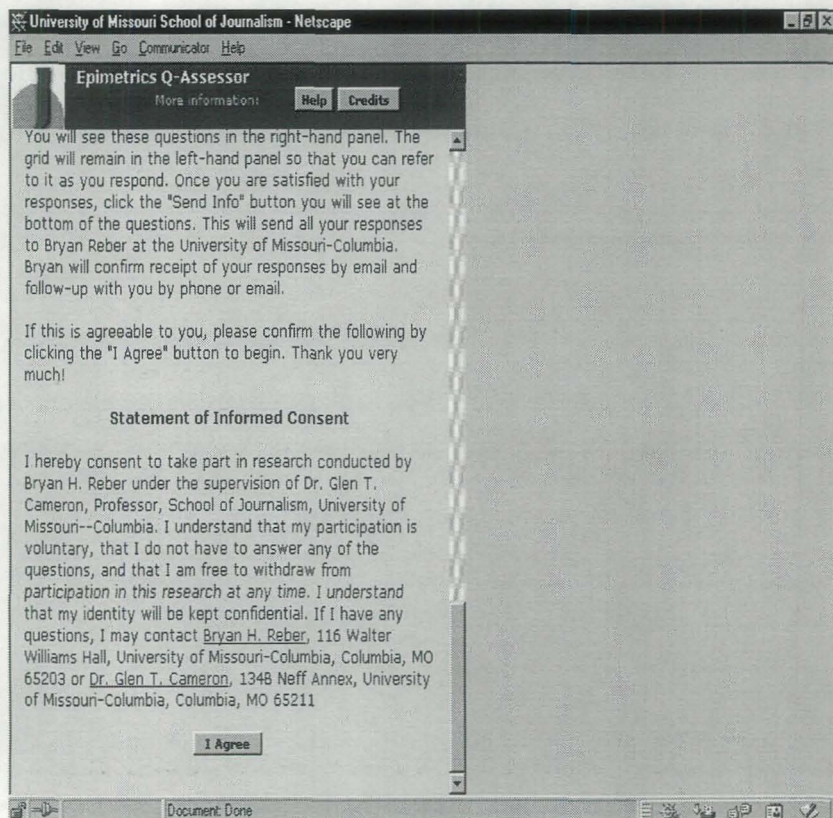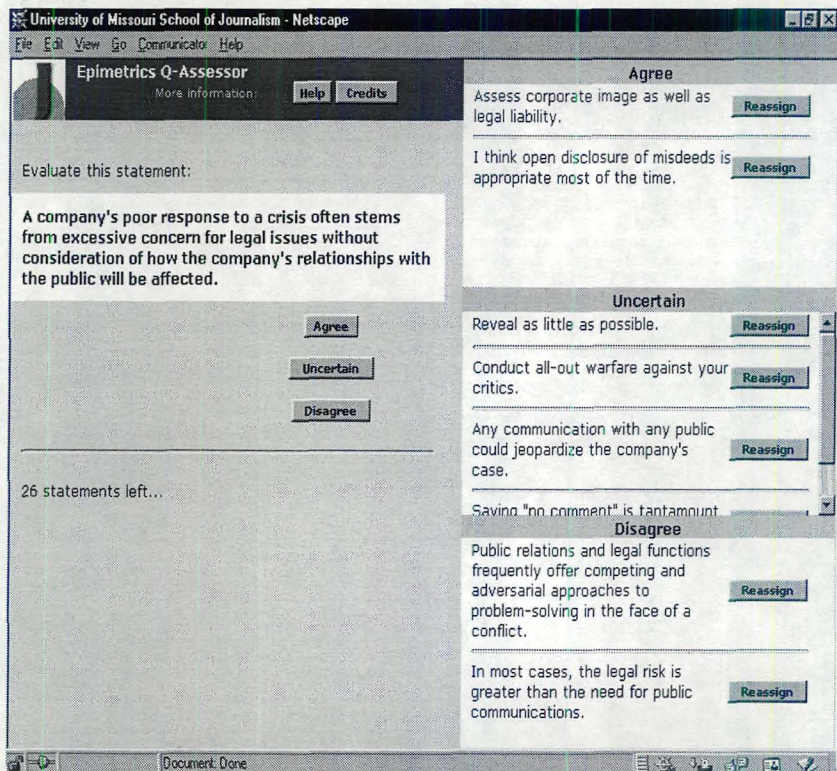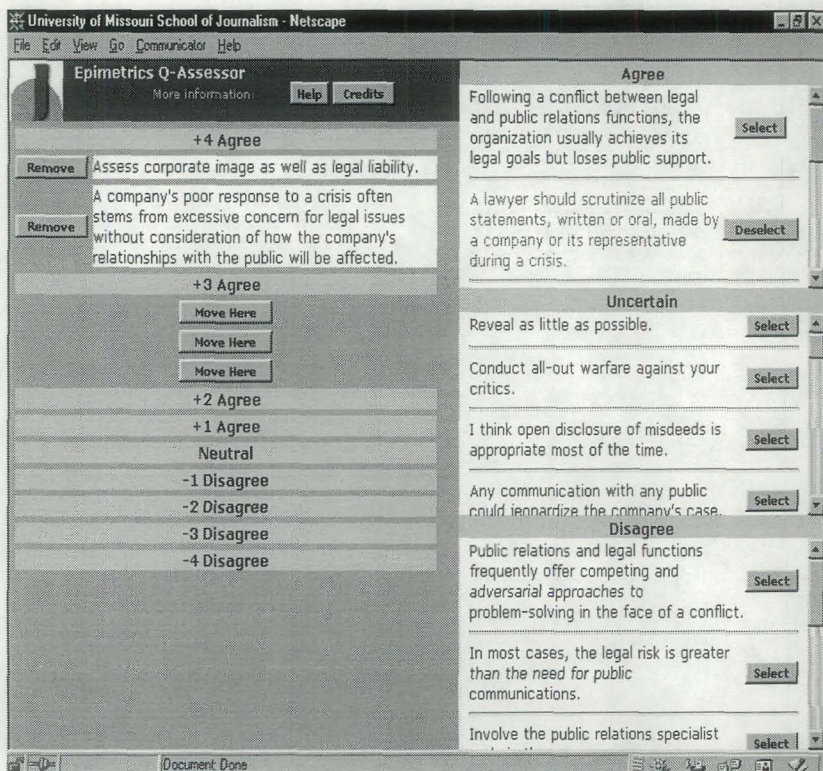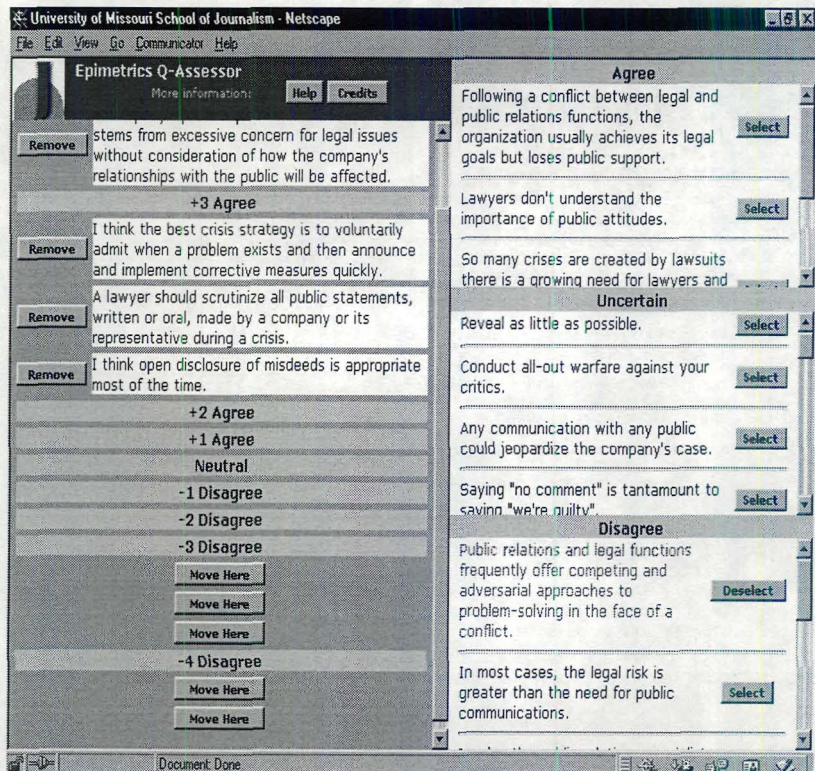
Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

Subject: MU Q-Method Study Results via Q-Assessor
Date: Sun, 19 Sep 1999 19:01:28 -0700 (PDT)
From: xxxx@xxxx.xxx
To: yyyy@yyyy.yyyy.yyy

Subject characteristics

_____

Address: xxxx@xxx.xxx.edu
Code: xxxxx
Gender: m
Job title: xxxxxxxx
****

Q-sort results:
+4,+2,0,-3,0,-1,0,-2,0,-3,0,+1,-3,-1,+3,-1,+1,+2,0,-1,-2,+2,+4,+1,+3,
-4,+1,+2,+1,+3,-4,-2,-2,-1
****

Comments re max agree:
In a crisis, it's important for both units to be involved.
****

Comments re max disagree:
Lawyers "compromise?" I don't think so......
I think the worst possible strategy in a crisis is to say nothing.
****

Study timings (minutes)

_____

Consent: 3.03
First part: 3.81
Q-sort: 18.5
Survey: 2.54
****

Figure 7

Since Q-Assessor is an Internet application, the user only needs to be able to connect to the Internet. No additional software need be downloaded or installed. At this point, Epimetrics Consulting Group can readily configure Q-Assessor for new Q-Methodology studies through substitution of different Q sets, post-study surveys, and other study-specific elements. Expansion into a full-featured Internet application that would support direct authoring and configuration by investigators is being explored[1].

Pilot Study

The goal of the pilot test was to directly compare the usefulness of Q-Assessor with the traditional paper-based Q sorting processes. Six subjects with professional public relations or legal background experience were asked to perform 2 sorts of the same set of 34 statements. One sort was performed online using Q-Assessor, the other was conducted through person-to-person administration with paper-based instructions, statement cards, and recording grid. Three of the subjects were asked to do their first sort online; the other 3 were asked to do the paper sort first. One author was present at each of the paper-based and online data-generating sessions.

Measured endpoints included:

- *Subject profiles:* subject's current level of computer use and expertise
- *Performance measures:* the time required to read the study instructions and perform both primary and final Q sorts
- *Subject preferences:* subjects' perceptions of the ease of explanation and use, clarity, and overall preference of the 2 approaches

Validation Study

Following successful testing of Q-Assessor in the pilot study, a Q study assessing co-orientation between public relations practitioners and lawyers was begun. The same 34 statements and the same Q-Assessor program were deployed. Thirty participants sorted the 34 statements twice – once as themselves and once projecting themselves into the role of their counterpart professional. Thus, 60 sorts were generated – 33 using Q-Assessor, 27 using traditional paper means.

Results

Pilot Study

Subject profiles
Five of the 6 participants in the pilot study were public relations professionals (2 doctoral students, 1 professor, 2 practicing professionals). The other

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participant was a lawyer and law school professor. Attempts to have 2 other lawyers participate were thwarted by technology. One of the lawyers did not have a browser that would allow Q-Assessor to load; the other did not have Internet access. Three participants were women; 3 were men.

Five of the 6 participants said they were "very comfortable" working on computers. The sixth said she was "very uncomfortable." Five of 6 said they log on to the Internet "at least once a day"; the sixth logs on "2 to 3 times a week." All 6 said they use e-mail daily.

Performance measures
The mean time to conduct the sort process in the pilot study was 2.9 minutes greater using Q-Assessor than the paper-based sort. The mean time to read instructions was essentially the same (2.8 minutes by Q-Assessor, 2.9 minutes by paper). The mean time to complete the primary sort (organizing the statements into agree-neutral-disagree categories) showed a substantial difference between methods — 7.5 minutes via Q-Assessor, 4.4 minutes by paper. The mean time to complete the final sort (transferring the statement numbers to the recording grid) was, again, essentially the same (12.4 minutes using Q-Assessor, 12.5 minutes using the paper method). The mean time for the investigator to record subject responses in the paper-based strategy was 2 minutes compared to instantaneous collection via Q-Assessor.

Subject Preferences
Overall, 4 of the 6 subjects said that in future sorts they would prefer Q-Assessor to the paper-based method.

Q-ASSESSOR CRITIQUES
Responses to the question, "What did you find most appealing about the web-based sort?" ranged from "It was quick and clean" to "It was efficient" to "Nothing." Respondents said they believed Q-Assessor was graphically well-presented, self-explanatory, and "less messy than the card sort." They recognized the greater efficiency of administration of the Web system. Respondents said the structure of Q-Assessor was a benefit. One participant said, "Seeing the locations where the statements go, exhibited next to the statement, provided a strong sense of structure. It may be easier to do the on-line sort because you're able to just chip away at the task rather than being overwhelmed by the visual clutter of paper statements strewn about." Another noted, "Being able to see the statements and the location where they are to be sorted all on one 'page' vs. having to shuffle through the cards is a benefit. The computer screen was nicely structured. You could just scroll up or down to see the statements displayed."

When asked what they found least appealing about the Web-based sort their responses ranged from "Nothing. I liked it," to "I liked nothing about it." The latter was from a respondent who said she was "very uncomfortable" working on computers.

The majority of responses addressed structural issues. One respondent said that scrolling around the computer screen makes comparisons more difficult than having a complete, quick visual comparison with statement cards. Another felt that Q-Assessor unfairly forced decisions. Two participants said they would have preferred a "drag and drop" structure as in card-playing software. The strongest critic of Q-Assessor said, "Because the screen kept jumping back and forth between statements, there's no way I'd change my mind and move a statement once I had placed it."

PAPER-BASED CRITIQUES

The main benefit identified for the paper sort was its flexibility. Subjects reported that having all the statements in front of them assisted the process of comparing and sorting the statements. One said, "You can see the whole thing at once. You have the option to change your mind in any way at any time, unimpeded." Another commented, "It seems more flexible, more manipulate-able, more agile. This is especially true when there are indecisions. The freedom might also serve the negative purpose of stymieing the sorter."

When asked what they found least appealing about the paper sort, respondents used terms such as "clumsy," "unwieldy," and "like shuffling cards." One respondent said he felt that the paper sort took more time. One participant observed, "It feels a little like shuffling cards. It feels like you'd manipulate the cards differently every time. There's less sense that the task is replicable." Another said the recording form was confusing. "It is easier on the computer to know which recording squares are to be processed next," he said. One sorter said she spent the whole time on the paper sort worrying about getting the piles mixed up and writing things down in the wrong boxes on the recording sheet.

OVERALL ASSESSMENT

When asked which sort was *easier* for them, 4 chose paper and 2 chose the computer. However, when asked what their preference would be if they were to participate in a *future sort*, the break was 4 in favor of Q-Assessor and 2 in favor of paper. Those who said the computer sort was easier said, for example, "It was more efficient and much easier" and "I liked that everything I needed was there on the screen. The scrolling makes it easier than shuffling." Those who found the paper sort easier cited the agility of the paper sort, being able to change decisions more easily. One said, "The computer process ... makes the comparative aspect of this exercise more difficult."

Validation Study

Thirty public relations professionals and lawyers were recruited by phone and electronic mail to participate in the formal study. They were given the choice of conducting their 2 sorts either online or on paper. Seventeen chose to conduct their sorts using Q-Assessor.

The performance measures used in the pilot study were not collected here, because each participant was not doing 1 paper and 1 online sort. They chose to do both of their sorts using 1 medium. However, Q-Assessor was deployed without any unanticipated problems. The only difficulty that occurred was related to the version of browser used by some participants. Q-Assessor was designed to use relatively recent browsers of Netscape or Internet Explorer, version 4.0 or later.

Anecdotally, several participants who chose to use Q-Assessor commented on its ease and efficiency. When analyzing the data, there was no difference between methods used. As expected, by-person factor analysis of the data from paper sorts grouped together in the same way as data from online sorts, thereby providing one measure of validity to the online process.

Discussion

The pilot study's small sample size does not support quantitative conclusions about process-related time variables. However, qualitative assessment of the acceptability of the Q-Assessor product is possible from the subjects' observed reactions and critiques to its use as well as those from the full deployment of Q-Assessor in the larger validation study.

The subjects' degree of comfort with Q-Assessor correlated quite closely with their level of general computer comfort. One of the 2 subjects who would prefer to construct paper Q sorts in the future admitted to being "very uncomfortable" using computers. Computer-based Q-sorting thus may prove more successful in studies with individuals who are already skilled in the basic techniques and metaphors implicit in using Internet applications. Potential study subjects should be screened for their level of computer expertise prior to enrollment in a study using Q-Assessor or other computer-based systems. This screening was done in the larger validation study by allowing the participants to self-select whether they preferred online or paper versions of the sorting materials. Access to the Internet is also an obvious prerequisite for using Q-Assessor. As time progresses, access will be less of a problem, except for circumstances where institutions use firewalls and prohibit Internet access as a matter of security policy.

The main limitation of Q-Assessor identified by the subjects is its use of long lists to display all the Q set statements. Scrolling lists are commonly employed as a user-interface when more information needs to be accessible than can be fit at one time within the constrained size of the computer screen. Despite their familiarity, scrolling lists allow only a subset of the information to be visible in one view. In contrast, a paper-based approach used with a sufficiently large physical tabletop surface can allow the subject to see all the statements at once. However, space constraints can also plague a paper Q sort if there are enough statement cards, the size of the cards is too large, or the

tabletop is too small. Indeed, if the subject must telescope columns of cards under each other to fit the limits of a small tabletop, the sorter is, in fact, creating a physical version of a scrolling list, but one that is less easily manipulated than the on-screen variety. The sort administrator observed evidence of this problem in all but one setting where the sorter actually laid the statements out on the floor so each one could be visible. Similarly, statements that are placed at the far side of a large tabletop may not always be clearly legible to the sorter.

Other strategies for compacting complex information into small on-screen viewing areas are possible. Statements could be displayed in a miniature, iconic form to show collectively the entire pattern. When clicked on individually, the statements could expand to a larger, legible size. However, this solution displays even less of the legible information at once than do scrolling lists, and furthermore, it requires more user activity to switch back and forth between the 2 modes. Clearly, on-screen viewing is a matter of personal preference. One participant, who was constructing the sort on a 17-inch computer monitor, suggested that the statement text could be smaller allowing more to be visible on the screen, while another said Q-Assessor would be vastly improved if only the statement text font were larger!

A difference was noted between how subjects attended to the instructions for the Q methodology procedure when using Q-Assessor and the paper-based version and its open-ended response sheets. Regardless of whether the paper sort was done first or second, subjects only briefly perused the paper instructions, while they thoroughly read the instructions presented by Q-Assessor. The investigator had to spend more time explaining the steps with the paper method than with Q-Assessor. Furthermore, the prescribed sort sequence was often not followed in the paper sort. If paper instructions are used, subjects may fail to comprehend fully what their tasks are and their order of conduct. If the investigator is not present to answer questions or correct sorting process mistakes, the usefulness of participant responses may be compromised. It appears that the investigator may be able to present more complete and well-understood instructions via Q-Assessor when compared to the paper methods. Most importantly, by tightly controlling the sorting process, Q-Assessor is able to constrain the subjects' actions to the desired steps, whether or not the subject fully understands their order and purpose.

The technological benefits of Q-Assessor for data management steps of the Q sorting process seem quite clear. By distributing all necessary materials via the Internet, Q-Assessor eliminates geographic concerns in the conduct of Q-methodology studies. In the formal validation study, data were collected internationally and from 11 U.S. states. Once the subject completes the responses and clicks the "Send" button, the data are formatted and delivered directly to the investigator in a digital form ready for analysis. Transcription errors and data checking labor are substantially reduced.

Delivery time of both instructions and data is dramatically reduced. It is feasible via Q-Assessor (and was done in the validation study) to deliver instructions to international participants and have their completed sorts within the course of a business day. Q-Assessor can also be configured to deliver other information about the sorting process, such as precise measures of the time spent in each phase of the study and the number of times the subject repositioned items during the 2 sorting steps.

Q-Assessor, in its current form, has some limitations imposed by the design decision to restrict programming techniques to capabilities generally found in up-to-date web browsers. The most notable example is the lack of the commonly used "drag and drop" user interface feature, which is not a capability currently available with JavaScript as implemented in both Netscape and Microsoft browsers. This feature was frequently suggested by subjects, although Q-Assessor attempts to approximate this with a "click to select and click to move" metaphor. As commercial browsers gain greater standardization, "drag and drop" capabilities can be added.

Conclusions

A small pilot evaluation of Q-Assessor, a new application of computer technologies to Q methodology processes, has been described followed by implementation of Q-Assessor in a full-featured validation study. Compared to paper-based interviews, Q-Assessor allowed users to accomplish the desired Q sort task at least as well as did the traditional physical paper method. Enthusiasm for Q-Assessor was proportional to subjects' comfort and experience with computers in general.

Respondents' self-reported advantages of Q-Assessor included enhanced delivery of instructions and easier adherence to the proper sorting steps. Other advantages include ease of distribution to subjects at a distance from the investigator, easier use of the standard reporting form for all data received by e-mail, and greatly enhanced speed and reliability of data collection. Researchers should find reduced time and labor because of receipt of digital results by e-mail, the absence of transcribing errors and the ease of importing the data into spreadsheets and data files used by comprehensive statistical analytic programs.

Current limitations of Q-Assessor result from the need to portray complex information in relatively small computer screens which necessitates the use of scrolling lists that cannot provide a single view of the full sort as is seen with paper cards spread over a large tabletop. Other limitations, such as the lack of a "drag and drop" feature, represent least common denominator programming compromises imposed by variability in technologies in the current generation of browsers.

Four of 6 participants in the pilot study would prefer using Q-Assessor for future Q sorting. Thus the Q-Assessor product merits additional development

and testing. It is also likely that, use of the Internet's less easily manipulated advanced communication technologies will revolutionize the Q sorting process and the conduct of Q methodology practices. Progress of this nature has the potential to increase the feasibility of conducting Q studies among geographically diverse samples without compromising any core principles of the method.

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