Increasing the Trustworthiness of Research Results: The Role of Computers in Qualitative Text Analysis

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Abstract.—By using computer packages designed for qualitative data analysis, a researcher can increase trustworthiness (i.e., validity and reliability) of conclusions drawn from qualitative research results. This paper examines trustworthiness issues and the role of computer software (QSR's NUD•IST) in the context of a current research project investigating the social benefits of urban greening projects.

TRUSTWORTHINESS IN QUALITATIVE RESEARCH

Natural resource managers are sometimes skeptical about whether information from qualitative research is more sound than the general understanding they develop in other ways, through conversations with constituents, for instance. For qualitative text-based research to be meaningful to natural resource managers and policymakers they must understand and trust the research process and results. To achieve this goal, the work must be rigorous in terms of validity and reliability.

Yet qualitative researchers are still grappling with how best to judge qualitative work in terms of validity and reliability issues. Many reject quantitative research's labels and underlying constructs of internal validity, external validity, and reliability, choosing instead to create new terms more specific to and reflective of issues in qualitative research (Guba 1981, Lincoln and Guba 1985). Some reject these issues altogether, usually on the grounds that socially constructed meanings belie any possibility of "truth" (Guba and Lincoln 1994).

Most scholars, however, see the need for reliability and validity issues to be addressed carefully in qualitative research. In their discussions of these issues, scholars have created many new terms, terms that can get muddled quite easily. Guba and Lincoln's terms are used most often, and I will use them here (Guba 1981, Lincoln and Guba 1985). They talk of trustworthiness as the general issue, with credibility (akin to internal validity), transferability (akin to external validity), dependability (akin to reliability), and confirmability (akin to objectivity) as aspects of creating trustworthiness. Regardless of these and numerous other choices of terminology, the fundamental question is very real: how do we know whether or not to trust certain results? As Wolcott (1994) puts it, how do we know that we are getting it right?

There is a growing consensus on at least some tactics to increase trustworthiness in qualitative research. These include searching for negative evidence, searching for rival explanations, looking beyond dramatic evidence, linking one's findings and conclusions to both data and theory, conducting coding checks, and reporting in detail. Other tactics are less widely implemented but can be both useful and supported by computer analyses. Chief among these is creating audit trails. Computer software designed for qualitative data analysis can help ensure the rigor of analysis and results.

Before proceeding with the discussion of trustworthiness issues, I need to briefly outline my ongoing study that is used in this paper as an example to explore the issues of trustworthiness and specialized software in qualitative research. (At the time of this writing, I am in the middle of analyzing the data and am not presenting final conclusions from this project). The study investigates claims of social benefits to neighborhoods involved in urban greening projects, such as tree planting and community gardens (Lewis 1996). I selected four blocks in Chicago where residents had participated in Green Corps Chicago, a city-sponsored greening program. The sites were selected based on Green Corps practitioners' feeling that social benefits were outcomes of the projects: two sites were thought to have such benefits, two

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were not. I interviewed both project participants and nonparticipants on each block to compare block residents' perceptions of change on their block to the Green Corps staff's views of that change.

THE QSR NUD•IST SOFTWARE[2]

I am using QSR NUD•IST™ version 4 for PCs (N4) to manage the copious amount of data (well over 800 pages of single-spaced text). NUD•IST is briefly explained in the foreword to this collection of papers; those interested in more detail about this and other qualitative data analysis software may want to visit the Computer Assisted Qualitative Data Analysis Software (CAQDAS) web site at: www.soc.surrey.ac.uk/caqdas/packages.htm

N4 does not restrict the researcher to any specific methodology for analyses: grounded theory, ethnography, case study, or other qualitative methods can all work in N4. Any text data can be imported into N4 for analysis, and N4 can also help analyze non-computerized data including government reports or photographs. The program can link with other analysis software like spreadsheets, statistical packages, and graphical analysis tools.

N4 allows the researcher to work with the data in several different ways. The researcher can work interactively, employ automatic coding, or both. Text searches can gather data meeting string or pattern search criteria for further analysis. Data can be coded finely or loosely, recoded, collapsed, and merged. Codes are arranged in an index tree, with a node for each code, text searches, or index search. Codes can be arranged hierarchically or not. In my current study I have used all of these approaches, using auto coding for demographic information, responses to the closed-ended questions, site, and participant/nonparticipant status. I have worked interactively with text search results, after careful coding of each text unit in a subset of the interviews.

Memoing is a tried and true method in text analysis where the investigator reflects on the data or topic at hand, its meaning, and implications for the analyses (Lofland and Lofland 1995, Strauss and Corbin 1990). N4 supports writing memos on both the documents and the codes. The memos track the development of ideas and are a useful place to record questions and issues for future clarification and exploration.

N4 has strong index search capabilities. This allows the researcher to slice the coded data any number of ways (e.g., finding out what older female project participants said about growing up in the South as it relates to trees), allowing the researcher to look for associations in the data and gather evidence as to their generality across the data. I think of these search functions as qualitative cross tabs.

N4 AND TRUSTWORTHINESS ISSUES

Earlier I discussed several of the trustworthiness tactics gaining consistent use in qualitative research. I will discuss them more fully here, with examples of how N4 can help to implement these tactics in practice. The trustworthiness tactics are: (1) searching for negative evidence and rival explanations, (2) looking beyond dramatic evidence, (3) linking one's findings and conclusions to both data and theory, (4) conducting coding checks, (5) creating audit trails, and (6) reporting in detail.

Issue: Searching for Negative Evidence and Rival Explanations

The search for negative cases and evidence is considered an important trustworthiness tactic by most qualitative researchers (Miles and Huberman 1994). It is thought to help increase credibility and confirmability. As researchers analyze data, they may have hypotheses, hunches, or "a-ha!"s that must be checked out. Finding the evidence that supports a hunch can be relatively easy. Searching out the evidence that might refute the hunch is another matter. But looking for this evidence is critical. There is some variation in opinion, though, in how the negative evidence must be handled. On one end of this continuum, Katz (1983) changed both his phenomena of study and his explanation of the phenomena to accommodate every and all negative evidence. This runs the risk of so diluting findings that they can be meaningless. Lincoln and Guba suggest "...perhaps the insistence on *zero* exceptions may be too rigid a criterion. Indeed, on its face it seems almost impossible to satisfy in actual studies..." (Lincoln and Guba 1985, p. 312). They go on to suggest that

[2] *Discussion of QSR NUD•IST does not imply an endorsement by the USDA Forest Service.*

a hypothesis supported by just 60 percent of the evidence can be sufficient. I think that the level of support needed depends on the conclusions being drawn. In my current study, conclusions about whether or not the greening projects were thought to be a positive change on the block need much support from the residents interviewed. Conclusions about the metaphors of cleanliness and dirt and their relationship to the greening projects may need less stringent levels of support because they are both more preliminary and based less on the face value of what respondents say. The more stringent support for this latter type of conclusion will be built over time and place as further studies are conducted.

Exploring rival explanations is related to the search for negative evidence. Both require researchers to try their hardest to debunk their own ideas. In quantitative research, the search for negative evidence involves the researcher looking for intervening variables, extraneous variables, and other potential causes of the phenomena under question. The qualitative analyst, too, must look for these variables in the interview text, photographs, or other qualitative data in the study.

How N4 Can Help

As Dey suggests, by using a computer in analyses of text data instead of "retrieving only those databits[3] which support our analysis, we can also retrieve those which are inconsistent with or contradict it. We can produce negative evidence as easily as positive evidence" (Dey 1993, p. 226). This negative evidence may then suggest rival explanations to explore. A simple example: say I hypothesize that greening project participants are more connected with their neighbors than nonparticipants. With an index search, N4 will produce for me *everything* anyone said (and I coded) about connectedness with neighbors, sorted by participant status. Or, if I have not coded for connectedness with neighbors, I can search on "neighbor" and any other word or phrase I think is a part of this phenomenon. N4 will present the results. I can then easily check for countervailing evidence to the idea that participants express closer neighborly ties. Perhaps participants will indeed have mentioned connectedness significantly more than nonparticipants—this would support my hypothesis. But perhaps respondents who did not participate in the greening project will talk of being connected with each other and not the greening project participants—maybe they even participated in a different project together. This challenges my hypothesis and leads to a rival explanation that a clique may have put in the greening project. Perhaps the neighborhood has problems with divisiveness. Or, it could suggest that different projects interest different types of people. The ability to see all the data sorted by participant status helps the researcher to see these alternative explanations and patterns and not just look at the evidence in support of an idea. Of course, each of these new ideas and explanations would need to be followed up in turn with searches for negative evidence and rival explanations.

Issue: Looking Beyond the Dramatic Evidence and Events

Another variation of the search for negative examples and data is the need to guard against basing conclusions on the most dramatic, sensational, or exciting data. This is a complicated issue. It is important to properly assess any given databit and to not rely on data that may stand out but actually be unrepresentative. At the same time, individual databits that at first glance might seem idiosyncratic and dramatic may trigger an important insight into the data.

In an earlier study, I investigated the motivations and values of urban tree care volunteers (Westphal 1993). In response to a question about favorite trees, one person said:

> *There was a huge oak tree at the bottom of our garden on our neighbors' side of the stream. One day when I was about 11 years old I came home from school and it had been cut down. Twenty-six years later there is still a wound in the sky.*

This is strong stuff, and the answer has stayed in my head in the years since that study. It would be a mistake to use this quote alone to argue for the importance of trees to children if there were not more evidence to support this idea—although in fact there were. But let us

[3] *Ian Dey (1993) uses this word to denote a bit of qualitative data. Highly contextual in meaning, a databit may be a word, phrase, photograph, or other piece of qualitative data.*

suppose there had not been additional supporting data. How do we handle this databit? Leave it aside altogether? No. In fact, this quote led me to look at the type of language the respondents used, and I found a high degree of poetic, aesthetic language (trees weren't described in cubic feet, but as giants; or the sky isn't blue, it's wounded). This proved to be one of the most intriguing results of this study.

How N4 Can Help

N4 can help researchers walk the fine line between overweighting dramatic data and following up interesting ideas prompted by these dramatic databits. N4 can produce a report indicating each answer to a given interview question, allowing a quick glance to reveal that only one respondent felt a certain way, even if they expressed themselves quite dramatically. N4 can also give data about the number of databits coded in any given category or set of categories. Seeing the full set of data facilitates looking beyond the dramatic evidence. At the same time, N4 allows the researcher to follow up the insights that may come from these dramatic bits of evidence, such as the use of poetic language as respondents talk about trees. The text and index search functions are particularly helpful in this regard, as is the ability to move easily between nodes and documents. These functions facilitate looking at the data from many angles.

Issue: Linking the Data to Conclusions and Theory

Another tactic on which there is near unanimity among researchers is the need to link data to conclusions. This seems obvious, because linking data to conclusions is a fundamental description of applied (if not all) research. But, unfortunately, I can readily think of articles based on field research where this has not been done. Scholars also suggest giving enough detail to "let the readers see for themselves" (Wolcott 1994, p. 350). Using sufficient quotes or other evidence from interviews is one approach to this concern, but the researcher's thought process must also be clear. Quotes alone do not link data, conclusions, and theory.

How N4 Can Help

N4 can help in several ways to ensure that conclusions are linked to the data. The memo function allows databits and researcher thoughts to be stored together for further reflection and analyses. For example, I have a code for community. I searched the interview texts for the word "community" and then read through this, noting how the word was used and who used it. This has led to two ideas, both of which are at least somewhat supported by the data: organizers tend to use the word "community" more often than other respondents, and "community" often means something like a group of people "pulling together." These ideas are explicated in the memo for "community," along with the text units supporting them. In this way, I am connecting conclusions with the data.

Some users of N4 use the software for their literature reviews as well, providing another opportunity to link data and theory. Data supporting or refuting a theoretical point can be coded to the same node as the literature citation. In a text or node search, both the theory and the data will be retrieved, allowing further analysis and a tight linking of theory, data, and conclusions. In my example above, I might code definitions of community from the scholarly literature with the definition of community emerging from my interview data, thereby linking data, conclusions, and theory.

Issue: Conducting Coding Checks

Like data cleaning in a quantitative study, it is important to check the coding in a qualitative study. This is important in studies with a solo researcher as well as in team research projects. In the case of a solo effort, intracoder reliability checks are a useful tool. In intracoder checks, the solo researcher codes raw data again, compares the first and second coding, and looks for a high level of agreement between the two coding passes. For team projects, intercoder checks are critical. In intercoder reliability checks, members of the team code the same data with the same coding scheme, again checking for a high level of agreement between the members. In either case, a low level of agreement requires a review of the coding procedures and code definitions, recoding of the data, and repeat coding checks. As in quantitative studies, what counts as "high" or "low" levels of agreement varies.

How N4 Can Help

N4 has several tools that help keep coding consistent, as well as reports that assist in

carrying out coding checks. Using the memos and node definitions, a researcher can specify the way certain codes are meant to be applied to the data. This helps to maintain accuracy during the coding process itself. I use memos extensively as I code data to record my thoughts of what fits in each coding category and why. When I have largely completed my preliminary analyses and coding, I codify the definitions before conducting intracoder checks. I then use N4's reports to compare which databits are coded to a particular code.

Issue: Creating Audit Trails and Conducting Audits

Audits and creating audit trails are trustworthiness tactics that are used less often by researchers. Like maintaining clear records that support your income tax deductions in case the IRS appears at your door, in a research audit trail you keep careful records of the process leading to your deductions from the data. And, like your tax records, it is not always easy (or fun!) to create an audit trail.

Lincoln and Guba advocate audits and creating audit trails (Lincoln and Guba 1985). Huberman and Miles also support the idea of audits, and point out that those audits that have been done, although few, have been helpful (Huberman and Miles 1994, p. 439). They suggest that due to time and cost constraints, audits may be limited to high-stakes studies (Huberman and Miles 1994, p. 440).

How N4 Can Help

N4 can do much of the work of creating an audit trail. Command files, memos documenting developing ideas and coding, archived copies of index trees (i.e., the coding structure and search results) all track the development of the project and allow a researcher or auditor to trace the process and thinking involved. For example: developing the index tree is a part of the analysis process. In my current research on the social benefits of urban greening, I am on my fourth major iteration and I expect at least one more major re-working of my index tree before I am finished. My first index trees were as nebulous as my thinking about the data. As ideas took shape, so too did the coding structure. In N4 when a node is moved from one location in the index tree to another, the program automatically notes this in the node memo, allowing a researcher to trace the movement of a concept as the analysis progresses. For instance, say my "neighborhood" text search results do show a clique was formed. I might move these data from the text search section to a "social interactions" part of the index tree. Archiving copies of the index tree allows a researcher to trace the development of the analysis. This sort of information is useful in an audit, as well as in further refining of analyses and conclusions.

Issue: Detailed Reporting

Detailed reporting is critical to any research, but is perhaps even more important in qualitative studies. Miles and Huberman suggest that detail in methods reporting has been lacking in qualitative studies and is also critical to "judging the goodness of conclusions" (Miles and Huberman 1994, p. 281). Because many scientific disciplines have a standard body of validity and reliability tools for quantitative work, it is easier to report in a kind of shorthand that needs little, if any, explanation. Qualitative work does not have this yet, and given the diversity of methods and approaches, it may never have it.

How N4 Can Help

Using the memo function in N4, archiving index trees, saving command files—in other words, using your audit trail—also helps in reporting fully and accurately the findings and conclusions drawn from a qualitative study. From these materials, the researcher can explain in clear detail the development of ideas, the coding methods employed, the queries made of the data, and other important methodological information. Reporting in detail also requires reporting on other tactics such as the search for negative evidence, as discussed above. Additionally, reporting in detail requires intimate familiarity with the data. N4 supports many different ways of looking at and analyzing the data, from up close to big-picture. This, in turn, supports the level of intimacy needed to present ideas and conclusions clearly and in detail.

CONCLUSIONS

The papers in this volume demonstrate that research using qualitative text analysis can provide valuable insight and policy guidelines for natural resource managers, from understanding the issue-driven nature of public

opinion about resource management to including sense of place in opportunity area planning. But for the information from these types of projects to be used, the conclusions must be perceived to be of high quality and rigor—they must be trusted. Increasing the trustworthiness of results and conclusions in qualitative research can be greatly assisted by computer packages like N4, helping researchers go deeper into their data, allowing them to easily trace the development of ideas and constructs, facilitating the reporting process, and facilitating the search for negating evidence.

It is important to recognize that no software packages for analyzing text data will do the analysis for you. But they can increase the trustworthiness of the results, and thereby help managers and policymakers see the usefulness of text-based analyses in solving their everyday problems.

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Manuscript approved for publication March 8, 2000
2000

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David N. Bengston
Technical Editor

Bengston, David N.
2000. **Applications of computer-aided text analysis in natural resources**. Gen. Tech. Rep. NC-211. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 54 p.

Ten contributed papers describe the use of a variety of approaches to computer-aided text analysis and their application to a wide range of research questions related to natural resources and the environment. Taken together, these papers paint a picture of a growing and vital area of research on the human dimensions of natural resource management.

KEY WORDS: Computer-aided, computer-coded, content analysis, human dimensions, text analysis, textual data.