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ICT and the Research Process: Issues Around the Compatibility of Technology with Qualitative Data Analysis

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Abstract: This paper explores the nature of qualitative data and the uneasy relationship it holds with computer-aided analysis. Qualitative research produces data that are rich and voluminous, shedding light on the lived experience of the "being-in-the-world" and the interactions inherent in complex social phenomena. Analysis of such data, however, is complex and time consuming in addition to which there is a lack of specific guidance on how to carry it out. The authors note that the philosophy underpinning information and communication technology (ICT) is not wholly compatible with that which underpins qualitative research. ICT is based largely on logical, objective and quantifiable procedures whereas qualitative research requires a more subjective, interpretative stance and seeks to explore meaning. On this understanding of the philosophies involved it is argued that the role of computer software in qualitative data analysis is limited.

It is accepted that the mechanistic tasks of qualitative data analysis, for example, organising, storing, reproducing and retrieving data, can be undertaken more efficiently and systematically using ICT than manually. It is the creative and interpretive stages of qualitative data analysis, requiring human reflection and understanding, which are most difficult to reconcile with the application of ICT.

The paper also discusses in some detail the use of NVivo software which supports the searching and coding of qualitative data and also has facilities for theory development and exploration.

Table of Contents

1. Introduction

It has long been the custom to make use of new technological developments in easing the burden of complex or routine tasks. This is as true for research as it is for any other aspect of human activity. Thus one finds, for example, that over the years typewriters, word processors and computers generally have come to be adopted as part of the essential hardware of research. [1]

By and large this is a process to be welcomed. If a labour or time saving technological artefact is available then there seems little to be gained by eschewing its use. Nevertheless, in the field of qualitative research, which for the

purposes of this paper we are taking to mean research utilising linguistic data derived from interviews or similar conversational settings, there are areas, we feel, where the untrammelled use of computer technology, specifically qualitative data analysis software, may do little to enhance the quality and value of the findings they produce. [2]

In elaborating on this position we consider the philosophical foundations that underpin the practice of qualitative research. These, we argue, make use of a worldview that is contrary to the philosophical orientation of the positivistic science that has helped develop computer technology. Qualitative research aims to uncover meanings as they are apparent to an individual respondent; quantitative research relies on aggregation, quantification and categorisation as an adequate method to arrive at a scientific truth. In quantitative research there is a congruence between the underlying philosophies of the research and its analysis and the computer technology employed to assist with this. For example, statistical analysis in quantitative research has become a fast and routine process with many different pieces of software available to support this. [3]

Software packages are now available to assist with the analysis of qualitative data which on the surface promise the same routinisation and speed benefits for the user as those available for quantitative analysis. Our argument is that qualitative data are derived from language and allow for the detailed exploration of feelings, drives, emotions and the subjective understanding a respondent had of a certain social situation at a particular point in time. They are indexical and context bound. The data are fuzzy, with slippery boundaries between meanings, and not ideally suited to categorisation and classification using digitally based software. Employing a digital tool of this type on qualitative data has the potential to distort any understanding arrived at. [4]

2. The Philosophy of Qualitative Data

There are fundamental differences between the philosophies which on the one hand underpin information and communication technology (ICT) and on the other the philosophical thinking behind qualitative research. Computing technology assumes a positivistic approach to the natural world that sees it as being composed of objects that humans can study, understand and manipulate. It is a view that finds acceptance amongst quantitative researchers. Within sociology, generally, this positivistic orientation encompasses the idea that everything in society is amenable to being numbered, counted, measured or otherwise quantified (SPENCER 1971; SWINGEWOOD 1991) and that there is a particular process (copied largely from the natural sciences) that allows true understanding to be arrived at. When looked at from this perspective, society comes to be seen as something external to the people who inhabit it and who in turn find their behaviour controlled and influenced by it (LAYDER 1994). Human behaviour, the complex patterns of social interaction, then becomes a reflection of the macro level structure. All observed phenomena, when aggregated together and quantified, can be related back to the macro structure for analysis and understanding. [5]

Qualitative research, and qualitative researchers, approach the world from a different perspective and set of understandings from quantitative researchers. Qualitative research is largely rooted in an understanding of the social world that sees human action as being the force that creates what we perceive to be society (STREUBERT & CARPENTER 1995); it is grounded in a humanist, phenomenological understanding of social action. The humanistic approach, common to much qualitative research, gives primacy to action over structure (LAYDER 1994). It becomes the goal of qualitative researchers therefore to try and see things from the perspective of the human actors. This is in direct contrast to the thinking of the positivistic schools where the external society is seen to shape human action. [6]

Generally, in qualitative research there is less acceptance of the argument that it is the existence of an objectified society that constrains, shapes and governs how people think and act. Because of this reduced emphasis on structure good understanding of the social world is not going to be achieved through the objective classifying and quantifying of observed phenomena; understanding social phenomena can only be achieved by accessing the meaning as it existed for the participants (PARKIN 1982; MORSE 1989; HOLLOWAY & WHEELER 1996). This is not necessarily to say that there is some kind of absolute prohibition on using qualitative methods if one takes the view that an external society is responsible for patterning and constraining actions and human behaviour. It is more that there is for those undertaking research an elective affinity between the adoption of a perspective on the location of the causal forces in society and the research paradigm to be employed in investigating them. For researchers of a phenomenological bent it follows more naturally to incline to qualitative research methods because of their focus on the individual. One consequence of this phenomenological approach is a greater sensitivity on the part of qualitative researchers to the ambiguities and subtle shades of interpretative meaning that social interaction can have for its participants (HOLLOWAY & WHEELER 1996). There is a recognition of the richness and complexity in human social interaction and an acceptance that this may not be amenable to quantification. [7]

A qualitative approach may be used when little is known about a subject and the researcher may have few pre-conceived ideas about the subject or about the data which will be gained. The aim is more likely to be inductive (that is, moving towards theory) rather than testing theory. [8]

Within the qualitative approach to social research and evaluation there are many different methods of collecting data resulting in many different types of qualitative data. With the focus on the lived experience of the individual, qualitative approaches are most suitable when the aim of the research is to understand and explore people's views, beliefs and experiences. To address such an aim, data are primarily linguistic; they may be textual or audiovisual and can be derived from, for example, interviews, observation, documents, diaries, field notes, which in turn may come from both primary and secondary sources. Interviews, of different levels of structure, are widely used methods and it is interview data and

its analysis that this paper addresses. The discussion also has application to the more in-depth and less structured approaches of narrative and (audio) conversation analysis. Indeed, narrative and conversation analyses are approaches which illustrate the inductive, interpretive nature of qualitative data. [9]

The importance to qualitative research of what Mead called the "significant symbol" (CRAIB 1984, p.73), or language, cannot be overstated. Human languages are complex yet at the same time flexible, being capable of describing and representing a vast range of social situations and responses (GADAMER 1989; MACANN 1993). It is language that gives humans the experience of their "being-in-the-world" (GADAMER 1976, p.3). Yet the complexity and ambiguity of language is not given full recognition in quantitative research. There language is used uncritically, for example, on questionnaires, without thinking deeply about what it is or how it works or how it allows the world to be constituted and made use of (GADAMER 1976). So although both quantitative and qualitative researchers use data that are language based, for the quantitative researcher the use of language is not in itself a problem or something that needs to be questioned. Quantitative researchers, arguably, tend to view language as a tool that can, with appropriate safeguards, be called upon to do a particular job in the same predictable and reliable way that a computer program might calculate a statistical measure. [10]

It is important for qualitative researchers to keep interview data in the context in which it was gathered and to preserve the respondents' use of their own language to protect, as far as possible, the original meaning expressed through the data. [11]

3. Qualitative Data Analysis

The characteristics and heterogeneity of qualitative data translate into challenges in analysis (LEE & FIELDING 1991; POLIT & HUNGLER 1991; RICHARDS & RICHARDS 1998) particularly when viewed in stark contrast to the structured, numerical nature of quantitative data. That there are differing ontological and epistemological assumptions between qualitative and quantitative research does have profound implications for data analysis. [12]

Quantitative data can be subjected to statistical analysis (contingent upon adequate knowledge of which tests to perform and how to interpret the results) and clearly displayed in tabular or graphical form to address pre-determined hypotheses. Contrast this with qualitative data analysis which is essentially although not entirely a hermeneutic enterprise, attempting to interpret the expressed experiences, views and beliefs of people in social situations and then making that interpretation available to the research community. For both quantitative and qualitative researchers it is important that the manner and techniques of analysis do not, to a greater extent than can be avoided, distort or corrupt the data. Although not addressed here, it is acknowledged that both qualitative and quantitative data can be collected in a single study. [13]

One particular analytical challenge in qualitative research which involves the spoken word is posed by the centrality of language, its meaning and context. Making sense of a speech utterance is more than just effecting a mental translation of the words. In much of everyday social interaction and the speech that it generates there is a high degree of indexicality (LAYDER 1994, p.83), that is, a determination of the meaning given to speech utterances by the context in which they are uttered (GADAMER 1976; HOLLOWAY & WHEELER 1996). For a speech utterance to retain the meaning that it had at the time it was uttered (assuming that it is possible to ascribe a single meaning to a piece of speech with any degree of absolute certainty) then it must be seen in the context of the surrounding speech and comments (and ideally the body language and non-verbal communication as well). Attempting to make sense of an utterance in isolation, without seeing it as part of a wider whole, will be to lose an essential part of its meaning. [14]

Whilst there is a multitude of data collection methods and sources of qualitative data, the focus here on the management and analysis of qualitative interview data can be simplified to a number of common activities and processes. A further key feature of qualitative research and evaluation is that rather than preceding analysis, data collection is concurrent and interactive with data management and analysis (STRAUSS & CORBIN 1990; MILES & HUBERMAN 1994; BERG 2001). As such the generic activities and processes, summarised as follows, are not necessarily undertaken in a "linear" fashion.

- It is a reflective process with the researcher recording analytical notes and "memos" (STRAUSS 1987; TESCH 1990; MILES & HUBERMAN 1994).
- Categories (themes) are derived from the data (BOULTON & HAMMERSLEY 1996; RICHARDS & RICHARDS 1998).
- Units of data are coded and annotated (STRAUSS 1987; STRAUSS & CORBIN 1990).
- The data coded are compared and contrasted (GLASER & STRAUSS 1967; STRAUSS & CORBIN 1990).
- Associations and patterns are identified and explored between categories (TESCH 1990; DEY 1993).
- The aim is a higher level synthesis (TESCH, 1990) perhaps moving towards theory generation and testing (MILES & HUBERMAN 1994). [15]

These activities fit most accurately with the elements of grounded theory (GLASER & STRAUSS 1967) or theory building approaches to qualitative data analysis (MILES and HUBERMAN 1994) with some application to content analysis (CAVANAGH 1997; BERG 2001). [16]

Whilst these common activities can be identified, qualitative data analysis is not prescriptive and precise details of how they are executed, for example, how to define categories and code data, identify relationships and explore theory, cannot be specified. This is largely due to the variety of types of qualitative data and

methods of data collection as well as the understanding that categories, and possibly hypotheses or theories, emerge from the data rather than being imposed upon it and that interpretation and creativity are required from the researcher. [17]

The stark contrast between a purely quantitative and a purely qualitative approach illustrates the different approaches to collecting and analysing data. A study which required the use of solely quantitative data could proceed in a more linear fashion and, although exploratory data analysis may take place before data collection is complete, any findings or reflections would not feed into data collection (STRAUSS 1987). Quantitative research, especially the questionnaire survey, is often likely to be deductive as opposed to inductive in approach and be focused on testing one or more pre-set hypotheses although this is obviously not always the case. Nevertheless, even when the research is not a typical example of the positivistic or experimental, quantitative ideal, it still contains a high degree of pre-determined structure. For example, the areas to be explored during analysis will already have been determined and the main variables for analysis are defined through the questions. [18]

HUBERMAN and MILES (1998, p.180) define (qualitative) data management as "the operations needed for a systematic, coherent process of data collection, storage and retrieval" necessary to enable the researcher to keep track of the volume of data, to flexibly access and use the data and to document the analytical process. Data analysis can be defined as consisting of three concurrent elements: data reduction, data display and conclusion drawing and verification (HUBERMAN & MILES 1998). [19]

The non-linear nature of data collection, management and report writing in the qualitative tradition mean that all stages of a qualitative research project link into the exploration and interpretation of the data (WEITZMAN & MILES 1995). [20]

4. Computers in Qualitative Data Analysis

The first and foremost point to make about the use of computers in qualitative analysis is that computers do not and cannot analyse qualitative data. The fact that we have seen a development of computer-aided qualitative data analysis software (CAQDAS) should not be surprising given the widespread development and accessibility of ICT. However the use of ICT for the analysis of qualitative data remains a contentious issue and one which has not been universally and unquestioningly embraced (LEE & FIELDING 1991; MORISON & MOIR 1998). Computer techniques of logic and precise rules are not compatible with the unstructured, ambiguous nature of qualitative data and so it may distort or weaken data (BECKER 1993; KELLE 1995; RICHARDS & RICHARDS 1998) or stifle creativity. The nature of qualitative research in terms of the volume and complexity of unstructured data and the way in which findings and theory emerge from the data also makes software packages, developed to manage and analyse such data, difficult to become familiar with and use adequately. [21]

The argument here is that it is not realistic, nor true to the purpose of qualitative research, to expect a social phenomenon, described in language by the participants themselves, to be broken up, quantified and analysed in a meaningful way by a tool based on a positivistic orientation to the social and natural worlds. Of course, quantifying, categorising, and breaking up the data is possible and is a legitimate part of the analysis process at least insofar as some general high level sorting is concerned. The issue is more the extent to which the researcher is going to lose or distort the meaning that the social phenomenon had by attempting the interpretative process in the same way. [22]

Computer technology and programs are, we would argue, philosophically suited to analysing inanimate objects and matter, but not social phenomena expressed through the medium of language and uncovered by qualitative research techniques. If one takes technological artefacts, such as computers and computer programs, and then applies them to research and data analysis, this grounding in a positivistic philosophical background is going to fit them to certain tasks more than others. For research activities where measuring and counting are deemed to be essential to the analysis, as in quantitative research (itself an expression of a positivistic orientation to the social world), a device that can assist with that activity is going to be well matched. [23]

It would be foolish and almost Luddite to argue that in the 21st century computers have no part to play in the process of qualitative data analysis. However, interpreting the complex meanings that social interactions and language can have, where they are coloured into many shades of grey, is not going to be achieved by forcing the analysis into using pre-defined analytical categories. Qualitative data, i.e. the conversational/linguistic material that we are concerned with here has what could be described as almost an "analogue" feel to it inasmuch as it is, when first encountered by the researcher, essentially formless raw material. By subjecting it to a process of quantitative digitisation, to square off its shape and straighten its rounded edges through pushing it into a set of pre-defined categories it is inevitable that part of the original meaning is going to be either lost or changed. [24]

This is not to say of course that an analytical approach that is not based on computers is going to leave the data in pristine condition and uncontaminated by the analyst. Any act of analysis is going to be influenced by the distance that a text stands from the original speaker or writer (GADAMER 1976). But, an approach that is not dependent on a digital logic system is going to be more sympathetic, to be more accepting of the quirks and inconsistencies inherent in any human social behaviour than one which is based on digital logic. To that extent an understanding that could present the lived experience of "the-being-in-the-world" would be better achieved without the intervention of a computer. [25]

The argument here is that ICT has definite application with many of the routine or mechanical tasks of qualitative research. However there remain difficulties and reservations regarding its widespread application in the stages of analysis which require understanding such as the development of themes, assigning codes to

the data and proposing and testing theoretical concepts. That is, although ICT can be of assistance in many of the data collection, management, storage and retrieval tasks, "the central analytical task in qualitative research—understanding the meaning of texts—cannot be computerized" (KELLE 1995, p.3). There are, as we have outlined, philosophical and methodological arguments against applying ICT to the analysis of qualitative data. Quantitative data analysis and the production of statistics, on the other hand, has been transformed by developments in ICT. [26]

The most widely cited advantages of CAQDAS are that time may be saved (LEE & FIELDING 1991; MOSELEY, MEAD & MURPHY 1997), the analysis of larger data sets may be possible (KELLE & LAURIE 1995; BOWLING 1997; WEBB 1999) and that claims to making qualitative data more "scientific" can be made (CONRAD & REINHARZ 1984; RICHARDS & RICHARDS 1991; KELLE & LAURIE 1995; WEBB 1999). Some authors argue that as time can be saved and management of data is less cumbersome, the researcher concentrates more on the creative and interpretative tasks (RICHARDS & RICHARDS 1991; MORISON & MOIR 1998) thus leading to more substantive analysis (MOSELEY et al. 1997) or enhanced quality analysis (CONRAD & REINHARZ 1984; TESCH 1990; LEE & FIELDING 1991). [27]

The debate surrounding the application of ICT to qualitative data analysis inevitably involves the discussion of both positive and negative effects. As stated by the developers of NUD*IST: "the computer method can have dramatic implications for the research process and outcomes, from unacceptable restrictions on analysis to unexpected opening out of possibilities" (RICHARDS & RICHARDS 1998, p.211). The argument here addresses both restriction and opportunity. [28]

Data reduction, incorporating the management, storage and cataloguing of data, can be made more efficient and more manageable by the use of ICT because of the speed and sophistication with which computer packages work. Audio taped data, hand written notes and summaries can be typed up, edited, saved in different formats and reproduced, as well as made available to relevant others, quickly and easily using word processors. For large projects, the potential volume of data and other information can be organised and managed more efficiently and conveniently (ROBSON 1993; KELLE 1995) in order to prevent "data overload" (MILES & HUBERMAN 1994). This includes enabling the researcher, for the duration of the project, to record, store and retrieve empirical data, field notes, emerging ideas, analytical memos and references whether using word processors or CAQDAS. Data overload, that is, "limitations on the amount of data that can be dealt with (too much to receive, process and remember)" (ROBSON 1993, p.374) is suggested here to be one of the deficiencies of the human as analyst which can be addressed by ICT. [29]

Whilst the mechanistic tasks or "routine elements" can be greatly supported by the use of ICT (BROWN, TAYLOR, BALDY, EDWARDS & OPPENHEIMER

1990), it is the activities which require human thought processes, interpretation, creativity and reflection which are most difficult to reconcile with ICT. [30]

Most analysis of qualitative data involves the allocation of categories or themes to sections of data, usually via coding, to enable subsequent retrieval, exploration and theory building. Adopting a purely inductive approach to data collection and analysis would mean all categories emerging from the data whilst a purely deductive approach would mean that all categories were pre-determined. The reality of categorising qualitative data is likely to be that some categories are determined before data collection ("coding down") whilst most emerge during data collection and management ("coding up") (BERG 2001). The first stages of developing categories will result in a large number with the general rule being to include rather than exclude. As the project continues, categories may be modified, merged, deleted or renamed. [31]

A crucial practice to enable themes to emerge from unstructured data, for memos to be recorded, for codes to be assigned and for patterns to be noted and explored is the researcher gaining closeness to the data (BOULTON & HAMMERSLEY 1996) by immersion in it (ABRAHAMSON 1983; HAMMERSLEY & ATKINSON 1995; STREUBERT & CARPENTER 1995). It is because the analyst is a human, with the ability to relate to other humans that the complex blending of speech forms and context can be put back together in such a way that understanding results. Immersion in the data also allows the researcher to keep the data in their original context. [32]

Word processors, like mechanised index cards, punched cards or filing systems, greatly improve and make more efficient, the traditional "cut and paste" method of coding and retrieving information. That is, once data has been thoroughly coded manually by the researcher, the word processor cut and paste functions can be used to create separate files for all data coded according to each category. Memos and notes can also be added as appropriate. This allows all data relevant to each code to be printed and examined or even pasted into published output. It is also possible to use in-built word processor facilities to "find", "edit", "go to" for searching data for coding (MILES & HUBERMAN 1994; WEITZMAN & MILES 1995; COOMBES 2001) at a very basic level. [33]

Using simple cutting and pasting does however pose a methodological problem for qualitative researchers in that the text is removed from its context (KELLE 1995) and different word processor files must be accessed to view the full data. [34]

These basic functions supported by word processing packages will be sufficient for those qualitative researchers whose data set is small or whose research or evaluation simply requires a description or overview of key themes from the data. Data management, storage, assigning categories and recording memos can equally all be undertaken using CAQDAS (WEITZMAN & MILES 1995). [35]

Automated coding can be undertaken by CAQDAS in a much more advanced and flexible way by using string searches. NUD*IST and NUD*IST Vivo (NVivo)

permit the inclusion and exclusion of data in searches (GAHAN & HANNIBAL 1998; RICHARDS 1999; BAZELEY & RICHARDS 2000; GIBBS 2002) for example according to descriptive data or coding already assigned to the data set. Text searches with different levels of specificity can be performed, wild cards (*) or searching for words with similar meaning or usage can be used to introduce flexibility, whilst Boolean searches ("and", "or", "not") and proximity searches (to find text near other text) allow more sophisticated and precise searching. It has been argued that new codes are easier to include when using ICT as the process is less time consuming and automated searches are easy to perform. [36]

Maintaining the richness and in depth understanding and meaning of data in its original context are key features of qualitative research. It is acknowledged that results of searches can only be as good as the commands entered but real concerns exist around the true meanings of words and phrases and their being missed or coded incorrectly and the richness of experience and explanation being lost or taken out of context. This is largely because automated searching can only be based on lexical as opposed to semantic analysis of text (MOSELEY et al. 1997). Caution must be exercised around words having more than one meaning for example as a noun and verb as in "nurse" or "train" and each find must be checked for relevance before assignment to a category. [37]

NVivo has the advantage over word processors in that it allows the researcher to easily view any coded data in its original context as well as alongside other data or memos coded in the same way. All data retrieved following coding contains an identifier of the original data source and retains links with the original data documents. In addition CAQDAS allow the modification of categories and coding (GAHAN & HANNIBAL 1998) much more easily than word processors and allow the list of categories to be readily viewed. [38]

The argument here is that automated searching facilities using ICT should only be used to support, rather than replace manual handling, reading and re-reading and gaining familiarity with the data which is the essence of qualitative data analysis. Reading data on screen and not handling whole parts of the data set can be argued to distance (MORISON & MOIR 1998) or alienate (WEBB 1999) the researcher from their data. CAQDAS searching also risks overly mechanising the process and marginalising the reflection of the researcher (MORISON & MOIR 1998) thereby encouraging prescriptive analytical methods which inhibit interpretation and creativity (DEY 1993). [39]

The centrality of coding to subsequent stages of analysis requires the thorough and accurate categorisation of all appropriate data. Getting to know the data thoroughly and coding according to human understanding are key elements of this process. Automated searching will not take the place of additional searches and checking undertaken by another member of the research team. [40]

The early CAQDAS concentrated on facilities to code text and search for occurrences of these codes (WEBB 1999) or to code and retrieve data (KELLE 1995). It is the subsequent stages of analysis, such as exploring patterns

between categories and moving towards theory development, which underlie the true complexity and richness of qualitative data and one of the purposes of employing a qualitative approach. The aim is to interpret and draw meaning from the data. [41]

Developments over the last decade in CAQDAS have seen these higher level functions also incorporated (WEITZMAN & MILES 1995; RICHARDS & RICHARDS 1998) to support the creative and interpretative activity of the researcher. Some advantages can be realised by CAQDAS but, as with searches for coding, the nature of language and the importance of context warn against over reliance on ICT. Familiarity with and closeness to the data are crucial for this higher level analysis and the same concerns exist around ICT distancing the researcher from the data and analysis becoming overly mechanised and prescriptive. [42]

For qualitative researchers, a common activity as categories are identified and codes are assigned is for emerging patterns and relationships to be displayed graphically for example using tables, matrices or diagrams (STRAUSS & CORBIN 1990). That is, data are presented "as an organised, compressed assembly of information that permits conclusion drawing and/or action taking" (HUBERMAN & MILES 1998, p.180) which may enable a new perspective on the emerging data. Displaying data in this manner may subsequently lead to further data collection or additional exploration of the data. [43]

In the case of NVivo the software writers have opted for a hierarchical "tree" structure which displays the categories used for coding (RICHARDS 1999); a display which must be manipulated and explored to move towards theorising. The tree is modified by the researcher as analysis proceeds and it can function as a summary of the coding structure. Ways in which NUD*IST and NVivo can assist with theorising include exploring and testing the inter-relationships between categories through "index searching" (WEITZMAN & MILES 1995; GAHAN & HANNIBAL 1998). Patterns, associations and relationships can be suggested and explored in this way by using for example contextual (such as "followed by" or "near") or collation operators (such as "less", "overlap" or "union"). Such facilities however share similarities with the analysis of quantitative data with the emphasis on variables and causality which go against the purpose and value of qualitative research. [44]

NVivo can suggest areas for further exploration in this way, which may otherwise have been overlooked, but the researcher risks losing contact with the context and meaning of raw data by too much data manipulation by computer. The main concern is that the researcher may not return to the original data with an open and questioning mind, or return as frequently as they may have done, were they not using CAQDAS. [45]

The restriction and opportunity posed to qualitative data analysis by ICT is apparent from this discussion. Qualitative data analysis is distinct from all other

stages of the research process (both quantitative and qualitative) in that ICT also represents a restriction rather than just an opening of opportunity. [46]

At all stages qualitative data can be organised, managed and manipulated effectively using ICT for example, storing and retrieving coded data and systematically searching patterns between categories. However, the emphasis on coding and the ease with which it can be undertaken pose a threat to the richness of qualitative data and the nuances of language and meaning. Coding data manually before using CAQDAS gains the advantage of applying human understanding to the raw data coupled with the efficiency of computer storage and retrieval. The problem with computer aided coding, the ease and simplicity with which it can be undertaken, is the opportunities and temptations it offers to create more and more codes, more discrete categories into which elements of the data are to be forced, without necessarily retaining sight of the larger whole. Creating and applying codes is not the same as analysis and indeed may only serve to break up and segment the data, fracturing the meaning that the integrated whole would have had. NVivo can also encourage and enable more complex manipulation and retrieval of data than is likely to be possible manually. Again, this is only the case once data has been thoroughly coded manually. However, it cannot give meaning to the data and is no substitute for gaining full familiarity with the data and for the researcher to adopt a questioning and exploratory approach. [47]

Extending possibilities, for example around larger data sets and more coding, should perhaps not be welcomed unquestioningly. The aim and purposes of the research must be the primary focus and the guide in data collection and analysis. [48]

5. Conclusion

This paper has explored the applicability of ICT based analytical tools in qualitative research. It has been argued that given the philosophical differences between qualitative researchers and the science that develops these technologies this is not necessarily to the benefit of qualitative research. While there are some elements of the qualitative research process that can benefit from computer assistance the process of data analysis could be harmed by reliance on software packages. Such are the differences in the philosophies, we have argued, that the original meaning inherent in the data could be distorted or lost. The employment of computer programs in qualitative data analysis is a practice that should be viewed with caution. [49]

Analysing qualitative material that is based on speech or texts derived from interviews and conversations must have regard for the context and the integrated whole. Computer based systems to aid with analysis are, we would argue, based on the natural scientific view of the world that sees social phenomena as reflections of the higher level ordering of an objective social structure. The ideal data type here is one which is amenable to quantifying and segmentation into discrete categories as this allows for numerical manipulation and analysis. It is a

worldview that is not, we feel, sympathetic to the types of qualitative data that we are discussing here. [50]

Speech derived data is rich data in the sense that it can encompass many meanings and requires careful reading with regard to the whole from which it is taken. CAQDAS packages possess features that reflect their quantitative and positivistic heritage, particularly their facilities for creating and adding coding categories. Over-reliance on these features could lead to a fracturing of the data whole and a loss of meaning. [51]

Researchers who make use of these packages must remain alert to the need to preserve the integrity and context of the original material and not lose sight of this during the process of coding and subsequent analysis. [52]

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