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Chapter X: Qualitative Methodology

1 Introduction

Qualitative methodology is increasingly used to lead and support Ergonomics and Human Factors (E/HF) studies in a range of contexts. This chapter provides an insight into the practical use of qualitative methodology in E/HF and outlines the theory and principles which underpin the use of such methodologies. We present an overview of the main qualitative approaches and provide guidance on undertaking a qualitative project; to support this we describe the use of thematic analysis, including examples of computer-aided analysis, discuss validity, reliability and critical appraisal in relation to research design and analysis and introduce a qualitative data management software package (NVivo).

A review of the use of qualitative methodologies in E/HF (Hignett, 2001) found early examples of methodological exploration including Exploratory Sequential Data Analysis (ESDA, Sanderson and Fisher, 1997:1472). ESDA was described as *'any empirical undertaking seeking to analyse systems, environmental and/or behavioural data (usually recorded) in which the sequential integrity of events has been preserved'* and was used as an umbrella term to group established techniques rather than proposing new ones. Sanderson and Fisher suggested three E/HF traditions supporting the exploration of qualitative methodologies (ESDA): (1) the behavioural tradition using directly observable laboratory-based experimentation, (2) the cognitive tradition to model indirectly observed or symbolic behaviour, for example in human computer interaction, and (3) the social or naturalistic tradition of social sciences as a more recent development.

The use of qualitative methodologies in E/HF has increased considerably since this chapter was first written in 2005, for example in inclusive design (Fisk et al, 2009), participatory ergonomics (Dixon and Theberge, 2011), organisational ergonomics (Berlin, 2011) and workplace analysis (Lundh et al, 2011). This reflects the maturation of the qualitative – quantitative debate and the appreciation of alternative epistemological (ways of knowing) perspectives giving new and critical insights for accepted practices (Symon and Cassell, 2004).

One worrying trend has been the use of qualitative methodologies without a clear statement (and understanding) of the underpinning philosophy. Although projects can be carried out to a satisfactory level without reference to the relevant theory (ontology and epistemology) this can lead to problems with the quality of the project. Silverman (2006) views this as a failure in analysis with, for example, an emphasis on the exploration of a problem and very limited testing of the findings (explanation) or proof that contrary evidence has been sought. This will be further discussed in sections X.4 and X.5 to set out both a generic process for qualitative projects and mechanisms to ensure that reliability and validity are considered and addressed.

2 What is Qualitative Methodology?

Qualitative research is concerned with the understanding of meaning. Qualitative researchers are interested in how people make sense of their world and how they interpret and experience different events.

The key points in defining qualitative methodology are (Hignett, 2001, Robson, 2011):

- **Non-numerical.** A consistency in representing the world in terms of words and pictures rather than numbers. There is little or no use of numerical data or statistical analysis in qualitative research.
- **Scale.** Focuses on a few cases with many variables. Qualitative studies tend to follow an idiographic mode of inquiry by focussing on the individual rather than groups (nomothetic)
- **Sampling strategy** develops during the study (not pre-assigned) driven by an inductive logic as theoretical concepts and ideas emerge.
- **Iterative data collection and analysis.** The details of the procedure are not fixed in advance (flexible design) and the focus is liable to change during the study.
- **Context.** Situations are described from the perspective of participants to understand phenomena in context (natural settings).
- **Influence of the researcher.** Recognising the important of the values of the researcher by reflecting on their interaction before and during the project. Objectivity is not valued as it may distance the researcher from the participants.

3 A Brief Philosophy for Qualitative Methodology

In order to fully understand and engage with the rest of this chapter it is necessary to introduce and define some important key concepts related to scientific research.

Ontology: The nature of our world and what we believe exists for us to know.

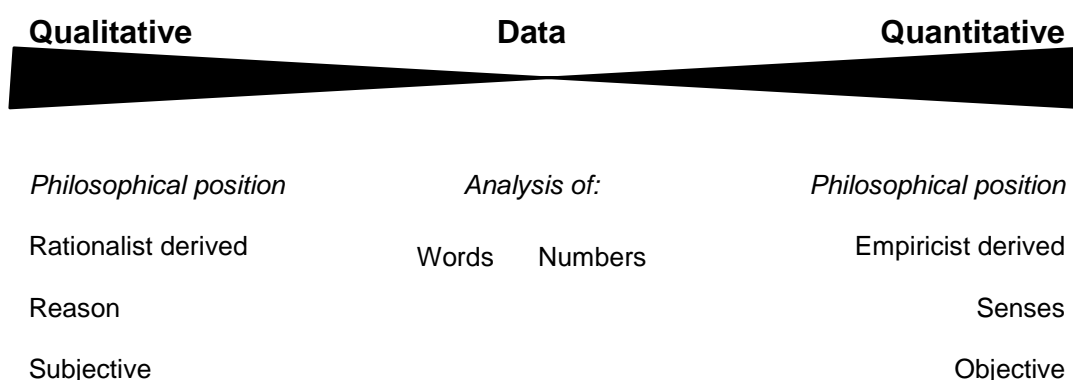
Epistemology: The branch of philosophy which studies knowledge and is concerned with how and what can we know.

Methodology: A general approach to studying research topics; ‘method’ refers to a

specific research technique (Silverman, 2006).

In the philosophy of science there are two extreme poles (rationalism and empiricism) (Fig. X.1). A rationalist has the belief that reason is the primary source of knowledge, with certain innate ideas that exist in the mind prior to all experience. The rationalists are roughly grouped as taking a world view, or ontology, with human reason as the central tenet. In contrast an empiricist believes that there is absolutely nothing in the mind that is not experienced through the senses. This dichotomy can be traced back to Ancient Greek philosophy where the mind (reason, rationalism, subjectivism) was contrasted to matter (senses, empiricism, objectivism) (Murphy et al, 1998:15).

Figure X.1 A simple qualitative–quantitative continuum (Hignett, 2001)



Symon and Cassell (2012:18) give an example using occupational stress to describe the different ontological positions. As an objectivist concept, stress is ‘*a real phenomenon that exists and can be measured*’. In contrast, the subjectivist description is that ‘*stress does not exist in individuals. It has no real, independent status separate from the act of knowing and is it created through perceiving/knowing the social world*’.

There is an ontological realism in which the dichotomy of qualitative and quantitative

methodologies can co-exist with the '*recognition of the existence of a real, independent world which operates according to natural necessity with a corresponding position of epistemological relativism*' (Bhaskar, 1975:250). Robson (2011) describes this as the '*Pragmatic Approach*' which recognises the existence of the physical world as well as the emergent social and psychological world. He describes knowledge as '*being both constructed and based on the reality of the world experienced and lived in...[with]...current truth, meaning and knowledge as tentative and as changing over time*' (Robson, 2011:29). This allows different (even conflicting) perspectives to be included and described as part of the research analysis and interpretation.

Methodology refers to the choices made about the problem definition (topic) and methods (techniques) of data collection and analysis (table X.1). It is used as an umbrella term to indicate the theory and account of how research is, or should be, carried out. Mixing methodologies is very different to mixing methods as methodologies reflect their underlying philosophy, for example discourse analysis and thematic analysis. In order to use mixed methods it is better to use a methodology which supports a middle ground ontology, for example realism (pragmatic approach). Table X.1 offers a list (not exhaustive or mutually exclusive) and description of different qualitative methodologies that E/HF researchers/practitioners may consider applying.

Table X.1 Qualitative Methodologies (Chenitz and Swanson, 1986; Cresswell, 1998; Miles and Huberman, 1994; Patton, 1990; Schwandt, 1997; Strauss and Corbin, 1990; Silverman, 2006; Robson, 2011; Symon and Cassell, 2004; Symon and Cassell, 2012; Braun and Clarke, 2006; King, 2004)

Methodology	Description
Content Analysis (Quantitative and Qualitative)	Textual analysis to compare, contrast and categorise data. Quantitative: Establish a set of categories then count the number of instances that fall into each category for statistical analysis. Qualitative: Used to understand categories and see how these are used to describe, for example working life.
Thematic Analysis	Generic approach (foundation method) to the analysis of qualitative data. Can be used as a Realist method to report experiences, meaning and the reality of participants or as a constructionist method to examine the ways in which events, realities, meanings and experiences are the effects of a range of discourses operating with in society.
Grounded Theory	Highly systematic research approach for the iterative collection and analysis of qualitative data using constant comparison and theoretical sampling until theoretical saturation is achieved.
Template Analysis	Similar to Grounded Theory but starts with an initial coding template which is verified and/or modified through data collection/analysis. The template is used to show relationships between the themes (often as a hierarchy) and stops after reading texts 3-4 times.
Ethnography	An ethnograph is a description and interpretation of a cultural or social group or system. The product of an objective knowledge based on personal interaction and subjective experience.
Phenomenology	Description of the experience of everyday life as it is internalised in the subjective consciousness of the individual. The structure and essence of the experience of a phenomenon for people.
Discourse Analysis	Analysis of the process of communication as everyday language by exploring structure, function and patterns. Discourses 'prescribe' appropriate behaviours and attributes across a range of social domains.
Conversation Analysis	Detailed analysis of audio and audio-visual recordings of naturally occurring social interaction to identify the interactional practices used by speakers to produce their own conduct and to interpret and deal with the conduct of others.

The rest of this chapter refers to thematic-type analyses, which focus on the discovery

of regularities and comprehension of meaning in data (e.g. what people think or feel), in contrast to looking at the characteristics of language as the ‘linguistic turn or rhetorical approach’ (Gomm et al, 2000:262).. Some of the qualitative methodologies in table X.1 (e.g. discourse analysis and conversation analysis) use linguistic analysis as opposed to thematic analysis.

4 Doing a Qualitative Project

This section looks at data sources, sampling, data collection, data management and data analysis. There are common (generic) processes across some stages of data collection and analysis which have been described as thematic in nature (Bannister et al, 1994; Braun and Clarke, 2006; Robson, 2011), but conclusion drawing reflects the underpinning methodological choices to interpret the findings within the context of the appropriate body of literature.

When planning a qualitative project there are basic research design decisions to be made (table X.2). The research strategy (point 4) is a key qualitative defining dimension. One way of achieving this is to use a conceptual framework to identify implicit and explicit theories and relationships. In a qualitative project this will be an on-going activity so a project diary can be useful to record memos, mind maps, reflective thoughts and iterations throughout the project. This diary can also be used as part of the audit trail in establishing reliability (see section X.X).

Table X.2. Project Design Decisions (Janesick, 1998; Silverman, 2006:15)

1. What is studied	Intellectual question, site, participants (data sources). Identify the range of solutions, devices or stratagems that can be used.
2. Under what circumstances	Access and entry to site and participants. Ethics.
3. For what duration	Time frame.
4. Research strategy	Methodology including personal position and viewpoint (conceptual framework) with respect to the research question, site and participants. Theory of scientific knowledge (philosophy) with assumptions about the nature of reality and the role of the researcher.
5. Methods	Preference for certain methods e.g. watching, questioning, listening, reading.
6. Procedural framework	A systematic sequence of procedural steps to give a good audit trail showing how data were collected and then managed with respect to the analysis.

4.1 Data Sources

Although qualitative data sources are many and varied, there are three basic types: spoken (interviews), visual (observations) and written data (documents) as shown in table X.3.

Table X.3. Qualitative Data Types

Miles and Huberman (1994)	Wolcott (1992)	Dingwall (1997)	Mason (2002)
Interviews (Spoken data)	Asking	Asking questions Researcher: researched relationship	Ontology = people's knowledge, views, understandings, interpretations, experiences and interactions are meaningful properties of the social reality which the research questions are designed to explore. Epistemology = a legitimate way to generate data on these ontological properties is to interact with people, to talk to them, to listen to them, and to gain access to their accounts and articulations. Knowledge and evidence are contextual, situational and interactional so each interview will be different, reflexive and responsive to the situation, context and interaction.
Observation (Visual data)	Watching	'Hanging out' Transactions between members	Ontology = a data collection method which sees interactions, action and behaviours, and the way people interpret these and act on them, as central. Epistemology = the knowledge, or evidence or the social world can be generated by observing, participating in, or experiencing natural or real life settings, interaction situations and so on, based on the premise that these kinds of settings, situations and interactions reveal data, and that it is possible for the researcher to be an interpreter, or knower of such data as well as an experienced, observer or participant observer.
Documentary (Written data), visual and other methods	Examining	Reading the papers	Ontology = (1) written words, texts, documents, records, objects, visual or spatial phenomena or aspects of social organisation, shape, form etc. are meaningful constituents of the social world in themselves, (2) interest in the processes by which they are produced or consumed; (3) belief that they act as some form of expression or representation of relevant elements of the social world; or (4) that aspects of the social world can be traced or read through them. Epistemology= texts, documents, written records, visual documents, visual records, objects, artefacts and phenomena, or visualisation (as a process more than a thing) can provide or count as evidence of these ontological properties.

4.2 Sampling

The sampling strategy for any research project should be defensible with respect to the appropriate relationship (or logic) of the sample and the intellectual question.

Sampling is one of the key dimensions in defining qualitative methodology. Non-probability samples are commonly used in qualitative work, whereas quantitative methodology uses probability sampling to test (or falsify) a pre-existing theory (Saunders, 2012:39).

The range of sampling strategies are grouped into similar logics (table X.4) for:

- Spreading the net.
- Following up leads.
- Focusing.
- Analysis.

It is usually necessary to use more than one sampling logic during a qualitative project (Sandelowski et al, 1992). The sampling strategy will develop during the project, so might start by spreading the net, and then go on to following up leads or focussing on a specific characteristic and conclude with some form of analysis sampling.

The size of sample for qualitative studies is ambiguous and dependent on the question being investigated, theoretical saturation and credibility (Saunders, 2012:44). Some authors have suggested minimum sizes for non-probability samples as 5-25 (interviews, Kvale and Brinkman, 2009), 20-35 (Grounded Theory, Cresswell, 1998), 20-30 (Template Analysis, King, 2012) and 4-12 for a homogeneous population or 12-30 for a heterogeneous population (Kuzel, 1992).

Table X.4 Sampling Strategies (developed from Patton (1990:182), Miles and Huberman, 1994; Kuzel, 1992; Coyne, 1997; Strauss and Corbin, 1990, Glaser, 1978; Yin, 1991; Saunders, 2012).

Sampling	Purpose
<i>Spreading the net</i>	
Purposive	Maximum variation/open sampling. Picking a wide range of variation on dimensions of interest (time, location, events, people) to provide the greatest opportunity to gather the most relevant heterogeneous data about the phenomenon.
Mixed purposeful	Triangulation, flexibility, meets multiple interests and needs.
Convenience (haphazard)	Save time, money, effort. Poorest rationale, lowest credibility. Yields information-poor cases.
<i>Following up leads</i>	
Theoretical	Analyst jointly collects, codes and analyses the data and then decides which data to collect next and where to find them in order to develop and inform the theory as it emerges. Central tenet of Grounded Theory (secondary or analysis sampling strategy).
Snowball (Volunteer)	Identifies cases of interest from people who know people, who know what cases are information-rich, i.e. good examples for study.
Opportunistic	Following new leads during field work, taking advantage of the unexpected flexibility.
<i>Focusing</i>	
Homogenous	Focuses, reduces variation, simplifies analysis using one subgroup (e.g. occupation or level in organisation)
Typical case	Illustrates what is typical, normal, average, trying to find more than one case.
Intensity	Information-rich cases that manifest the phenomenon intensively but not extremely such as above/below average.
Stratified purposeful	Illustrates characteristics of a particular subgroup of interest, facilitates comparisons.
<i>Analysis sampling (inductive analysis)</i>	
Extreme or deviant case	Learning from highly unusual manifestations of the phenomenon of interest. Qualify findings and specify variations or contingencies in the main patterns observed.
Confirming and disconfirming cases	Elaborating and deepening initial analysis, seeking exceptions, looking for variations. Disconfirming cases limit conclusions and indicate points of greatest variation.
Criterion	Picking cases that need some criterion, such as children abused in a treatment facility. Quality Assurance.
Multiple case	Grounding a finding using replication strategy.

Indiscriminate	Choosing sites, persons and documents that will maximise opportunities for verifying the storyline, relationships between categories and for filling in poorly developed categories.
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4.3 Data Management, Display and Analysis

Table X.5 sets out a generic process for the management of qualitative data for a thematic analysis (Marshall and Rossman, 1989; Dey, 1993; Miles and Huberman, 1994:10; Sanderson and Fisher, 1997; Braun and Clarke, 2006). All start in the same way by organising, reducing and describing the data through primary coding.

Spoken and visual data may be converted into written data via transcription but can also be analysed directly as audio and image files. Silverman (2006:204) lists the benefits of recording data as providing a public record, allowing repeat reviews/analyses (and improving transcriptions) and preserving the sequences of talk. Transcriptions require careful planning and attention to detail (Barbour, 2008).

Although no 'standard' has been established, it is important to decide what level of transcription is required. For linguistic analysis, a greater level of exactness will be required (including, for example, pauses and changes in pitch) whereas a thematic analysis may only require a verbatim transcription. Transcribing is a time-consuming process but does allow familiarisation (immersion) with the data at an early stage (Grey, 2009). If an external transcription service is used the researcher will need to listen to the original empirical dataset (audio or video files) and check the transcription for accuracy.

Step two marks the start of the analysis by displaying the data either visually or as text. Step three mostly involves interpretation or conclusion drawing. As the qualitative process is iterative these steps are intertwined and cyclical, rather than

linear. Theoretical saturation is the point during a research project at which no new instances are being identified and data collection can cease. It developed from Grounded Theory but is now more widely used in contemporary qualitative projects for directing the sampling and data collection phases.

There are different levels of written data from field notes to verbatim transcription; the level and type of detail will be driven by the research question, methodology, resources and planned analysis. The data can be read literally, interpretively and/or reflexively (table X.5). The levels are not exclusive and many research projects will include analysis on all three levels. Typically thematic analysis does not require the same level of detail as for example conversation and discourse analysis (Robson, 2011).

Table X.5 Levels of Data ‘Reading’ (Analysis) (Adapted from Mason, 2002:149)

Literal	Form, content, structure, style, layout etc. Interview = words and language used, sequence of interaction, form and structure of dialogue and literature content.
Interpretive	Construction or documentation of a version of what the researcher thinks the data means or represents or what can be inferred from it. Reading through or beyond the data for texts, artefacts, visual images etc. Includes interviewee’s and researcher’s interpretations and understandings or versions and accounts of how sense is made of the social world.
Reflexive	Locates the researcher as part of the data that has been generated and explores the researcher’s role and perspective in the process of generating and interpreting the data.

Primary analysis starts by generating initial coding categories within the data before moving to identifying themes and trends. A code is a label which exemplifies the

same theoretical or descriptive idea and is applied to ‘chunks’ data of varying sizes (single words, sentences, paragraphs, sections of pictures, segments of audio). An example of initial coding can be found in Figure X.2.

Figure X.2. An example of initial coding of qualitative data

<p>P: Usually people in this job love the job, and they love going in the mountains so they’ll go anyway, and also the work ethic, I think you’ll find people in this job have a pretty strong work ethic, not the kind of people who would phone in sick.</p> <p>Int: Do you think there is reflective practice? Acknowledging that this isn’t doing you any good?</p> <p>P: Yes, people aren’t stupid, possibly if you work for yourself, there’s not much choice. I don’t know what the case is for getting insurance working self-employed in the mountaineering industry; I would imagine the cost is quite high, so a lot of people haven’t got it.</p> <p>Int: Some people have also mentioned the benefits of outdoor activity?</p> <p>P: I suppose it would ensure you have a good strong heart, but I think the wear and tear on the joints is the main factor.</p>	<p>People love the job People love the mountains Strong work ethic</p> <p>People are aware of what they are doing</p> <p>High cost of insurance - preventive</p> <p>Benefits of outdoor work Drawbacks of outdoor work</p>
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Robson (2011: 479) provides an extensive list of coding options which can include specific acts, behaviours, events, activities, strategies, practices, tactics, states, meanings, participation (involvement), relationships, conditions or constraints, consequences, settings and reflexive (researcher’s role).

Coding at this initial stage can be considered as a data reduction exercise and a data organisation process in preparation for more in-depth and detailed analyses. However it can also be used as an analytical strategy as a more subtle process of having ideas and using concepts to describe the data by noticing relevant phenomena; collecting examples of those phenomena; and analysing the phenomena in order to find commonalities, differences, patterns and structures. Tools for reducing data include:

- Contact summary sheets are used to summarise thoughts and to review the data immediately after data collection as a quality assurance or reflective mechanism. They are also used in analysis for identifying key points and areas which need further exploration.
- Memoing during transcribing, reading and re-reading of the data. This is a continuation of reflection which started when formulating the conceptual framework. Memos are ideas about codes and their relationships as they strike the researcher during coding (Glaser, 1978).

Pattern coding is the second level, where coding is used to expand, transform and reconceptualise the data (Coffey and Atkinson, 1996). Miles and Huberman (1994) suggested ways of using pattern coding:

- To map the codes by network displays (tables, maps and models) to show how components interact.
- To check out the codes in the next wave of data collection to ensure that all the coded extracts and entire data set are included. This is likely to require a revision of the initial codes.

Step two in table X.6 is data display. Miles and Huberman (1994), Robson (2011) and Braun and Clarke (2006) provide a number of suggestions for data display including:

1. Context chart, where the inter-relationships between roles and groups are mapped in graphic form.
2. Checklist matrix to tabulate the data in terms of a specific question.
3. Time ordered display to show the flow and sequence of events. This is similar to an activity record or critical incident chart.

4. Conceptually ordered display to show well-defined themes and interactions.
5. Thematic map as tables and mind maps to explore the relationships both between codes and themes, and the different levels of themes.

Data display can also be used as part of the analysis, to identify and find relationships and then test these against the data. This creates the framework for the next process of analytic induction as part of the conclusion drawing.

Conclusion drawing is listed as step three whereas, in fact, there is a fuzzy boundary between this and the previous step. Analytic induction is the process whereby negative or extreme cases are sought to firstly test, secondly extend the scope, and finally determine the limits of the developing theory. Basically the theory is revised until all the exceptions are eliminated by inclusion (Silverman, 2006:295; Mason, 2002:136; Fielding and Fielding, 1986:89). At this stage it is important to bring all the reflective strands together. Testing the interpretation will include checking against researcher biases as acknowledged at the start of the project in the conceptual framework, as well as the influences (underpinning philosophy) of the methodology.

Table X.6 Generic Data Management Steps

Author(s)	Step One: Data Reduction	Step Two: Data Display	Step Three: Conclusion Drawing/Verification
Miles and Huberman (1994)	Summarising and packaging the data Managing field notes, transcripts etc. Data are reduced in anticipatory ways as conceptual frameworks are chosen and cases and questions are refined. Data are summarised, coded and broken down into themes, clusters or categories.	Repackaging and aggregating the data E.g. matrices, charts, graphs, networks. Data display describes diagrammatically pictorial or visual forms in order to show what those data imply to give an organised compressed assembly of information that permits conclusion drawing and/or action taking.	Developing and testing propositions to construct an explanatory framework Regularities, patterns, explanations, causal flows. Conclusion drawing and verification using different tactics, e.g. analytic induction.
Marshall and Rossman (1989)	Organising the data.	Generalising categories, themes and patterns.	Testing emergent hypotheses against the data, looking for contradictions. Searching for explanations for the data. Writing the report.
Dey (1993)	Describing, including context of action, intentions and process of social action.	Classifying, as themes and codes, to give meanings.	Connecting concepts.
Braun and Clarke (2006)	Familiarisation: transcribing, reading and re-reading data to note initial ideas. Generating initial codes and collating data relevant to each code Collating codes into themes	Reviewing coded data within themes and across whole data set by generating a thematic map of the analysis Defining and naming themes to refine the specifics and overall story Generating clear definitions and names for each theme	Producing the report. Selection of vivid compelling extract examples, final analysis of examples relating back to the research questions and literature.
Sanderson and Fisher (1997)	Commenting, chunking and coding	Connecting and converting	Comparing, constraining and computing

5 Procedural Framework

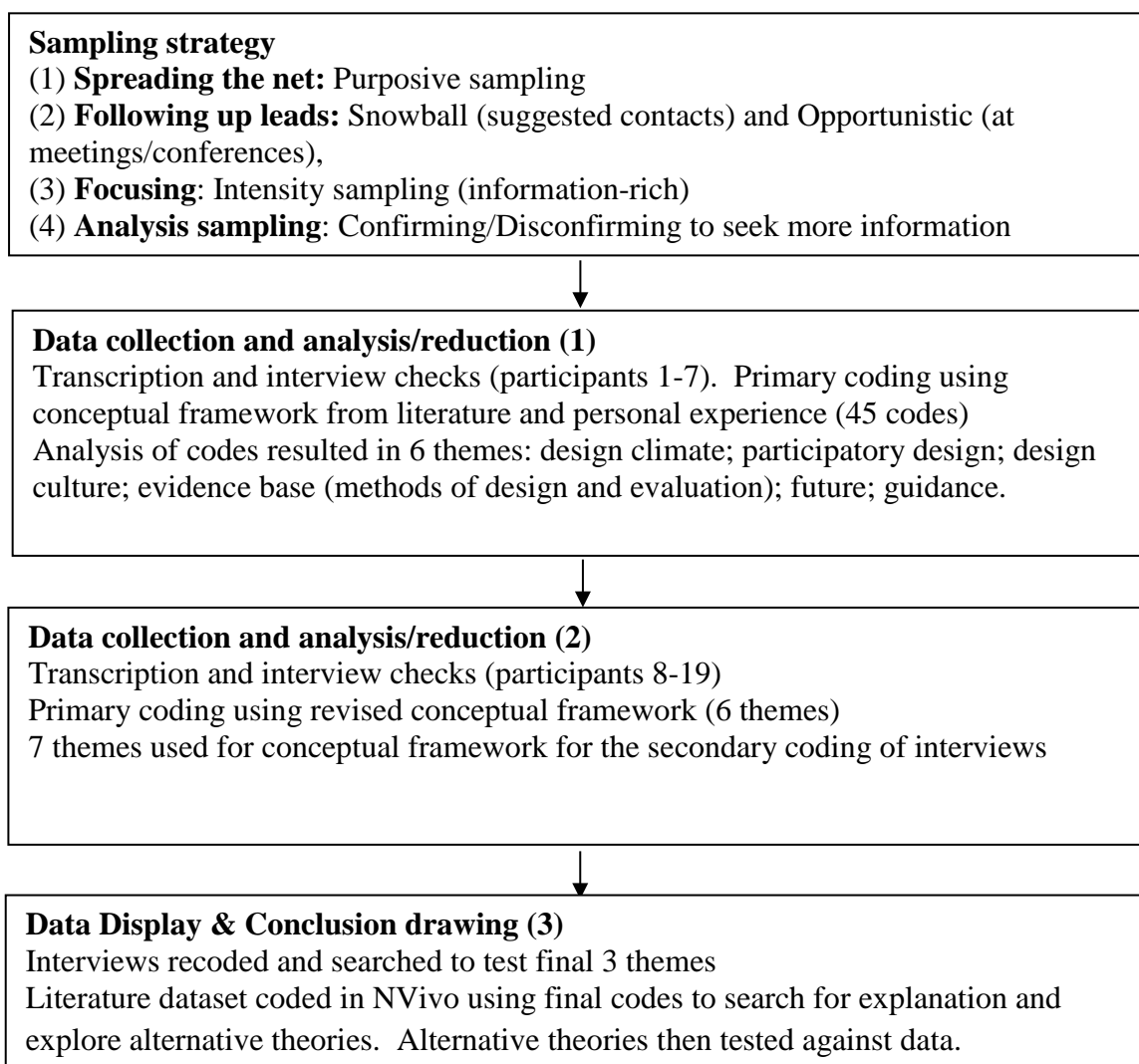
This section will give examples of how thematic analysis was used in two E/HF studies.

Example 1

The first example is a study that explored the use of building design guidance by healthcare architects and planners in the United Kingdom (Hignett and Lu, 2009). 16 participants were interviewed individually or as a group with the interviews being audio-taped and transcribed verbatim for analysis. Contact summary sheets were completed after each interview to capture immediate thoughts and summarise the main points (Miles and Huberman, 1994). The sampling strategy followed a four stage process involving: (1) purposive sampling with a wide range of experts, (2) snowball and opportunistic sampling to follow new leads during field work, (3) intensity sampling to obtain clarification on aspects of the interpretation, and (4) confirming and disconfirming case sampling to elaborate and deepen the analysis, seek exceptions, limit conclusions and look for variations.

The verbatim transcripts were returned to participants for confidentiality and accuracy checking and data from one interview (a group interview of three participants) was requested to be withdrawn from the study.

Figure X.3. Procedure Framework (Hignett and Lu, 2009)



Initially the data were organised and reduced using the qualitative data management tool in NVivo (see section XX) (Bazeley and Richard, 2000) and classified into 45 preliminary codes. Following this, a detailed secondary coding was conducted within the codes to identify six higher level themes. The first five interviews (participants 1, 2+3, 4, 5+6, 7) were re-read and re-coded with these higher level themes. During the coding of the next two interviews (participants 11, 12+13) minor changes were made to clarify and expand the definition of each theme. As the study progressed and theoretical saturation was achieved. The analysis of the final four

interviews (participants 14+15, 16, 17+18, 19) developed the codes to more inclusive descriptions and explanations resulting in three final themes:

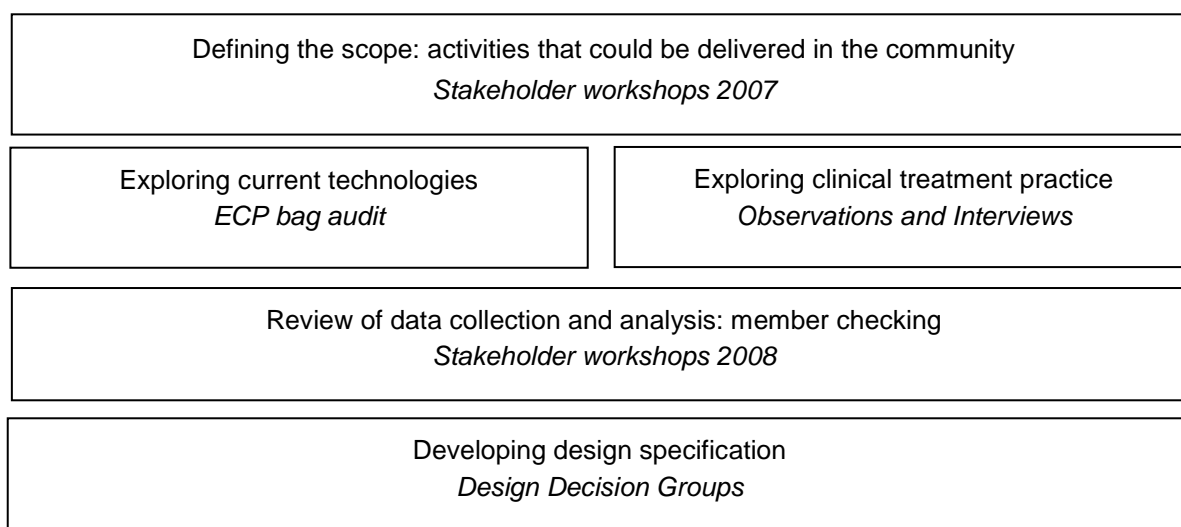
1. Design culture including design climate and participatory design.
2. Research/evidence including design history, international research and quality issues.
3. Future guidance needs including concepts and philosophy and patient expectations.

The use of a qualitative approach for this project enabled a reflexive position to be maintained with respect to both the research question and the data. The analytical induction strengthened the development of the interpretation by searching for negative cases in the data and the analysis and by reviewing the themes until an acceptable representation was produced.

Example 2.

This study describes an explorative and descriptive study about urgent care technologies from the acute, primary care and ambulance sectors with 125 staff and 88 patients over 18 months (Hignett et al, 2011). Qualitative data were collected from stakeholder workshops, portable technology audit, treatment observations in emergency departments and walk-in centres, and design decision groups (DDGs) (figure X.4).

Figure X.4. Urgent Care Technologies (Hignett et al, 2011)

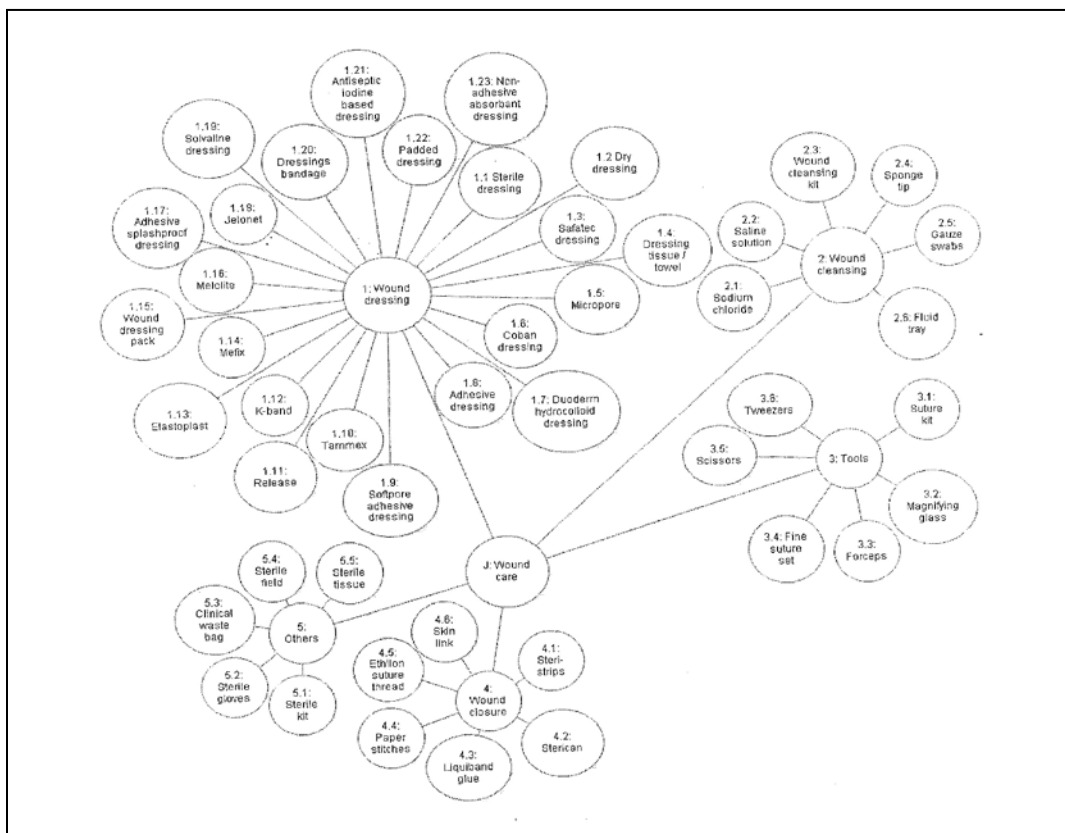


The scope of the project was defined at two stakeholder workshops in 2007 with participants recruited from different healthcare sectors (acute, ambulance and primary care) using mixed purposive sampling to give variation on the dimensions of interest. The use of current technologies was explored with an audit of portable equipment and consumables for Emergency Care Practitioners (ECPs) selected using homogenous sampling. Data were collected using interviews and a checklist and then grouped for comparison with the equipment lists. Clinical treatment practices for urgent complaints were explored through 84 observations of patient treatment (stratified purposeful sampling). Observational (Link Analysis) and staff interview data (hierarchical task analysis) were collected until theoretical saturation was achieved and no additional information was being generated.

In 2008 a second workshop was held to present the findings of the 2007 workshops, audit and observations. Data were collected as a series of semi-structured questions in individual workbooks. The triangulated data (see section X.5.2) from the four data sets (stakeholder workshops in 2007 and 2008, ECP bag audit and observations) were reviewed by the second researcher before being taken to the DDGs. This resulted in eight primary themes: wound care (figure X.4); drugs, gases and vaccines; diagnostic equipment; office stationary; hygiene/sanitation; additional technologies (e.g. razor); immobilisation (e.g. splint/sling); and phlebotomy equipment/consumables.

The final stage used criterion sampling for the DDGs as a quality assurance approach to test the on-going analysis. Data were collected using round robins, word maps and drawing exercises to produce both paper mock-ups and prototypes for the discussion and modification of the design requirements. From these iterations it emerged that the supporting portable technologies for urgent care should consist of a three level technology system.

Figure X.5. Example of triangulation of four data sets for wound care (Hignett et al, 2011)



6 Validity and Reliability in Qualitative Methodology

The words validity and reliability are taken from quantitative methodology (see Chapter 1) and need interpretation in a qualitative context. Table X.7 summarises some of the terms used by Guba and Lincoln (1981), Lincoln and Guba (1985), Miles and Huberman (1994) and Robson (2011).

Table X.7 Alternative terms for validity and reliability

Internal Validity	External Validity	Reliability
Credibility	Fittingness	Auditability
Truth Value	Applicability	Consistency
Trustworthiness	Transferability	Dependability
Authenticity	Generalisability	

Internal validity addresses issues of credibility and authenticity in the research (table X.8). At an operational level this can be established through the use of an audit trail and the analytic induction process of testing theory. External validity looks at issues of generalisability and transferability. Reliability addresses the issues of auditability or quality control. This could be the consistency by which instances are assigned to the same code in analysis, or on a broader level to the wider process itself.

The detail given with respect to the context, researcher bias, sampling strategy and history of the research question can all help to establish the conditions whereby the findings could be transferred to another setting. Dingwall (1997:62) gave three tests for general validity:

1. Distinguish clearly between data and analysis.
2. Examine the extent to which the study has looked for contradictory or negative evidence and set out to test statements proposed on theoretical grounds or reported from previous studies.
3. See how it reflects the interactive character of social life and deals even-handedly with the people being studied.

Table X.8 Strategies to establish validity and reliability (Adapted from Robson, 2011)

Internal validity (Credibility)	External validity (Generalisability)	Reliability (Auditability)
Richness of descriptions Comprehensiveness of account Linkage to theory Internal coherence of concepts Evidence of addressing	Description of original sample Sampling limitations Scope, boundaries and variation Transferability potential Data presentation	Clarity of research question Role and status of researcher Meaningful analysis across data sources Clear connection to theory

areas of uncertainty (surprises) Negative evidence Checking the meaning of outliers and extreme cases Rival explanations Member checking Accuracy of conclusions and predictions	Member checking Further testing Replication	Scope of data collection Coding checks Data quality checks Peer review
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At a fundamental level the aim of all research should be to convince the reader of the validity, reliability and relevance of the research findings. Whether this is achieved using large sample sizes and statistical tests, or by detailed descriptions of a situation or point of view, depends on the design of the investigation or exploration. If the **reader** is able to use the research by incorporating the findings in their own work then boundaries have been extended and knowledge has been generated, and robust scientific research has been achieved.

6.1 Respondent Validation

Respondent validation, also known as member checking, is when the interpretation of the researcher is presented back to the participants as part of the conclusion drawing and verification (Walker, 1989). This is a different process to accuracy checking of data where an interview transcript is returned to the interviewee for that purpose. Mays and Pope (1995) suggested that member checking could be used to add to both the internal (authenticity check) and external validity (transferability of findings).

6.2 Triangulation

Triangulation is another method which can be used to establish both internal and external validity. It refers to the use of more than one data source, method, or investigator and the convergence of these to add credibility to a **study (see chapter 1)**. The underlying rationale

behind this is that through combining different methods, the weakness of one method may be addressed through the strength of another (Magnusson, Finnerty & Pope, 2005).

Coffey and Atkinson (1996:14) argue that if the philosophical (ontological) positions have not been defined the combination of different analyses would look at if they had been stuck 'together like children's building blocks in order to create a single edifice', resulting in a comparison will be between optimal and inferior methods and data. If the data are generated from different contexts Silverman (2006:295) suggests that triangulation may be inappropriate as it may ignore the '*context-based and skilful characters of social interactions*'.

7 Critical Appraisal

Figure X.6 shows a critical appraisal question set from Hignett et al (2003) incorporating criteria for assessing quality from Robson (2011:486). This can also be used to internally review a project prior to writing the final report to identify the strengths and limitations of individual project designs.

Figure X.6 Question set to critical appraise qualitative studies

- | |
|---|
| <ol style="list-style-type: none"> 1. Is the research question/aim/objective of the study clearly described? 2. Are the research methods appropriate to the question being asked? 3. Was the qualitative method that was used made clear in the aims of the study? 4. Is there a clear connection to an existing body of knowledge/wider theoretical framework? 5. Is the context for the research adequately described and accounted for? 6. Are the criteria for, and approach to, sample selection, data collection and analysis described clearly and systematically applied? |
|---|

7. Does the paper describe the sample in terms of gender, ethnicity, social class etc. (if appropriate)?
8. Was the sample appropriate?
9. Were the processes of fieldwork and the means of data collection described adequately?
10. Is the relationship between the researcher and the researched considered and have the latter been fully informed?
11. Is sufficient consideration given to how findings were derived from the data and how the validity of the findings was tested (negative examples, member checking)?
12. Has evidence for and against the researchers interpretation been considered?
13. Are the findings systematically reported and is sufficient original data reported to justify conclusions?

8 CADQAS (Computer Assisted Qualitative Data Analysis Software)

The use of CADQAS helps to make non-linear research processes more systematic by adding both flexibility and rigour. Most CADQAS packages can handle a wide range of data types including text, video, audio and graphics and have tools to enable content searching, linking, coding, querying, memoing, modelling, mapping and networking (Sinkovics and Alfoldi, 2012). It is important to reinforce the point which is often made when discussing the use of computers in data analysis; although they can help with the organisation and processing of the data, computers cannot do the thinking, interpreting or relationship exploring, this must come from the human (researcher).

7.1 NVivo

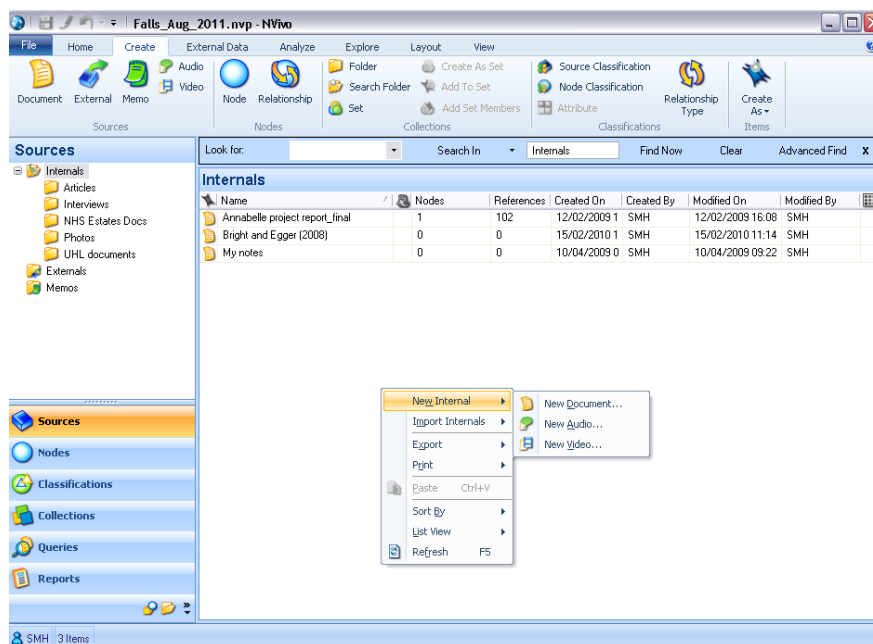
NVivo is a qualitative data management software package that is designed to store and manage different types of qualitative data (Richards, 2009; Daws, 2011), for example; interview transcripts; field notes (from observations); focus group transcripts; literature review notes; audio and video sources; other types of documents (e.g. minutes, diagrams); and any type of ‘*external*’ data (e.g. documents that cannot be imported).

An NVivo project has two fundamental parts:

1. Sources (data) are created or imported into the project as data are collected.
2. Nodes are created for themes or categories by coding sources.

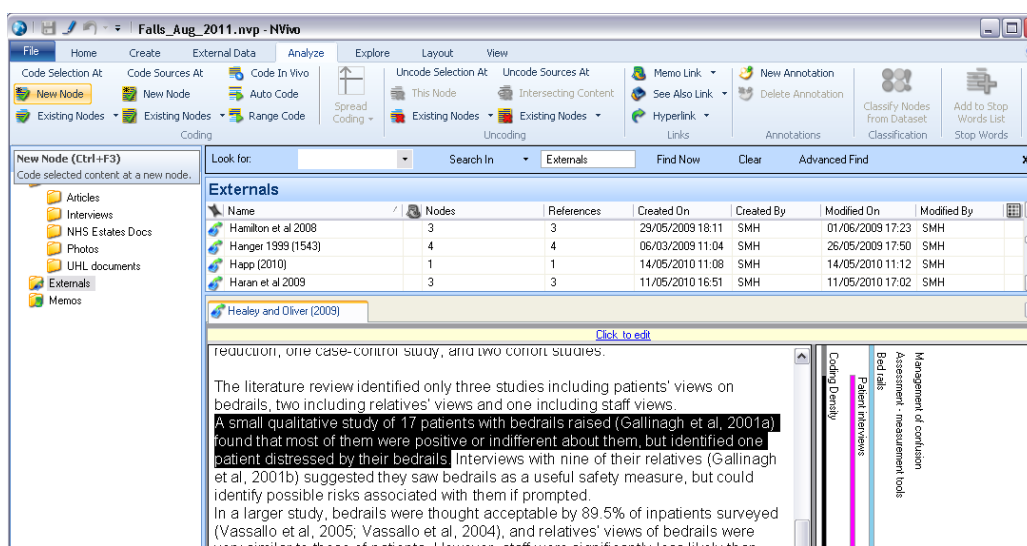
It can be used to systematically organise and manage data, code and retrieve data (figure X.7), search and theorise data using queries, record new ideas and annotations as *memos*, modify and merge *nodes*, draw *models* to represent ideas about the project (can be linked directly to the data/node), develop an *Audit Trail* of searches and analyses to enhance the research reliability, and use *Visualisations* (e.g. word trees and tag clouds) to gain new/different perspectives on the data.

Figure X.7. Importing Sources into NVivo (version 9)



In NVivo, the themes/categories and coding are stored at nodes. Nodes provide a location for gathering all related material in one place to look for emerging patterns and ideas. Nodes can be created and named as new nodes (in-vivo), from the words in the data; created from prior ideas by coding 'down' (theoretical framework / research question) or created and coded 'up' from meanings in the data (Figure X.8).

Figure X.8. Coding in NVivo



a middle ground position and combine both qualitative and quantitative methodological approaches for the same research question. In taking this pragmatic position a generic process for doing qualitative research has been described using a thematic analysis approach with three steps of data reduction, data display and conclusion drawing.

At the moment it seems (from conference proceedings and journal publications) that ergonomics is currently more at the quantitative end but there are influences tipping the balance back towards the qualitative side.

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