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Research Design in Design Research: a practical framework to develop theory from case studies

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1. Problems Associated with Case Study Method

Case studies in design research often involve the investigation of phenomena in 'real-life' situations, where we want to understand factors surrounding the design process. Yin (1993) defines case study as being appropriate when contemporary phenomena is to be investigated in their real life context; when the boundaries of the phenomena and the context are blurred; and multiple sources of evidence are used. Chetty (1996) argues that its main strength is its ability to measure and record behaviour and that multiple sources of data can be brought together to gain as full an insight as possible.

'These include documentation, archival records, interviews, direct observation, participant-observation and physical artefacts.'

(Chetty, 1996, p.74)

Unsurprisingly case study method has been used extensively in design research. A review of the published papers for the last two Design Research Society conferences found that the method had been employed across many areas including new product development, product innovation, design behaviour, risk evaluation, and supply chain management (see for example: Bussracumpakorn, 2002; Horne-Martin, *et al.* 2002; Cooper, *et al.* 2002).

Yet, case study has been seen as being 'soft' due to the difficulty of making generalisations from a site-specific context and the common journalistic style of reporting a single 'case' as being typical of a wider phenomena (Yin, 1993). This can be further complicated in multiple case study research when a massive amount of data is generated with limited structure to make sense of it. This has sometimes led exponents such as Yin (*ibid*) to perceive its value as being under appreciated:

'Most people use it as a method of last resort, and even they use it with uneasiness and uncertainty. Despite the availability of key works on how to do case study research'

(Yin, 1993, p.40)



Another problem is that case study method is a broad term and encompasses many approaches, some of which cross paradigms. It is a hybrid, even though it inevitably errs on the side of qualitative research, due to the need to understand 'how' and 'why' questions, it can be attacked on ontological grounds because it can accommodate both qualitative and quantitative techniques (Guba and Lincoln, 1994). Langrish (1993) rightly points out that these perspectives originate from a different 'world view' with the 'physics' approach on the one hand, which looks for underlying principles, and the 'biological' approach on the other, which glorifies diversity.

In addition, there is the more practical problem of creating a detailed and transparent process of data management which still allows the reader to see the relationship between data, concept development and theory. As Silverman (2000) suggests:

'Unless you can show your audience the procedures you used to ensure that your methods were reliable and your conclusion valid...research descends into a bedlam where the only battles that are won are by those who shout loudest.'

(Silverman, 2000, p.175)

However, as we will see in the following sections, there is a growing argument for case study method which demonstrates that the strengths outweigh the weaknesses.

2. Types of Case Study in Design Research

The table below seeks to explicate some of the common forms of the method used in design research.

Type	Description	Methodological Approach	Ontological/Epistemological Implications	References
Exploratory / Intrinsic / Classic Case	Used where there are signs of limited knowledge To 'explore the territory' 'What, 'how', 'where', 'when' research questions To gain a better 'deep' understanding Illustrates a particular trait Explore abstract concept or phenomena 'the one off' 'How' or 'why' research questions	Develop theory and then test where possible In depth using range of methods and observation over time Empathy essential to building trust with respondents	Subjective Can be ethnographic – transformative and empowering or part of multiple case approach Largely inductive and qualitative Can illustrate existing argument or predisposition – constructivist / ideologist	Yin, R. (1993) Stake, R. (1994) Dyer, G. and Wilkins, A. (1991)
Explanatory / Instrumental	Test cause and effect relationship Insight into an issue or refinement of a theory Case chosen as part of larger research interest	Used to test theory Large range of research methods	Hypotheses testing Errs toward deductive Can lead to theory building Objective Realist	Yin, R. (1993) Stake, R. (1994)
Collective/ Multiple Case	Instrumental study in multiple Cases chosen due to theoretical representation of phenomena, population or general condition	As above and; Allows cross-case comparison Usually between 4 to 10 cases in practice Develop theory Methodological 'framework' essential Can be inductive or deductive Likely to lead to theory building and generalisations	More post positivist than phenomenological Objective Realist	Stake, R. (1994) and Eisenhardt, K. (1989)
Common / Features	Focused on site specific instance/s – 'real life' Ability to understand complex interaction of phenomena in play – 'How' and 'why' questions	Multiple sources of evidence are used Boundaries between phenomenon and context appear blurred	Nearly all ontological / epistemological positions are possible	



Table 2.1. Different approaches to case study research

Case study method has many variations and indeed opposing viewpoints. This is exemplified by the debate surrounding the promotion of the exploratory/intrinsic case or classic case, as referred to by Dyer and Wilkins (1991), and the multiple case study approach proposed by Eisenhardt (1989).

'the essence of case study research is the careful study of a single case that leads researchers to see new theoretical relationships and to question old ones.'

(Dyer and Wilkins, 1991, p.614)

Whilst this reinforces the importance and deep understanding of a single 'story', other researchers support the view that case study research can be used to test hypotheses in a deductive manner by deriving a sample of cases that are 'explanatory' in nature (Yin, 1993).

There is also some convergence in classification of case study types by researchers, although the terminology varies. For example, Yin's (ibid) identification of the 'exploratory' and 'explanatory' case study and Stake's (1994) 'intrinsic' and 'instrumental' case study. The exploratory and intrinsic is important when few theories or limited knowledge within the field exists and when one wants to better understand the particular case. Whereas, the explanatory and instrumental case study approach becomes relevant when there is a need to refine existing theory or extend knowledge in alternative settings.

Most design researchers undertaking field research need to be far more pragmatic, requiring the flexibility to combine categories and research techniques whether they be inductive, deductive, qualitative or quantitative. This often involves spanning paradigms in order that research objectives can be met. 'How' and 'why' questions are almost essential tools for the design researcher when conducting research and there is often the need to yield deep and meaningful insights into the perceptions, assumptions and meanings which underpin findings.

So how do design researchers resolve these issues and at the same time derive credible, reliable and verifiable findings? To answer this question we need to turn our attention to the research design itself.

3. Research Design

The need to develop an integrated research design when using case studies has been commented upon by many notable researchers. Glaser and Strauss (1967) detailed a comparative method for developing grounded theory within cases and Strauss and Corbin (1990) have outlined components of the process to analyse data from contrasting groups. Miles and Huberman (1984, 1994) have focused on methods to 'bound' the cases selected and techniques to process qualitative data within them. Yin (1993) has focused largely on the design and selection of the case studies – their nature, form and type – within a wider methodological framework from which to derive theory. However, there is a dearth of research studies which provide a procedural description to develop theory from case studies in design research.



Let us turn to an example to illustrate the point. A recent multiple case study research project undertaken by the author sought to reveal the complex interaction of factors which influence the performance and development of design research groups in the United Kingdom. Three primary objectives were identified:

- i. to identify management factors that contribute to the performance of successful design research groups;*
- ii. to understand the interaction of factors (cause and effect relationships) which contribute toward successful development over time; and*
- iii. to propose a generic model of design research group development.*

As the purpose was to understand the reasons 'how' and 'why' some design research groups performed better than others the study used multiple sources of evidence including observation, interviews, and reference to documents and statistical material. The research design consisted of the following basic stages:

- i. a review of the documentary evidence surrounding the design research group to establish background and history;*
- ii. visits to observe the working environment, culture, processes, procedures and structures;*
- iii. interviews with directors, designers, and client managers to allow individuals to reflect upon the performance and development of the group; and*
- iv. analysis of each individual 'case' before analysis 'cross case' to establish commonalities and differences.*

However, there were some immediate problems which needed to be overcome to ensure that the study did not become compromised, such as the need to:

- *establish procedures to maintain and manage clear audit trails to give credibility to the evidence presented*
- *balance consistency of approach with flexibility to gain new insights across case*
- *give equal weight to multiple sources of evidence e.g. documentary evidence, interviews, observation and statistical/archival analysis*
- *establish clear and transparent procedures to analyse and condense data, within and across cases, to derive reliable and verifiable findings*

For example, there was the potential for conflicting accounts from interviewees on how and why events occurred, the order in which they happened and their influence on the group. Different lines of inquiry could have been pursued in each case, thereby yielding data sets varying in quantity and focus. Equally, additional meaning could have been ascribed to particular respondents, events, or techniques such as phenomena observed rather than reported.

Silverman (2000) argues that at one extreme 'anecdotalism' can lead to selective quotes being used to support key concepts when no attempt has been made to provide a rationale for why such views have been brought forward over others. At the other, long and detailed narratives appear to attribute privileged status to individuals and as such, attempts to ensure 'validation' of the data trail become detrimental to a useful, open, and well rounded version of events. If these issues were not addressed, the study could have been open to the accusation of imposing a subjective and simplistic interpretation of events.



4. Building an Integrated Framework

There are only a few studies which help to explain practical techniques on how to overcome these issues in case study research (for example Eisenhardt's 'Roadmap', 1989). It was for these reasons that an integrated methodological framework using case studies needed to be developed.

The framework used covers the following stages:

Stage	Purpose
1 – Getting Started	Establishing the research aims and objectives
2 – Selecting Cases	Conducting an initial 'trawl' of prospective cases against criteria to identify a suitable sample frame
3 – Crafting Instruments and Protocols	Drawing upon the literature to establish an interpretive set of themes from which to guide appropriate research tools
4 – Entering the Field	Gaining access and developing a research design to elicit appropriate data
5 – Analysing the Data	Ascribing meaning to data in a consistent and systematic way
6 – Shaping Hypothesis	Identification of patterns of causality across cases
7 – Enfolding the Literature	Reintegration of findings into existing literature to establish the contribution to knowledge
8 – Reaching Closure	Justification, hypothesis testing and presentation of findings

Table 4.1. Stages within an integrated framework

The eight stage process builds upon the work of Eisenhardt (1989), to cover the initial phase of entering the field of inquiry right through to the presentation of findings and articulation of theoretical concepts with common contexts, conditions and consequences. Throughout the description, reference will be made to the methodological issues which arose during the study with particular emphasis on how they were resolved.

Stage 1 – Getting Started

This stage will be familiar to most researchers. As suggested by Eisenhardt (1989, p.536) *'an initial definition of the research question, in at least broad terms, is important in building theory from case study research'*.

A thorough understanding of the field of inquiry and the research aims and objectives not only helps us to focus and locate the study within the context of previous work but also defines what the study isn't and therefore what we don't need to concern ourselves with. As stated in the aims and objectives above, the purpose is to articulate the nature, range, scope and boundaries of the research arena under investigation in order that the researcher does not become overwhelmed by the sheer volume of data.

Stage 2 – Selecting Cases

Yin (1993) and Eisenhardt (1989) place a great deal of importance on the selection of cases – *'as in hypothesis-testing research'* (p.537). The understanding of the population and the relevance to the sample of cases are key to being able to develop theory that might have resonance to the universe as a whole. Wide definitions such as a 'bounded system' (Smith, 1978) are too loose a definition for Yin and Eisenhardt, because they lack clarity and purpose.

'the objective must be a 'functioning specific' (such as a person or classroom) but not a generality (such as a policy). This definition is too broad. Every study of entities qualifying as objects (e.g., people, organizations, and countries) would then be a case study, regardless of the methodology used (e.g., psychological experiment, management survey, economic analysis).'

(Yin, 1994, p.17)



Thus, a suitable sample frame of cases was required for the process of data collection and a web based search for design research groups operating in the United Kingdom was undertaken. As a first cut, from the many groups identified, information was interrogated against a common definition and equivalence of services in order that alternative terminology surrounding the activity could be ameliorated.

In addition, a further stage of evaluation was conducted to begin the process of isolating 'successful' cases. To gather more detailed information direct contact was made with the groups and information secured which was then tested against performance criteria to ensure that the group located firmly in the upper end of the spectrum both in terms of performance and longevity.

Although the term 'success' could be considered contentious and a social construct, the use of clear criteria to determine case selection represented a clear indication of the study's purpose – to analyse and identify factors which determine a 'favorable outcome' in the development of design research groups. As Eisenhardt reported: 'given the limited number of cases which can be studied, it makes sense to choose cases such as extreme situations and polar types in which the process of interest is 'transparently observable.'

(Eisenhardt, 1989, p.537)

The outcome of Stage 2 is not just a sample frame of cases but clarity over definition, research boundaries and most importantly, a rationale for why each 'case' contributes to the purpose of the study.

Stage 3 – Crafting Instrument and Protocols

Trow (1957) advocates that the problem under investigation dictates the methods of investigation. Kane (1985) puts forward a useful analogy:

'Research techniques are a bit like fishing flies: you choose the right one for the one you want to catch. No fisherman would use the same kind of fly for twenty different varieties of fish, just because it was the first kind he ever tried or even the one he felt more comfortable with'.

(Kane, E. 1985 p.51)

This stage seeks to identify, evaluate and critically reflect upon the current field of inquiry in order to anticipate and establish the most appropriate tools to observe or record. A 'trawling' and 'fishing' exercise was undertaken to identify appropriate literatures (as described by Kane, 1995) and where necessary, adjacent domains of knowledge were explored for convergence.

Here the literature review serves to establish a broad set of themes on which to build an interpretive set of protocols which can be operationalised through, for example, semi-structured interviews.

This practical view of selecting research techniques was adopted comprehensively, after an assessment of research techniques available, two forms of interview were employed – exploratory and standardised combined with observation and documentary analysis. Oppenheim (1992) describes 'exploratory' interviews as being free



in style and depth. Standardised interviews are based around a predetermined set of questions, determined through the literature, to form an interview schedule.

It is worth noting here however, that further sources of knowledge become pertinent during the inquiry as the study progressed, and these became the focus of detailed discussion within the final section, ‘Stage 8 – Shaping Theory’, when the findings were re-integrated into existing knowledge. This reinforces the need to craft research tools carefully, in a flexible and speculative manner, to allow new insights to emerge during the research.

Stage 4 – Entering the Field

To allow the research design to be implemented, attention needed to be paid to key groups of respondents who were in a position to yield meaningful data. In this instance this meant the directors, designers, client managers and administrative staff.

All respondents undertook an exploratory interview to provide a ‘rich’ story of the design groups development followed by a standardised interview to identify the factors in play. Staff were also observed working at several stages during the research. Interviews were fully transcribed in each case and more than a hundred thousand words were committed to tape for analysis in this way.

In all cases, the exploratory interview with the Director was the first intervention to establish empathy and understanding before the commencement of the semi-structured interviews. It was also felt that the technique itself – enabling the rendition of events as the Director saw them – provided the foundation for a degree of trust between interviewee and interviewer in a non-threatening environment. This was to prove invaluable as the Director became a key figure in terms of access to other staff during the latter phases of the data collection process.

A second visit was carried out to conduct interviews with designers and client managers. The timing between visits was purposefully elongated and ranged from eight to twelve months. Firstly, it was felt that to an extent, interventions at differing timeframes could capture changes in environment, structure, management processes or procedures over the intervening period, and secondly, that this would ameliorate any potential bias from a single respondent due to temporal issues (whether organisational or personal) that might not have been apparent to the researcher.

In summary the field work conformed to the following schedule:

	Respondents	Method	Objective	Phase
Initial Contact	Administrator / Secretary / Director	Telephone interview followed by formal letter of approach outlining the aims and objectives of the study Follow up telephone call if necessary	Gain access and identify preliminary documentary evidence Establish whether ‘case’ would meet selection criteria Clarify any outstanding issues and identify interview dates	Phase 1
Exploratory Interviews	Director Designer	Protocol derived using Plummer’s (1983) approach of an auto-	Obtain ‘emic’ account and rich insight of the set up and development of the group.	Phase 2



	Client Manager	biographical account of origination, evolution and development. Intervention is minimal i.e. prompts such as 'can I just take you back', 'you said' were used if interviewee 'dries up' before giving a full account.	Identify 'critical' events and phenomena in play surrounding them Make sense of respondents world view Establish likely patterns of cause and effect relationships Shed light on the relationship between the group and the external environment	
Observation	Designer / Junior Designer	Observation sheet used to record process and procedures evident, working relationships, operation structures and environment	Understand interaction (implicit and explicit), organisational structures, methods of working, culture and environment	Phase 3
Semi - Structured Interview	Director Designer / Junior Designer Client Manager	Protocol derived through the thematic and indicative factors derived from the literature Semi-structured questions with supporting 'how' and 'why' prompts (when required) to elicit 'open' responses	Identify factors as having a positive, negative or neutral effect on the development of the group over time Identify whether the respondent believes the group has been successful Establish key 'success' factors and key 'inhibiting' factors	Phase 4

Table 4.1. Entering the field

In addition, initial findings were noted on the interview protocols themselves to act as prompts for the analysis which followed. As Eisenhardt (1989) suggests:

'Overlapping data analysis with data collection not only gives the researcher a head start in analysis but, more importantly, allows researchers to take advantage of flexible data collection.'

(Eisenhardt, 1989, p.539)

Stage 5 – Analysing the Data

Each interview was taped and fully transcribed before being entered into a qualitative software analysis package (Scholari Nvivo) where the data was labelled and numerically ordered. For example, '*we realised that we needed to have a space of our own*' might have been coded as 'identity'. Here, Strauss and Corbin's (1990) well detailed method of building substantive and formal theory from qualitative data was employed, whereby open coding was used to label discrete events or phenomena, and categories identified to group concepts identified through phenomena pertaining to common themes. When all the text had been coded in each of the transcripts – in 'open' and 'categorised' form – patterns of cause and effect were examined across the narratives to determine 'umbrella' nodes: representative of critical events in the group's development.

Early on in the study it became clear that an approach needed to be adopted which established a clear and verifiable relationship between the events, incidents and happenings, which had occurred over time, and the current factors identified at the point of data collection. The study utilised causal connection diagrams as described by Miles and Huberman (1994) and Roworth-Stokes and Perren (2000) to provide a visual representation of the complex interaction of phenomena within each group.

Importantly, the diagram encompassed two key components of the analysis, 'factors' drawn from the exploratory interviews and their positive, negative or neutral effect on the group's development (see below), and 'nodes' which describe patterns of phenomena drawn from the respondents accounts (numbered boxes throughout the centre of the diagram). Together they related factors pertinent to the group's successful development, and the cause and effect relationships that had become evident over time. Essentially, a rich



picture of the complex interaction of events, incidents, and happenings was created in a logical and visually coherent way.

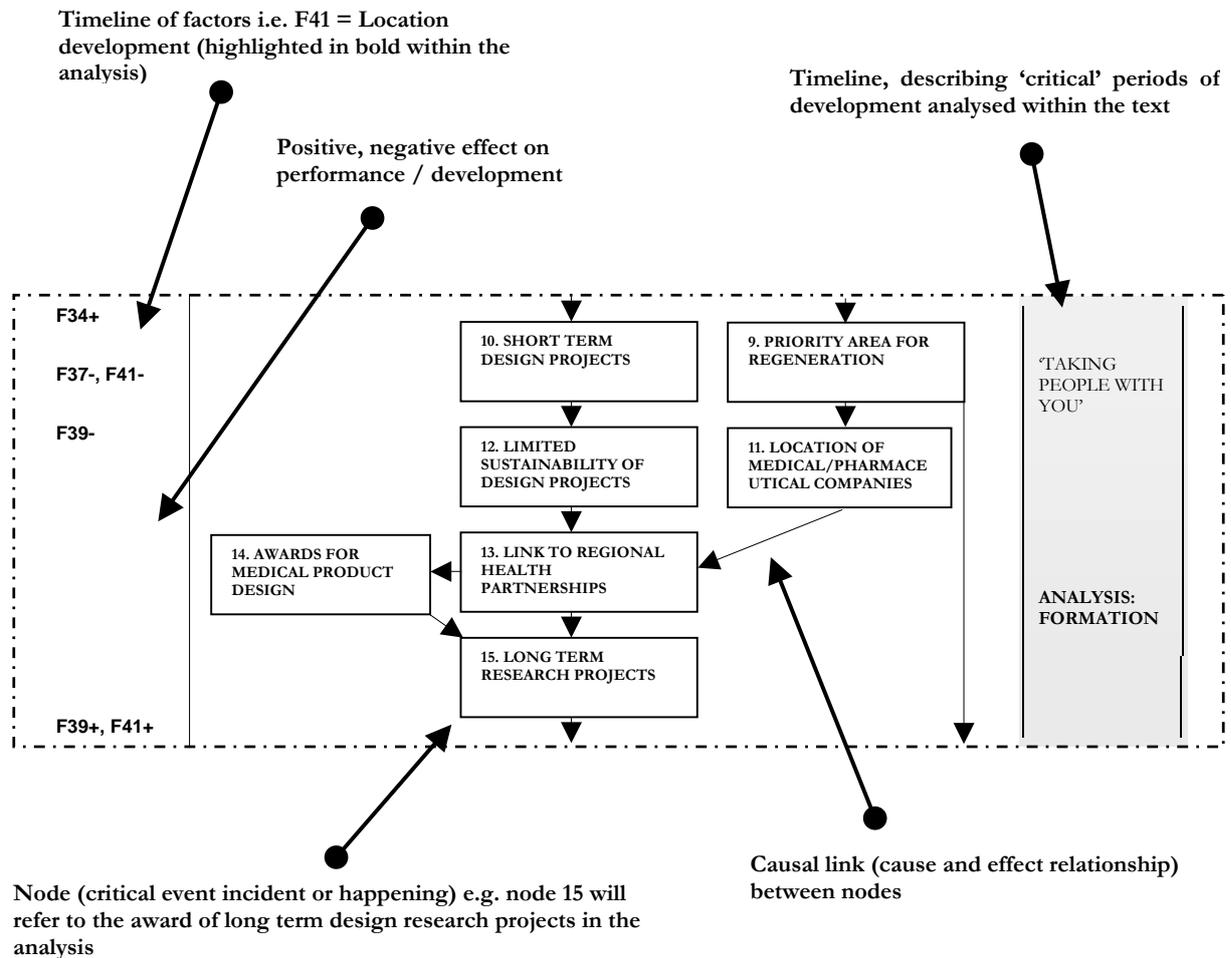


Figure 4.1. Extract from a causal connection diagram

For example, node (9) above shows the difficulty of operating in an area with limited local market opportunity for design services, an inhibiting factor in the group's development [F41-]. This later becomes a positive factor [F41+] after several major medical and pharmaceutical companies relocate with the support of regeneration initiatives, from which long term design research projects are secured (node 15).

As suggested by Miles and Huberman (1994):

'such a chain [of causal connections] helps analysts lay out explicitly what may be causing certain phenomena. Although the chain does represent a simplification, that very simplification carries with it the seeds of a fuller explanation'



(Miles and Huberman, 1994, p.227)

The right hand column on the diagram also establishes the broad sections of analysis and their sub-divisions, which are broken down through respondents' own words. This process remains transparent as the data becomes condensed.

Stage 6 – Shaping Hypothesis

Finally, the condensation of data was subjected to a third level of abstraction to develop theoretical concepts representative of patterns of causality cross case. This approach was conducted in accordance with Strauss and Corbin's (1990) method of axial coding:

'a set of procedures whereby data are put back together in new ways after open coding, by making connections between categories. This is done by utilizing a coding paradigm involving conditions, context, action/interactional strategies and consequences.'

(Strauss and Corbin, 1990, p.96)

As Eisenhardt (1989) recognises, this point marks the period when '*tentative themes, concepts, and possible relationships between variables begin to emerge*' (p.541).

Stage 7 and 8 – Enfolding the Literature and Reaching Closure

The findings from the study were reported within eight axial concepts with a rigorous data to capture the nature of the interaction with each of the factors. Here, the metaphor of an axis is highly relevant, as these meta level concepts are formed from the connections between data categories, which in turn, are supported by many empirical indicators.

Within this final stage, the relationship between axial concepts was displayed graphically as the basis to contextualise previous work by reviewing the literature surrounding each of the concepts in turn, thereby making a clear and verifiable contribution to knowledge.

5. Conclusions

This paper has sought to provide a practical framework to help design researchers derive empirically valid, reliable and credible theory through case studies.

As discussed above, arguably the most contentious part of qualitative data analysis is the process of transition from transcript to categorisation (reduction) and subsequent theory building (analysis), particularly if this is not transparent, consistent and coherent in its rationale. Although it seems foolish to suggest that any process of reduction can ever be a truly objective process – even if highly respected authors in the field of qualitative research would suggest so (see Strauss and Corbin's [1990] claim for reproducibility for instance p.27) – this paper has sought to establish a logical and coherent foundation for data collection and analysis.

In essence, it has established an integrated theoretical framework through which data can be consistently and systematically collated, codified and analysed in a pragmatic manner. The framework is summarised in diagrammatic form below.

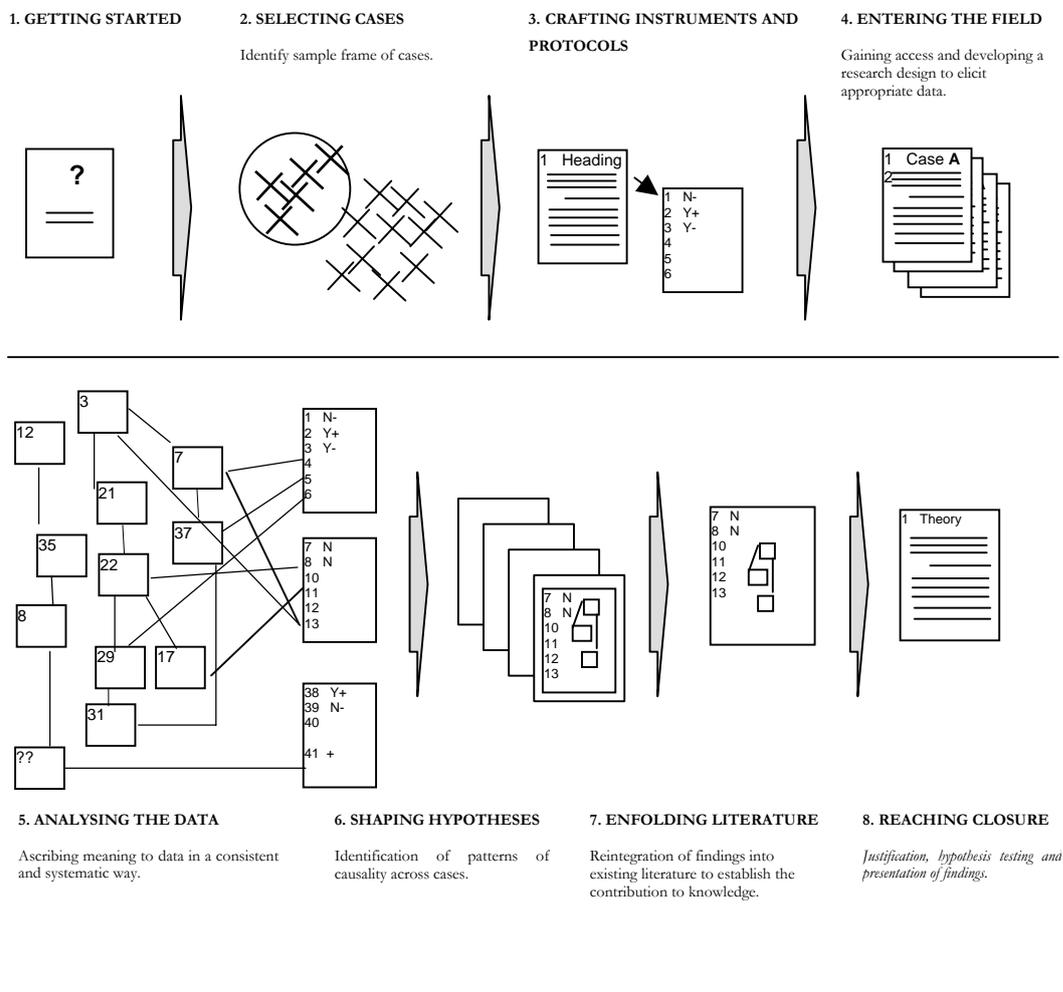


Figure 5.1. A practical framework to undertake design research using case studies

The framework manages to straddle an epistemological tightrope, through the interplay of ‘etic’ factors, derived from the thematic interviews, and ‘emic’ phenomena, native patterns of critical events, incidents and happenings in the respondents’ own accounts (as described by Spradley and McCurdy, 1979, p.231). In addition, it is able to cope with the huge amount of data often accumulated when undertaking case study research. It maintains clarity of purpose within the data analysis and a consistent data trail to ensure transparency throughout the process of condensation. Furthermore the transparency and accessibility of moving from one stage of analysis to another helps the reader assess the legitimacy of the findings.

This approach strikes a balance between depth (the ability to undertake detailed observations over time) and breadth (the number of cases) whilst overcoming the worst criticism of all, that of imposing a subjective and journalistic interpretation of events, which may bear little resemblance to participants’ own recollection of reality.



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