

Grounded Theory Method in HCI and CSCW

Michael J. Muller* and Sandra Kogan *

Grounded Theory Method in HCI and CSCW	1
Abstract	2
Introduction	3
Grounded Theory Addresses HCI and CSCW Topics.....	4
Grounded Theory is a <i>Conceptual</i> Method.....	4
The Uses of Grounded Theory Method in HCI and CSCW	5
Analyzing Data that have Already Been Collected	5
Organizing an Exploratory Study	5
Strengths and Weaknesses of GTM: A Preview.....	7
A Synopsis of Grounded Theory Method.....	8
A Brief but Necessary History of GTM.....	9
Divergence	10
Steps toward a Unified Practice	12
Working with Data in GTM.....	12
Describing the Data.....	13
Open Coding	13
Axial Coding.....	15
Selective Coding.....	18
Core Concept and Closure	20
Issues in Choosing the Core Concept	21
Working with Theory in GTM.....	22
Theoretical Sampling through Constant Comparison.....	22
Initial Sample	23

-
- IBM, One Rogers Street, Cambridge MA 02142 USA, {michael_muller, sandra_kogan}@us.ibm.com

Subsequent Samples.....	23
Theoretical Sampling.....	24
Constant Comparison.....	24
Memo Writing, and Writing from Memos.....	24
Forms and Genres of Memos.....	25
Connections through Memos	27
Writing from Memos	27
Structuring a GTM Research Project.....	29
Applying Grounded Theory to HCI and CSCW.....	31
Use of the Research Literature.....	31
Sensitizing Concepts.....	32
Coding Families	32
Summary	33
Presentation of Results and Implications.....	33
Conclusion	33
References.....	35
Appendix 1: Summary of Differences between Glaserian and Straussian Grounded Theory Method.....	45

Abstract

Grounded Theory Methods (GTM) are a set of thought-processes and procedures for qualitative data analysis that can help a researcher pursue a highly disciplined exploration of a new area, or of a domain without a dominant theory. The thought-processes and procedures are focused on the data, and always return to the data – i.e., the “grounding” in GTM is grounding in the data. In GTM, there is no hypothesis to be tested. Rather, research is guided by open-ended questions, and by a set of rigorous strategies that guide data collection, the choice of which data to sample, and the method for developing and testing insights into the data. The result is a rich, deeply interwoven description of the phenomena, and a set of new open-ended questions for further work. In this chapter, we provide an account of the multiple forms of grounded

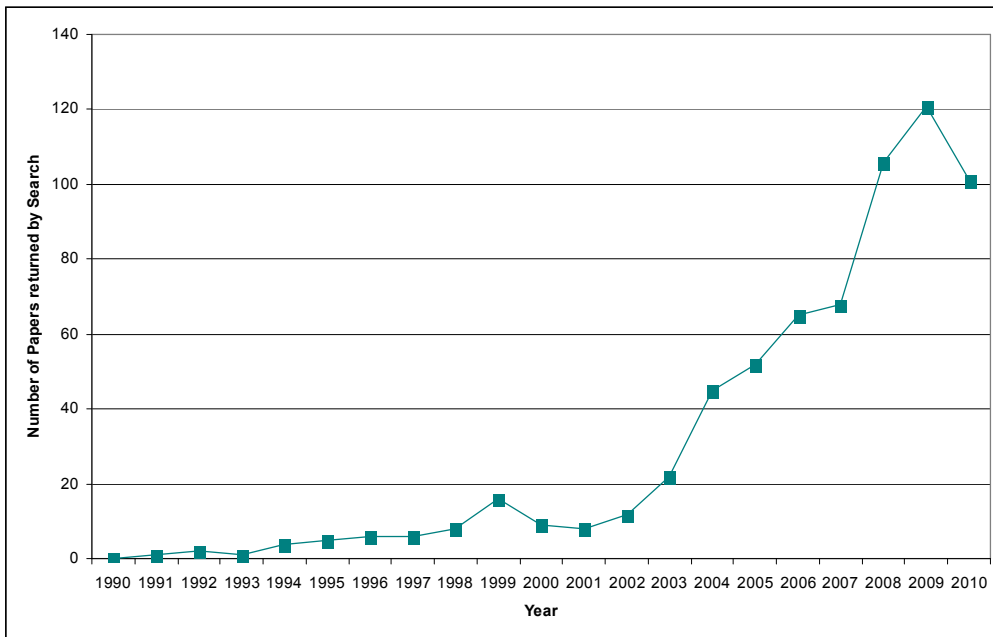


Figure 1. Grounded Theory references in the ACM Digital Library (2010 is an estimate based on data through May 2010).

theory, and a synthesis of the multiple views of method for use in HCI and CSCW.

Introduction

Grounded Theory Methods (GTM) are a set of practices for exploring a new domain, or a domain without an organizing theory (Glaser & Strauss, 1967). The practices are strongly *grounded in the data* and the theory is said to *emerge from the data*. These practices provide intellectual rigor for organizing an inquiry (Corbin & Strauss, 2008; Charmaz, 2006a, 2009; Gasson, 2004). Most GTM inquiries in HCI and CSCW are based on qualitative data, but the same rigor can be applied to exploratory studies that use quantitative data, or a combination of qualitative and quantitative data (for examples, see contributions in Bryant & Charmaz, 2007; Morse et al., 2009).

Grounded theory has been growing in importance. Hood (2007) reports figures from the Social Science Citation Index, in which grounded theory was mentioned in 101 journal articles during the 1970s, more than twice that number (296), in the 1980s, and six times that number (605) between 2000 and 2006. At the time of writing, the Association for Computing Machinery Digital Library

lists 645 entries for the search ‘ “grounded theory” , ’ with 180 articles on that topic during January 2009- May 2010 (Figure 1).

Grounded Theory Addresses HCI and CSCW Topics

In recent examples from the ACM Digital Library, grounded theory has been used in papers on software engineering, including developers’ orientation to new projects (Dagenais et al., 2010), metrics (Umarji and Seaman, 2008), software testing and quality processes (Taipale and Smolander, 2006), bug-tracking (Bertram et al., 2010), and a developers’ open source community (Ge et al., 2006). Developers’ views on user interface design issues and team cohesion were also explored (Ferreira et al., 2007; Whitworth and Biddle, 2007), as well as their use of forecasting visualizations (Asimakopoulos et al., 2009; see also Faisal et al., 2008, for and user experiences with visualizations), along with developers’ social relations (Williams et al., 2007), their relationship to marketers (Jantunen and Smolander, 2006), and the differences between their views and the views of their managers (Umarji and Seaman, 2009). Managers’ views of software development were also explored (Adolph, 2008; Lee et al., 2006; Morgan and Finnegan, 2010).

In a more traditionally sociological framework, grounded theory has been used in the study of (organizations Sousa and Hendriks, 2006), virtual teams (Sarker et al., 2006), and management of information systems methodologies Goede and de Villiers, 2003). In the organizational context, grounded theory has also been used to understand the transfer of training (Fincher and Teneberg, 2007), and individual self-interruptions (Jin and Dabbish, 2009).

Outside of the strict workplace context, grounded theory has helped to understand social phenomena in families (Dalsgaard et al., 2006), the needs of families managing collections of music (Sease and McDonald, 2009) and viewing the contents of videos related to smartphones (Blythe and Ciarns, 2009; see also Swallow et al., 2005). Accessibility needs have also been addressed (Kane et al., 2009; Sayago and Blat, 2009). In more personal domains, grounded theory has been used to study people’s formative experiences with computers (Schulte and Knobelsdorft, 2007), impression management during disease (Mamykina et al., 2010)), and value issues in games software (Barr et al., 2006).

Finally, in a more reflective way, grounded theory has been used to explore the needs of scholars in media studies (Kierkegaard and Borlund, 2008), and for an examination of HCI methods Nørgaard and Hornbæk, 2006).

Grounded Theory is a *Conceptual* Method

The “methods” in GTM are *not* a series of step-by-step procedures that are to be carried out with participants, or that are to be applied to data. Rather, the methods relate to *ways of thinking* about data (Glaser & Strauss, 1967), and

especially ways of making sense of the data (Charmaz, 2006), gradually and iteratively developing a theory to describe the data and the phenomena that are manifested through the data. Ideas, understandings, and new possibilities are recorded in a series of memos, which then form part of the structure of the report of the work. In the process of GTM, the theory is rigorously tested, again and again, by constant comparison with the data, and the series of tests both strengthens the theory, and leads to new insights (Chiavotti & Piran, 2003; Haig, 2005; Stern, 2007; Suddaby, 2006). This combination of open-minded exploration and rigor is the hallmark of GTM (Bowen, 2006; Stern, 2007). It is also a perplexing paradox, and we will spend considerable effort in this chapter to make sense of that paradox.

The Uses of Grounded Theory Method in HCI and CSCW

Grounded Theory originated in sociology (see below), and has become a key methodology in certain fields such as nursing. In those fields, it is often used as the major organizing principle for an entire large project (see examples in Bryant & Charmaz, 2007; Morse et al., 2009). Within HCI and CSCW, GTM has also been used as a method for data analysis within a larger project, which is then integrated with more formal theories in the broader research literature. There are two major ways that researchers have applied GTM in HCI and CSCW.

Analyzing Data that have Already Been Collected

Perhaps the most common usage in HCI and CSCW is to make sense of data that have already been collected. For example, a researcher might conduct a series of open-ended interviews with a predetermined sampling strategy. Once the interviews have been transcribed, the researcher could use GTM to discover the major themes that emerge from the interviews, and then develop a sense of conceptual categories among those themes, perhaps with high confidence about how several subthemes contribute to the same category. Then the researcher would set each category in relation to the other categories, finally producing a detailed analysis of the conceptual structure of how the informants described their experiences.

In this way, GTM is used to analyze data that have been collected in a relatively familiar HCI research programme. In this structure of work, the domain is known; the type of data to be collected is known; the sampling strategy is known; and the number of informants has been pre-determined. Most of the readers of this chapter have conducted research in this relatively familiar and straightforward manner.

Organizing an Exploratory Study

The second usage of GTM in HCI and CSCW is different, and is closer to the original intentions and claims of the methodology (Glaser & Strauss, 1967). In

this second usage, the researcher has only a general sense of the domain. The researcher collects an initial small sample of data, and then *immediately begins to construct a theory* of the domain. The researcher knows that the theory is based on insufficient data, and that therefore *the theory will be wrong in some respects*. The researcher analyses her/his incomplete theory, and determines its weakest point – a research strategy known as abduction (Pierce, 1958; see also Reichertz, 2007). That weakest point becomes the focus for the next small sample of data. The researcher tests the theory with the intent of *learning how it fails* at its weakest point, and of making a stronger theory based on that failure.

The stronger theory is, of course, also incomplete, and shows the way to its own weakest attribute. Abductive testing continues with iterations of small data samples and further theorizing – i.e., the researcher continues to try to make the theory fail. Each failure leads to more knowledge, and the theory becomes stronger, more detailed, and broader with each iteration. Finally, the researcher discovers that s/he is no longer learning anything new from each iteration, and the theory is ready to share with others.

This way of constructing theory follows a different form of scientific reasoning from the conventional paradigm of hypothesis-testing (e.g., Popper, 1968; Sanderson, 2003; for discussion, see also Dodig-Crnkovic, 2002; Greenberg & Thimbleby, 1992; Jaccard & Jacoby, 2010; Mackay & Fayard, 1997). Where hypothesis-testing is often called *deductive* or *confirmatory*, GTM follows a form of *inductive* or *emergent* theory development (Glaser & Strauss, 1967; Goulding, 1998; Jaccard & Jacoby, 2010). There is a large scientific and philosophical basis for inductive theorizing (e.g., Awbrey & Awbrey, 1995; Dewey, 1986; Eiter & Gottlob, 1995; Menzies, 1996; Patokorpi, 2009; Pierce, 1865/1982; Yu, 1994), but it may be less familiar to many readers of this chapter. There is also a 400-year tradition of abductive reasoning, which is a core component – and a key differentiator – of grounded theory (Reichert, 2007)¹.

More controversially, there is a disagreement about whether grounded theory follows an objectivist research agenda (i.e., sensing the world *as it is*) or whether grounded theory is part of a post-objectivist, constructivist agenda that recognizes all scientific descriptions and theories as being contextualized in a particular culture, and potentially in the biography of a particular researcher (see Charmaz, 2007, 2008; more generally in HCI, see Kaptelinin et al., 2003). The reader is entitled to know that our own views tend toward the constructivist position. However, most of the methodology of grounded theory can be applied across both

¹ See also the International Research Group on Abductive Inference, <http://user.uni-frankfurt.de/~wirth/>

sides of this disagreement, and we have been careful to present the material that is common to both perspectives in this chapter.

Strengths and Weaknesses of GTM: A Preview

Before we begin to provide details, it is fair to ask, *What is GTM good for in HCI and CSCW?* We provide some quick answers here, and we will return to this question at the conclusion of the chapter:

- Grounded theory is useful to explore a new domain, or a domain without a dominant theory.
- Grounded theory is a useful method for *constructing* a theory of this new domain.
- Grounded theory is an excellent method for avoiding a premature conclusion about the domain. In medicine and forensics, we would say that GTM helps to avoid “confirmation bias,” or the tendency to collect data that we expect to agree with our hunch (or our developing theory). The principle of abduction (Pierce, 1865/1982; Reichertz, 2007) is exactly opposed to confirmation bias, because it makes us avoid testing the theory at its strongest point, where we would expect it to succeed, and where the success will provide little new information. Rather, abduction teaches us to test the theory at its weakest point (Awbrey & Awbrey, 1995), where we would expect it to fail, and where the failure will provide a large amount of information about how to improve the theory. Abduction helps us to be *surprised*, and surprise is often the gateway to new insights and the kind of “discovery” that is at the heart of the grounded theory method (Reichertz, 2007).
- Grounded theory is *not* a useful method for testing a hypothesis, or for trying to prove or disprove a theory (Suddaby, 2006). The deductive, hypothesis-testing methods are much better suited to that kind of problem.

We also think that GTM transforms a human weakness into strength. Most of us think about the data we are collecting. Most of us try to explain the data to ourselves and our colleagues, even while we are engaged in the early stages of a research project. In a conventional data-collection discipline, this kind of informal theorizing is considered a problem. It can lead us to ask the wrong questions, or to bias the answers. It can cause us to make subtle changes in the way we analyze our data, or in the strategies we use for finding informants. We fear that we may unintentionally distort what was supposed to be a uniform process for collecting data in the same way from each informant. In conventional

data-collection, we try to avoid this kind of premature theorizing, and we try to discipline ourselves to prevent that theorizing from influencing how we collect data.

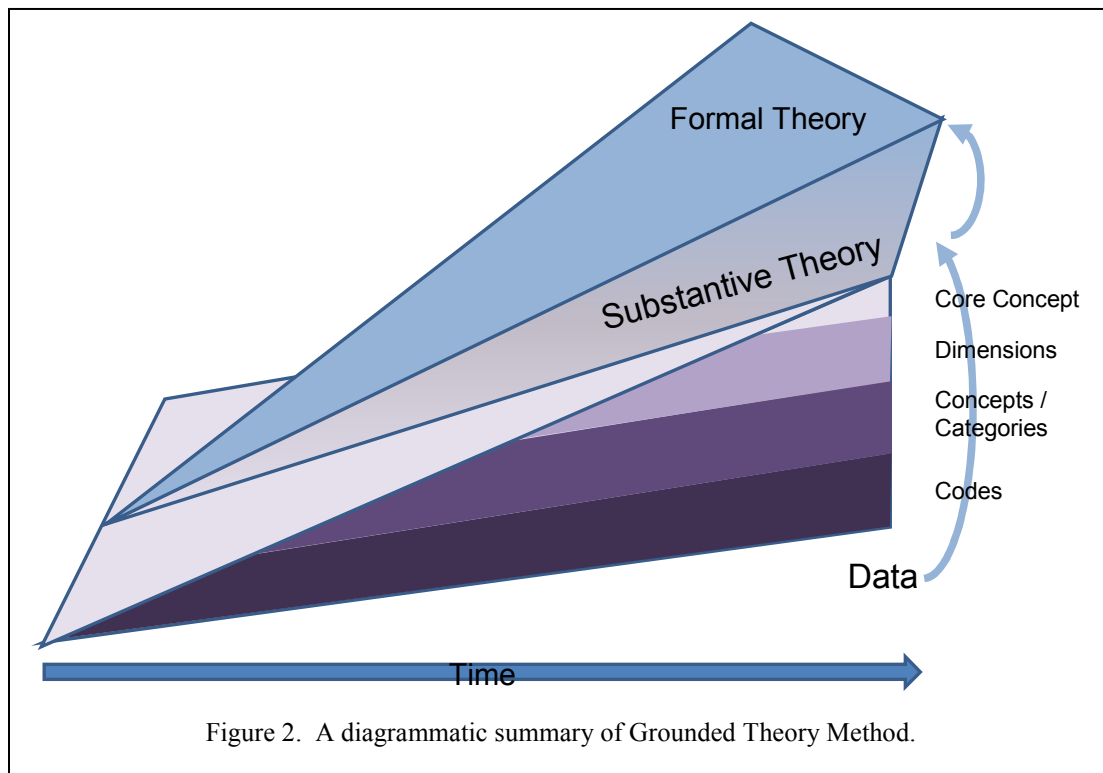
By contrast, GTM encourages us to theorize throughout the process of choosing where and how to sample, and throughout the period in which we collect and analyze our data. In GTM, we use our tendencies to think and to theorize as advantages. Rather than try to deny our thoughtfulness, we develop disciplines, such as abduction, to try to formalize our theorizing into a quality process that leads to new insights and new theories. As *thinking* scientists – as reasoners who are often passionate about our research -- we can use the rigor of GTM to make us more fully human.

A Synopsis of Grounded Theory Method

Charmaz (2008) writes, “Grounded theory methods consist of simultaneous data collection and analysis, with each informing and focusing the other throughout the research process. As grounded theorists, we begin our analysis early to help us focus further data collection. In turn, we use these focused data to refine our emerging analyses. Grounded theory entails developing increasingly abstract ideas about research participants’ meanings, actions, and worlds and seeking specific data to fill out, refine, and check the emerging conceptual categories...”

Research using GTM usually begins with a broad, very shallow set of unorganized information (left side of the “Data” portion of Figure 2). Over time, through a series of disciplined procedures (Charmaz, 2006a; Corbin & Strauss, 2008; Glaser, 1978, 1992, 1998; Strauss, 1987, 1993; Strauss & Corbin, 1990, 1998), the information becomes more narrowly focused, and is understood in greater depth (i.e., moving from left to right in the “Data” portion of Figure 2) (Glaser & Strauss, 1967). These disciplined procedures take the form of

- **Coding** of the data in greater degrees of integration, breadth, and understanding (Star, 2007), usually including
 - Open coding
 - Axial coding
 - Selective coding
- Development of **theory** through memo-writing (Charmaz, 2006; Dick, 2005; Lempert, 2009)
- **Theoretical sampling**



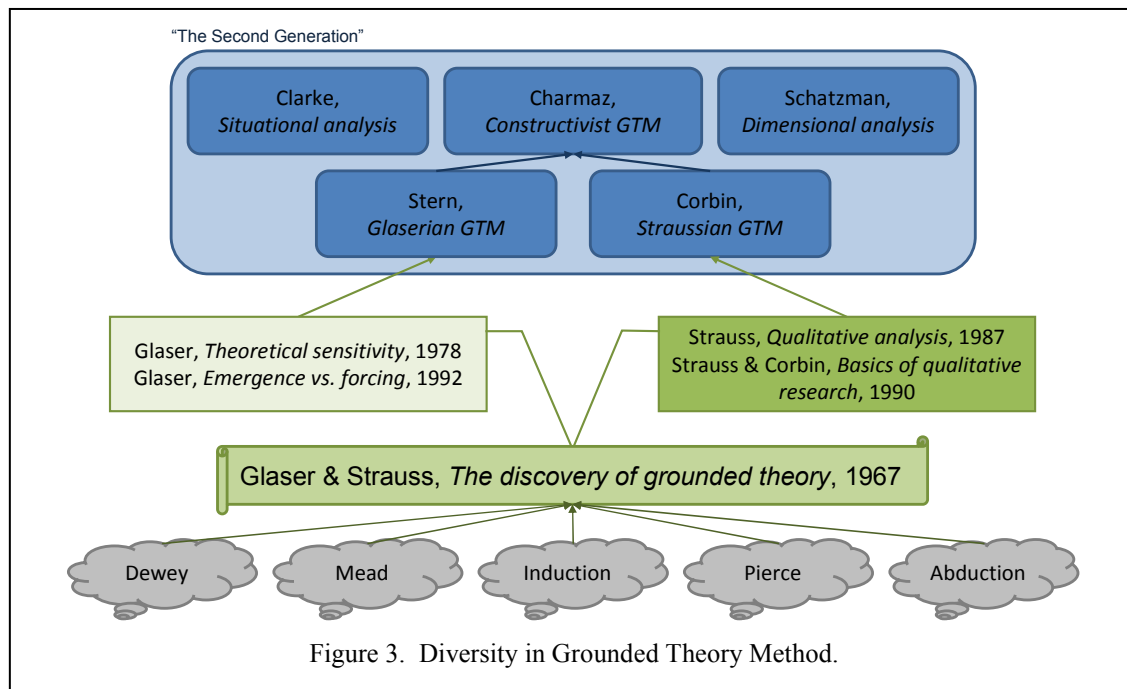
- **Constant comparison** of the developing theory with the data, always returning to the data (Glaser & Strauss, 1967; Corbin & Strauss, 2008)

Each of these concepts will be explained below.

As the data-collection becomes more focused, the researcher begins to develop more and more powerful descriptions (theories) of the domain; in GTM, these are called “substantive theory” (Glaser & Strauss, 1967) as shown in Figure 2. Finally, the substantive theory, which is developed from the data *internal* to the project, is brought into relationship with more formal theories from the research literature or from past investigations (Corbin & Strauss, 2008; Lempert, 2007). These more formal theories are *external* to the project, but are of course important in broader interpretations of the project, and in integrating the project’s findings into the broader research literature.

A Brief but Necessary History of GTM

The history of Grounded Theory has been told many times (e.g., Bryant & Charmaz, 2007; Charmaz, 2006a, 2006b, 2008; Locke, 2001; Morse et al., 2009), and we will not rehearse it in detail here. However, it is helpful to know about a schism in the thinking of the two founders of the approach, and the “second



generation” of grounded theorists (Morse et al., 2009) who have begun to heal that schism, and who are introducing new directions of their own (Figure 3).

Grounded theory was “discovered” during collaboration between Bernard Glaser and Anselm Strauss during the 1960s, and was first described as a methodology in their *Discovery of Grounded Theory* (1967). Glaser and Strauss had already worked together on topics of death and grieving (Glaser & Strauss, 1965), and they continued their collaboration into the next decade (Glaser & Strauss, 1968; Strauss & Glaser, 1970).

In the logical positivist atmosphere of the 1960s in the United States, their insights were a revelation. Star (2007) described the impact of Glaser’s and Strauss’s early work as “a manifesto for freedom from the sterile methods that permeated social sciences at the time.” Others were similarly moved; students gathered; and this new form of inquiry developed an enthusiastic and increasingly influential set of students, who in time went on to teach their own students about grounded theory.

Divergence

Subsequently, Glaser and Strauss proposed different types of procedures. Strauss favored a formalized set of methods, published in a series of theoretical works (Strauss, 1987, 1993). With Juliet Corbin, Strauss provided and repeatedly revised a set of core procedural descriptions of methods (most recently published as Corbin & Strauss, 2008) – a work that has sometimes been called “the

cookbook” by Strauss’s students and *their* students. Strauss’s work in methods – especially the series of methods revisions with Corbin -- has been extremely influential, and has allowed researchers with no direct ties to Strauss or his students to become competent practitioners of GTM.

Glaser considered these finely detailed methods to be a form of interference between the researcher and the data, and critiqued the Straussian procedures as “forcing” the data into a straitjacket imposed by arbitrary procedures (summarized in Glaser, 1992). Glaser’s perspective focused intensely on matters of “sensitivity” and “emergence” (Glaser, 1978, 1998). A researcher who had attained theoretical sensitivity (Glaser, 1978) would learn to attend to the data, and the theory would “emerge” from the data directly to the researcher, without being “forced” through unnecessary Straussian procedures (Glaser, 1992).

These differences of emphasis led to increasingly divergent practices. Strauss developed detailed coding strategies and a vocabulary of coding methods and even of the kinds of notes that researchers keep about their data (see “Memos,” below), as well as recommendations about how to fit a grounded theory analysis into the prior research literature. By contrast, Glaser’s emphasis on working *only* from the data until the theory *emerges* from the data, led to a strong rejection of specific steps or procedures, and an insistence that the research literature should be avoided during the early stages of a project, as more of a source of distortion than of clarity. Appendix 1 summarizes these and other differences between the two approaches.

Students of Strauss, and students of Glaser, learned two increasingly divergent sets of concepts and methods, while leaders of each school continued to claim that it was the correct form of Grounded Theory. Understanding and resolving the differences in perspectives became, for some, a critical problem (e.g., Kelle, 2005, 2007; van Niekerk & Roode, 2009). In their analysis, van Niekerk and Roode (2009) suggested that the two versions of GTM could look very similar to a novice researcher. Focusing on the difficult process of *conceptualizing theory*, they contrasted the procedural approach of Corbin and Strauss (2008) with a greater flexibility and creativity in the approach of Glaser (1978, 1992, 1998). In their view, flexibility and creativity are an advantage, but only for the experienced researcher. Unfortunately, mentors who follow Glaser’s approach are few and far between (see also Simmons, 1994; Stern, 1994). The Corbin and Strauss approach (2008), and the syntheses of Charmaz (2006a) and of Clarke (2005), offer stronger guidance for people who need to use grounded theory in the absence of a mentor. For this *Handbook* chapter, we have relied more on those accounts than on Glaser’s works, because Glaser wrote more as arguments to experts, or as supplements to a formal mentoring relationship (1978, 1992, 1998).

Some of the students made additional methodological refinements, and brought in additional philosophical and theoretical concepts. Stern (e.g., 2007, 2009) pursued Glaser's approach, while Corbin (2009; Corbin & Strauss, 2008) pursued Strauss's approach. Others developed their own innovations, many of which are summarized in Bryant's & Charmaz's *Sage Handbook of Grounded Theory* (2007).

Steps toward a Unified Practice

A group of noted GTM students gathered together as a self-described "second generation" of ground theorists, and published a set of essays and method descriptions, along with transcripts of their discussions, as they attempted to bring the diverse strains of GTM back into a common discourse space: *Developing grounded theory: The second generation* (Morse et al., 2009). Among the "second generation," Charmaz's work on constructivist grounded theory (2006a, 2006b, 2008, 2009) has become influential as both a source of procedural advice and a statement of the responsibility of the grounded theorist for the theory that s/he reports.

In Charmaz's constructivist synthesis of Glaser and of Strauss, the work of the grounded theorist goes beyond "forcing" and "emergence" to become a conscious *construction* of theory, always guided by data and disciplined by a set conceptual procedures that add rigor, credibility, and accountability of the theorist to the data at every step of the analysis (Charmaz, 2006a, 2008; for a partially convergent perspectives, see Bryant, 2002, 2003; Clarke, 2005, 2008; Seale, 1999). The synthesis in our chapter is based primarily on the "cookbook" by Corbin & Strauss (2008) and the procedural descriptions of Charmaz (2006a), as well as pertinent observations by Glaser (1978, 1992, 1998), and illuminated by the work of other grounded theorists as appropriate.

Working with Data in GTM

There are three major aspects of GTM: working with data, working with theory, and structuring a GTM research project. In practice, a grounded theorist has to think about all three aspects in parallel. It is easier to write and read about the aspects separately, and we will therefore present each subtopic in its own section. We will integrate the three aspects as we go.

As outlined above, GTM is deeply concerned with data at every stage of the analysis. It seems fitting to begin with methods for working with the data. Corwin and Strauss (2008) and Charmaz (2006) outline a similar set of practices for working with data. To make the concepts concrete we will illustrate them with examples from several different research programmes (Allen, 2003;

Charmaz, 2006), including some of our own (Muller et al., 2009; Thom-Santelli et al., 2008).

Describing the Data

The core work of grounded theory is to describe the data and the domain of the data through a series of descriptive *codes*. The descriptions are both highly detailed and specific to the domain, but also become more generalized and applicable to other domains as well (Figure 2). Star (2007) wrote, “A code sets up a relationship with your data, and with your respondents.... a matter of both attachment and separation.... Codes allow us to know about the field we study, and yet carry the abstraction of the new.” Writing descriptions that are both accurately detailed and powerfully abstract is challenging. Kelle (2007) comments, “Glaser and Strauss’s initial idea that categories would emerge from the data if researchers with sufficient theoretical sensitivity would apply a technique of constant comparison was difficult to realize in practice. Consequently, this idea was modified and refined several times in the ongoing development of grounded theory leading to a variety of different, new, and complex concepts like *theoretical coding*, *coding families*, *axial coding*, *coding paradigm*, and many others which supplemented and sometimes displaced the concepts of constant comparison and theoretical sampling from the early days.” Influential accounts of GTM provide a four-step process to help to meet the challenge of how to get started in coding (Charmaz, 2006; Corbin & Strauss, 2008; Dick, 2005; Star, 2007): open coding, axial coding, selective coding, and the designation of the core concept.

Open Coding

Coding of data begins with writing simple descriptive labels. This process is usually called “open coding.” Initially, open coding is done by creating labels for the persons, objects, or concepts in each item of data (typically, an interview transcript, or a paragraph in an interview). Over time, certain codes (labels) begin to recur, and the researcher can begin to keep a list of recurring codes. A number of software applications² are available to help with keeping a list of codes, and with applying codes directly from the list to the data.

² Because both authors work for a large company that provides software, we are ethically bound not to comment on other companies’ software products. Therefore, with regret, we will not provide information about the available commercial tools that can be used to support grounded theory coding, or other aspects of GTM. Interested readers can use words from this chapter as search terms to begin to find these tools, and to find blogs and articles that review these tools.

Informant Statement	Open code
From my perspective	• <i>Personal view</i>
the main challenge is	• <i>Assertion</i>
in changes in technology	• <i>Changes in technology</i>
or the product improvement	• <i>Changes in product</i>
done by the ... supplier.	• <i>Supplier</i>
You	• <i>Pronoun shift</i>
can never guarantee that	• <i>Assertion</i> • <i>Uncertainty</i>
if you are buying several	• <i>Procurement</i>
they will all be the same.	• <i>Product inconsistency</i> • <i>Necessary condition</i>

Figure 4. Microanalysis coding from a study of Configuration Management (CM) (excerpted from Allen, 2003)

Informant Statement	Open code
Status accounting is used to report monthly to the Project Board.	• <i>CM process</i>
Main difficulty is in getting people to buy-in to CM.	• <i>People difficulty</i>
3 rd parties have a preconceived set of established tools and are not willing to see the in-house point of view	• <i>People difficulty</i> • <i>Tool difficulty</i>
Developers saw CM as a control mechanism rather than a helpful tool.	• <i>Not helpful</i> • <i>Control</i> • <i>People difficulty</i>

Figure 5. Key-point coding form a study of Configuration Management (excerpted from Allen, 2003)

There has been much discussion the granularity of coding. For example, in a study of configuration management, Allen (2003) attempted to follow the recommendations in the second edition of Strauss & Corbin (1998) for coding by “microanalysis which consists of analyzing data word-by-word...” (Figure 4). He found this level of analysis to be too time-consuming, and to lose the pattern of the data in too much irrelevant detail. Allen switched to a procedure he called “key-point coding,” in which he first excerpted useful sentences or statements, and then applied codes against those large units of analysis (Figure 5).

Our own work has used open coding to identify topics of interest. In a study of employees who create named “collections” of files in a social file-sharing system (Muller et al., 2009), we conducted interviews via instant messaging, and we coded the text that was recorded in the saved chat-session logs.³ The “Open

³ Employees were aware that all chat-session logs could be recorded by any participant.

Chat question	Informant's Chat Answer	Open Code	Axial Code
Q. what was your goal (or goals) in using collections?	A. put some structure around the content I collect/create around my topic for me and readers	<i>Structure around content</i> <i>For self</i> <i>For others</i>	<i>Purpose/structure content</i> <i>Self</i> <i>Audience</i>
Q. what kind of structure?	A. taxonomy By Topic I guess	<i>Structure</i> <i>Taxonomy</i>	<i>Purpose/taxonomy</i>
Q. did you make collections for yourself, and other collections for your readers? or were all the collections for both "audiences"	A. both: what's good for me is good for my readers ☺	<i>Collection for both self and others</i>	<i>Audience</i> <i>Self</i>
Q. who are your readers?	A. sales teams, technical teams I do this basically for the sellers and supporting communities in the web1.0 world I used teamrooms I needed an alternative	<i>Readers</i> <i>Sales team</i> <i>Technical team</i> <i>Prior technology</i>	<i>Audience/Sales-team</i> <i>Audience/Tech-team</i> <i>Technology/team-room</i>

Figure 6. Open coding and axial coding from a study of Collections in a social file-sharing service (data from Muller et al., 2009)

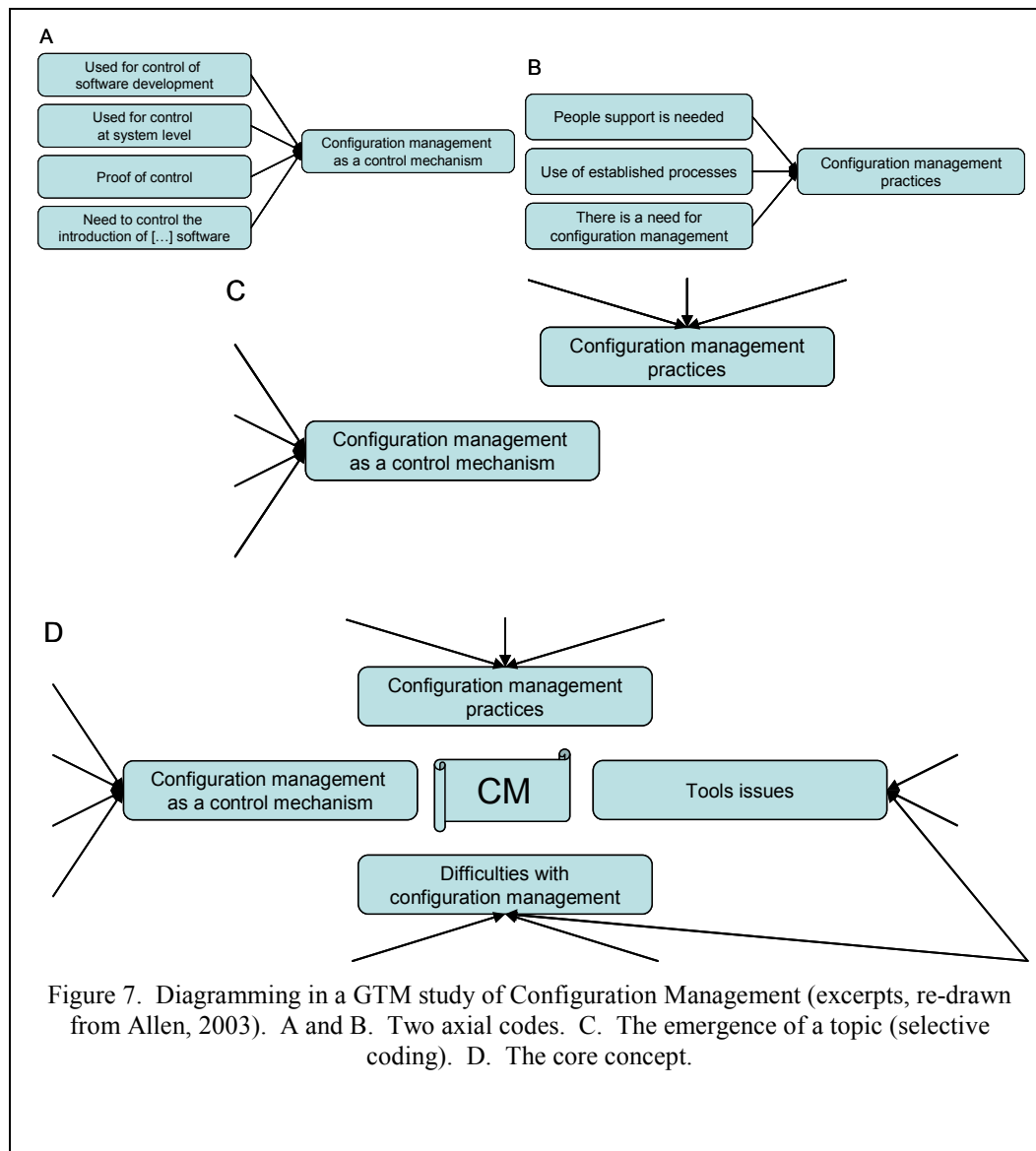
Code” column of Figure 6 provides an excerpt of open coding from one of those logs. For our purposes, coding at the level of each interchange (pair of turns) in the chat session allowed sufficient granularity without making the coding task – or its outcome – overwhelming.

Many other discussions could be cited here (e.g., Charmaz, 2006a, 2006b; Corbin & Strauss, 2008; Locke, 2001). The choice of the granularity depends in part on the sheer quantity of the data. Small sets of data can conveniently be analyzed in great detail, almost as if one were performing a close reading or an explication de texte. Larger sets of data will necessarily require a more macro-level focus.

Initially, the labels in open coding are not part of an organized body of concepts. Organizing the open codes into more complex conceptual structures occurs in the next several steps.

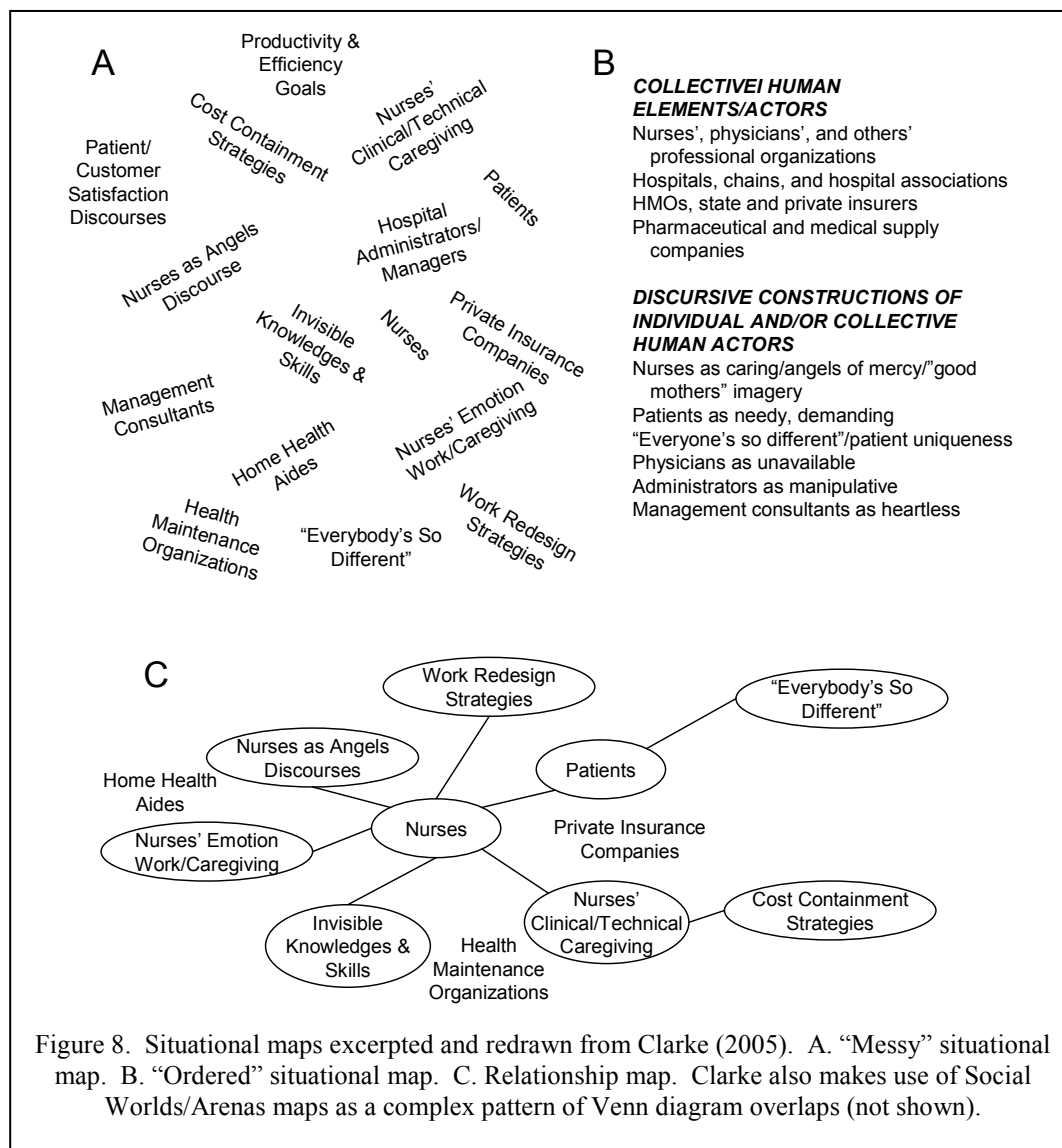
Axial Coding

In axial coding, the researcher begins to find relationships among the open codes (Charmaz, 2006; Corbin & Strauss, 2008). Some of the relationships lead to clusters of codes. Often, it is possible to name each cluster. A named cluster is often called a “category,” and much of early coding in GTM is a search for



powerful categories. The right-most column of Figure 6 provides examples of axial coding, in which the open codes are organized into more abstract conceptual categories (axial codes).

In some cases, the codes that are organized into categories are simple, mutually-exclusive alternatives, such as color names. In other cases, the codes can be arranged in a sequence or along a scale of some sort, such as the stressfulness of life events. In the latter case, the category is often termed a “dimension,” and another goal of early coding in GTM is to discover these dimensions and to arrange the open codes along the dimensions – a process that is



sometimes called "dimensionalizing the category." A dimension is a powerful concept for organizing the data, and is a step toward the "abstraction of the new" that Star wrote about (2007).

The relationship of axial codes to their constituent open codes can be described in several ways. Some grounded theorists prefer diagrams. In Allen's study of configuration management (Figures 4-5), he detailed the relationship of multiple open codes to a single axial code, as shown in Figures 7A and 7B (for reasons of space, we have presented only two of his axial codes, in summary form). Here, we can see a re-use of some of the open codes that were introduced in Figure 5, but now they have been renamed and organized in relation to one

another. By contrast, we used *textual* representations, as shown in the right-most column of Figure 6 (Muller et al., 2009).

Several different forms of diagrams have been richly investigated by Clarke in her situational analysis revision of GTM (Clarke, 2005), intended to be used after some basic coding has been done. Her *situational maps* (Figure 8) are similar to the diagrams of axial codes presented earlier (e.g., Figure 7), insofar as they can present a number of concepts in relation to one another, usually in a superset-subset visual organization. Clarke works back and forth between “messy” and “ordered” situational maps, as illustrated (by excerpt) in Figure 8. In the language of the preceding discussion, we interpret that the “messy” situational map contains primarily the open codes, while the “ordered” situational map organizes the open codes under axial codes.

Once a category or a dimension has been determined, the researcher may need to return to the data, and re-code the data in terms of the emergent concept that is summarized in the category or the dimension. For example, in the study excerpted in Figure 6, we had anticipated coding in terms of *Self* vs. *Other*, but we had to return to each chat transcript in order to rework those open codes into the axial code of “Audience,” and to catch all of the different types of audiences. While this return-to-the-data takes time, it is an essential step in knowing the data well. In the language of Glaser, the constant return to the data is part of developing sensitivity, and allows the emergence of the insights that become theory.

Most projects are complex, and contain multiple categories and/or dimensions. The process described above – clustering open codes via axial coding, followed by re-coding – may have to be followed multiple times, once for each axial code.

Selective Coding

Eventually, the researcher determines that some axial codes are more important than others. The researcher can then begin to focus on those sets of codes, and can begin to ignore the other, less important codes. By selecting certain codes for further development (Glaser, 1978, 1992; Corbin and Strauss, 2008), the researcher is making a decision about what topics to pursue. When Charmaz (2006) writes about *constructing* grounded theory, she is noting the importance of the researcher’s choice in deciding what to focus on.

According to the standard sources for GTM, there are several ways to make this decision (Charmaz, 2006; Corbin & Strauss, 2008). One way is to see which codes occur more often, or with greater generality across many different informants or different situations (Figure 8C presents a good example, in which the concept of “Nurses” is a strong organizing principle). . A second way to do

this is to see which codes occur in some contrasting pattern – e.g., certain codes occur primarily with informants from one situation or attribute, while other codes occur primarily with different informants from a second situation or attribute (our *self-vs.-and-audience* category from Figure 6 is a good example). A third way to do this is to note more complex patterns, or to understand that a particular category or dimension has explanatory power across many different situations or attributes. Each researcher will develop her or his own additional heuristics for deciding what is important.

Another way to determine importance, is to consider broader, more formal theories that are *external* to the research project. This strategy was discouraged in the initial presentations of GTM (e.g., Glaser & Strauss, 1967), and is anathema to the strict Glaserian school of GTM (e.g., Glaser, 1992, 1998). However, HCI and CSCW make distinct demands upon researchers and research reports, including the requirement to explicate relevance to other work in the field. In our disciplines, it may be appropriate to consider formal, external theories at an earlier point in the research than in the “pure” grounded theory methodology from sociology and nursing.

Yet another possible heuristic is to consider the organizational setting in which the researcher is working. Grounded theory was developed in an academic setting, where researchers are often able to choose their GTM research topics based primarily on the data. By contrast, a GTM research project in an organization (Locke, 2001) may be expected to produce answers to certain questions. During selective coding, it may be appropriate to choose topics based on those organizational priorities (e.g., what does the researcher’s organization need to learn?).

In Allen’s study, configuration management began to appear as a recurrent theme, as shown in Figure 7C. The two axial codes (Figure 7A and 7B) pointed toward the overall area of configuration management. However, other open codes and axial codes could have led in a different direction. Perhaps in part because of organizational priorities, Allen chose to narrow his focus to configuration management.

In our study of “curators” in file-sharing, we began to see several key categories – *self-vs.-audience*, and *self-sourced-vs.-added-by-others*. Those two concepts emerged from the data. In addition, our previous GTM research in social-tagging had led to similar categories of *audience* and also *impression-management* (Thom-Santelli et al., 2008; see also Thom-Santelli et al., 2006). Based on the strong *audience*-related theme that we found in the initial file-sharing codes, we used the external information from the social-tagging study as an additional way to search for open and axial codes in the file-sharing study. This step also required some amount of reviewing and re-coding. The themes

were indeed present in many of the interviews, and so we began to code selectively on themes of *self-vs./and-audience*, *source-of-file*, and *impression-management* around the role of the collection-creator.

Core Concept and Closure

Finally, toward the end of the coding process, the researcher has to ask herself or himself, “What is this data a study of?” (Glaser, 1978; also Kaufman, 1986). What is the topic of this research? Once determined, the focal topic is often referred to as the “core concept” of the project and its report, and the process of determining the core concept is referred to as “closure.” The answer to this question is found in the codes that were revealed through the previous step of selective coding – including the contextual constraints that were discussed in the previous subsection (e.g., need for relevance to other theories; fulfillment of organizational responsibilities).

How does the researcher determine the core concept? Opinions vary. In Charmaz’s approach to GTM (2006), the construct of the core concept is exactly that – a *construct* that is created as a human choice by the researcher, who then bears the responsibility for that act of construction. In Clarke’s situational analysis, the accountability is also on the researcher, including a responsibility to ask (and to design the study to ask) *whose voice is not being heard (and why)? Whose silence is significant (and why)?*

By contrast, Glaser would claim that there is a kind of *inevitability within the data* to determine the core concept – that the core concept “emerges” after the researcher has spent sufficient time working with the data (e.g., Glaser, 1992). Corbin & Strauss have tended to present a broader analytic framework that conveys its own *inevitability through the analytic process* leading to the core concept; at least one version of this analytic framework was entitled “THE PARADIGM” in earlier editions of their procedural work (e.g., Strauss & Corbin, 1990).

In Allen’s study, the choice made in selective coding led directly to the core concept of configuration management (Allen, 2003).

In our study of file-sharing, several interviews provided a key additional insight into how the file-collectors viewed their own role, as shown in Figure 9A. All three of these informants appear to be engaged in an on-going process of selecting files for their collections, with an explicit concern about how other people would be able to use those files (*collecting for others/audience*). In addition, these and other informants also thought about how to name and describe their collections for the easiest discovery and use by others (Figure 9B).

A. Collecting for others

“regular collections with manually selected / curated resources.... trying to help people (and myself!) make sense of the files that are available.... putting together a collection and deciding what goes into it... and if they are different from the ones I’ve seen before then I add them to my collection...” (I15, enterprise 2.0 evangelist, Canada)

“a kind of editor, you share you own and other useful info via collections” (I18, sales, Finland)

“put some structure around the content I collect/create around my topic... what is good for me is good for my readers ☺” (I19, product manager, France , already quoted in Figure 5).

B. Making the collection findable and usable

“very short descriptions... the intent of the collection – so I can keep the collection name really short!” (I9, project management, UK)

“sometimes I used the [descriptive field] to link to other related content [cross] reference” (I19, product manager, France)

and *“i asked everyone to use the naming convention, and I enforced it”* (I22, sales, USA)

Figure 9. Excerpts from the study of curators in a file-sharing service. A. Code: *Collecting for others*. B. Code: *Making the collection findable and usable*.

These insights came from five informants in five different countries, and in four distinct job roles. Following the GTM principles of *theoretical sampling* (see below), we tentatively concluded that this curator/editor code was found broadly across our sample. We also thought that the axial codes we had discovered earlier – *self-vs./and-audience* and *source-of-file* – were convergent with the concept of curating/editing. In addition, we realized that many people in a role similar to curators or editors would want to be known for their work, and that therefore the axial code of *impression-management* was also relevant. We conducted a last review of open codes and axial codes, and we reread selected chat-sessions, and finally decided to construct our report around the concept of “curators.”

Issues in Choosing the Core Concept

Is a core concept really required? Heuristically, most grounded theorists have recommended choosing a single topic around which to base an analysis, and choosing that topic as early as possible in the project (e.g., Corbin & Strauss,

2008; Glaser, 1978, 1992; Glaser & Strauss, 1967; Locke, 2001; Morse et al., 2009; Stern, 2007; Strauss, 1987, 1993). It is usually helpful for readers and reviewers if they know (to repeat Glaser's question, 1978) "What is this data a study of?"

But is this focus a *requirement* of grounded theory methodology? Or is it just a heuristic, or a rhetorical move, to increase the likelihood of publication? In their revision of GTM called "dimensional analysis," Bowers & Schatzman (2009) recommend delaying the choice of the core concept, and possibly keeping multiple core concepts throughout the later phase of the project. This is a minority view among grounded theorists, but it is available as a framework for researchers with complex domains.

In our discussion of the "Uses of Grounded Theory Method in HCI and CSCW" (above), we noted that some HCI researchers use grounded theory primarily for data analysis, and not to organize an entire project. In this case, the grounded theory part of the analysis is encapsulated within the broader project, and the "outcomes" of the grounded theory analysis may be partially structured by the requirements of that encapsulating project. For example, in a study of online communities (unpublished), we conducted a series of quantitative analyses of the social dynamics of more than 8000 distinct communities, and we used GTM to understand the attributes of a smaller number of communities that we had selected for detailed study. The results of the grounded theory analysis were then interpreted in the context of the broader quantitative study. In this case, the overarching themes of the research came from the quantitative study as well as the organization's needs, and we entertained multiple "core-concept-equivalents" as we developed and reported our grounded theory analyses. Other research projects have made similar uses of GTM to understand user comments or interviews within the context of a broader, multiple-method research project.

Working with Theory in GTM

The preceding sections have discussed how to code data, once the data have been collected. We also wrote, in the section on "Organizing an Exploratory Study," that GTM advises to collect a small amount of data, and immediately begin coding and theorizing from that small sample. How is this done?

Theoretical Sampling through Constant Comparison

Outside of GTM, the conventional experimental approach favors either (a) large samples with high internal homogeneity, or (b) stratified samples in which a particular variable is systematically varied (e.g., income, or gender). The goal is to have sufficient data be able to characterize *all* the members of the large, homogeneous group, or *all* the members of each of the "strata" that make up the

stratified sample (e.g., a homogeneous subset of high-income people, a homogeneous subset of medium-income people, and so on). By contrast, the usual initial strategy in GTM is to *sample for diversity* (e.g., Corbin & Strauss, 2008). The assumption is that most interesting phenomena will become visible in the different ways that they occur across the diversity of people and organizations. Our observation of those differences will lead us to the factors that cause the differences, or at least the factors that are associated with the differences. Each set of observations is kept deliberately small, to allow for sampling across a greater diversity of people and situations.

Initial Sample

Remembering that the goal is to sample for diversity, the immediate question is, *How to start?* To choose the first sample of data, the researcher may try to find the most “representative” case or situation. Alternatively, the researcher might begin at an extreme of the range of possible person attributes or situations. For example, in our study of file-sharing, we began by interviewing people who had used the “collection” features more than most other users. This initial sampling strategy assured us that we would receive a lot of information about collecting, but it also postponed interviews with people who were less frequent users. We made this choice, assuming that we would sample from the mid-frequency users later on.

We wanted to avoid any other source of bias in our sample, so we structured our list of high-frequency users in frequency order, and then we selected the informants such that they spanned as broad a range of attributes as possible. We interviewed at most one person from each country, and we tried to choose informants from as many different organizations as possible. This approach had the added advantage of avoiding the researcher's tendency to study other researchers. Using our criterion of different organizations, we would interview fewer members of the research organization, despite the ease of finding and recruiting them.

Subsequent Samples

In GTM, the first sample leads to the first set of codes, and then the first theory. The first theory allows us to make a quick, informal hypothesis – often of the form that, *if the phenomenon occurs under these circumstances, then it should (or should not) occur under a predictable second set of circumstances*. This hypothesis tells us how to choose our next sample: The second sample should abductively test the initial hypothesis. If the phenomenon occurs according to the hypothesized pattern, then that outcome strengthens the initial theory. If the phenomenon does not occur as predicted, then that tells us a limit to the initial

theory, or tells us to recast the initial theory, or to replace it with a very different hypothesis.

Theoretical Sampling

The selection of the second (and subsequent) samples is made on the basis of the developing theory. For this reason, grounded theorists speak of *theoretical sampling*. In each case, the goal is to provide the strongest test *against* the developing theory (abduction), to reveal its weaknesses early, and to broaden the range of situations and attributes over which the theory makes good predictions or descriptions. As Charmaz writes, “Consistent with the logic of grounded theory, theoretical sampling is emergent. Your developing ideas shape what you do and the questions you pose while theoretical sampling” (Charmaz, 2006).

Constant Comparison

Theoretical sampling is a process of creation and destruction. What survives is a stronger theory, and a more informative – more powerful – way of describe the data. To continue Star’s statement (2007) that we quoted in “Describing the Data,” “Codes allow us to know about the field we study, and yet carry the abstraction of the new... When this process is repeated, and constantly compared across spaces and across data... this is known as theoretical sampling... Theoretical sampling stretches the codes, forcing other sorts of knowledge of the object... taking a code and moving it through the data... fractur[ing] both code and data.”

Another way to describe this process is to say that data are always at the heart of ground theory, and that theory grows only by being tested against the data. Theory emerges *from the data* that we already have, and the emerging theory provides guidance about where or how to collect *the next set of data*. In summary, theory is repeatedly compared with old and new data. And new data are repeatedly compared with old data. As Star wrote, this is the principle of *constant comparison*, and lies at the heart of the inference process in GTM.

Memo Writing, and Writing from Memos

In keeping with the incremental nature of theoretical sampling, most grounded theorists write their emergent theory incrementally as well. In GTM, this process is called memo-writing, and is the recorded manifestation of the inference process, answering questions such as “what do I think is going on here?” and “what are the next data that I need to collect to test my theory?” and “what have I learned from the new data, and how do I code what I have learned?” and “what do I need to do next?” In the language of the preceding section, “Memos are excellent source of directions for theoretical sampling—they point out gaps in existing analyses and possible new related directions for the emerging theory”

(Glaser, 2004). Consequently, memo-writing is begun as soon as the first data are collected, and continues throughout the project (Corbin & Strauss, 2008).

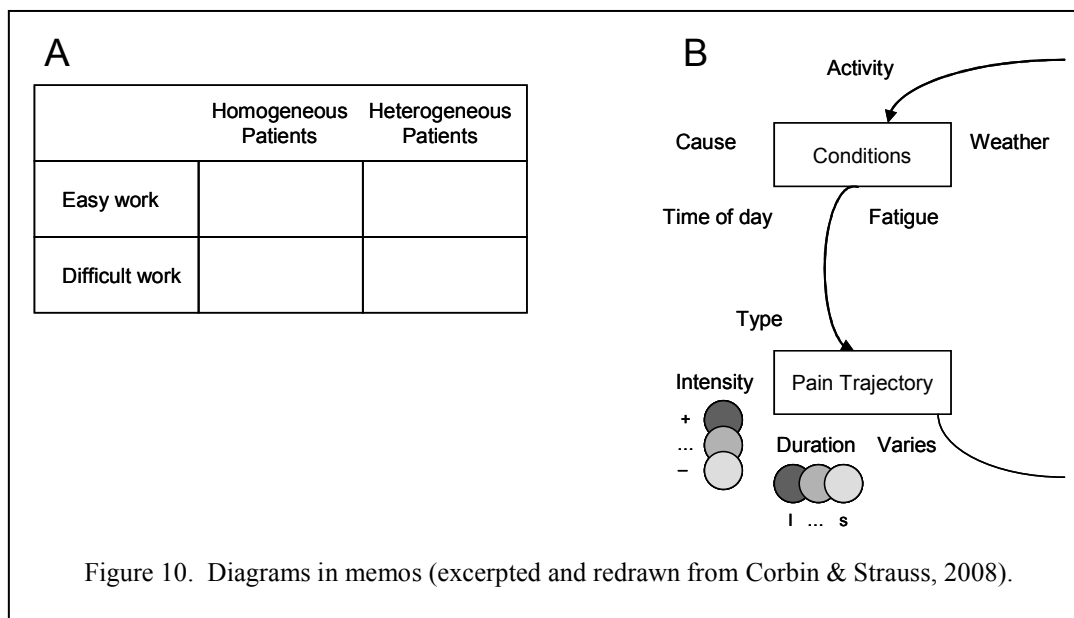
Memo-writing is considered to be a necessary component in conducting a GTM project: “Theory articulation is facilitated through an extensive and systematic process of memoing that parallels the data analysis process in GT. Memos are theoretical notes about the data and the conceptual connections between categories. The writing of theoretical memos is the core stage in the process of generating theory” (Glaser, 2004). Corbin and Strauss (2008) concur: “[Memos] force the analyst to work with ideas instead of just raw data. Also, they enable analysts to use creativity and imagination, often stimulating new insights into data.” Charmaz (2006) agrees: “Memo-writing constitutes a crucial method in grounded theory because it prompts you to analyze your data and codes early in the research process.... [N]ote where you are on firm ground, and where you are making conjectures. Then go back to the field to check your conjectures.”

Memo-writing goes on simultaneously with data-collection and coding. In the memos, the researcher writes her or his justification for the codes, and makes a note of potential alternatives, hypotheses not yet tested, and implications (Glaser, 2004). Stern writes (2007) “If data are the building blocks of the developing theory, [then] memos are the mortar.” Charmaz adds (2006), “You write memos throughout your research. Memos provide ways to compare data, to explore ideas about the codes, and to direct further data-gathering. As you work with your data and codes, you become progressively more analytic in how you treat them and thus you raise certain codes to conceptual categories.”

According to Glaser (2004), part of what makes memo-writing valuable is that it prevents jumping to conclusions, and permits thought: “Memos slow the analyst's pace, forcing him/her to reason through and verify categories and their integration and fit, relevance and work for the theory. In this way, he/she does not prematurely conclude the final theoretical framework and core variables. “Corbin & Strauss agree about the importance of memo-writing: “Doing memos and diagrams should never be viewed as chores, or as tasks to be agonized over... [M]emos... grow in complexity, density, clarity, and accuracy as the research progresses... They move the analysis forward and as such are just as important to the research process as data gathering itself.”

Forms and Genres of Memos

Memos can be long or short. Corbin & Strauss (2008) provide examples of memos related to many distinct perspectives and topics in a GTM investigation; not surprisingly, the length and structure of the memos vary from one-to-two paragraphs to a page or more. Charmaz (2006) provides examples of memos that



range from single paragraphs to well-structured essays, with explicit structuring of those essays using headers and sub-headers. By contrast, Dick (2005) writes that he always carries a supply of file cards, so that he can write memos as they occur to him; we infer that most of his memos are briefer than what can fit on a file card. Zaltman & Coulter (1995) used vignettes, and sometimes images. In our own research, our memos have ranged from writing multiple, numbered brief lines scribbled on a single file card, one memo per line, to a three-page, formally-structured table that required several hours to produce with a word-processor.

Specific memo-writing practices vary widely. Some researchers keep their memos in an organized set of files online. A few researchers record them sequentially in a notebook.⁴ Still other researchers write simple or elaborate diagrams (e.g., expanded versions of Figures 7, 8, and 10), or use software applications to generate diagrams from hierarchically-structured codes (from open codes to axial to selective to core-concept). For collaborative analyses, we often share memos online as documents in a social software application that supports collections of documents with controlled access to each collection. In addition to many textual examples, Corbin & Strauss (2008) described simple tables to

⁴ However, the notebook format would interfere with another important attribute of memos according to Corbin & Strauss (2008), that they be capable of being physically sorted and re-arranged. See “Writing from Memos,” below. The use of online tools may provide most of the advantages of notebooks (dated, sequential entries) with sort-ability, and may facilitate sharing and coordination as well.

explicate the relationship among multiple factors (Figure 10A), and causal diagrams to show hypothesized conceptual relationships (Figure 10B).

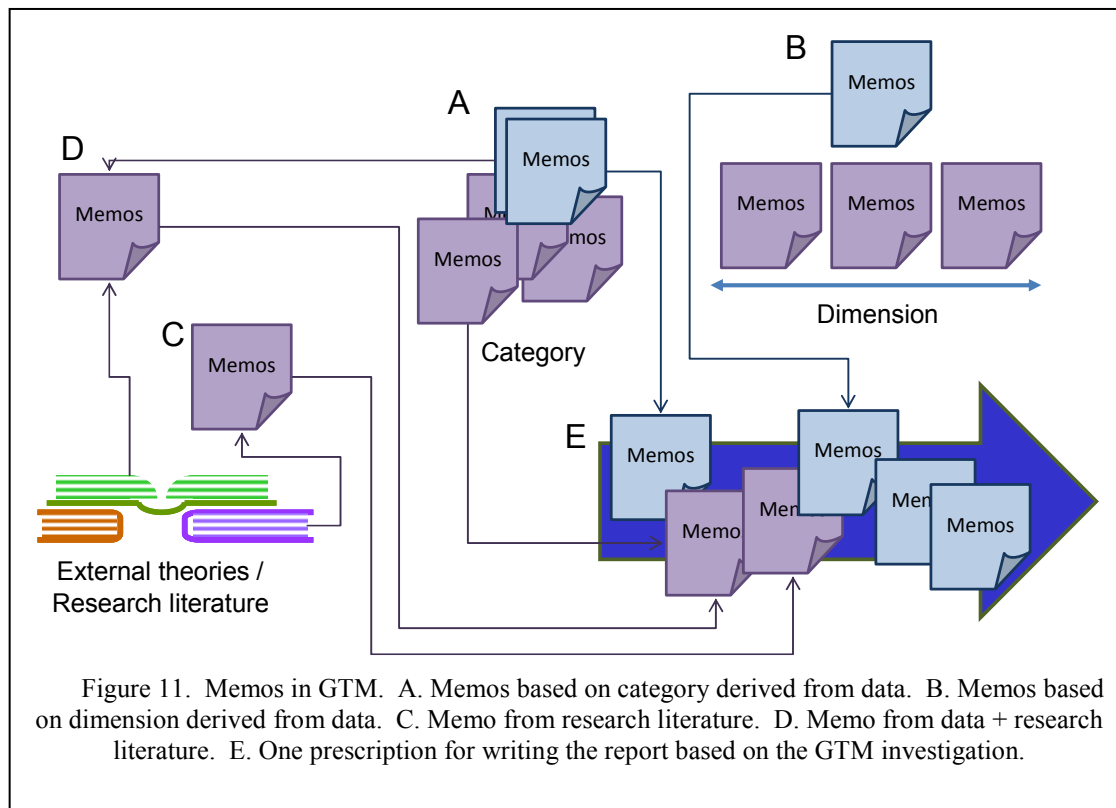
Some researchers write specific genres of memos, while others do not differentiate. Using a memo classification scheme from Strauss & Corbin (1990), Jaccard and Jacoby (2010) described types of memos as follows: “Researchers write down field notes to themselves about ideas and insights... which they then consult when analyzing their data, or when they formally posit their theory. One type of memo is called a *code memo*, which is a note relevant to the creation of coding or categories. A *theoretical memo*, by contrast, focuses on theoretical propositions linking categories or variables. *Operational memos* contain directions about the evolving research design and data collection strategies. Memo writing occurs in the field during data collection and also during data analysis.” In their third-edition revision, Corbin & Strauss (2008) proposed six general types of memos, but with less formality in the differentiations: open data explorations; identification and development of categories and dimensions; comparisons and questions; explorations among categories, dimensions, concepts; and development of a story line. By contrast, for Gasson (2004), all memos are “theoretical memos.” As with much of the details of GTM, how the researcher adapts GTM to her/his own work is an emergent and highly personal process.

Connections through Memos

Stern’s statement -- that memos can serve as the “mortar” in constructing a grounded theory account (2007) – can be applied in several ways. First, memos can be used to summarize and integrate the findings from categories (Figure 11A) or from dimensions (Figure 11B) – i.e., from concepts that originate in the data. In addition, as proposed by Glaser (2004) and as described in Pryor’s thesis (2005), memos can serve as “mortar” between data and *external* information (Figure 11C), and between data and the research literature (Figure 11D). Memos provide an opportunity to try out different ways of exploring the meaning of data, or of connecting one item of data with another, or of looking for relationships among data, external knowledge, and the research literature. Some memos turn out to be valuable in report-writing, while others can be “carried forward” into subsequent projects.

Writing from Memos

As we wrote, above, memos have much intrinsic value to the researcher during the process of doing the research, such as: coding clarification; theoretical sampling, exploration of hypotheses; recording of paths not taken, and general support for the human thought and construction that is the core GTM activity. Memos are also valuable in the process of writing interim reports (which may stand as memos by themselves) and more formal results.



Of course, most researchers keep notes. What is special about memos in GTM? Grounded theory memos span predictable ranges, from instance to generalization, from concrete to abstract, from factual to theoretical (see “Forms and Genres,” above). Over time, each concept of interest will have multiple memos related to it. When the researcher collects the relevant memos, s/he can assemble them into structure that “tells the story” or “makes the argument” about the relevant concept. Memos, thus, are both a concurrent tool for thinking, and also serve as an investment of sorts for later work, including report-writing – as Glaser (2004) says, “a memo fund that is highly sort-able.”

If, as Star said, “Theoretical sampling stretches the codes... fractur[ing] both code and data” (Star, 2007), then “Sorting is essential—it puts the fractured data back together [because] the outline for writing is simply an emergent product of the sorting of memos.... Sorting... has a conceptual, zeroing-in capacity. The analyst soon sees where each concept fits and works, its relevance and how it will carry forward in the cumulative development of the theory” (Glaser, 2004). Glaser (2003) recommends finding a large surface and literally sorting the memos into the writing-order for the report (Figure 11E). AlKaissi (n.d.) says, perhaps optimistically, “The sort structure is the report structure. It is often just a matter of preparing a first draft by typing up the cards in sequence and integrating them into

a coherent argument.” However, Stern (2007) cautions, “The idea is to make labels act as rubrics for all known categories and their properties. Life isn’t that tidy, and neither is memo sorting: it turns out that new labels are needed as categories collapse upon one another, and memos turn out to be misfiled and belong to another category.” In this necessarily challenging process, “Sorting helps the analyst integrate the theory; in the physical display of their thought processes, the appearance of the theory begins to take shape” (Stern, 2007).

Memo-writing practices have implications for sorting. Dick (2005) and AlKaissi (n.d.) advocate writing memos on cards (e.g., file cards), which are easy to sort on a large table. By contrast, the longer memos described and shown by Charmaz (2006a) and Corbin & Strauss (2008) do not lend themselves to simple physical sorting: Most of these memos contain more than one idea. The diagrams-based memos (Figures 7, 8, and 10) that have been advocated by Clarke (2005) and Corbin & Strauss (2008) are unlikely to appear in their entirety and their multiplicity in a final report. The three-page table that we referred to from our own work presents similar problems.

Like so much of GTM, there is agreement in the overall concept of *writing from memos*, but each researcher will have to find her/his own set of personal best practices. In theoretical terms, memos can be used as a kind of externalization or crystallization of the researchers’ thoughts (as in activity theory, e.g. Bazerman, 1997), or can serve as a kind of extension of the researcher’ cognition (as in distributed cognition, e.g., Ackerman & Halverson, 2000; Hollan et al., 2000). Each researcher thinks differently from one other researchers, and our work practices are different, and we think in a social context which may have its own requirements for information-sharing at various stages of the grounded theory project (e.g., a researcher working alone as contrasted with a student being advised by a mentor). Some researchers will develop memo-writing strategies that are structured in terms of the eventual sorting process (e.g., AlKaissi, n.d.; Dick, 2005; Glaser, 2004). Other researchers will choose to make selected memos serve as collaborative documents, or highly-specific and tightly-focused interim reports on a particular concept (Charmaz, 2006a; Corbin & Strauss, 2008). Still other researchers will write memos containing first drafts of paragraphs or even sections for their reports. Or combinations of these practices.

Structuring a GTM Research Project

Earlier, we wrote that there were three simultaneous components in a grounded theory project: working with data, working with theory, and structuring the project. We now turn to the third of those topics.

Grounded theory projects are both easier and more difficult to manage than conventional projects. The ease of management comes from being able to pursue

new directions, and to use the researcher's developing knowledges and skills to follow-up on insights and possibilities. As we have said, grounded theory is as much about *thinking* as it is about the data, and it provides the thoughtful researcher with abundant opportunities to think long and hard and creatively and responsibly.

The difficulty of management comes from the potentially unbounded structure of the work. In a conventional, hypothetico-deductive project, the researcher designs a study with a known number of factors, a known number of informants, a fixed (and carefully planned) set of procedures that result in a set of data whose structure is known in advance, and a nearly automatic way of using the data to answer the research question. We know how to conduct these studies, and we know when each step is completed. By contrast, a grounded theory project has no "stopping rule" to tell us when data-collection is complete, and when theorizing is complete. How do grounded theory researchers manage this problem?

One of the important concepts in grounded theory is "saturation" or having "saturated categories" (Charmaz, 2006a; Clarke, 2005; Corbin & Strauss, 2008; Glaser, 1978, 1992; Glaser & Strauss, 1967; Strauss & Corbin, 1990, 1998). The development of category or a dimension, from open codes through to selective coding, is a matter of going from concrete data to abstract concepts. Eventually, each new item of data produces less and less change in those abstract concepts – they become stable (a mathematician might say that they "reach asymptote"), and the categories on which they are based become fully connected with other categories and the emergent (Glaser & Strauss, 1967) or constructed Charmaz, 2006a) core concept. Because the categories are fully informed by data, and no longer develop, they are said to be "saturated." In a study of family violence, Stern (2007) describes the researcher's experience of saturation very persuasively: "I realized that I had reached the point of saturation when the [informant] was telling me how when he was a small child he stood witness as his mother shot his father dead, *and I was bored*. I made all the right noises... but I knew that my data collection for that study had come to an end." (italics in the original).

Another way to think about saturation is to refer back to the concept of abduction. As Reichertz (2007) reminds us, abduction is concerned with *surprise*, and with the structuring of a research project such that we are constructively and creatively surprised by new data and new concepts. When the surprise stops happening – when we are bored – then abduction is no longer taking place, and it is time to stop collecting data (and constructing theory), and time to start writing the report.

The process that we have just outlined is a "perfect" sequence for an academic research project with an unbounded timeframe and infinite resources. In practice, the researcher might face various constraints regarding time, access to informants,

and budget – especially in an organizational setting. The stopping rule in the “perfect” academic setting might be “saturation,” but in an organizational context, the stopping rule might very well turn out to be “Friday,” or “when the budget is exhausted.” As Charmaz (2008) reminds us, research takes place in a cultural and an organizational context. The researcher who adopts grounded theory in an organization, may need to adapt some of the practices of grounded theory to meet the requirements of that organization.

Applying Grounded Theory to HCI and CSCW

Grounded theory began in sociology, and has gained strength in many research disciplines, especially nursing. How can grounded theory be integrated within research and practice in HCI and CSCW?

Use of the Research Literature

A recurring problem in grounded theory is *What weight to give the research literature?* Early work (e.g., Glaser & Strauss, 1967) took a firm stand for naïve investigations. Students were urged to postpone reading the research literature in order to remain open to the data, and only the data. This approach has turned out to be problematic in many ways. In the context of HCI and CSCW, research is required to make a novel contribution. We can’t know if our project or problem is novel, unless we have read extensively in the research literature.

There are deeper problems with the position of naïveté, *within* the process of conducting a grounded theory investigation. Kelle (2007) criticized this position as follows: “the request ‘literally to ignore the literature of theory and fact on the area under study, in order to assure that the emergence of categories will not be contaminated’ (Glaser & Strauss, 1967...) can lead inexperienced users of grounded theory procedures to adopt an unrealistic idea about their work. Novices who wish to firmly observe the principle of ‘emergence’ often experience the search for categories as extremely tedious and a subject of sometimes numerous and endless team sessions, leading to a proliferation of categories which makes the whole process insurmountable...”

How, then, can the research literature enter a grounded theory investigation without distorting the process? Dey (1993) claimed that “there is a difference between an open mind and an empty head. To analyse data, we need to use accumulated knowledge, not dispense with it.” Discussing Dey’s work, Vasconcelos (2007) adds “In other words, analysis is emergent, but not ‘atheoretical’” (see also Goulding, 1998). In HCI and CSCW, this point is particularly important, both in making the argument from the data, and in demonstrating the value of the research as a novel contribution that answers questions relevant to the research literature in our fields.

In Figure 2, we offered a summary diagram of how a grounded theory investigation proceeds – from a broad view of the data to a narrower focus, and from a shallow set of categories and dimensions to a richer, deeper, more interconnected set of concepts. In grounded theory research, the theory that emerges (or is constructed) *from the data* is called “substantive theory,” whereas concepts from the research literature are called “formal theory.” The question thus becomes, *When and how should substantive theory be informed by formal theory?*”

Sensitizing Concepts

Grounded theorists have discussed an approach to this problem by reference to Blumer’s earlier proposal of the “sensitizing concept” (Blumer, 1954). A sensitizing concept is to be used as “a starting point in a qualitative study” to “draw attention to important features... and provide guidelines... in specific settings...” (Bowen, 2006). Charmaz describes sensitizing concepts as “background ideas that inform the overall research problem” (Charmaz, 2003; see also Glaser, 1978; Vasconcelos, 2007). Earlier in this chapter, we claimed that grounded theory takes advantage of the human tendencies to think and to theorize. In keeping with that claim, we note Bowen’s quotation of Gilligan’s argument that “Research usually begins with such concepts, whether researchers... are aware of them or not.”⁵

The principled use of sensitizing concepts helps us to be aware of how we think and theorize in this way, and to understand where we are led by the data (in the purer sense of grounded theory) and where we are influenced by the work that has gone before our own research. Based on Blake (2000), Bowen (2006) suggests that sensitizing concepts be used *not* as a source of hypotheses to be tested, but rather “to lay the foundation for the analysis” or “to develop thematic categories” from data that have already collected, perhaps then helping to choose the next set of data to be (iteratively) collected.

Coding Families

A second strategy for making carefully limited use of the research literature was proposed by Glaser (1978), as a set of “coding families.” Glaser offered his coding families in the form of established sets of axial codes, based in broad theoretical backgrounds in sociology, and ready to be applied to data as needed. Coding families include concepts such as causality, limit or range of values, part-whole relations, and collective beliefs. These selected types of relationships, collected by a seasoned researcher, may be one way to inform the work with an attenuated set of results from the research literature: “The conception of coding

⁵ Gilgun’s source paper, referred to as a webpage in Bower’s paper, is no longer available online.

families makes clear that certain types of theoretical knowledge are clearly helpful in deriving grounded categories from the data” (Kelle, 2007).

Summary

Our impression is that grounded theorists continue to struggle (as we do) with the “right” balance between maintaining an “open mind,” while avoiding the problems associated with an “empty head” (Dey, 1993). Researchers in HCI and CSCW will need to inform their choice of research area and problem-to-be-solved with a strong knowledge of the research literature; too much naïveté is likely to lead to repeated work and missed opportunities. What appears to be crucial, is remain aware of when we are working from the research literature, and when we working from the data, and to make thoughtful choices about how to mix the two perspectives. Discussions of this question, written in the context of HCI and CSCW, would be very helpful, and we hope our colleagues will address these issues.

Presentation of Results and Implications

The fields of HCI and CSCW have their own norms of how arguments are made, and how reports are structured. If a grounded theory project is to be published in these literatures, then of course it must be “rhetorically recognizable” – i.e., it must present its method and its analysis in a rigorous manner, and it must make a case for the quality of the data reporting and analysis, and for the conclusions that are drawn from the data. We recommend that the researcher indicate clearly whose grounded theory methods s/he has adopted, and (if appropriate) how s/he has adapted the method in response to local circumstances or organizational requirements. Most HCI and CSCW audiences will not be familiar with the special language of grounded theory, so we recommend that the researcher make careful decisions between necessary precision of GTM terms, vs. burdening the reader with what may appear to be jargon. Grounded theory methods are intended to help the researcher to achieve clarity and precision of thought. The researcher has a responsibility to provide that precision and especially that clarity *to the reader*, in terms that the reader can understand and use in her/his own research.

Conclusion

Grounded Theory Methods are less than 50 years old, and are undergoing change, reformulation, innovation, and experimentation (e.g., Morse et al., 2009). The adoption of GTM in HCI and CSCW has begun even more recently, and researchers in our fields are continuing to learn about the methods, and about how they can be adapted to advantage under the various constraints of HCI and CSCW work in academia, industry, government, and non-profits. In this *Handbook*

chapter, we have presented a summary of our understanding of GTM in 2010, written with the intention that researchers can learn enough from these pages to begin their own practices (the learn-by-doing approach is advised by many of the sources on GT methods). We anticipate rapid growth in understanding of GTM in our fields within the next five years. We hope that this chapter helps to spur that growth, and that the new understandings will replace this chapter with a better set of advices and findings.

During this period of learning, growth, adoption, and adaptation, each researcher will be developing her or his own set of practices, and will be struggling with the conflicting advices of the many grounded theorists, as well as their diverse philosophical positions. As Floyd (1987) noted in her account of *process-oriented software engineering*, practices in our field are under development, just as software and hardware are under development. In this chapter, we have attempted to provide a broad survey of practices and the rationales behind them. We have noted the disagreements, while focusing on the commonalities, and we have provided pointers to discussions and divergent approaches that we hope will be useful as each HCI or CSCW researcher navigates this rich, promising, and challenging domain of analysis, thought, action, and passion.

Grounded theory has tended to be used in HCI and CSCW in two distinct ways. Perhaps the greater number of papers have used grounded theory as an analytic method on data that have already been collected. All of the coding methods and iterative theory-construction practices come into play here, except of course for the fullest extent of theoretical sampling (because, in most of these studies, the data set has already been collected, and there is limited or no opportunity to determine a need for more data from a previously-unsampled source). We note that many HCI and CSCW web researchers currently face more data than any human can analyze, and that they can, to some extent, exercise theoretical sampling by choosing *which data to focus on* among the huge datasets that come to us in internet or intranet sampling.

A numerically smaller number of HCI and CSCW projects has used a grounded theory approach that is closer to the “ideal” sociological methods from the 1967 *Discovery of Grounded Theory* – i.e., the ability to collect data in small samplings, using constant comparison techniques in order to choose where, how, and with whom the next data iteration should be conducted.

There has been an extended discussion of issues of quality and rigor in GT (Corbin & Strauss, 2008; Charmaz, 2006a, 2009; Gasson, 2004; Muller, 2010), including several distinct positions about boundaries – i.e., what kind of work qualifies as GTM (Adolph et al., 2008; Becker, 1993; Cutliffe, 2005; Matavire and Brown, 2008; Skodal-Wilson, 1996; van Niekerk & Roode, 2009; and of

course the on-going disagreements by Glaser and by Strauss, cited earlier)? In our survey of critiques of GT quality and rigor, we discovered some authors who claimed that the “full” or “ideal” version of GTM was the only valid way to conduct research that could be called “grounded theory.” However, we think it is too early for anyone to say, for HCI and CSCW, what “is” or “is not” grounded theory. We make reference again to Floyd’s (1987) insights about the development of *methodology* that accompanies the development of technology and of theory. Researchers in HCI and CSCW will continue to develop our fields’ understandings of these methods, and as a community of researchers we will make new HCI- and CSCW- based innovations in grounded theory for our domains. Where appropriate, our community will bring our innovations to the sociologists and nursing researchers who have taught us so much about grounded theory, and inform their practices with insights from our own.

What we need now is continued growth and development of GTM in HCI and CSCW, but we principally need discussion. By analogy, it is time to begin to apply the grounded theory concept of “constant comparison” to our own fields, comparing our methods and our findings with other people in HCI and CSCW as a kind of “data about doing GTM research.” We will rapidly form iterative theories about what works and what doesn’t, and then we should abductively test those theories in further GTM-based studies. We hope to see not only more papers on grounded theory in HCI and CSCW, but also more workshops and panels, where we can perform a collective “constant comparison” of adaptations of GTM to our fields. To heal the schism and advance the field, Morse et al. (2009) wrote *Developing grounded theory: The second generation*. Perhaps we will soon be able to write and read a collection of papers called, *Developing grounded theory in HCI and CSCW: The third generation*.

References⁶

- Ackerman, M.S., & Halverson, C.A. (2000). Reexamining organizational memory. *Communications of the ACM* 43 (1), 58-64.
- Adolph, S., Hall, W., and Kruchten, P. (2008). A methodological leg to stand on: lessons learned using grounded theory to study software development. Proceedings of Conference on the Center for Advanced Studies on Collaborative Research 2008, Toronto, Ontario, Canada.
- AlKaissi, A.A.E. (n.d.). Grounded theory. An-Najah National University, <http://www.najah.edu/file/Essays/english/Aidah%20Kaisi/19.pdf>

⁶ All URLs listed in this chapter were verified during July 2010.

- Allen, G. (2003). A critique of using grounded theory as a research method. *Electronic Journal of Business Research Methods* 2 (1), 1-10.
- Asimakopoulous, S, Fildes, R., and Dix, A. (2009). Forecasting software visualizations: an explorative study. Proceedings of British Conference on HCI, Cambridge, UK, 269-277.
- Awbrey, J., and Awbrey, S. (1995), "Interpretation as Action: The Risk of Inquiry", *Inquiry: Critical Thinking Across the Disciplines*, 15, 40-52.
- Barr, P., Noble, J., Biddle, R., and Khaled, R. (2006). From pushing buttons to play and progress: value and interaction in fable. Proceedings of Australian User Interface Conference 2006, Hobart, Australia, 61-68.
- Bazerman, C. (1997). Discursively structured activities. *Mind, Culture, & Activity* 4 (4), 296-308.
- Becker, P.H. (1993). Common pitfalls in published grounded theory. *Qualitative Health Research* 3 (2), 254-256.
- Bertram, D., Volda, A., Greenberg, S., & Walker, R. (2010). Communication, collaboration, and bugs: The social nature of issue tracking in small, collocated teams. *Proceedings of CSCW 2010*. Savannah, GA, USA, February, 2010.
- Blaikie, N. W. H. (2000). *Designing social research: The logic of anticipation*. Cambridge, UK: Polity.
- Blumer, H. (1954). What is wrong with social theory? *American Sociological Review* 18, 3-10.
- Blythe, M., and Cairns, P. (2009). Critical methods and user generated content: the iPhone on YouTube. Proceedings of CHI 2009, Boston, MA, USA, 1467-1476.
- Bowen, G.A., (2006) 'Grounded theory and sensitizing concepts,' *International Journal of Quality Methods* 5(3), Sep. 2006.
- Bowers, B., & Schatzman, L. (2009). Dimensional analysis. In Morse, J.M., Stern, P.N., Corbin, J., Bowers, B., Charmaz, K., & Clarke, A.E. (eds), *Developing grounded theory: The second generation*. Walnut Creek, CA, USA: Left Coast Press.
- Bryant, A. (2002). Regrounding grounded theory. *Journal of Information Technology Theory and Application* 4, 25-42.
- Bryant, A. (2003). Doing grounded theory constructively. A reply to Barney Glaser. *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research* 3 (3). Charmaz, K., (2006a). *Constructing grounded theory: A*

- practical guide through qualitative analysis*. Thousand Oaks, CA, USA: Sage.
- Bryant, A., & Charmaz, K. (2007) (eds.), *The Sage handbook of grounded theory*. Thousand Oaks, CA, USA: Sage.
- Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis*. Thousand Oaks, CA, USA: Sage.
- Charmaz, K., (2006b). 'Grounded theory,' in Ritzer, G. (ed.), *Encyclopedia of sociology*. Cambridge, MA, USA: Blackwell.
- Charmaz, K. (2008). Grounded theory in the 21st century: Applications for advancing social justice. In N.K. Denzin & Y.S. Lincoln (eds.), *Strategies of qualitative research – 3rd edition*. Thousand Oaks, CA, USA: Sage, 203-241.
- Charmaz, K. (2009). Shifting the grounds: Constructivist grounded theory methods. In Morse, J.M., Stern, P.N., Corbin, J., Bowers, B., Charmaz, K., & Clarke, A.E. (eds), *Developing grounded theory: The second generation*. Walnut Creek, CA, USA: Left Coast Press.
- Chiovitti, R.F., & Piran, N. (2003). 'Rigour and grounded theory research,' J. *Adv. Nurs.* 44 (4).
- Clarke, A.E. (2005). *Situational analysis: Grounded theory after the postmodern turn*. Thousand Oaks, CA, USA: Sage.
- Clarke, A.E. (2009). From grounded theory to situational analysis: What's new? Why? How? In Morse, J.M., Stern, P.N., Corbin, J., Bowers, B., Charmaz, K., & Clarke, A.E. (eds), *Developing grounded theory: The second generation*. Walnut Creek, CA, USA: Left Coast Press.
- Corbin, J., & Strauss, A.L. (2008). *Basics of qualitative research 3e*. Thousand Oaks, CA, USA: Sage.
- Cutcliffe, J.R. (2005). Adapt or adopt: developing and transgressing the methodological boundaries of grounded theory . *Journal of Advanced Nursing* 51 (4), 421-428.
- Dagenais, B., Ossher, H., Bellamy, R.K.E., Robillard, M.P, and deVries, J.P (2010). Moving into a new project landscape. *Proceedings of Conference on Software Engineering 2010*, Cape Town, South Africa, 275-284.
- Dalsgaard, T., Skov, M.B., Stougaard, M., and Thomassen, B. (2006). Mediated intimacy in families: understanding the relation between children and parents. *Proceedings of Conference on Interface Design and Children 2006*, Tampere, Finland, 145-152.

- Dewey, J. (1986). Logic: The theory of inquiry. In J.A. Boydston (Ed.), *John Dewey: The later works, 1925-1953. (Vol 12: 1938)*. Carbondale, IL: Southern Illinois University Press.
- Dey, I. (1993). *Qualitative data analysis: a user-friendly guide for social scientists*. London: Routledge.
- Dick, B. (2005). *Grounded theory: A thumbnail sketch*. Resource papers in action research, <http://www.scu.edu.au/schools/gcm/ar/arp/grounded.html>.
- Dodig-Crnkkovic, G. (2002). Scientific methods in computer science. *Proceedings of Conference for Promotion of Research in IT*, Skovde, Sweden, April, 446-460.
- Eiter, T., and Gottlob, G. (1995), "The Complexity of Logic-Based Abduction, *Journal of the ACM*, 42.1, 3-42.
- Faisal, S., Craft, B., Cairns, P., and Blandford, A. (2008). Internalization, qualitative methods, and evaluation. *Proceedings of BELIV 2008*. Florence, IT.
- Ferreira, J., Noble, J., and Biddle, R. (2007). Up-front interaction design in agile development. *Proceedings of Conference on Agile Processes in Software Engineering and Extreme Programming 2007*. Como, IT, 9-16.
- Fincher, S., and Tenenberg, J. (2007). Warren's question. *Proceedings of Workshop on Computer Education Research*. Atlanta, GA, USA, 51-60.
- Floyd, C. (1987). Outline of a paradigm change in software engineering. In G. Bjerknes, P. Ehn, and M. Kyng (Eds.), *Computers and democracy: A Scandinavian challenge*. Brookfield, VT, USA: Gower.
- Gasson, S. (2004). Rigor in grounded theory research: An interpretive perspective on generating theory from qualitative field studies. In M. Whitman & A.B. Woszczynski (eds), *The handbook of information systems research*. Hershey, PA, USA: Idea Group.
- Ge, X., Dong, Y., and Huang, K. (2006). Shared knowledge construction process in an open-source software development community: an investigation of the Gallery community. *Proceedings of Conference on Learning Sciences 2006*, Bloomington, IN, USA, 189-195.
- Glaser, B.G. (1978). *Theoretical sensitivity*. Mill Valley, CA, USA: Sociology Press.
- Glaser, B. G. (1992). *Basics of grounded theory analysis: Emergence vs forcing*. Mill Valley, CA: Sociology Press.

- Glaser, B.G. (1998). *Doing grounded theory: Issues and discussions*. Mill Valley, CA, USA: Sociology Press.
- Glaser, B.G. (2003). *The grounded theory perspective II: Description's remodeling of grounded theory methodology*. Mill Valley, CA, USA: Sociology Press.
- Glaser, B.G. (2004). Remodeling grounded theory. *Forum: Qualitative Social Research/Sozialforschung* 5 (2).
- Glaser, B.G., & Strauss, A.L. (1965). *Awareness of dying*. Chicago, IL, USA: Aldine.
- Glaser, B.G., & Strauss, A.L. (1967). *The discovery of grounded theory*. Chicago, IL, USA: Aldine.
- Glaser, B.G., & Strauss, A.L. (1968). *A time for dying*. Chicago, IL, USA: Aldine.
- Goede, R., & de Villiers, C. (2003). The applicability of grounded theory as research methodology in studies on the use of methodologies in IS practices. *Proceedings of the 2003 annual research conference of the South African institute of computer scientists and information technologists on Enablement through technology 2003*.
- Goulding, C. (1998). Grounded theory: The missing methodology on the interpretivist agenda. *Qualitative Market Research*, 1 (1), 50-57.
- Greenberg, S. and Thimbleby, H. (1992) "The weak science of human-computer interaction." In *CHI '92 Research Symposium on Human Computer Interaction*, Monterey, California, May.
- Haig, B.D. (2005). Grounded theory as scientific method. *Philosophy of Education Yearbook 2005*. Philosophy of Education Society.
- Hollan, J., Hutchins, E., & Kirsh, D. (2000). Distributed cognition: Toward a new foundation for human-computer interaction. *Transactions on Computer-Human Interaction* 7 (2), 174-196.
- Hood, J.C. (2007). Orthodoxy vs. power: The defining traits of grounded theory. In Bryant, A., & Charmaz, K.(eds.), *The Sage handbook of grounded theory*. Thousand Oaks, CA, USA: Sage, 2007, 191-213.
- Jaccard, J., & Jacoby, J. (2010). *Theory construction and model-building skills: A practical guide for social scientists*. New York, NY, USA: Guilford.
- Jantunen, S., Smolander, K. (2006). Towards global market-driven software development processes: an industrial case study. *Proceedings of Workshop*

- on Global Software Development for the Practitioner. Shanghai, China, 94-100.
- Jin, J., and Dabbish, L.A. (2009). Self-interruption on the computer: a typology of discretionary task interleaving. *Proceedings of CHI 2009*. Boston, MA, USA, 1799-1808.
- Kane, S.K., Javant, C., Wobbrock, J.O., and Ladner, R.E. (2009). Freedom to roam: a study of mobile device adoption and accessibility for people with visual and motor disabilities. *Proceedings of ASSETS 2009*, Pittsburgh, PA, USA, 115-122.
- Kaptelinin, V., Nardi, B., Bødker, S., Carroll, J., Hollan, J., Hutchins, E., & Winograd, T. (2003). Post-cognitivist HCI: Second-wave theories. *CHI 2003 Extended Abstracts*.
- Kaufman, S.R. (1986). *The ageless self: Sources of meaning in late life*. Madison, WI, USA: University of Wisconsin Press.
- Kelle, U. (2007). The development of categories: Different approaches in grounded theory. In Bryant, A., & Charmaz, K.(eds.), *The Sage handbook of grounded theory*. Thousand Oaks, CA, USA: Sage, 2007, 191-213.
- Kelle, U. (2005). "Emergence" vs. "forcing" of empirical data? A crucial problem of "grounded theory" reconsidered. *Forum: Qual. Soc. Res.* 6(2).
- Kierkegaard, B., and Borlund, P. (2008). Characteristics of information needs for television broadcasts of scholars and students in media studies. *Proceedings of Symposium of Information Interaction in Context 2008*, London, UK, 116-122.
- Lee, G., DeLone, W., and Espinosa, J.A. (2006). Ambidextrous coping strategies in globally distributed software development projects. *Communications of the ACM* 49 (10), 35-40 (October, 2006).
- Lempert, L.B. (2007). Asking questions of the data: Memo writing in the grounded theory tradition. In Bryant, A., & Charmaz, K.(eds.), *The Sage handbook of grounded theory*. Thousand Oaks, CA, USA: Sage, 2007, 245-264.
- Locke, K. (2001). *Grounded theory in management research*. Thousand Oaks, CA, USA: Sage.
- Mackay, W.E., & Fayard, A.-L. (1997). HCI, natural science and design: A framework for triangulation across disciplines. *Proceedings of DIS'97*, 223-234.

- Mamykina, L., Miller, A.D., Mynatt, E.D., and Greenblatt, D. (2010). Constructing identities through storytelling in diabetes management. *Proceedings of CHI 2010*, Atlanta, GA, USA, 1203-1212.
- Matavire, R., and Brown, I. (2008). Investigating the uses of “grounded theory” in information systems research. *Proceedings of SAICSIT 2008*, Wilderness. South Africa, 139-147.
- Menzies, T. (1996), Applications of Abduction: Knowledge-Level Modeling, *International Journal of Human-Computer Studies*, 45.3, 305-335.
- Morgan, L., and Finnegan, P. (2010). Open innovation in secondary software firms: an exploration of managers' perceptions of open source software. *ACM SIGMIS Database* 41 (1), 79-95.
- Morse, J.M., Stern, P.N., Corbin, J., Bowers, B., Charmaz, K., & Clarke, A.E. (2009). *Developing grounded theory: The second generation*. Walnut Creek, CA, USA: Left Coast Press.
- Muller, M.J. (2010). Grounded theory method. Tutorial at HCIC 2010. Slides available at <http://www.slideshare.net/traincroft>.
- Muller, M.J., Millen, D.R., & Feinberg, J. (2009). Information curators in an enterprise file-sharing service. *Proceedings of ECSCW 2009*, Springer, Vienna, Austria.
- Nørgaard, M., and Hornbæk, K. (2006). What do usability evaluators do in practice?: an explorative study of think-aloud testing. *Proceedings of DIS 2006*. University Park, PA, USA, 209-218.
- Patokorpi, E. (2009). What could abductive reasoning contribute to human computer interaction? A technology domestication view. *PsychNology Journal* 7 (1), 113-131.
- Peirce, C. S. (1865/1982). On the logic of science. In Peirce Edition Project (Eds.), *Writings of Charles S. Peirce: A chronological edition. (Vol. 1: 1857-1866)*. Bloomington, IN: Indiana University Press.
- Popper, K. (1968). *The logic of scientific discovery*, 2nd ed. Harper Torchbook, New York, NY.
- Pryor, J. (2005). *A grounded theory of nursing's contribution to inpatient rehabilitation*. Ph.D. thesis, School of Nursing, Deakin University.
- Reichertz, J. (2007). Abduction: The logic of discovery of grounded theory. In Bryant, A., & Charmaz, K.(eds.), *The Sage handbook of grounded theory*. Thousand Oaks, CA, USA: Sage, 2007, 214-228.

- Sanderson, P.M. (2003) Cognitive work analysis. In J.M. Carroll (ed.), *HCI models, theories, and frameworks: Toward a multidisciplinary science*. Morgan Kaufman, San Francisco, CA, USA, 225-264.
- Sarker, S., Lau, F., & Sahey, S. (2001). Using an adapted grounded theory approach for inductive theory building about virtual team development, *Data Base for Advamced Information Systems* 32(1).
- Savago, S., Blat, J. (2009). About the relevance of accessibility barriers in the everyday interactions of older people with the web. Proceedings of Cross-Disciplinary Conference on Web Accessibility 2009, Madrid, Spain, 104-113.
- Schulte, C., and Knobelsdorf, M. (2007). Attitudes towards computer science-computing experiences as a starting point and barrier to computer science. *Proceedings of Workshop on Computing Education Research 2007*, Atlanta, GA, USA, 27-35.
- Seale, C. (1999). *The quality of qualitative research*. London, UK: Sage.
- Sease, R., and McDonald, D.W. (2009). Musical fingerprints: collaboration around home media collections. *Proceedings of GROUP 2009*, Sanibel Island, FL, USA, 331-340.
- Simmons, O. E. (1994). Grounded therapy. In B. Glaser (ed.), *More grounded theory methodology : A reader*. Mill Valley, CA, USA :Sociology Press, 4-37.
- Skodal-Wilson, H., Ambler-Hutchinson, S. (1996). Methodological mistakes in grounded theory. *Nursing Research* 45 (2),122–124.
- Sousa, C.A.A., & Hendriks, P.H.J. (2006). The diving bell and the butterfly: The need for grounded theory in developing a knowledge based view of organizations. *Organizational Research Methods* 9(3).
- Star, S.L. (2007). Living grounded theory. In Bryant, A., & Charmaz, K.(eds.), *The Sage handbook of grounded theory*. Thousand Oaks, CA, USA: Sage.
- Stern P.N. (1994). Eroding grounded theory. In Morse J (ed.), *Critical issues in qualitative research methods*. Thousand Oaks, CA, USA: Sage.
- Stern, P.N. (2007). Properties for growing grounded theory. In Bryant, A., & Charmaz, K.(eds.), *The Sage handbook of grounded theory*. Thousand Oaks, CA, USA: Sage.
- Strauss, A.L. (1987). *Qualitative analysis for social scientists*. New York, NY, USA: Cambridge.

- Strauss, A.L. (1993). *Continual permutations of action*. New York, NY, USA: Aldine.
- Strauss, A.L., & Corbin, J. (1990). *Basics of Qualitative Research*. Thousand Oaks, CA, USA: Sage.
- Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (2nd ed.). Thousand Oaks, CA: Sage.
- Strauss, A.L., & Glaser, B.G. (1970). *Anguish*. Mill Valley, CA, USA: Sociology Press.
- Suddaby, R. (2006). From the editors: What grounded theory is not. *Academy of Management Journal* 49 (4).
- Swallow, D., Blythe, M., & Wright, P. (2005). Grounding experience: Relating theory and method to evaluate the user experience of smartphones. *Proceedings of EACE 2005*. Chania, Greece.
- Taipale, O, and Smolander, K. (2006). Improving software testing by observing practice. *Proceedings of Symposium on Empirical Software Engineering*. Rio de Janeiro, Brazil, 262=271.
- Thom-Santelli, J., Cosley, D., & Gay, G. (2006). What's mine is mine: Territoriality in collaborative authoring. *Proceedings of CHI 2009*. Boston, MA, USA.
- Thom-Santelli, J., Muller, M.J., & Millen, D.R. (2008). Social tagging roles: Publishers, evangelists, leaders,' *Proceedings of CHI 2008*. Florence, IT.
- Tran, M.Q., and Biddle, R., (2008). Collaboration in serious game development: a case study. *Proceedings of Conference on Future Play 2008*, Toronto, Ontario, Canada, 49-56.
- Umarji, M., and Seaman, C. (2008). Why do programmers avoid metrics? *Proceedings of Symposium on Empirical Software Engineering and Measurement 2008*, Kaiserslautern, DE, 236-247.
- Umarji, M., and Seaman, C. (2009). Gauging acceptance of software metrics: Comparing perspectives of managers and developers. *Proceedings of Empirical Software Engineering and Measurement 2009*, 236-247.
- van Niekerk, J.C., & Roode, JD. (2009). Glaserian and Straussian grounded theory: Similar or completely different? *Proceedings of SAICSIT 2009*.
- Vasconcelos, A.C. (2007). The use of grounded theory and of arenas/social worlds theory in discourse studies: A case study on the discursive adaptation

- of information systems. *Electronic Journal of Business Research Methods* 5 (2), 125-136.
- Whitworth, E., and Biddle, R. (2007). Motivation and cohesion in agile teams. *Proceedings of Conference on Agile Processes in Software Engineering and Extreme Programming 2007*. Como, IT, 62-69.
- Williams, L., Layman, L., Slaten, K.M., Berenson, S.B., and Seaman, C. (2007). On the Impact of a Collaborative Pedagogy on African American Millennial Students in Software Engineering. *Proceedings of Conference on Software Engineering 2007*, 677-684.
- Yu, Chong Ho (1994), "Is There a Logic of Exploratory Data Analysis?", *Annual Meeting of American Educational Research Association*, New Orleans, LA, April, 1994.
- Zaltman, G., & Coulter, R. (1995). Seeing the voice of the customer: Metaphor-based advertising research. *Journal of Advertising Research* 83, 35-51.

Appendix 1: Summary of Differences between Glaserian and Straussian Grounded Theory Method

Because Glaser and Strauss pursued different approaches to grounded theory, there has been some controversy. Even the comparisons of their two approaches are somewhat controversial. For this summary, we draw on work by Bryant (2002, 2003), Bryant and Charmaz (2007), Charmaz (2006a, 2009), Corbin and Strauss (2008), Gasson (2004), Glaser (1978, 1992, 1998, 2003, 2004), Heath and Cowley (2004), Kelle (2005, 2007), Morse et al. (2009), van Niekerk and Roode (2009), Strauss (1987, 1993), and Strauss and Corbin (1990, 1998).

Issue	Glaserian GTM	Straussian GTM
Who should try this?	Only researchers who have conceptual ability and theoretical sensitivity	Anyone who is willing to learn the appropriate procedures
Research question	None or very general. Learn from the data	Begin with a question, and refine it through data and theorizing
Use of the literature	After ground theory analysis is complete	Before, during, and after analysis, as appropriate
Theoretical sensitivity	Comes from immersion in the data	Use and learn from appropriate methods and tools
Questioning	Focus is always on the data	Use the data to pose questions, and answer the questions through constant comparison with other data and new data
Coding	Substantive coding (also called open coding). Open coding ceases as soon as a core concept emerges. Codes are then refit and refined around the emerging core concept.	Simultaneous and constantly compared open coding, axial coding, and selective coding. Categories and dimensions are integrated with one another, leading to identification of core concept, leading to further coding compared with core concept.
Causative model	None	In some versions of the “cookbook,” a generalized causative model is recommended
Theory attributes	Parsimony, scope, and	Detailed and dense, with full

	modifiability	description of process to refine theory
Theoretical outcome	Abstract conceptualization	Full description
Memos and diagrams	Ideas about categories and their relationships. Diagrams used as needed.	Memos help to develop abstract thoughts (theory) about the data. Different types of memos are recommended for different types of coding issues (open, axial, selective, etc.). Diagrams help to clarify relationships among categories.