A Visual's Worth a Thousand Codes: Illustrative Techniques for Grounded Theory Methodology

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Abstract

Academic research should show a transparent methodology. Transparency is important for replicability, trust in the results, and adapting to new contexts. Due to its subjective nature, transparency is especially important for qualitative work, such as grounded theory methodology (GTM). In this paper, we report aspects of a GTM study that highlights several visuals aimed at increasing transparency. This paper aims to contribute novel, transparency-enhancing GTM illustrations that others can adapt for their purposes. The illustrations are analyzed and discussed with suggestions for implementation.

Keywords: grounded-theory methodology, figures, visualization, surveillance, autonomy, well-being

1. Introduction

Academic researchers have an obligation to reveal their methods, steps of analysis, and theorizing that lead to their conclusions (Moravcsik, 2014). Transparent reporting allows scholarly work to be reproducible, trustworthy, critiqued, and, hopefully, extended to new contexts. However, as Aguinis and Solariano (2019) have found, qualitative research often lacks the same degree of transparency as quantitative research.

A qualitative research study focuses on generating and analyzing non-numerical data. Qualitative research is most often done with the purpose of discovering or exploring ideas through observations and interpretations of unstructured data. Quantitative data, on the other hand, is more often used with structured data to measure and test relationships. The historical debates over superiority were dominated by "hard" (i.e., quantitative) approaches (Orlikowski, 1993; Walsham, 1995). These arguments are unwarranted in both directions; qualitative and quantitative research are used for unique purposes. They each accomplish objectives that the other cannot. Unfortunately, debates criticizing the interpretivist paradigm combined with the disproportionately high number of quantitative research in top-tier journals have called into question the value of qualitative research (Conboy et al., 2012). One way qualitative researchers can increase the perceived value of their work is by providing greater transparency into their interpretations and inferences.

Grounded theory methodology (GTM) is a common technique of qualitative research. The seminal book *The Discovery of Grounded Theory* defines grounded theory as a theory-building method in which the theory is discovered from the data (Glaser & Strauss, 1967). The aim of GTM is to generate or discover a theory (Urquhart, 2013). GTM offers a systematic way of obtaining this theory from data through induction (Glaser & Strauss, 1967).

In GTM, the researcher collects and categorizes data for analysis. This data typically comes from historical texts, observations, or in-depth, open-ended interviews. Then, the data is coded to highlight the important concepts to be generalized and later crafted into theory. Due to the inductive, theory-building process, past literature often plays a reduced role in the analysis. Rather than using previous literature for theorizing, the point of GTM is to allow the *emergence* of theory from the data.

To improve reproducibility, grounded theorists are encouraged to be transparent in how the data was collected, coded, and analyzed (Glaser & Strauss, 1967). Without adequate description, the results become unanchored from their context and difficult to understand (Urquhart, 2013). All the same, too much context might leave the reader wondering if research is little more than a nice story (Urquhart, 2013). Many journals also have page limits restricting the amount of detail available, which could limit transparency. So, finding efficient ways to provide transparency is important to GTM and other interpretive methods.

To increase transparency, we offer one such technique: visualizations. A visualization allows the reader insights into the mental processes occurring during interpretation and inference. Visuals can be thought of as stage props that support what an author is attempting to convey (Sutton & Staw, 1995).

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Indeed, they should be seen as complementary to the study rather than replacing the written articulations. In this paper, we use a study of teleworker surveillance to introduce visualizations of interpretive, qualitative data analysis that effectively and efficiently provide transparency into how theoretical relationships were inferred from qualitative data. We believe that our visualizations can easily be adapted to other studies, allowing interpretive researchers a method for improving transparency.

The rest of the paper is organized as follows. First, we will provide background on how GTM visualizations have been used in the IS literature. Next, we will present our GTM results. The main goal of presenting our GTM study is to provide our readers with a demonstration of how visualizations could be used. The presentation of results and theoretical contributions are secondary to the methodological contributions.

2. Background

Biederman's (1987) Recognition-by-Components theory suggests visuals have a far greater representational capacity. Even more, Gestalt psychology provides a foundation for what patterns or configurations are most easily perceived in illustrations (Koffka, 2013; Köhler, 1967, 1970; Wertheimer, 1938). Merging these two perspectives, we believe that effective GTM visualizations should use familiar components but also should include easily understandable patterns and combinations. This approach should reduce the cognitive load associated with interpreting and understanding the visualizations. Thus, using these principles can be beneficial when designing visuals for summarizing complex information. For example, Gavrilova et al. (2015) used Gestalt psychology to help improve the design of knowledge mind maps. Rosli and Cabrea (2015) apply Gestalt principles to multimodal data representation.

Combining their usefulness with the decreased cost of creating such visuals has increased the adoption of visualizations for communication purposes. Visual illustrations are being used in countless ways to improve the managing and interpretation of large or complex data sets, processes, or other phenomena. Experiments have shown that using visual techniques can support cognitive abilities to make successful decisions even with complex data (e.g., Grady, 1992). For example, databases are designed using a graphical illustrations that show how data tables are connected (Frost et al., 2006). Eigenvalues are often printed in a chart to support author decisions (or justifications) of construct dimensionality (Hair, 2010). Theoretical diagrams are useful for structuring otherwise rambling or inconsistent arguments (Sutton & Staw, 1995).

The need for transparency is important in all academic work; unfortunately, qualitative work often has difficulty demonstrating adequate transparency. Aguinis and Solariano (2019) found transparency to be an issue in qualitative research. They found after reviewing 52 articles published in the Strategic Management Journal that none of the articles were transparently adequate for exact replication, empirical replication, or conceptual replication.

GTM especially has challenges when it comes to transparency. Boudreau and Robey (2005) had 188 open codes that were pulled from 2090 text segments. Espinosa et al. (2007) reported having 480 single-spaced pages of transcriptions! And, as we can attest, the amount of coding becomes quite overwhelming. In order to help manage this data, there are CAQDAS (computer-aided qualitative data analysis software) packages, such as Atlas, Dedoose, MAXQDA, NVivo, or WebQDA. Even with help from the software, presenting the data in a summarized yet transparent way is indeed a difficult dilemma.

Table 1 shows a list of GTM studies from the information systems literature, which we selected to review based on high citation counts from Wiesche et al.'s (2017) review of GTM in information systems research. As shown in Table 1, most of these articles use several tables to describe categories of codes, descriptions, etc. However, few demonstrate actual examples of how a transcript was analyzed into the first-level code. It is also apparent that tables are more commonly used to summarize mid-level codes, and figures are more commonly used to illustrate high-level codes.

There are several acceptable ways to do GTM coding and analysis. Open coding (sometimes called initial coding or template coding) can be done by attaching descriptive labels to a single word at a time (Urquhart, 2013). One might code several sentences simultaneously (e.g., Volkoff et al., 2007) or give several labels to the same excerpt. Even the nature of labels can vary. Open codes can be labeled as an abstract, analytical label as the researcher understood the text (as suggested by Urquhart, 2013), a descriptive (less analytical) label of how the researcher interprets the meaning (e.g., Strong & Volkoff, 2010), using descriptive vocabulary from the interviewee (Volkoff et al., 2007), or simply naming the code as suggested by the analyzed transcript itself (what Strauss (1987) calls an 'in vivo' code).

Even the terminology around coding can become confusing and should thus be clearly stated and described in the manuscript. For example, Glaser (1992) and Strauss (1990) use the term selective

Citation	Tables	Figures
Boudreau & Robey, 2005	1 – Categories Resulting from Axial Coding 2 – constructs, their definitions, and an illustration from the transcript	None
Espinosa et al., 2007	1-3 – frequency data of participants discussing categories in mid-level codes 4 – list of propositions	None
Levina & Ross, 2003	1 – interviewee characteristics 2 – interview inquires 3 – data analysis phases 4 – process of how an analytical theme was developed from data 5 – summary of core competencies	1 – illustration of challenges in vendor operating environment 2 – model of vendor's core competencies 3 – vendor's value proposition
Maznevski & Chudoba, 2000	1 – literature review for background 2 – categories for research design 3 – data collection protocol 4 – categories/subcategories and their definitions	1 – model showing multiple dimensions in each construct
Orlikowski, 1993	1 – interviewee information from data source 1 2 – interviewee information from data source 1 3 – categories, concepts, and open codes from both data sources	1 – process of induced theory with the constructs and subcategories described from tables
Strong & Volkoff, 2010	1 – interview info 2 – coding examples showing connections from transcript, open code, axial code, and themes 3 – types of misfit category definitions 4-9 – misfit categories and how they were described in data 10 – induced types of organizational enterprise system fit and associated misfit 11 – summary of other article's misalignment framework	1 – model of how the enterprise system misfits can be structured within the organizational structure
Volkoff et al., 2007	1 – interview descriptions 2 – mid-level code groups showing the open codes used, also including the number of passages and sources for each open code	1 – induced, theoretical model of interactions

Table 1

coding to mean different things. There are also uses of bottom-up coding, top-down coding, mid-range coding, and thematic coding, among others (Urquhart, 2013).

So, it seems apparent that GTM can benefit from greater transparency, but ideally, that transparency will not unduly increase the complexity of GTM study reports. Visualizations offer one way to increase transparency efficiently and effectively. In the next section, we use a study of teleworker surveillance to illustrate how visualizations can be used to increase GTM transparency. Note that our focus here is on the visualizations rather than the theoretical implications of the study itself.

3. Example Study

As mentioned, the results from our GTM study are secondary to the demonstration of our visual illustrations. The goal of this manuscript is to provide concrete examples for visualizing GTM interpretive processes and results. To situate the visualizations in context, we provide an overview of our motivation, research questions, questionnaire, etc.

3.1. Context

Our study was motivated by the COVID-19 pandemic forcing countless employees to work from home. The novelty of this mandated teleworking situation created new and unique challenges. In particular, we were interested in understanding how employees are being surveilled when working from home and how the at-home surveillance affects their well-being.

A semi-structured interview guide was developed based on a review of the relevant literature. Given the nature of the ground-theory methodology, the

Int	Occupation	Organization description	Telework Experience	Monitoring Characteristics
1	Project Engineer	Contracting company for the department of defense	None	6-minute intervals recorded and visible by supervisor and colleagues.
2	Marketing Assistant	Banking/Credit Union	None	Automated, 60-second time-out system on computer
3	Director of product development and corporate strategy	Telecommunication services	10 years of hybrid	Outcome oriented only. No activity metrics tracked. Manages subordinates the same way.
4	Vice President for Technology, Innovation, and Development	Academic institution	None, but managed remote employees for several years	Frequent meetings with colleagues. Manages subordinates through meetings and outputs as well.
5	Director of Communications	Academic institution	None	Frequent daily communication with supervisor. Supervisor gives expectations but is flexible.
6	Graduate Student	Graduate school	None	Attendance during class taken. Random attention checks throughout class. Strict eye-tracking and noise-tracking software during tests.
7	Human Resources Recruiter	Trucking transportation company	None	Average time to complete task monitored. Supervisor is hands-off if everything is operating as expected.

Table 2

researcher should set aside theoretical ideas to let the theory emerge from the data (Glaser & Strauss, 1967). However, it should be noted no researcher should ignore existing theories and work in the area; qualitative researchers should "have an open mind as opposed to an empty head" (Giles et al., 2013). Rather than looking into theory around our constructs, we reviewed literature to see how surveillance and well-being are defined and operationalized. This was beneficial as we often reflected back to the boundaries of definitions.

We interviewed seven individuals who are briefly described in Table 2. Each interviewee is given a shortened name (e.g., Int1 is short for interviewee 1).

We present our data analysis in organized sections outlined below in order of coding levels (open, selective, and theoretical), which might seem like the analysis occurred in a linear procedure. In reality, our data collection and analysis occurred in a more iterative process as the GTM intends (Glaser & Strauss, 1967). The end results are shown in Figure 1.

Our overall findings suggest that when one perceives their own actions, behavior, or output to be more frequently surveilled, they will lose a sense of autonomy. Having autonomy, as suggested by self-determination theory (Ryan & Deci, 2000), is essential for one's well-being. However, when the surveillance

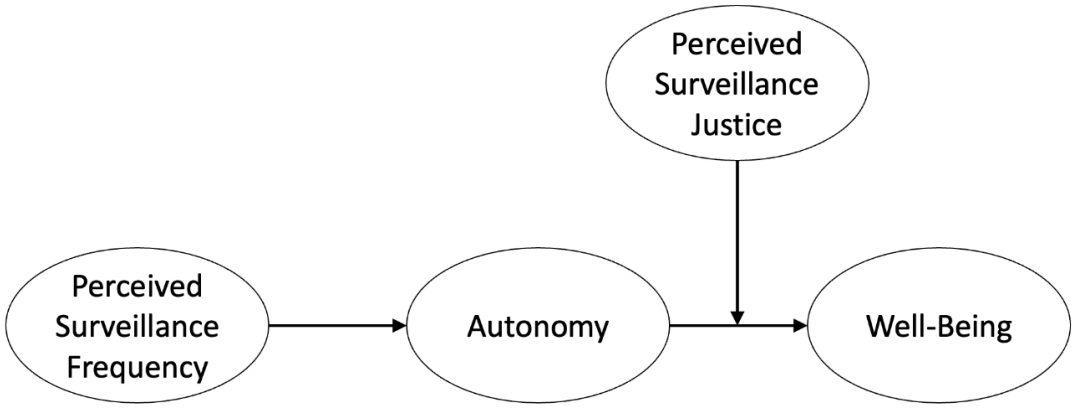

Figure 1

is perceived as just, reduced autonomy did not affect well-being. The following sections show the coding steps that occurred to get to this final model.

3.2. Open Coding

Interviews were transcribed for analysis. The first step in GTM coding is most commonly referred to as open coding (Glaser, 1978, 1992; Strauss & Corbin, 1990), though it is sometimes also referred to as initial coding (e.g., Charmaz, 2006)). This first step in the coding process is very in-depth, reviewing the transcription line by line (Charmaz, 2006; Glaser, 1978, 1992; Strauss & Corbin, 1990) or even word for word (Urquhart, 2013). Figure 2 is an excerpt from our transcription that visually demonstrates how we coded.

The first coding step is seemingly the most subjective process of the GTM analysis. Not only is it dependent on which parts of the transcript are deemed important by the research, but there are several types of labels that can be attached to an excerpt, as we discussed in the background. Showing the reader how this step occurred is one way to overcome transparency constraints with GTM. The visual in Figure 2 gives the reader a concrete example of how our open coding occurred.

Demonstrating how every transcription was (openly) coded would be as preposterous as fully reporting every participant's response in survey data. However, visual examples allow readers to better understand how the process the interpretations and inferences made. Such visualizations allow the reader to see how the foundation of the results were determined.

A grounded theorist could demonstrate a line of coding showing how the code was analyzed (as in Figure 2). Another option is to provide the sample sentence and merely describe the codes assigned. We believe that the visual approach is easier to follow and more concise. Either option allows the reader to understand the nature of coding that occurred, which, as mentioned, can vary drastically.

3.3. Selective coding

Following the Glaserian approach, selective coding happens when open codes are organized into groups that will soon make up the core categories (Glaser, 1978; Urquhart, 2013). A sample of initial selective codes derived from the analysis is shown in Table 3. With several selective codes identified, multiple dimensions of the phenomenon can be identified. Although graphical visualizations can more efficiently enable transparency in some cases, we found that a tabular representation of selective codes was sufficiently concise and easy to understand.

Selective code	Open codes
Frequent	*Short time* (x2), every time, constant
Uncertainty	Unsure of use, unsure if watching, does not know why, assumption
Types of surveillance	*Reviewing charge codes*, monitoring weekly deliverables, automated activity monitor, random check-ins, peer surveillance, RFID tracking
Rigid rules	*No exceptions*, required camera, blanket rules for the company
Work improvement	*Accountable*, *justification*, better environment, multitasking, protecting company assets
Autonomy	Flexible (x3), freedom, any time, free decision
Justice	Fair, clear reasons why, agree with logic, reasonable

Table 3

Though Table 3 is abridged for demonstration purposes, we used a large table with all selective codes and their respective open codes during data analysis. Although a large table with all selective codes might not be desired by the reader, it was beneficial for the analysis process. Having the selective codes in a single table allowed us to identify the major themes of our data and abstract them into smaller but multidimensional constructs. In particular, autonomy and perceived justice were recurring themes in our data, which were theoretically connected as described in the following subsection. Early stages of selective coding are still subject to change, which is justified by the idea of GTM's iterative process. Ultimately, the researcher must determine the ideal level of transparency with respect to selective codes.

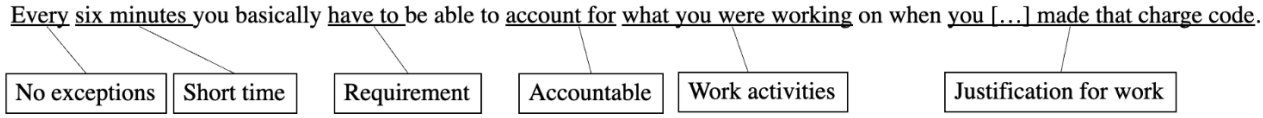

Figure 2

3.4. Theoretical coding

Theoretical coding is the step when categories of codes are conceptually liked to each other. Throughout the process of open and selective coding, we noticed surveillance often affects one's perceptions of autonomy. Therefore, we examined all instances in the data mentioning surveillance and autonomy to delve into and further define this relationship. We focused on this relationship because autonomy is thought to affect well-being (Ryan & Deci, 2000), and surveillance is the focal phenomenon for our study. The notion of surveillance frequency emerged as the most influential characteristic of surveillance that affects autonomy. In other words, our data suggested when one feels they are being surveilled more frequently; they reported having less control over their actions. We visually demonstrate the relationship between these two constructs in Figure 3.

Figure 3 shows an excerpt in a box, which is an exact quote from the interview. On the far ends of the figure are categories identified in the selective coding step. For example, the quote, "Every six minutes you basically have to be able to account for," is grouped in the "high surveillance frequency" category, and "Mine is outcome-based …" classified as low surveillance frequency. Similarly, low autonomy and high autonomy are illustrated with relevant interview excerpts. Figure 3 also shows how these two continuums are connected, which demonstrates the theoretical coding step. Each row of transcripts (i.e., adjacent boxes connected by the arrows) comes from the same interviewee. So, this visualization concisely provides insights into selective and theoretical coding. Further, this visual demonstrates triangulation as there are four separate data sources provided. Note that we use familiar graphical elements, including directional arrows to show theoretical relationships, bidirectional arrows to show a continuum, and rectangles (boxes) to delineate individual research participants. It is important to note that by providing the relevant quotes at the interviewee level, we provide transparency that may enable readers to take exception with our interpretations and inferences. This may be uncomfortable for researchers, but such transparency strengthens GTM studies.

Proceeding, we reflected on the well-known self-determination theory (Ryan & Deci, 2000), which posits autonomy is an innate psychological need for well-being and happiness. We again examined this relationship in the same way as discussed in Figure 3. Interestingly, there were cases where this relationship was not supported, but other cases in which it was. For example, we noticed that one interviewee's autonomy was highly restricted, but well-being was high. However, other interviews showed a clear relationship between autonomy and well-being. We reviewed the transcripts to better understand these anomalies.

This analysis made it apparent (through the same, iterative open and selecting coding discussed earlier) that perceived justice was a moderating variable in this relationship. Figure 4 visually shows one of the examples of this theoretical relationship. In the conversation broken up and displayed in Figure 4, our interviewee discussed the strict surveillance environment in their organization (surveillance frequency to autonomy relationship is not shown due to spatial constraints). The nature of this employee's surveillance prevented employees from logging hours

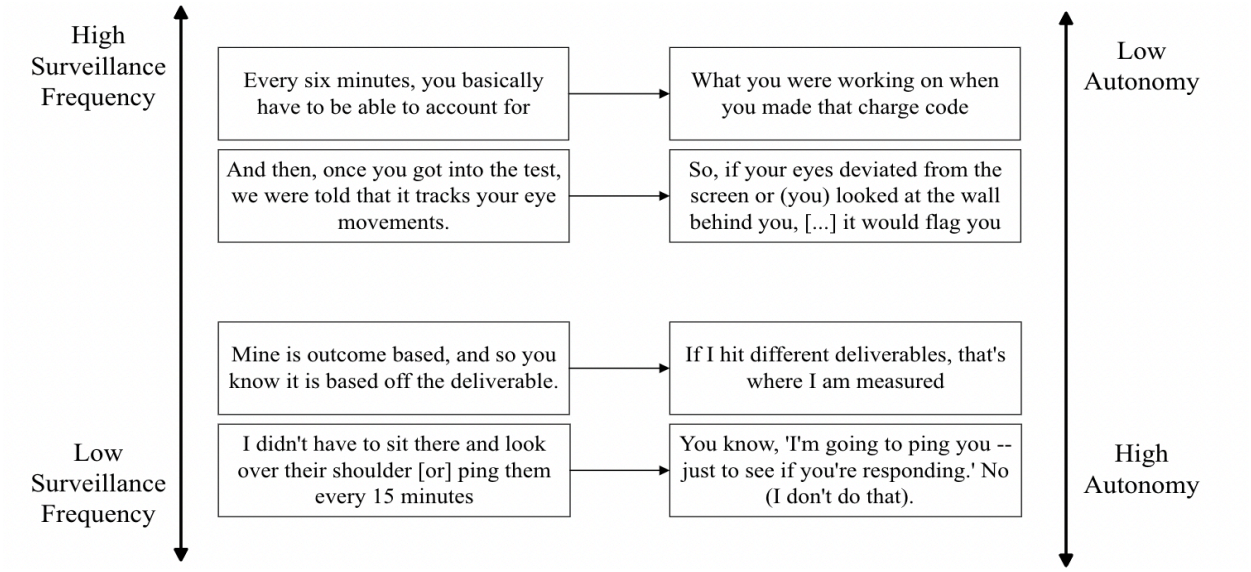

Figure 3

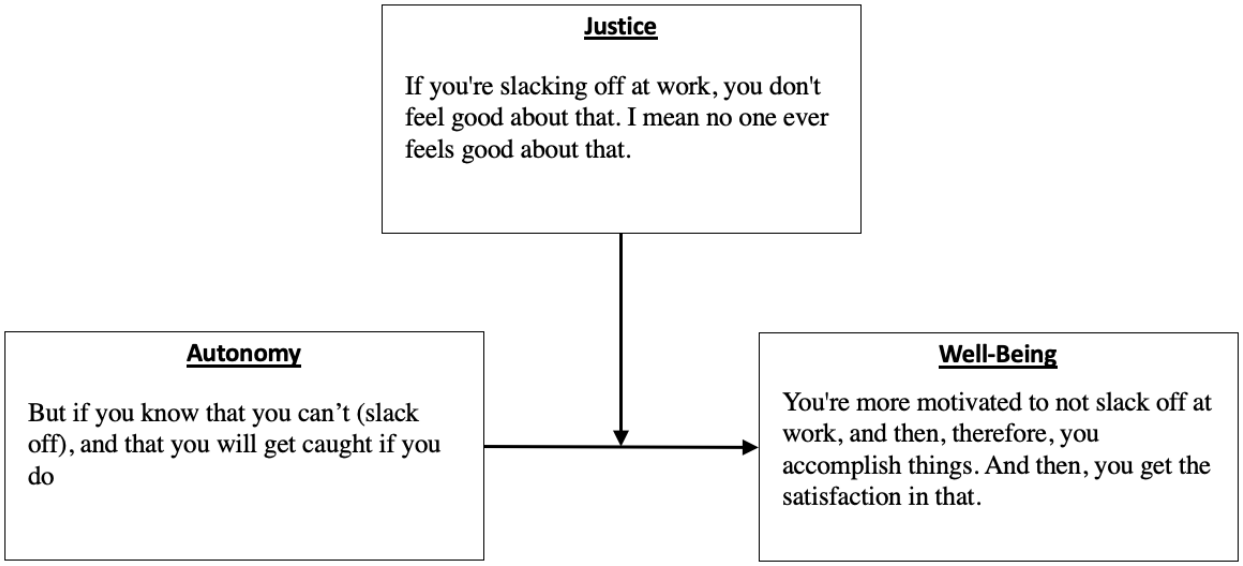

Figure 4

without actively working and, in turn, restricted autonomy. This visualization purposely uses the same graphical elements as Figure 3. In addition, the arrow from the justice quote to the autonomy to well-being relationship arrow is similar to how moderating relationships are shown in traditional research models. Using familiar visual elements lowers the cognitive load associated with interpreting this visualization.

Discussion

Transparency is important for qualitative, interpretive methods such as GTM. Transparency allows readers a window on the interpretive process that is critical to these methods, which enables readers to evaluate the legitimacy of the inferences made during the analysis process. However, due to the large volumes of data involved in interpretive analysis, providing proper transparency is challenging, especially when attempting to publish in conferences or journals that have strict article-length limits.

In this paper, we provide several visualization approaches that allow us to give readers some insight into the reasoning behind our inferences regarding constructs and causal relationships that are induced from interview data. In designing these visualizations, we sought to provide transparency in a concise way that efficiently and effectively allows readers to understand the reasoning behind our analyses.

There were several design goals reflected in our visualizations. First, we sought both presentation and cognitive efficiency. With respect to presentation efficiency, we tried to show sufficient information to achieve transparency in a relatively small space. We also sought cognitive efficiency by using familiar aesthetic elements, such as causal arrows and regions surrounding constructs and quotes. Recognition by components theory predicts that we understand objects (and visualizations) by first recognizing their components. Therefore, the use of these familiar elements lowers cognitive load when interpreting the visualizations.

We further eased interpretation by following several Gestalt principles, which are widely acknowledged as effective design principles (Rosli & Cabrera, 2015). Specifically, we used the Gestalt principles of enclosure (sometimes called common region), similarity, and connectedness. Enclosure was used by enclosing quotes representing and corresponding construct labels in rectangular boxes. Because both constructs and quotes are contained in a single enclosed region, it is clear that the quote corresponds to the construct. This also uses the principle of similarity; the boxes contain conceptual labels (for either codes or constructs) and quotes that correspond to constructs and are not used for any other purpose. Similarly, unidirectional arrows are used to represent causal relationships, whether direct or moderating, bidirectional arrows are used to represent a continuum, and arrowless lines were used to link statements with open codes. Finally, we used the principle of connectedness to show related elements with lines. These include antecedents to outcomes, ends of a continuum, moderating influences (to causal arrows), and lines linking snippets to open codes.

Even the selective code table can be considered a visual display of relationships, although we acknowledge that this is not novel. Regardless, the table provides transparency in a relatively efficient

and concise way. In addition, the table takes advantage of familiarity and the Gestalt principles of enclosure and similarity (rows showing related concepts).

These representations of our inferences provide transparency that allows readers to understand the nature of our inferences and, when readers find these questionable, enables easy pinpointing of specific criticisms.

Furthermore, Figure 3 demonstrates triangulation of a single relationship. We used transcript data from several sources to demonstrate how the relationship was supported in multiple cases.

Our brief literature review highlighted the lack of transcription analysis in tables and figures in the current research. Furthermore, figures in the GTM studies listed in Table 1 most often displayed an abstract, theoretical model. Our Figure 4 provides a novel attempt at combining the transcription's role in the abstract, theoretical model.

Visualizations can also be beneficial for the investigator. Our visualizations also clearly show how, in this case, our analysis surfaces a relationship that represents a departure from established theory. In our case, Figure 4 clearly illustrates a potential new boundary condition for self-determination theory. According to our data and analysis, the well-established negative relationship between autonomy and well-being is subject to a boundary condition; when the limits on autonomy are seen as just, reduced autonomy does not necessarily reduce well-being. Of course, further research is necessary to determine if our result is idiosyncratic to the context of telework surveillance.

That being said, the purpose of our article is not to delve deeply into this potential boundary condition. Rather, we seek to provide qualitative, interpretive researchers with new ways to visualize their inferences to enable transparency efficiently and effectively. Although we are sure that our visualization approaches can be improved upon, we believe that they represent a solid foundation on which others can build visualizations that are well suited to their particular research contexts and goals.

In essence, the use of tables and figures for transparency is dependent on the goal of the study. If the goal of a study is to categorize and define domains, it might be easiest to use tables to list components of each category (e.g., see Strong and Volkoff, 2010). On the other hand, if describing relationships among constructs is the goal, a diagram might be a more effective illustration.

When GTM work induces a relationship, it is fundamentally based on a subjective interpretation of what was meaningful in the original transcript due to the process of coding. Providing as much transparency on the thinking process from start to finish improves the ability to critically evaluate the author's work – for good or bad.

4. Conclusion

This study provided a list of illustrations – and their design techniques – for a grounded theory paper. We followed Gestalt principles that allow for the visuals to be less taxing on cognitive processing, ways for showing triangulation, and demonstrating (in a single figure) how actual transcript can be used in an abstract model. Our contributions serve as a good foundation for those wanting to improve transparency of GTM work through illustrations.

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