

A Guide to Conducting Design Ethnography of Information Infrastructures Design

BRUNO HENRIQUE SANCHES

ESCOLA DE ADMINISTRAÇÃO DE EMPRESAS DE SÃO PAULO (FGV-EAESP)

A Guide to Conducting Design Ethnography of Information Infrastructures Design

1. INTRODUÇÃO

Almost one decade ago, Tilson et al. (2010) stated that information (or digital) infrastructures were an orphan subject in the Information System (IS) field. Since then, little progress seems to have come about. While IS researchers agree in conceptualizing the design of information infrastructures as an open-ended and decentralized phenomenon (see Ciborra & Hanseth, 1998; Constantinides et al., 2018; Tilson et al., 2010; Yoo, Henfridsson, et al., 2010), they generally approach it from an institutional and top-down perspective (e.g., Bygstad, 2010; Fink et al., 2020; Henfridsson & Bygstad, 2013; Øvrelied & Bygstad, 2019).

However, the digital generativity of information infrastructures pushes IS design to the edge of networks, enabling heterogeneous actors to be part of the infrastructure formation. From this perspective, the separation of use and design is a blurred terrain (Suchman, 2002), and we should go beyond the corporation setting to inquiry the design of information infrastructures ‘in the wild’ (see Karasti & Syrjänen, 2004), i.g., we need to explore information infrastructure beyond corporations setting, and get to the heterogeneous people reappropriation, adjustment, and modification the infrastructures in real life.

In this regard, we should ask how to study such complex, ongoing and decentralized phenomena? From this perspective, I propose that Design Ethnography (DE) might be a well-suited inquiry methodology. Design Science Research and Ethnography are well-established research methods in IS field (Baskerville et al., 2018; Myers, 1999). Despite these two approaches came from distinct philosophical traditions, Baskerville and Myers (2015) proposed that the Design Ethnography methodology might be combined in such a way that the researcher is both a designer and an ethnographer in the field, i.e., the researcher seeks to iteratively describe and contribute to the unfolding of a IS design.

To the best of my knowledge, DE has not yet been used to study information infrastructure design. Therefore, in this work, I drew on Baskerville and Myers' (2015) and Karasti and Blomberg's (2018) work to present a guide to conduct DE to inquiry the design of information infrastructures. It is important to emphasize that this work not intends to be a guide with fixed rules but a purposive path for researchers engaged in studying infrastructure design from a bottom-up perspective.

The remainder of this work is organized as follows; the next section reviews the information infrastructure in IS field and the design of information infrastructures from the edges. Then, is introduced the DE approach, followed by the research steps, data collection techniques, and the provisional research criteria. Lastly, is presented the conclusion of the work.

2. LITERATURE REVIEW

2.1 Information Infrastructures

Information Infrastructure is a class of IT artifact that underlies digital convergence (Tilson et al., 2010) and sets a "shared, open (and unbounded), heterogeneous and evolving socio-technical system" (Hanseth & Lyytinen, 2010, p. 1). Information Infrastructure comprises numerous networked artifacts such as the Internet, data centers, open standards (e.g., TCP/IP and HTML), and consumer devices such as smartphones and tablets (Constantinides et al., 2018).

These artifacts are conceptually desegregated as an interrelation of multiple layers (Hanseth & Lyytinen, 2010), primarily composed of the physical layer (the interconnect hardware), the logical layer (software, including standards and protocols such as TCP/IP) (Frischmann, 2009; Tilson et al., 2010), and the content layer (information accessible to end-user). While the physical layer is restricted by its physical materiality, other layers operate on the level of bits and bytes. That digital materiality results in unique characteristics such as digital convergence, heterogeneity, and generativity, enabling an increasing level of re-combinations (Yoo, Lyytinen, et al., 2010).

The content layer is where the bits and bytes are recognized as information (Constantinides et al., 2018; Yoo, Lyytinen, et al., 2010; Zittrain, 2009). It is the final layer of information infrastructure usually available to end-user. The content layer is where users access maps, news, videos, and other pieces of information (Constantinides et al., 2018; Zittrain, 2009).

The logical layer (or code layer) is an intermediary between bits and bits that transits in the physical and content layers. It comprises software such as TCP/IP protocols, word processors, and browsers (Benkler, 2006; Frischmann, 2009). This layer is responsible for bringing digital flexibility; upon this layer, IT artifacts are adapted and recombined, although its flexibility potential can be restricted by socio-technical and regulatory arrangements (Tilson et al., 2010).

The characteristics of information infrastructures, such as editability, interactivity, re-programmability, openness, and distribution (Kallinikos et al., 2013), produce "an unprompted change driven by large, varied, and uncoordinated audiences" (Zittrain, 2006, p. 127). Scholars agree that digital generativity pushes innovation potential to the edge of networks, enabling heterogeneous actors such as individuals, groups, or organizations to shape and be shaped by information infrastructures (see de Reuver et al., 2018; Fink et al., 2020; Ghazawneh & Henfridsson, 2013; Koskinen et al., 2019). Therefore, the design of information infrastructures might be approached as a continuous adaptation, reappropriation, adjustment, and modification by heterogeneous actors in the network's edge, as we shall see in the next section.

2.2 Designing from the edges.

Currently, increased computing miniaturization and processing power of digital technologies (Yoo, Lyytinen, et al., 2010) have made possible the rise of virtually ubiquitous information infrastructure (Hanseth & Lyytinen, 2010). Digital ubiquity has brought innovation closer to the network's periphery, and "user's ability to innovate has been improved radically" (von Hippel, 2005, p. 14), which might lead to opportunities to democratize the innovation process (von Hippel, 2005). As a result, a distributed

innovation agency has been formed, wherein an unexpected combination of actors engages in the innovation process and enables community-based generativity (Nambisan et al., 2017).

Then, the generativity of digital technologies creates an open-ended space where the digital is continuously adapted and recombined by users beyond their purpose initially projected by designers (Nambisan et al., 2017; Yoo, Lyytinen, et al., 2010). Generativity is "a system's capacity to produce unanticipated change through unfiltered contributions from broad and varied audiences" (Zittrain, 2009, p. 79). For instance, personal computers (PC) success was due to its openness to being "reprogramming and thus repurposing by anyone" (Zittrain, 2009, p. 23). A system's generativity is defined regarding its properties and how that system relates to its user. In other words, the system's generativity defines how much users can be identified as innovators in the system rather than as mere consumers (Zittrain, 2009).

Furthermore, information infrastructure is essentially open regardless of user identity or intended use (Frischmann, 2009). Take, for example, the emergence of the Internet and the beforementioned PC, which was strongly reliant on its open generativity (Zittrain, 2009). In this regard, the generativity of information infrastructure forms a backbone for democratic innovation (von Hippel, 2005). However, what we have called 'democratic' should be questioned, considering that the current winning model of information infrastructure is based on private firms, often big techs, such as Microsoft and Google, who fundamentally own the digital products, although some aspects of them are open through boundary resources (e.g., API, Toolkits, Software Packages) (see Fink et al., 2020).

From this perspective, the design of information infrastructures is not a structured project but an open-ended and ongoing "[...] process by which multiple human actors translate and inscribe their interests into a technology, creating and evolving network of human and non-human actors" (Koutsikouri et al., 2018, p. 1003). Therefore, the design of information infrastructures is subordinate to continuous reinvention carried out by the users themselves "on a local, often tacit basis, outside or at the margins of the master plans and designs, in an endless process of bricolage" (Ciborra & Hanseth, 1998, p. 317).

In this vein, the separation of use and design is a blurred terrain. The very 'user' and 'designer' words should be questioned since users also construct the technology symbolically and literally (Suchman, 2002). However, how can we study such fluid and decentralized phenomena? In the next section, I drew on Karasti and Blomberg's (2018) and Baskerville and Myers's (2015) work to propose the Design Ethnography (DE) as an alternative.

3. DESIGN ETHNOGRAPHY

Ethnography has been considered an important research method in exploring infrastructures (see Star, 1999, 2002). While early ethnographic studies focused on inquiring about the past, revealing infrastructure's invisible structures, and tracing back its formation, recent advances in the Anthropology and Design field foreground a new future-oriented approach to studying the ongoing formation of infrastructure and information systems (Baskerville & Myers, 2015; Blomberg & Karasti, 2012; Karasti & Blomberg, 2018; Otto & Gunn, 2013; Pollock & Williams, 2010).

Using ethnography to study design is not new. Baskerville and Myers (2015) pinpointed that ethnography has been an instrument to inform design activities since the 1970s. They called this approach of **ethnography for design**. In this case, the

ethnographer aims to deeply understand user (consumer) behavior and generate insights and valuable ideas for design (Baskerville & Myers, 2015). Therefore, ethnography for design is essentially about improving designs through a deep understanding of how people live and what they do, more than what they say. Furthermore, researchers have applied **ethnography to study design**. Baskerville and Myers (2015) exemplified this approach by pointing to studies conducted under the Scandinavian school of participatory design, which typically draws on techniques such as workshops to include user's vision in information systems.

Grounded on these two approaches before mentioned, DE combines design and ethnography in a future-oriented and interventionist method (Baskerville & Myers, 2015). DE is also called design anthropology (see Otto & Gunn, 2013); however, the term 'Design Ethnography' would be more appropriate in this work.

In DE, "the ethnographer is actively immersed and engaged in a setting where people are either designing artifacts, producing artifacts, or introducing artifacts into a social and cultural context" (Baskerville & Myers, 2015, p. 29). While prior methods separate the design and ethnography process, DE merges it so that the researcher is a designer and an ethnographer in the field. Therefore, beyond just immersing in the field and describing it, the researcher is actively engaged in the field, changing it as the research goes on. In Baskerville and Myers's words:

"[...] the researcher is actively intervening in changing the subject area—the context—in which the researcher is researching. The researcher is actively engaged with others in a future-oriented way: designing, creating, innovating, and improvising artifacts that may affect the cultural and social values under study" (Baskerville & Myers, 2015, p. 31).

Baskerville and Myers (2015) argued that DE transcends the "dependence on ethnography as a descriptive practice" (p. 29). Unlike traditional participant observation, to observe, the DE's researcher engages in the design, and along with it, they might introduce new concepts and artifacts into the field (Baskerville & Myers, 2015). Thus, beyond just participating in the field, the researcher should build **correspondence** between them and the informants (Baskerville & Myers, 2015).

"Correspondence refers to being in accordance with the flow of events, to moving forward with people in the pursuit of their dreams and aspirations rather than dwelling on their past [...], [emphasizing] what is produced during fieldwork rather than after fieldwork" (Otto & Smith, 2013, pp. 17-18). It is a reposition of participant observation beyond its documentary retrospective to embrace the researcher's contribution in the "unfolding happenings in fieldwork" (Otto & Smith, 2013, p. 148). This reposition is essential for the researcher realizes the "effects of people's vision and hopes for the future, the not-yet, on their current activities" (Otto & Smith, 2013, p. 149).

Similarly, Karasti and Blomberg (2018) questioned the idea of the field as a 'naturally occurring entity', i.e., the field would not be a standalone setting waiting to be explored by the researcher, but it is constructed as the researcher engages with it (Karasti & Blomberg, 2018). Therefore, beyond changing the context throughout their interventions, as Baskerville and Myers (2015) pinpointed, the researcher also defines the context itself regarding their conscious and unconscious choices (Karasti & Blomberg, 2018). For instance, the very definition of an infrastructure is a 'categorical act' that might leave some individuals, relations, and settings out of the inquiry (Karasti & Blomberg, 2018). In short, "[the] researcher engages in forming the object of inquiry during fieldwork, informed by their interests and motivations and enabled by specific resources, situations and opportunities" (Karasti & Blomberg, 2018, p. 242).

Therefore, the phenomenon is not passively presented to the researcher, but they need to pursue it in their fieldwork. In such complex phenomena as infrastructure design, Karasti and Blomberg (2018) recommend ‘following connection’ and ‘discovering discontinuities’ to unveil the field. Resembling the above-cited concept of correspondence, **following connection** resonated the idea of ‘being in accordance with the flow of events’, whereas **discovering discontinuities** stems from the conception of breakdown in information infrastructures studies.

Moreover, the DE of infrastructures deals with the **challenge of scale**. Karasti and Blomberg (2018) warned about the endless unfolding of infrastructures and the necessity of researchers to cope with it. In this light, they introduced some approaches to ‘extend the field’, such as ‘scalar devices’, ‘multiplication of sites’, ‘biography of artifact’ and ‘multi-sited ethnography’. The latter is emphasized by Karasti and Blomberg (2018) and resonates with the approach followed in this work. Multi-sited challenges the notion of the site as a physical location and is aligned with the idea of following humans and non-human actors (Karasti & Blomberg, 2018). Therefore, this approach also resembles ‘correspondence’ in fieldwork, in the sense of acknowledging that the researcher “constructs the field through their engagement with it over the course of the study, [...] and the object of study cannot be known beforehand” (Karasti & Blomberg, 2018, p. 249).

Additionally, DE requires **changing the temporality** of traditional ethnography research, typically retrospective. As Gatt and Ingold (2013) stated, it requires “[...] following the ways of the world as they unfold rather than seeking to recover a chain of connections from an endpoint to a starting point on a route already traveled” (p. 145). In this regard, “[u]nderstanding how change happens and how it can be directed by human agency” (p. 17) is one of the central challenges in DE research (Otto & Smith, 2013).

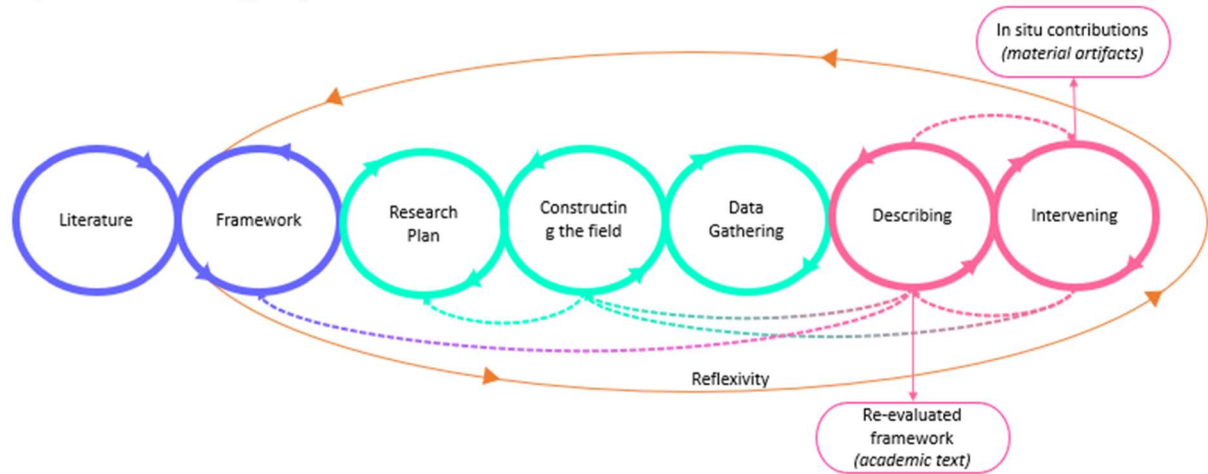
That said, DE of infrastructuring could not be done without researcher reflexivity. Albeit reflexivity is not directly approached by Baskerville and Myers (2015), it is pinpointed by Karasti and Blomberg's (2018) work and sides with what has been accounted so far. For Karasti and Blomberg (2018), “[t]he field is reflexively constructed by every choice the ethnographer makes in selecting, connecting, and bounding the site and via the interactions through which s/he engages with the material artifacts and the people who define the field.” (Karasti & Blomberg, 2018, p. 242). Then, when the researcher is engaged in the context, their “[...] agency should be considered as a constructor of reality” (Karasti & Blomberg, 2018, p. 250). The researcher must “examine their methodological choices for the directions they push, the exclusions they create, and their relation to possible study contexts” (Karasti & Blomberg, 2018, p. 251). In this regard, Karasti and Blomberg (2018) called for researchers ‘question taken-for-granted ideas about infrastructures’.

The above picture of DE may stress its interventionist character. However, it does not imply rejecting the contributions of description and documentation. For instance, Otto and Smith (2013) noted that both description and intervention are essential, albeit, occasionally, the latter might be more valuable in their view.

Therefore, in DE, interpretive and pragmatism epistemologies come together. Goldkuhl (2012) demonstrated how these two traditions could dialogue in qualitative information systems research. In his case, for instance, several principles from pragmatist research were adopted, such as ‘contribution to local improvements through interventions and design’, ‘continual exploration and learning’, and ‘generation of constructive knowledge aimed for general practice’. In addition, he mentioned adding some elements of interpretive research such as ‘focus on participants’ meaning-universes and professional languages’; and ‘interpretations of social constructs’ (Goldkuhl, 2012).

Overall, DE of infrastructures is about ‘being open to surprise and serendipity’, following the phenomenon as it unfolds – albeit relying on prior planning to some extent. It is about being immersed in a setting where people participate in an infrastructure design, actively seeking to contribute to the design activities during the fieldwork. Also, it embraces the researcher's reflexivity in the field construction and demands us to be aware of taken-for-granted technological design assumptions. So far, I have outlined the main characteristics of DE of infrastructures; in the next section, the DE steps are introduced (see **Figure 2**).

Figure 1: Methodology steps.



Source: elaborated by the author

3.1 Research Steps

3.1.1 Initial Research Plan

Baskerville and Myers (2015) suggested engaging in the context as the first step of the DE approach. It bears a resemblance with the inductive approach of interventionist methodologies in which DE is inspired, for instance, the step of ‘awareness of problem’ in Design Science Research (see Baskerville et al., 2018) and the ‘diagnosing phase’ of Action Research (see Baskerville, 1999). However, given the complexity of infrastructure design and the typically limited resources and timeframes of researchers and students, an **inductive top-down** (Shepherd & Sutcliffe, 2011) approach might be appropriated.

Therefore, rather than coupling the literature review with an early empirical investigation to define the initial research question (Sein et al., 2011), the first step is to engage with the literature with a loose question in mind. After a first literature review, the researcher might devise a provisional research question. At that point, the inquiry raised should be sufficient to define a study site. A provisional set of field selection criteria is presented in **Section 3.3**. After the site selection, the literature review might go on iteratively with small informal conversations with further participants to sense site opportunities and the literature fit with the context. Next, the researcher might build a provisional framework, later revised with field interactions

The step mentioned above provided support to bound the research context, select the site, build prior assumptions, and developed a general understanding of the phenomenon’s relationships and explanations (Shepherd & Sutcliffe, 2011). In this regard, this approach is aligned with Pollock and Williams's (2010) ‘strategic

ethnography', regarding when "the choice of research settings and the scope of studies is informed by provisional theoretical/empirical understandings of the locales in which new technologies are being shaped as well as by the specific research concerns and issues under examination." (p. 532).

3.1.2 Immersing in and constructing the field

Baskerville and Myers (2015) noted the importance of **engaging in the context**, i.g., formal or informal agreements and arrangements regarding the researcher's participation in the design practices. Engaging in the context is the first step that gives the researcher access to the field; albeit a formal agreement could precede it, engaging in the context is an ongoing negotiation among participants. After the research context is settled, the researcher **moved into the field** and joined in the design activities of the research setting (Baskerville & Myers, 2015). At that point, the researcher came to be "part of the research context" (Baskerville & Myers, 2015, p. 9). How much a researcher becomes part of the field depends on their ability to integrate and build relationships, which is facilitated by intellectual interests in common (Marcus & Fischer, 1999, as cited in Gatt & Ingold, 2013).

Furthermore, the field is not delimited by a physical location. The researcher follows a **co-presence** strategy in the field. Co-presence was presented by Beaulieu (2010) as an epistemic strategy to deal with decentralized fields and phenomena that happen beyond a specific physical location. In this regard, the notion of space is decentralized, without excluding physical location, and embraces the textualities, infrastructures, and mediations of knowledge production (Beaulieu, 2010). It means that the field is positioned not in a physical location but in places where the phenomenon occurs, considering their online interaction and textual production.

3.1.3 Describing and Intervening

Ethnography studies aim primarily to describe a culture (Spradley, 2016). Observation is the essential cognitive tool applied to that end, which may involve the researcher's participation in the cultural setting of study when needed to draw closer (Spradley, 2016). The degree of participation may vary from passive to complete participation (Spradley, 2016), whereas it is essentially documentary, not transformational (Gatt & Ingold, 2013). Seen in this light, we might understand that traditional participation is a one-way path towards description.

Conversely, the DE researcher draws on "[...] deliberate and reflexive participation in the production of artifacts (such as personal relations, documents, or even texts) during fieldwork" (Gatt & Ingold, 2013, p. 154). Therefore, the researcher participates in and actively intervenes in the field (Baskerville & Myers, 2015). The kind of intervention, however, differs from Action Research and Design Science Research. Instead of diagnosing a problem and proposing an intervention, the researcher immerses in a design process where they are one more participant. This does not mean being passive in the field; otherwise, the researcher seeks to actively contribute to the design process during the fieldwork (see Baskerville & Myers, 2015). In Gatt and Ingold's (2013) words: "[The researcher] become participants in among, rather than above and beyond, the ongoing life situations with which they deal, where they and their designs play out on the same level field as everyone else." (p. 154).

In this way, this work side with Pors et al. (2002) understanding that "[...] describing the field and changing it as interwoven rather than separate practices, [...] that

intervening in the field is not something the researcher can choose to do or not to do, but that it is an unavoidable condition when conducting ethnographic research” (pp. 4-5). From this perspective, the outputs generated in the field intervention are ideas, insights, assessments, and artifacts produced “[...] throughout [the project] rather than being its closing phase” (Zuiderent, 2002, p. 61).

3.2 Data collection techniques

Ethnography-inspired research typically relies on three data gathering methods: interviews, observation, and document analysis (Karasti & Blomberg, 2018). Participant observation is the primary source of data collection. Also, such as other qualitative methods (see Stake, 1998), DE of infrastructure needs to be triangulated with the interviews and document analysis to provide a deeper relational and contextual understanding of the findings. In this regard, participant observation and document analysis are conducted on an ongoing basis, as the field is constructed, whereas the interviews might be collected at specific points of time.

Furthermore, Otto and Gunn (2013) pointed out that DE should “extend the temporal horizon both forward and backward, to anchor images of the future in reliable constructions of the past” (p. 5). Therefore, the documents and interviews collected might be used to reconstruct moments before design and after design.

3.2.1 Participant Observation

Participant observation is one of the principals data gathering methods in ethnography studies (Baskerville & Myers, 2015; DeWalt & DeWalt, 2011). In Anthropology, “[...] participant observation involves the long-term immersion of a researcher in a social setting to observe and document everyday practices comprehensively and in detail” (Otto & Gunn, 2013, p. 17). It is generally a standalone process that aims to observe and document (Otto & Gunn, 2013). On the other hand, in the DE, more than observing and documenting, the researcher intends to collaborate with stakeholders and scholars to intervene in existing realities (Otto & Gunn, 2013). Therefore, the participant observation is drive-by “building relationships and making things” (Gatt & Ingold, 2013, p. 148). In this vein, participant observation is not an independent observation but is formed by a close relationship between researchers and the people participating in the field (Gatt & Ingold, 2013).

Furthermore, Baskerville and Myers (2015) pinpointed that the ethnographic designer “[...] goes beyond observation and actively engages with people in the field” (p. 2). Therefore, an interventionist posture ought to be adopted, seeking to understand a phenomenon while contributing to its formation.

When pursuing a **co-presence** strategy, the “focus of fieldwork [is] elaborate[d] upon the streams of practices (visible in interactions and inscriptions, i.e., texts and traces)” (Karasti & Blomberg, 2018, p. 243). The physical co-colocation is just one of the possibilities of participant observation, whereas co-presence is “particularly relevant for settings where online and offline connections are pursued back and forth, as well as for fully online and distributed settings” (Karasti & Blomberg, 2018, p. 244).

3.2.2 Interviews

“The qualitative interview is one of the most important data gathering tools in qualitative research” (Myers & Newman, 2007, p. 2). Following Karasti and Blomberg

(2018), the field site is understood as a non-predetermined entity. Thus, we need to ‘create the field’ of investigation during the analysis of infrastructuring. Creating the field means that “it is not always possible to identify in advance where the relevant social dynamics for understanding a particular technology are going on” (Hine, 2009, as cited in Karasti & Blomberg, 2018, p. 249).

Therefore, the interviews might be conducted in two stages. First, Karasti and Blomberg (2018) suggested the interview of ‘members who are already involved in the infrastructuring. In this stage, a semi-structured interview protocol with beforehand identified agents would be recommended. In the second stage, the researcher might remain open and sensitive to interview opportunities as the field unfolds.

3.2.3 Document Analysis

Ciborra and Hanseth (1998) advocated that "designing technology is more than the design of pure, isolated technological artifacts" (p. 314). It also involves the design of non-technological elements, such as documents and organizational rules. In this regard, studying the design of infrastructures requires the investigation of ‘unexciting things’ such as “lists, mundane plugs, technical specifications, standards, bureaucratic forms and details buried in inaccessible code” (Karasti & Blomberg, 2018, p. 251). Therefore, document analysis is necessary to reveal the invisible work of infrastructure design materialized in public and private documents.

Although documents are not the primary data source in the DE approach, its analysis is essential to the researcher's sense of what happened before they moved into the field and analyzed the crystallization of the design process in documents, protocols, rules, codes guides, and other materials.

3.3 Research Criteria

3.3.1 Field selection

Karasti and Blomberg (2018) highlighted that, to study an infrastructure, the researcher must explore the contexts in which the new technologies are being configured and consider opportunistic and pragmatic criteria when choosing the location. In this regard, selecting a field of infrastructure design resembles Stake's (1998) criteria of instrumental case selection. The study of infrastructure requires a processual focus on its building, primarily oriented on design ‘intentionalities’ (Karasti & Blomberg, 2018). In this regard, the DE research would require a site where “the ethnographer is actively immersed and engaged in a setting where people are either designing artifacts, producing artifacts, or introducing artifacts into a social and cultural context (Baskerville & Myers, 2015, p. 6).

Therefore, the researcher needs to be attentive to the field **timing** since it is essential to follow the design process as it unfolds. Furthermore, as the researcher needs to become part of the field, their **access** and **opportunity to learn** should be core criteria in selecting the field. Also, the field needs to be **rich** enough to reveal the complex work relations, interdependences, and unfoldings of the information infrastructure design.

3.3.2 Research quality

Baskerville and Myers (2015) proposed six DE research criteria: **authenticity, plausibility, criticality, theoretical contribution, and insight into the design culture** (see **Table 1**). Furthermore, based on Karasti and Blomberg (2018), the author's reflexivity is proposed as one more criterion. The reflexivity is a critical factor in the field formation, as abovementioned. To articulate reflexivity as research criteria, I drew on Pozzebon and Petrini's (2013) work. Each of the criteria is followed by indications of how researchers might address these criteria in studying information infrastructure design. In this regard, Pozzebon and Petrini's (2013) work was also used as an inspiration and reference guide.

Table 1: Research Criteria

Research Criteria	How might it be addressed?
<i>Research rigor</i> : "The design ethnographer should explain their active engagement throughout the design process. The design ethnographer should demonstrate authenticity." (Baskerville & Myers, 2015, p. 13)	All interactions with the field may be recorded in detail, containing information about the author's situations and his interventions in the field, interactions, reflections, and concrete observations. Documents that demonstrate the historical construction and current context of the field and its actors also might be analyzed.
<i>Plausibility</i> : "The design ethnography should be plausible and a contribution to new knowledge in IS; it should demonstrate insight into the meaning and relevance of the design practices in the particular context to designers in other contexts." (Baskerville & Myers, 2015, p. 13)	The interaction with the field might take place from a theoretical gap in the literature and the practical relevance of the subject. From this point on, the construction of the text might follow an academic standard, seeking to clarify possible controversies and communicate the practical and theoretical contributions of this work.
<i>Design Ethnography Criticality</i> : "The design ethnographer should critically reflect upon and challenge taken-for-granted assumptions and be encouraged to imagine new ways of designing artifacts." (Baskerville & Myers, 2015, p. 13)	The study might seek to question and understand the participants' assumptions and engage with the construction of new design possibilities. The work might be written in order to bring reflections on the adopted design model.
<i>Theoretical contribution</i> : "The design ethnographer should describe a theory that explains how and why people create artifacts and adapt them to their environment." (Baskerville & Myers, 2015, p. 13)	The study might follow the theoretical framework built from the literature review, forming a theoretical lens from which the data might be analyzed.
<i>Insight into design culture</i> : "The design ethnographer should explain why the artifact and design experience is important to the subjects in the field, providing rich insight into their culture." (Baskerville & Myers, 2015, p. 13)	The study might be conducted near the artifact's designers and users, seeking to understand its conception and use process.
<i>Critical Interpretive Reflexivity</i> : The researcher should reveal their [...] personal role and personal biases and assumptions" (Pozzebon & Petrini, 2013)	The author's assumptions might be clearly articulated in the research text. The authors might attempt to be aware of their impact in the field formation and clarify their interventions to the reader.

Source: elaborated by the author

CONCLUSION

Information infrastructure is increasingly pervasive and intertwined in all aspects of human life. In this context, it is no longer possible to distinguish the role of the user and designer. The design of information infrastructures increasingly moves from the center to the edges in the process of generative innovation where heterogeneous actors are constantly recreating, adapting, and reconfiguring. In this sense, we need to expand our research methodologies tooling to contemplate such ongoing and open-ended socio-technical phenomena. Therefore, this work proposed the use of DE as a viable alternative for this type of study.

DE mixes pragmatism and interpretive epistemologies and proposes a method in which the researcher, at the same time, seeks to describe, also intervenes, and contributes to the design of the information infrastructure. However, such an approach requires establishing a genuine exchange relationship with the field in a correspondence strategy. Also, when studying infrastructure design, the author needs to build the field as the research unfolds. In this regard, the research should remain open and aware of the field possibilities, following the connections and discovering the discontinuities.

This work sought to provide a guide regarding how we might conduct DE research to investigate the design of information infrastructures from a bottom-up perspective—presenting its main steps, main data collection techniques, and initial criteria for field selection and research evaluation. As mentioned already mentioned, this guide is an indicative path and not a set of rigid rules. Future research can contribute with empirical validation of the elements introduced in this study and expanding the understanding of the strategies listed above, such as ‘correspondence’, ‘following the connections’, and ‘discovering the discontinuities’

REFERENCES

- Baskerville, R. (1999). Investigating Information Systems with Action Research. *Communications of the AIS*, 2(19).
- Baskerville, R., Baiyere, A., Gergor, S., Hevner, A., & Rossi, M. (2018). Design Science Research Contributions: Finding a Balance between Artifact and Theory. *Journal of the Association for Information Systems*, 19(5), 358–376. <https://doi.org/10.17705/1jais.00495>
- Baskerville, R. L., & Myers, M. D. (2015). Design ethnography in information systems. *Information Systems Journal*, 25(1), 23–46. <https://doi.org/10.1111/isj.12055>
- Beaulieu, A. (2010). From Co-Location to Co-presence: Shifts in the Use of Ethnography for the Study of Knowledge, forthcoming in *Social Studies of Science*. *Social Studies of Science*, 40(5), 453–470.
- Benkler, Y. (2006). *The Wealth of Networks—How Social Production Transforms Markets and Freedom*.
- Blomberg, J., & Karasti, H. (2012). Ethnography: Positioning ethnography within Participatory Design. In J. Simonsen & T. Robertson (Orgs.), *Routledge International Handbook of Participatory Design* (0 ed). Routledge. <https://doi.org/10.4324/9780203108543>
- Bygstad, B. (2010). Generative mechanisms for innovation in information infrastructures. *Information and Organization*, 20(3–4), 156–168. <https://doi.org/10.1016/j.infoandorg.2010.07.001>
- Ciborra, C. U., & Hanseth, O. (1998). From tool to Gestell Agendas for managing the information infrastructure. *Information Technology & People*, 11(4), 305–327.

- Constantinides, P., Henfridsson, O., & Parker, G. G. (2018). Introduction—Platforms and Infrastructures in the Digital Age. *Information Systems Research*, 29(2), 381–400. <https://doi.org/10.1287/isre.2018.0794>
- de Reuver, M., Sørensen, C., & Basole, R. C. (2018). The Digital Platform: A Research Agenda. *Journal of Information Technology*, 33(2), 124–135. <https://doi.org/10.1057/s41265-016-0033-3>
- DeWalt, K. M., & DeWalt, B. R. (2011). *Participant Observation A Guide for Fieldworkers* (Second Edition). AltaMira Press.
- Fink, L., Shao, J., Lichtenstein, Y., & Haefliger, S. (2020). The ownership of digital infrastructure: Exploring the deployment of software libraries in a digital innovation cluster. *Journal of Information Technology*, 35(3), 251–269. <https://doi.org/10.1177/0268396220936705>
- Frischmann, B. M. (2009). Infrastructure Commons in Economic Perspective. In W. H. Lehr & L. M. Pupillo, *Internet Policy and Economics* (p. 29–54). Springer Science + Business Media.
- Gatt, C., & Ingold, T. (2013). From Description to Correspondence: Anthropology in Real Time. In W. Gunn, T. Otto, & R. C. Smith (Orgs.), *Design anthropology: Theory and practice*. Bloomsbury.
- Ghazawneh, A., & Henfridsson, O. (2013). Balancing platform control and external contribution in third-party development: The boundary resources model: Control and contribution in third-party development. *Information Systems Journal*, 23(2), 173–192. <https://doi.org/10.1111/j.1365-2575.2012.00406.x>
- Goldkuhl, G. (2012). Pragmatism vs interpretivism in qualitative information systems research. *European Journal of Information Systems*, 21(2), 135–146. <https://doi.org/10.1057/ejis.2011.54>
- Hanseth, O., & Lyytinen, K. (2010). Design Theory for Dynamic Complexity in Information Infrastructures: The Case of Building Internet. *Journal of Information Technology*, 25(1), 1–19. <https://doi.org/10.1057/jit.2009.19>
- Henfridsson, O., & Bygstad, B. (2013). The Generative Mechanisms of Digital Infrastructure Evolution. *MIS Quarterly*, 37(3), 907–931. <https://doi.org/10.25300/MISQ/2013/37.3.11>
- Kallinikos, J., Aaltonen, A., & Marton, A. (2013). The Ambivalent Ontology of Digital Artifacts. *MIS Quarterly*, 37(2), 357–370. <https://doi.org/10.25300/MISQ/2013/37.2.02>
- Karasti, H., & Blomberg, J. (2018). Studying Infrastructuring Ethnographically. *Computer Supported Cooperative Work (CSCW)*, 27(2), 233–265. <https://doi.org/10.1007/s10606-017-9296-7>
- Karasti, H., & Syrjänen, A.-L. (2004). Artful infrastructuring in two cases of community PD. *Proceedings of the Eighth Conference on Participatory Design Artful Integration: Interweaving Media, Materials and Practices - PDC 04, 1*, 20. <https://doi.org/10.1145/1011870.1011874>
- Koskinen, K., Bonina, C., & Eaton, B. (2019). Digital Platforms in the Global South: Foundations and Research Agenda. In P. Nielsen & H. C. Kimaro (Orgs.), *Information and Communication Technologies for Development. Strengthening Southern-Driven Cooperation as a Catalyst for ICT4D* (Vol. 551, p. 319–330). Springer International Publishing. https://doi.org/10.1007/978-3-030-18400-1_26
- Koutsikouri, D., Lindgren, R., Henfridsson, O., & Rudmark, D. (2018). Extending Digital Infrastructures: A Typology of Growth Tactics. *Journal of the Association for Information Systems*, 1001–1019. <https://doi.org/10.17705/1jais.00517>

- Myers, M. D. (1999). Investigating Information Systems with Ethnographic Research. *Communications of the Association for Information Systems*, 2. <https://doi.org/10.17705/1CAIS.00223>
- Myers, M. D., & Newman, M. (2007). The qualitative interview in IS research: Examining the craft. *Information and Organization*, 17(1), 2–26. <https://doi.org/10.1016/j.infoandorg.2006.11.001>
- Nambisan, S., Lyytinen, K., Majchrzak, A., & Song, M. (2017). Digital Innovation Management: Reinventing Innovation Management Research in a Digital World. *MIS Quarterly*, 41(1), 223–238. <https://doi.org/10.25300/MISQ/2017/41:1.03>
- Otto, T., & Gunn, W. (2013). Design Anthropology. *Design Anthropology*, 331.
- Otto, T., & Smith, R. C. (2013). Design Anthropology: A Distinct Style of Knowing. In W. Gunn, T. Otto, & R. C. Smith (Orgs.), *Design anthropology: Theory and practice*. Bloomsbury.
- Øvrelid, E., & Bygstad, B. (2019). The role of discourse in transforming digital infrastructures. *Journal of Information Technology*, 34(3), 221–242. <https://doi.org/10.1177/0268396219831994>
- Pollock, N., & Williams, R. (2010). e-Infrastructures: How Do We Know and Understand Them? Strategic Ethnography and the Biography of Artefacts. *Computer Supported Cooperative Work (CSCW)*, 19(6), 521–556. <https://doi.org/10.1007/s10606-010-9129-4>
- Pozzebon, M., & Petrini, M. (2013). Critérios para Condução e Avaliação de Pesquisas Qualitativas de Natureza Crítico Interpretativa. In A. Takahashi (Org.), *Pesquisa Qualitativa em Administração: Fundamentos, métodos e usos no Brasil* (p. 51–72). Atlas.
- Sein, Henfridsson, Purao, Rossi, & Lindgren. (2011). Action Design Research. *MIS Quarterly*, 35(1), 37. <https://doi.org/10.2307/23043488>
- Shepherd, D. A., & Sutcliffe, K. (2011). INDUCTIVE TOP-DOWN THEORIZING: A SOURCE OF NEW THEORIES OF ORGANIZATION. *The Academy of Management Review*, 36(2), 361–380.
- Spradley, J. P. (2016). *Participant observation*. Waveland Press.
- Stake, R. E. (1998). Case Studies. In N. K. Denzi & Y. Lincoln, *Strategies of Qualitative Inquiry* (p. 445–454). Sage Publications.
- Star, S. L. (1999). The Ethnography of Infrastructure. *American Behavioral Scientist*, 43(3), 377–391.
- Star, S. L. (2002). Infrastructure and ethnographic practice—Working on the fringes. *Scandinavian Journal of Information Systems*, 107–122.
- Suchman, L. (2002). Located Accountabilities in Technology Production. *Scandinavian Journal of Information Systems*, 14(2), 91–105.
- Tilson, D., Lyytinen, K., & Sørensen, C. (2010). Digital Infrastructures: The Missing IS Research Agenda. *Information Systems Research*, 21(4), 748–759. <https://doi.org/10.1287/isre.1100.0318>
- von Hippel, E. (2005). *Democratizing innovation*. MIT Press.
- Yoo, Y., Henfridsson, O., & Lyytinen, K. (2010). The New Organizing Logic of Digital Innovation: An Agenda for Information Systems Research. *Information Systems Research*, 21(4), 724–735. <https://doi.org/10.1287/isre.1100.0322>
- Yoo, Y., Lyytinen, K. J., Boland, R. J., & Berente, N. (2010). The Next Wave of Digital Innovation: Opportunities and Challenges: A Report on the Research Workshop “Digital Challenges in Innovation Research”. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.1622170>
- Zittrain, J. (2009). *The Future of the Internet—And How to Stop It*. Penguin Group.

Zuiderent, T. (2002). Blurring the center: On the politics of ethnography. *Scandinavian Journal of Information Systems*, 14(2), 59–78.