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# Introduction: Communication and design infrastructures

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## ABSTRACT

This article is the introduction of the first of two *Communication Design Quarterly* special issues focused on conceptualizations of infrastructure. This introduction explains the inspiration for these two special issues and details the growth of infrastructural research across the humanities and social sciences. This article also explains the structure of the issue and argues that the articles found across these two issues make a strong case for centering infrastructural knowledge in our work going forward.

## CCS Concepts

Information systems

## Keywords

infrastructure, writing studies, design, user experience, UX

These two special issues were completed before Jordan Frith took over as Editor-in-Chief of *Communication Design Quarterly*.

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*Communication Design Quarterly*. ACM SIGDOC, New York, USA.

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Date of publication September 2022.

CDQ 10.1145/3507857.3507858

## INTRODUCTION

The introduction to a special issue is always a bit of a unique genre with unique challenges. The editors need to give background on a topic without narrowly defining terms in ways that should be left up to the contributors, and the editors need to justify the exigence for the unifying theme without narrowing what “counts” as relevant. The challenge is even more unique when there are two back-to-back special issues that will each have their own introduction, and this is the first of two *Communication Design Quarterly (CDQ)* special issues focused on infrastructure (broadly defined). Consequently, we’re going to walk that fine line here by starting in what may be a strange place: a more personal explanation of why the two of us—Jordan Frith and Sarah Read—pushed so hard for a collection of writing and design work that centers conceptualizations of infrastructure. And to explain those origins, we have to go back a few years to a friendship that was born out of a serendipitous interest in rethinking both how infrastructures shape writing and design and rethinking the infrastructural role writing and design plays in the world.

An important piece of background to this story is the fact that the last two decades have seen a marked growth across the social sciences and humanities in research focused on infrastructure, a point we examine in more detail in the next section. The increased transdisciplinary focus on infrastructure, however, has—with a few notable exceptions (DeVoss et al., 2005; Grabill, 2010; Johnson & Johnson, 2016; Swarts, 2010; Vee, 2013)—mostly not made its way into writing and design research. That began to change recently, in part through work we published that explicitly tied technical and professional communication work to infrastructural theory. Sarah drew from extensive ethnographic work to examine how writing actually works as infrastructure for other infrastructures and developed a framework for understanding the infrastructural role writing plays within organizations (Read, 2019, 2020). Jordan built upon Sarah’s framework and performed a qualitative analysis of a major technical standard to show how writing also externally works as infrastructure by building a base that shapes how other organizations create products for end users (Frith, 2020a, 2020b). He argued that writing becomes embedded within objects in

invisible, often ignored ways. We barely knew one another when we started that work, but the overlap was obvious, and we started talking. Since then, we have been friends and collaborators, and we both knew that if we really wanted infrastructural research (broadly defined) to become a more central part of our discipline, we could not do it through our research and conversations alone.

Consequently, these two special issues were born out of a conversation over ramen at the 2019 SIGDOC conference in Portland, Oregon. The two of us do not agree on everything, with Jordan more interested in the infrastructural theory side and Sarah more focused on merging rhetorical and genre theory with infrastructural work. But despite our relatively minor differences, we both are devoted to growing the role of infrastructural approaches in our disciplines. Consequently, we both felt that for infrastructure to be a more central concept in our discipline, we needed to draw from the broad expertise of multiple authors, and a special issue in an inclusive venue like *CDQ* was the best way to do it. We then pitched the idea of a special issue focused on infrastructure to *CDQ* and put out a call for abstracts as soon as it was approved. Then we waited. And waited. We both worried that maybe the idea of infrastructure as a way to conceptualize and understand writing and design was simply *too* out there, and we feared that we were maybe stuck having a theoretical conversation with one another. But then in true academic fashion, the abstracts began pouring in right before the CFP deadline, and we were overwhelmed by both the quantity and the quality of the submissions. So many authors proposed so many interesting ways to center infrastructure in writing and design work, and we decided to split into two separate special issues because we had more than enough quality submissions to support that choice. Even with two issues, we had to make difficult decisions and reject exceptional abstracts. The sheer breadth of innovative work represented in those submissions signaled that there is a strong future for centering conceptualizations of infrastructure in writing and design research.

This is the first of those two special issues. We titled this issue *Communication and Design Infrastructures*, and the second issue will be titled *Writing Infrastructures*. The two issues share many similarities, and there is not a fully clean dividing point between the articles featured in each issue. However, they do differ in some ways, with this issue focused more on material infrastructures and collaborative infrastructures and the next issue focused more on the infrastructural functions of writing. But before we dive deeper into this issue and the articles it features, we first want to provide background on the development of infrastructure as a significant object of research across the social sciences and the humanities, which we do in the next section. Our goal is not to provide a “correct” framework for conceptualizing infrastructures of writing and design or even how best to examine the infrastructural roles communication, writing, and design can play within organizations. Rather, we decided that this introduction should provide background on the growth of infrastructural research, which some have argued has become significant enough to label an emerging field of “infrastructure studies” (Sandvig, 2013).

After we provide background on the growth of infrastructure studies, we then outline the different articles in this issue, which range from examinations of Git as a boundary infrastructure to analyses of how automated data infrastructures may shift how we understand user participation research. We conclude by reiterating the shared goals of these two special issues and foregrounding some of the articles found in the next issue. What we ultimately

hope these special issues show *CDQ* readers is that infrastructural research has much to add to research on writing and design, and equally importantly, we believe the excellent work the authors did across these two issues shows that research on writing and design has much to add to the growing body of transdisciplinary infrastructural research.

## THE GROWTH OF INFRASTRUCTURAL RESEARCH

In one sense, infrastructures don’t seem like a natural fit for research in the humanities and social sciences. Almost by definition, infrastructures are designed not to be noticed. As Star and Ruhleder (1996) put it, they often remain invisible and only become visible when they break down. Whether we are talking about material infrastructures like roads or fiber optic cable or discursive infrastructure like internal documents or standards, they remain in the background of the more typical objects of studies in most fields. After all, most humanistic and social scientific research focuses more on the interfaces with which people interact, the texts that shape discussions, the apps people use to network, and so on, than on the mostly ignored infrastructures that make those practices possible (Parks & Starosielski, 2015).

Infrastructural research has, however, seen significant growth across the social sciences and humanities over the last few decades. Researchers from various disciplines have increasingly begun to analyze the agential role infrastructures (defined broadly) play in shaping practices and holding together—or not holding together—various parts of the social world. What’s maybe most interesting about this growing focus on the importance of infrastructure is just how transdisciplinary the move has been. Researchers from disciplines such as communication studies (Frith, 2019; Mukherjee, 2020; Parks, 2005; Starosielski, 2015), anthropology (Anand et al., 2018; Appel et al., 2018; Harvey & Knox, 2015; Larkin, 2013), information science (Bowker & Star, 1999; Kling, 1991), computer science (Dourish & Bell, 2011), and many more have begun speaking a somewhat common language and communicating across traditional disciplinary lines to situate understandings of the important role oft-ignored infrastructures play in our lives. These conversations have become common enough that some researchers now argue that “infrastructure studies” has become its own identifiable transdisciplinary field of study (Sandvig, 2013).

The history of infrastructure studies as a semi-coherent body of transdisciplinary scholarship is not just background for background’s sake. Instead, we argue the history of the field is relevant to the different objects of study and, in a few cases, the somewhat different conceptualizations of infrastructure found among the articles of these two special issues. And while we have no intention of “defining” infrastructure as a concept or using this introduction to carve out a supposedly “correct” framework for infrastructural research, we do want to give background on the development of infrastructural research to better situate a few different ways infrastructure can be analyzed.

Infrastructure studies has its roots in the 1990s in more technical fields like information science and engineering. Scholars like Kling (1991), Star (Star, 1999; Star & Ruhleder, 1996), and Bowker (Bowker, 1994; Bowker & Star, 1999) began exploring the “soft” social infrastructures of science and engineering to examine the role these infrastructures play in holding together larger projects. As Sandvig (2013) documents, these scholars came from disciplines

that were comfortable describing and explaining technical, material infrastructures, but these disciplines had less of a vocabulary for describing the “soft infrastructure” of people, policies, and collaborative platforms that were key to various projects. This research from information science, especially research by Susan Leigh Star and Geoff Bowker, then became central to what Sandvig describes as the “relational” strand of infrastructure studies, and we want to briefly detail two major contributions here to help contextualize just why and how scholars have embraced a relational approach to infrastructure.

Formative early research introduced a number of approaches and theories that still dominate infrastructure studies to this day, and multiple articles across both these issues draw from some of this early work. One example was Bowker’s (1994) introduction of “infrastructural inversions” as a broad methodological approach for studying infrastructure. “Infrastructural inversions” are basically a foreground/background flip where researchers look beneath the surface to examine the infrastructures—whether material or discursive—that shape the higher-level practices that are the more typical area of focus in the social sciences and humanities. In other words, infrastructural research, regardless of discipline, tends to analyze the mostly invisible objects and processes in the background of more typical areas of study: the satellites that shape communication (Parks, 2005), the collaborative organizations that shape scientific output (Star, 1999), the documents that become embedded in objects (Frith, 2020b; Read, 2020), the agential role of highway projects in Peru (Harvey & Knox, 2015), the phenomenology of computing infrastructures (Dourish & Bell, 2007, 2011), the analysis of economic infrastructures (Buhr, 2003), and so on (see Read, 2019 for more detail on different definitional approaches to infrastructure). In other words, infrastructural research inverts objects of focus to analyze how higher-level practices are shaped by the layers of infrastructure found below.

Infrastructural inversions are a key approach in infrastructure studies, but the reason Sandvig labels this group “the relationists” (2013, p. 91) is because of one of the key concepts in infrastructure studies that emerged in earlier work: Susan Leigh Star’s argument that infrastructures are relational (Star, 1999; Star & Ruhleder, 1996). In other words, arguing about or trying to define whether something is or is not an infrastructure is not really the goal of most infrastructural research. Rather, as Star and her colleagues argue, infrastructures are relational and do infrastructural work through practice, not through any deep ontological categorization. Or, to put it slightly differently, “we ask, *when*—not *what*—is an infrastructure” (Star & Ruhleder, 1996, p. 113) For example, a cell tower is an infrastructure to most of us. It remains in the background and is mostly ignored except in moments of breakdown when we cannot get a signal. But for tower technicians, that same tower is not an infrastructure; it’s a primary object of focus. And as both authors of this article have argued, the same is true of discursive infrastructures. Writing, whether internal documents or documents like standards, do infrastructural work for some audiences while remaining a primary object of focus for others.

Relationality is a key concept for many infrastructural researchers, and it is deployed by multiple authors throughout both of these issues. But as Sandvig (2013) points out, a different approach to infrastructural research has also developed and—while it still draws from relational researchers like Bowker and Star—has a different starting point and slightly different object of analysis (though there is significant overlap). Sandvig (2013) labels this group “the

new materialists” and points out these researchers tend to come from more humanistic backgrounds and focus more on the “hard infrastructures” of communication, writing, and design (Frith, 2019, p. 91). Influential examples of the materialist approach includes work like Parks’ (2005) cultural analysis of satellite infrastructures and their relationship to globalization or Starosielski’s (2015) anthropological approach to the study of undersea cable. Whereas the relationists tended to start with the social to invert infrastructures, the materialists tend to perform those inversions by focusing on the “hard” infrastructures of communication and design, a trajectory shaped in part by disciplinary starting points.

We don’t want to overstate the differences between new materialist and relational approaches. They draw from similar theories, and in many cases are almost indistinguishable. Both often focus on social justice issues and how infrastructures can embed inequality in often invisible ways (Busch, 2011; Frith, 2019; Graham & Marvin, 2001). Equally as important, they are both united in the core belief that infrastructures matter and are more than bases upon which more interesting things just happen; instead infrastructures—whether social or material—shape higher level practices. But despite the similarities, this history can be important because it shows just how widely infrastructural approaches can be applied across various research domains. For some researchers, the contribution may come in exploring how the “soft infrastructures” of communication inform material practices. For other researchers whose audience already has expertise on the “communication” part but maybe less so on the “material” part, the contribution may come in uncovering the agential infrastructural role of various material forms that remain in the background. In other words, to quote Star (2000), “it’s infrastructure all the way down” (p. 1), and regardless of the specific approach or object of study, thinking infrastructurally means uncovering that which is hidden; it means digging into the layers of practices and materials that shape higher-level practices that are more commonly researched. And these two special issues embrace the capaciousness of infrastructural thinking by examining a wide variety of the often-invisible layers of infrastructural practice that are key to the work people do as practitioners of communication, writing, and design.

## THE STRUCTURE OF THIS ISSUE

Once we decided we had more than enough excellent abstract submissions to make two special issues, we then had to decide how to group the articles in the two issues. We decided that this first issue would group together articles that focus more on technical infrastructures like Artificial Intelligence and Git as well as the buried communicative infrastructures of social collaboration. The second issue focuses more on the infrastructural role of writing, though we want to be clear that the articles across the two issues are all in conversation with one another, and the split between the two is far from clean. The articles in this issue feature discussions of writing and design practices, just as the articles in the next issue include discussions of technical and collaborative infrastructures. We both believe the separation into two separate issues illustrates how capacious infrastructural research can be, but we also don’t want to overstate the split: the two issues are more similar than they are different, and we hope they are read together as a framework for just how widely infrastructural research can be applied in our discipline.

The introduction to the next issue will obviously focus more on those articles, so here we want to outline the articles in this issue

and provide a roadmap for how they broadly fit together as part of what we hope becomes an even more prominent conversation. To return to an earlier point, our goal in putting together these special issues was not to direct infrastructural research in one way or another. We did not tell authors how to define infrastructure or which bodies of theory from which they should draw. While that kind of consistency across a special issue can certainly have its benefits, we decided early on that writing and design research would be best served if we let authors be creative in how they approach the role of infrastructure in their research. Nevertheless, the main thing we wanted to ensure across these two issues was that the focus had to be on infrastructure (broadly defined), however the authors chose to conceptualize the term. We wanted explorations of the often-invisible practices and products that shape outputs in communication, writing, and design, and the articles in this issue (and the next) maintain that unifying focus even as they analyze widely different objects and draw from occasionally different theoretical frameworks.

The first two articles focus on a topic that has long been central to technical communication and design: users. In the first article, “Infrastructural support of users’ mediated potential,” Nupoor Ranade and Jason Swarts use infrastructural thinking to reconceptualize the role of users and user research in the design process. The authors argue that to build better user models we need to carefully consider how users are situated amongst multiple social and technical infrastructures. And maybe most importantly, we need to consider how users’ ability to communicate in certain ways (or not communicated in certain ways) is shaped by those infrastructures. In particular, they argue that conceptualizations of the role infrastructures play in communication can help researchers and practitioners more accurately model user behaviors for communication design. Their approach draws from both infrastructural theory and cybernetics research to introduce a unique approach to user design: the concept of “mediated potential.” Mediated potential is a framework for more accurately conceptualizing the “user + infrastructure” relationship for user modeling, and to return to the previous section, their framework includes close attention to both the “hard” and “soft” infrastructures that fall under the infrastructure studies umbrella.

The second article shares the focus on the relationship between infrastructures and user design, though the authors use an infrastructural approach to head in a different direction. In the article “Automated infrastructures,” John T. Sherril and Michael J. Salvo explore how core concepts of participatory design may be impacted by the growth of infrastructures of artificial intelligence and automation. They draw from Star’s anthropological approach to infrastructure to make an impassioned argument that new data infrastructures can be useful for participatory design, but they should not replace the expertise of technical communicators. To make their argument, they introduce the concept of automated infrastructures for design and show how increasingly complex data infrastructures can provide designers with increasingly detailed user profiles. However, no matter how powerful those infrastructures become, they argue that the role of the technical communicator who engages users and interprets user data should not disappear. Importantly, they do note that the role of the practitioner may have to change as these design infrastructures grow, but the practitioner should remain the bridge between data infrastructures and users regardless of broader infrastructural shifts in the product design process.

Users remain central to the other three articles in this issue, though

the focus shifts more from user modelling and more towards how people use individual infrastructures and how people work behind the scenes to maintain them. The third article, titled “Building ethical distributed teams through sustained attention to infrastructure” and written by Michelle McMullin, Hadi Riad Banat, Shelton Weech, and Bradley Dilger focuses on the Corpus and Repository of Writing (Crow) project. The authors situate the corpus as an infrastructure, but they dive even deeper to conceptualize the collaborative processes that holds the project together as its own kind of infrastructure. Their work as a project team is driven by the concept of sustainable infrastructure, which involves building both social and material infrastructures that are able to be maintained over time and are able to quickly introduce new members to the deeper infrastructural process. Their article innovatively conceptualizes how mapping strategies for collaborative work can make infrastructures more visible and argues that infrastructural visibility is key to developing equitable, socially just infrastructural research practices.

The fourth article shares the focus on both the role a database can play as infrastructure and the importance of building infrastructural collaborative practices. That article—“Writing infrastructure with the Fabric of Digital Life platform”—is written by Katlynn Davis, Danielle Mollie Stambler, Jessica Lynn Campbell, Daniel L. Hocutt, Ann Hill Duin, and Isabel Pedersen, who are all members of the Building Digital Literacy (BDL) research and pedagogy team. The article analyzes the Fabric of Digital Life (FABRIC) archive as a pedagogical infrastructure that reaches across multiple institutions. The FABRIC archive tracks the emergence of various technologies and is collaboratively created. As the authors describe, students are able to both access and contribute to the archive and doing so requires teaching digital literacies like metadata that themselves do infrastructural work. And maybe most importantly, the authors use the FABRIC project to show how similar classroom work can help make invisible infrastructures visible to students. In that way, they are in conversation with the previous article by arguing that emphasizing visibility is key to building more socially just infrastructures. To drive that point home, the authors develop an innovative framework for analyzing data from the FABRIC project. Their framework combines infrastructural theory with Walton, Moore, and Jones’ (2019) 3Ps framework to put distinct bodies of research into conversation and reconceptualize the role privilege, positionality, and power play in how we relate to infrastructures more broadly.

The final article—“Alternate histories and conflicting futures”—continues the focus on collaboration through infrastructure by analyzing the software Git. As Eric J. York argues, Git is one of the most influential, dominant collaborative infrastructures of all time. Git is used in the majority of large coding projects to make collaborative editing and version control possible with a large number of contributors. York first analyzes Git as collaborative infrastructure before drawing from infrastructural theory to argue that Git works as a “boundary infrastructure” that crosses lines of expertise and retains shared meaning. Like the previous two articles, York’s work focuses on the role infrastructure—in this case a dominant platform—plays in collaborative processes, and like the previous two articles, he also argues that infrastructural analyses can help build more socially just infrastructures. As he points out, knowledge of Git has become essential to collaborative software design, which can lead to hegemonic practices that researchers must make visible.

## CONCLUSION AND LOOKING FORWARD

The five articles that comprise this special issue (six if you count this introductory article) help show how broadly infrastructural thinking can be applied to communication, writing, and design. Some of the articles include more materialist focuses on platforms like Git and automated data infrastructures, while others do include materiality but focus more on the social infrastructures that undergird larger projects. We argue in this issue introduction that what is so exciting and valuable about infrastructural approaches to communication, writing, and design is that they can encompass all of these different topics. Beneath almost all higher-level practices, there are layers upon layers of infrastructures—both social and material—that shape those practices. Infrastructural theories can help researchers in our discipline look below the surface and peel back those layers.

Importantly, every one of these articles makes a unique case for just why it's important to extend our research to the often-hidden infrastructures that shape our work. Ranade and Swarts show that users need to be understood within their infrastructural context, while Sherril and Salvo argue that technical communicators need to evolve their role amongst new design infrastructures. The Crow team argues that equitable research infrastructures must include high levels of visibility that can be furthered through social mapping practices, while the BDL team shows how infrastructural research can be combined with the 3P framework to build equitable pedagogical and research practices. York examined how infrastructures can become so dominant that, even as they work as boundary objects, they also can become their own form of gatekeeping in possibly inequitable ways. These articles drew from somewhat different frameworks and different objects of analyses, but they all highlight in their own unique ways how inverting the foreground/background relationship and peeling away material and social infrastructural layers can make significant contributions to our research.

This collection of articles, of course, is only half the story we hope to tell with these two special issues. While these articles work in conversation with one another, the next special issue of *CDQ* will further build upon that conversation, showing more areas of divergence and emergence as more authors use infrastructural approaches in their work. We hope this introduction has helped make part of the case for why communication, writing, and design research should become a bigger part of infrastructure studies as a loosely organized, transdisciplinary area of research. More importantly, we believe the authors who contributed their excellent work to this issue makes that case more persuasively than we ever could in a special issue introduction.

The goal of both this issue and the next is to put a wide range of authors into conversation through a shared focus on infrastructure. And we hope this conversation shows just how much our discipline can contribute to infrastructural research more broadly, while also showing how infrastructural research can contribute a great deal to our disciplinary work. This issue is the first part of that conversation that we hope continues to happen across our journals and conferences, and we are excited to see the publication of the second issue, which will include everything from conceptualizations of citational practices as infrastructures that are in a moment of breakdown to analyses of how infrastructural writing becomes embedded within oysters. Infrastructure, after all is everywhere and shapes everything almost all the time. Consequently, we are excited to see how the contributions of authors in this issue and the next

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help shape the conversation in our discipline as we peel back more and more layers to understand the infrastructural role of so many different aspects of communication, writing, and design.

## ACKNOWLEDGEMENTS

We want to thank all of the authors in this issue for their excellent contributions. It's their work that makes this issue what it is. We also want to thank the former *CDQ* editor—Derek G. Ross—for seeing the potential in this issue and giving us such fantastic guidance. Ironically, Jordan is taking over as *CDQ* editor and will be the editor by the time this issue comes out, but both this and the next special issue were completed well before the position even became open. Consequently, we are very appreciative for Derek's guidance and the *CDQ* editorial board's feedback on the special issue proposal. And as we mentioned before, we are so thankful for every contributor who took the time to share their work and help us along the way.

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Sarah Read is Associate Professor and Director of Professional and Technical Writing in the English Department at Portland State University. Her publications include single-authored and collaborative articles in *Technical Communication Quarterly*, *Journal of Business and Technical Communication*, *Written Communication*, *College Composition and Communication*, *Programmatic Perspectives* and the *Journal of Writing Research*, as well as the conference proceedings of SIGDOC (Design of Communication (ACM)) and Pro Comm (IEEE). In addition, she has published four book chapters in edited collections and recently co-edited (2022) a double special issue of *Communication Design Quarterly* on the topic of Infrastructure. She currently serves as Vice-Chair of SIGDOC.