ABSTRACT

RANADE, NUPOOR. Re-contextualizing Audiences: New Conceptualizations of User Interactions in Product Documentation Spaces. (Under the direction of Dr. Jason Swarts.)

The goal of this dissertation is to re-contextualize the ways in which technical communicators learn about audiences in product documentation spaces, especially in the software industry. Technical writers write help content that users use to solve their problems. To do so, writers first conduct an audience analysis to know who the users are and how they access the content. While interacting with content, users sometimes become content (and data) producers. The content created by them can provide writers with users' behavioral insights, characteristics, and information on the methods that they use to access content. So far, limited research has been conducted on analyzing content produced by users. This dissertation describes how users' interactions create content, what can we learn about users from analyzing that content, and how does such an analysis change the roles of technical communicators. These concerns are condensed into two main research questions: 1) How can we learn about users from implicit interactions with content? 2) How does analyzing content created by audiences impact the role of technical communicators?

The research was conducted in two stages. First, 19 practitioners from 13 different organizations across the US were interviewed to collect inputs on product documentation spaces where users interactions led to content creation. Three out of the 13 spaces found, were picked for further analysis. The first case study was a pull request on GitHub where a user edited the documentation to add few new lines of content which, within a few days and with few interactions with the corresponding organizations' stakeholders, were merged with the public facing product documentation content. The second case consisted of a study on data analytics where users' interactions were tracked through 3 different tools – Google Analytics, Pendo, and Salesforce. The third case study involved a user's task of reporting a product documentation issue on GitHub. Each case study was viewed as an actor-network. In the second stage of the research, the Actor Network Theory (ANT) approach was used to analyze each case study to trace the process of how users' interactions destabilize heterogeneous product documentation networks, and how technical communicators can stabilize them by assuming roles, undertaking responsibilities, and performing negotiations with stakeholders and other actors.

The two important findings of this project revealed through the case study analyses are that 1) (Implicit) Audience interactions reveal audience needs 2) Technical communicators can benefit from interdisciplinary skill sets to play multiple roles such as the software tester, moderator, data analyst, etc. to create and maintain effective product documentation spaces. A significant contribution to the field is a generalized methodological framework, Planning-Implementation-Testing, which can be used to conduct audience analysis for studies outside of the case studies mentioned in this dissertation. The limitations of this project stem from using user data ethically leading to privacy and surveillance concerns. Future research will look at such concerns more closely.

Re-contextualizing Audiences: New Conceptualizations of User Interactions in Product Documentation Spaces

by
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DEDICATION

to aai (a mother).

BIOGRAPHY

Nupoor Ranade (née Jalindre) was born in Nigdi, Pune in the state of Maharashtra in India. She started her academic journey in the field of Computer Science. After completing her Bachelors of Computer Engineering at the University of Pune, she started working as a software developer for a start-up company in the city of Pune. During this stint she wore multiple hats and enjoyed the communicator role the most. She came across the field of technical communication through a happy accident and was instantly attracted to the possibility of combining her passion for communication and expertise in the technological sector. Soon she started her journey as a technical writer and enrolled in the Masters in the Technical Communication program at NC State University to hone her writing skills and developed several research interests along the way. She decided to pursue her Ph.D. at NC State itself to continue working on the same research avenues with the mentors and collaborators from her Masters journey. The M.S. and Ph.D. programs prepared her well for an industry as well as for an academic career. Her work experience showed her different possibilities of applying technical communication work in the workplace. So in the last 6 years, she has conducted research and simultaneously worked at various organizations such as Palo Alto networks in California, Citrix in Florida, and SAS Institute in North Carolina in various positions. With one foot in the industry and another in academia, Nupoor's goal is to bridge the gaps between the two, to the best of her ability. She is an incoming Assistant Professor at the George Mason University where she plans to continue her research, teach and collaborate with industry partners to get closer to that goal.

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INTRODUCTION

"It is not competition that drives processes,
but rather the inventive collaborations of density."
- Steven Johnson, *Where Good Ideas Come From*

On June 3, 2016, Jeff Sandquist, the General Manager in the Cloud & Enterprise Division (as of March 2020) at Microsoft published an announcement on the organization's blog [130] which notified users about the new features the organization had released for the product documentation website. The features were meant to improve users' experience as they continued to use the company's documentation website. The blog post contended that this step was a response to user feedback about their documentation that they had been collecting over a long period of time. It suggested that the team evaluated the feedback and tried to find ways to create a better user experience. However, this process could not be done with the infrastructure they were using to publish documentation until then. Several reforms were made in order to change the ways in which knowledge was "created and consumed".

Reforms on an organizational level are never sufficient. Stakeholders need to be trained to adapt to new knowledge consumption models. For example, while discussing his experience at Bell Labs, Dicks also described the considerable effort in training, retooling, and redefinition required for both writers and users when the publishing approach is changed [38]. Microsoft's blog post served the rhetorical purpose of informing users of the new approaches carried out to bring about a positive change with respect to their experience of the documentation website.

Out of all the features mentioned in the blog post, 'Community contributions' gained a lot

of attention from users as well as technical communication teams at other organizations. The responses on the post (found at the bottom of the post - marked as closed issues) [130], expressed users' curiosity about the template for implementing a similar approach for their own company, tools and infrastructure-related questions, and transparency across platforms. The post announced that Microsoft had made all their documentation open-sourced. Users could now view and make changes to all the documentation source files written in the Markdown format on GitHub, the platform used by Microsoft to publish their product documentation. Although viewing source files is open to the public, the editing feature is not as direct as one would expect (like Google docs). Along with being a collaboration platform, GitHub acts as a version control tool for project management similar to Google docs where older versions are stored and users can rollback to a version from the past. However, unlike Google Docs, instead of making changes directly to the source files, GitHub provides the "Propose changes" feature which allows users to create a pull request; essentially to make a copy of the content, make changes, and submit it to the owners of the content to be merged with the original version. Original creators or moderators of the content can then review those changes and make decisions about using it for the published version. If they decide to incorporate the changes, they can merge the copy created by the user with the original 'master' document. Such a pull request, while enabling collaborative authoring, provides a space for collaborators to communicate about changes, express ideas, assign tasks, discuss details, and conduct reviews (see chapter 3 for more details about GitHub). This idea of allowing collaborations from multiple stakeholders and especially users intrigued technical communicators engaged in more traditional practices of documenting product information, who then wanted to adopt the open authoring approach.

Before making major infrastructural changes to move to an open authoring approach it is important that technical communication teams understand the affordances of such a system, implications for the organization as a whole, social and technological challenges of accepting and managing user inputs, and their own role in the process of converting users' inputs to knowledge. These considerations raise several questions such as, what are the ways to collect inputs from users, how can we handle the inputs, who is responsible for doing that, what are the other dependencies, and so on. This dissertation attempts to address a few of these questions by acknowledging the contributions of previous audience analysis studies, identifying the limitations of past literature, and suggesting new ways to consider making changes to the audience analysis processes in the technical communication field. This research also highlights the value of users' interactions and simultaneous contributions in documentation development environments, and provides a methodological framework to help investigate them as a way to understand audiences.

1.1 Background

Before looking at users' interactions, types of interactions that qualify as feedback, and their impact on the technical communication field, it is important to remind ourselves of the evolution of content,

shift in the roles of users, and the ever-transitioning roles of technical communicators in meeting audience needs. This section describes these topics by discussing three significant lessons learned from the history of technical communication in engineering fields: 1) Online content increases the amount of total content present in the world 2) Online content makes it easier for users to participate in content creation, and 3) Online content requires us to think of new ways of content filtering such that content is not only easily consumable, but also enables users to use filtration techniques that help them navigate through the content.

The amount of content being written has grown tremendously over the last decade. In his presentation at the STC Silicon Valley chapter meeting (on November 14, 2016), Ralph Squillace stated that Microsoft's product documentation has grown exponentially and now consists of more than 45 million topics. Users engage with documentation not just to consume content, but also by writing considerable portions of the required content. Internet and collaboration technologies have made this easy.

The problem of information overload has become ubiquitous but is not new. In fact, we can argue that everytime audiences information seeking behavior changes, information overload takes place. This was experienced long before the appearance of the Internet. Philosophers like Socrates believed that the problem of information overload began when humans learnt to write. Until then they were only listening to consume information. Human history is a long process of accumulating information, especially once writing made it possible to record texts and preserve them beyond the capacity of our memories [13]. And if we look closely, we can find a striking parallel to the history of technical documentation. The invention of printing in the 15th century led to a flood of books in the market. As audiences became more diverse, the need for documentation became a standard practice resulting in loads of content. Just like Word processing software replaced slips of paper used for cutting and pasting information from manuscripts and printed matter, single-sourcing and topic-based authoring allowed breaking up of content into topics so that they could be reused.

For example, technical communication researchers found that users adopt strategies that involve the smallest expenditure of energy to find adequate information [7]. To account for the changing nature of audiences' information seeking behavior, they found new ways to present information. Instead of publishing documentation as PDFs or other formats that focus on long-form content, topic-based authoring was used which shifted the focus from documentation structure to designing content for bite-sized consumption [7]. This made topic-based authoring popular among technical communicators. As independent web pages began to be designed for each topic, in open source documentation spaces, users started encapsulating more content without worrying much about the information design and reuse leading to accumulation of a lot of user contributed content which needed to be filtered.

The tables of contents and alphabetical indexes were developed to help filter content and to guide navigation in printed information. However, tables of content don't scale a lot. Topics are designed to be navigated from the bottom up (even if they are also part of a top-down organization) and to support the reader in steering their own course through the content [7]. Filters are thus often

created by users for themselves. Some of the other content navigation methods like internal and external search work in a similar fashion. Algorithms and data structures make it possible to respond to users' search queries within seconds. However, they rely on users' knowledge of search terms, and success depends on whether they are trained to use the ones matching the content.

Electronic media revolutions led not only to the production of high volumes of content, but also to the spread of information far and wide. The most significant media revolution was the Internet which made overload spread beyond scholarly fields into users' day-to-day activities like shopping and entertainment, and visible to anyone doing a basic Internet search. A substantial change brought about by the Internet was less expensive publishing [13]. Before the rise of the Internet, media used for publishing was expensive. The process of filtering made sure that only the most valuable content was published. This changed and the amount of content being published grew and the amount of filtered content reduced.

The Internet also led to easy collaborations across audiences who were located in different regions across the world. Online communities were developed. Users with shared views formed groups and started contributing content. This made open source documentation grow at a faster space. Authoring technologies also made fast publishing commonplace. While printed material requires longer to be produced and propagated, Internet content moves quickly, making it possible to release products and accompanying documentation every year or even every week (as seen in recent software products). It is not uncommon for software companies to have one-week release cycles (see Release cycle by Smartsheet) where product updates, also known as patches, and related documentation are pushed to the users constantly. The other aspect of information overload is the need to share and contribute to information. Constant updates have fueled users' enthusiasm for experimenting with the new forms of products, accumulating corresponding information and sharing the knowledge with others who could benefit from it. Contributors are driven by this enthusiasm, even beyond their hopes for acquiring reputation or financial gain.

The other advantage of collaborating publishing and online communities is communication with stakeholders. Not only could users publish with each other in groups, but they became accessible to technical communicators who collaborated with them to use their inputs as feedback to improve documentation. Users' ability to participate in content development gave them the tools and power to provide qualitative feedback on various platforms such as product documentation websites, social media, user forums, and so on. Users became coauthors. In democratizing the ability to contribute to each and every shared experience, however, we have opened doors for information increase without figuring out the best way to deal with the content [32, 13] or content producers. This dissertation investigates the other side of user contributions which is treating the content produced as feedback, that can be used to learn more about users themselves, and their subjectivities. To do so we first need to separate content created by users and technical communicators, and then make sense of user contributions that are highlighted from what they contributed. The content may not always be qualitative. In this research I argue that users' interactions may lead to content, but it may or may not be visible at the surface (interface) of documentation sites. We need to study them more

carefully to be able to use them for our audience analysis processes.

1.2 Exigency for research

Collaborating with users and treating them as coauthors is a popular phenomenon in the technical communication industry. At the SIGDOC 2001 conference, Berglund and Priestley [9] discussed the use of open source documentation as a solution to alleviate the pressure on writers who handle increasing amounts of content changes with fewer and fewer resources. They argued that successful open source documentation systems are highly dependent on the projects' abilities to attract and accumulate large numbers of users who are invested in its development. Limitations of these systems are that smaller projects may have difficulties producing enough user contributions and users may not be able to participate at all if they have questions but no answers on how to solve them. Technical communicators would merely act as gatekeepers and moderators for FAQs and formal documentation, and as literate expert users of the system they are documenting [9].

The Microsoft model explained at the beginning of this chapter removes the dependency on users and changes their role to secondary contributors. This model of partial user involvement in the documentation process is popularly known as the 'Open Authoring Approach'. Open authoring allows users to enter and exit the documentation space as they want, and switch roles from consumers of content to producers when required. Apart from Microsoft, many other companies have now started adopting this model including IBM and Citrix. While this approach preserves the advantage of just-in-time improvements in user-driven content provided by fully open sourced documentation systems, it provides a platform to encourage user interactions for large and small scale projects alike.

In collaborative technical communication spaces, where collaborators interact using any means of participation like forum posts, feedback comments or edits to wiki-based documentation systems, the value of technical communicators work remains of the utmost importance when functioning as an intermediary between the content experts and those users. By more clearly adopting the roles of director and editor they become user advocates in the field [125]. While citing Weiss' work, Albers [2] explains that with most of the challenges of usability and communication already solved (or handled by other teams), technical communicators' roles need to evolve. A possible direction for evolution is to become problem solvers and designers who along with creating content also handle user requests by architecting content management systems and documentation databases [2]. The backend of product documentation which involves the tools and technologies make it harder for audiences to participate in content production processes. Swarts [149] argues that such design issues complicate social adaptation and need to be replaced by Mirel's 'constructivist' documentation approach in order to include the social, cultural, and technological dynamics of users' work. Technical communicators' role as information architects must be to become mediators between technologies and users. To gauge user problems, their contributions need to be closely monitored. Sharing the genre understanding, context and technology will motivate users to participate in organizational

processes enabling technical communicators to interact with them more directly.

1.3 User roles

Historically, users have primarily been content consumers. The field of technical communication developed during the world wars and has since then evolved to satisfy various audience needs [149]. Technical communicators are generally responsible for creating information products like instructions/manuals, web sites, and presentations, as well as develop definitions, social media content and grants/proposals [16, 82, 6, 43]. These information products belong to different genres and produce distinct content types for a variety of audiences. Brumberger and Lauer [19] found that the most essential skills to produce them were technical communicators' abilities to collaborate with subject-matter experts and co-workers, to write clearly for specific audiences and purposes. Scholars have also emphasized the abilities to focus on analyzing user needs, utilizing word-processing and document-design software, learning to assess and use new technology; and motivate, critique, and evaluate oneself constantly [123] while producing content. Over time, users and technologies together and separately have led to alterations in the ways in which technical communication is performed. These alterations help us understand the history of the field. Coincidentally, in the technical communication business, documentation histories are maintained by tracking alterations in content commonly referred to as 'revisions'. Groups invested in information-making often negotiate numerous socio-technical and rhetorical barriers [35, 41] to create knowledge despite these alterations.

The methods of providing feedback raise new questions about the agency of feedback contributors, and their role in the technical communication process. Content producers rarely share their position with everyone else in the content development network. For example, although anyone can contribute to sites like Wikipedia, or social media sites like Facebook, only that content which gets moderated is made available for public viewing. To understand the roles and positions of stakeholders and users, we need to look at content development processes closely. Additionally, users' feedback is often related to the problems they are trying to solve and their needs. How can we use users' feedback and interactions to identify their needs? One way to do that is to treat content moderation as a process that coincides with audience analysis. To do so, it is important to first look at the evolution of user needs and audience analysis processes.

1.4 User needs

Analyzing user needs is the ability to listen to users in a timely manner and facilitate the spread of knowledge that originates in the body and context of an individual content developer, so that others can use it [67]. Most researchers and theorists have argued for technical communicators to be involved actively in all stages of the process with a primary role as a "user advocate" [26, 125, 142]. Yet, there is evidence that even with decades of research to support this role, many companies

do not fully integrate their technical communicators or permit them to exercise this role as user advocates by having contact with users [157]. This work is carried out by other user-facing teams in the organization like business analysts. When users get involved with content creation, it gives writers an opportunity to learn about their users from the content being created. This phenomenon is fairly new. Technical communicators traditionally had used other ways of understanding audience needs.

A common approach was to fictionalize them. Ong [114] argued that the writer must “construct in his imagination, clearly or vaguely, an audience cast in some sort of role” and that “audience is a collective” – they share needs and preferences. The history of use of "audience" in technical communication parallels a similar trajectory where audience analysis shifts from writing for readers, to writing with readers.

Technical communication audiences are more subjective in terms of how they read and use documentation. Therefore, Ross [128] argues that the phenomenon of defining and analyzing audiences is increasingly complex in technical communication. Ross also provides a brief description on different audience analysis approaches. Ede and Lunsford [47] work relied on demographic inputs about audiences to understand them. Warren [160] demands to expand the method to include organizational and psychological analyses along with demographics. Albers’ method of multidimensional audience analysis accounts for audiences’ needs and expectations in relation to levels of knowledge, detail, and cognitive abilities [2]. Persona driven approaches also account for demographic and cognitive abilities. Coney and Steehouder [34] expresses the need to input rhetorical conceptions that include more details about communication situations in persona design. The approaches mentioned so far do not consider readers’ feedback that can be used to understand audience needs and problems more precisely to update documentation. Schriver [133] introduced the feedback-driven approach akin to participatory design and usability testing methods. Several studies followed suit to not only acknowledge user participation, but also to study their impact on documentation practices [67, 149]. As we start looking at audiences as active participants and contributors of knowledge in open authoring models we can closely follow their role in product documentation processes in software companies. Thus it becomes critical that we learn not only about the information products but also about the collaborative content production processes.

1.5 Collaborative content development

While illustrating the complexity of knowledge development processes in an organization, Slattery [137] describes the distribution of organizational resources, multiple texts and technological products. Technical documentation is produced through the act of coordination of several texts including past versions of the documentation set, a series of drafts and revisions, inputs from other teams (especially product developers), emails, messages resulting from project management activities and several other sources. While consolidating multiple texts into one document, several rhetorical negotiations are made. These coordination activities resonate with Johnson-Eilola’s idea

of symbolic-analytic work [80]. Symbolic analysts attempt to solve problems with information, texts, and images [80]. They find, arrange, synthesize, and transform existing texts to meet the needs of diverse users. The key to understanding the process of coordination thus is to pay attention to the stage of how raw content gets transformed into useful knowledge. It can be studied by observing how content moves from one system to another, from one user group to another, and even from one culture to another [67]. Another important factor in coordination is the use of the same underlying technology used to produce and merge content. The ability to transfer content in one format to be captured and manipulated into another, lays the foundation of what some scholars refer to as 'micro-content' [135, 80], or the parts of content that collaborators (including writers) create that later fit into a finished information product. Anderson states that this content management process benefits from using content management systems (CMS) that automate and support the process of storing, managing, and publishing content objects [4]. Jenkins [77] and Hart-Davidson [68] argue that content management systems enable cross-department collaborations. Hackos [65] and Clark [30] describe the role of CMS as a content organizer, separating, categorizing and delivering information to users in desired formats. Although these works discuss CMSs as process-oriented technologies, they do not acknowledge user participation in content development. While Hart-Davidson asserts that "the whole organization must write, and write well" ([67], p. 59), user contributions received through sources beyond the CMSs are ignored. How beneficial would it be to share CMS's access with users to create open authoring platforms? And how does that change the role of a technical communicator?

1.6 User generated content

User-generated content plays an important role in documentation cycles. Technical communicators are finding ways to gather user-generated data and using it to improvise content to resolve audience concerns [43, 149]. Users are becoming more involved in writing content for organizations than ever before. For example, 'wiki-based documentation platforms' for products such as Fit and Knoppix or 'user forums' such as those for Apple and Red Hat are great places to get insights about users' queries and concerns.

As most product documentation systems have become web-based, commenting features have become commonplace. Unlike traditional print or PDF documents, web access offers users an opportunity to engage with the documentation as well as with each other. It allows users to engage in reasoned opinion expression in an attempt to identify solutions to a common problem and/or to evaluate those solutions [64]. One method of enabling engagement as well as connecting with users is through the use of 'comments' [57]. In public sphere theory research, commentors is attributed to participatory methods as a means to provide input, to increase the throughput and by enabling decision making by creating consensus or dissent [29, 146]. User knowledge about their specific use cases, needs or problems they experience, contributes towards making the content accurate. Users who do not contribute, also called lurkers may observe user-generated communications at all

stages, from input to output [85]. Lurkers impact web-based communication positively [146]. Actions that result from user comments if noticed, encourage contribution from lurkers as they become more aware of participation opportunities. Gallagher [56] affirms the use of online comments as tools that help deepen our understanding of the way audience interaction processes emphasize production and distribution of content. This study is designed to look at other ways (apart from the ones mentioned here) that involve user participation to investigate users' interactions that help us understand audiences.

1.7 User participation

The examples mentioned in the previous sections discuss platforms or infrastructures which are purposefully designed to collect audience feedback. For example, wiki-based platforms follow a publish first review later approach. Once developed, they are primarily managed by users who assume different roles such as writer, reviewer, moderator and control what gets published. User forums provide users a space to ask questions and respond to other users' questions. The infrastructure is set up for synchronous communication, and to build a network of users who can help resolve each other's problems through a shared medium. In such cases, user participation is encouraged and made visible on these platforms.

This leads us to an important question – how are users different from audiences? Researchers have frequently toyed with this question when studying interactive spaces. Webb and Wang [161] describes users as a subset of audiences. They explain that users can be categorized in the following ways: low-level audiences such as implementers, medium level such as those who install and maintain the product and finally high-level users popularly known as end-users, those who use the product in its normal and intended manner [161]. The last category of users can be categorized as stakeholders, customers or technical decision-makers who make the purchase decision but who may never use the product. Laurel [91] makes use of metaphors to compare software audiences to theatre audiences. Laurel compares interface design to a theatre stage where actors perform, delivering content to their audiences in the form of a play. Audiences are not aware of the technical aspects responsible for content production and presentation. If we introduce the idea of interaction into the space, where audiences are merely engaged in passive content reception, Laurel [91] argues that we will need to reconsider aspects of audience (human) agency. She defines "users" as the human actors who, by participating and interacting with the system, in this case, the performance happening on the stage, "are like audience members who are able to have the greatest influence on the unfolding action" (p. 26) than simply absorbing the content being shared with them. These users are set apart from the audience due to their own peculiar ways of connecting, interacting, communicating or participating in the act of content production. Just like any interface, the backend – technical aspects responsible for content production and presentation – remains foreign to these users, they stand out in the content ecology. Going back to Laurel's analogy of a theatre, these new participants would not know the script and their clothes and skin would not match the other actors' on stage. To get

the unprecedented situation in control, the actors would "attempt to improvise action that could incorporate the interlopers and still yield something that had any dramatic integrity". That is, the core content production team would need to make improvisations to incorporate the new content produced as a result of participant(s) interactions. This is where open authoring moves away from open sourced documentation. Instead of being participants, users become improvisers of content, but they do so by contributing.

Crowd-sourced documentation systems like wikis are on a rise since 2006. In his Ph.D. dissertation, Thominet [153] argues that the crowdsourced form of documentation using wikis is valuable for two reasons: first, it helps resolve systemic destabilization in documentation systems, and second, it offers technical communicators a means to build a relationship with their user community. Destabilizations occur as a result of contradictions in sociocultural activity. In other words, since each user can have a unique way of using a product, documentation produced by experts who have domain knowledge (in technical communication and/or system expertise) can fail to meet the needs of the community. Gentle [58] raises a similar concern while explaining the need to move towards wiki-based systems for documentation. A single person's knowledge is limited and can impact how they interact interact with a variety of customers. However, wiki technology complicates notions of usable design as the information architecture of a wiki site may be created on the fly by all participants rather than by a dedicated technical communicator. Johnson-Eilola [80] explains other drawbacks of wiki-based systems which include a constant need for moderation, complex infrastructure limiting the editing and publishing processes and unstyled content. Similarly, while user forums enable user participation globally thus enhancing group cultural and social perspectives, forums often produce a large volume of posts. They also need constant moderation and additionally also lack contextual cues [163, 115] present in wikis. Crowd-based systems thus require technical communicators' intervention "to shape, stylize, make consistent, and organize the content to make it usable" [79]. In the same article, Johnson draws attention to the fact that although technical communicators "would write 75% of the content anyway, it will be more informed and accurate" due to user participation. An important point to note from Johnson's argument is the amount of content contributed by users.

Clay Shirky [136] calls the phenomenon of excess user generated content as a "filter failure" - our systems for managing information abundance are swamped by the growth of information (at the Web 2.0 Expo). This problem has had and will impact the field of software documentation. This case may be unique for the genre of technical communication because users have historically relied on published content on product documentation websites. The development of user generated content may be an interesting genre situation, but from the perspective of technical communicators, this orientation of publishing content before filtering content is socially responsible, reduces content quality and impacts the representation of the organization that they are part of. This puts an added level of organizational process requirement, in other words, a filter, to wrestle with the new idea of democratized power distribution around information circulation and access.

Due to the emphasis on horizontal communication, coworking and ubiquitous access to social

software, organizational boundaries are blurring leading to the opening of black boxed organizational processes to accommodate potential collaborators' activities [143]. Technical communication research has adapted to managing and designing content architecture to control ways in which it is published to gain trust from users. However, so far, most of the research manages to explore avenues of social software platforms like social media [143], user forums [142, 116, 137, 147], wikis [81, 147, 138], which are inherently designed to display users' contributions as disconnected from the organizational processes [61, 66, 145, 168, 147, 4, 122]. These works have helped us look at social structures and technical infrastructures and in some cases content management systems. Technical communicators view textual production as a dynamic and iterative process through which meaning is contingent on culturally situated experiences. Some works have discussed the role of user centred design as a precursor to the shift of organizations' process improvement activities that have helped in the inclusion of project management in TPC curriculum [69, 39, 92]. However, TPC scholars haven't yet dived deeper into looking at formalized genres of publication, especially avenues like product documentation websites with respect to user correspondence. Such formal genres compile the many unofficial voices, black-box them [88] into a single official, authoritative voice before being released [143]. The genre develops by incorporating more regulated moves that instantiate the assumptions of the activity. By opening those black boxed processes we'll learn more about how user voice is transformed into organizations' standard knowledge form. Following the assumptions drawn from relevant current works, this study aims at studying intersections between the market, organizational practices, rhetorical vectors and technologies and ways in which they impact the role of a technical communicator in organizations. The study was set up to answer the following research questions:

1. Do user interactions contribute to knowledge production? What can we learn about audiences from the contributions they make?

2. How do audience re-conceptualizations impact the role of technical communicators?

While previous research has mainly focused on contributed content only (such as feedback comments, social media posts, etc.), this research takes into consideration the whole network of relationships that include user contributions, the role of technical communicators, and how organizations manage those interactions. To do so, this research relies on a two-step methodological approach. In the first step, spaces of user interactions that lead to content generation are identified in software documentation spaces. Interviews with practitioners are crucial in order to get current and relevant information. In the second step, the process from interaction to audience analysis must be traced in the collaborative networks where interactions generated content. Finally, the content must be evaluated to understand user characteristics, needs, and other parameters.

Examining constructs relating to these questions can help organizational leaders address issues with user participation, knowledge creation and knowledge sharing in technical communication spaces. Knowledge constructed through collaboration in these spaces can contribute to enhanced productivity and work quality, and signal competence to external stakeholders [63]. Results from

this study will help organizations understand the impact of user perceptions on the acceptance of technologies used for increasing knowledge sharing in virtual environments and to prevent losses on technology investments. The next section is a summary of chapters in this dissertation that provide more detailed theoretical and methodological frameworks used to conduct this study, findings, recommendations and implications to the field of technical communication.

1.8 Summary of research

Chapter one discusses the background of the study and stated two primary research questions used to investigate the current technical communication spaces. It aims at enhancing our understanding of the factors that help in shaping online product documentation, users' involvement in the documentation spaces, and technical communicators' contributions. The chapter discusses how open authoring, as a way to encourage users' involvement, with documentation content is increasing everyday. Such collaborations are leading to a large increase in online communities that has extended to corporate environments. Audience analysis methods discussed in the past scholarship fall short in understanding such audience phenomena. Therefore, we need new methods to record new data and contextualize audiences.

Chapter two reviews previous studies on audience analysis, acknowledges the value of this body of research, and identifies some limitations. The previous theoretical frameworks are classified into dichotomies in each of the fields: technical communication, composition, and rhetoric. The chapter sets up a platform to discuss the complex nature of audience interactions to understand why audiences' involvement with content lies on a spectrum and cannot rest on these dichotomies. The limitations of current literature not only confirm the exigence, but also help in choosing methodologies that go beyond what are currently available.

Chapter three sets out to describe the methods used for this study. The research uses a two-step framework: first is a qualitative analysis of interviews with practitioners to choose case studies from technical documentation spaces in software companies; second, case study analysis using Actor Network Theory (ANT). The background of ANT (theoretical framework for this study) is described to introduce the notions of control and translation, and the principles of generalised symmetry, agnosticism, and free association through which user interactions entailing the use of a collaborative technology can be studied. This chapter was used to propose guidelines to be used to inform the analysis of Chapter four, in which case studies were explored closely in the light of ANT. The chapter concluded by discussing previous controversies and potential limitations of ANT.

Chapter four describes the findings gathered from analyzing case studies. The analysis was informed by the sociology of translation and its related concepts as discussed in Chapter 3. Prior to tracing the main findings, each case study was described as being composed of different actor-networks. Further, a chronological narrative of how actor-networks get formed, how relationships between actors are established, and what roles do audiences and technical communicators play in those networks, were described in which primary attention is given to how the focal actors attempt

to enrol audience actors (roles) to support their participation in knowledge development. This chapter answers the first research question by carefully tracing how interactions lead to content production.

Chapter five helps in answering the second research question by highlighting technical communicators' roles in open authored documentation systems. Key findings of the research were mapped to the current understanding of audiences, to point out what is missing in those conceptualizations, and make recommendations on how to track the evolving nature of audiences and their participation in knowledge networks. A methodological process consisting of a three-step framework (planning-implementation-testing) is proposed that can enable technical communicators to use their existing humanities knowledge and computational skills to conduct detailed audience studies by finding ways to collect audience data by recording audience interactions, and making useful collaborations to find meaning from that data.

Chapter six encapsulates the key content of previous chapters and provides details about how the aims of the study were met, how the research questions were answered, and how the findings can be applied to the study and practice of technical communication. It lists out the pedagogical implications of the study and proposes two methods of bringing audience analyses discussions in classrooms. The chapter also suggests the implications of this research and contributions it can make to the practice of technical communication. The chapter concludes by listing the gaps and limitations of this research that will be addressed through future work.

Understanding the significance of technical communicators' changing role is more important now, than ever before. We know that users' participation, collaborative partnership with technical communicators and content generative actions help us understand them better. But user analysis is only one of the reasons. The other reason is that we need to predict the changes in technical communicators' roles to be prepared for the rapidly changing information economy. In 1996, Johnson-Eilola argued that we live and work in a post-industrial age, where information is fast becoming the most valuable product. Although products are still manufactured and purchased, their primary value lies in information [80]. Due to this, the task of information management was often entrusted upon employees (especially technical and professional communicators) to safeguard and carry out flawlessly. But soon markets realized that the real value of information can be derived through circulation and association. Circulation refers to information being made easily accessible so that users can share it among their networks, which increases its value. Further, the networks revealed that there were still gaps in information owing to socio-political differences. An association space helps both – information developers and users – think of information in a more social, inter-textual, dialogic, socially responsible and active way [80]. The World Wide Web makes associations possible by providing networked users a space to help fill those gaps [80]. With the expansion of WWW, we have witnessed the rise of decentralized web (information) technologies like wikis, social media platforms, user forums, etc. The technical communication field has been directly impacted by some (if not all) of these technologies. Instead of being reactive to future changes in content contributions, we can be proactive and start analyzing situations which will enable us learn more about our users,

and help users to filter information for easier and more effective consumption.

CHAPTER

2

PERSPECTIVES ON AUDIENCE INVOLVEMENT

The previous Chapter 1 focused on highlighting the significance of audience contributions to technical communication (TC) work. Software documentation systems cannot be developed without knowing users' problems, nor can they function without technical communicators who systematically deploy content to users. While technical communicators seek users' contributions, they also get an opportunity to learn about users' information seeking behavior. They are in a symbiotic relationship with one another. In this chapter, I continue the discussion on audience involvement by primarily focusing on previous scholarship on analyzing audiences and their interactions. Following a literature review style, this chapter identifies progressions and investigations in the studies of audiences, especially in the rhetoric and composition fields, along which technical communication is generally placed. My survey of literature revealed that each of the fields have somewhat conflicting notions of audience, received through various disciplinary traditions. Technical communication studies have been learning from these adjacent field for many decades. However, for the interactive online audiences discussed in the previous chapter, those notions of audiences and audience learning strategies seem inadequate. Towards the end of this chapter, I depict a more practical approach of looking at audiences developed through the studied literature.

Audiences in technical communication are ubiquitous and always at the center of any research. For example, usability studies describe the usefulness and findability of content, accessibility and inclusion considerations are about making sure that no populations get marginalised and have a fair and equitable access to content resources [125, 126, 55], social justice work in technical

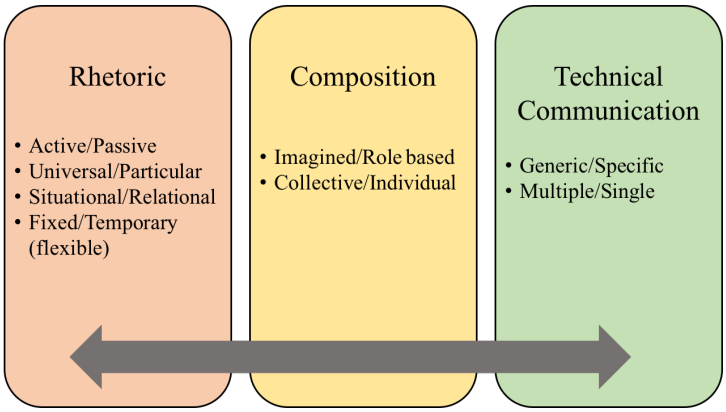


Figure 2.1 Audience dichotomies as located in the corresponding fields

communication aims at providing action-focused resources and tools for scholars to enact social justice [159]. These resources support the work of scholars and practitioners in conducting research and teaching classes in socially just ways. So focusing on only audience definitions is tricky. The field constantly relies on composition and rhetoric to get definitions and build strategies to understand audiences. Therefore it is important to first review the audience analysis approaches that have been used previously in the broader fields of rhetoric and writing. It not only helps get a generalized picture of audiences, but also to establish connections with relevant concepts in technical communication.

I use Moretti's method of distant reading to examine literature to not only look at ways in which audiences have been studied in the past, but also to analyze the commonalities, differences and tensions in defining audiences in different fields [107]. Distant reading refers to the "condition of knowledge" [107]; instead of looking at just one field in too much detail, Moretti's approach allows focusing on different units, small and large, that can be traced from the previous literature. The best metaphor that we can use to understand this method of distant reading is that of a telescope, allowing us, at a distance, to ingest, process, and understand texts within grand perspectives, even while losing some detail of the image. This helps reduce the complexities and detailed implications of audience definitions. The themes drawn in this chapter will help in revealing tensions in audience understandings that are useful for characterizing the new kind of audience relationships described in the subsequent chapters. It is important to mention that this method is used for the literature review chapter alone.

To complete the full research proposed in Chapter 1, a close study will be conducted that will use both quantitative and qualitative methods, including an analysis of artifacts, which will be detailed out in the next chapters. Such a detailed analysis helps dive into characteristics of audiences like communication devices, themes, tropes, genres and genre systems, as well as minute details like the roots and development of audience involvement beyond the scope of this chapter. The analysis will describe the role of infrastructure and writers, and also describe few types of user interactions of technical communication audiences.

2.1 Dichotomies in audience research

Literature suggests that audience studies, especially in the writing field, originated in the Rhetoric, Composition, and Technical Communication disciplines [117, 18]. Further, audience research was influenced by academics conducting pedagogical research on writing in non-academic settings who realized the need to adapt writing strategies to satisfy the needs of multiple audiences. Academic researchers emphasized exchanging this knowledge with the rhetoric and composition fields because first, they used rhetoric and composition theories and methods to teach technical writing, and second, they were in close proximity to these fields due to their departmental structure; most technical programs are housed in English, Communication, and/or Rhetoric and Composition departments. A distant reading of these disciplines led me to different dichotomies that are associated with the abstract understanding of the audiences in these fields. In Rhetoric, the audience is commonly seen as Active/Passive, Universal/Particular, Situational/ Relational and Fixed/Temporary (flexible). In Composition studies, the audience is commonly seen as Imagined/Role based, and Collective/Individual. In Technical Communication, as Generic/Specific, and Singular/Multiple. It was found that these fields not only learn from each other, but the overlaps can cause certain tensions among these abstractions. In this chapter, I deliberately focus on the definitions of audiences in these fields, the dichotomies, and resulting tensions in situating audiences, especially in today's technology-driven, social landscape of technical communication.

This section first traces the dichotomies in audience studies through the three disciplines, Rhetoric, Composition, and Technical Communication, followed by marking their inadequacies in defining audiences. The notions of audiences in these three fields are sometimes found to be conflicting and inadequate to the task of defining interactive audiences. Instead of focusing on one of more dichotomies, I argue that we need approaches that can help us analyze audiences on a continuum of these dichotomies to not only meet the ever-changing needs of audiences, but also to consider the different roles they play in consuming knowledge produced by technical communicators.

2.1.1 Active and passive audiences

The oldest studies on audience come from the field of rhetoric. Audience has been an important concept in rhetoric dating back to ancient Greece, including figures such as Socrates, Isocrates, Plato, and Aristotle [18]. Classical rhetoricians often described audiences as passive listeners, who were merely spectators, and had no power to control the discourse. They were not able to exercise dialectic/didactic abilities because they did not have a chance to question, give feedback or engage actively in forming the discourse [51]. An active audience is one that engages, interprets and responds to a message in different ways and is capable of challenging the ideas encoded in it. Over time there has been a shift in rhetorical theory toward a more active understanding of audiences. Many factors contributed to this shift, including digital technologies, which played an important role in this shift [18].

2.1.2 Imagined and role based audiences

To address the needs of a passive audience, a rhetor had to learn strategies to assess the audience to understand how they might receive messages. This idea of understanding audiences, who have no control on the communication outcome, was conceptualized in composition studies by Walter Ong [114] as the *imagined* audience. Ong [114] made this point by asserting that the writer's audience is always a fiction, a concept of the writer's imagination, squarely within the writer's control. Ong's work echoed Walter Gibson's, who had introduced the notion of the "mock reader," in his 1950's article in College English [59] which also relied on the writers' assumptions about their readers. A "mock reader" is an identity constructed by the author who manipulates the textual reader to adopt the qualities necessary for the actual reader to better understand the message being transmitted [59]. He argued that this notion can be used to evaluate the writing of a book; if the reader finds it difficult to assume the role designed by the author, the book is a "bad" one. Gibson's article marked the beginning of viewing text as being inseparable from its producer and its user [59]. In 1975, Walter Ong echoed Gibson's point while suggesting that the writer must "construct in his imagination, clearly or vaguely, an audience cast in some sort of role" ([114] p. 12).

While rhetoric and composition disciplines were establishing these abstract positions of audiences through different dichotomies, scholars in the field of technical communication had started building their own methods of identifying audiences, or borrowing them from relevant research. In 1988, Norman [112] defined the need for UX studies, taking up the lens of cognitive psychology, to explain how users' experiences of using information products (roles) create variations among them. Usability testing sought support from composition studies and relied on the work of *imagined* audiences [114] to define personas to help in assuming audience characteristics. Coney and Steehouder [34] defined personas as users with specific characteristics which are determined by the technical communicator. They provided different approaches for defining personas based on imagining audience characteristics: 1) credible and inviting personas which persuaded users to engage with the content by using stylistic principles; for example, user forums are platforms where users can post questions or responses to be viewed by other users and the only content is the one created by a participatory mechanism. Credible personas for user forums would be the ones who have roles higher than those of users, like moderators or expert users determined based on their background knowledge as well as participatory activities on the user forum; 2) attractive and playable personas where user characteristics were used for persuasion; for example, creating video content for an urban population demographic, and 3) personas with comfortable relationships with the product. Such personas represent users who are well versed with using the product and are looking for help information. Help is directly related to the context and the issue that users are facing, therefore, exigence becomes critical. The usability testing method attempts to employ the active/passive and imagined/role-based dichotomies, but the extreme polarities create tensions such as *multiplicities* of audience types and the lack of representation of *individual* audience characteristics.

2.1.3 Multiple audiences as a solution

Similar tensions appeared in the other disciplines as well. Audiences' roles were *imagined* and were therefore limited. When composition scholars started adopting Ong's approach, there were at least two issues: first, if the entire audience was assumed to have the same role, the audience had to be imagined as a *collective* which undermined preservation of individuals' characteristics. Second, since the act of analyzing audiences was not considered part of the writing process and therefore not a part of the role that writers played, understanding *multiple* audiences to address their needs was not considered, but was increasingly needed in composition classrooms, especially for teaching workplace communication. For example, technical communication practitioners had felt the need to cater to *multiple* audiences like scientists, reviewers, editors, and clients in addition to end users bringing a plethora of needs into consideration [141]. During the late 1980s, Spilka observed that more and more technical-communication specialists were joining rhetoricians in exploring the phenomenon of *multiple* audiences [141]. In researching audiences, technical communicators had to focus their attention on the *individual* needs of multiple audiences in the invention of documents in common workplace settings [141]. Many scholars of the time, including Spilka, thus discovered the incompatibility of audience definitions (*collective/individual, multiple/single*) for real-world scenarios. Audience analysis in rhetorical situations became an important step in communication processes and classrooms and writers were delegated the task of performing it in composition processes.

2.1.3.1 Audiences as part of rhetorical situations

Lloyd Bitzer's definition of the rhetorical situation, which consists of the exigence, audience, and constraints of a given rhetorical act, became a useful reference point since it helped promote external circumstances as forming a defining context to which discourse must respond in fitting ways [117]. The audience in the rhetorical situation is a defined presence outside the discourse, with certain individual characteristics such as beliefs, attitudes, and relationships to the speaker or writer and to the situation that requires the discourse to have certain characteristics in response [11]. A rhetorical situation is therefore "a natural context of persons, events, objects, relations, and an exigence which strongly invites utterance; this invited utterance participates naturally in the situation, is in many instances necessary to the completion of situational activity, and by means of its participation with situation, obtains its meaning and its rhetorical character" [117]. In Bitzer's terms the more *specific* the rhetorical situation, the more precise its characteristics, including those of the audience, the more it determines the specific features and content of the discourse [11]. Bitzer argued that the audiences gained power not only to impact the rhetor's role, but to actively engage and disengage from the content creation and consumption process.

As per Bitzer [11], rhetorical discourse itself comes into existence as a response to a situation, in the same sense that an answer comes into existence in response to a question or a solution in response to a problem. While Bitzer's focus while defining audiences was primarily on content

ecology, Sharon Crowley [36] provided a new perspective to understand the rhetorical situation, by looking at the origins of the situations, by replacing the exigencies with issues [11]. Crowley argues that the reception of discourse depends as much upon the rhetor's relation to the audience and the issue discussed as it depends upon the content of the discourse itself [36]. These conversations opened new avenues for research on audiences and paved a way for critical analysis of theories on audiences.

2.1.4 Universal and particular audiences

The New Rhetoric that started after the 1950s, recognizes rhetorical situations as the basic principle of communication and revives invention as an indispensable component of rhetoric. It challenges the classical division between dialectic and rhetoric, seeing rhetoric as a subject that can be applied or analyzed through all sorts of discourse including philosophical, academic, or professional in nature. So audience considerations can be seen as applicable to all discourse types. The New Rhetoric was founded on Chaïm Perelman and L. Olbrechts - Tyteca's work on argumentation [101]. They stated that argumentation is a meeting of the minds that requires people to share a frame of reference . Therefore, all argumentation must be related to the audience. This led them to looking closely at audiences [101]. They defined audience as "the ensemble of those whom the speaker wishes to influence by argumentation" and introduced the dichotomy of *universal* and *particular* audiences. But this dichotomy was unsuccessful as well. The universal audience consists of any number of people, who are physically present, reasonable and competent. The particular audience on the other hand, is the group chosen by the rhetor to be influenced [119]. Because the universal audience requires there to be equality for all speakers, ideas, and audience members, it is not a realistic representation of a situation that would ever occur and thus the idea of a universal audience is not practical. The theory of a universal audience was challenged by several theorists. Henry Johnstone Jr., argued that the philosophical and cultural changes over time are sometimes so great, that arguments cannot be universally effective and understood [70]. Simply due to the differences in circumstances, it is impossible for a *universal* audience to exist. The 'New Rhetoric' thus paved the path for interaction, conversation, and joint construction of knowledge as important factors for the rhetorical process and as vital sources for invention. These concerns started discussions about how to understand audiences through their interactions with content.

This notion of situating audiences in a rhetorical situation places several other dichotomies such as individual and imagined audiences, on the either extremes of the spectrum. However, doing that makes the similarities and differences in those dichotomies across the disciplines of rhetoric, composition and technical communication more apparent. The meanings of "audience," tend to diverge in two general directions: one toward actual people external to a text, the audience whom the writer must accommodate; the other toward the text itself and the audience implied there, a set of suggested or evoked attitudes, interests, reactions, conditions of knowledge which may or may not fit with the qualities of actual readers or listeners ([117], p. 249).

These audience types demonstrate that the way we conceptualize audiences has tensions. These

conceptualizations assume audiences to be present in fixed spaces. So they fall short when audiences roles change from consumers of content to producers of content. Although the term multiple audiences can seek to encompass some of the interactive audiences, it is insufficient when the roles shift in invisible spaces such as private editing spaces (like GitHub where one needs an account to enter the text editor space to change content; the change is only visible to the user making the change, moderators and other authorized individuals), and algorithms (natural language processing algorithms that look for patterns are untraceable). We need to look at interactive audiences and methods of tracing them in collaborative authoring spaces.

2.1.5 Collective and role based audiences

The first, most literal direction of meaning for "audience" was more widely accepted and followed initially due to its roots in the oral tradition and classical rhetoric. The basic image from which the concept of audience derived was that of a speaker addressing a group of people in a well defined political, legal, or ceremonial situation. The group of people, the audience, listens intently because they have some specific involvement in the situation thus forming a collective. The orator persuades them by using various rhetorical devices. But the collective does not always share all their characteristics resulting in audience variations. Each member of the group could be persuaded differently. One attempt to understand audience variations in rhetoric was through the study of enthymemes or the “body of persuasion”, by Aristotle.

2.1.5.1 Enthymemes and their role in understanding audience involvement

During the construction of the enthymeme, the rhetor assumes that there can be variations among the audience (primarily composed of jury and judges in Aristotelian works) opinions begging for consideration of audiences as active phenomenon [48]. The construction of enthymemes is primarily thought of as a matter of deducing from accepted (audience) opinions. The success of enthymemes was to be determined from the fact that the content and the number of its premises are adjusted to the intellectual capacities of these varieties of audiences, where the position of the audience remained fixed, at the receiving end of the communication process [48]. In this context, enthymemes were looked upon as a method of persuasion and not as a tool to identify the intellectual differences in audiences. But these ideas were later challenged by scholars who debated that the deductions were suitable only for the oral traditions of communication. Therefore, while enthymemes provided a direction to understand active participation of audiences, their position limited the scope of their role along with the emphasis on oral tradition of communication. These limitations made enthymemes – as a mode of understanding audiences – disappear from rhetorical discussions only to be revived as a method to understand audience interactions and audience involvement with content in composition classrooms [134, 48] in the 1970s.

Bitzer defines the enthymeme as a form "whose function is rhetorical persuasion" and whose "successful construction is accomplished through the joint efforts of speaker and audience [134]. Enthymemes are rhetorical devices in which terms (claims) construct (when connected) larger

claims called premises, which in turn line up as evidence toward a final, overall conclusion. Premises, or *imagined* situations, function both as a new stage of argumentative realization and, as proofs toward yet a higher level of argument, which helps in concluding the enthymeme. It becomes the composer's job to understand, generate, and connect these hierarchical levels of argument, as they draw on principles both of intention and of function in writing processes [134]. But the joint effort also entails the audience's ability to follow the logic of that arrangement and willingly append the argument with those premises that would logically lead to the composer's conclusion.

Thus enthymemes made two primary contributions to the study of audiences: first, audiences differ based on their intellectual capabilities to process content, and their differences must be taken into consideration while composing content for them; second, interaction between audiences and content producers is important to analyze differences in audience characteristics. We need an audience analysis framework which solicits collaboration and cooperation between writers, and other stakeholders of the discourse to develop audience models.

2.1.5.2 Collaborative audience involvement

In her study, Spilka [141] discovered that audiences help writers to write. Therefore, audience analysis is an important step as audiences impact not only the rhetorical situation, but also affect the invention and delivery beyond composition. For example, she observed that successful writers were more likely to interact and communicate constantly with audiences or potential users of content produced by the technical writers. Interaction between writers and audience was crucial in determining audience needs as well as resolving incompatibilities and conflicting perceptions or goals between themselves, readers and other audience segments ([141], p. 45). Similarly, Blakeslee [14] discusses the need for social and interactive audience studies especially in scientific conversations. According to her work, audiences are important to incorporate innovation in content. To contribute in the process, audiences should be able to collaborate with scientists and to do so they need to make sense of the scientific work. This can be done by attending conferences and publishing in journals. Such activities are done by the scientists. While doing that they should not rely on distant guessing about audience characteristics but rather use interactive mechanisms that will transform audiences into self-defining interlocutors [14]. User experience research and human centered design fields that include usability testing are examples of interactive mechanisms used by technical communication scholars, teachers, and practitioners frequently in order to study audience characteristics.

Spilka [141] proposed an Audience-Adaptation model which can help in analyzing social contexts and interaction for the purpose of inventing documents in naturalistic settings through a step-by-step discourse formation approach. The method starts with an initial round of analyses performed for the purposes of planning. It progresses with building a feedback loop that will allow changing audience definitions along the way. Thus, this process transforms from an independent role of the writer, someone who imagines the audience, conducts audience analysis to confirm audience understanding based on their position as per the rhetorical situation, into a quasi-independent phase where audience definitions are constantly revisited based on the social interactions with the

audience [141]. For the purpose of teaching writing in non-academic settings, researchers primarily focused on audience interactions through qualitative user feedback. The process of writing required writers to use the knowledge gained from the social interactions with readers which helped them set reader-based goals for their documents. With this approach, writers were more likely to produce documentation perceived by readers as appropriate to their rhetorical situations. Spilka's research also suggests that although considering the audience as a *collective* is problematic, categorizing readers according to their organizational *roles* does not solve the problem [141]. Rather it can lead to a focus on just one audience segment or feature resulting in mistaken impressions about readers' needs, expectations, attitudes, and behavior patterns; and to a limited audience analysis that certainly can result in composing decisions destined to further alienate readers. Instead of classifying readers based on their *roles*, we need to focus on methods that are socially sensitive to particular rhetorical situations [141]. For example, classifying audiences based on who they interact with, what is the kind of information they contribute and on how they react could be useful characteristics to identify *multiple* audiences.

Such examples of collaborative content development processes are still common in today's technical communication environment. Instead of deviating from the historically prevalent audience dichotomies, they converge on more than one of them thus complicating the contextualization of audiences. For example, Soderston's definition of usability as a function of the interaction between the text and reader requires writers to work closely with readers to make sure they create usable content [139]. She proposed an editorial approach to achieve this. The approach relied on understanding situational context of interactions between writers and readers [139]. It combines at least two dichotomies – collective/role based and active/passive. When writers interact, they become active, role-based readers, while at other times they remain collective, passive audiences, consuming content proving its readability.

Since the picture of collaboration has changed tremendously since Soderston's research, the dichotomies fall short to help with analyzing the readers' interactions with content and with writers. The next section describes interactions, audience roles, and challenges of these dichotomies in more detail which will help locate the nature of current audiences of technical communication with respect to the dichotomies.

2.2 Audience contributing to the text

To understand audience roles it is important to pay close attention to the collaborative work of writers; writers create a context into which readers can enter and to varying degrees become the audience that is implied in the text. Audience can be involved in the text due to its context in varying degrees. Audience participation in the text needs to be analyzed to understand their needs, characteristics, and roles that can help us define them.

While analyzing works by composition scholars like Andrea Lunsford and Lisa Ede [47], Robert Johnson [78] paid close attention to the idea of collaborative authoring where more than one writers

were involved in the writing process. He wanted to reconsider the classical rhetorical understanding of audiences, assumed as a *collective*, as material objects who needed to be informed, persuaded, or entertained. In his work, Johnson [78] argued that the traditional model which is rendered invisible during the act of discourse production must be updated to include involved audience, as audiences are an actual participant in the writing process who create knowledge and determine much of the content of the discourse; "the involved audience bring the audience literally into the open, making the intended audience a visible, physical, collaborative presence" ([78] p. 363). Johnson also suggested that the knowledge creation process consists of two steps: first we need to analyze the needs of users and second we need to analyze the knowledge of users. Therefore, audience definitions need to be grounded in social constructivist theories. [78].

While there may be carefully delineated ways in which the aforementioned dichotomies might be beneficial to situate audiences, the extreme polarity in the dichotomies renders them insufficient. For example, when we try to place audiences reading a blog post, it is easier to record their activity as passive, but when they write a comment on the post, the action calls for an active relationship with the text. The active and passive, general and specific, and universal and particular, focus too much on the micro-level questions of how the individual interacts with the discourse, which undervalues the role of individual subjectivities in audience behavior (e.g. [127]). Conceptualizing the audience-as-mass has consequences if we treat them as a simple summation of individual responses. It focuses too little attention on the audience-as-mass by inviting simple-minded generalizations of how audiences interact with the blog. On the other hand, too much focus on individual audiences can also be problematic. Audiences have characteristics that are invisible at lower levels of analysis [162]. To understand such specific, multiple audiences, we need to understand their needs which are influenced by not only what *roles* they play, but also by social contexts and individual interactions and changing rhetorical situations [141]. To do so, technical communicators have become drawn to other fields to understand the phenomenon of audiences that has resulted in several interventions. Some key interventions include, but are not limited to usability studies, cultural studies in technical communication, and purpose-oriented data analysis due to technological breakthroughs.

Although the feature of collectiveness of audiences was prevalent, comparisons with other fields revealed specific characteristics of audiences making scholars curious about their intersections. Scholars who engaged closely with technical communication work along with rhetorics and/or composition (such as Miller and Rutter) were able to identify the limitations of dichotomies from each of the fields for studying audiences. Rutter [129] argued that technical communication must accept that communication is open-dynamic because it involves people, who cannot be totally predicted, quantified, containerized, or defined. Technical communication has to be rhetorical because its task is not to serve technology abstractly conceived but rather to produce writing that accommodates technology to the user [129]. In the late 1970s, Carolyn Miller explained the idea of multiple audiences which can also be seen as parallel to "universal and particular" in rhetoric; "some audiences are capable of seeing some aspects of reality while others are more capable and can see more" [103]. Based on this phenomenon, although the classification *general* and *specific* should be

enough, unfortunately it is not. Imagining audiences and placing them in one of these two categories originates from "positivism" or the tendency to analyze audiences in terms of "levels". Miller argues that the positivist legacy in technical writing encourages us to analyze only the relationship between the reader and the reality (and whether the reader is mentally adequate to the reality) [103]. As a result, audience adaptation too often becomes an exercise in vocabulary rather than being rhetorically situated. As technical writing remains focused on sciences, Miller argues that the arguments we make while producing content ask for "assent" for "an act of will on the part of the audience". This focus on the persuasive version of audience-specific experience instead of documenting absolute reality, makes technical writing closely related to composition and rhetoric [103]. Therefore, audience adaptation, a central part of technical writing, needs broader and more flexible methods which will permit analysis of the relationship between the writer and the reader beyond the dichotomies. To do this we need systematic approaches grounded in qualitative and quantitative methods that will help in analyzing interactions to situate audiences, writers and content.

2.2.1 Analyzing interactions between content, audience and writers

In Qualitative (literature) and quantitative (data based interventions) methods, there exist tensions that arise from analyzing audiences and situations using interdisciplinary approaches. As the number of disciplines relying on a deep understanding of human behavior in order to achieve a more informed decision making process has increased, so has the number of terms and micro-methods used to conduct user research. With the growth in data and technological updates that engage users, diverse fields such as cognitive psychology and computer science are also participating as user research methods and closely analyzing interfaces that provide a fertile environment to capture micro-interactions made by users. As the industry is becoming more interested in applying the user-based research ideas to technical communication work, the fragmentation of terms and methodologies, along with their interdisciplinary connections, slows adoption and has created a situation in which many companies, though interested, do not have a clear grasp of how to make user research an integral part of their process and get multiple teams within the organization to collaborate on it. Collaborative culture of the workplace should be supplemented by increased attention to humanistic questions of what can we learn about users from their actions. The primary challenge for academic research is defining a focal point that will bring all research from other fields in close proximity, to conduct a closer reading on these fields including the literature and quantitative research as well as collecting data that is timely and captures audience interactions. This challenge culminates from other limitations of data based analysis.

Qualitative feedback mechanisms discussed in Chapter 1, such as feedback through comments posted on websites, social media posts, results from usability testing, and so on can be rhetorically analyzed to understand users. However, data generated through user actions and interactions with interfaces, such as content inputs on GitHub, digital footprint and audience journeys to access content published on websites, and conversations with users on a platform disconnected from the content publishing environment, gets sidetracked and remains hidden from technical

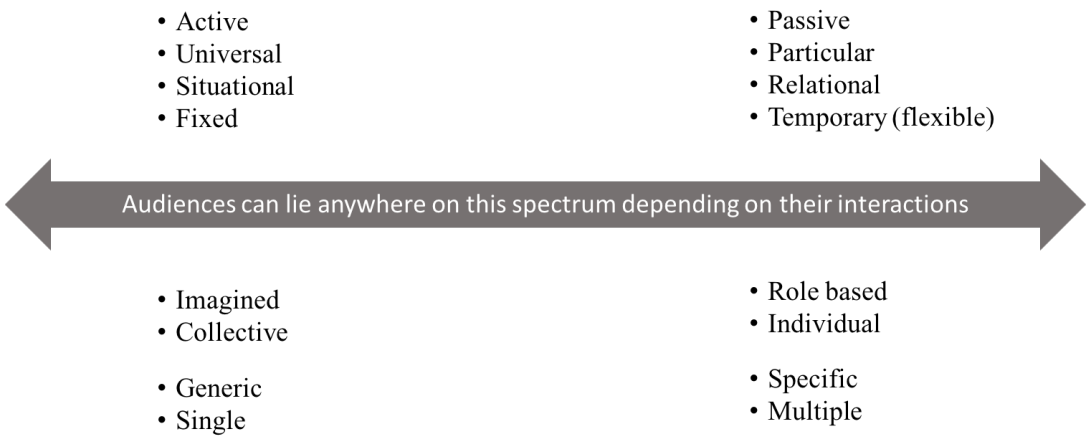


Figure 2.2 Audiences lie on spectrum

communicators attempting to analyze their users.

One reason could be that describing audience analysis completely using these methods will not suffice to analyze users for the first time. For example, practices like data analytics capture audience characteristics as a whole, but looking closely at them to analyze their needs may not be feasible. On the other hand, interactions through GitHub may not provide a complete picture of audience needs. Audiences that contribute to content creation through GitHub pull requests have a specific need that they try to convey by making updates to the content of product documentation websites. This has a reverse problem. Only particular audiences are analyzed and the unique characteristics identified by analyzing their interactions may not be repeatable. Although this resonates with universal and particular audiences in classical rhetoric, generic and specific audiences in technical communication, which can be defined by making certain assumptions (imagining) about audience journeys and audience footprints on interfaces, the multiplicity of audiences makes using any of these methods in isolation almost impossible. This research plans to define audiences in the modern technological workplace of technical communication by drawing from these historical dichotomies and definitions, but through an understanding of their roles on a continuum instead of focusing on the polarities.

In this study I analyze audiences through their interactions by first looking at the contextual information about user tasks which lie on a spectrum of passive to active interactivity (see Figure 2.2) followed by tracing the process and members involved in the interaction. In the following chapters, I explain how we can understand audiences from what we have learnt through different fields, how we can isolate users from each other and from other entities that get black-boxed with users' actions, to contribute to scholarship about audiences by providing more concrete audience analyses. To do so, I use data from case studies to outline ways that various methods of capturing user data that

often get ignored in technical communication theory and practice. The next chapter will describe methods used to collect case studies from practitioner communities and negotiations made to make selections from available ones.

CHAPTER

3

AUDIENCE PARTICIPATION EVALUATION: SETTING, METHODOLOGY AND METHODS

This chapter details the methodological design and methods used to conduct this research in order to answer the following research questions outlined in the previous chapters:

1. Do user interactions contribute to knowledge production? What can we learn about audiences from the contributions they make?

2. How do audience re-conceptualizations impact the role of technical communicators?

Different methods were used to seek answers to these questions, and the description of the methods and results are spread across the next few chapters. To answer the first question, I identified a few case studies (where audience interactions contributed content) by interviewing practitioners and analyzed them. The results from the analysis were able to provide insights on technical communicators' roles useful in answering the second question. In addition to that, the insights (answers to the second question) were validated from practitioner interview content. The literature review helped focus on aspects of audience interactions that were absent from previous analysis of audiences. For example, although collaborative authoring with audiences is a common phenomenon, only visible contributions are studied. In the past, many technical communication scholars have studied audience contributions to collaborative knowledge production platforms such as user forums [147, 54], feedback on public websites such as blogs [56], and interactions with social media posts [18].

There is little research on invisible interactions. Such interactions change audiences drastically, especially in the software documentation field. The research questions mentioned above seek to not only extend such work but also to contribute to the growing scholarship on audience analysis in the technical communication field by borrowing literature and methods from other fields and analyzing newer sites of study.

Media scholarship has extensively looked at audience interactions as creators of participatory culture. New terms such as produser [154] collaborator, and co-creator [20] entered academic spaces to highlight users' increased production capabilities. In the 1970s, futurist Alvin Toffler highlighted the emergence of a more informed, more involved consumer of goods who would need to be kept content by allowing for a greater customisability and individualisability of products. This indicated the shift from mass production of goods to a model of on-demand, just-in-time production of custom-made items. Bruns [20] refers to produsage as a community collaboration that participants can access in order to share "content, contributions, and tasks throughout the networked community" (p. 14). Produsage occurs when the users are the producers and vice versa, essentially eliminating the need for these "top-down" interventions which conventionally controlled production processes. The collaboration of each participant is based on a principle of inclusivity; each member contributes valuable information for another user to use, add to, or change. In a community of learners, collaboration through produsage can provide access to content for every participant, not just those with some kind of authority. Every participant has authority.

Another important concept borrowed from media studies for this study is "implicit audience participation". In the previous chapters and above section I mentioned that gap in previous audience research – looking at invisible contributions made by users. In other words, spaces where users interact but do not leave any visible traces of their interaction for other users are not studied sufficiently in technical communication field. We can draw parallels between such interactions and Mirko Tobias Schäfer's concept of implicit participation described as the subtle conscious engagement of users in online communities which provide more information about their agency. Explicit participation is less subtle, active engagement where user data can be revealed instantly.

Schäfer [132] argues that implicit participation is achieved by implementing user activities into user interfaces and back-end design, and the success of popular Web 2.0 and social media applications thrives on implicit participation. The notion of implicit participation expands theories of participatory culture as formulated by Henry Jenkins and Axel Bruns who both focus most prominently on explicit participation ([132], p. 44). Considering implicit participation allows therefore for a more accurate analysis of the role technology in co-shaping user interactions and user generated content ([132], pp. 51–52).

So for the research it was important to use methods that would look at the back-end design of audience interactions and analyze processes that led to content creation. Therefore, the research was conducted in two stages: first, a mixed-methods approach was used to conduct interviews with practitioners in the technical communication field and to find spaces of user interactions (both implicit and explicit). The interview data led to various sites of user interactions that result in

knowledge production. Three sites were picked as case studies for this research: first, a pull request on GitHub that results not only in content creation by users, but also a back-and-forth communication channel to improve content and make it more usable. Second, data from content analytics tools that track user engagement on the documentation interface of a new product. The findings from this data reveal users' needs and that need to be addressed them in a more effective and timely manner. The third, and final case study looks at the feedback mechanism that provides users with access to the organization's internal ticketing tool to create issues/tickets for the documentation team to handle. After selecting these case studies, the next step was to analyze them.

The second stage of this research study was the *analysis* phase which consisted of a qualitative analysis of the select case studies to reveal the complex networks of people, technologies and technical communication roles that not only mediate knowledge development in software documentation spaces, but also lead to a more inclusive contextualization of audiences. Each of the case studies are different, and represent typical models of how audiences interact with content as shared by practitioners during the interview phase. While the results of interviews pointed to the changing roles of technical communicators and helped in selection of case studies, the results from the case study analysis helped contextualize the audience analysis process itself and methods of doing so. Results of the analysis phase are described in the next chapter (Chapter 4). The following sections provide a detailed account of the process of data collection (which will also provide a rationale for selection of the sites of study) and also the methodological framework used for analysis.

3.1 User interactions

We understand audiences through their interactions with content, and for this reason, audience interactions are the object of my study. For the purpose of this research I define a user interaction as a social (organizational) and functional network that gets created when a user comes into contact with an information system's interface. Since 1998 when Johnson proposed that users should be treated as producers of knowledge, scholars have explored the ways in which technical communicators can participate in distributed knowledge activities by recording user interactions and making sense of user contributions in knowledge development processes. Although scholars have studied user interactions in the technical communication field, most of the research similar to media studies, looks at *explicit* user contributions. As the genre of information products in the field of technical communication is expanding, so are the means for users to interact with content. Chapter 2 demonstrated the need to analyze interactions on a continuum. In this research I sought to understand the more *implicit* user interactions that produce content and their impact on technical communicators' roles. To identify such invisible audience interactions, technical communication practitioners who designed or utilized systems that record user interactions were interviewed. The interview process is described in the next section.

3.2 Interviews and participant selection process

Long-form interviews were used for data collection in this research. Scholars have used this method to investigate topics such as coworking [144], and entrepreneurship in technical communication [93]. I chose to focus my data collection and research in the computer and software industry. Apart from my experience and industry partnerships built over several years in these fields, this choice was dictated by the significant amount of technical communication and user research in the technology industry that this research could contribute to. The case studies, while picked through a convenience sampling method, are not only typical for the software field, but are gradually becoming popular in other industrial sectors as well [40] (https://www.writethedocs.org/guide/docs-as-code/).

Audience interactions, especially in online environments, are and more prevalent in the software industry. The IT revolution in the late 1980s gave rise to the need to publish product documentation online (web-based). Businesses became more globally distributed and teams no longer worked in the same location. Software industries quickly adopted new technology and approaches to allow collaboration among remote teams. Therefore, practices such as structured content and Agile became more prevalent in software industries. Since it was possible to develop, implement, and maintain technological solutions required to complement these approaches completely in-house, software companies became quick adopters as well as leaders in legitimizing these approaches. Similarly, the docs-as-code or open authoring approach, which motivated this study (see Chapter 1), also started in the software industry and is mostly popular in the same field. Additionally, studies such as Techwhirl (Document 360) show that over half of the employed technical communicators in the US work in technology-related fields. The U.S. Bureau of Labor Statistics' employment projections show that a majority of writers from 2019-2029 will be hired by the Professional, scientific, and technical services industry. These reasons not only make studying cases from the software industry more important, but ensure that results of this research will be applicable to the current industrial scene. Data from online interactions is also more easily available making those interactions ideal for research purposes.

Participants from software companies were recruited using a targeted selection followed by a chain referral system to recruit even more participants. First a list of technical communicators' names and contact information was created based on my experience of working with them in their respective organizations (during past internships or collaborative projects), or peer-referrals from other employees (except supervisors) who have known their work. I also scanned public profiles (such as social media sites like LinkedIn, Twitter & professional websites) of potential participants who had desirable characteristics based on the stated experience on those platforms. I also publicized the study through a podcast to gain interest from technical communicators in the field. About 60% interview participants were recruited using this system. The remaining 40% were recruited through a chain-referral system, that is, initial subjects were asked during the interview to identify peers that would be able to make relevant contributions and also be interested in participating in this study. During recruitment, information about the research goals and research process was

shared with potential participants over email. If they agreed to the interview request, they were asked to sign a consent form, and share their availability for interviewing. Based on participants' availability, interviews were scheduled for one hour each and questions were shared in advance. All interviews took place over Zoom. Interviews were recorded and transcribed before being analyzed for identification of case studies.

The interview process for this study was semi-structured [37, 83, 60], that is, the questions lay somewhere between completely structured (or standardized) and completely unstructured. The goal of structured interview questions is to expose all participants to exactly the same interview experience [52] so that any differences are assumed to be due to variations among participants rather than to differences in the interview process itself [52]. A list of 10 structured questions (listed below) was made to ask technical communication practitioners about the practices in which they learn about their audiences and record audience interactions, as well as their roles in the company apart from writing documentation content. The motive of interviews was to see what contexts of the audience where they engage with content, should be studied more closely; and how writers manage or access content created through such interactions could be reworked to see what contexts of audience interaction with content should be studied.

1. Do you develop content collaboratively for internal/external documentation?
2. Can you describe your role as <professional title/position> at <organization name>?
3. Do you have access to users of the project/s you work on either through usability tests, content development processes, analytical software or any other means?
4. How do you solicit contributions from internal and/or external entities?
5. Do interactions with users generate content? Is that content used? How do you handle that content? Do users know that they can participate in content development?
6. If yes for content development processes, can you describe the process in detail. How can users participate? How is the content moderated? How many stakeholders are involved?
7. What does the publishing process look like from the time they contribute to inclusion or exclusion in released docs?
8. What other tools are involved in the process? Are the users/contributors familiar with them?
9. How long have you been working with projects that use participation from the community of users? Do you think it has changed the role of business and/or professional communicators?
10. How do you manage collaborative projects? (Methodology – agile/kanban/scrum/scaled agile/waterfall).

Unstructured interviews mostly consist of open-ended questions. Sometimes they start with a single topic-introducing question and the remainder of the interview proceeds as a follow-up

and expansion on the interviewee's answer to the first questions [84]. After learning about their practices, open-ended questions were asked to follow-up and document as many details about the process of content generation and its inclusion into the official technical documentation as possible. The motive of open-ended questions was to understand different organizational processes and components involved in enabling audiences to interact with information platforms and writers' role in facilitating those interactions. This portion of the interview can be considered as the unstructured one. Participants were also questioned to understand technical communicators' responsibilities during this process. Every interview was thus designed to be semi-structured, non-linearly moving from structured and unstructured questions.

In total, 19 interviews were conducted. The participant pool consisted of employees who worked for 9 different software companies who all identified themselves as technical communicators and played roles such as writers, technical communication managers, content strategists, data analysts, information developers, information designers of technical communication teams. On an average interviews lasted for approximately 40 minutes (total interview time: 566 minutes). All participants were asked the same set of questions. In cases where data was uniquely relevant to the research, or if responses were not completely clear in terms of providing details of the organizational processes, follow-up questions were asked. As mentioned earlier, the chain referral system was used to recruit more participants after the preliminary interviews. After 13 interviews similar data patterns were observed. So I decided to terminate the interview process. At that point, all interview recordings were saved in a secure location and transcribed to identify viable case studies. A closer analysis of the transcribed interview data revealed that there were over 13 practices (see Figure 3.1) in which audiences interacted with documentation platforms and each of those practices could be used to learn about audiences. Since analysis of all 13 would have made this research too long, I boiled down to 3 of the most used yet under researched practices. I have decided to save some of the others for my future research.

Although the interview sample size might seem small, I hit a saturation point in terms of the variety of data that I could derive from interviews after completing the first 19. Saturation is defined by many as the point at which the data collection process no longer offers any new or relevant data [45]. There is a variability in expert opinions on what is a minimum number of interviews required for a study like this one. A large body of literature suggests that anywhere from 5 to 50 participants is adequate. Most scholars argue that the concept of saturation is the most important factor to think about when mulling over sample size decisions in qualitative research [28, 45]. In this study, I noticed a saturation when the discussions (interviews) with practitioners revealed similar tools and practices used by them to collect user inputs in the documentation development and publication process. The snowball method allowed me to analyze the data soon after collecting it helping me detect saturation early on in the process. Participant demographics was another criterion that was overlooked. Charmaz [28] suggests that other key stratifiers are only critical if they provide an in-depth understanding of the topic being examined. As demographics of technical communicators do not impact user contributions, participants who worked in technical communication roles were

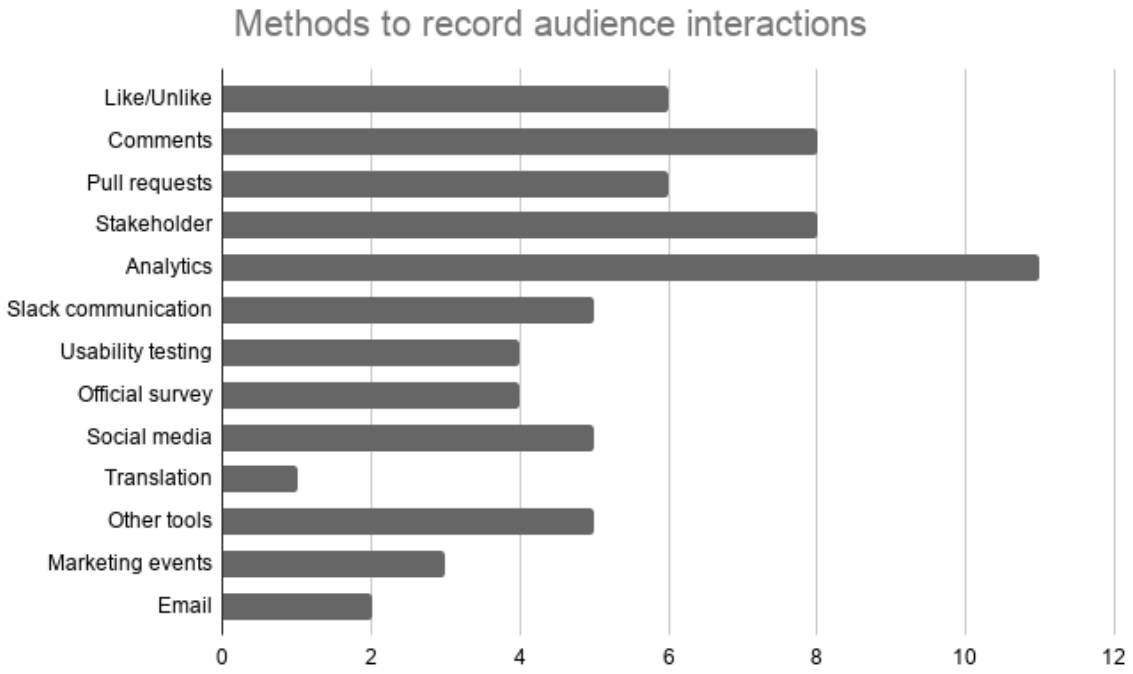


Figure 3.1 Practices to record audience interactions

noted as designations, but treated similarly.

3.3 Results of analyzing interview data

As mentioned earlier, three practices were picked from the total of 13 practices that were revealed in the interview data. This section describes the process for choosing them.

The interview data were transcribed and then coded based on different themes. Two broad themes were quantitative and qualitative. Qualitative methods were further broken down based on the nature of content being produced by audiences. For example, pull requests on GitHub, and translated content on repositories (created using a crowd-sourced system) were classified as content contributions; on the other hand, back-and-forth messages like those on support calls (support personnel and any user on a one-to-one communication channel), posts on Slack (organization's communication tool), and emails, user forum posts, and other messages were all classified as social media practices. Figure 3.1 shows all the 13 practices revealed from the interview data.

There were three important criteria used to choose the 3 practices or case studies from these 13 – first, the data to link cases to the propositions [25] that motivated this research. The theoretical predilection for this research was that users' roles were evolving from content consumers to content producers in turn impacting technical communicators' roles on how they handled not just the content, but also the processes leading to content/knowledge development. I wanted to focus

on implicit practices only. Preliminary fieldwork demonstrated content generation on versioning systems (implicit) like GitHub which became the key motivation; the process to create a pull request on GitHub became an important consideration (see Chapter 1) and opened the perspective on what to ask the participants so that they can reveal similar cases in their content development processes [25].

Second, literature was consulted to define each case study, especially to generate ideas that would help establish the purpose of the research [25, 124, 167]. As noted in Chapter 2, studies on audiences so far have primarily focused on dichotomies and the purpose of this research is to provide approaches to study the continuum by understanding contextual information about user contributions which lies on a spectrum of passive to active interactivity. Implicit interactions was the first criteria, and the second was produser approach. Only cases where audiences created content useful toward content development were to be selected. Each case was analyzed using the lens of continuous collaboration between audiences and technical communicators that enabled users' participation as well as helped record processes to understand their contributions closely. The definitions of case studies then helped draw empirical data associated with each case study to understand the social, user oriented phenomenon in the documentation production process.

Third, to collect such empirical data it was important to choose participants corresponding to case studies who would be willing to be consulted on multiple occasions to understand the social phenomenon in detail [124]. The last criteria was the ability to make analytical generalizations from the case studies applicable to the broader field. Case studies make it possible to study social phenomena by identifying essential factors, processes, and relationships. Yin [166] and Campbell [25] argue that unlike laboratory experiments that are pursued to find a new, remarkable phenomenon, case studies should be used as representative samples that will shed empirical evidence to demonstrate a theory that can be applied to common processes in the field. The case studies picked for this research are therefore based on what can be considered "typical" in the field of technical communication, likely to achieve generalizable findings. Typical for this research are cases that are frequently occurring phenomena across multiple technical communication environments, which may have some commonalities in the way it is set up, but different in terms of how it may be interpreted or used by technical communicators across all organizations. In this research, case studies will primarily be used to contribute to theory building about audiences, to analyze other concrete situations engaged in knowledge building in the technical communication field, and to predict future trends that can be applied to technical communication practice.

3.4 Defining case studies

Yin [167] defines case study as an empirical research activity that, by using versatile empirical material gathered in several different ways, examines a specific event, series of events, or action in a bounded environment. The objective of examining a case study is to do intensive research on a specific case by identifying essential factors, processes, and relationships between all actors who

participate in the construction and working of the case study site. Case study research consists of a detailed investigation with empirical material collected over a period of time from a well-defined case to provide an analysis of the context and processes involved in the phenomenon. The context and phenomenon are not disconnected, but rather the context is responsible for making the phenomenon interesting for study. In the case studies chosen for this research, the phenomenon is user interactions producing content. Since the process for content generation may not always be linear, the starting and ending point of the content generation process have been defined to isolate the case and get a cogent, end-to-end and definite contextualization. This section describes each case study based on the end points of the processes involved in the case study, actors involved, interactions between actors, outcomes of the process, the data gathered, practices for collecting data, and the theoretical frameworks used to understand and analyze it.

The goal of using three case studies is not to compare or contrast between them, but rather to provide a heuristic way of reading audience engagement across each case. The heuristic is used to understand different audience interaction models. Following are descriptions of each case study:

3.4.1 Creating pull request on GitHub

The first study is that of a pull request also known as merge request on GitHub (Figure 3.2). GitHub is a platform used by several companies to publish their online documentation. User's create a pull request to suggest a change or an update to the documentation topic published. For this research, a pull request is regarded as a notable user interaction.

The term pull request is used for version control platforms only where users send a request for something to the creators or managers of the project involved. GitHub is set up on Git, a version control system, which also acts as a database or repository to store (data, code, and/or) content. Essentially it maintains all copies of source code, files, or any other content that is staged on it. Additionally, GitHub offers access control and several collaboration features such as bug tracking, feature requests, task management, continuous integration and wikis for every project. Conventionally, users left their comments on online documentation platforms such that the comments were visible to the public. The technical communicator associated with the product (and thus the product documentation of that page) responded to the comment and/or incorporated the user's feedback to improve and update the content on that page in their own way. Platforms like GitHub provide users with access to the backend or server-side of the documentation website which they can use to propose the change they want. The backend is responsible for storing and organizing content and also holds code that manages the look and feel of the content published (frontend). Although the backend is not visible to the users when they are viewing content, they can use the "Edit" button to enter it. This is a key component of the process of recording user interactions (Figure 3.2). Unless users click the button, they don't have the tools to provide feedback in content form. The backend and frontend are usually connected such that the backend communicates with the front-end, sending and receiving information to be displayed as a web page. However, in documentation platforms where users can give their feedback or request change by entering the backend

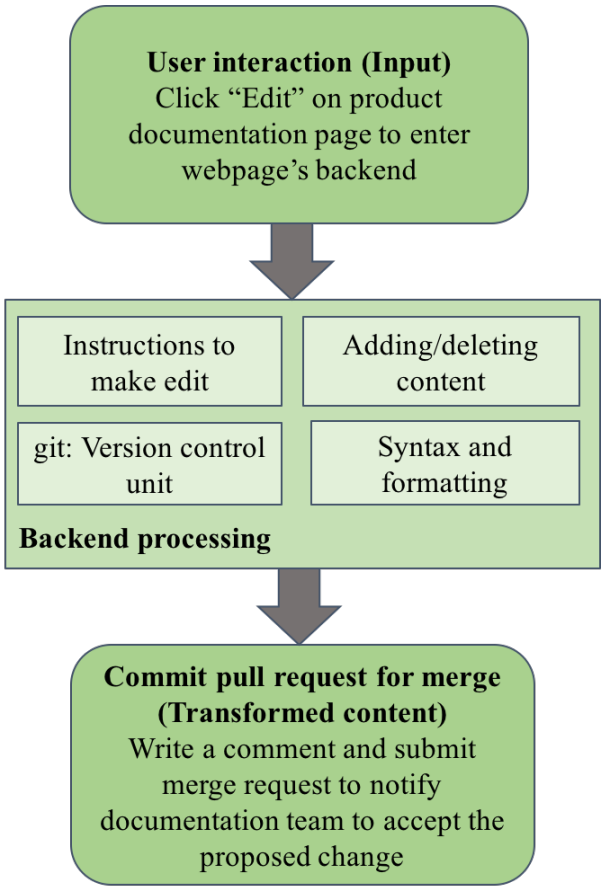


Figure 3.2 Block diagram of the pull request process

to make the change, another layer – staging server, is placed between the published content and editable content backend (Figure 3.2).

To summarize, in the case of a pull request, to propose a change or leave feedback that requires changing the content directly, users first click on the Edit button, enter the backend space where they get access to various tools to make necessary content updates including writing a comment for managers of the content, and submit a pull request to notify the managers asking them to accept the change to improve the content, resolve a problem with the content, or raise an issue. This method can be categorised as a hybrid feedback mechanism (between invisible and visible) since users can see the content they create, but the input may not necessarily be publicly visible. Other users can only view the content added if they open the backend as well.

3.4.2 Collecting data from web analytics tools

Another common tool to record user interactions is a data analytics platform like Google Analytics (GA). As users interact with content on the online documentation website, web analytics scripts running in the background of the website record user activity and collect data points that enable

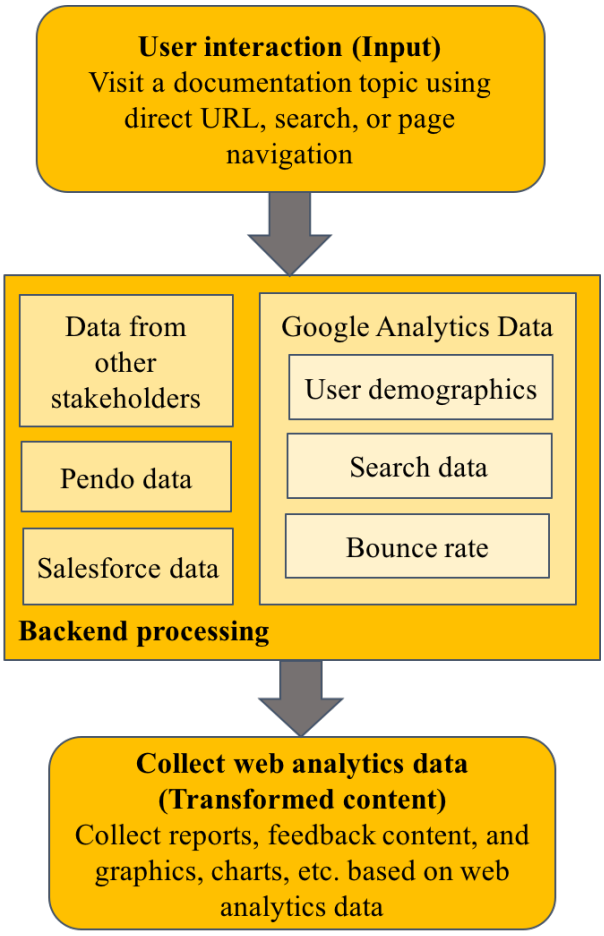


Figure 3.3 Block diagram of process for using web analytics data

technical communicators to check metrics, spot trends, and identify content that audiences spend time viewing (Figure. 3.3). Web analytics is the measurement, collection, analysis, and reporting of web data to understand and optimize web usage. Web analytic scripts collect user data in an invisible manner.

In most cases, users don't have access to the data recorded from their interactions on the documentation websites stored on the web. The Google Analytics interface is full of useful data and valuable insights, providing multiple ways to visualize data including tabular reports (default), pie charts, pivot tables, comparison charts and performance charts (Figure 3.3). The various report types allow technical communicators to dive deeper into understanding customer behavior. For example, traffic or site visit reports provide an immediate picture of online documentation traffic with respect to the source of traffic, number of views per page, bounce rate (how many users spent less than 10 seconds on the page), etc. On the other hand, audience reports help categorize users based on their demographics and levels of engagement. Such insights can help to inform information design and content strategy of the site.

A large number of interview participants mentioned the use of data analytics to understand user behavior (õ60%). This case is retrieved from a company's approach of using data analytics in combination with additional data retrieved through other sources to make sure that documentation is effective and successful at resolving users' problems. In this case, Google Analytics is the primary tool used to record users' movements on the online documentation site. Google Analytics in this case was configured to record page views, average time on topic pages, bounce rate, and the actual amount of time spent on page. The main requirement to record this data is that users interact with the webpage. If they don't, no data will be recorded. In order to make sense of the recorded data, the technical communication team at this company, paired the Google Analytics data with other data sources (Figure 3.3). The company uses a combination of Google Analytics with Pendo – to record user interactions with the product interface, Salesforce – to trace support tickets that refer to issues relevant to the topic on the corresponding product documentation page with useful data analytics, and Feedback comments – qualitative feedback on the website stated by product stakeholders(Figure 3.3). For this case study, users interactions that result in production of data that gets recorded by Google Analytics will be considered. However, the process to make sense of that data, as related to data from the other tools will also be considered to study the knowledge network thus formed.

3.4.3 Reporting errors in documentation

The last case study is the error reporting tool provided to users through the documentation website. Users interact with documentation platforms to report errors that they encounter when they use documentation. The company from which this case is derived uses two practices to enable users to submit errors.

First, GitHub Issue reporting tool, and second, a feedback form set up by the organization on the product documentation platform used to specifically report errors (Figure 3.4). Both practices end up creating an issue or ticket on the company's internal issue tracking tool called 'Jira'. Jira is used for issue tracking and project management by many organizations. It enables employees to create issues, assign them to team members, set priority for resolution of the issue, and so on. In this case, users click on the feedback tool to create an issue, or open the topic on GitHub (backend), and fill required parameters to create an issue or ticket for the technical communicators to solve.

As users click the link to create the issue on the product documentation page a window gets displayed with open text boxes asking the user to insert a title and description of the issue (Figure 3.4). The URL of the topic page gets recorded by default. Once the user submits the request, an issue gets recorded in the company's Jira portal, and the technical communicator, technical communication manager and product manager, all get notified via email linking it to the Jira instance. This method can also be categorized as a hybrid. Issues on GitHub can usually be viewed by other users, but issues entered in Jira may not be visible to stakeholders outside the organization (Figure 3.4). Once users enter the issue, they may lose all control over the content as it gets transferred to the organization and can be modified by authorized personnel only.

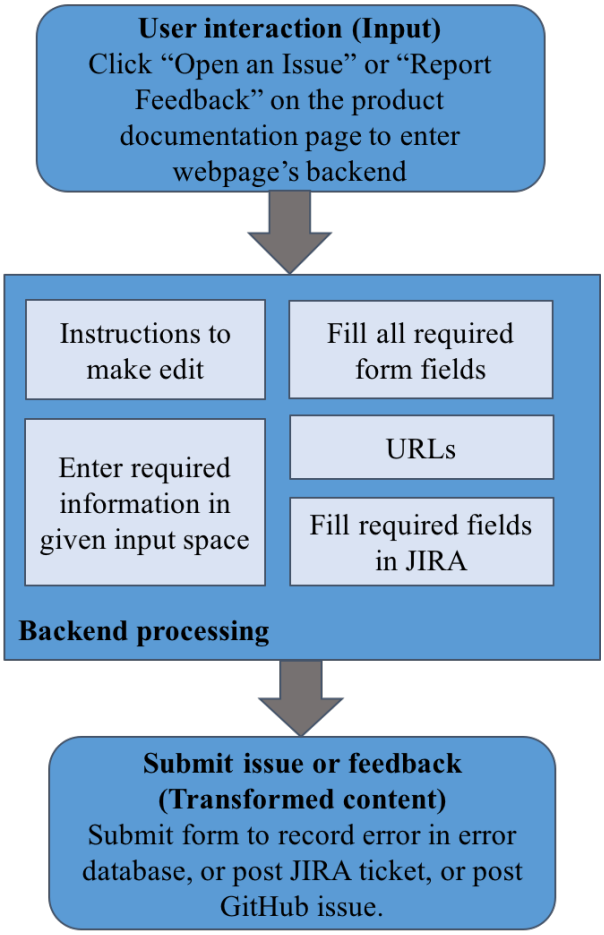


Figure 3.4 Block diagram of error reporting process

3.5 Factors for analytic generalizations

The three case studies are important practices of collecting evidence about users’ needs and concerns about documentation. However, these practices still remain under-researched in the technical communication field. The little research on them helps us address concerns of content strategy and information design. These case studies were not experimental, but rather collected from common experiences of technical communicators working in software companies. Therefore, we can assume them to be typical and representative specimens of audience interactions with technical documentation content. Although the goal of this research is to analyze these case studies to answer the research questions, I also wanted to list the distinctive features of these case studies which make them representative of similar cases in the field in general. This will especially be helpful in applying analytic generalizations of the findings of this study to the broader technical communication field. The following factors, Networked structure, Visibility, and outcomes of interactions thus help to delineate the similarities of these cases while also helping establish the commonalities and

implications of studying these cases for the field.

3.5.1 Networked structure

Each of the cases can be studied from a network perspective. Many technical communication scholars have time and again proved that interpreting discourse requires understanding the social context in which it is produced and used. One way to do so is looking at the framing of discourse communities that lead to knowledge production. In their article, Miller and Selzer analyzed rhetorical conventions to separate knowledge producers that form those discourse communities [105]. They classified them based on generic, institutional, and disciplinary conventions that correspond to the roles that content producers play in engineering institutions. When we add users to the knowledge production space, we need to look beyond such definitive conventions. Nardi [111] proposed a sociocultural approach that allows researchers in neighbouring fields such as human computer interaction and computer-supported cooperative work to study complex situated contexts while producing findings that are generalizable (p.70). To study the content produced by individuals and groups in everyday work situations we need to understand the contexts of the particular communities in which the content was created [105]. One way to study those situations is to analyze the rhetorical conventions of creating technical discourse. But separating communities by the role they play is not enough. Maggiani studied the more social nature of technical communicators' work as they engage in "a collaborative effort, combining the knowledge of all [associated] participants in a many-to-many communication to produce content which then results in new genres of technical communication [102]. Based on these studies, one way to look at the case studies and audience interactions is to study the network of participants responsible for contributing content in some way or another. In each case, a network of human and non-human actors [88] is created and dynamically reconfigured each time a user interacts with the documentation platform. Networks of participants are created and destroyed to contribute to data that can be used for audience contextualization and knowledge creation occurs in dynamic, flexible, and re-configurable networks of employees [27] that extend widely within and beyond the organizations' employees. Since such networks – composed of infrastructure, writers, stakeholders and other actors are constantly evolving – they cannot be studied as fixed system but rather as ongoing forms of networked activity.

3.5.2 Visibility

During the interviews, participants noted that technologies were important for how they solicit user interactions that results in collection of data. Although the role of technology is evident in each of the situations, the work of content creation is not always visible. For example, the "Edit" button on the GitHub page leads to users' contributions to content, but the backend where content is actually being altered is not visible on the documentation platform. web analytics used to record audience journeys on the documentation platform are not visible to anyone except the managers of the content platform. Results of analyzing these cases can therefore be generalized for both visible and invisible contributions of data in knowledge development processes.

3.5.3 Outcome of interaction

Another characteristic crucial for this study is the transformation of user interactions into data or content. Similar to networks being reconfigured for the purpose of soliciting user contributions, the infrastructure and tools used to record those interactions transform content created by users into forms that can only be interpreted through a specialized system of interpreting the content. For example, while user movements across documentation may help them navigate different topics that will help them use the software product in an efficient manner, web analytics may record the search terms, topics they visited before arriving at the topic that resolved their problem, and the time they spent to read the topic while solving their problem. In this manner, user activities get transformed into data which can then be used to design the content strategy, decide metadata of the content page, and so on. This research will analyze each case to factor in the transformations of content from the moment of user's interaction, the method of storing the transformed content, and the implication on technical communicators' decision making process.

Although each of the case studies is a different framework with different actors doing different actions, these common characteristics will help us understand audiences through generalizable findings.

3.6 Uncovering audience networks

This section describes the process of data analysis in order to answer the research question – "How can we read audience interactions from the content that we have, generated by them, through their interactions with documentation platforms?"

The main objective of this research is to observe case studies where audiences are studied as being one category of actors involved in co-creation of knowledge within the product documentation development network, which in turn provides insights about them, such as their needs and other characteristics. The approach, of acknowledging audiences' role in the knowledge networks to study audiences, is unique and has not been explored in the field of technical communication. The focus is not on the outcome of interactions, but rather the process of interacting and responding to interactions. From an empirical and analytical point of view, Actor Network Theory (ANT) is one of the approaches used by researchers who are interested in analyzing such processes where actors in networks are assembled and maintained in place. ANT enables researchers to understand how actors are enrolled in new programs of activity and prevented from following their own designs in similar processes. Hence, ANT is used in this research as the primary theoretical framework to understand audiences' role and interactions on documentation platforms that result in content development. The interactions and related processes are studied as being an outcome of social constructions [99].

3.6.1 Actor Network Theory

Actor Network Theory (ANT) was used to outline the process of network creation as a result of audience interactions which enables technical communicators to study audiences and brings a transformation in technical communicators' roles. It is important to understand that ANT is neither a theory nor a method being applied directly to study case studies for this research. ANT is instead an analytic framework that supports other theories. All case studies are assumed to be knowledge networks as mentioned in multiple instances in this and the previous chapters. Other theories such as social network analysis [62, 53] or rhizome theory [50, 73, 31] can also be used to analyze the networks qualitatively. ANT does not stand in opposition to other theories. It instead provides a tool to understand the complexity and meaning of the actors in the network who are performing their roles, and by analyzing them in real-time reveals other actors in the process. The results thus do not suggest the structure of the network, but rather demonstrate how audiences' participation and technical communicators' roles are translated and how they impact knowledge networks that they are part of.

3.6.1.1 Background

ANT is a social theory framework that originated in the field of the epistemology of science. ANT was adopted by Michael Callon and Bruno Latour (e.g. [22, 90, 86, 87] to study the sociology of science and technology. Initially, ANT was concerned with how scientists achieved the support of others for their propositions about scientific facts, and how power and resources were acquired to perform their work [155]. This network theory puts emphasis on the concept of non-human actors and the interplay between entities with agency, human and non-human actors, as well as relations formed by negotiations and interactions to produce stable, heterogeneous networks of actors with aligned interests [95]. By tracing the transformation of these heterogeneous networks, ANT explores how these networks of actors and their relations emerge, are maintained, and compete with other networks of aligned interests [151]. Actor-Network Theory can therefore be used to characterize knowledge networks in which audiences participate to explore their roles, their placement in the network (which determines their associations, relationships and proximity to other actors), how they generate effects such as smaller groups within larger organizations, inequalities, hierarchies, and dependencies. The actors that make up a system play an important role as they help give meaning and social explanations based on interconnections with each other, as opposed to looking for self-contained meaning to the independent actors. So the first step is to identify actors. All ANT principles and concepts rely heavily on the definition of actors.

There have been numerous studies that use ANT to examine the implementation of projects where the social aspect of knowledge development has been traced, the role of technology is studied in facilitating the success or failure of project development, and so on. These studies have shed new light on how projects are implemented. For example, Swarts' study reveals the relationships between functional and rhetorical knowledge to establish how technological literacy reflects a complex and

distributed social [148], Albrechtslund and Lauritsen [3] analyze three empirical examples to follow traces of participation in a broad range of everyday surveillance spaces, and [122] uses ANT to argue that everyday citizens are often eager to participate in conversations surrounding emergencies but face challenges in doing so because of a variety of barriers in access and interface design; ANT is used to gain an understanding, formulation and stabilisation of groupings, referred to as networks of data sets, in the analytics of big data at a strategic level in an environment by Iyamu [76], while Islam, Mäntymäki, and Turunen [75] build on ANT to investigate blockchain split as a translation process, and employ case study methodology to examine Bitcoin splits. Although these studies are relatively new, ANT for analyses work has been used for over three decades, primarily to interrogate social, scientific and technological networks [74]. The theory is scalable and flexible in that it can be combined with other approaches or techniques for analytic purposes. Therefore, I consider ANT to be appropriate for gaining an understanding, formulation and stabilisation of networks of knowledge production in the case studies for this research viz. a user's pull request on GitHub, content analytics data about audience behavior, feedback mechanism used for error reporting.

3.6.1.2 Applying ANT

Empirical data from the three case studies were used to identify cases that will help contextualize the understanding of audiences in technical communication. The data comprised of the network-formation activities that were initiated by user interactions. ANT was used to analyze case studies to establish a new understanding of audience analysis methods. The objective of using theoretical approaches was to start the analysis process by looking at the actors participating in the networked content production process. The study depends on the interpretations derived from case studies' data and the validity checks performed in order to ensure that the analyses can be practically used for future approaches. While it was important to start tracing all the social actors in each case study, it was also crucial to set boundary conditions on the extent of interactions being studied.

This section focuses attention on introducing various parameters that were used for this study, along with ANT concepts such as the four moments of the sociology of translation. The follwoing section discusses potential limitations due to the controversies and challenges of using ANT, reliability concerns, and ways of addressing them.

3.6.2 Boundary conditions

A lot of earlier work that looks at audience analysis, approaches it from the lens of empirical research methods so that data remains fixed. For example, data created by audiences such as in social media, blogs, forums, etc. analyzed to understand audience needs can be limited by some sort of stopping-criteria such as duration of time, or quantity of messages. Such criteria are not useful for analyzing case studies identified for this research as the content created is not uniform. Therefore, this research begins by analyzing the role of one primary actor and tracing the network of content creation thereafter. Two main criteria drove the analysis process:

- A starting point: A starting point was defined as the instant at which the user interaction took place. Instead of looking at more than one generalized case to identify a pattern across multiple similar cases, each of the case studies denotes a typical case of user interaction and the moment of interaction was initiated as the starting point. The process, chronology of next steps, and other dependent processes were based on this starting point.
- Stopping condition: Process analysis can be a never-ending journey without a predefined endpoint or an assumed stopping condition. For this research, the stopping condition was defined as the moment when the process network was stabilized, that is, it returned to the initial state just before the user interaction took place.

For example, in case of Twitter, or any other social media platform, content, once placed, remains static on the platform's surface, until a user interacts with it. If a user clicks the like button on a Twitter post, the user interface changes, several other actions are triggered to first, fill color (red) in the heart icon (like button), display the user's name as a user who like the tweet on the tweet dialog, send notifications to the user's network about the user's interaction, and so on. While these tasks are processing, the network of chain reactions can be said to have destabilized as compared to the initial steady state. Each case study has been analyzed from the user's interaction that leads to the unsteady state, until it is stabilized again by the network of actors working towards that goal.

Although there can be infinite actors that form the knowledge network, data were only retrieved from one instance of interaction that produced content in each case, until the network was stabilized and/or content was translated [22] to set a defined scope for this research. Additionally, knowledge networks in larger organizations are fluid, owing to constant evolution, re-organization, and transformations in roles and procedures used by actors at large organizations. As an attempt to keep the study definite, relevant, and within the context of technical communication, only the actors that became part of a network as a result of those audience interactions were considered, and new actors were added until the point of content transformation, thus helping to set the scope of this project. Three steps were necessary to trace networks:

1. Begin by identifying the primary actor at the moment of interaction.
2. Identify subsequent actors and their associations with the previously detected actors.
3. Analyze how new relationships were built or exercised in an attempt to force the network to return to its conventional state.

To trace the interactions for the Twitter example, the chronology of events becomes important. As mentioned earlier, the Like button triggers many subsequent actions and associations among participants of the network (the features of the social media platform) such as the placement of the post on other Twitter users' timeline in the network, several invisible records in Twitter's database that store the information, and so on. After the post is Liked, the user who liked the post cannot re-like the post (only deactivate the like button), so their relationship with the post changes. Throughout

this analysis, ANT allows treating human and non-human participants of the network equally. This makes it a fitting approach to analyze case studies for this research. The next section describes the use of ANT to analyze each of the case studies in more detail.

3.6.2.1 Tracing network actors

Once it was established that human and non-human actors will be identified starting from the "point of user interaction until a stabilized network was created", the process was guided by three main principles that underlie the ANT approach: generalised symmetry, agnosticism and free association [23]. Firstly, the principle of generalised symmetry is reflected in the way ANT defines actors [155]. According to this view no distinction between human and non-human actors should be made. Both should be analysed in the same terms without making any discrimination [23, 97, 98]. ANT invites us to not impose preconceived analytical categories on the problem at hand, but remain open and let the actors themselves reveal the categories we're studying. In so doing, this principle maintains that both human and non-human actors have the ability to take actions, and can be anyone or anything [97]. Actors are defined by Law et al. [98] as individual entities who take actions through which they can "exert detectable influence on others". Actors are traced from the moment of audience's interaction with the knowledge platform that creates content – this moment reveals the primary actor – and until the content gets transformed owing to user(s) interaction. In any analysis, the actors' relationships and the way they explain their worlds must be allowed to fluctuate. The second and third principles require researchers to systematically avoid censoring any interpretations provided by the actors studied when they describe their own actions or other actors [23], even when the interpretations can differ from observers, including the researcher [97]. The second principle, 'agnosticism' suggests that the observer of the actor network needs to be impartial, and requires that all interpretations be unprivileged. The third principle, 'free association' requires the abandonment of all a priori relationships that could be assumed to exist between human and non-human actors [23]. Since this research uses a mixed-methods approach, there was a higher chance for the researcher to get influenced by the interview data before analyzing case studies and have preconceived notions about who the participants in the network are, based on the interview data rather than observations of case studies. To prevent that, data from case studies was separated from the interview data. The interviews only yielded ideas for the kinds of case studies that might be viable. The absence of data related to case studies from the interview process, eliminated their impact on later investigations. Rather than imposing relationships upon the actors, I focus on the translation process. The principle of generalisation was used to treat all actors equally, regardless of their position (order in the translation process) and their ability to take actions (primary or secondary).

As mentioned earlier, to trace each case study, I started with the primary actor. Other actors were added to the list based on their effect on the network and role in the translation process. Actors roles are determined by the associations they have with other actors. For example, if they influence other actors to perform certain actions, or undergo negotiations to stabilize the network, and so

on. Understanding associations is incremental to 'following' actors. The next section describes a strategy to trace associations that lead to identification of actors beyond the primary actor.

3.6.2.2 Tracing associations in actor-networks

While actors are individual entities, actor-networks, or simply networks, are groups of actors: networks of heterogeneous materials linked with one another through different relationships, and whose resistance has been overcome [95]. For a new network to emerge, the primary actor who has the main control when network tracing begins, and those exercising control on its behalf - needs to enrol other actors in order to align their interests, and weaken the presence of other actors that might act against the goals of the network to ultimately stabilize the network. The control exerted by the primary actor determines in which direction will the network be traced. To understand the process of translation or of tracing (adding) actors to the existing network, we need to first understand what *control* means in ANT.

Control is being able to persuade other actors to perform specific roles. To exercise control over others, controlling actors must develop different strategies through associations that may involve negotiations with other actors in the network. A controlling actor cannot exercise control alone, as Law highlights when discussing how the process of transformation of networks is achieved – Law states that "Texts of all sorts, machines or other physical objects, and people, sometimes separately but more frequently in combination, seem to be the obvious raw materials for the actor who seeks to control others at distance ([97], p. 255)." However, those 'raw materials' needed by the controlling actor to exercise control and those aimed at being controlled, more often than not, pose different sorts of resistance and struggle [95] that can come from different sources and at different moments during a translation process. The controlling actor might create a successful actor-network only when all other actors are successfully persuaded. While networks are continuously evolving and transforming in ANT, usually certain entities take control, even if temporarily, to create temporary actor-networks [23, 97]. Those playing the role of the controlling actor develop different strategies to drive the translation in order to enrol and mobilise other actors [12]. During a successful translation, those being controlled are obliged to remain faithful to the objectives of those who control, and those exerting control are given the right to represent those mobilised [23]. Sometimes, some actors may not be able to be persuaded (and therefore enrolled) because their roles are not visible, needs are not met, their roles have not been communicated, and so on. In such cases, spokespersons play a critical role. When changing the state of an actor, the spokespersons can express what others say and want in their own language. Moreover, a process of translation not only entails some actors establishing themselves as spokespersons, but also requires processes of displacement to take place. In addition to spokespersons' playing their part, negotiations can take place between the controlling actor and those who they seek to enrol. For example, in the case of product documentation platforms, the platform infrastructure needs to be designed in a way that audiences and technical communicators can control it and their movements can be traced through communication patterns to trace changes (edits). In this case, infrastructure refers to the technological environment in which user interactions

occur, and which holds the network together. Once the controlling actor has translated the interests of others to achieve its aims, the actor-network becomes stabilised. This means that in the example mentioned, infrastructure becomes the controlling actor, bringing all actors together in a network to stabilize it. Technical communicators can be spokespersons of how the infrastructure gets designed. Audiences need to interact with infrastructures to become associated with the (knowledge) network that may be formed and stabilized as a result of this process. The next chapter includes visualizations about this process to help in understanding these these connections between actors.

While tracing networks it was found that there could be infinite number of associations among each of the network's actors that could stretch the networks in all directions. Actors that can be classified as belonging to technological infrastructures, usually black-boxed, have the ability to breakdown into tiny units. The black-boxing ability itself enables grouping of those tiny units into larger groups. The decision of choosing actors from the list of tiny units or grouped systems was to be dictated by the possible associations and the roles that those associations brought to light. An exhaustive list of associations was therefore created before beginning to trace the network and used to enrol new actors (units or groups). Following is the list of associations that was coded and used such that it could be applied to all three cases:

There are two important considerations for stabilized networks: first, they can be black-boxed if all the actors have not been identified; and second, the network always has the potential to change and evolve since the relationships linking the actors of the network may be weakened, or because other actors external to the actor-network can impact its stability. Only when a network is formed of a range of durable materials can it be seen as relatively stable [95]. I studied the process of translation to analyze such ever-changing networks. The sociology of translation helps understand how networks emerge, stabilize, and get transformed. A translation process entails four interrelated moments: problematization, interessement, enrolment and mobilisation [23]. During a successful translation, those being controlled are obliged to remain faithful to the objectives of those who control, and those exerting control are given the right to represent those mobilised [23]. The process of translation is not linear. In this study, it helps trace actors based on their presence, control, and role in the transformation of content from the point of user (audience) interaction.

1. **Problematization**: This process involves finding actors that go through the 'Obligatory Passage Point' (OPP). Asking questions will give you a list of actors and also the links between them. In the 'problematization' stage, one or more key actors attempt to frame the nature of the problem in their own terms [152, 131]. They also identify and involve a number of actors whose roles and relationships configure an initial problem-solving network [100]. At this stage, the identities of other actors must be defined. Once the controlling actor configures an initial actor-network [100], it is crucial for it to define the problem in its own terms by establishing it as an OPP through which it renders itself as indispensable [23]. Thus, by establishing an OPP the controlling actor imposes its view on others. It thus suggests that the problems of others would only be resolved by passing through the OPP [97]. Should other actors wish to pass through the OPP, they first need to modify their current interests and to align them to

those of the controlling actor. Only by imposing its propositions as OPPs, will the controlling actor be successful.

2. **Interessment**: The second moment of translation is 'interessement'. It involves checking what the actors are interested in. They help in stabilizing the network and addressing the concerns of the actors in the network. Interessement embraces a group of actions by which an actor interests others sufficiently to agree with its proposal [23]. Through this process, those supporting the emerging network incite actors into fixed places [152], and weaken the influence of other actors that may disestablish the developing network [100]. Methods used for this process of checking the actors' interests are called devices of interessment. Independent of the devices, the final goal is to isolate those being enrolled by impeding any other possible alliance that may challenge the legitimacy of the OPP. Finally, for interessement to be successful, it needs to achieve enrolment ([23], p. 211).

3. **Enrolment**: The process of translation is not over once the actors have been identified as interessement does not necessarily lead to successful alliances. It needs to be reinforced by enrolment [23]. The process of enrolment consists of "negotiations, trials of strength and tricks that accompany the interessements and enable them to succeed" ([23], p. 211). If the necessary alliances are to succeed, a definition of roles played by those actors to which control is being exercised is devised according to the scheme proposed in the OPP [100, 97]. The spokesperson assigns roles and makes sure that actors are satisfied with those roles. This process is called enrolment. While doing so there might be arguments (dissidence) or complaints against the spokesperson. For a successful network, a majority of actors need to be satisfied which means that they should support the spokesperson's stand on situations and arguments.

4. **Mobilization**: The final step is when the spokesperson sends the message across. The actors are mobilized by the spokesperson who was able to clearly articulate the concerns of the actors, the actors are left with no choice but to agree and follow the spokesperson.

The above four-stage translation process implies that a) A network represents the structure of interrelationships related to the matter at study, in this case, to the case study of user interactions. Networks are built and torn through a series of actors engaging in interest work, enrolment, alignment and translations [95]; in this case, user interactions cause many changes in the network such as who gets involved, which stakeholders are included, which ones are excluded, what role they play, and so on, and b) Organisations and their components are effects generated in multiple interactions, rather than existing merely in the order of things [88, 90, 95]. The four-stage translation process of how an actor joins a network is not thought to be smooth sailing. First of all, as argued by ([95], p. 384), as actors are themselves actor-networks consisting of heterogeneous actants ([95], p. 384), with every new interaction from external elements (such as a user), the translation process becomes complicated. These translations involve a complex series of negotiations within the networks whereby identities are fought over, roles are ascribed, and power relations fixed to ensure that the network becomes stable again.

3.6.3 ANT in action

From an empirical and analytical point of view, ANT researchers are interested in how actor networks are assembled and stabilised (maintained in place). Callon [23] is a good example that demonstrates how actor networks are interested in how autonomous actors are enrolled in new programs of activity and prevented from following their own designs. At the same time, it shows Law [95] argument of how actor networks are also interested in how actor networks stabilize over time, become black boxed, punctualized, or part of the taken-for-granted fabric of the social. This study benefits from using ANT as an analytical framework to both identify actors, actor networks, and also to understand what draws them together to make a functioning network audience for knowledge production. The four-stage translation process [23] provides a framework in guiding discussions of the complex processes involved in identifying the roles of audiences, infrastructures and technical communicators in assembling an actor-network configuration from heterogeneous entities involving negotiations, the placement, and displacement of some or all actors.

3.6.3.1 Creating a pull request on GitHub (CS 1)

Several participants in this study identified the use of collaborative platforms like GitHub as a means to solicit user feedback. A pull request (PR) from Microsoft's product documentation titled "Added procedure to open Performance Monitor #2562" or "CS 1", hosted using GitHub, was used for this research for analysis as a case study. While creating a pull request, users need to first sign into the platform (GitHub) which helps identify who created it. Organizations who solicit such feedback generally provide instructions to help users format the feedback and add all the required information in the PR that is necessary to create meaningful and useful content. Users can decide to follow the instructions to create the PR, add content, and submit it. Users can also provide qualitative feedback, such as comments, to make their PR easy to understand. After making the desired change, users push the PR so that it can be merged with the main documentation. In CS 1, thethales created the PR (`https://github.com/MicrosoftDocs/windows-driver-docs/pull/2562`) to add a small snippet of content – a new procedure to open Performance Monitor (`https://github.com/MicrosoftDocs/windows-driver-docs/pull/2562/commits/6be04e06cb2335ae0912025ba52caec0c4eb8241`). The PR was assigned to the designated official DOMARS by Ted Hudek, another user associated with Microsoft, and handled by DOMARS until it was merged with the original content that appears on the public facing documentation site (`https://docs.microsoft.com/en-us/windows-hardware/drivers/debugger/determining-whether-a-leak-exists`). To study this case using an ANT approach, the complexity of the case must be understood. Audience that includes the user thethales contributes to the documentation thus forming a network with other participants (Microsoft personnel) and GitHub infrastructure who become part of the network. If the personnel had decided that the content or feedback is not relevant, they had the power to close the PR without making any changes. According to ANT, all components of a network, such as objects, ideas, processes, and any other

relevant factors, are considered as important as humans in creating social situations. ANT analysis and decisions made to to trace all the actors and associations that form the knowledge network is discussed in the next chapter.

3.6.3.2 Collecting data from web analytics tools (CS 2)

To understand audience behavior and analyze information consumption, companies pull abstract data and conduct research to extract knowledge using different tools. This research uses data retrieved from various tools used by company ABC to understand their audience's behavior. Three main tools used for collecting analytical data are Google Analytics (GA), Pendo, and Salesforce. Results from analyzing data from these three platforms are triangulated by technical communicators to gain insights about their users. As users navigate through online documentation, GA records their behavior. As users use the product, Pendo tracks the features used most frequently. Finally, although Salesforce data is entirely managed by the organization, content created to record user actions of requesting help from support teams, leaving feedback for the service, and ability to resolve problems after the call has been completed, all contribute to significant data that gets stored on the platform. Without infrastructures in place, user data will not be generated for analysis. This case study also analyzes the network of actors that gets formed as a result of multiplicity of data points and dependencies on each other.

3.6.3.3 Reporting errors in documentation (CS 3)

The third case study analyzes a method of reporting error that can be accessed by users. Tools that record customer feedback allow organizations to use a black-boxed task allocation and bug tracking framework. When a user posts a feedback comment (on the documentation site) or creates an Issue (using a platform like GitHub), it goes into the issue tracking system. In this case, I analyzed an issue created by a user Xunzhuo on IBM's documentation platform GitHub (https://github.com/istio/istio.io/issues/8888). Similar to content modifications, to report an error, users have to create issues. In this case, GitHub was the platform used to report errors. The journey from when user Xunzhuo created the issue - the issue being the primary actor – to when the issue was handled by an employee of the organization (IBM) was tracked to study this case. I also came across bots that are used by IBM's documentation platforms to assign tags and keywords to the content created on the platform. I analyzed all the actors that form the knowledge network for communicating problems in the documentation, and also investigated the translation of the error from an error message, to adoption in the documentation.

Analyzing these cases as networks enables us to understand activities among different components of the network, such as information coordination, transfer of control and agency among those components, the act of combining components with each other, and so on. This use of ANT to study information coordination and network fluidity has gained attention by other technical communication researchers. This study makes use of the ANT concepts to identify actors in order to trace how they create information from raw data, technological systems, and by associating and

dissociating from the network at particular instances of time. This move is different from observing static systems and instead urges technical communicators to look at flexible models of knowledge creation.The following questions were used to analyze the flexibility nature of knowledge networks that get formed in each of these cases.

1. Which actors are participating in these networks?
2. What activities are being carried out by the actors during content development processes?
3. What kinds of relationships are built among the actors exercised while carrying out these activities?
4. Can we identify how power is being exerted and how agency is being transferred from one actor to another?

These questions allow analyzing each case through a chronological lens. Secondly, they help simplify the network to look at independent actors and their relationships. To make some actions possible, the network reconfigures and these questions help in understanding how and when these reconfigurations are taking place.

3.6.4 Limitations of methodological framework

While the study relies on ANT to derive novel interpretations and insights of the knowledge networks, associations, dependencies, and interconnections between actors, and an adaptable system to track the translation process for content, it also becomes necessary to acknowledge the critiques and potential challenges of some of ANT's controversial claims. This section highlights the typical criticism that using ANT would bring to this research and how to overcome that.

First, critics argue that when using ANT, there is a tendency to adopt an objective stance; that is, the vocabulary that ANT analyses tend to use fails to match the descriptions and explanations that research participants would provide themselves [109]. In adopting this position, Whittle and Spicer [164] note that those taking ANT as their theoretical lens seem to suggest the theory is capable of offering a superior or expert view that implies members' explanations might be incomplete, naive, or wrong. Whittle and Spicer [164] also argue that in an attempt to find parallels with the four step process of translation, researchers may eliminate some other perspectives resulting in one common truth that will appear in the result. To avoid this from happening, this research is based upon the belief that: 1) reality is a process of construction and interpretation in which the researcher plays a key role; and 2) the potential of multiple other interpretations is not only possible but also desirable.

Second, rather than engaging in a deductive approach to test or refute the conceptual tools provided by ANT, these analytical devices are adopted as sensitising ideas to explore the phenomenon under investigation in the light of the case studies approach. The study is meant to lead to a new conceptualization of the audience rather than to prove that an already existing theory works.

Another relevant controversy has been around the "flat ontology" of ANT [164]. This refers to low attention ANT pays to how broader social structures influence the local [158]. Those arguing

against ANT suggest that its ontology tends to neglect the regulating role that social structures play in shaping and giving consistency and continuity to relations developed among actors. This phenomenon is acknowledged and steps are taken to prevent its impact on the study. These steps include: first, generating a context that is used to set up each case so that actors inside and outside the organization with differential power are clearly visible. Second, the context provides a narrow lens to scrutinize the contents of each case study, but at the same time, using the content transformation process as a driving rule provides a set of boundary conditions which then enable the tracing of actors not too broadly, but as a part of a specific, and restricted system (documentation). Latour has suggested that ANT allows moving between different levels of analysis, thus assisting with the investigation of both the macrostructures and the microstructures using the same methodological approach. This viewpoint is also supported by Callon and Latour [24], who argue that "all differences in level, size and scope are the result of a battle or a negotiation" and can be studied through ANT.

Finally, the most controversial debate surrounding ANT, is the principle of general symmetry. The basis of this principle argues that humans and non-humans must be seen as active entities. Accordingly, technologies must not be seen as neutral, or inert, but as actors that cannot be taken for granted. Collins and Yearley [33] were among the first to criticise this principle, arguing that the symmetrical treatment to humans and non-humans is intellectually and morally problematic because it removes humans from their pivotal role [108, 164]. However, those supporting ANT suggest that the symmetrical stance seeks to overcome the over-emphasis given to human agency that is favoured in sociological studies. In relation to this, my research adopts a stance that acknowledges that the extreme position of symmetry is difficult. However, I also acknowledged that assuming a symmetric stance towards humans and non-humans has the potential to examine critically the key role of technology that supports the network of audiences as well as the network of infrastructures that control audience movements. In so doing, my research is aligned to the aim proposed by Callon and Latour [24] of using this principle as a means to develop a 'symmetric metalanguage' to refer to humans and non-humans with an 'unbiased' vocabulary, and to adopt it as an analytical stance, not as an ethical position [95].

3.6.5 Validity and reliability

Law [96] argues that whilst entities in their broadest sense are usually conceived of as having stability and uniqueness, in contrast ANT advocates that they are a result achieved when different heterogeneous elements are continually assembled together (see also [23, 94]). using this assumption, one can say that the case studies used for this research are never completely stable and cannot be used to establish generalized theories, in this case audience conceptualization. To that effect, this research relies on other methods to achieve validity and reliability.

Although choosing ANT as the theoretical framework forced me to approach case studies from a network perspective, the view was only used to study the social structure of audiences. A social network analysis would have fallen short as it primarily focuses on human actors. This was also driven by the fact that low attention is paid to how audiences come from social structures, and that

they not only form communities but also networks as they become involved in the process of content production. ANT helps focus on infrastructural elements of not only the knowledge network, but also the way audiences get involved and become part of the network for knowledge production. The focus on human and non-human actors ensures that all parts of the network system are adequately traced. When technical communicators work with documentation systems, they are responsible for not just information production, but also making sure that users are able to access it in the most effective manner. They rely on content strategy and design thinking approaches to do so. Such approaches rely on infrastructures and their abilities to engage the users as well as participate in knowledge making. Therefore, analyzing infrastructural elements is useful for validating the impact of the findings of this research.

To ensure that the results are reliable, the analysis of case studies was reviewed by one academic scholar and one practitioner. Both of them looked at each case study objectively. The academic reviewer made sure that the cases were clearly depicted as networks. The practitioner reviewer corroborated with the network setup based on their practice and working environment depicted through the network described for each case, as well as confirmed the results of the research as critical for the field.

The research also uses results from analyzing participants' interviews to corroborate the insights from analyzing case studies. My research responds to two research questions as describe in the introduction: first, to understand whether audience contributions provide insights about audiences. Participant interviews helped the researcher build a preliminary hypothesis about this which will be validated through analysis of the case study. Second, the study points out to the changing roles of technical writers. While tracing actors and their roles in the translation, some of the roles of technical writers were recorded. Those were then compared to the feedback received during interviews.

The next chapter discusses the results of analyzing the case studies. Each case study is depicted using network visualizations and described in detail in terms of how networks are established, maintained, and contribute to audience analysis processes. Reviewer feedback will also be shared along with the discrepancies between the researcher's understanding of the case as compared to the practitioner reviewer's and what steps were taken to achieve reliability of findings.

CHAPTER

4

AUDIENCE NETWORKS AND TECHNICAL COMMUNICATORS' ROLES

This chapter provides an overview of the findings of this research derived from the second stage of the research process when case studies (identified in stage 1) were analyzed using Actor Network Theory (ANT).

Case study reporting is as important as empirical material collection and interpretation [124]. A story-like structure that establishes chronological steps of events that take place after a user interacts with the documentation platform is used for reporting. Therefore, the sequence of reporting results starts with case descriptions followed by actor-network descriptions, descriptions of associations, details of ANT protocols, and finally the findings and interpretations.

Dubinsky [42] stated that, "the best judges of the making are not the makers but the users" (p. 5). Because we cannot consistently predict what kinds of information might be useful to specific groups and in specific circumstances, we need methods by which we can understand the dynamic relationships between users and how they prefer to use technology. To investigate such dynamic relationships, we need to systematically observe and analyze users' behavior and the constant changes that they are bringing to the content ecology.

Actor network theory allows this type of analysis to understand the traces of movements of both – people and technology. Therefore, this analysis was designed using ANT, especially the sociology of translation and its related concepts as discussed in Chapter 3. Prior to tracing the main findings, each case study is described as being composed of different actor-networks. Further, a chronological narrative of how actor-networks get formed, how relationships between actors are established, and

of the roles that audiences and technical communicators play in those networks, are described in which primary attention is given to how the focal actors attempt to enrol audience actors (roles) to support their participation in knowledge development.

The chronological narrative is important because it helps understand how users forage for information, assemble it to be useful to solve their problem, validate it, and in case of discrepancies, make an attempt to fix it. As they perform these tasks, users build narratives across multiple systems on what they need and how that can be best provided. Technical writers and information designers can learn from these narratives to ensure effective content deployment. In addition to that, understanding the affordances of complex methods to support users' interaction that lead to the narratives can help them design systems that will improve meaningful exchanges between content and its users. Analyzing such activities needs a specialized approach, requiring a comprehensive lens through which users' content experiences and their contributions can be studied to define the entire ecology.

As one of the main goals of this research was to understand whether audience contributions can shape audience analysis processes, this chapter details observations on how the translation process occurs in each case study to enrol actors that disclose audiences, audience roles, audience characteristics and other actors that support these disclosures during audience interaction activities. These contributions will help predict audience needs. Using ANT lets us focus on the bigger picture that consists of more than one actor, to allow analyzing the entire ecology of data and content production through user interactions in each of the cases. The findings show that not only do audience interactions disclose information about them that can lead to a new contextualization of audiences, but can also enable technical writers to negotiate the roles they play to ensure smooth functioning of a collaborative knowledge development process and support necessary technological frameworks. Such negotiations impact the relationships between technology, writers, and the users, so technical communicators need to be wary and constantly adapt their roles based on the tools they need to lead those negotiations. This phenomenon leads me to the second research question which is answered in Chapter 5.

Some of the black-boxes in the processes studied through the case studies, especially technological, are left as is for the purpose of simplicity. The role of infrastructure (technology) is important and all actors are in some way connected by it. The technology needs to be configured such that it supports user interactions, and the associations between various actors in the network. For this reason, an important consideration about technology has been made – in an attempt to produce a simplistic network representation, technological components/actors in each case studies' actor-network, that can be divided into minute units are encapsulated together and named after the technology or action that initiates the technology to perform and cause a change in the network. For example, while creating a pull request, several components of the GitHub architecture are into play. Although some aspects of the process of creating a pull request are described in detail, only relevant components of GitHub, which are sometimes grouped together, are incorporated as the non-human actors. Other considerations of this study hail from using ANT as a strategy to map

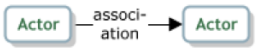
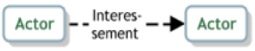
Concept	Definition (Bengtsson & Lundström, 2013)	Legend
Actor	Any element which bends space around itself, makes other elements dependent upon itself and translates their will into the language of its own	
Actor-network	Heterogeneous network of aligned interests, including people, organizations and standards	
Punctualization	Treating a heterogeneous network as an individual actor to reduce network complexity.	
Problematization	The first moment of translation, during which a focal actor defines identities and interests of other actors that are consistent with its own interests, and establishes itself as an obligatory passage point (OPP), thus rendering itself indispensable	
Obligatory passage point (OPP)	A situation that has to occur for all of the actors to be able to achieve their interests, as defined by the focal actor.	
Interessement	The second moment of translation, which involves negotiating with actors to accept definition of the focal actor.	
Enrollment	The third moment of translation, wherein other actors in the network accept (or get aligned to) interests defined for them by the focal actor	
Focal Actor	Performing several responsibilities as mentioned above.	

Figure 4.1 Visualization legend for the key concepts in ANT

networks.

The analysis of each case begins with a description of the case that includes a chronological interpretation of events that follow users' interactions in each of the cases. The descriptions aid in setting up each case as a complex network which is also visualized using network diagrams.

In ANT research, especially in the field of information field, graphical representations often accompany the ANT-analysis in order to improve visibility of the case and the actors' interests and powers [8]. Through the years, different forms of diagrams and flow-chart analogs have been used [23, 156]. In the important work of Callon [23] when he explores the domestication of the scallops and fishermen of St. Brieuc Bay, several visualisation approaches are used as an aid to support the narrative, ranging from relational diagrams to more naturalistic depictions illustrating the interests of different actors. A different approach to visualisation is used by Akrich and Latour, based on Latour [89], that depicts an association chain of human and non-human actors. From the latter they also used a more narrative visualisation to discuss technological change as means of promoting change in an actor-network. Bengtsson and Lundström [8] have identified three important categories of ANT visualizations from the literature. The categories are: a) Frameworks that visualise the relations of the actor-network, necessary translations, (obligatory) passage points, etc. that build up the domain, b) Models that visualise the actor-network at some stage of the narrative, and c) Supportive visualisations that act as an aid for the user to better understand certain key concepts or stages in the narrative [8]. Visualizations belonging to one or more of these categories are used to depict each case. Figure 4.1 serves as a Visualization Legend for the Key Concepts in ANT.

The network is broken down to explore the position and role of each actor involved in the network. The snapshot of actors' roles helps in developing an understanding of the translation

process. Translation in ANT as described in the previous chapter, is a four-stage process, by which an actor-network is created and stabilized. This process is followed from the perspective of one actor known as the primary or focal actor. The first moment of translation is problematization, in which an actor defines a problem/task opportunity/challenge and tries to persuade other actors to accept the solution proposed by the primary actor. This moment establishes the actor, usually the focal actor, as an obligatory passage point. Subsequently it renders the actor indispensable for the entire network. The second moment is interessement, in which the primary actor as the initiator of a particular problematization tries to place other actors into roles proposed in the programme. The third moment is enrollment. In this phase, the focal actor succeeds in convincing other actors to accept the roles proposed as part of the interessement moment. The fourth moment is mobilisation. By ensuring durable and irreversible relations, the actor-network becomes stabilised. This process of translation is analyzed in each case starting with the interaction moment(where the focal actor is determined) to describe which actors are primary, how problematization and interessement are taking place, how various actors are getting enrolled into the network to play their respective roles, and how can we map the results of the network translation process to answer the research questions of this study.

The next section describes the analysis of each case study using the ANT approach which helps to first complicate aspects of the case to study the heterogeneous elements involved in it as well as to understand processes that make it dynamic.

4.1 Using ANT to analyze the pull request on GitHub (CS 1)

This case study looks at user contributions on product documentation platforms. In this case, users interactions are able to contribute actual content about their experiences and record it in the form of edits. GitHub acts as the technological medium to support creation of a network among users, content, technical communicators, and other actors to enable recording user narratives using pull requests. This method differs from other input types such as comments provided on blogs, or posts on user forums because the inputs are only visible through the GitHub platform (see explanation on implicit and explicit interactions in Chapter 3). Such systems also known as open authoring platforms help audiences record their own subjective experiences, report missing information or suggest other forms of edits.

This case was analyzed to find out the process of how user interactions are converted to content (by editing the content on GitHub), how that content can be transformed into information (for example, through content moderation done by technical communicators), and how technical communicators can support processes of doing the same (for example, through various roles and taking up difference responsibilities).

Before diving into the case, I would like to elaborate more on how GitHub was chosen for the case study and not any traditional wiki which seem to have similar functionality of version history and collaborative writing. To understand that it is important to note some differences between wikis and

git platforms. While GitHub and wiki are both collaborative platforms they use different versioning systems. GitHub operates on git. When using git, documentation can have the same workflow as code, such that product documentation can be stored in the same repository as the software code, and also reviewed along with it. When code and documentation are done with reviews and changes, such that no open issues are pending, the stakeholders can all agree on the project being done [15]. This is especially useful in Agile environments [15]. Wikis do not support code. Second, wikis do not have owners unlike GitHub content where each document can be traced to one owner [106]. Lastly, GitHub is also quite different from not only wikis, but also other social media platforms like Twitter and user forums as the focus is only on content creation and reuse, not so much on community building [165]. The benefits of a GitHub case study go beyond ensuring that we only track implicit interactions, to see clear connections between various stakeholders, not just users and technical communicators, a pull request (edit request) on a GitHub topic is an ideal case to start describing this study.

A pull request (PR) is created by users when they wish to make a change or propose a change to the existing documentation by making the change themselves. A PR is different from the way other forms of feedback, especially commenting features work. In qualitative feedback techniques, such as leaving comments in the space at the bottom of the page or through a feedback form, users provide explanations about what change is needed, where, and why that change is required. On the other hand, a change proposed using a PR can be made by directly editing the content on the public facing documentation page `https://docs.microsoft.com/en-us/windows-hardware/drivers/debugger/determining-whether-a-leak-exists` that requires modification, by clicking the Edit button and entering backend setup.

All the data related to this PR "Added procedure to open Performance Monitor #2562" was analyzed. The goal was to analyze the actor-network that gets created from this PR until the content gets transformed. In order for the content to be transformed, it was important to make sure that the request was accepted, and that the PR was merged after the intervention of the designated Microsoft personnel. This PR was created by the user "thethales" and was identified in October 2020. The progress on the PR was monitored regularly until PR was merged by "DOMARS" into the published content. DOMARS' GitHub account was used to confirm that the user was associated with Microsoft. All the data generated throughout the process (from opening PR until merging) was recorded.

Analyzing the user thethales' interaction with Microsoft's product documentation platform through ANT implies that the documentation platform is essentially a network. So we can also assume that before thethales interacted with the platform, the network, composed of the documentation platform along with the employees of Microsoft responsible for developing and maintaining it, is a stable actor-network. The actor-network, until the point thethales joins, consisted of:

- technical communicators who are primarily responsible for documentation content
- project managers who assign tasks to the writers and/or technical communicators
- the GitHub system used by the technical communicators to develop their content (as a

workspace)

- reviewers who review content
- technical communication managers who manage documentation projects and the publication environment (server) that connects directly to the documentation interface or frontend
- information also known as help content deployed on the documentation interface
- and users who read content and use it to solve their problems

Each actor had its own roles and interests to ensure that the network operates in a stable manner to achieve the goal of delivering product documentation content to all the relevant audiences.

Sarker and others [131] interpretation on the definition of actors that stemmed from Callon and Latour's ([24], p. 286) work, was used to choose actors to define this preliminary, stable, actor-network. Sarker et. al. [131] define an actor as an element in a network which negotiates with others around itself to make them dependent upon itself and translate their will to accept the position in the network as determined by the actor alone. For example, in this case the GitHub platform determines the position and placement of users as well as technical communicators on opposite sides of the documentation interface, users on one side who are receiving content, and technical communicators who interact with the workspace to produce and publish it.

As soon as the user thethales interacts with the platform to enter the technical communicator's workspace, the network becomes complex and the actors in the network are destabilized. ANT makes it possible to trace the complex network to reveal heterogeneous elements that cause the actors to interact, negotiate together and work together or separately to claim power and/or agency that will stabilize the network. Figure 4.2 shows all the actors identified in the tracing of this actor-network and also depicts the translation process.

As can be seen in Figure 4.2, the network is composed of human and non-human actors. Among the human actors, users, managers and technical communicators are most prominent, while among non-humans the documentation interface, infrastructure and metadata are significant ones. ANT allows us to look at all the actors equally. The function of tracing actors was to identify some actors that were not visible initially, but were made visible after their actions were invoked by separate events. As mentioned in the previous chapter (see 3), the user interaction to create a PR and the series of events that are non-linear. This complicates the process of tracing actors. However, the process of tracing can be done chronologically to reveal actors. A chronological description can also be used to understand the role of actors and their relationships in more detail.

4.1.0.1 Chronological narrative of thethales' pull request

This chronological account is useful to understand how a set of controlling actors aimed to enrol other actors to successfully merge a PR into the existing documentation published on Microsoft's documentation website. When the user, thethales, clicked the edit button on the documentation

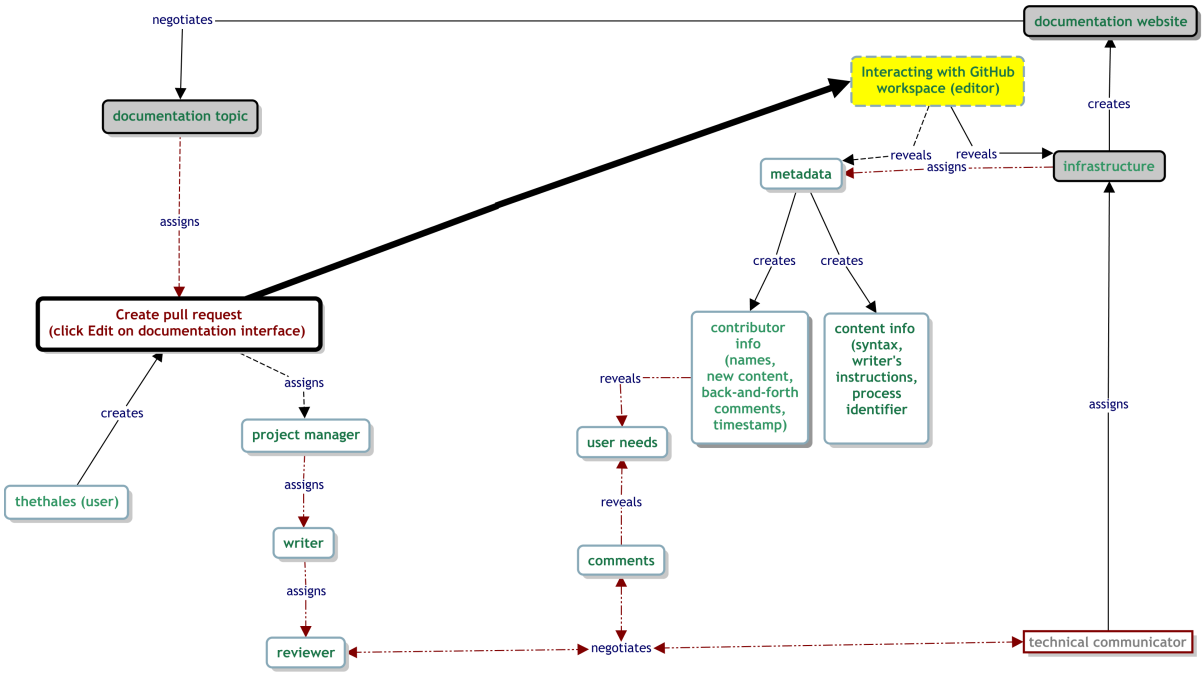


Figure 4.2 ANT analysis of pull request on GitHub (CS 1)

page and entered the GitHub workspace, the GitHub environment becomes the controlling actor. An actor-network gets created led by the GitHub environment actor to enroll more actors to support the publication process. A successful translation of the network would depend on the ability of the GitHub environment to enroll relevant allies that have authority to control the publishing process and to strengthen the relationships among them. The infrastructure gets involved instantly, since it is designed to pay attention to users' requests.

The infrastructure stores data about how the content must be designed to be submitted to the documentation system. The user writes the content, and the infrastructure introduces other metadata, such as the user's (contributor's) identity. The infrastructure also separates original content from the new content added by the user. The new content, if carefully analyzed, reveals users' needs.

As soon as the PR is submitted, the manager of the corresponding documentation project gets notified and participates and becomes associated with the infrastructure. But the manager's role in participating differs from that of the user. The manager detects the request and chooses the author of the original content that the user is interested in modifying. The manager assigns the PR to the author or technical communicator who might then either edit the content, verify it, or assign it to the reviewer to propose any new change. At this stage, the technical communicator(s), user, and reviewer can communicate through GitHub's commenting feature to arrive on the same page about whether the new content is applicable and worth the change. Content may or may not get updated while the back-and-forth commenting. Once it is finalized, content is published using the GitHub

framework. In sum, the GitHub framework is a crucial actor that is accepted by the other elements as a necessity for them to access raw information, make changes, communicate, process content, and acknowledge their individual roles and contributions to achieve their common goals of making the documentation useful for users.

4.1.0.2 Stabilizing the new actor-network

The new actor-network that gets created due to the PR goes through three translation phases (problematization, interessement, and enrollment) before being stabilized. From the previous discussions, problematization is the phase in which the focal actor (i.e., the Github workspace)identifies the potential actors. Interessement is the process whereby the focal actor defines and negotiates the interests and roles of the potential actors. Enrollment is the process whereby the actors accept their roles and interests and become part of the new actor-network.

- **Problematization**: The problematization phase consists of two steps: (1) the focal actor selects the potential actors and identifies their roles and interests, and (2) the focal actor defines the problem by highlighting how the problem affects the other actors. Then the focal actor lays out a strategy to deal with the problem and identifies the process by which the strategy can be achieved. This process is called the obligatory passage point (OPP). In this case, the Github workspace is the focal actor because the PR cannot be created without using the features of the GitHub interface and working through each of the steps designed to submit a PR. If the PR is created and submitted by the user, but not authorized by the organization's employees who manage the documentation platform, the actor-network remains incomplete. An incomplete network is a problem. The goal of all actors in this process is to make the documentation accurate and useful. To solve the problem and include actors that will help meet the goals, the GitHub environment needs to enroll actors that can be made responsible for completing actions that would result in the PR getting merged with the published documentation.

- **Interessement**: To enroll actors, first the roles and responsibilities must be selected and shared with other actors. In the interessement phase, the focal actor negotiates the interests and roles that it identifies with the different potential actors, seeking to convince them to accept these new roles and align their interests accordingly. The GitHub interface can be configured such that authorized individuals will get notified when a new PR is created. In this case, the authorized actor, tedhudek, who is affiliated with Microsoft, responds to the request by assigning the request to another actor, DOMARS, who is also affiliated with Microsoft. Metadata is an important actor in this process as it helps actors to track responsibilities and ensure that processes are being handled by assigned actors. The documentation website's infrastructure is directly linked to GitHub. We can say that the documentation platform is the frontend whereas GitHub serves as the backend for managing content.

- **Enrolment**: Although technical communicators are crucial actors in this process, their responsibilities only get included in the third phase of the translation process. In the enrollment

phase, the actors accept the roles assigned to them in the new network and become part of the post-PR network. Technical communicators' responsibility is to create and publish content. When a PR gets submitted, they get involved in the process of maintaining content which starts and ends in a separate network, disconnected from their routine work. In this case we see the actor, tedhudek, assigning the maintenance task to DOMARS. The OPP here, that is the GitHub interface, is the necessary and only connection between the technical communicator and user. Therefore, information is conveyed through the same platform, further proving GitHub's role in facilitating the successful inclusion of new content. The technical communicator (identities revealed by metadata) communicates with the user (identities revealed by metadata) using GitHub to confirm that the change proposed through the PR is valid (message reads "Happy to add this additional information on how to run Performance Manager under Windows. Thanks for the PR.") and accepts the request by merging the request with the "MicrosoftDocs:staging" thread. Through this process of validating content accuracy, the enrolment phase reveals the role of a reviewer (tester). While metadata is used to identify actors in this process, the content added by the user highlights the user's need that was found missing from published documentation which was added using the PR.

Thus we see that while ANT was useful in revealing hidden actors, the translation process brings to light the following three associations that are not evident in the traditional content development and deployment process carried out by technical communicators:

1. Technology plays a crucial role in not only ensuring that the documentation is up-to-date, but also provide a direct channel for communication between technical communicators and users.

2. Technical writers review the new content, adding the responsibility of verifying and validating whether the content is relevant and useful for inclusion in the corresponding documentation set. They require the necessary technical know-how, understanding of information organization, and understanding of user needs to ensure that the new content will add value to the documentation topic being updated.

3. Users can use PR to communicate their needs. The PR not only allows users to compose information about their needs in a suggestive format but also provides them an opportunity to communicate with organization's employees, including technical communicators, and to track the changes to the documentation closely by monitoring each step of their request getting converted to published content (if PR gets merged).

4.2 Using ANT to analyze web analytics data and findings (CS 2)

Web analytics findings are standard. Most organizations set up web analytics dashboards in a way that allows them to derive useful insights from the data provided by the web analytic tool. For

example, Hocutt and Ranade [72]) discuss technical communicators' task of setting up a view to make sense of data made available through Google Analytics; "Data collected can be configured, processed, and reported. One of the most frequently used methods involves setting up a view that filters data into and/or out of the collection activity, which in turn affects what can and can't be configured, processed, and reported". The authors also provide the technical details of the black-boxed analytics mechanism. Web analytics tools like Google Analytics, use cookies to record audience information. The tools can be embedded on any website by making few additions to the website code. In a typical content consumption scenario, such as that of a product documentation website with web analytics enabled, when a user visits a documentation topic, their information gets recorded without their knowledge.

This method differs from the PR in the previous case study in two main ways. First, users interactions record their information seeking behavior more rather than the discrepancies reported by them. Second, while on GitHub, users are consciously engaging in content creation, here they may or may not have knowledge that their interactions are being tracked as a method of understanding their needs. Since the genre is different from a content edit, it may not be as well developed as a content edit request (pull request).

This case was analyzed to find out how users' interactions create quantifiable data that provides insights about their information seeking behavior and how to make sense of that data. For example, if the analytics tool is configured to record the search terms that the user uses while navigating the website, not only do the terms get saved, but technical communicators can instantly retrieve that information to match the terminology used throughout the product documentation to that the user used, or make provisions to train users to use appropriate terminology. Such scenarios can be assumed to operate in stable environments where all actors involved in this network are already set up to fulfill goals, and carry out their responsibilities without intervening in other actors' processes. However, this case study examines a new approach to using analytics. Although web analytics is pre-configured in this case, the configuration of the knowledge network is more complex.

While web analytics is gaining importance in the information development field, not enough attention is paid due to the complex nature of the data. Technical communicators need to collaborate with multiple teams to carry out multiple processes using diverse skills to make meaningful predictions about audience characteristics using web analytics data. This case provides one example of how the process takes place in an organization to provide technical communicators tools to develop information systems that record such data and to help them make sense of that data.

Technical communicators use more than one analytics tool. In addition to Google Analytics, two more tools viz. Salesforce, and Pendo are used to record user interactions. Data from these tools is separately recorded and there is no single platform to integrate all data to get meaningful insights. Therefore, the technical communicators manually set up views to visualize relevant data. Technical communicators are tasked with formulating research questions that can be answered using the available data. As available data changes, it changes the configuration of this knowledge network.

To study how the network was configured and reconfigured, ANT was used to trace actors in

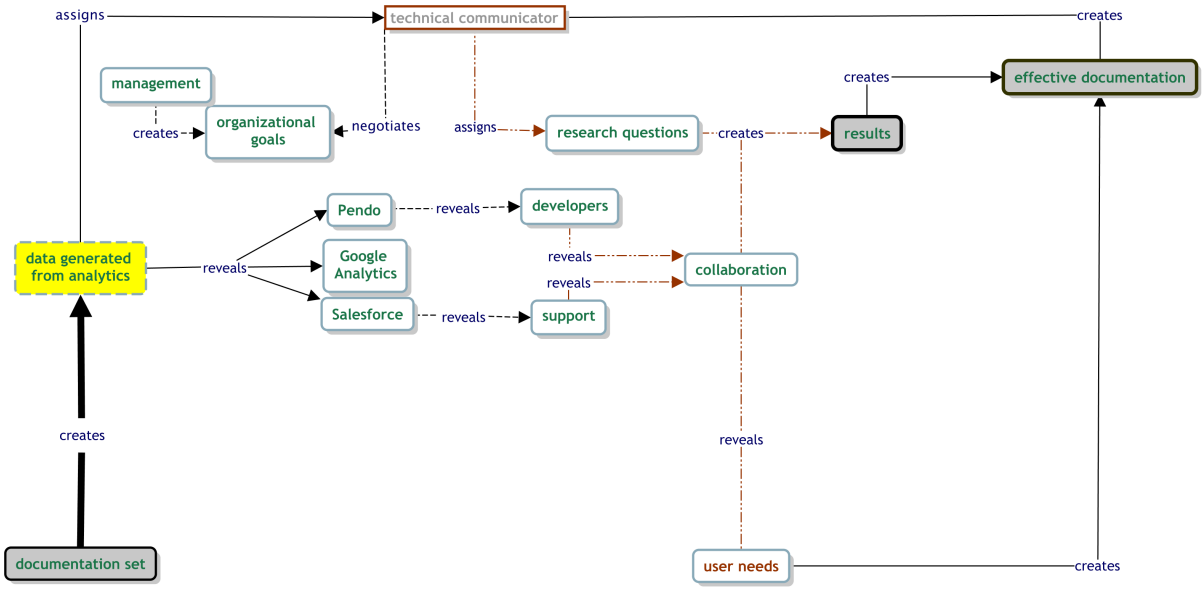


Figure 4.3 ANT analysis of web analytics data and findings (CS 2)

this case, starting from the point when data became available (in the form of reports). Most actors for this case were not visible and were traced using data reports. The process of tracing revealed actors that are not primarily involved in documentation activities but that get involved to support the goals of documentation teams.

Figure 4.3 depicts the complex network with multiple data analytics tools and other human and non-human actors that come together to form the network such that useful insights can be drawn from the available data. Among the human actors, users, managers and technical communicators are most prominent, while among non-humans the documentation interface, infrastructure and metadata are significant ones. ANT allows us to look at all the actors equally. The function of tracing actors was to identify some actors that were not visible initially, but were made visible after their actions were invoked by separate events. As mentioned in the previous chapter (see 3), the user interaction to create a pull request (PR) and the series of events that are non-linear. This complicates the process of tracing actors. However, the process of tracing can be done chronologically to reveal actors. A chronological description can also be used to understand the role of actors and their relationships in more detail.

4.2.0.1 Chronological narrative of web analytics for technical communication work

The chronological account of analyzing data and reporting findings seeks to understand the role of all actors, apart from technical communicators who form the network. This case differs from the other two in two ways: first, the nature of content contributed by audiences; second, the ways in which collaboration takes place. As mentioned in Chapter 3, data analytics tools record users' data automatically when users navigate the content website. They do not consciously decide what data

to share. So the interactions although implicit, content generated is beyond the control of users unlike other two cases. Second, in the other case studies the visible collaborations are between the users contributing feedback, and writers who will then review the content and publish it. However, collaborations in this case take place in invisible ways. Collaborations for analyzing audiences through data analytics requires different stakeholders, tools and other infrastructure, writers, and other individuals invested in the organizations goals to come together. The collaborations can best be revealed through a detailed analysis of the content network.

As mentioned earlier, data analytics tools are constantly running in the background of published web documentation. The company from where this case study was retrieved uses Google Analytics as their primary tool to provide teams with content consumption information. This information includes two sets of data useful for audience research. First is data about users which includes user demographics, information about browsers that they used, their approximate location, and so on. Second is data about each web page in the documentation set and analytics, such as number of visitors for each page, amount of time spent on the page by users, users' entry and exit points and so on. All this information is combined when it is viewed by the organizations' technical communicators.

To make sense of this data, technical communicators keep some research questions ready. When new data comes in, they have to revisit their questions after identifying current goals of the organization as well as other available data. The organization uses additional tools to gather audience interactions. Pendo is embedded in the product for which documentation is written, so it provides data on user interactions with the product interface. Technical communicators try to map their findings from analyzing Google Analytics data using their initial research questions. For example, the case study data shows that the technical communicators questioned why the Licensing information topic page had most views and whether that was related to the difficulty in finding that information on the product. To map these findings, they use data from Pendo to check how the licensing information was accessed through the product interface. They found out that the keyword 'license' was replaced by 'registration' on the product's interface. So users were not being able to locate the product's licensing information for which they visited documentation pages. After these findings were made, the technical communicators wanted to be consistent with the terminology. To do that, they needed further research on which keyword was more acceptable to users. Another data set helped them make these decisions. Technical communicators had access to data from Salesforce, which was a tool used to record external communications. Salesforce recorded support calls and a list of frequently asked questions. Technical writers used that information to collaborate with the support team and formulate a new research question to pick the most relevant keyword for licensing information which is consistent with the documentation as well as with the product's user interface.

An integrated view of all data points provides the organization with not only relevant research questions to solve immediate problems, but also to reveal audience needs and motives. Although research questions are the key actors, they are formulated and answered based on the needs of the organization to create effective documentation. Gaining access to tools that would help meet these

goals is an important consideration for those who wish to make sense of data analytics to gain user information. Available data, along with the collaborations made to integrate that data, destabilizes the network. Therefore, studying one case of using data analytics leads to findings about how audiences activities are impacting documentation platforms and what technical communicators can do to make use of data recorded from audience interactions.

4.2.0.2 Stabilizing the new actor-network

The new actor-network that gets created includes actors that are absent from a stable network in which technical communicators analyze data made available by web analytics tool and make use of the findings to improve documentation. In this case study, the network is destabilized by several other participating actors which are explained using the three translation phases (problematization, interessement, and enrollment) before being stabilized.

- **Problematization**: The problematization phase in this case also consists of two steps. First, the focal actor – the technical communicator (or TC team) – selects the potential actors and identifies their roles and interests so that the data is used efficiently to improve documentation. Second, the focal actor leads to defining the research question by integrating other actors and processes into the network. The dataset retrieved from Google Analytics is the obligatory passage point (OPP) as without that, the other actors would become involved. Similarly, the technical communicator is the focal actor since they are responsible for bringing actors together and assigning responsibilities, supervising the actors as responsibilities are carried out, and making data accessible to each process. If data collected from various sources remains stored but unused, the network is already stable, but not helpful. Therefore we can say that the technical communicator initiates the network, and in order to derive meaning from the data analytics, integrates other processes and actors that destabilizes the network. To stabilize the network, all actors have to perform certain tasks assigned by the technical communicator until the network leads to useful findings from the various types of data in order to stabilize the network.

- **Interessement**: To enrol actors, first the roles and responsibilities must be selected and shared with other actors. In the interessement phase, the technical communicator assesses the interests of the organization to access data that can help achieve the desired goals. To access data and make sense of it, the technical communicator collaborates with several teams, including developers and support. The new actors carry out two main responsibilities. The first is to retrieve data that is relevant to the questions that the technical communicator declares as crucial based on the organization goals. The second is to provide required information to make correlations between the data retrieved and analytics data by running different scripts and processes. After the technical communicator identifies actors that can carry out these responsibilities, they seek to convince them to accept these new roles and align their interests. Successful collaborations lead to correlations between data collected by developers through

Pendo used to reveal the search terms used ("licensing information"). This information is mapped to Salesforce data accessed by the support team to validate the research question "Does documentation search reveal useful results to users seeking information?".

- **Enrolment**: In this phase of the translation process, the actors accept the interests assigned to them in the new network, designed to find suitable research questions that will make the network successful for meeting user needs. The enrolment of both actors viz. the development and support teams are successful since they momentarily detach from their roles in other networks to participate in the user needs analysis process by contributing knowledge to the network built by the technical communicator to make sense of analytics data. The data derived from Google analytics is introduced to them and questions surrounding the issue of licensing information (receiving maximum hits) is discussed with them. The development team participates by sharing user interface features related to licensing information on the product and introducing Pendo data that provides information on how the feature was accessed. Similarly, when the support team is invited to become part of the new network, they share information about the various kinds of information related to licensing that customers look for and the terminology used by them. The support team contributes to the Salesforce data to record information related to customer needs. Salesforce data helps technical communicators understand users' needs as articulated by them. By comparing Salesforce data to data analytics results, they are able to map terminology discrepancies such as registration VS licensing in product documentation.

Beyond revealing hidden actors, this case demonstrates the use of ANT to highlight the crucial role of technical communicators as data evangelists working across the company to understand how data is collected from users' interactions and how it impacts different business units across the organization. Using insights developed from an integration of data sets, technical communicators can identify and work towards resolving users' problems.

1. Data analytics tools cannot reveal useful insights in isolation. While the methods to collect data may not be visible, by making the data accessible to multiple stakeholders, organizations can resolve critical problems associated with content delivery.

2. To triangulate findings using all data sources, technical communicators create collaborations and partnerships with different business units across the organization, aiding their audience analysis efforts.

3. Technical communicators act as data analysts by identifying the most valuable problems to solve for an organization, suggesting which teams should be responsible for solving those problems, and confirming whether the problems have resolved using audience analysis techniques

4.3 Using ANT to analyze the error reporting framework (CS 3)

Technological affordances, such as those provided by GitHub to make context-specific changes, encourage users to provide practical feedback and take up civic responsibilities to fix qualitative content problems. For example, content updates on Wikipedia are often made to reflect day-to-day happenings such as names and logo images being changed to reflect the latest one used by the corresponding brand. Investigating content validity checks performed by users helps understand a possible method of informally utilizing users' expertise to test content to aid the task of maintaining content accuracy and the network responsible for enabling and supporting users while they participate in the validation process.

This case is similar to CS 1, as both are implemented on the GitHub platform. However, the cases diverge at the point where the task to incorporate the user's request becomes part of the project management system for the documentation platform. While the earlier case describes a user's interaction to make a content edit to make it relevant or useful to their specific case, this case demonstrates a unique approach employed by users to report documentation validation errors that they notice.

User Xunzhou interacts with the documentation platform which leads further to the GitHub interface. The moment of interaction is again important here as in CS 1 because it marks the transformation of the stable network into a destabilized one. The actor-network until the point Xunzhou participates in the content validation process consisted of the technical communicators and project managers who manage the content development platform and processes, the documentation platform's frontend and backend, as well as a team of content validators who test the content against validity, quality and needs of users.

In software companies, the task of content validation is often assigned to software testers who are responsible for testing the product and corresponding documentation with it. During content validation if testers find any problems they report bugs. 'Issues' on GitHub is a tool that allows anyone to file a bug or error report.

When Xunzhou opened a new issue, in other words, a bug was reported, but since it was not created through the conventional process i.e. testers creating the issue after the task of testing has been assigned to them, the network becomes destabilized. Although the existing network participants exist in the new destabilized network, some network responsibilities get assigned to the user by default. The user resides in the new network until the error is solved and in most cases can view and participate in the communication process that takes place until the error resolution.

ANT makes it possible to trace the new, complex network to reveal heterogeneous elements that cause the actors to interact, negotiate and work together, allowing and disallowing interference from external actors to stabilize the network. Figure 4.4 shows all the actors identified in the tracing of this actor-network and also depicts the translation process.

Figure 4.4 depicts the complex network which comprises several actors involved in the process of reporting an issue or error using the GitHub infrastructure. Punctualization permits reducing

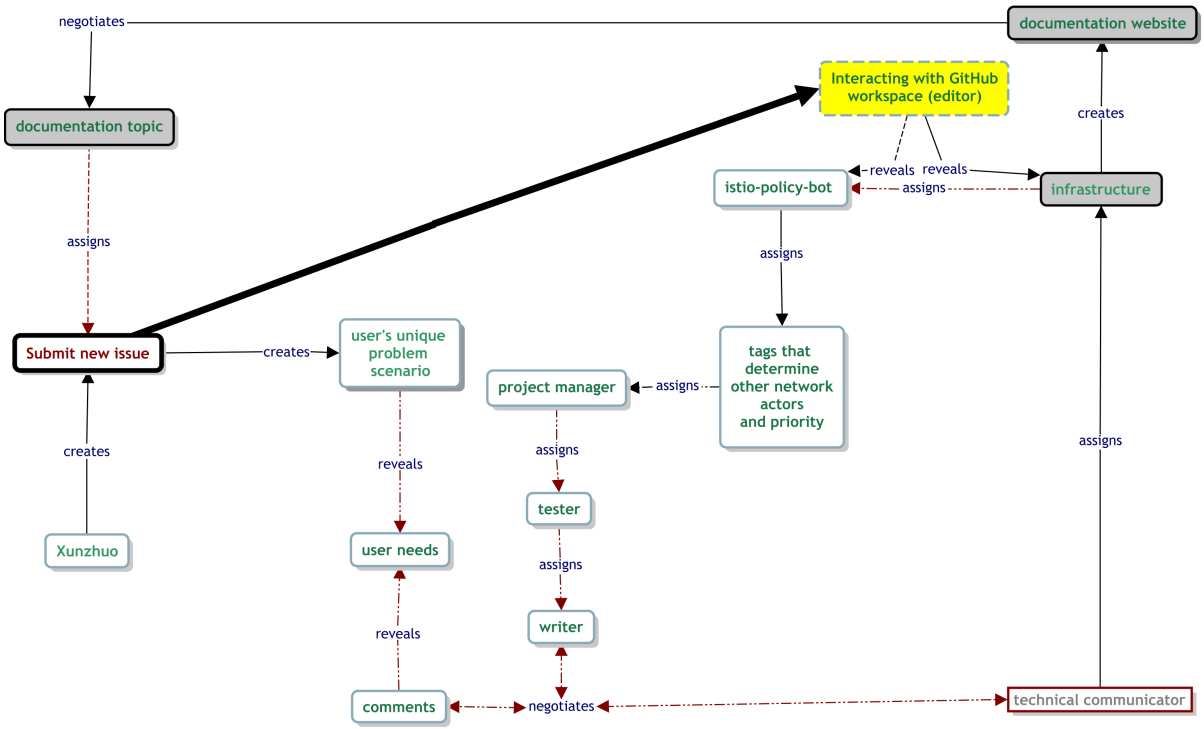


Figure 4.4 ANT analysis of user's interaction for error reporting (CS 3)

the complexity of the entire infrastructure system relevant to the documentation system that gets invoked when a user decides to submit an issue and depicting it as a single actor. CS 3 resembles CS 1 in many ways since both cases are based on the GitHub framework. However, CS 3 analyzes more project management components while CS 1 is used to investigate the content creation components of GitHub. This case involves both human and non-human actors that supervise and manage the process of supporting the error submission process, assigning the error to the corresponding stakeholders, and making sure it is resolved at the right time. The complexity of this process lies in the fact that actors associate and disassociate with the network after performing their role, thus making it difficult to conceptualize the network without tracing its actors at different stages. The chronological narrative describes these stages in more detail.

4.3.0.1 Chronological narrative of error reporting through user interactions

The chronological account of the error reporting process seeks to understand the role of all actors, including technical communicators and project managers who connect and disconnect from the network to perform their responsibilities. Error reporting or bug reporting is a standard process used in organizations to improve their product. Testers use different strategies to imagine scenarios in which users are capable of using the product, or interpreting the documentation, and the testers try to find errors in cases where users would not succeed. Bugs are reported and tasked to developers (in case of product bugs) and writers (in the case of documentation bugs) to be fixed and to ensure

that all scenarios of users' utilization of the products goes smoothly.

The CS 3 case if specifically for a documentation error so developers are eliminated from consideration. In cases where a user comes across a scenario which was not tested by the organization, documentation platforms like GitHub provide users with the opportunity to create an issue or in other words, report the bug themselves instead of the tester. After the error is submitted, the product manager of the corresponding product gets notified. Product (or project) managers are responsible for assigning the bug to authorized personnel to make sure the error is valid, and then for fixing it. The writers may choose to communicate with the user who reported the bug using the commenting feature. After the error is fixed, writers close the issue by marking it as fixed. The managers, users, and everyone involved in the process get notified and the case history is preserved under the category of closed issues, which may or may not be reopened in the future in case content for it changes. In short, users participate by reporting the error before exiting the network, project managers assign writers and enrol them into the network and exit, writers resolve the error and remain in the network until all actors previously enrolled accept the resolution. This non-linear, iterative process destabilizes the network and can be analyzed using Actor Network Theory.

Tracing actors involved in this process helps to delineate not only the participation of different actors but also to consider different roles played by the same actor. This case study helps reveal the additional roles played by technical communicators in error reporting processes and unique scenarios suggested by users through their interactions.

4.3.0.2 Stabilizing the new actor-network

The new actor-network that gets created to involve actors temporarily to fix errors contributes to the process of improving documentation and making it error-free by acknowledging all possible subjectivities of audiences. In this case study, the network is destabilized when users participate in the network by reporting errors. The process is traced using ANT's phases of translation (problematization, interessement, and enrollment) to understand the entry and exit points of actors and to reveal any hidden actors before being stabilized.

- **Problematization**: The technical communicator has been identified as the focal actor in this case for two reasons: a) they are constantly present in the network, b) the network tracing reveals that the technical communicator is responsible for setting up the infrastructure to enable other actors to perform their roles. The problematization phase in CS 3 also consists of two steps. In the first phase, the focal actor associated with the network identifies potential actors and identifies their roles and interests to resolve the new issue submitted by user. In the second, the focal actor assigns responsibilities based on the problem as identified and defined by them. Based on a strategy developed by the focal actor, the GitHub workspace is set up to automatically enrol different actors and allow them to enter and exit the workspace. The GitHub workspace acts as the obligatory passage point (OPP). Without GitHub, all stakeholders will have to be identified manually by the user to ensure their request to resolve an issue has

been detected. As the users lack organization's internal knowledge, the network would remain incomplete and the issue unresolved. The goal of all actors in this process is to make the documentation accurate by considering subjectivities of all users. The GitHub environment needs to enroll actors that can be made responsible for completing actions that would result in the issue getting resolved making the public facing documentation accurate.

- **Interessement**: To enroll actors, first they need to be notified and given responsibilities. The istio-policy-bot is designed and set up to assign the documentation team to an issue if users pick Documentation as the category when reporting the bug. The bot is an automated algorithm that is also constantly running in the background of the GitHub framework to ensure that users' interactions are recorded. The bot assigns the tag *kind/docs* to identify the problem as related to documentation which notifies the documentation team, in this case howardjohn, who identifies as an employee of the organization on GitHub. The manager in this case is also the writer for the project who validates the error and communicates with the user to communicate ways in which it can be fixed.

- **Enrollment**: The enrollment phase begins providing the users with necessary tools to create and submit an issue. User Xunzhuo fills in necessary details in the structure set up by technical communicators which helps them understand the issue. The user selects the category of the issue as 'Documentation' which then notifies the bot. The istio-policy-bot enters the network and assigns the tag 'kind/docs' to the issue. The technical communicator gets notified when the tag is set to documentation and monitors the process of fixing the issue from then onward. While the user and bot may enter and exit the the network only when triggered, the technical communicator ensures that the infrastructure is set up for users, bots and other actors to participate in the process. The technical communicator, howardjohn, enrolls other actors such as the reviewer for validating the error, testing the method used to resolve it and to communicate with the user while the error is being resolved. All actors' roles including the bot are assigned to them in a manner defined by technical communicators. While communicating with actors involved in the process, technical communicators identify subjectivities of users, document them (as comments), and may choose to convey them to the relevant stakeholders. The overall network is supervised by them making their role crucial for the network.

Although the translation process for CS 3 is not covered until the issue gets resolved, the primary goal was to identify the focal actor and trace how users' interactions are handled. Along with revealing the process of enrollment, the various activities of technical communicators were also revealed through the translation process. The main findings are as follows:

1. Open authoring environments and infrastructures such as GitHub allow technical communicators, as well as users, to participate in organizational processes more intimately.

2. Users are able to create issues to communicate with all the organization's stakeholders about their needs which stem out of their subjectivities.

3. Technical communicators assist in knowledge production practices through project management activities.

4. Technical communicators are always responsible for validating content accuracy by taking roles such as reviewers (in more traditional settings) and software testers in open authoring environments.

4.4 Benefits of using ANT concepts

Working with ANT enables us to describe and enact associations in networked realities in ways that we believe improve our understanding of the workings and doings of the network. As described in the previous chapter (see 3), an important characteristic of ANT studies is their stress on general symmetry to observe the role of human and nonhuman elements. It insists that researchers should refute all pre-given distinctions between categories of possible actors (natural/social, local/global, and economic/cultural) and focus instead on the process of network building and network consolidation [23, 95, 110]. Consequently, ANT approaches the world as consisting of heterogeneous relations and practices through which humans and nonhumans alike are treated as possible actors. From this follows that we cannot take anything for granted, and since everything is an effect of relational practices (as actors are assembled and structures are arranged in a recursive process of networking or translation), ordering of those practices becomes important. ANT allows us, or in some cases forces us, to assume some stabilities of networks to establish orderings for the purpose of analyses. The assumptions made for this research are supported by ANT features such as multiplicity, the aspect of social, and decentralization and are important considerations that have a direct correlation with the findings of this research.

4.4.1 Multiplicity

Multiplicity highlights that actions involved in an event can have multiple consequences in terms of when each of them were performed and there is no final ground or a root order on which ordering work is based [44]. Furthermore, multiple realities entail the presence and absence of each action in every ordering attempt. This implies a condition of incommensurability of the elements making up our realities, that is, no single order, determining the world into a coherent whole is attainable [71]. ANT helps us draw attention to a heterogeneous ordering work underlying what seems to be more or less stable features of a network. In this research, user interactions give rise to various series of events. However, with small differences in actions, there would be infinite possibilities of what happens next. For example, if a user creates an Issue on GitHub, but does not provide a sufficient explanation of what the issue is, the issue might never get resolved and lie in the stack forever. In order to order events chronologically, all properties of the network when all actors described in the findings are assumed to be present and stable when the analysis is performed.

4.4.2 The social aspect

By abandoning the differential attributes between humans and non-humans, ANT depicts the world as a mobile arrangement [44]. Any network's projection created by ANT can thus always be represented by an association of heterogeneous elements. ANT does not strive to uncover the "order of things," but rather to describe the diverse orderings through which each process of translation takes place. Although the elements are heterogeneous and disconnected, because of generalized symmetry, each of them is assumed to have the capacity to enact – to integrate, connect, disconnect with other elements creating stable networks when all actors agree with one another, or controversies when there are disagreements. Thus, ANT brings out the social aspects that give networks a structure to allow heterogeneous elements to group together.

4.4.3 Decentralization

While groupings are important to give the network its structure, the space between network actors is important to see how elements are connected with one another. All actors seem to be connected to one another, but the space between them conveys the relationship that they have and the power one actor has over another. Spatial formations help conceptualize the length, distance, location, power, dimension, size and scale between two elements. These properties help in describing what is local or global, intrinsic or extrinsic, which changes the theoretical understanding of the network structure. For analyzing case studies, network tracing began at the moment of user interaction, which was assumed as the primary actor. However, without the primary actor, the same network can be traced to find the relationship between various actors. If the actors' distance with respect to the primary actor grows, their role in the network does not become weaker or stronger, thus maintaining network decentralization.

These considerations of Actor Network Theory invite us to inspect knowledge networks created by user interactions through a more complex topological approach to analyze user interaction processes and ordering of events as they stretch through space and time, localizing and globalizing actors along the way. Actor network theory is really not a method as mentioned in the previous chapter (see 3), but an overarching approach to thinking about interactions between documentation systems, users, and technical communicators as social interactions. Applying Actor Network Theory allows us to think about these social interactions as socially integrated systems where all these three elements are treated equally and create dynamic networks as and while they intersect with one another.

The findings from analyzing each of the case studies help in not only identifying the impact of users' interactions on technical communication processes, but also provide a methodological framework to analyze other similar interactions in technical communication spaces. However, simply implementing the framework is not sufficient. Employing skills that will help technical communicators to set-up infrastructures to capture user interactions, and then interpret those interactions using specialized skills and/or project management practices, are key to audience analysis practices.

The next chapter provides more details on these findings which will help understand implications of this research on the technical communication field and generate relevant discussions in both pedagogical and practitioner spaces.

CHAPTER

5

AUDIENCE ANALYSIS FRAMEWORKS AND IMPLICATIONS ON THE FIELD

Chapter 4 details the findings from analyzing case studies where audience interactions were recorded. Actor Network theory (ANT) was used to trace the impact of audience interactions on software documentation production networks for this study and the goal was to draw attention to the visible and invisible data that is created as a result of users' implicit interactions with documentation systems. The ANT analysis shows how the data about user interactions reveals the translations that allow users to engage with documentation in an agential and mobilized form which is different from what earlier studies have shown.

Little research in the field discusses the concept of audiences' involvement in technical communication spaces. Most of that research analyzes audience involvement only through quantitative and qualitative analysis of visible data. This research goes beyond that to propose a methodological framework to not only reveal data generated by users to find out more about their needs, but also to suggest a systematic way to encourage users to contribute content specific to their unique use-cases. This chapter discusses the proposed methodological framework and highlights technical communicators' roles to implement the framework, thereby answering the primary research questions of this study which are a) How are user contributions aiding the process of audience analysis, and b) How do audience contributions impact the role of technical communicators. To do so, the following sections map the key findings of this research to the current understanding of audiences, point out what is missing in those conceptualizations, to see how the evidence of users interactions reveal what kind of audiences we are dealing with, and to make recommendations on how to track the

evolving nature of audiences and their participation in knowledge networks.

This chapter brings together key content from previous chapters to argue that:

- Audiences have shifted from being content consumers to content contributors. Interviews with technical communication practitioners demonstrated the different ways in which content contributions were recorded. These ways have shifted the understanding of audiences and we need to carefully analyze audiences' positions in the content ecology to make accurate assumptions about their characteristics and predictions about their information needs.

- The role of technology is crucial in bridging the communication gaps between audiences and technical communicators. Unless audiences' interactions through technological systems are analyzed, we will miss out on the opportunity of understanding them and connecting with them. This research uses Actor Network theory to reveal those connections, however, that is not the only approach to study them. A conceptual methodological framework is proposed to conduct the analysis using the most convenient method available to technical communicators.

- Writers roles need to adapt to the shifting conceptualizations of audiences and the evolving nature of audience needs. Writers can either collaborate with specialized personnel to interpret audiences' interactions, or develop skill sets to not only perform the analysis themselves, but also to develop systems that can encourage audiences to participate in knowledge development processes.

- An audience analysis framework proposed in this study can be used to aid audience analysis studies. The framework consists of 1) identifying, where audiences' interactions are identified 2) planning, where a plan is laid out in order to analyze data from those interactions 3) testing, where conventional audience analysis techniques are used to validate results from using the framework.

The next sections lay out these points in detail starting with the renewed conceptualization of audiences found through this study and concluding by proposing the new methodological framework to analyze audiences to figure out such conceptualizations in software documentation spaces.

5.1 Audience as content contributors

The findings of this research show that audiences are actively participating in content production. Sometimes the content they create may be hidden, such as in the case of data analytics where audience information is recorded automatically; or hidden on documentation platforms where audiences can access it only through the server space (such as GitHub); while in some others it may be visible via GitHub Issues to technical audiences. Jonathan Saunders, a technical writer at Uber, an invited guest for the 10 minute Techcomm podcast hosted by Ryan Weber, mentioned how users of technical documentation content (such as developers) want to actively participate in writing

documentation so that it represents their use cases. He also mentions that user participation is made easy through platforms like GitHub supported by free content editors, and formats like Markdown that programmers and other technical users are already familiar with. Since the conception of technical communication as a field, the necessity to understand users' needs and to update our interpretations of users based on those needs have changed our understanding of audiences and consequently the methods to study them.

The definitions of audiences are constantly changing. For example, if we look at the history of audiences in the field of rhetoric, it only took less than three decades to change the conceptualization of audiences as being a fixed part of the rhetorical situation [11], to audience as a conglomeration of social elements that are in a constant flux [10, 120], to audience as an ecology of effects, enactments, and events created by shifting the lines of focus from rhetorical situations to rhetorical ecologies. Audiences in the field of composition saw a similar shift around the same period of time. The idea that audiences are passive consumers of writing, born from the imagination of writers [114], shifted quickly to looking at audiences as critics of writers' work who receive content and provide feedback that then needs to be incorporated into the information that writers are responsible for producing [47]. New methods had to be developed to the audiences, and different strategies were designed to equip technical communicators with proper audience analysis tools. The work of media theorists gets closer to defining online audiences' interaction with content making them producers of content [20], but needs constant updates as technologies are changing and spaces of interactions are becoming more complex and concealed. Thus, audiences, and the methods used to study them evolve simultaneously.

Among the existing methods analyzing audiences, qualitative and quantitative are the most common. Qualitative content is collected through usability studies, surveys, interviews, focus groups, social media, publicly posted comments, and so on. While quantitative analysis also uses some of these types of data, additional measurable parameters such as upvotes on user forums, likes on social media, number of page views for web and multimedia content, are more widely used. To make sense of data, these methods attempt to employ a broad range of dichotomies such as active/passive, imagined/role-based, universal/particular, single/multiple for classification (see Chapter 2). Such extreme polarities create tensions in understanding multiplicities of audience types, and lead to a lack of representation of individual audience characteristics. This study helps to resolve this issue by focusing on data collection and interpretation from a more holistic perspective.

Rather than focusing on data in the form of feedback that the existing methods do, this study relies on triangulating data from various sources and collaborating with multiple stakeholders to develop a useful interpretation of the types of audiences who are then placed on a spectrum rather than on the aforementioned dichotomies terms of their contributions. For example, when users comment on a blog post, we can say that they are involved in content development through their interactions. However, since their feedback is content-specific it can only shed insights on that single unit of information. The case studies identified for this research locate audience interactions where content is designed to provide knowledge and not to create engagement. Therefore, analysis

of users' interactions provide insights on the entire product documentation, to develop a more complete picture of their perspectives, needs, and subjectivities.

5.1.1 Multiple audiences and audience adaptation

Carolyn Miller goes beyond the "universal and particular" audiences to explain the idea of multiple audiences as some audiences are capable of seeing some aspects of reality that others are not [103] which leads us to audience adaptation. To understand multiple audiences, Spilka argues that we need to understand their needs which are influenced by not only what roles they play, but also by social contexts and individual interactions and changing rhetorical situations [141]. Findings from case studies used for this research highlight audiences' adaptable behavior. In each of the cases, users' interactions destabilize the initially stable knowledge network (see Chapter 4). In other words, passive audiences, who were initially engaged in content consumption, notice an exigence which motivates them to take necessary steps to modify content, thus making them active participants in content production. The entire product documentation platform is the test field rather than a specific topic that writers hope to test for usefulness and validity (like that of usability testing). After making the desired change in the content ecology, audiences in each case go back to their roles as passive consumers of content. This process places them on a continuum of not only active/passive interaction, but also for the following categories mentioned in Chapter 2:

- fixed/temporary (flexible) as audiences volunteer to mobilize their place from the receiving end of the communication process to that of the active contributing on an entirely volunteer basis
- general/specific based on the type of content they are able to contribute, for example, communicating a specific requirement of translating content to Chinese, as opposed to fixing a typo for accuracy of general audiences
- external/internal when audiences contribute to the content on the documentation server which allows them to engage with content to act as important stakeholders of the organization
- imagined/role-based when audiences participate to validate content written to meet their needs as imagined by writers

While these results have been acquired through a preliminary analysis, more research needs to be done in order to compare the results to develop parallels with other binary conceptualizations of audiences. Technology plays a crucial role in enabling audiences which is described in the next section.

5.2 Role of technology in audience analysis networks

Web 2.0 drastically changed the meaning of 'audience invoked' and 'audience involved' as defined by Ede and Lunsford [47]. Interactive websites such as blogs, social networking sites, user forums,

and general call-and response web-writing dramatically changed the focus on writer –"It is the writer who, as writer and reader of his or her own text, one guided by a sense of purpose and by the particularities of a specific rhetorical situation, establishes the range of potential roles an audience may play" (p. 166) – to the audience. Writers may be guided by a sense of their audience for these web-texts, but they started being literally guided by their audiences as well. Obviously, the change in control was drastic compared to that afforded by print technology. While technological affordances warrant new conceptualizations of audiences, it is important to understand why once conceptualization can vary from the other by closely analyzing the affordances provided by one over another.

The use of Actor Network Theory placed emphasis on the notions of translation and control that are crucial to examine the tensions between the various actors in the network involved during the process of user interactions to create content including enterprise software such as GitHub, Salesforce, Google Analytics and Pendo. The findings show that this process was characterised by exchange of control, communication, and negotiation between actors, as well as a linear transactional model afforded by technology. Technology had a significant impact on the formation of associations, especially dependencies, between actors during the translation process that ended up shaping participation in the network. We can say that technology led to the development of networks by enabling users to interact and participate in the network, and also that technology supported the growth of an actor-network by facilitating negotiations.

Data gathered from interviews supported this finding. Most practitioners suggested that they relied on technology to establish a direct or indirect communication channel with their users. Writers use technology to persuade their readers to provide feedback on the written material. Similarly, technological frameworks are also used to make participation more accessible for users who wish to validate content, report errors, or provide more information about their problems. The first and third case studies relied on a GitHub framework which was set up in a way to help audiences believe that they were making changes to the public facing content. In case study 2, data analytics tools were set up in a way as to record various types of data about the users and then triangulate findings to make approximate predictions about audience behavior about content consumption and navigation.

To successfully record user interactions, technical communicators have to ensure they set up a technological framework in two stages: first, to invite participation, and second to provide necessary support to link the users to the network until they have successfully contributed the desired inputs. The next section describes these roles in more detail.

5.3 Impact on the role of technical communicators

Several scholars have conducted research to document the impact of technology on the roles of technical communicators from their own perspectives. This section answers the second research question about how audience interactions that produce content can impact the work of technical communicators. These results are not meant to be generalized, but to be used to develop a new

perspective to study audiences in similar scenarios. The results can be extended to pursue research on audience models and the role of infrastructure as well (which is beyond the scope of this study).

Data was collected for this research from practitioner interviews as well as case studies making it most relevant to practice. As the data was acquired primarily from product documentation spaces in software and technology companies, it is most relevant to technical communicators who work in these fields. The data analysis results suggest that technical communicators' roles have shifted from being producers of content to managers of organizational processes, that are carried out by making sense of the contributions made by audiences.

Traditionally, the primary task of technical writers in software product documentation companies was to create instructions and reference materials for users who wished to use the technological products. In a few instances, people were hired with formal training in technical writing, but during the 1970s, employers typically emphasized technical knowledge over writing skill [140]. Field experience with the product was also sought from editors and illustrators, though they, too, could expect to receive specialized training in those areas. Writers prepared the content and nearly all of it was published in printed form. Help documentation was seen as a supplemental resource.

In the 1980s as the production and use of personal computers grew, an additional emphasis was placed on documentation as it helped users to perform simple tasks with the use of instructions. To do more complex tasks, technical support personnel were hired who also provided users with case-specific help. For example, if a user's computer broke down or needed reassembling, their requirement was considered unique and they could get help from contractors or technical support, the technical experts, who provided the service for a price. Both support and documentation were supplemental resources, and could be easily distributed and more widely used. Primary focus was still on the product than the users, but technical communicators started attempting to understand their audiences to whom their content was distributed to ensure it was useful and accessible.

In the 2000s, U.S.-based companies grew substantially and content increasingly needed to be translated and localized. Writers' tasks grew beyond writing as they tried to influence the design of the systems so that they would pose fewer barriers to users, and enhance the overall usability of products. Writers came to be known as information developers who saw themselves as the user advocates and began using multiple methods to learn about users. Although product and technical expertise continued to be highly valued, because the new job emphasized synthesizing information in context to understand users, and employing a variety of communication skills to create technical content, the preferred job candidate for information development positions required formal training in technical communication or a similar field.

Usability testing was more common until recently. The previous chapters discuss other methods used by writers to understand audiences. This section demonstrates that not only do writers need to employ different skills, they also need to attach to and detach from organizational processes outside of those related to content development. Some of these responsibilities were shared by practitioners during the interviews. Not only were those responsibilities validated in the case study analyses, but some others are added to the list that even technical communication practitioners are not aware of,

but engage with. In the interviews practitioners mentioned the following roles:

- **Content moderators**: As more users are contributing to content platforms, technical communicators' roles are shifting to becoming content moderators. For example, in case study 1, user thethales added a few new lines of content. The designated technical communicator DOMARS not only helped merge the content into the public facing documentation, but before doing that, reviewed it and made sure the information was accurate and suitable for use by other audiences in addition to the user posting it.

- **Reviewers**: The previous example described a writer's role in moderating content after reviewing it. Although we can say that the reviewing tasks are not new; writers have always conducted peer reviews within technical communication teams before publishing. But in the case studies analyzed for this research, writers are responsible for reviewing content generated by other stakeholders as well.

- **Product testers**: Writers commented that in cases where users have reported errors in the content on documentation sites, as recorded in case 3, writers first try to reproduce the errors and then solve it by creating appropriate content. Traditionally, this task was performed by software testers or the quality assurance team. Due to the direct communication channels between users and writers, writers are able to participate in such processes that ensure accuracy of content. This also entails that writers have technical expertise to perform the steps required to reproduce the bugs.

- **Content strategists**: Writers' tasks have grown beyond writing to develop information designs that will not only make documentation platforms usable, but also enable users to interact with content more freely. Although only a few participants had these experiences, most participants agreed that their teams are increasingly expected to get involved in usability testing and content strategy operations.

Other roles that were identified from analyzing case studies:

- **Technical support specialists**: As seen from the case studies, platforms like Github have made direct communication possible between users and technical communicators. Exchange of information through comments on Github provide evidence of a direct conversation channel. Such interactions are observed as being similar to the one-on-one conversations that take place between support specialists and users. Social media, official user forums, and other communication channels like Slack, that enable users and technical communicators to interact directly with each other are other methods of supporting users and resolving their problems. Although only few interview participants mentioned that they played the roles of support specialists, the correlation was made based on the nature of responsibilities that got created due to technological affordances.

- **Data analysts**: Users activities on web platforms are recorded by tools like Google Analytics. These interactions create an overwhelming amount of content. Technical communicators

have to employ statistical skills and also collaborate with data scientists, marketing teams, and other stakeholders throughout the organization to make sense of that data and understand audience behavior.

- **Project managers**: This role was seen in two instances: first, in case study 3, technical communicators were responsible for assigning the error to the appropriate stakeholder to be resolved, assigning priority to the issue, and assisting in other project management tasks. Second, in case study 1 it was observed that technical communicators were responsible for developing infrastructural support to enable users to communicate effectively. For example, setting up the GitHub framework, providing users with the syntax to input content, and finally, to create bots that assign appropriate tags and priorities to the content added, require systematic processes which are handled by technical communicators or their managers.

The scholarly work to describe these roles is limited. More research is needed to understand the specificities of each of these roles and to what extent can writers' involvement make product documentation spaces more effective. A systematic analysis of available data will help in such research, not only to extend the scholarship on audience analysis, but also for practitioners to play the above mentioned roles successfully. The next section outlines one method of doing so.

5.4 Framework for audience analysis

While answering the research questions of this dissertation, two main goals were accomplished: first, the literature review and case studies analyses revealed that we need a new conceptualization of audiences that is based on analyzing users' needs in real-time, using contributions they make to product documentation platforms; second, technical communicators play additional roles to facilitate the audience analysis process. Although these activities are carried out in most organizations, a clear and systematic description of the steps to perform such analyses are missing from technical communication literature. This section describes a three-step process that will enable technical communicators to use their existing humanities and computational skills to conduct detailed audience studies by finding ways to collect audience data by recording audience interactions, and making useful collaborations to find meaning from that data.

This methodology builds on theory-based and objective-driven analysis components. It (1) develops and builds on a conceptual model of audience analysis to retrieve useful data; (2) investigates associations between goals and stakeholders who can help achieve those goals; (3) uses structured communication systems to create links between the data and outcomes.

5.4.1 Step 1: Planning

During this phase the technical communicators (or other stakeholders interested in understanding audience needs) will first make a list of all the elements that can be used for audience analysis and frame research questions that need to be answered about audiences. This methodology tracks

the logical sequence and coherence of planned elements that include user interactions tracking mechanisms, the available data about audiences, organizational goals, funding requirements to make sense of the data, policies, methods, and anticipated results. This step relies on 'plan logic mapping' to determine whether the plan is logically capable of achieving its anticipated outcomes through provisions. The technical communicators will map their needs (of understanding audiences) to the organizational goals, and make decisions about which questions should be answered and how can the available elements help in that. Unrealistic goals will be eliminated or recorded for a future iteration. The output of this process is a list of research questions that align with organizational goals and can be addressed using available data (or from data which can be made available by manipulation of available resources).

5.4.2 Step 2: Implementation

The second step is an objective-driven process to make sure that we meet the goals outlined in step 1. This step calls for an evaluation of the associations between different stakeholders who participate in the data generation activity, as well as those who can help in data analysis activities. Stakeholders who have access to data may not often think of using it for audience analysis purposes. If technical communicators are able to match that data to the goals of the project by tracing human and computational associations that will help them do so, those stakeholders, processes, and methods should be outlined. The implementation process ensures that necessary steps are being taken, and relevant organizational stakeholders are participating, in order to address research questions. This step can be theoretical and data-driven, especially if it relies on organizational structures and/or secondary data. The lack of access to organizational structures limits the degree to which associations can be traced, or attributed, while being mapped to the existing plans. This step provides information about the progress toward achieving goals, but does not attribute outcomes to planning actions.

5.4.3 Step 3: Testing

The third step seeks to explain the outcomes observed. It builds on local and contextual knowledge to identify the audiences based on the impacts of the plan, the influence of plan and non-plan factors, helpful associations created with relevant stakeholders and the unintended consequences of planning activities. The audience analysis is obtained through structured and deliberative contextualizations derived from a combination of observations made by expert-driven data analysis as well as audience contextualization before data was introduced to the planning process. The outcomes are also compared to other observations about audience analysis to understand whether they confirm, or contradict those observations. These results can initiate an iterative execution of this model which can be performed multiple times to achieve strong findings about audiences.

This methodology provides an informed conceptual framework of factors that influence audience relationships with software product documentation and their relative associations with

different organizational groups and stakeholders. It helps in carving out a new conceptualization of audience definitions as explained by the following example.

5.4.4 Open authoring – example scenario

One of the benefits of the open authoring approach is that audiences can participate in content development processes. One example is the first case study where GitHub is used to collect audiences' feedback on documentation, where users can directly post to the platform itself. The methodological framework begins with the planning stage. For this case, some potential research questions would be: 1) How can we identify users' needs from the information that they are contributing? This aligns with the organization's goals because the technical communication team is meant to create content that is useful to their audience. It is important to check if there are sufficient resources available to help answer the research question. Users contributions will be collected through the GitHub infrastructure that is set up by the organization. Technical communicators have access to that data. They are also able to define the formats and syntax through which users can add new content to the platform through instructions embedded in the editor pane.

In the second step, technical communicators will first review the content to ensure it represents the need of a wider audience and needs the documentation content to change. Next, they find associations of that additional content with other stakeholders. If the content is of a technical nature, interventions may be needed from other technical experts within the organization to ensure the validity and accuracy of the content. After making such checks, and dependency roles, the content will be accepted and pushed for publishing.

In the final stage, based on the inputs received from users through the updated content, technical communicators will be able to see a new need in what information do audience need, and how they go about looking for it. In some case these needs might be termed as specific to the user subjectivity, but in some others might be representative of broader audience requirements. Evaluating these implications will help technical communicators change their conceptualization of audiences.

This methodology for audience analysis responds to local planning contexts within organizations and integrates the expertise of technical communicators as well as other stakeholders interested in developing audience models for the organization. The methodology not only enables employees to work together, but also reveals whether the goals are achieved. In this manner, the main outcomes of this study are not just to provide more ways to record implicit user interactions to reveal invisible data and content creation practices, but also to think of new methods that can help analyze such data to learn more about audiences.

This methodology is in the process of implementation for a study where audience analysis is being done using data from data analytics tools. The results will be used to conduct future research on processes to conduct specific data analysis and metrics development. Some positive features of this methodology are that it can be used to conduct inclusive design work to include audience concerns while also building collaborations within the organization to be able to do that. While users can leave feedback, they can also engage in conversations about the content update. The direct

communication process allows them to develop relevant solutions for problems that are context-specific to users' needs. Apart from inclusivity, the methodology uses an interdisciplinary approach allowing diverse entities across the organization to participate in audience analysis unlike usability testing or other methods that focus only on few (in most cases just one) teams. Another advantage is that unlike usability testing, audience data is collected from a larger sample of audiences. Since all audiences participate (either knowingly on platforms like GitHub, or unknowingly through data analytics) there is a higher likelihood of finding audience needs that are representative of a bigger audience sample. This creates some challenges and concerns for technical communicators.

Production documentation platforms are primarily designed for disseminating information to audiences, not for soliciting inputs. Therefore, technical communicators will have to focus on the information design aspect to develop infrastructures that welcome users' feedback. This raises concerns about incentivization, free labor, and transparency about users' work for organizations. Such issues must be analyzed more carefully and audiences must have a choice of participation. The next chapter discusses the limitations of this research and implications for the field of technical communication.

CHAPTER

6

CONCLUSION

This chapter shows how all the work described in the previous chapters works together to make contributions to the field of technical communication. It describes how the aims of the study were met, how the research questions were answered, how the findings can be applied to the study and practice of technical communication. The chapter begins a discussion on how this study contributes to existing knowledge in the field, especially what the implications are on theory and practice. It concludes by considering the limitations of the study and by suggesting directions for further research.

I opened this project by asking questions: how users interactions were creating content and what could we learn from them about users? Additionally, how do these new conceptualizations of audiences change the role of technical communicators? The data collection and analyses processes were focused on enabling me to answer these questions. Interviews with practitioners confirmed some assumptions about technical communicators' intentions about encouraging audiences to participate in content evaluation tasks by contributing content. The case studies affirmed 1) the presence of data which results from audience's interactions with product documentation platforms; 2) the role that technical communicators play in order to make sense of such data. Technical communicators can derive users' needs as well as their characteristics from analyzing content contributed by users. To do so, I recommend using a methodological framework to strategically collect and make sense of information that is hidden due to the invisible, black-boxed communication platforms embedded within documentation websites. Revealing those embedded communication platforms to analyze users' interactions help steer away from the audience dichotomies described in Chapter 2 to think about audience involvement as being on a spectrum from active to passive, universal to particular, imagined to role based, single to multiple, and so on. Their involvement leaves traces

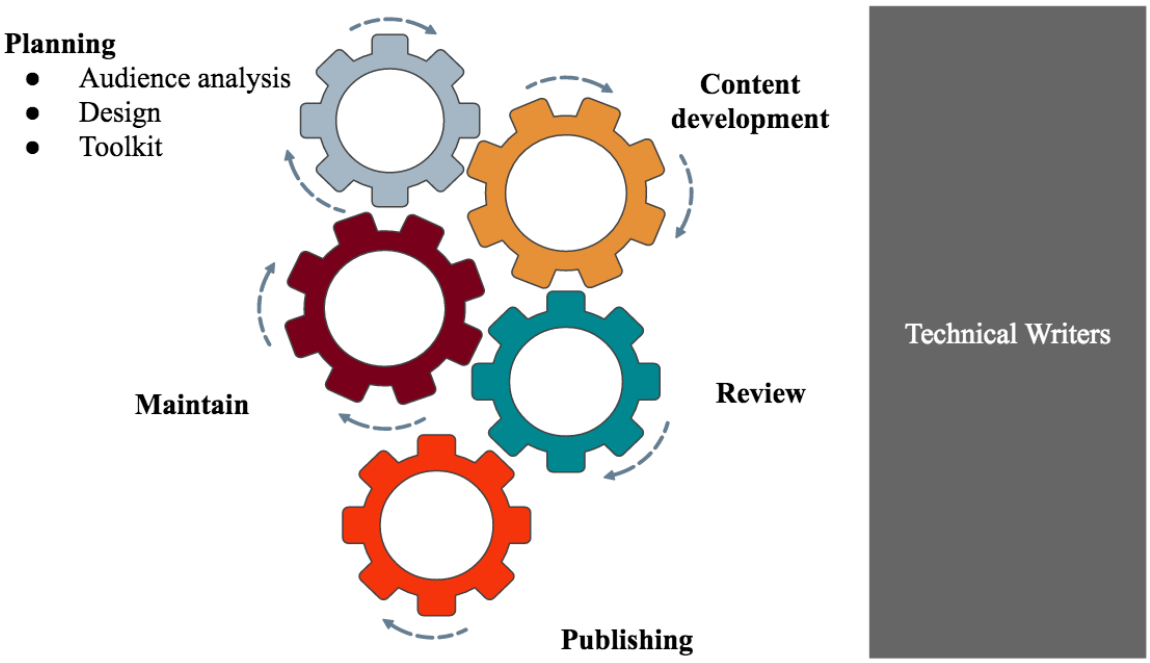


Figure 6.1 Conventional DDLC

of their needs and problems, intentionally or otherwise. The method used to identify traces of their activity reveals moments they connect and disconnect from platforms. The following sections describe the rhetorical, pedagogical and practical implications of this new conceptualization of audience involvement. Before discussing the answer to the above mentioned research questions, it is important to understand the traditional documentation development life cycle to show what changes once users start getting involved. Documentation life cycle, similar to a product life cycle in software organizations, starts with planning, where writers analyze audiences, develop platforms for content development and delivery, and manage deploying content by following the principles of information design (see Figure 6.1). They develop content which is reviewed by technical reviewers and writing editors and then published. After documentation is published it goes through constant changes to reflect the updates of the corresponding product.

When users enter this process, first of all, they directly jump into the writing phase. They make changes based on their specific needs and accessibility concerns (see Figure 6.2). These inputs can help writers to derive subjectivities of their audiences and create appropriate content. To understand audiences' participation, first we need to find out which are the spaces in which audiences are contributing to.

Some of these inputs were collected through interviews with practitioners and the remaining through case studies. Most technical communication practitioners mentioned that they pay attention to users' interactions for audience analysis purposes. In all, 19 practitioners from 12 different organizations across the country were interviewed. There were over 13 ways in which audiences in-

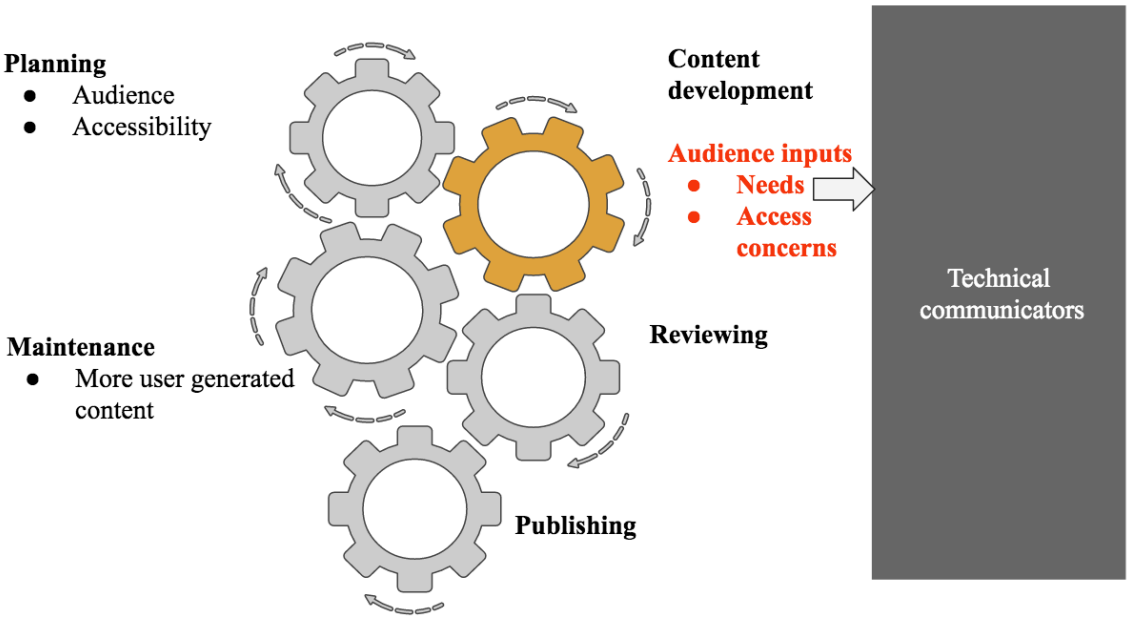


Figure 6.2 Updated DDLC after user interaction

teracted with documentation platforms and technical communicators' could use all those methods to learn about audience needs. The next part of the research looked closely at 3 of the 13 methods mentioned by practitioners. These 3 cases were modeled as networks since they consisted of human and non-human components; the input of the network was users' interactions and tools used for those, while the output was the content created as a result, and the transformation of roles of everyone involved in the network to make sense of that content. Actor network theory was used to trace these networks, especially the transformations that took place in the human and non human entities.

In this project's case studies, audiences are engaged in ongoing cycles of content production. Although they do not always intend to, they can be seen as producers of content. Their engagement with content development, and interaction with interfaces that causes them to create content toggles between active and passive. These constantly changing network structures, based on the involvement of audiences, for content production and distribution are aided by infrastructure. Especially Web 2.0 helps us look at audiences and how they fit with the larger theories of writing and rhetoric in online information systems. In this sense, the concept of audiences as content producers can be clearly explained through the systematic analyses of the case studies.

Additionally, the concept of audiences can also be described using rhetorical theory. However, the exchange of audiences roles, and well as the transformation of the network that they participate in, challenges the notions allowed by rhetoric. Ede and Lunsford [47] explain audience addressed and audience invoked as a byproduct of a rhetorical situation. They call it a paradigm which is situated in static, non-electronic texts. Gallagher [56] updates the conceptualization to add emerging

as a more useful way of thinking about the audiences than the address/invoke paradigm. Their conceptualizations are guided by a sense of purpose and by the particularities of a specific rhetorical situations. It is clear that to learn more about audiences, we need to learn more about the situations that they are part of. Bitzer's model consists of exigence, audience and constraints [11]. Miller [104] and Edbauer [46] argue that the dimensions of history and movement alter our visions/versions of rhetoric's public situations. Fatima Pashaei [118] argues that as discourse circulates through various environments, spaces, times, and societies, it results into a multitude of possibilities for interaction and engagement between writers and their discursive publics. Pashaei uses the rhetorical situation to study the identity creation of muslim women using blogs [118]. None of these can be used to fit the definitions of audiences as content producers because 1) we will need to freeze audiences into a single moment of interaction to be able to analyze the situation they are in. But their movement from one position to another in a single case study makes that challenging; 2) Audiences are operating on their own sense of purpose, and not the technical communicators'. Their level of interactivity can only lead to co-production and formation of a network. Therefore, the Actor Network Theory was seen as the best approach to analyze the cases.

The results about audience's involvement and subsequent changes to technical communicators' roles based on each of the case studies are as follows:

1. **Technical communicator as obligatory passage point** In the first case, I analyzed a pull request created by a user who suggested adding a new set of instructions to a product documentation topic. To perform such a task, the user first has to click on the edit button on the product documentation page, enter GitHub, login to record authorship, and make the change and then commit/save their work with a remark for the writer who will potentially approve it. A copy of the entire version gets created with this new change. The technical writer receives a notification about the change. Their job is then to act on it. First by locating the change, making sure that the change is actually valid, changing the style of content to meet company standards, sharing the change with reviewers to make sure no technical errors exist and then merge it to be published on the public platform. We see that writers play the role of what is called 'the obligatory passage point in this process'. Although they play the most important role to drive a content update, the underlying GitHub infrastructure and the documentation website also play an important part. In addition to that, Markdown language is used to add content, it's syntax and editor are part of the user's toolkit which are originally designed by the technical communicator. Finally, the edit icon on the documentation page and instructions provided by authors for users who wish to make changes located on another website, are all important components of the knowledge making process. Writers play the role of first the moderator, followed by tester/quality assurance personnel and finally of an editor.

2. **Technical communicator as network administrator** In the second case, users' interactions create content in an invisible manner. Tools like Google Analytics record user journeys as they navigate through documentation websites. Analytics reports generate data about their entry point, even details such as the browser used, exit path, search terms that they use, user

demographics and other characteristics of the user visit. These details can be difficult to interpret in isolation, but when linked with other data about the docs, they can be useful. For example, in this research, the content generated by Salesforce and Pendo (other analytics tools) were reviewed. Technical communicators collaborated with other stakeholders of the organization to validate users' problems that were identified through Google Analytics alone. Results help the technical communication team to work on navigation of the documentation website, detect keywords used for website searches as well as other metadata for the relevant topic pages.

3. **Technical communicator as product manager** The second and third cases are where the technical communicator and user interchange roles in the knowledge networks. On websites like blogs, users leave comments to provide feedback. Usually such comments can be viewed by everyone. In this case study, I observed that instead of public facing comments, users get the opportunity to create defects on the organizational defect tracking platform. Defects are nothing but tickets to propose changes or report problems. In the case studied, users used GitHub to report Issues (errors) in documentation. Organizations are also known to use other tools like JIRA, Bugzilla and many others for this purpose that can be used for communication purposes. Traditionally only internal organization members had access to such tools. So in this case, an external user assumes the role of an internal stakeholder to report the defect. When it is a documentation related bug, technical communication managers get notified. They then assume the role of product managers to assign defects to whichever team is responsible. They can also set the priority of the bug, set a timeline and copy all stakeholders that need to get involved in fixing the issue. In this manner, technical communicators play a crucial role in managing the knowledge network. Prominent roles played in this case are project coordinator and process facilitator.

These results suggest that:

1. Audience interactions have modified the role of technical writers. We have to develop skill sets to become managers of content as well as the infrastructure.

2. Along with information design, if we help students learn ways to utilize corpus analysis skill, and show the bigger organizational picture, we can help them move into leadership positions at their workplaces.

The next section describes these implications in more detail.

6.1 Implications for technical communication research

While ANT was used to trace knowledge networks in this research, other approaches can be used to understand audience subjectivities through the content they create. To do so, first we need to mine the content, store it, and find appropriate methods to further analyze it to separate meaningful

data about audience characteristics and needs. The 3-step framework that consists of planning, implementation and testing can be used. Some takeaways for researchers and practitioners include:

1. They must develop the ability to first construct tangible research questions. This must be done in the planning stage. The sheer volume of data provided by tools that capture audience interactions makes it difficult to filter characteristics required to shape audience research. Research questions must be constructed in a way that helps make strong correlations between data characteristics, user characteristics and business outcomes by using disparate data types and sources provided by various tools and infrastructures.

2. To play the different roles underlined in the results, technical communicators must develop an understanding of organizational structures. Unlike sales and marketing content, the effectiveness of documentation cannot be quantitatively evaluated. A closer analysis of what users' are saying through content contributions, or implying through recorded interactions, are crucial to understand their information seeking behavior as well as their characteristics. Audience analysis leads to re-evaluations of product documentation design, quality, and product design as well. Collaborations with product design teams, testing teams, technical support teams (who communicate with users directly to resolve their problems) are important stakeholders whose roles get black-boxed. Linking these aspects of the organization helps in developing a holistic view of the problems articulated by research questions and also encourages interorganizational communication.

3. To establish inter-organizational communication and facilitate coordination efforts, teams should build collaborations within (and outside if needed) the organization. Associations with other stakeholders make it easier to not just make sure to meet organizational goals, but also gain diverse perspectives on the available data. For example, in the data analytics case study (CS 2), it was observed that working with data gathered by other stakeholders through various tools like Salesforce and Pendo led to valuable insights.

Collaborations are also helpful beyond the audience analysis process, after all research questions are answered. For example, after finding user characteristics from data anlaytics data, technical communicators can collaborate with search engine optimization teams and content development (writers) teams, to design effective models to conduct website search to incorporate findings on users' information seeking behavior.

These considerations are also important to conduct training sessions for technical communicators and in pedagogical practices.

6.2 Implications for pedagogy

Scholars have stressed the need to include audience analysis activities early in the process of writing in technical communication. This study shows that collaborators with other stakeholders can help

record and analyze audience interactions to learn more about their needs and problems. Collaboration with other stakeholders is useful for collecting and making sense of the data. Collaborations with stakeholders with varying competencies including engineers, product managers, technical communicators, marketing specialists, business analysts, usability experts, and so on [21, 126, 150] will prove beneficial for audience analysis studies. Through collaborations, and extended audiences analysis processes, we can begin to operationalize audience expectations, prioritize action items [17], and in most cases improve the likelihood of the information being useful and valuable to solve users' concerns throughout the lifecycle of the product for which documentation is written [55]. To make collaborations happen we need to train technical communicators to develop competencies, leadership skills, and translate their existing humanistic attitudes to articulate information and connect one group to another.

Collaborations between teams are complex. Many organizations rely on groupware — technologies that support collaborative work [113]. Such technologies range from electronic mail, video conferencing, business analytics, workflow management and process visualization systems. Most recommended solutions emphasize the role of product managers [150] in aligning tasks that would meet organizational goals. But technology by itself is not the answer. What we need is the potential to create awareness of the existence of content created by users' interactions, and the importance of other teams to identify and make sense of that content. In TPC classrooms, students must be encouraged to explore data characteristics to understand some of the correlations between audience analysis, users' interactions, organizational goals, and the role of collaboration.

To learn about organizational structures, students must be exposed to coursework that focuses on publication management and be informed about project management needs, practices and methodologies such as Agile. To emulate collaboration scenarios in classrooms, efforts must be taken to conduct self-organizing and cross-functional group work. In addition to the traditional audience analysis techniques, the methodological framework of planning, implementation, and testing can be brought into classrooms to help students critically analyze situations and work collaboratively to learn more about audiences from every opportunity provided to them.

The following sections suggest two approaches of doing so: a) Intra-organizational relationships and b) Agile project methodology to do so.

6.2.1 Intra-organizational relationships

Although the significance of intra-organizational relationships has been established in the 1960s, it hasn't percolated fully in today's corporate environment. Intra-organizational relationships increase division of labor making organizations more complex but also more innovative [1]. The need to support such innovations, promotes interdependence and integration of teams and resources within the organization [1]. Organizational structure becomes more open and horizontal so that teams can collaborate with each other. However, the managerial distribution for such collaborative teams is complex and becomes a topic of concern. Without a well-designed management process, opportunities for collaboration within an organization remain limited. Additionally, in software

companies, product teams or knowledge teams act as boundaries. These challenges impact inter-organizational collaborations and hinder proper utilization of audience data to study their needs and subjectivities. Students can benefit from exposure to case studies that help them understand the dependencies and importance of inter-organizational relationships. It can also help to formally introduce them to processes and tools that are built to involve teams and derive meaning from audience data. Case studies CS1 and CS3 and available publicly and can be used to teach students audience analysis.

6.2.2 Agile methodologies

Little research exists in the field of technical communication on classroom activities that help students understand organizational workflows in content publication processes. Group assignments as the one mentioned below can help students learn more about organizational processes and track spaces where users are involved in content creation. Since most software companies use agile methodologies to create communication workflows, an agile framework is a recommended approach for group assignments. In such assignments, group members must first be assigned various roles to emulate tasks that take place in organizations such as project manager (1 per group) who creates a timeline for project, delegates tasks and check that the group meets deadlines; Technical communicator(s) who develops content, publishes it to the documentation website, and tracks audience interactions with the published content; Content reviewers who perform testing on the content to ensure it is valid and accurate; Data analyst who combines various data sources to find meaningful insights about audiences; Users (any number) who consume content and can interact with the content delivery platforms.

Groups meet every week for short 13-minute meetings called “Scrum” [121] to attack the highest priority collaboration objectives. Each team member on a group discusses their completed tasks, next steps, and roadblocks. The information on completed tasks allow groups to stay on track with the deadlines and have clear communication on what each member is working on through the project. The roadblocks convey challenges such as dependency on other teams, for example, dependency of managers and technical communicators to review feedback content given by users before incorporating it into the published version. The assignment uses these core methods and allows students to learn different roles similar to what they would take in a practitioner position. The “scrum” workshop in class helps students to learn about communication gaps, need for manager’s intervention, and strategies they need for collaboration in the industry.

As students mentally visualize the content publication (assignment completion) process workflow in their own project groups, they develop the ability to extend such visualizations in the organizations that they work for in the future to track their own roles and well as those of their users. Visualizations are considered extremely crucial in project management. They have the potential to improve communication while enabling effective and seamless collaboration especially across disciplinary boundaries [49]. Kanban is can also be used to teach workflow visualizations [5].

6.3 Limitations and future research

One of the main concerns that composition and rhetoric scholars can have with study is the absence of the rhetorical impact of the audience-writer relationship. The Actor Network approach focuses more on the participants than the rhetorical impact on infrastructures, users and their agency, genre systems, and content effectiveness strategies. Additional research will need to be conducted to define the audience through a new rhetorical lens.

The study also lacks investigations about the persuasiveness of technology that encourages users to participate in content production. Some concerns with that are especially related to the labor provided by users to develop content, and the corresponding lack of incentivization.

Lastly, the issue of surveillance and consent is crucial. For example, unlike official usability testing processes, users are not informed about their contributions being analyzed for modeling their behavior. This is especially important because content on GitHub or data analytics tools is hidden from the public. Users should provide consent if the data is to be extracted and used to reveal their characteristics.

These limitations will drive research to address the following research questions: The ability to contribute to knowledge infrastructures raises issues of access. GitHub is accessible, but has a slight learning curve. Data analytics platforms on the other hand hold ethical concerns when recording users' movements. Are these issues being communicated to the users? Will methods like open authoring make it easier to collect data from marginalized populations? Because anyone can add new content, however unique the problem, writers may be able to include marginalized voices. Some of them can also amplify those voices to propagate that understanding in the rest of the organization. Currently the edit button may not be easily findable on the page. How can writers make content contribution platforms persuasive? And finally, Is it ethical to get user contributions for free or how can we incentivize user contributions as we learn from them?

In summary, this research has highlighted the need to ask broader questions and to adopt more complex methods for data collection when studying audiences in online product documentation spaces. These questions and methods must aim at broadening the simplistic views of user interactions that solely look at audiences' motivations and interests based on already existing methods of collecting feedback. We need to ask broader questions to explore their contributing behaviours, and compare it to the context within which the user communities exist. We must also move away from the reductionist view of users' contributions, which look at them as as a static one-time event, to look at how interactions are disconnected, they evolve, and how they shape audiences behavior, and information seeking performance.

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