Rhetorically Defining 'Information' For Designers and Technical Communicators: Transport, Institutional Shift, and Usability

P. Love
Purdue University 500 Oval Drive
West Lafayette
IN
USA
lovep@purdue.edu

ABSTRACT

"Information" is a boundary concept affecting work in multiple sectors. This paper examines classical information theory and modern research in technical rhetoric and circulation to define "information" for technical communicators and designers as something other than a usable unit or quantified intelligence. Defining information as a pattern allows designers to consider what leads to "information" and what its consequences are as part of usability. This paper also examines how knowledge is being made in the current climate of uncertainty and institutional erosion.

CCS CONCEPTS

Human-centered computing → Collaborative and social computing → Collaborative and social computing theory, concepts and paradigms

KEYWORDS

Information, data, knowledge, circulation, design, technical communication, usability

1. INTRODUCTION

There is more demand than ever before for specialized information to solve massive ecological problems—climate change, volatility in food supply and pricing, water supply,

energy costs, and general market volatility to name few—yet despite the wealth of usable information, there seem to be few clear ways forward [5]. Take climate change for example: in the Introduction to *Modes of Existence,* Latour describes a confrontation between a climatology professor and an industrialist in a French policy meeting. After the professor presents their argument for regulations responding to human-made climate change, the industrialist replies simply with "why should we believe you more than someone else?" [21]. Instead of citing specialized knowledge and disciplinary methodology, the professor describes his institutional and disciplinary structure, arguing that, while imperfect, it is set up to provide checks, balances, and testing mechanisms to produce the most rigorous information possible [21]. Latour compares this to a priest producing an org chart of the Vatican to prove the existence of God, citing *trust* in the institution itself [21]. This example illustrates the difficulty of 'informing' while institutions erode: experts are still necessary, but their input is not especially valuable when skeptics overtake the domain of certainty against rigor, and uncertainty implies all sources are equal [21]. The rise of "fake news" makes this dilemma an everyday concern of communication and design: information constructed as a usable unit should offer actionable ways forward, and communication and knowledge infrastructures rely on information being "good" to the point that suddenly finding it "bad" is demoralizing. Given the risk, why, exactly, should anyone trust a particular source over another?

Lazer et al's 2018 report in *Science* defines fake news as fabricated information mimicking news media genres but not their process or purpose, and the report further delineates between "misinformation" (false information) and "disinformation" (false information intentionally spread to deceive) [22]. Data and Society's 2018 "Dead Reckoning" report differentiates between "fake news" as a criticism lobbed at media companies and "problematic content" studied by media scholars and similarly differentiates misinformation and disinformation as false "information" unintentionally and intentionally spread, respectively [6]. Nowhere in these reports is "information" itself defined. Information as a concept is a boundary object, connecting different concerns and purposes through abstract meaning [34]. Technical communication and usability

researchers, as disciplines connecting domains of expertise and work through research and production, are in a good position to explore the connections made by this boundary concept [19]. Furthermore, institutional erosion and information overload prompt us, as user advocates, to think about what constitutes usable information beyond quick comprehension and action. Through examining the relationship between classical information theory, technical communication, modern ecological-rhetorical models, and ongoing shifts in the way data and information transform into knowledge, this paper describes the links between information, data, and knowledge from a rhetorical perspective, and proposes a definition of information-as-pattern, as opposed to information-as-usable-unit or information-as-quantified-intelligence. This definition helps map the shift from institutional to market-based knowledge-making, and produces new questions about information that designers can use when uncertainty outweighs institutional endorsement.

2. INFORMATION THEORY OVERVIEW

Claude Shannon developed information theory in 1948 to solve an engineering problem: getting signals to clearly reach their destination without just boosting their power, since signals of equal power traveling concurrently add noise to each other (hence "signal" vs "noise" in shorthand) [13]. Shannon proposed encrypting signals to make them pragmatic cryptograms, functionally indistinguishable from noise when scrambled and clear when decoded. Signals as cryptograms can either be inductive or deductive, relying on a noticeable internal logic or using outside clues, instructions, or context to understand the pattern [13]. Three particular elements of Information Theory lend themselves to rhetorical interpretations of information: transport, bits and redundancy, and stochastic structure.

2.1 Transport Information

In treating information as a string that is legible just at its origin or destination (when it's encoded or decoded) Shannon created a way to filter noise through one of information theory's major advancements: separating a message from its meaning in transit [13]. In other words, the meaning of a message is not affected by its journey—it is identical (or symmetrical) with noise while moving. Through emphasizing starting points and destinations, Shannon pioneered a transport model of information, a paradigm Ingold describes as emphasizing endpoints in journeys to minimize the transformative potential of the journey somewhere and maximize the transformative effect of getting there [17]. Advancing transport means finding ways to compress travelling time (of people, things, information), treating time as a barrier. Transport models of information contribute to ethics of expediency and focus the development of technology on accelerating transfer as the logical way to increase access and reach [20].

2.2 Bits and Redundancy

Bits are the mathematical subunit of information "quantifying" intelligence in Shannon's original work [13]. Because meaning is

separated from message in information theory, bits are computational units that information is 'made of.' However, for the purposes of this paper, bits are not what information is 'made from.' In order to form an idea, one wouldn't go "get some bits"; rather, one would likely "collect some data." A field of true random bits has high information density but lacks redundancy, making it indecipherable and, therefore, meaningless (despite being information-heavy) because random bits have no inductive (internal logic) or deductive (contextual cues) pattern to help decipher it. [13]. In other words, internal redundancy is an important trait of information, and data is a better rhetorical starting point for information (see section 4.1).

2.3 Stochasticity

Legible information contains redundancy because it proceeds *stochastically*, meaning its order of events is 1) probable based on previous events and the overall flux of the system, but 2) neither totally random nor 100% calculable from those previous events (though still related to them) [13]. Language is another example of a stochastic process: spelling or reading a word references previous characters and predicts upcoming ones. Therefore, redundancy is part of what gives information rhetorical meaning because redundancy is a way to identify inductive or deductive *patterns* in data [13].

2.4 Information Theory Wrap-Up

The technical and mathematical side of information theory is best left to information theorists. From a human-centered point of view, information's important traits are: 1) it emerges from analysis of a larger corpus, 2) its tendency to be packaged and transported, and 3) its possession of patterns a receiver can decipher based on existing knowledge and abilities. From a user-centered perspective, the mechanics of information theory are inherently audience-focused, but the relationship between sender and receiver is narrow: the sender assumes the receiver can decode the information somehow, at which point its meaning is self-evident. In other words, the receiver assumes that the information is "good" or worth understanding before deciphering it, and that it arrives as it was sent.

In this context, technical communicators and designers, as human-centered researchers and producers, already critically engage users with the information they receive by seeking to make its design, through architecture, instructions, and documentation, as relevant and realistic as possible [19, 26, 28]. Institutional erosion and shift, however, are changing the ways users judge relevancy and realism, as well as changing the relational value of experts and their institutions [21]. Institutional erosion would, on the one hand, prevent institutional technocracy, but it also removes barriers to technocratic dogma emerging from private entities or other network members with pre-existing power. Technical communicators and information designers need to study these shifts to support the public's involvement in research and restore faith in empirical inquiry. Part of this is developing theories of

Rhetorically Defining 'Information' For Designers and Technical Communicators: Transport, Institutional Shift, and Usability

SIGDOC '18, August 3-5, 2018, Milwaukee, WI, USA

information that extend beyond the time and place of consumption [17, 37].

3. TOWARD RHETORICAL DEFINITIONS FOR TECHNICAL COMMUNICATORS

To define information rhetorically, we have to identify what rhetoric adds to it. Rhetoric is a discipline of assessing situations, ecologies, and experiences to make decisions, participate in developments, and work for mobility [2, 8, 16]. Rhetoric values both evidence and experiences because evidence devoid of humanity can be collected unethically or become dogma intentionally or unintentionally [16, 20]. Therefore, rhetorical definitions of information should focus on how it transforms to and from other things—rather than how it transports things.

While empirical inquiries into technical communication and design often render it as the study of transporting information expediently and actionably [33], technical communication also develops theories of audience to change the way information is made and rendered through usability, and it uses that research to promote equitable relationships between experts and non-experts [19, 37]. A rhetorical description of information, as well as data and knowledge, works for the second goal and impacts the first. It also furthers the value of "information" as a boundary object and prepares for continuing to make information equitable and actionable under shifting institutionalization mechanisms.

3.1 Data and Information

Information and data can conflate, and the distinction between the two is usually a matter of audience: one person's data is another's information. Defining information is troublesome because Latin and Greek origins of the word (informatio, morphe, or plērophoria) connote the act of conveying something to someone or giving form to ideas (i.e. design) [4]. Information-as-quantified-intelligence renders it as a persistent thing, beyond a contingent form for conveying. Rhetorical descriptions of information and data, then, should account for the transformation of one into the other based on the purposes they serve for people interacting with them, while still accounting for the trouble inherent in working with them [23].

Buckland distinguishes between information in four forms spread across 1) tangibility and 2) whether or not it is a process [4]. Data, in this matrix, is one of the ways information takes form, but *informing* also takes place through processing data [4]. Salvo (2004) identifies data as the product of analysis, and describes information as a unit emerging out of an "ocean" of data [28]. Buckland further describes data as collected records available for processing, either virtually or in a physical place [4]. Based on these interpretive relationships between data and information, any description of data has to take into account the possibility of data "to inform," but that it has to be processed first. "Raw data" is a misnomer, but to say a dataset "informs" without processing labor is disingenuous. Therefore, *data, as untransformed information, could be described as records purposefully chosen or collected, manually or through automation, for processing.* The "Results" section of a report presents the collected "data," for instance, before the researchers "discuss" the results, producing their major conclusions.

Data transformed into a legible, stochastic pattern for readers is information from a rhetorical perspective. Information-as-quantified-intelligence for encoding and transporting and information-as-usable-unit describe its form, and both are useful to technical communicators doing usability tests of documents, infographics, and other informational texts. Information-as-pattern-making enables heuristic questions about information and the way it extends in time and space from its moment of creation, such as:

- What labor went in to making this pattern?
- What data was collected to contribute to this pattern? How was it collected?
- What resources did this pattern consume?
- What resources will this pattern enable more consumption of?
- Who will benefit from the continuation of this pattern? Who will suffer from the continuation of this pattern?
- Will this pattern align with patterns made elsewhere?

Questions like these focus on the ethical and social consequences of information, instead of on the "unit" itself, making the context and consequences of the information part of its literacy. The last question in particular connects to the rhetorical function of information in knowledge-making and calls attention to the gatekeeping going on in the pattern. The following example illustrates some of the ways these questions are useful to designers.

3.1.1 Information Example: A Fictional Case . A fictional research center collects demographic data about all of its participants for its yearly report. This data on participant gender, race, ethnicity, and citizenship is collected and stored in a spreadsheet for each year. The center's yearly report publishes a brief informative report and infographic of this demographic data.

A technical writer charged with writing a white paper on the center's diversity procures these spreadsheets from across three years and makes charts of the shifts in each demographic category across the three years. The charts show mostly stable demographic proportions, but the amount of participants who opt out of reporting jumps from year one to two, meaning there is less overall demographic data. However, there is one category where reporting does not fall off like in the rest: gender.

The original infographic in each year's spreadsheet, which isolated the year's data from larger context, is transformed into these multi-year informational infographic-patterns (fig. 1–4). The resulting pattern enables new analysis. The biggest change in these charts, year over year, is that more participants choose to 'not report' their demographic information, with the notable exception of "Gender," which sees a small bump in reporting. Other than that, the demographic distributions stay relatively

stable. This means that a significant amount of people responded to at least the gender questions and not others.

Applying the heuristic questions enables the technical writer to ask further questions, such as: how was this data collected? Did the students see any benefit to providing the data? Was gender a more stable construct (as presented) to the students answering the questions? What occurred between year one and two that caused respondents to be cagier about providing demographic data beyond gender? Where was this center located and did that impact the diversity? Beyond those methodology questions, as measures of diversity, how will this data shape center decision-making? What behavior or practices will this pattern enable or end if this data is taken as a sign of diversity?

3.2 Knowledge

Information known by one person constitutes a belief. Knowledge is belief shared with others, but knowledge-making is not just a pattern two or more people possess. Knowledge has to be information *experienced* by multiple people.

Information patterns come together in knowledge-making (question 6 of the above heuristic). Foucault's argument about the enlightenment is that truth in knowledge moved out of the domain of the monarch and into the domain of (more) people, making it social [9, 10, 11, 12]. Buckland differentiates information-as-knowledge when it is solely the possession of one person's mind, like a belief or opinion [4]. Therefore, in order for information to be knowledge to more than one person, it has to be socially shared. However, networked information (a pattern replicated through a network) is not really knowledge [13]. *Information that multiple people share experiences of—that they find legible and the pattern of which fits the extensions of the other information or knowledge they possess—is the rhetorical transformation of information into knowledge, when multiple people can rely on and defend it* [24]. Citing a report—either for its data, conclusions, or methods—is a sign that information aligns with others' experiences, thus institutionalizing it.

4. INFORMATION WORK OF DESIGNERS AND TECHNICAL COMMUNICATORS

Technical communication and design have been part of experience-sharing knowledge-making since enlightenment [3, 40], when communication technology was slower and institutions started serving as infrastructure for verifying experiences and validating those who claimed them.

The ties between technical communication, UX, and information are well-established by Barnum and others [26]. Technical communicators and usability researchers share skills and background, and they often take on project roles that deal with making the informative patterns in websites and products, at various stages [26]. Broadly, the goal of usability is to shape the best future for people, and rhetoric research helps UX develop advocacy models for users as part of the design process [26, 39]. As such, designers and technical communicators are already aware of how virtual interfaces naturalize fragmented information and how things like algorithms and data

visualization templates act as "silent partners," shaping information and knowledge-making [1, 18].

Usability's rhetorical function is to bridge the knowledgeable beliefs of experts with experiences of the public to create realistic, ethical, and mutually-affirming theories of design and technology through making usable documentation and products and building theories of audience that effect design [19, 37]. In this sense, technical communication has always participated in helping information get identified (signal) and reach its intended destination through design (encoding) and literacy (decoding) at the most actionable speed possible (transport).

Circulation studies of rhetoric complicate this mission by building on ecological communication models and studying context [8, 30]. Circulation studies generally find that context contributes more to information taking hold than? an ecology [30]. Studying context provides a way to map the consequences of information as it travels, showing how it becomes knowledge (shared experience). Gries's Iconographic Tracking methodology is an example of this work [14, 15].

Together, usability and circulation theory track information's role in ecologies, and the consequences it has for users, especially at times when they need quick answers to urgent problems. Bringing a rhetorical perspective to information adds a way to rationalize the challenge of users facing information overload: when information and data are omnipresent and endlessly produced, institutions struggling to keep pace with the production (not to mention individuals have limited control over the contextual ecology, so individual mobility becomes a negotiation with the whole network). Consequentially, new institutions—or markets—emerge to help with the filtering.

5. SHIFTING GROUND OF INSTITUTIONALIZATION

Information-as-pattern-making and technical communication and design as information labor lay the groundwork for understanding the institutional shift from a design perspective and the challenges of "informing" facing designers. Turning attention to that involves discussing how, in the expanded information ecology of the 21st century, information is filtered and marketized.

5.1 Filtering

While the Enlightenment made knowledge production more social, it was not free. Foucault argues that expanding the domain of truth and opening the process of making it created new moderation or governing mechanisms that he grouped under "biopower" or "biopolitics": Knowledge-production through peer-to-peer judgements of what is socially acceptable [12]. In other words, everyone is "free" to make knowledge, but their freedom is socially confined. Today, we might call biopower the "filter" of knowledge in the enlightenment. Beyond social filters, resource constraints also filter knowledge, since empirical inquiry and sharing experiences require literacy, labor, and time. Knowledge institutions are part of filtering, making them oppressive as well as enabling: they serve as a network hub

Rhetorically Defining 'Information' For Designers and Technical Communicators: Transport, Institutional Shift, and Usability

SIGDOC '18, August 3-5, 2018, Milwaukee, WI, USA

for members' shared experiences. Designers and technical communicators, in both theory and practice, work to make institutions accessible to the public (and vice versa) and to reduce the resources necessary to share experiences between people. The shift in public information access, post-internet, from the web to social media to mobile devices makes information more available and enables anyone to produce it from (almost) anywhere [29]. In other words, whereas getting reliable data and sharing information used to be the challenge, there is now an embarrassment of riches. Enlightenment-era institutions are outpaced by ecological production and circulation, but information and knowledge are still filtered. When the problem facing users is that they have too much data and information instead of not enough, new filters are inevitable.

5.2 Marketization

Knowledge institutionalization and experience sharing is arguably undergoing a process of neoliberalization to filter information. Neoberalization and neoliberalism are loaded terms, so I will define them as follows: by neoliberalism, I mean the post-WWII political and economic movement to decentralize and distribute power and decision making so that centralized power (fascists) can never again make mass tragedies [5]. By neoliberalization, I mean the conversion of institutions, or institution functions, into markets [5]. Neoliberalism theorizes converting institutions into markets so that their power is decentralized and distributed into the purchasing power of individuals. Market-based decisions are treated as emergence-like events, wherein the incalculable will of the crowd produces inherently-positive decisions [5]. Practically, neoliberalism endorses deregulating institutions and promoting individual freedom under the assumption that freedom *to do* things is more important that protection from harm, since a state of unpredictable vulnerability and acceptance of an always-shifting assemblage motivates people to engineer solutions to their problems [5, 38]. Marketization harnesses the power of crowds to economically filter the overwhelming data and information enlightenment-era filtering and technical communication networks have accumulated and preserved.

5.2.1 Marketization Example: Wikipedia . For example, Wikipedia was once a contested site of knowledge and information and is now accepted as a knowledge hub because of the networked information it hosts in aggregate. Wikipedia's authority does not come from having power over any group in particular but because the market propelled it to its position [13]. Wikipedia supplements its accountability through edit records and article histories, assuming its ocean of users moderate, correct, or otherwise show discrepancies and promote correct information [13]. Wikipedia, as an information-filtering site, offers a real-time, crowd-sourced experience-sharing platform motivated by collective acceptance of the risk inherent in the platform and the shared responsibility for maintenance by users. In short, users accept Wikipedia because it offers expedient information and its limitations are known, whether or not they are fully accounted for.

5.3 Market Manipulation

Market-based solutions are always vulnerable to market manipulation. Markets are not equitable with democracy, though they can be founded on similar principles. Neoliberalism assumes access to markets and information is symmetrical for all participants and that accumulation of capital is meritocratic [5]. Therefore, regulating markets disrupts the natural order emerging through entrepreneurial problem-solving. However, assuming symmetry is a constant can naturalize existing power differentials [41]. Capital is also the measure of success in marketization—market value—because disciplinary measures of value centralize power. Therefore, marketizing information valuates it through indirect means, i.e. the capital it generates efficiently [5]. Information-as-quantified-intelligence and information-as-usable-unit capitalize through circulation impact: citations, recirculation, remix, etc.—what is known in circulation studies as "velocity" [27]. These markers communicate success because they represent a network effect of rising approval (citations, remixes, and endorsements keep information relevant in the economy) through user-generated movement and acceleration [5]. For example, Lazer et al's report on "fake news" circulation, produced in cooperation with Twitter and with access to their internal usage data, reports that engagement of any kind promotes information patterns (tweets, hashtags, keywords) in Twitters algorithms (i.e. citing something to refute it actually promotes it in the algorithm) [22]. Modern capitalism assigns value to organizations through growth, so information that circulates has value because it is growing, despite other extenuating circumstances. In information economies, circulation is the precarity motivating information production and knowledge-filtering.

Indirectly valuing information through circulation is the market validating shared experience. Absent an authority or an institution to endorse patterns as knowledge, economic factors indicate the public's shared experience through indirect capital assessments. Ideally, this creates political-rhetorical network engagement, replicating pseudo-democratic decision-making through discourse: participants vote for a position by engaging with it [32]. In doing so, the decision-making processes, goals, and other circumstances are flattened into the outcome, obscuring other human concerns and vulnerabilities [31]. It also means that information benefits in the market from discouraging opposing participation, such as in GamerGate when women and people of color were discouraged from taking certain positions by GamerGate supporters through abusive acts, such as circulating their personal information and creating network effects to destabilize their private and professional lives [42, 43].

Posthuman elements can also manipulate information markets. Lazer et al estimates that 9-15% of Twitter accounts are bots [22]. While humans outnumber bots, humans and bots share and engage with information on the platform just as purposefully [22], meaning bots contribute to experience-sharing during modern tragedies (mass shooting, terrorism attacks), usually promoting alternative narratives (AN) denying the event

or stymying the response [25, 36]. These practices collectively function like High Frequency Trading [7].

Neoliberalism accounts for these events as inherent risks creating the precarity to motivate users to be more vigilant and protective of the system [5]. For technical communication and designers, the question is whether we consider these issues inherent parts of the information system or if they can be overcome through usability.

6. RECOMMENDATIONS FOR DESIGNERS

No single course of action will adequately respond to the challenges facing information work in marketized knowledge-making, but designers and technical communicators are researchers and problem-solvers. I focus my recommendations on three threads that have problems to solve: data as a commodity, transport information design, and agnotology.

6.1 Resisting Data as Commodity

As a starting point for information, data is a unique commodity in neoliberal knowledge-making: it has huge value in aggregate, but users provide it as if it were value-less. User experience (UX) designers are part of designing the interface mechanisms that collect it from users. Data collection is an essential act, so collecting data alone is not a danger. Ownership of data needs more attention, and users need more control over what happens to it. In another context, if all data on crops, agricultural forecasts, and weather patterns were sole property of isolated private organizations, that would create critical points of failure in global food supplies. For now, public research universities do agricultural research that is, by extension, property of the public and usable by any farmer and private company. Personal data is different, but no less important. For privacy and security reasons, individuals' data must be protected from exploitative and invasive use. Designers, as user advocates and usability professionals, can argue for expanding user advocacy to protecting user data and arguing for healthier data practices, such as public involvement in data custody, and use their position as researchers to curtail exploitative data practices.

6.2 Non-Transport Models of Information Distribution

The connection between technical communication and design is easy to see in the information transport model, where the goal of technology and design is to deliver information as fast as possible [17]. Transport assumes that the best form of information is prefigured by its meaning [17]. Transport presents a truism of technical communication: the information is the information and the presentation persuades the user to accept or "know" it. Designers and technical communicators know there is more to it than that. What transport cuts off is the journey of getting from one thing to another, and the wealth of information users are presented with pressures them to filter the information they believe in more ways than one. As designers, we need to explore ways for users to travel and move *with* information and have a relationship with it through moving

(what Tim Ingold calls "wayfaring") or to record and track their engagement with information beyond usage metrics or rating systems. Indirect measures such as these contribute to devaluing information because they reduce it to numbers [35]. There needs to be a way for users to qualitatively engage with information (e.g. journaling space, timelines of access) to make their own movement through information more visible to them, not just to the platform owners.

6.3 Design Against Agnotology

Returning to Latour's example briefly, the industrialist creates symmetry between the climate professor (specialist) and himself (skeptic) through agnotology: 1) cultivate doubt in the specialist by asking them to produce 100% certainty 2) imply that the specialist is motivated by self-interest and overstating a problem to get money and attention, as markets compel, and 3) offering a privately-sourced alternative with the same validity from a market perspective [5]. Specialists will rarely claim objectivity or complete certainty because of scientific tradition [21]. Agnotology exploits market knowledge-making by framing all informative patterns as equally tainted or externally motivated and asking users to choose which information pattern they prefer. Such a setup often frames the choice between something challenging (changing behavior) or something comforting (in Latour's example, continuing environmental deregulation). Designers should look for ways to present new content to users based on more than prior search history and broad engagement metrics. In other words, users should be presented with new content not just because it is already popular (or part of a promotion).

7. CONCLUSION

The future of knowledge-making institutions is uncertain and ongoing. While enlightenment institutions had clear biases toward Western (white) ethnocentrism and masculinity, marketization, for the time being, has not yielded drastically different results. Many believe that the road to rehabilitating the public's relationships to information lies in making institutions better information gatekeepers and making the public more literate in informational genre conventions [6, 22]. These approaches revolve around the transport model, where usable information filters choices instead of broadening them manageably, and usability just makes usable units. The options facing users in that arrangement come down to allegiance: the information is "good" or "bad" based on its genre and the visible infrastructure around it. Instead, we need to engage users with the consequences of information beyond the moment of access, where it comes from, and how it can develop in the future.

In an era of varied uncertainty, it makes pragmatic or common sense to pay attention to certain aspects of information as producing a pattern, enabling us to ask and answer questions such as:

- What labor went into making the pattern?

Rhetorically Defining 'Information' For Designers and Technical Communicators: Transport, Institutional Shift, and Usability

SIGDOC '18, August 3-5, 2018, Milwaukee, WI, USA

- What data was collected to contribute to this pattern? How was it collected?
- What resources did this pattern consume?
- What resources will this pattern enable more consumption of?
- Who will benefit from the continuation of this pattern? Who will suffer from the continuation of this pattern?
- Will this pattern align with patterns made elsewhere?

Treating information as a pattern in technical communication and design prompts us to answer these questions and present them to users as we work with data and design information. As information workers, we can also work to treat data and information as less of a commodity and more as something that moves with us and with users, developing our lived experiences. Inherently, solving the large ecological problems the earth is faced with will involve more cooperation between diverse experts and the public, as well as more attention to the ways information patterns and knowledge work extend to the past and future.

ACKNOWLEDGMENTS

REFERENCES

[1] Applen, J. D. and Stephens, Sonia H. (2017). Digital Humanities, Middleware, and User Experience Design for Public Health Applications. *Communication Design Quarterly* 5.3. p24-34

[2] Aristotle. (2007 trans). *On Rhetoric: A Theory of Civic Discourse.*Trans. George A. Kennedy. New York: Oxford University Press, Inc.

[3] Bacon, Francis. (1605). *Advancement of Learning.*Ed John Devey.

[4] Buckland, Michael K. (1991). Information as Thing. *Journal of the American Society for Information Science.*42(5): p351-360,

[5] Busch, Lawrence. (2014). *Knowledge for Sale: The Neoliberal Takeover of Higher Education.* Cambridge, MA: MIT Press.

[6] Caplan, Robyn; Hanson, Lauren; and Donovan, Joan. (2018). Dead Reckoning: Navigating Content Moderation After "Fake News." *Data & Society Research Institute,* datasociety.net (February)

[7] DiResta, Renee. (2017). There are bots. Look around. *Ribbon Farm* May 23.

[8] Edbauer, Jenny. (2005) Unframing Models of Public Distribution: From Rhetorical Situation to Rhetorical Ecologies. *Rhetoric Society Quarterly ,*35: 4, 5 — 24.

[9] Foucault, Michel. (1984). What is enlightenment? *The Foucault Reader.* Ed. Paul Rabinow. New York: Vintage Books, 2010 ed.

[10] Foucault, Michel. (1975). The body of the condemned. *The Foucault Reader.* Ed. Paul Rabinow. New York: Vintage Books, 2010 ed.

[11] Foucault, Michel. (1975). The means of correct training. *The Foucault Reader.* Ed. Paul Rabinow. New York: Vintage Books, 2010 ed.

[12] Foucault, Michel. (1978). Right of death and power over life. *The Foucault Reader.* Ed. Paul Rabinow. New York: Vintage Books, 2010 ed.

[13] Glieck, James. (2011). *The Information: A History, A Theory, A Flood.* New York: Pantheon Books, Knopf Doubleday Publishing Group. Kindle Edition.

[14] Gries, Laurie. (2013). Iconographic tracking: A digital research method for visual rhetoric and circulation studies. *Computers and Composition* 30 pp332-348

[15] Gries, Laurie. (2015). *Still Life with Rhetoric: A New Materialist Approach for Visual Rhetorics.* Boulder, CO: Utah State University Press. Kindle

[16] Hinks, D. A. G. (1940). Tisias and Corax and the Invention of Rhetoric. *The Classical Quarterly,* Vol. 34, No. 1/2 (Jan. - Apr., 1940), pp. 61-69

[17] Ingold, Tim, (2011). *Being Alive: Essays on Movement, Knowledge, and Description.* New York, NY: Routledge

[18] Johnson-Eilola, Johndan. (2001). Datacloud: Expanding the Roles and Locations of Information. *SIGDOC '01,* October 21-24, 2001, Santa Fe, New Mexico, USA. pp47-54

[19] Johnson, Robert R, Salvo, Michael J, Zoetewey, Meredith W. (2007). User-Centered Technology in Participatory Culture: Two Decades "Beyond a Narrow Conception of Usability Testing." *IEEE Transactions on Professional Communication,* vol. 50, no. 4, December 2007.

[20] Katz, Steven B. (1992). The Ethic of Expediency: Classical Rhetoric, Technology, and the Holocaust. *College English* Vol 54, No 3: 255-275

[21] Latour, Bruno. (2013). *An Inquiry Into Modes of Existence: An Anthropology of the Moderns.* http://modesofexistence.org/inquiry/?lang=en

[22] Lazer, David M. J.; Baum, Matthew A.; Benkler, Yochai; Berlinsky, Adam J.; Greenhill, Kelly M.; Menczer, Filippo; Metzger, Miriam J.; Nyhan, Brendan; Pennycook, Gordon; Rothschild, David.; Schudson, Michael; Sloman, Steven A.; Sunstein, Cass R.; Thomson, Emily A.; Watts, Duncan, J.; Zittrain, Jonathan L. (2018). The Science of Fake News: Addressing Fake News Requires a Multidisciplinary Effort. *Science* 359 (6380), pp1094-1096. DOI: 10.1126/science.aao2998

[23] Law, John. (2004). *After Method: Mess in Social Science Research.* New York, NY: Routledge.

[24] Merrill, M. David. (2002). First principles of instruction. *Education Technology Research & Development,* Vol. 50, No. 3, 2002, pp. 43–59

[25] Nied, A. Conrad; Stewart, Leo; Spiro, Emma; Starbird, Kate. (2017). Alternative Narratives of Crisis Events: Communities and Social Botnets Engaged on Social Media. *CSCW.*

[26] Redish, Janice and Barnum, Carol (2011). Overlap, Influence, Intertwining: The Interplay of UX and Technical Communication. *Journal of Usability Studies.*Vol. 6, Issue 3, May. pp. 90-101

[27] Ridolfo, Jim, and DeVoss, Dànielle Nicole. (2009). Composing for Recomposition: Rhetorical Velocity and Delivery. *Kairos: A Journal of Rhetoric, Technology, and Pedagogy,* 13(2), January 15. Retrieved December 24, 2017, from http://kairos.technorhetoric.net/13.2/topoi/ridolfo*devoss/remix.html*

[28] Salvo, Michael. (2004). Rhetorical Action in Professional Space: Information Architecture as Critical Practice. *Journal of Business and Technical Communication,* Vol. 18 No. 1 January. 39-66 DOI: 10.1177/1050651903258129

[29] Schmalstieg, Dieter, and Hollerer, Tobias. (2016). *Augmented Reality: Principles and Practice (Usability).* Boston, MA: Addison-Wesley. Kindle iOS version. Retrieved from Amazon.com

[30] Seas, Kristen. (2012). Writing Ecologies, Rhetorical Epidemics. *Ecology, Writing Theory, and New Media: Writing Ecology* .Ed. Sidney I. Dobrin. New York, NY: Routledge. 51-66.

[31] Simmons, W. Michele; Moore, Kristen; Sullivan, Patricia. (2015). Tracing Uncertainties: Methodologies of a Door Closer. *Thinking With Bruno Latour in Rhetoric and Composition.* ed. Lynch, Paul and Rivers, Nathaniel. Carbondale, IL: Southern Illinois University Press. Chapter 16, Kindle Edition

[32] Spinuzzi, Clay. (2008). *Network: Theorizing Knowledge Work in Telecommunications.* New York, NY: Cambridge University Press

[33] Spinuzzi, Clay; Hart-Davidson, William; and Zachry, Mark. (2006). Chains and Ecologies: Methodological Notes toward a Communicative-Mediational Model of Technologically Mediated Writing. *SIGDOC'06,* October 18–20, 2006, Myrtle Beach, South Carolina, USA.

[34] Star, Susan Leigh and Griesemer, James R. (1989). Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. *Social Studies of Science,* 19: 387. DOI: 10.1177/030631289019003001

[35] Star, Susan Leigh and Strauss, Anselm. (1999). Layers of silence, arenas of voice: The ecology of visible and invisible work. *Computer Supported Cooperative Work* 8: 9–30.

[36] Starbird, Kate. (2017). Examining the Alternative Media Ecosystem through the Production of Alternative Narratives of Mass Shooting Events on Twitter. *Association for the Advancement of Artificial Intelligence* (www.aaai.org)

[37] Sullivan, Patricia. (1989). Beyond a Narrow Conception of Usability Testing, *IEEE Transactions on Professional Communication,* vol 32 no 4, December. p256-264.

[38] Tsing, Anna Lowenhaupt. (2015). *The Mushroom at the End of the World: On the Possibilities of Life in Capitalist Ruins.* Princeton, NJ: Princeton University.

[39] Williamson, Bill and Kowalewski, Scott J. (2017). Cultivating a Rhetoric of Advocacy for Usability Studies and User-Centered Design. *Communication Design Quarterly* 5.3 p35-47

[40] Yates, JoAnn. (1989). The Emergence of the Memo as a Managerial Genre. *Management Communication Quarterly* vol 2 no 4 May. pp485-510

[41] Galloway, Alexander R. (2006). Protocol. *Theory Culture and Society* 23(2-3) p317-320

[42] Mortensen, Torill Elvira. (2016). Anger, Fear, and Games: The Long Event of #GamerGate. *Games and Culture,* pp1-20. DOI: 10.1177/1555412016640408

[43] Trice, Michael. (2015). Puting GamerGate in Context: How Group Documentation Informs Social Media Activity. *SIGDOC '15,* Limerick, Ireland