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## A Stasis Network Methodology to Reckon with the Rhetorical Process of Data: How a Data Team Qualified Meaning and Practices

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#### ABSTRACT

Prior scholarship argues that facts derived from data are not separate from their contexts and values. In this study of a data journalism team, I define and apply a sociotechnical network approach to stasis that maps their rhetorical actions with their quantitative work. The stasis network methodology identified how their process confronted competing definitions of metrics, which impacted their sense of what was significant and ethically possible, when developing the goals for their report.

#### **KEYWORDS**

Stasis; critical data studies; data science; data journalism; network analysis

#### Introduction: confronting the "god trick" problem

Data are difficult to understand because they describe aspects of the world under the alibi of describing it fully. Numerous scholars have explained how this alibi perpetuates the belief that data objectively mirrors reality and speaks plainly for itself. Frith (2017) argued that the key to disproving this faith in data is to study the more ephemeral communication practices of data work. He called for technical and professional communication (TPC) to study the rhetorical processes of data to confront this faith, since the rhetorics of data are easily "sacrificed at the altar of positivist quantification" (p. 177) rather than ironically valued enough to track, document, and better understand.

Sacrificing the rhetorical process of data in lieu of understanding it as TPC is not new. Haraway (1988) named this sacrifice the "god trick" (p. 581): the belief that the scientific process, which collects and analyzes data, are neutrally objective and transcend the constraints of our situated, material realities of interpretation and communication. Decades of research (Adams, 2016, Bowker, 2005, D'Ignazio & Klein, 2020, Gitelman, 2013, Loukissas, 2019) have yielded interdisciplinary consensus that data, regardless of its size, are situated and contextualized by the goals and values of the people using the data. TPC scholars have contributed to this theoretical position that the context of data work matters across data practices, whether it be collection (Atherton, 2021a, Atherton, 2021b), processing (Beveridge, 2015, Lindgren, 2021), analysis (Danner, 2020, Overmyer, 2019, Roundtree, 2013), or visualization (Lauer & O'Brien, 2020, Welhausen, 2022, Wolfe, 2015). The god trick problem has been well defined. Yet, as Frith (2017) argues, there is still much more for TPC to understand about the undocumented rhetorical processes of data work.

TPC scholars have started to theorize data as a rhetorical process. Roundtree (2013) confronted the misplaced belief that the data work in the hard sciences are not strictly a deductive process to discover the capital-T Truth. She found that simulation scientists used ad hoc, abductive reasoning to infer "virtual evidence" (p. 33) – that is, speculative variables in the data – to test and understand the gaps in their understanding of simulation models. She argued that the scientists working with simulation modeling data produced a situated relationality that helped them "make conspicuous" (p. 106) aspects of the data model unknown to them prior to their simulation studies.

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In the context of TPC curricula, Wolfe (2015) argued that the field's courses must shift their focus from data visuals as a static product to the range of choices to visualize data, such as whether to present the same data as either raw numbers, percentages, or central tendencies (mean, median, or mode). Danner (2020) extended Wolfe's insights by putting this range of material choices into the broader rhetorical process to tell stories with data. He conducted an activity theory analysis of data professionals at an organization, and he found that data professionals navigated multiple "arenas of influence" (p. 9). Specifically, data professionals needed to negotiate the demands placed upon them by their supervisors and the limitations of the data. Each arena brought different demands to the team's uses, analyses, and reporting of the data. He argued that the rhetorics of data must account for the social and technical arenas that influence decisions about how to "humanize the numbers, craft a call-to-action, [and] create a place where audiences can identify their own role in the story" (Danner, 2020, p. 10) – a finding backed by others (Carter & Sholler, 2016).

These studies illuminate how data sets always set limits on our reality based on the situation in which people define and use them by reconciling what the data offers them in relationship with their goals. They each highlight how data professionals span a spectrum of people who negotiate the pluralism of data either tacitly or explicitly in relationship with their situated goals, values, and ideas. In a similar vein as Frith's (2017), Roundtree (2013), and Danner (2020) call on TPC to develop methodologies to study data as a rhetorical process. In this article, I confront the god trick of data work by defining and applying a stasis network (SN) methodology to trace and theorize the rhetorical actions of a data journalism team during their reporting process.

This SN methodology joins two theories that respectively identify and overcome ambiguity among people and the interpretive pluralism they bring to their work: the stasis procedure (DeVasto et al., 2016, Prelli, 2005) and sociotechnical networks (Spinuzzi, 2008, 2018). In the next section, I explain how stasis and sociotechnical networks complement each other as a means to map the situated rhetorical processes of data professionals at a large news organization – professionals.<sup>1</sup> who are impacted by multiple, sometimes competing, factors to report quantitatively driven information regularly and often. Stasis, as a sociotechnical network, enabled me to construct a substantive theory about the data team's process to weave especially strong relationships about how to define metrics, assess and promote their stance on the quality of metrics, all which advanced their potential uses of the metrics in service of the developing story. Overall, I demonstrate how SNs guided the mapping of how data professionals negotiated the incompleteness of data in relationship to their situated goals.

#### **Defining stasis networks**

In this section, I define stasis networks and describe how this methodological tool can guide researchers and practitioners to map the situated details about the god trick problem by making the ephemeral aspects of data work more legible. First, I discuss previous insights about how the predefined hierarchy and linear stasis procedure maintain the god trick problem by separating facts from values (DeVasto et al., 2016, Graham & Herndl, 2011). This classical, procedural stasis model limits it as a methodology to study situated communication activities (Blythe et al., 2008, DeVasto et al., 2016). After reviewing these issues with stasis, I extend previous work (DeVasto et al., 2016) to open up the relationships between the stases by combining it with Spinuzzi's (2008, 2018) sociotechnical network (STN) methodology. Finally, I describe how the two frameworks complement each other as a SN methodology.

#### How the stasis procedure purifies facts from values

Traditionally, stasis is a procedure designed to guide peoples' deliberation toward consensus about an issue through a sequence of guiding questions called stases: questions of fact, definition, cause, quality, and action. Numerous scholars (Brizee, 2008, DeVasto et al., 2016, Dingo, 2012, Fahnestock & Secor, 1988, Gerdes, 2022, Graham, 2015, Prelli, 2005, Weber, 2016) have theorized the procedure and

considered it with a variety of both types and number of stases. Next, I combine the definitions of the five frequently applied stases<sup>2</sup> by oft-cited rhetoricians of science (Fahnestock & Secor, 1988, Prelli, 2005) in their sequential order:

- (1) Conjectural: problems of fact (Is it? Did it happen?)
- (2) Cause: problems of cause (What caused it?)<sup>3</sup>
- (3) Definitive: problems of definition (What is it?)
- (4) Quality/Value: problems of nature or quality (Of what significance is it? Why is it important or not?)<sup>4</sup>
- (5) Translative: problems of action (What action (if any) is appropriate in the given case?)

Over the past 30 years, rhetoricians of science have argued that each stases act as a stopping place within the stasis procedure, so scientists can confront the ambiguities and problems they inevitably encounter. TPC researchers have been attempting to apply this procedural stasis to code situated data for rhetorical moves made by professionals. Yet, such researchers (DeVasto et al., 2016, Dingo, 2012, Gerdes, 2022, Graham, 2015) have found that professionals do not abide by the procedural, stopping-place model as they interpret and communicate complex information.

DeVasto et al. (2016) surveyed scholarship on stasis and found that rhetoricians have yet to contend with how stasis forces a taxonomy on situated deliberation. They argued that the stasis procedure removes or, at the very least, makes it difficult to represent much of the complexity and messiness of the stases in situ (p. 136). When DeVasto et al. (2016) applied the stases as codes, they found it difficult to theorize the rhetorical process because the procedural aspect of stasis theory "isolates individual stases to the flow of argument" (p. 143).<sup>5</sup> They noted how Blythe et al. (2008) expressed the same difficulty to study such flows – flows that do not map neatly with the stasis procedure. In response to this limitation of stasis, DeVasto et al. (2016) cautioned TPC that its rigid linear structure perpetuates a modernist purification of fact from values – our own discipline's adherence to the god trick.

The stasis procedure's fact-value problem remains with Fahnestock and Secor's (1988) additional organization of the sequenced stases into a two-level hierarchy. They separated the linear stases into a set of first-order "lower" stases (conjectural, definitional, and cause) and second-order "higher" stases (quality and translative). They conceded that these levels permeate and mediate each other, because "all arguments involve a prior value argument that establishes the significance of addressing an argument in a particular stasis to a particular audience" (p. 434). However, they argued that an audience's prior set of values is not an explicit concern for stasis to trace and account for, because such prior values are merely "an awareness of where the audience is" (p. 433). In other words, prior values impact how people wield stases, but if such audience-based, social values do not produce conflicting perspectives, there is no need of remedying them and are therefore not a concern to map across flows of deliberation.

Despite Fahnestock and Secor's (1988) acknowledgment that the stases are interrelated, they did not consider how the procedure's discreteness, hierarchies, and linearity could be revised to trace relationships *between* the stases in a more open manner not beholden to a predefined structure or sequence. In this article, I extend DeVasto et al. (2016) proposal to revise stasis to "better capture the complicated relationships *between* the stases used in arguments" (emphasis mine, p. 144) that can remedy its fact-value purification problem. In the following section, I propose a SN model that incorporates the stases in a nonprocedural and nonlinear analytical codes with Spinuzzi's (2008, 2018) network methodology. I further explain how there is a precedence in stasis scholarship to make such a theoretical move and how such a move provides a means for mapping relationships between stases and sociotechnical practices.

#### Understanding stases as nodes with strong ties

Spinuzzi (2008, 2018) argues that STNs provide TPC a methodology to analyze and understand how professionals communicate complex information to achieve their goals. In a similar vein as stasis

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theory, Prelli (2005) revised the stasis procedure in relationship with the material means of quantitative work that scientists conduct. In this section, I join stasis and STNs by explaining how they complement each other.

Prelli's (2005) revised stasis stems from his survey of philosophies of science scholarship on incommensurability. He identified four general sources of ambiguity when people conduct and communicate science:

- (1) Evidential: adducing evidence
- (2) Interpretive: interpreting constructs and theory,
- (3) Evaluative: evaluating significance, and
- (4) Methodological: applying methodologies.

Prelli (2005) argued that these four sources of scientific ambiguity separated the actions linked to ambiguity from the ways that people rhetorically framed such actions. He posited that this distinction between the original stases and these sources of ambiguity could be mapped as a two-dimensional stasis procedure (Table 1). However, Prelli's stasis model retained the procedural action of stasis by sequencing the sources of ambiguity along its columns, which he named the "superior stases" (p. 304), and by sequencing the traditional stases as the "subordinate stases" along its rows. He transformed the stasis procedure into a  $4 \times 4$  procedural matrix. In network terms, he described the goal of this matrix as tracing a "web" (p. 303) of relations between sources of ambiguity and the way people rhetorically frame them.

Prelli's (2005) procedural matrix traces the relationships between science's general actions (interpreting, evaluating, and applying a method), those actions' mediating artifacts and ideas, such as evidence (data), concepts, and methodologies, against the traditional stases. For example, if scientists stop within each cell in the Evidential column, he argued that they could pause and remedy incommensurate communication about scientific evidence, i.e., data:

- (1) Evidential-Conjectural: "Is there scientific evidence for claim x?"
- (2) Evidential-Definitive: "What does the evidence mean?"
- (3) Evidential-Qualitative: "Which empirical applications of the evidence are more warranted?"
- (4) Evidential-Translative: "Which from among alternative evidence better addresses ambiguities about existence?"

Table 1. Recreation of Prelli's (2005) procedura	I stasis matrix of scientific discourse (p. 305).
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		Superior Stases (Ambiguities)						
Subordinate Stases (Framings)	Conjectural	Evidential ls there scientific evidence for claim x?	Interpretive Is there a scientifically meaningful construct for interpreting the evidence?	Evaluative ls claim x scientifically significant?	Methodological Is procedure x a viable scientific procedure in this case?			
	Definitive	What does the evidence mean?	What does construct y mean?	What does value z mean?	What does it mean to apply procedure x correctly?			
	Qualitative	Which empirical applications of the evidence are more warranted?	Which interpretive applications of construct y are more meaningful?	Which evaluative application of value z are more significant?	Which methodological applications of procedure x are more appropriate?			
	Translative	Which from among alternative evidence better addresses ambiguities about existence?	Which from among alternative constructs better addresses ambiguities about meaning?	Which from among alternative values better addresses ambiguities about significance?	Which from among alternative procedures better addresses ambiguities about scientific action?			

Graham (2015) and DeVasto et al. (2016) noticed how this matrix enabled them to examine more complex relationships *between* the stases during the situated flow of deliberation. They, too, aimed to remedy the traditional "taxonomic approach to stasis" (Graham, 2015, p. 92) that assumed the stases are discrete from each other. They called for a functional stasis (FS) model that they argued would serve as a better rhetorical methodology to analyze the dynamic rhetorical process of discourse. Functional stasis aimed to not be beholden to the linear organization and discreteness between stases. However, I argue that the FS still carries these issues, because the matrix design still operates under predefined relationships rather than open and a procedural approach built into its matrix design. I extend the aims of FS by opening up the relationships between the stases and sociotechnical aspects of professional work. The key is how the procedural matrix design can be revised by looking to theories of networks to extend the goal of applying the stases as analytical codes to trace situated deliberative flows.

The matrix tool offers the necessary revision to accomplish the previously mentioned goal. In network science, matrices are a data structure that organize and trace the relationships, called *edges*, between *nodes* (e.g., humans, nonhumans, activities, etc.) in a network (Figure 1). The design of functional stasis' matrix implies that the superior and subordinate stases are nodes. However, the stases are no longer nodes in this matrix. Instead, stases are edges, because the intersections are where people are meant to stop and deliberate. This distinction matters for two reasons. First, functional stasis does not explicitly recognize how the superior stases (sources of ambiguity) are sociotechnical practices and mediating artifacts. Secondly, the act to define more explicitly the stases as nodes, instead of edges, opens stasis up to becoming a tool that can account for interrelationships among the practices, mediating artifacts, *and* the stases – a shared goal of functional stasis.

Mediating artifacts and practices should be left open for the researcher to inductively trace based on the context of a given study. If mediating artifacts and practices remain as implicitly as stases, problems of discreteness and linearity also remain. For example, evidential stases are meant to compartmentalize issues with data. However, the matrix's other superior stases – Interpretive, Evaluative, and Methodological – implicitly are all Translative data activities: collecting, processing, and analyzing it. Additionally, along the matrix's subordinate Qualitative (i.e., Quality) row, each cell repeats questions regarding "applications of ..." (Prelli, 2005, p. 305) across the superior stases. This verb conveys the relationships between Qualitative and Translative subordinate stases without addressing it explicitly because the original stases are relegated as row only.

To resolve these problems, I posit that the traditional stases should remain distinct from their interrelationships with mediating artifacts and practices. If the traditionally named stases and sociotechnical properties (mediating artifacts and practices) are nodes in a sociotechnical network, then both can be openly and inductively organized along both rows and columns.



Figure 1. Example of an adjacency matrix data structure (right), which counts the co-occurrences (edges) of nodes within a network. The co-occurrences between nodes in the matrix are accompanied by a visualized result as a network graph (left) (Oloomi, 2014).

This open sociotechnical network arrangement guides the mapping of their interrelationships and opens new possibilities for TPC to confront contexts where data professionals may still adhere to the god trick of quantitative work argue with and the stasis model's fact-value purification problem.

I define mediating artifacts and practices in the Method section, but it is first important to briefly explain how Spinuzzi's (2008, 2018) sociotechnical network (STN) methodology compliments stasis and gains from the inclusion of the stases. Spinuzzi argues that STNs guide researchers who need to map how humans and nonhumans adapt their communicative strategies as they traverse contexts and negotiate the situations in those contexts. I add the stases to STNs as a means to focus on the rhetorical dimensions of professional work.

Stasis and STNs are complimentary because both diagnose where "breakdowns" occur in a communicative process. Their main difference is how STNs specialize in tracing *how* people, tools, and artifacts intermediate to transform how professionals communicate and interpret their ideas and goals across time and space. Conversely, stasis specializes in isolating the rhetorical framings linked to the process of focusing on such breakdowns. Their respective specialties complement each other, because the stases are nodes that represent recurrent rhetorical issues, while STNs specialize in mapping the relationships between nodes like mediating artifacts and practices coordinated by professionals. This complementary relationship is how I combine them as SNs.

Table 2 shows SNs leave the types of mediating artifacts and practices open and distinct from the stases, both of which are organized along both dimensions. By creating this co-occurrence structure, SNs offer researchers and practitioners a tool to inductively code for the co-occurrences between professionals' practices, mediating artifacts, and the stases with situated field data from their professional domains, such as quantitative-driven work. The general set of nodes can be summarized as an acronym MAPS: Mediating Artifacts (MA), Practices (P), and Stases (S). I discuss the MAPS categories in more detail in the Method section, but examples of MAs from this case include identifying properties of data sets (metrics and provenance) or visuals (color scale and tooltips). Practices are the type of expert activities conducted, such as whether the project is data-driven or hypothesis-driven – a detail that impacts their collection, processing, and analysis work. The stases include the traditional five that I defined in the previous section. Overall, this new analytical coding tool identifies strong and weak ties between nodes, so researchers can diagnose recurrent clusters of MAPS.

In this article, I analyze the co-occurring MAPS patterns of a data journalism team's quantitative practices. In this research context, the inductive construction of rhetorical clusters enabled me to develop a substantive theory about data as a rhetorical process that does not separate facts and data from the values of those doing data work. This goal to identify the strong ties of data as a rhetorical process is guided by the following questions:

- (1) Occurrences: What mediating artifacts, practices, and stases (nodes) occur most frequently?
- (2) Co-Occurrences: What mediating artifacts, practices, and stases (nodes) co-occur (edges) most frequently?

· · ·	Conjectural	Definitive	Cause	Qualitative	Translative	Practice 1	 Artifact 1	
Conjectural Definitive Cause Qualitative Translative Practice 1 Artifact 1	-	-	-	-	-	-	-	

Table 2. Example of a stasis network matrix structure.

#### **Background and context**

Data journalism's job growth runs parallel with the expansion of the networked infrastructure of open and big data. Yet, since the 1960s, journalists have been invested in developing new methods to layer their narrative reporting about quantitative and computational techniques with data. The seeds of data journalism were planted in the field of precision reporting, which has been attributed to Philip Meyer's (1973) uptake of social science methods and data with an IBM mainframe computer to develop stories after the 1967 Detroit riots. Meyer later wrote a book, *Precision Journalism*, which helped establish journalism's particular approach to quantitative practices. The field was later namedComputer-Assisted Reporting in the 1980s, when desktop computers become a more prominent fixture in the workplace. Although the technologies and methods may have changed over time, the broader pattern demonstrates journalism's investment in developing inventive workflows to quickly collect, analyze, and share findings to the public audiences while being committed to the transparency of their processes.

The data team and newsroom reporters in this study evince these values and goals too (Table 3). The senior editor Vince has devoted his career to creating opensource digital tools for reporters and the broader public. The team's producer, Jun, is invested in quantitative approaches to reporting about issues regarding civic policy. The two web developers on the team, Ray and Phil, each have a long list of opensource, civic-driven projects. Overall, the team enacts the broader values and goals of data journalism. Specifically, their goals to create data-rich stories evinces their value of metrics and data at a low per-instance level by which to conduct quantitative analysis, which is linked to their assumption that the audience values the key information and takeaways provided by their quantitative-driven reporting. Ray once stated in an interview that the team's editor, Vince, often said that "the power is in the per instance." In other words, they value disaggregated data, so they can adapt to the dynamic reporting landscape.

#### Method

In this section, I first explain the sampled data derived from an IRB-approved, five-month case study (Lindgren, 2021). Then, I describe my analytical coding process that applies a SN methodology.

#### **Data collection**

The team relied heavily on telecommunication technologies because Ray was located in a different state, the other three team members were often out of their office, and newsroom reporters were external to the team. These telecommunication artifacts worked well to collect much of their deliberation throughout a project. I sampled the team's telecommunication in Slack, a professional chat software, for five of the six projects, and 1 used audio recording with accompanying fieldnotes derived from a phone conversation with a reporter and follow-up observational interview with Ray. The sampling process considered any chats that included deliberation about data and/or were mediated by data. Overall, the sample included 539 messages in Slack and 103 turns between Ray and Vick on the phone, all which totaled 7,398 words. Table 4 summarizes the six projects and the data professionals who are sampled discussing each project.

Table 3. List of participants, including their organizational context and job title within the news organization.

Participant	Organizational Context	Job Title
Ray	Data-Journalism Team	Developer
Phil	Data-Journalism Team	Developer
Vince	Data-Journalism Team	Editor
Jun	Data-Journalism Team	Producer
Vick	Newsroom	Reporter

Project	Participants	Messages/ Words	Davs	Objective	Data Sets
Toxic Sites	Jun, Phil, Ray, and Vince	117/1762	5	Jun onboards Ray to the project about the state's management to remediate toxic sites. They discuss the reporter's angle, the data itself, and the best analysis to conduct.	<ul> <li>Per location state management data to remediate toxic sites</li> <li>Census-tracts</li> </ul>
Housing Restoration	Phil, Ray, and Vince	111/1349	3	Ray prototypes an interactive map about the status of the city's rebuilding relief program for home-owners after a major weather disaster. After completing it, he follows up with the reporter to ask about potential data discrepancies.	<ul> <li>Year-end per neighborhood progress data on housing rebuilding initiative after a major weather disaster</li> </ul>
City Payroll	Jun, Phil, Ray, and Vince	153/1652	5	The team is in a bind to publish a quick story, so they try to develop a publishable story angle from a newly released data set about state- employee salaries. Ray shares slices of the database with the team on Slack to facilitate their discussion.	<ul> <li>Year-end per person city payroll data for the year</li> </ul>
Natural Disaster Effect on Train Times	Ray and Vick	100/1309	1	Ray consults Vick about her newly acquired city transit data. They discuss her potential angle and how her data can or cannot be used with the data- journalism team's custom transit data that they have been collecting.	<ul> <li>Per transit line schedule data</li> <li>Per transit stop, per line real-time data feed</li> </ul>
School Diversity	Vince and Phil	103/1326	4	Vince announces how the city is about to release new data about the public- school system's diversity programs. He notes how the data will include more metrics at a less aggregated level than previous years. Vince and Phil discuss what initial hypotheses they might pursue, based on their knowledge about the set from previous years and what their sources say will be new metrics to use	<ul> <li>Year-end per student public school data on diversity program outcomes</li> </ul>
Felonies	Vince and Phil	55/1350	2	Vince announces the release of this data set at the same time as the School Diversity set. Vince notes how it's a similar situation as the School Diversity set. Vince and Phil also discuss and plan potential hypotheses together.	• Year-end per person

Table 4. Project summaries: participants,	, sum of messages and word	count in transcripts,	sum of messaging day	s, project objectives,
and data sets.				

\* Ray and Vick discussed the project over a phone call, so the "Messages" sum total reflects the number of times they took turns speaking to each other.

Of course, this sample is an incomplete description of their quantitative work. The team also communicated via video and had face-to-face interactions, and the full case involved more in-depth, two-hour observations conducted 2–3 times per week, which focused on Ray and his coding activities. These videos and face-to-face interactions were not collected in the original study. However, I collected all the Slack messages across all their channels within the timeline of the study.

#### Analytical coding: creating MAPS with stasis networks

The broader case study applied a modified grounded-theory method (Farkas & Haas, 2012, Glaser & Strauss, 2009) to collecting and analyzing the data, which is described in more detail elsewhere (Lindgren, 2021). The role of the stases were not hypothesized but instead emerged from the

coding of the previously cited study in which I noticed a deliberative pattern between participants, when discussing the data in Slack. Because I knew about stasis theory, I recognized how the team seemed to be deliberating in a manner aligned with its topical moves: the stases of conjecture, cause, definitive, quality, and translative. However, after conducting a pass with the stases, I could not reconcile the linearity of the procedural aspect of stasis with their deliberative flows. Additionally, I found it difficult to ignore the sociotechnical aspects of the deliberation, which provides the richer context of the stases. Due to these issues, as I discuss in more detail in the introduction, I created the MAPS categories.<sup>6</sup>

In the list that follows, I summarize the three main MAPS categories of SNs: Mediating Artifacts (MA), Practices (P), and Stases (S). The MAPS categories serve as the initial coding scheme that guided my qualitative coding of the team's rhetorical flow of deliberation. It is important to account for MAs, since data and other documents operate as intermediaries between people and their understanding of the world (Haas, 1996, Witte & Haas, 2005) – that peoples' understanding and use of MAs are always limited and cultural (Haraway, 1988). Accounting for practices allows for a method that traces the different ways people coordinate themselves and the mediating artifacts. The stases are time-tested rhetorical moves established across millennia of scholarship, so tracing these communicative moves in the context of professional practices serve as a foundational approach to trace rhetorical ways people carry out their data and quantitative work. Refer to Appendix A or a complete codebook derived from this case, which provides all the codes within each MAPS category, their respective subtype and code hierarchies, definitions of each code, and an example from the case itself.

- MA (Mediating Artifacts): Any action/statement mediated by or about material artifacts, such as documents, data sets, visuals, etc.
- P (Practices): Any action/statement that coordinates their work in a recurrent manner
- S (Stases): Any action/statement that makes one of the following 5 rhetorical moves (stases): Conjectural, Definitive, Cause, Quality, and Translative (Brizee, 2008; Fahnestock & Secor, 1988; Prelli, 2005)

In preparation to code the data, I organized the sampled data by their respective projects in MAXQDA's document system, so I could compare and contrast results across the projects. I coded the data with a method informed by DeVasto et al. (2016, pp. 143–144) nesting and resolution. As demonstrated in Figure 2, I coded the scope of an originating set of MAPS that instigated and coordinated a series of other *nested* MAPS within that originating scope. This method accounted for the flow of deliberation. The coding of nested MAPS ended when the originating scope was either resolved or the discussion was dropped or redirected to another distinct discussion. This method provided the means to trace and account for co-occurrence relationships that the team wove between MAPS. I wrote analytical memos to refine the subcodes within each MAPS category.

After coding the available data across the projects, I aggregated the code totals and conducted cooccurrence tests to answer the two research questions. To answer the first question, I used MAXQDA's built-in "Code Matrix Browser" tool to export the total of MAPS codes across the six projects as a Microsoft Excel spreadsheet. To answer the second question, I used MAXQDA's built-in "Code-Relations Browser" tool to conduct an intersection co-occurrence analysis, as opposed to a proximity analysis. The intersection analysis only accounts for actual overlapping codes on a segment rather than a defined proximity to it. I also exported the results as a Microsoft Excel spreadsheet. By exporting both results for each question, I could further work with the data to generate the results reported in the findings section.

Before I report the findings, I summarize the distribution of the MAPS coding results in Table 5 to contextualize the results across the six projects. Five of the six projects were of relatively even distribution. The Toxic Sites project yielded the most codes (319, 23.6%), while the Felonies discussion yielded the least (5.7%). This distribution difference with the Felonies project is due to the length of the discussion at 55 messages (refer back to Table 4).

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**Figure 2.** Screen capture from MAXQDA that shows how I analytically coded the MAPS categories that accounts for their cooccurrences within nested and resolved relationships (DeVasto et al., 2016, pp. 143–144). Red lines indicate MA codes, while black lines are P codes, orange are translative, purple are quality, and green are definitive. Other codes not shown in this example were designated distinct colors too. All identifiers are pixelized for confidentiality.

#### Table 5. Distribution of the MAPS categories across the 6 projects.

		School					Total Codes
Code Type	Toxic	Diversity	Payroll	Housing	Transit	Felonies	for All Projects
Mediating Artifacts	23.0%	17.0%	15.1%	21.9%	17.0%	6.0%	365
Practices	24.4%	28.2%	15.1%	13.1%	13.1%	6.1%	312
Stases	23.6%	18.4%	21.0%	15.0%	16.6%	5.3%	673
Total Codes for Project	319	274	243	222	215	77	1350
Percentage of Total	23.6%	20.3%	18.0%	16.4%	15.9%	5.7%	100%

#### **Findings**

Among the 1,350 total codes of the 642 messages in Table 6, the stases represent approximately half of the corpus (49.9%, 673), while the mediating artifacts (365, 27.0%) and practices (312, 23.1%) represent approximately even proportions of the other half. The overall top 10 codes represent 70.4% (950 codes) of the corpus across all the six projects. (Refer to Appendix B for the full list of codes and their frequencies.) Four of the five main types of practices were within the top 10 codes – the fifth being data-driven (DD) practices. Metrics (11.7%, 158) was the only mediating artifact within the top 10 and was the second most frequent code overall. Notably, cause (39) was the only stases to not appear within the top 10.

#### What are the most frequently occurring MAPS?

In this section, I report the results from the first research question, regarding the most frequently occurring MAPS. Each subsection discusses the results of the MAPS categories organized in Table 7 for reference throughout.

#### Practices: hypothesis-driven practices occur most frequently among all practices

When code frequencies are aggregated across their subtypes, hypothesis-driven (HD) practices (12.6%, 170) appear most frequently across five of the six projects, while data-driven (DD) practices (41, 3.0%)

Top 10 Codes	Code Frequency
S\Translative	162
MA\Data\metrics	158
S\Definitive	152
S\Quality\alignment	82
S\Conjectural	70
P\HD\analysis	69
P\Visualization	57
S\Quality\significant	56
P\HD\processing	55
P\HD\angle	46
P\Collection\external	43
Total	950
Total Codes in Corpus	1,350
Representation of Top 10 Codes in Full Corpus (Percentage)	70.4%

Table 6. Top 10 most frequently occurring codes. Codes are labeled within their hierarchy within the main type and subtype delimited by a backward slash ("\").

Table 7. Code frequencies and their respective central tendency across the projects.

		Subtype Frequency	Projec	Occurrence Central Tendency		
Subtype	Sum	Percentage of Column	Max	Mean	Median	
MA\Data	288	21.4%	6	2.5	2.0	
S\Quality	250	18.5%	6	3.1	3.0	
P\Hypothesis-Driven	170	12.6%	5	4.0	4.0	
S\Translative	162	12.0%	6	6.0	6.0	
S\Definitive	152	11.3%	6	6.0	6.0	
S\Conjectural	70	5.2%	5	5.0	5.0	
MA\Visual	64	4.7%	3	1.3	1.0	
P\Visualization	57	4.2%	4	4.0	4.0	
P\Collection	44	3.3%	4	2.5	2.5	
P\Data-Driven	41	3.0%	1	1.5	1.5	
S\Cause	39	2.9%	4	1.6	1.0	
MA\Reporting	13	1.0%	2	2.0	2.0	
Summary of Column	1350	100.0%	6	2.6	2.8	

appear less frequently and within the Payroll project only. Visualization practices (4.2%, 57) were discussed less frequently than HD practices. Despite visualization being discussed across four of the six projects, it predominantly occurred in the discussions about the Housing project. Data collection practices represented (3.3%, 44) of the corpus across four projects but were predominantly found in two of those four projects in which new data releases were integral to their exigencies: School Diversity and Felonies. Findings indicate that the team wove few ties to Translative during DD practices, which mainly occurred during the Payroll project.

#### Mediating artifacts: data occur most frequently across all subtypes

Across all MAs, data were discussed and/or shared most frequently (289, 21.4%) and distributed evenly across all projects. Data visuals represented 5.1% (69) of the corpus, which were discussed and/or shared across three projects. Yet, as mentioned before, visual-related discussion and work predominantly occurred during the Housing project, based on the available data. Reporting MAs represent the corpus the least (7, 0.5%) since it involved one moment when Vince shared a draft reporting copy for a combined story about the city's new data releases during the School Diversity and Felonies projects.

#### Stases: quality occurs most frequently among all stases

Among the stases, Quality (18.5%, 250) was most frequent. It occurred across all the projects, and it was second most frequent overall among subtypes. The frequencies of Translative (12.0%, 162) and

Definitive (11.3%, 152) were similar because, as I report later, they co-occurred quite frequently across all the projects. Conjectural (5.2%, 70) occurred across most projects, but it predominantly occurred in the lone data-driven Payroll project. Cause (2.9%, 39) occurred the least frequently across four of the six projects, but it also mostly occurred in the Payroll project.

#### What are the most frequent co-occurrences among MAPS?

In Figure 3, the strongest top three co-occurring nodes across all projects and all codes included S \Translative (709), MA\Metrics (652), and S\Definitive (635). This particularly high degree of relationships between definitive, metrics, and translative nodes co-occurred during numerous practices, so I identified it as an important cluster of nodes called DMT.

The quality of a metric's definition had strong ties across all the practices because its definition impacted how the team developed the goals and tasks of their project. Two main sets of quality stases had strong ties with the **DMT** cluster: (1) Alignment, and (2) Significance, and Oddities/ Interestingness. Alignment refers to discussions about perceived incongruencies between their goals and interpretations of metrics in particular. Quality codes of significance, oddities and interestingness involved moments when the team wove their idiosyncratic a priori values of what they deemed significant, odd, or interesting (or not). In the following two subsections, I report findings regarding these two sets of quality that co-occurred with the DMT cluster.

#### Alignment: deliberating about the incongruencies of competing definitions and uses of metrics

As an overall judgment of quality, alignment involved pursuing the value of conducting ethical work to understand and act on the limitations of data. Alignment issues were impediments to a reporting goal when the definition of metrics was mis-aligned due to different provenances of data, if an analysis

Full Code Hierarchy	S \ Translative	MA \ Data \ metrics	S \ Definitive	S \ Quality \ alignment	P \ HD \ analysis	P \ Visualization	P \ HD \ processing	S \ Quality \ significance	P \ Collection \ external	P \ HD \ angle	S \ Conjectural
S \ Translative		<del>9</del> 7	90		56	39	52	36	30	21	17
MA \ Data \ metrics	97		119		49	27	37	30	28	12	21
S \ Definitive	90	119			41	34	39	27	22	11	13
S \ Quality \ alignment			61		20	31	22	2	0	2	3
P \ HD \ analysis	56	49	41	20		9	10	27	23	7	7
P \ Visualization	39	27	34	31	9		6	12	8	1	1
P \ HD \ processing	52	37	39	22	10	6		10	11	3	0
S \ Quality \ significance	36	30	27	2	27	12	10		31	19	26
P \ Collection \ external	30	28	22	0	23	8	11	31		8	5
P \ HD \ angle	21	12	11	2	7	1	3	19	8		37
S \ Conjectural	17	21	13	3	7	1	0	26	5	37	
SUM of Column	501	481	457	265	249	168	190	220	166	121	130

Figure 3. Heatmap of the codes across the MAPS categories. The top co-occurring codes included translative, metrics, definitive, and quality.

did not address the goals of the story, or if the visual of the metric did not align with the team's definition and communication goals. Alignment co-occurred 347 times overall, wherein 23.6% (82) co-occurred with the DMT cluster. Alignment co-occurred with metrics across the following four practices: HD Visualization (31), HD Processing (22), HD Analysis (20), and DD Processing (2).

Alignment concerned data processing, when combining two or more data sets that either share a common topic and potentially shared metric(s). During the Transit project, Vick asked Ray if they could combine and compare Vick's train *schedule* data from the city with the data team's custom data being collected about the trains from a different *real-time* feed. Below, Ray tries to explain the importance of this potential misalignment of how the different data sets define the time metric in relationship to Vick's later analysis goals.

Ray: [City name redacted] has their schedule data feed, [as well as] this real-time data that says that "This train is [now] leaving this station." We're collecting that [real-time data] every 30 seconds.

Vick: Is there a way to compare the [schedule] data in my spreadsheet [with your real-time feed data]?

Ray: If you can figure out more specifically what these numbers are, then maybe.

Vick: Do you mean like what they consider on time?

This DMT work highlights how Ray had the insight to ask Vick to verify the provenance and definition of this metric, as well as how Vick, who focuses more on the reporting and not quantitative work, could not identify the issue without such experience.

During the Payroll project, Phil shared the lone HD angle and analysis, stating his interest in analyzing the relationships between seniority and overtime, which he based on his initial impressions from data tables that Ray shared in Slack. Ray responded with the following concern about Phil's definition of a seniority metric:

Phil: I would be mostly curious about a) how does overtime relate to seniority? Over the course of a career, is overtime a thing that savvy senior people get, or is it spread more evenly within a department? ...

Ray: That would be interesting. The data [metric] we have is "start-time at agency." I think that's an ok data point, but I'm not too confident that it necessarily equates to seniority.

Ray questioned the alignment of Phil's proposal to equate the "start-time" metric with the concept of seniority. Such a request impacted whether the team could pursue this line of analysis (translative) that other team members expressed as interesting (quality). Ray attempted the analysis with the starttime metric, but the team deemed the results not interesting enough to pursue further.

During the HD Housing project, the team also addressed alignment issues when defining metrics related to how to produce and revise how the metric is represented in a visualization (translative). In the following conversation, Phil challenges the reporter's direction for Ray to use a particular color-scale scheme to emphasize neighborhoods that have received less support to rebuild homes:

Phil: I'd stay in the same hue set. But lighter should be less construction; darker should be more construction: a reflection of concentration.

Ray: Right. But, the [reporter's] idea is that it makes more sense to highlight the places that have less construction.

Phil: They get highlighted in their absence and the strong borders. I'm going to respectfully disagree with [the reporter's] interpretation. I think the "missing" areas make the point: "It's not happening here."

Phil, who has many years of experiences creating data interactives, disagrees with the reporter's colorscale for the metric and notes how standard less-to-more ordinal scales move from lighter to darker color hues. Overall, alignment issues were strongly tied to values of understanding the ethical limitations and compatibility of metric definitions in relationship to their potential story ideas.

#### Significance, oddities, and interestingness

Recall that a priori values (Fahnestock & Secor, 1988, p. 434) are typically ignored by the traditional stasis procedure since stasis traditionally focuses on overcoming incommensurability rather than tracing accepted flows of deliberation. In this section, I report findings on how the team wove their idiosyncratic a priori values about what they deemed significant, odd, or interesting (or not) in relationship to the DMT cluster.

When data sets offered the team more flexibility to aggregate data in numerous ways, the DMT cluster had high degree relationships with significance (123 co-occurrences), as well as interestingness and oddities (47 co-occurrences). For instance, Jun and Ray needed to finalize the definition of a metric to analyze issues about what demographics lived in close proximity to toxic sites in need of remediation. After they considered a few ideas, they conducted a distance-based analysis called "centroid-containment" (Kearney & Kiros, 2009, p. 3), which calculated how many of each Census-tract demographic were within X miles of at least 50% of the surrounding unit's geographical center. In this case, they used the address of the toxic sites as a locus to calculate how many people lived within proximity to a site.

To conduct this analysis, they needed to decide the size of the buffer radius around each site: the X miles variable of the calculation. Ray shared the following tabulated results from a ½-mile radius to compare against results from a one-mile radius.

Significance played a role in Ray's judgment about which metric to apply, i.e., DMT work. Specifically, Ray wrote to the team in Slack: "I don't think the ½ mile [buffer radius] is really any different [from the one-mile buffer radius]. It's actually difficult to compare. The 1-mile numbers seem a bit more powerful."

During the School Diversity project, Vince shared his excitement about the city's end-of-year data release because the data were indexed at a lower aggregate level than previous years (presented in the excerpt below). It is worth quoting the excerpt from Vince and Phil's discussion because it demonstrates some of the quality-driven rhetorical work completed to anticipate the definition of potential metrics and prepares for a quicker turnaround in processing, analyzing, and visualizing the data so that they could immediately publish a report that they derived from their previous knowledge of the data.

Vince: Tomorrow the DOE is releasing racial data at the *program* level. (Currently we only have that at the school level.) It could mean we'll see crazy segregation when sorted by things like Gifted & Talented and Dual-Language programs.

• • •

Worst case scenario: they give us something like: "dbn, program\_no, white, black, hispanic, asian," so we merge the demographic data with proper program numbers (may have to be dbn+program\_no).

Then we aggregate it by both program description (i.e. "Business" or "Dual Language") and by admissions policy (i.e. "Screened" or "Limited Unscreened"). I think those will be the quick-hit looks. (emphasis original)

Phil: ... I'm prepared to sum/average based on a combo of program + admissions type, or should I look at the breakdown by admissions type and breakdown by program as two separate issues?

Vince: Separate issues. Just to see where the stories are, initially.

Phil: Ok. So like, "what % of students in screened programs are white vs. other programs," and then, "what % of students in science and math programs are white vs. other programs"?

Vince: The whole issue of "screened" vs "limited unscreened" isn't going to track for anyone. So we'll need to pick what we actually do. But I can imagine a phrase that says something like "At schools where students need to apply ...." I think the visual is probably either two bars stacked, or a slope graph.

After this exchange, which continued at some length, Vince and Phil anticipate how to work with metrics linked to the "screening" of students in relationship to demographics – aspects that they deem important for the audience. They consider different possibilities that apply these metrics across admission and program data by suggesting particular questions to test and quickly, as Vince states, "see where the stories are." Vince also revises the metric's original language of "screening" to "applying" for their audience, which he thinks will "track" better with the audience. In short, they work quickly together to devise an almost complete report before they even get the data itself, which is based on their previous experiences with the data.

Significance, interestingness, and oddities co-occurred regularly during the Payroll project's DD practices, but their interrelationships were different from those in the HD DMT cluster. During the predominantly DD Payroll project, the team wove a different set of co-occurrences with significance, interestingness, and oddities with that of Conjectural and Cause stases. Because the team had never worked with the Payroll data before, they had no prior knowledge of its metrics. Rather than generating hypotheses and spending more time defining metrics, Ray conducted an exploratory data analysis that aggregated and tabulated data slices, which he shared with the team in Slack. Based on these tables, the team pitched (Conjectural 132) a total of angles (72) based on their idiosyncratic interpretations of a datapoint (45). Their angles were derived from their sense of a datapoint's quality: its significance (91), interestingness (48), or oddity (39), i.e., their historical sense of audience values. Interestingly, these DD practices involved the most oppositions about why (Cause 154) their angle was of a good quality. Many of the angles were speculative (11), and their deliberation about Cause become very anecdotal (6) to justify their sense of the angle's quality. In the moment below, Ray had just shared a table summarizing "Top 20% OT by department." Vince quickly suggested a focus on the Board of Elections department, because he thought it seemed odd that they were ranked third overall.

Vince: I want to see a Board of Elections OT story. That [amount of OT] makes no sense.

Ray: Vince, why doesn't that make sense?

Phil: Yeah, I would expect BoE to get overtime.

•••

Vince: Assuming 1.5x pay for OT, working an average of 91 hours a week (pretty sure the city weeks are 35 hours/week), I suspect that is not humanly possible.

Ray: Definitely possible, but definitely improbable.

Vince: Naaaah. You can't do that all year!

Ray: I definitely couldn't.

Vince: Unless I screwed up the math, which is possible.

Ray: Just looking at it, he is working more than twice as much, assuming the regular pay is 40 hrs, then that's 80+ hours, which some people do, but not many people would do that every week for a year. Even if it's possible, it's ridiculous for the city to be paying that much.

Overall, the team's data work was quality-driven with their respective idiosyncratic senses about the significance, interestingness, and oddities of metrics during HD practices and predominantly data-points during DD practices.

#### Discussion

Stasis networks provide TPC a methodological tool to identify and understand the rhetorical moves that data professionals make by tracing the relationships between MAPS nodes as they conduct their quantitative work. Findings from this case extend previous calls (Danner, 2020, Frith, 2017, Roundtree, 2013, Wolfe, 2015) to understand data work as a rhetorical process, which I argue confronts the god trick problem by providing substantive and descriptive evidence about how

- (1) The team explicitly exposed and confronted the limitations of data; and
- (2) A priori values implicitly impacted the what and how of collecting, processing, analyzing, and reporting the data.

Stasis networks helped me identify the strongest ties across MAPS, wherein the team incorporated a quality driven DMT cluster of quantitative work. Across the six projects, the DMT work involved various judgments about the *quality of metrics* based on their developing definitions, which co-occurred prevalently with how team members initially devised goals for the project (translative). Findings indicate how their goals to collect, process, analyze, or visualize data changed or were refined through their shifting definitions of the metrics.

For example, DMT work in relationship to alignment was a hotspot of negotiation to expose the constraints and limitations of data. Within these moments, their deliberations to define metrics involved contextualizing and (re)defining metrics by critically comparing and contrasting external provenances

against their current reporting goals. Such moments included Ray and Vick's discussion about the incongruency between the data team's custom transit-feed data versus the data Vick requested from the city. These findings about DMT and alignment offer substantive descriptions that speak back to the god trick: that data are neutral and complete representations of reality. As Atherton (2021a) reminds TPC, "data is created, not found" (p. 86), and the DMT cluster illuminates how team members' work to collect, process, analyze, or visualize data evinces this claim.

Additionally, findings about quality stases, such as significance, interestingness/oddities emphasize the relationships between facts and values. Furthermore, during the DD City Payroll project, quality stases implicitly drove each team members' abductive reasoning approach to propose angles (conjecture) derived from a single datapoint, which were often met with rebuttals to downplay the initial perceived significance. Much of the causal stases occurred during DD practices, which came in the form of anecdotal speculation from competing ideas about which angle to pursue. Overall, these more ephemeral rhetorical moves provide a substantive description about how the team's rhetorical and sociotechnical practices wove a priori and changing values with decisions about what they deemed an impactful and ethical data-story, as well as the best steps to create a publishable story. In a Slack chat, Vince once noticed how this deliberation about what angle with the data to pursue was a process to "see where the stories are" – a position that also aligns with Danner's (2020) findings about a different team's work to "humanize the numbers" (p. 10).

This case also extends the work of functional stasis (DeVasto et al., 2016, Graham, 2015), which adheres to a procedural matrix approach by demonstrating the benefits of not applying a predefined hierarchical and linear stasis procedure. I argue that the findings demonstrate the benefits of openly coding the links between stases and accompanying material artifacts and practices. Theories of sociotechnical networks (Danner, 2020, Spinuzzi 2008, 2018) provide TPC the ability to generate and verify a substantive theory of stasis by inductively coding the interrelationships between the MAPS categories and their codes. For example, the data professionals in this case were not beholden to a linear and procedural stopping-place approach to stasis, because stases were not being used as a classical method of invention. Additionally, the SN methodology provided a means to map how matters of quality were always interrelated with their sociotechnical work, even when matters of, significance and oddities/interestingness were in agreement. Overall, the SN methodology's inductive and open approach to the stases provides a more pliable methodological tool to study in situ flows of deliberation.

The SN methodology importantly frames quantitative work as TPC. Stasis networks provide a new means to extend existing theories about *how* data are subject to the interrelationships between facts and values (Adams, 2016, D'Ignazio & Klein, 2020, Haraway, 1988). Future studies can apply SNs to isolate clusters of data work, such as the DMT, by mapping a professional's values about the data to their claims about what the data "says." Such qualitative research could identify hotspots where conflicts or groupthink fact-value dynamics might be occurring. I argue that SNs have the potential to isolate instances when professionals might be either intentionally or accidentally overlooking angles, data, and practices integral for ethical quantitative reporting.

This case study offers a starting point toward a more descriptive theory of data as a rhetorical process. Limitations include the consideration of the case's scope to this domain and particular team's context. Additionally, I cannot provide intercoder reliability due to my IRB agreement with the legal team at the organization. These constraints are important to carry into future research. Yet, the aims of this case have been to extend the theorizing of quantitative work with data as a rhetorical process and provide a means by which to guide future studies.

After conducting this study, I recommend that future researchers collect and sample a wider array of data types, such as more situated observations of data work as it iteratively relates to a team's deliberation. For example, findings found variances between HD and DD practices and their respective strong ties with quality stases of significance and oddities/interestingness specifically, HD practices and defining metrics versus DD practices and proposing angles with datapoints. Future studies could more directly sample and compare HD and DD practices as a way to potentially find any variances in how and when value judgments become more prevalent in the data process. Additionally, this study did not isolate people with more

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precision as nodes. Future studies could more pointedly isolate people as nodes within a MAPPS where the additional "P" includes people within the coding framework as a means to isolate different rhetorical relationships across quantitative work. This inclusion could provide additional variables for intersectional analyses across gender, sex, race, etc. in relationship to their respective clusters of rhetorical activity. Such future studies can test the veracity and refine the boundaries of the findings herein about data as a rhetorical process and the application and theorizing of stasis as sociotechnical networks.

#### Notes

- 1. All names, places, and artifacts have been altered to maintain confidentiality of participants in this institutional review board approved case study (University of Minnesota No. 1509P78181 and Virginia Tech No. 17–924).
- 2. There are numerous variations of stasis theory, which also have varying numbers and structures.
- 3. Refer to Fahnestock and Secor (1988).
- 4. Refer to Fahnestock and Secor's (1988) revision of quality to value.
- 5. Later, I explain how DeVasto et al. (2016) take up Prelli's (2005) updated stasis model.
- 6. I also thank the anonymous reviewers for their questions and comments about the analysis and codes.

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# Appendix A. Complete MAPS codebook for the case study including code hierarchy, definitions, and examples

Code System	Defin	ition	Example
Mediating Artifacts (MA)	Any action/statement n	ediated by or about	
	material artifacts, suc	h as documents, data	
MA > Reporting	Any action/statement mediated by or about the material reporting properties of the data		
MA > Reporting > copy	Any action/statement mediated by or about the reporting copy aspect of the data.	During the School Diversity projec "Does this copy look ok?" and p an excerpt for review.	t, Vince asks Phil, proceeds to share
MA > Visual	Any action/statement mediated by or about the material properties of the visualized data.	·	
MA > Visual > type of chart	Any action/statement mediated by or about the type of chart that the team should create to represent the claim they want to emphasize.	Vince suggests to Phil how he thin represent segregation in city sc probably either two bars stacked Or, maybe, two columns with b between"	hks the visual to hool programs "is d, or a slope graph. endy paths in-
MA > Visual > sample	Any action/statement mediated by or about the sample of the data that has generated the visual.	During the Toxic Sites project, Ray map just the 'abandoned' sites	asked Jun, "Is that or all active sites?"
MA > Visual > result	Any action/statement mediated by ro about the results provided by a visual.	During the Toxic Sites project, Ray with toxic sites represented as state. He remarks to Jun, saying [city_2], and [city_3] are [state_ biggest poor urban cities. And clusters seem to be."	y glances at a map dots across the g "I mean [city_1], redacted]'s that's where the
MA > Visual > tool	Any action/statement mediated by or about the use of a particular tool to create a particular visual.	Jun shows Ray a map in Mapbox th a similar use of the tool for and	hat reminds Ray of ther project.
MA > Visual > tooltip	Any action/statement mediated by or about the tooltip on a visual.	Phil provides Ray some feeback of map for the Housing project. Ph the phrasing of the tooltip may I understand correctly, shouldn' construction projects have begu	n Ray's visualized il suggests "I think 'be off? If 't it be: 'XX% of un.*'"
MA > Visual > color scale	Any action/statement mediated by or about the color scale on a visual.	During the Housing project, Ray ro on his visual map. Phil responds that right now I get confused b construction is a darker color, w contradictory to me."	equests feedback s: "My only thing is ecause 'less' vhich seems
MA > Data	Any action/statement mediated by or about the material properties of the data.		
MA > Data > metrics	Any action/statement mediated by or about metrics.	During the City Payroll project, Ph investigating the relationship b overtime and seniority. Ray que not the available metric of "star seniority.	il is interested in etween employee estions whether or t-time" aligns with
MA > Data > data point	Any action/statement mediated by or about a very particular data point value in contrast to a broader metric or aggregated result.	During the Felonies project, Phil s a particular data point, saying " crime is in 1975, but it's 12:01a	ingles out the 4th oldest m on January 1."
MA > Data > provenance	Any action/statement mediated by or about the provenance of the data set.	During the phone call between Ra inquires why their data set FOI/ different from the data team's t responds: "The city has a sched they have this real-time data th train is leaving this station. We' every 30 seconds."	ay and Vick, Vick A'd from the city is cransit data. Ray ule data, and then hat says that this re looking at that
MA > Data > release	Any action/statement mediate by or about the release, i.e., publication, of a particular data set.	Vince shares his excitement with the how the latest version of the circle scholastic programs now include data.	he team about ty's public school le demographic

Code System	Defin	ition	Example
MA > Data > qual expert statements	Any action/statement mediate by or about qualitative, expert testimony.	During the Toxic Sites she will be support abandoned sites m story by contacting advocates.	project, Jun lets Ray know that ting their definition of the etric central to their developing g local developers and
MA > Data > result	Any action/statement mediated by or about the results of the data.	During the City Payro "Top 20 X" aggrega	Il project, Ray shares tabulated ations to the team.
MA > Data > request	Any action/statement mediated by or about data requests, such as FOIA requests from government agencies.	During the Transit pro and Ray, Ray and V city will provide a aggregation level.	oject phone call between Vick Vick discuss the likelihood the better data set at a lower
MA > Data > sample	Any action/statement mediated by or about the sampling of the data.	During the City Payro a table of the "Top department level, I be interested in se across all department	Il project, Ray had just shared 20 overtime" at a per but Jun notes how she would eing the results from a sample ents.
MA > Data > tool	Any action/statement mediated by or about the tool used to access or use the data	During the City Payro there seems to be socrata interface, o a computer"	Il project, Phil remarks how a "weird bug in the clunky or I just don't know how to use
MA > Data > aggregate	Any action/statement mediated by or about the	During the Felonies p surprise that the n a lower aggregate didn't realize it was it was going to be	project, Vince remarks his ewly released data will be at level than previous years: "I s individual incidents. I thought aggregated!"
MA > Data > use	Any action/statement mediated by or about the use of the data.	During the Transit pro realtime schedule t a complete [15-mo your] set, so we ca	oject, Ray notes how the team's feed data does not "have onth cycle that is reported in in't compare the whole year."
Practices (P)	Any action/statement a	bout how the team	
P > Collection	Any practice devoted to requesting, collecting, and creating/collecting data from internal or external sources.	к.	
<i>p</i> > Collection > external	Any practice or discussion of a practice that focuses on finding and collection data external to the news organization.	During the School Div the team how "Tor Education is releasi level. (Currently we level.)"	versity project, Vince informs morrow the Department of ing racial data at the *program* e only have that at the school
<i>p</i> > Collection > internal	Any practice or discussion of a practice that focuses on collecting custom data for internal use to the news organization.	Ray and the team has custom schedule d system at a per mi available to reques	ve been collecting their own lata of the city's public transit nute level – data not readily st from the local government.
P > Visualization	Any practice or discussion of a practice that focuses on visualizing data.	Ray and Jun discuss h disparities between demographic grou proximity to toxic	now to best represent the n more marginalized, ps who are more often in close sites.
	Any practice or discussion about a practice that focuses on hypothesis-driven (HD) approaches to working with the data. HD approaches involve deductively discussing and testing claims from the data.		
p > HD > hd-analysis	Any HD approach to analysis or discussion about an HD analysis.	During the School Div that Phil prepares significant "segreg, sorted by things [p and Dual-Languag	versity project, Vince suggests to test if there are any ation when [the data are] programs] like Gifted & Talented e"
			(Continued)

#### Code System Definition Example During the School Diversity project, Phil suggests p > HD > hd-processing Any data processing work or discussion during an HD approach to the team's process. that "Worst case scenario, they give us [metrics] like: "dbn, program\_no, white, black, hispanic, asian." If so, we merge the demographic data with proper program numbers (may have to be dbn +program\_no) and then aggregate it by both program description (i.e. "Business" or "Dual Language") and by admissions policy (i.e. "Screened" or "Limited Unscreened") p > HD > hd-angleAny angle to the story pitched and discussed Vince shares his initial questions to test with the during an HD approach to the team's process. Felonies data. He is interested in the topic of reporting lag time, since he sees that there are two metrics related to the matter: occurrence date vs. date it was entered into the system. After he explains this, he suggests the following question: "... has there been a change in lag time for reporting of rapes and assaults?" P > DDAny practice or discussion about a practice that focuses on data-driven (DD) approaches to working with the data. DD approaches involve discussing and working through whether or not claims made inductively or abductively from the data can be used. p > DD > dd-angle Any statement that pitches, defends, criticizes, During the City Payroll project, Ray shares tabulated or develops an angle derived inductively results about the top paid positions and remarks from the shared data. how "a Correctional Standards Review Specialist got paid the highest 445k; though their base pay was 61k. Some sort of contractor maybe." p > DD > dd-processing Any data processing work or discussion during During the City Payroll project, Phil remarks to Ray an DD approach to the team's process. how Ray's "step-by-step slicing" of the city's data is a "good" process. Additionally, Ray often notified his team how the database tool to look at this data has some data processing quirks to be aware of. p > DD > dd-analysis Any data analysis work or discussion during an During the City Payroll project, enough discussion DD approach to the team's process. about odd and interesting angles to seniority and overtime led to a correlation test between the two variables. p > DD > dd-Any DD work or discussion about following up After much deliberation on the City Payroll project, investigativeabout a potential angle derived from the Phil suggests that they "report out" their strongest followup data. angles: "... even if we're not naming names it seems like we need to call some of these departments and try to get explanations about what these jobs do, about why they might have more overtime than others. Otherwise we're flying very blind." Stases (S) Any action/statement that makes a rhetorical move (stases): Conjectural, Definitive, Cause, Quality, and Translative (Brizee, 2008, Fahnestock & Secor, 1988, Prelli, 2005). S > Cause Any action/statement about what may or may not have caused the issue. S > Cause > quant verify Any Causal stases action/statement regarding During the School Diversity project, Phil notifies the verifying quantitative results. team that "I need to check the 1/3 citywide numbers ... but the rest looks right."

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👄 C. A. LINDGREN

Code System	Defin	ition Example
S > Cause > qual verify	Any Causal staces action/statement regarding	During the City Payroll project Vince petities the
	verifying info with qualitative support.	team how an external newsroom reporter asked their source from the city to verify some details regarding a metric: "So, thanks to Ray's poking around already, I asked her [reporter] to ask them if it includes things like settlements, back-pay, etc. And she did. And they said, oh, no, we just took the numbers straight from the agencies."
S > Cause > unknown	Any Causal stases action/statement that indicates the team does not know enough about the matter at hand.	During the City Payroll project, Phil writes to the team that their data-driven work has led them to a point of unknowns: "we need to call some of these departments and try to get explanations about what these jobs do, about why they might have more overtime than others. Otherwise we're flying very blind."
S > Cause > anecdotal	Any Causal stases action/statement that uses anecdotal evidence to support their claim.	During the City Payroll project, Ray responded to a potential angle about how much janitors make, rebutting how "I have a friend that used to be a janitor in a NYC school. He always said he was paid pretty well."
S > Cause > speculative	Any Causal stases action/statement that uses speculation to support their claim.	During the City Payroll project, Phil responds to Vince's surprise that the Board of Elections should receive so much overtime pay with a speculation: PHIL: yeah I would expect BoE to get overtime VINCE: Really? For two nights out of the year?. I'm suspicious. PHIL: more than two nights I would think; a few weeks at minimum.
S > Quality	Any action/statement about the quality of the issue.	
S > Quality > recent	Any action/statement about the recency of the data, angle, analysis, or other aspects of the project.	During the City Payroll project, Ray responds to Vince's request about a quick story to produce by sharing the very recently released data set.
S > Quality > alignment	Any action/statement about whether or not the proposed metric, analysis, etc. aligns with the current goals for the project.	During the State Toxic Sites project, Jun and Ray discuss the current hypothesis and analysis goals. Jun writes to Ray that, "the theory is that there are more concentrations of these "abandoned" sites in lo-income communities of color. Ray responds: "Well, looking at correlation on the census level does not support that [hypothesis]. But that's not the only way to look at it It does say that we can't confidently predict that a tract with a high percent of people of color will have a higher number of sites."
S > Quality > unverified/ unknown	Any action/statement about the current state of the project as being publishable or capable of moving to a next step until it has been reviewed and verified.	During the Housing project, Phil asks Ray about the results on the drafted map visualization; specifically about the cutoff value for neighborhood applications being "50+." Ray responds that he isn't sure and will verify it with the newsroom reporter.
S > Quality > oddity	Any action/statement about whether or not the proposed metric, analysis, etc. seems odd to the person.	
S > Quality > oddity > odd	- -	During the Payroll project, Ray shares a table of the Top 20 Paid employees and writes: "a Correctional Standards Review Specialist got paid the highest 445k though their base pay was 61k"
S > Quality > oddity > not odd	-	PHIL responds to Ray: "that last one doesn't seem that unusual. I know in CA the highest paid employees were often corrections workers earning tons of OT"

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Code System	Defin	ition Example	
S > Quality > missing	Any action/statement about potential issues with the data or goals that depend on missing data/materials.	During the School Diversity project, Vince shares the newly published data and is surprised to see that the initially available data set has been aggregated to a level that is not very useful to their goals: "Um, I think this [data set] is useless. They mashed all of the programs together"	
S > Quality > issue/error	Any action/statement about any errors or issues with regards to the data.	During the City Felonies project, Phil mentions to Vince how there may be some errors with the dates: "I'm guessing the 1915 is a mistake and it's supposed to be 2015."	
S > Quality > interestingness	Any action/statement about whether or not the proposed metric, analysis, etc. seems interesting or not to the person.	<ul> <li>During the Toxic Sites project, Jun and Ray discuss angles that have the potential to be interesting for the story:</li> <li>RAY: When I look at the map, I can see that 5 cities have a good chunk of these abandoned sites.</li> <li>Maybe we look at it at the city level?"</li> <li>JUN: "Yeah, maybe"</li> <li>RAY: "I mean [city names redacted] are [state name redacted] biggest poor urban cities. And that's where the clusters seem to be. Or maybe we look at where these sites are relative to land values?"</li> </ul>	
S > Quality > interestingness > not	-	-	
interesting			
S > Quality > interestingness > interesting	-	-	
S > Quality > significance	Any action/statement about whether or not the proposed metric, analysis, etc. seems significant or not to the person.	During the Toxic Sites project, Ray shares some results from the analysis with a note about its significance and the team also responds: RAY: "The second list is comparing those to their totals. So, 41% of white people in [state redacted] are within 1 mile of a abondoned site. There is definitely a disparity there." VINCE: "Whoa."	
		PHIL: "Nuts."	
S > Quality > significance > not	-	-	
significant			
S > Quality > significance >	-	-	
significant S > Quality > significance > mediocre	-	-	
S > Translative	Any statement about what action to take regarding the issue.	During the City Transit project, Ray tells the newsroom reporter that "We could contact the state agency to see if we can get more definition on those and possibly see how they translate a city report into that."	
S > Definitive	Any statement about how to define the issue or mediating artifacts, such as metrics, analysis, etc.	During the City Transit project, Ray and Vick have the following back and forth about defining a particular metric for the data set: RAY: "If you can figure out more specifically what these numbers are, then yeah, maybe yeah." VICK: "Do you mean like what they consider on time?" RAY: Yeah, like 94% and what that exactly means. I assume that it's just a time cut off of what they consider late.	

Code System	Defi	nition	Example
S > Conjectural	Any statement that posits a claim about the data or other aspects of the project.	During the City Felony a hypothesis/questio each year's trendline trendline of tempera anecdotal heat = vio thing shows up"	project, Phil shares n to pursue: "comparing of assaults/murders to the ture to see how clearly the lence at the start of summer

## Appendix B. The sum occurrence results of all codes

Туре	Subtype	Code	SUM of Codes	Percentage of Sum Codes	Projects
S	S\Translative	Translative	162	12.0%	6
MA	MA\Data	metrics	158	11.7%	6
S	S\Definitive	Definitive	152	11.3%	6
S	S\Quality	alignment	82	6.1%	4
S	S\Conjectural	Conjectural	70	5.2%	5
Р	P\HD	hd-analysis	69	5.1%	4
Р	<b>P</b> \Visualization	Visualization	57	4.2%	4
S	S\Quality	significant	56	4.1%	6
Р	P\HD	hd-processing	55	4.1%	3
Р	P\HD	hd-angle	46	3.4%	5
Р	P\Collection	external	43	3.2%	4
Р	P\DD	dd-angle	30	2.2%	2
S	S\Quality	interesting	30	2.2%	4
MA	MA\Data	provenance	27	2.0%	4
MA	MA\Data	result	26	1.9%	2
S	S\Cause	quant verify	24	1.8%	4
MA	MA\Visual	tooltip	23	1.7%	1
S	S\Quality	unverified/unknown	23	1.7%	5
MA	MA\Data	data point	22	1.6%	3
MA	MA\Visual	color scale	17	1.3%	1
MA	MA\Data	use	16	1.2%	3
S	S\Quality	missing	14	1.0%	2
MA	MA\Visual	result	14	1.0%	3
MA	MA\Data	sample	13	1.0%	3
S	S\Quality	issue/error	13	1.0%	3
MA	MA\Reporting	сору	13	1.0%	2
S	S\Quality	not significant	12	0.9%	5
MA	MA\Data	release	11	0.8%	2
S	S\Quality	not odd	8	0.6%	1
S	S\Quality	odd	8	0.6%	1
MA	MA\Data	request	7	0.5%	2
MA	MA\Visual	introduction	6	0.4%	1
Р	P\DD	dd-processing	6	0.4%	2
MA	MA\Data	aggregate	5	0.4%	2
MA	MA\Visual	type of chart	5	0.4%	1
S	S\Cause	speculative	5	0.4%	1
S	S\Cause	unknown	5	0.4%	1
Р	P\DD	dd-investigative-followup	4	0.3%	1
S	S\Cause	anecdotal	3	0.2%	1
S	S\Quality	not interesting	3	0.2%	2
MA	MA\Data	qual expert statements	2	0.1%	1
MA	MA\Visual	model	2	0.1%	1
MA	MA\Visual	sample	2	0.1%	1
S	S\Cause	qual verify	2	0.1%	1
MA	MA\Data	tool	1	0.1%	1
MA	MA\Data	representation	1	0.1%	1
Р	P\Collection	internal	1	0.1%	1
Р	P\DD	dd-analysis	1	0.1%	1
S	S\Quality	mediocre	1	0.1%	1
SUM			1350		