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PEER-REVIEWED ARTICLE

Elements of Trust in Maps

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INTRODUCTION

The topic of trust in maps is increasingly relevant in a time where misinformation is abundant and scholarly critiques of maps' objectivity and truthfulness continue to evolve. This relevance is evidenced by a growing body of research evaluating methods that can be utilized to study trust in maps (e.g., Prestby 2024), and how different design factors interact with individuals' cultural and psychological factors to influence their trust in maps (e.g., Gartner et al. 2024; Christen et al. 2021; Ly 2024), While these studies are important, they fail to interrogate trust in maps at its most fundamental level. What separates trust in maps from trust in media, trust in people, etc.? What similarities does trust in maps have to trust in other objects? Are maps inherently trustworthy, and if so, what are the elements that make them so? These foundational questions are essential to guiding a more cohesive and robust research focus on trust in maps.

Despite the many claims that maps are an especially trustworthy information medium (e.g., Boggs 1947; Kent 2017; Flanagin and Metzger 2008), only a single empirical study has compared trust in maps with trust in other information mediums. Accordingly, Meier (2017) found that news stories featuring maps were perceived as more credible than those with other visualizations or only text, but these differences were not statistically significant. Other evidence suggests that visualizations are more trusted as a way of transmitting information than other means such as narrative text or photography (Tal and Wansink 2016). Still, research assessing people's trust in maps versus other mediums is limited. Moreover, it is not clear *how* trust varies across national and cultural lines in the global field of cartography.

We want to interrogate the claim that "people trust maps," or rather try to provide tools for that interrogation, in two dimensions. First, we want to break up the broad claim into pieces: What specifically do "people trust" about maps? Presumably it is not an absolute, un-nuanced trust. The literature on trust generally treats it in terms of overall quantity: in virtually every study we looked at, trust and trustworthiness in any given relationship is evaluated as a sum total, rather than as unevenly weighted depending on the aspect of the relationship being considered. Lewicki et al. (1998) identify this tendency in management studies and suggest it as a weakness, and O'Neill (2018) alludes to it but mostly focuses on "intelligent" application of differential trust. But when it comes to foundational studies in other trust fields (like psychology and sociology) the notion of partial or circumstantial trust does not seem to have been widely taken up or deeply analyzed. This is surprising because partiality seems to be a fundamental aspect of trust—we trust this person to repay a loan but not to be a good driver, or that person to take care of our kids but not to correctly diagnose the pain in our gut. An analogous example for maps would be trusting Google Maps to show us the quickest route but not necessarily the most scenic or enjoyable route to drive on. And so we will attempt to outline how this segregation or siloing of trust applies to how people trust maps.

Second, we want to examine the differences between trust and trustworthiness—between efforts to make a map or map producer more *trustworthy* on one hand and more *trusted* on the other. The implications of the difference between these two ideas reach into the ways trust is established and confirmed, and end up, we believe, uncovering some profound ways of addressing map quality and discussions about it. As a fact-grounded field, we tend to generally want trust on the basis of systematic, objectively judgeable criteria, the same sort of criteria that we center in assembling information on maps. Indeed, Fairbairn et

al. (2021) acknowledge that maps fulfill a variety of functions, the most important of which is communicating spatial information. Such information is based on symbolic relations and observable reality that can be perceived as facts. More heuristic judgment *is* also part of the mix, and we know this and "dress" our maps in "clothing"—both in terms of "mappy" style and including elements that indicate "real maps" to the general public—that will signal trustworthiness in a kind of shorthand to users. For example, the presence of a scale and north arrow may be an instant signal of a "good" map to some users (whether or not they are actually appropriate to the projection being used), but examination as to whether north orientation or scale are *accurate* takes more detailed systematic analysis. We think it is important to reconcile these two kinds of information that get included in maps, especially in a world where the construction of factuality has itself become a political subject up for debate.

It needs to be said up front: "trust" is an emotionally loaded term. It is a basis of every contract and treaty, every loving relationship, and practically every human drama ever written. Trust is arguably *the* human social linchpin, and as such, no paper should be trusted to be bias-free in discussing it, including this one.

It also should be noted that the underlying issues of what maps are and how they function in society are contested. The field of critical cartography has been wrestling with how to address the fundamental nature of maps for decades now. For the purposes of this paper, we wish to sidestep this discussion, and address the cognitive center of the field. Most maps in the public sphere (and thus the cartographers who make them) assert the idea that they represent factual and measurable phenomena in a geographic space (Fairbairn et al. 2021). Are there maps and discussions about maps that challenge this assertion? Yes. But we here assert that there remains a practical core that the broad statement "people trust maps" depends upon. We want to look at that core in itself, not to address its legitimacy, but to elucidate its structure. This is not meant to argue against that questioning of legitimacy, but to provide grounds for discussing the structure of map truth within the context of the idea of factuality.

Our research into trust has leaned heavily on studies in a variety of fields. Broad social science approaches (psychology and sociology) have helped us frame the discussion, but we have also been informed by the robust discourses within media and journalism studies, information sciences, organizational management, and marketing studies. As a strongly intersectional field, cartography can learn a lot by looking over the shoulder of near-neighbor fields that deal in communication, factuality of information, and data organization, and we use numerous examples from studies of trust in such fields in this paper.

We think that it is especially important to study trust in the field of cartography at the present time as the democratization of mapmaking (Sieber et al. 2016) and the new proliferation of generative artificial intelligence (Kang et al. 2023) have introduced community-, user-, and machine-generated content into the mix of maps that are consumed broadly. Consequently, neither we on the producer end nor those on the consumer end of the map world are entirely sure how to structure the basic trust we want to have in how we visualize geographic space. The social model of cartographic communication we have inherited, where much of that trust was grounded in persistent institutional sources of maps, is fragmenting, and we need a model that does not depend so much on those institutions.

The contributions of our paper are threefold. First, we link trust in maps to the rich discourse on trust in sibling social science disciplines. Cartography and geography are inherently interdisciplinary fields but they are also unique as they specialize in analyzing and generalizing spatial information. In carving out a research thrust on map trust, we expect that our ideas and findings will generate insights for related fields, and vice versa. Second, we outline ways that trust in maps is not binary, but rather fluid, with different elements playing a greater role depending on the situation. Third, we synthesize three key approaches for interrogating that trust: in terms of function, in terms of creator, and as a body of knowledge.

We organize the rest of the paper as follows: we begin by dissecting trust from the perspectives of related disciplines, paying particular attention to how trust has been conceptualized and its defining characteristics. Next, we explore three ways that trust in maps plays out. These include functional trust, trust in the mapmaker(s), and trust in the geographic body of knowledge. We then dive a bit deeper, bringing these perspectives together by interrogating trust in maps in terms of nuance and manipulation. We conclude by restating our contributions and offering avenues for future work.

THE IDEA OF TRUST AND ITS COMPONENTS

Trust is the subject of substantial subfields in sociology (Schilke et al. 2021), philosophy (McLeod 2023), economics (Glaeser et al. 2000), and psychology (Evans and Krueger 2009). Trust is also a central issue in more functionally organized fields like marketing (Raimondo 2000), media studies and journalism (Schudson 2022), political science (Levi and Stoker 2000), business management (Zenger and Folkman 2019), and education (Vodicka 2006). The literature is overwhelming enough that even broad studies in trust often end up only covering a subset of the overall discussion, but it is informative to dip one's toes in other fields' approaches, because the inherent biases and foci of each field tend to shape their discourse. For example, we found the **Trust Project** at Northwestern University's Kellogg School of Management a very approachable meeting place to explore a variety of views on the subject.

In the context of information science, a field adjacent to cartography, Kelton et al. (2008) propose a framework for discussing a variety of aspects of trust. Within "trustworthiness" they identify these further components, which we have chosen to use in this paper: competence, positive intentions, ethics, and predictability. That list has echoes in other literature: in the context of management, Zenger and Folkman (2019) identify positive relationships, good judgment/expertise, and consistency; and in educational leadership Vodicka (2006) identifies consistency, compassion, communication, and competency. In terms of e-commerce and financial services respectively, Gefen (2000) and Sekhon (2004) also conceptualize trustworthiness in terms of ability, benevolence, and integrity. The variety of terminology across areas of trust study can make precision difficult; we do what we can here, but we have needed to be flexible in considering parallel theoretical constructions.

Three of these components have clear analogues in how we think about cartography. Competence and expertise include skill with mapmaking tools, but also the ability to handle geodata with appropriate care for precision and accuracy, taking into account such issues as generalization, change over time, accuracy of positioning, and accurate place names. Consistency is also a basic quality, both within any given map and across sets of map products: consistent categorization and symbolization, and the assumption that any dataset will be as complete as possible within stated bounds (e.g., when showing US states, do not leave off Delaware) are so obvious that it is hard to find it named as an issue. And communication is so clearly what maps inherently *are* that it seems redundant to include them as a particular component of trust in maps.

Ethics is an area that has had less fundamental attention within cartography. This issue of *Cartographic Perspectives* and other work in professional forums is bringing fresh attention to it, but it has been taken for granted more than deemed irrelevant since it was first raised in the early 1990s, for example in the pages of this journal (McHaffie et al. 1990).

What Kelton et al. (2008) call "positive intentions" and Zenger and Folkman (2019) call "positive relationships"—referred to by others as "compassion" and "benevolence"—is harder to place in existing professional discourse. It does appear in literature about the complicity of maps in immoral or unethical systems (e.g., Kelso 1999) and approaches to mapping or not-mapping ethically (Holloway 2021), but in a sense ethics and intentions have become conflated in our discourse. That is to say, benevolence/malevolence has been conflated with how we conform to a moral code or system. But this conflation may be hard to avoid: In a summary of trust in philosophy, Goldberg (n.d.) says, "to trust someone to do something is to rely on them to do it and to do so out of a certain attitude towards the proposition that they will do it *for the right reasons* [emphasis added]."

Defining trust in the context of cartography is an entire paper in its own, but we can lean on a sibling discipline, media studies, to provide a definition of trust in maps. The explicit function of news is to selectively communicate information about the complex world, so readers can figure out where they stand in relation to others and adjust their perceptions of societal issues (Kohring and Matthes 2007). Cartography is not so different, as Usher argues: "Cartography, like journalism, is an exercise in the reduction of complexity and requires making choices about what matters and who counts" (2020, 251). Consequently, trust in maps and trust in news both entail relying on someone else to provide an accurate and truthful accounting of reality.

Kohring and Matthes (2007) define trust in news media as reliance on them to communicate information that will

guide actions and decisions in modern society. Hanitzsch et al. (2018) define trust as an individual's readiness to expose themselves to potential risks from news content, guided by the belief that the media will act in a competent and satisfactory way. These definitions parallel a definition of trust in maps that entails being willing to believe the information presented based on the expectation that the cartographer "has tried to communicate accurately and was capable of doing so to some adequate approximation" (McGranaghan 1999, 4).

ANTECEDENTS AND DIMENSIONS OF TRUST

In this section we review "antecedents": variables that precede and can be used to observe trust, and are also key dimensions of trust.

ANTECEDENTS

Trust has been broadly framed as generalized (e.g., "Are we a trusting society?") or particularized (e.g., "Do I trust you?"), notably by Putnam et al. (1993). More recently, Wollebæk et al. (2012) have added trust within smaller social groups in the middle of this framework. Considerable literature follows each of these. Kelton et al. (2008) propose a model of trust in digital information, arguing that the elements of competence, positive intentions, ethics, and predictability apply particularly to interpersonal trust—which in their usage means specifically directional trust (e.g., "I trust you") rather than mutual trust (e.g., "We trust each other"). For our discussion, generalized, group, and mutual trusts are not immediately relevant. We focus on the context of directional trust: what we are most concerned with is how much an individual "trusts maps."

Directional, interpersonal trust involves an individual called a "trustor" who willingly assumes vulnerability in depending on a "trustee" (something or someone else believed to act positively on behalf of the trustor; Gefen 2000; Kelton et al. 2008; Sekhon 2004). Trust is not just a proposition: in order to be *trust*, and not *trustworthiness*, it needs to be acted upon and future-oriented (Fawzi et al. 2021). A trustor's evaluation of trustworthiness precedes and informs the act of trust. For instance, if someone perceives a map to have a high level of trustworthiness, they are more likely to trust it. In other words, trustworthiness is one of the antecedents (predictors) to trust.

Another antecedent of trust is *credibility*. Credibility is often used interchangeably with trust in cartographic, information visualization, and media literature, but the two concepts are distinct. Credibility is akin to perceived believability whereas trust is akin to willing dependence. A key distinction between credibility and trust is that both are judgments, but credibility is evaluative in nature while trust is predictive (van Dalen 2019). Namely, trust is oriented to the future, as it hinges on expectations about future behaviors/outcomes. Credibility is narrower as it "concerns a specific evaluation of media content . . . at a given point in time" (Fawzi et al. 2021, 156). In sum, credibility is a facet of trust that is primarily concerned with believability (van Dalen 2019). Most researchers believe that credibility judgments likely precede trust and help a trustor determine how much to depend on a trustee.

DIMENSIONS OF TRUST

While definitions and conceptualizations of trust vary widely within and across disciplines, there is a growing consensus that trust in itself consists of three major dimensions: cognitive, affective, and behavioral (Lewis and Weigert 1985). Each of these dimensions interact with one another and together influence the degree of trust. Cognitive trust is inherently rational and evidence-based: trustworthiness in this dimension is determined based on prior knowledge and familiarity with the trustee. Put another way, cognitive trust boils down to whether we have good reasons to trust someone/something. At a certain point, though, people go beyond this knowledge-based, rational justification of trust and turn to affective (i.e., emotional) and behavioral dimensions (Lewis and Weigert 1985).

Affective trust concerns the emotional bonds formed between the trustor and the trustee (McAllister 1995). While originally conceptualized to characterize interpersonal relationships, affective trust has been remapped to capture the exchange between individuals and digital information (Huang et al. 2022; Kim and Sundar 2016; Soh et al. 2009). Accordingly, affective trust may be akin to likability and emotional security in terms of dependability and faith.

How much the basis of trust is weighted towards affective or cognitive dimensions may depend on the type of

information processing used. A much-used model posits that people process thought in two major ways. Chaiken (1980) describes information processing as "systematic" or "heuristic," echoing Wason and Evans (1974), and this has been in turn echoed by Stanovich and West's work (2000), often summed up as "slow and fast thinking." Systematic processing is effortful and cognitively demanding, whereas heuristic processing relies on simple decision rules (mental shortcuts) to quickly assess information. When something is being scrutinized systematically (as trust itself is in this paper), trust is more likely to be based on the cognitive dimension (Kim and Sundar 2016). Conversely, trust informed by heuristic processing is more likely to be affective in nature.

The final dimension of trust, behavioral, embodies this fundamental fact: trust carries inherent risk. Behavioral trust refers to the trustor accepting vulnerability to the trustee based on the expectation that the latter will act in the former's best interests (Lewis and Weigert 1985). Behavioral trust can both inform and be informed by cognitive and affective trust. Limited evidence suggests that behavioral trust is more linked to affective trust and is more a product of heuristic processing (Kim and Sundar 2016), which implies that most acts of trust must go through a heuristic phase—that we can't easily avoid the affective dimension.

So what do these dimensions tell us about maps? For one thing, trust is more irrational and emotional than not (McAllister 1995). So, an individual's personal beliefs about topics and sources, and their reactions to mapped content, may play a greater role than whether a map is accurate or transparent. Additionally, this research tells us that trust is multifaceted and that we need to consider it holistically when studying maps.

Trust is a pervasive feature of human relationships. It constitutes a social lubricant for all kinds of transactions. While it is ubiquitous, trust cannot be taken for granted: gaining, retaining, and losing trust are ongoing factors in any social relationship. Trustors inherently make themselves and their resources vulnerable to exploitation by trustees. The decision to trust others is typically conceptualized as an interplay of the institutional or social setting—capturing the incentives and constraints that individuals face—and individual factors such as prior beliefs and preferences. We reason here that individual trust behavior is embedded in a constant flux of social interactions that can lead to positive and negative experiences that affect trust in general and in particular. As emphasized in Akerlof (1983), such personal experiences are often powerful and particularly meaningful events to individuals, with the consequence that when "people go through experiences, frequently their loyalties, or their values, change" (Akerlof 1983, 54). Indeed, evidence presented by Alesina and La Ferrara (2002) suggests that prior (traumatic) experiences and belonging to groups that (historically) have been discriminated against are negatively associated with trust. So, an individual's trust in a particular map or type of map doesn't happen in a rational vacuum: it is likely to be based on former positive or negative experiences and understandings of their wider social context.

We also wonder about the relationship between information intended to be used in systematic evaluation (like scale, projection information, metadata, etc.) and how it itself can then be used as a heuristic marker rather than for actual systematic analysis. The same information can be (and presumably is) evaluated both ways: "A good map has a scale" triggers a fast heuristic evaluation as a marker, while "Does this map have a constant scale and is this scale actually accurate?" triggers a more involved systematic evaluation. How does that duality affect the status of that information, and how can awareness of it guide mapmaking?

To sum up, we can see antecedents to trust in trustworthiness and credibility, and dimensions in trust against which those antecedents are judged: they are evaluated in systematic, codifiable ways; through heuristic, less rational ways; and then in the act of trusting itself: we test our trust constantly as we see its results. It seems clear to us that behavioral trust is where nuance and variety in trust would develop, being iteratively shaped by our experience as we engage in trusting (or suspicious) behavior.

WHO/WHAT ARE WE TRUSTING?

Using these multiple ways of dividing up the antecedents to trust and its basic components, we now want to look specifically at how trust and trustworthiness play out in the mapping field. We see three ways of answering the question, "When someone trusts a map, what or whom exactly are they trusting?" Functional trust, trust

in the mapmaker, and trust in the body of knowledge that led to the map are how we frame these channels of trust. We remain focused on directional rather than mutual, group, or generalized trust, but while the model of a trustor remains constant, the nature of the trustee varies as we proceed.

TRUST IN MAP FUNCTION

Cartographic literature like that written by Robinson (1952) in the "positivist era" of cartographic discourse after World War II focused on task-based functionality: a "good" map is spatially accurate, clear and transparent in symbology, current, and properly generalized to the scale. In other words, the map is subject to systemic evaluation. Map function includes the obvious categories emphasized in that era, of navigation, territorial/property definition, and generally understanding the structure of geographic-scale phenomena. But function can also include intentionally affective results like pleasing décor, effective persuasion (changing minds) and reinforcement of established social order (cementing minds).

In this functional register, the judgment that leads to trust is based on the question, "Does this map do what it should?" As examples: "Does this map show currently open roads so I can get to my lunch appointment?" or "Will this map show me the best place to drill for oil" or "Does this map accurately show the floodplain so my house won't be washed downstream?" When we measure trust in this register, we are measuring people's actual and predicted experience with such function—map use, in other words—or reported experience of (trusted) others. We are measuring systematic and behavioral trust in tandem.

When we bring in the idea of aesthetic function, things become less clear. On one hand aesthetic design is the basis of the clarity component of trust, and design is a basic component of map quality (Wallace and Huffman 2012). A study by Lin and Thornton (2021) shows that when visualizations that included maps were perceived as more beautiful, they were also more trusted. Aesthetic quality was taken as a marker of the mapmaker's competence, and therefore greater trustworthiness. On the other hand, aesthetics are also the basis of décor, or a map's fit within the overall design of a publication. So, while aesthetic function includes support of systemically evaluated functionality, it also supports more heuristic judgments of taste and visual fit. This separability of appeal from function is, as we have discussed, one of the two main ways we come to trust something, but it is not necessarily only a "quick" decision: aesthetic appeal has a lot of depth and force to it. In other fields, for example music, where aesthetic taste is by far the largest judgment point, we can see how "authenticity" or "credibility" itself can become entirely separate from practical function and can become a point of style that's deeply embedded in musical identity (Barker and Taylor 2007). While the relation of a devoted fan to a particular artist can be seen as emotionally analogous to trust, we do not believe it is the same thing we are talking about in trust in maps. However, it is worth noting that aesthetic qualities do have a function—an operation—which can be as persuasive as systemically-evaluable qualities.

When we come to functions of persuasion and reinforcement, this basic user-centered judgment breaks down more completely: here the function—what the map is supposed to do—is not a matter of a user acting on the world, but of the map acting upon the user(s): if a map changes or reinforces minds, that will be as the *result* of users trust in the map, not the basis of it. Propaganda maps are most effective when their audience views them without the critical lens of who created them and why, while those that create them are more likely to spend time considering how to manipulate and selectively frame their data to make their point.

This is true even of benign communications: maps often have narrative directions that are simply part of storytelling, not an intent to subvert public opinion away from truth. As Harley (1989) and Wood and Fels (1992) point out, all maps have a point of view and an agenda, even those whose agenda is to keep hikers from falling off of cliffs. One of their points was to bring the question of benevolence back into the picture, to disrupt an assumption that maps as commodified containers of information are immune from questions of trust and ethics, and they did so in part by pointing out this fact: that maps are both operated by end users, and operate upon them.

TRUST IN THE MAP MAKER(S)

The last section demonstrated that "function" itself is not only about end-user (trustor) operability isolated from relationship to the map source, but also includes functions that necessarily include that source trustee. In these cases the success of the map is as much about "how can this map benefit the user?" as "how can this map intentionally

influence that end user?" Evaluating trustworthiness in this situation from an end-user perspective *does* include those dangling aspects of trust: ethics and benevolence.

"Intentional influence" is not necessarily as sinister as it may sound. Most things made for sale in the marketplace (or even freely offered in the "marketplace of ideas") will have an aspect of "appeal," whether solely on apparent merits or based on content designed to attract users' attention. Our main point here is that there is a social relationship that comes into play in evaluating trust, even when there is no direct apparent social connection between map user and mapmaker. Such relationships, especially in maps that are distributed through publication or broadcast to a mass audience, are likely to be signaled heuristically.

People are "cognitive misers" that prefer to take the path of least resistance when processing information (Chaiken 1980). Namely, people will decide whether to trust something based on whether the source is familiar, authoritative, and/or endorsed (Metzger and Flanagin 2013). Source has traditionally been the primary way that people assess the trustworthiness of information, broadly (Sundar and Shyam 2008), and specifically with maps (Flanagin and Metzger 2008). Indeed, a review of empirical research on trust in maps highlighted that people view a map's source as a key indicator of its trustworthiness (Prestby 2023). Source may play an even greater role in affecting trust in maps since most widely circulated maps have historically been produced by a handful of "expert" gatekeeping organizations who could (in theory) be trusted due to adherence to strict information quality standards (Flanagin and Metzger 2008).

The field of cartography tends towards a culture of relative individual anonymity and corporate authorship. By contrast, other content-production fields such as motion pictures commonly have "top billing" for directors and actors, and long credit rolls. Books tend to have strong authorship, but little credit for contributors like copy editors and book layout artists. In newspapers, reported stories with bylines are normal now but their presence has been variable. In the early twentieth century, *New York Times* publisher Adolph Ochs avoided bylines as a policy, saying, "the business of the paper must be absolutely impersonal" (Shafer 2012). And between these two models of centered and uncentered authorship, maps of the last century have tended towards uncentered authorship. Data sources for maps are often less transparent, though recent practices like Creative Commons licenses have nudged many of us towards greater data source transparency. The result of these common practices is that for end users, "trusting the source" is more about publishing institutions and other corporate groups than the voice of individual cartographers.

Complicating matters, source information or even indirect cues are not clear or may be entirely absent in much social media and user-generated content. For instance, maps shared on social media tend to be screenshots of maps made by other traditional sources (government, news organizations, etc.; Lisnic et al. 2023). Information about who made the map, where the data came from, etc. can be lost in this process. In other cases, there may be multiple source cues, so it is challenging to determine which is the true source. For example, a map created by a government agency may be reposted by a politician and then forwarded to you by a friend. In this case the true source is the agency, but people may perceive the friend as the source since it is the most surface-level entity (Henke et al. 2020).

So how then do people come to have a "relationship" with a map source they often cannot identify? We point to lessons from researchers studying trust in marketing, which as a field is in a sense about nothing *but* manipulation of trust—what most marketing boils down to is how to get consumers to trust your brand over other brands (Chaudhuri and Holbrook 2001). It is worth considering that it is actually most common for consumer products to operate without identifiable authorship. In many fields, to *have* such an authorship relationship is a mark of high-end "designer" or "artisanal" products. It is largely in content-based products that we take for granted the normality of authorship as part of marketing. However, when we look at branded *services* (as opposed to off-the-shelf products), positive branding is more about personal relationships and personal identity, including the sense of trust in reliability and quality (Hess and Story 2005). Consider the ubiquity of ads in the service sector saying, in essence, "we are here for you" or showing providers interacting with happy customers, as opposed to ads for products promoting how well the products function or how they will enhance the lives of users. It is worth noting that while maps themselves are mostly business-to-consumer products, many cartographers work in a business-to-business service model, within which relationship-based differentiation is the basis of their brand, so both kinds of relationship are prevalent in the field.

We identify maps *as products* then by their quality and consistency. And we identify *sources* of these maps in large part through their branding. How are maps "branded"? Explicit branding by publishers and online providers is one piece of the puzzle, but as Gartner et al. (2023) point out using national topographic map series as an example, the look and feel of non-commercial products can operate the same as named branding and can affect trust in maps. Look and feel can also become cultural norms for particular map use cases. Geological, air navigation, and orienteering maps each have a specific family of symbology: producer branding then is a subset of how we come to recognize a map we will provisionally (heuristically) trust as being the right sort of map for our purpose.

So it behooves us to consider the balance between trust based on evidence and sound social networks, and trust that is a matter of pose and social signaling. On its own, "mapicity," the qualities of maps that make them identifiable as such, per Denil (2011), is not that far from "truthiness," in that it is about form and style rather than substance. This is a disturbing idea for those of us who have devoted careers to substance, and clearly there is substance to the subject matter of most maps, but when we discuss *trust* in those maps, we may be talking about something that ends up being less about substance than we might like.

This sense of style is a central part of what artificial intelligence has been able to do to date: it knows what things should look like and read like, and it imitates styles convincingly, without intelligently doing the underlying rational thinking. That it works as well as it does at this early development stage, including in some aspects of map work—for example the machine-learning-based Eduard relief shading software (Jenny 2022)—points to some profound rethinking of what we think our work as cartographers is mostly made up of: how much of what we do is restyling and rearranging information so it looks how we want, and how much is the deeper analytic and systematic work much of our self-image is grounded in? As of this publication, artificial intelligence programs have not been developed that convincingly remove the "hallucinations" from generated maps that quickly signal their untrustworthiness, but this does not mean that the challenge will not be met (and soon; Robinson et al. 2023).

The question of source benevolence can mask something we think forms a third answer to "Who am I trusting if I trust this map?" Map sources do not usually decide how to draw boundaries or name places. That information comes out of a common body of knowledge that mapmakers and users alike mostly trust as the underlying facts of geography.

TRUST IN THE BODY OF KNOWLEDGE

There are aspects of information in most maps we just do not suspect of intentional falseness or untrustworthiness, and so questions of map source benevolence are irrelevant. It is well established, for example, what the shape of Iowa is, or what the elevations of many of the Himalayas are. Even when there are boundary disputes or disagreement on place names, arguments are generally between claimants of sovereignty, or legitimate naming authority, not on whether the surveyed line or name is *incorrectly* placed. There are of course maps where data is hidden or altered for secrecy purposes, but it is understood that to be meaningful as a map, enough of the map has to correspond to the world it depicts for these secrets to be exceptions. There is a huge body of geographic data that grows more and more sophisticated by the year, and any cartographer can see clearly when they ask themselves what the original source of ground-truthing the data on the map is, that that data, or some key aspects of it, simply do not bear argument. Significant parts of most maps are like many reference works: they are not works of original research, but compendia of existing knowledge. People trust maps, we argue, like they trust a dictionary, an almanac, or a directory: the information may be out of date, or there may be errors, but a body of knowledge that is held in common by society as a whole forms an underlying foundation. *That* is a lot of what people trust about maps, the underlying body of knowledge.

The idea of a "body of knowledge" is also used in efforts like the *GIS&T Body of Knowledge*, which seems to be more about deriving a common ontology for interoperability of systems such as the work of the **Open Geospatial Consortium**. And when we refer to trust in underlying data, we are not talking about specific trust in geodata, as for example Lush et al. (2018) discuss. What we are talking about here is more like the vocabulary that underlies a dictionary, or the "**compendium of knowledge**" included in Wikipedia. Getting a sense of what this body looks like is hard because it does not have a single, clear criterion; the line between established and propositional geographic knowledge depends in large part on the

consumer, both in terms of personal knowledge, and because no knowledge is 100% non-controversial. Viewing statements of Wikipedia's scope may help give some shape to the idea of a body of common geoknowledge, for example Wikipedia's **Five Pillars**, that "Wikipedia is an online encyclopedia; Wikipedia has a neutral point of view; Wikipedia is free content; Wikipedians should interact in a respectful and civil manner; and Wikipedia does not have firm rules."

Although we stated at the beginning of this paper that we were focused on directional, interpersonal trust, the idea of a body of knowledge implies trust relationships that are more mutual or group-oriented, which may mean we need to reconsider how trust in maps might also be a matter of social trust among group peers rather than just trustors trusting a trustee.

Geographic knowledge is, however, only partly contained in amorphously governed common sense. Government agencies remain the largest and most authoritative repositories of basic geodata and place names, and they have policies and processes that govern how information is presented (Flanagin and Metzger 2008), often including formal codes of ethics. The line between "authoritative" and "common" knowledge is often blurred, as the example of indigenous geographic knowledge (discussed below) demonstrates: one of the aspects of governmental power, at least in the modern world, is that government policy over place names often becomes "what the place is called."

This knowledge, the part that is trusted, is analogous to commodified products, where differentiation between brands is more a matter of things like cost and convenience than meaningful functional difference: any gallon of gasoline or sack of white flour will work more or less as well as the next, while we tend to make stronger distinctions and pay attention to reviews when choosing hotels or entertainment. At some point, certain information on maps—the basic shapes of countries, the names of major cities—is not special or uncommon knowledge, and just as we trust that a gallon of gasoline will do what it needs to do, we trust that basic knowledge to be accurate, unless someone has made a careless error, in which case it is clearly the fault of the mapmaker, not our collective knowledge.

This line of trust is not as monolithic as the word "body" might imply. Reference maps generally have a higher percentage of body-of-knowledge content than thematic maps, but in both types of maps there will be disputes over facts that appear clear and "commonplace" to others. Where there are conflicting national claims, and especially where countries dictate what can and cannot be shown on maps in that country (e.g., China, India, and Pakistan), markers of national affiliation may affect how readers gauge the reliability of the resulting maps. All of which is to say, "common" does not equate to "universal" but exists within broader groups than we discuss when we refer to trust in map source.

Disputes over this body of knowledge can go very deep indeed, as we can see in other knowledge fields today. In American and European media, questions of political orientation affect how viewers trust news and analysis stories. For example, Ad Fontes Media's "**Media Bias Chart**" measures this in the context of political and ideological affiliation in the United States. To the extent that a media source is seen as being part of a worldview the reader agrees or disagrees with, it seems logical that that reader will tend to view a map produced by that source with a similar trust or distrust. Indeed, Peck et al. (2019) found that political ideology was a key factor affecting trust in visualizations for rural Pennsylvania residents. Participants were first asked to rate how useful a series of visualizations (two of which were maps) were. No information about who created the visualizations was provided. Then, researchers revealed who made the visualization and asked participants if they wanted to change their ratings. Around half of participants altered their trust perceptions of a visualization depending on the organization that created it. Many of the participants who did change their ratings were motivated by their political identity. For instance, a very liberal participant trusted government agencies but not a conservative news outlet. Conversely, a conservative participant did not trust government agencies. These results highlight that people may choose to trust or not trust something solely based on whether the source of information coincides with their general worldview.

A deeper challenge to the basic idea of collective acceptance of map information comes out of post-colonial counter-cartography. For example, indigenous land-claim arguments posit that a map may be precise in its representations, but the institutions that produced it exist in part to support the (colonial) government that disowned the indigenous population, and some of that "trusted" information (non-indigenous place names and colonially-imposed boundaries) is far from accepted (Turnbull and Watson

1993; Fields 2021). In this type of situation, the body of knowledge is not disputed as a body, but its fundamental "rightness" is shown to be cultural rather than natural, and competing sets of knowledge are presented as equivalent in value.

The depth of this line of critique has no practical end. One can, for example, cite something along the lines of the classical Vedanta idea of *māyā*, the illusory nature of reality. Muehlenhaus (2023), for example, has critiqued our idea of geographical reality on this basis, drawing from quantum theories of the perceptible universe as being made of information. Our point here is not to say that this trust is an inherently good idea or not, or that models of reality cannot be challenged. This study exists within the context of a more or less cohesive culture of cartography whose existence we find self-evident, and "trust in maps" as a subject exists within and around that culture, regardless of the ontological justifiability of that culture's legitimacy in a universal sense.

THE SHAPE OF TRUST: MANIPULATION AND NUANCE

Thus far, we have tried to provide a broad schematic outline of trust in maps. We want to close the arguments of the paper with two areas where we feel trust studies can help make clearer what is actually happening on a functional level when it comes to map trust.

MANIPULATION OF TRUST

We have earlier touched on the issue of trust not just being earned but being strategically generated. We want to focus on this issue with the framework we have developed. Some discussions of trust in other fields are just as much about getting people to trust you as they are about actually being worthy of that trust. Many popular press articles we looked at were about how to generate trust, with the assumption that trustees are already trustworthy. However, the tools they suggest are just as applicable to trustees who want to generate unjustified trust in order to deceive trustors.

While we value honesty and trustworthiness, we are also often fine with deceiving our competitors, or more precisely maintaining an information advantage over them. For example, the justification for the original degraded accuracy of GPS signals was a matter of advantage for the American military that had put the satellites in place. The decision to remove that selective availability of more accurate positioning was a matter of **invoking public need** over security. Some other national mapping agencies have deliberately put incorrect information on maps for the same reason; do we regard this as inherently wrong or expected in a world of competing security? In the commercial sphere, examples of proprietary information such as mining companies keeping information about discoveries of underground deposits from competitors make sense to us, whether we are part of that company or not: is that withholding of information deceptive? In a sense, yes, but in a way we would expect from a commercial venture in competition with others. Another example is that we do not expect police to make information about the movements of criminals public in the course of an investigation, thus tipping their hand. As long as a deception does not endanger the public, we accept that public statements meant to catch criminals as in a "sting" operation are acceptable.

Monmonier (2018) lays out a variety of deceptions that occur in maps, some of them outright "lies" and others more subtle misdirection, and his main thesis is that we should not assume that all maps are provided to us with wholly benevolent intent. Our point here is that benevolence is relationship-specific: the functional operability of a map should in theory be the same for an ally or an enemy with similar ability to implement it. Systematic evaluation should return the same results of quality. But as we have shown, trustworthiness is not just about mechanical function, and trust evaluation will then necessarily include benevolence, and will tend to suspect deception if the source is seen as malevolent to the user.

If this sounds familiar to readers of the news, it should. Accusations of hidden agendas and hidden malevolence are not new. Indeed, the phrase "The Media" itself (as opposed to "The Press") was invented by Richard Nixon's advisors to broadly discredit journalism as biased against him in the wake of the 1960 election (Schudson 2022). Recent developments have shown that even in the 2020s, entire knowledge fields can be widely held up as sources of disinformation on the basis of personal loyalty rather than systematic analysis. Certainly, history shows that this

relationship between the power of knowledge and social/political power is an inherently wobbly one at best.

We also think that historical examples are a good way to envision the intersection of partisan interest, factual knowledge, and the manipulability of trust. Schudson (2022), for example, examined American news media since the 1940s. He found that on one hand partisanship in media went from high in the post-War era to low in the era of national TV news dominance. News media have returned to stronger partisanship in the internet era, but with a change in the role of investigative and analytical reporting as opposed to "a spokesperson said" reporting that began in the Vietnam era. These are speculatively tied to the documented overall decline in "trust in news media" since then.

It would be worthwhile, we think, to take a similar look back at the changing nature of what mapmakers have delivered and what map users have expected. Have there been similar cultural shifts over the last century? A review, for example, of Monmonier's (2015) summing-up of twentieth-century cartography, sees some discussion of the growth of critical cartography in the last decade or so of the century, but less re-setting of expectations between consumer and producer. That is, he sees that the focus on reproducible factuality at the heart of the field has not seriously moved. On the other hand, digital mapping technologies have changed the role of the end user in shaping their experience: interactivity can involve altering the map itself rather than imagining scenarios upon or sketch on top of a printed map. The ability to pan infinitely, scale easily, and change layers of foreground and background, have made using maps a matter of user interaction much more than was true a quarter century ago. How does this change in the "normal" stance on the part of the user affect the relationship between trustor and trustee in the map world? To us, this is unclear, because map providers are still largely responsible for providing the factual products being used. It seems potentially analogous to the ways that the greater ubiquity of roleplaying games may be changing how textual and filmed fiction are perceived by their audience: the functional relationship between author and audience may not be as solid as many of us who grew up in the age of print and broadcast assume.

In 2025, the world faces a global phenomenon of intentional disinformation (deceit) engineered to produce downstream misinformation (unintentional adoption of false information; Szalai 2023). In our eyes, a big part of the urgency of this subject in our profession is not just to protect the context of "good mapping," but also to lend perspective to the broader knowledge fields. Disinformation and misinformation are real dangers to the common knowledge base humanity has available to it and have the potential to greatly manipulate trust (Rainie 2022). We believe that being intentional, building on these tools to characterize general trust in maps and specifically our own trust in maps and cartography, can help strengthen cartographers' ability to be both truthful and trustworthy in the face of deliberate deception.

The "positive intentions" or "benevolence" aspect of trust that we noted above is the core issue here, we think. Deceptions in the name of "our team" are broadly accepted, but this comes into direct conflict with the idea of a body of knowledge. The knowledge in question cannot be withheld or distorted, as it is held and confirmed by so many competing hands. But the institutions that package and create new iterations of that knowledge *can* be considered benevolent or malevolent. It is here we find ourselves in the midst of broader cultural arguments about the need for expertise on the one hand (Nichols 2017), and unjustified gatekeeping on the other (DeIuliis 2015). In this landscape, as contemporary politics shows, discourse often simply devolves into arguments about relative benevolence and malevolence.

THE NUANCE OF REAL-WORLD TRUST

We began the paper by holding up the claim that "people trust maps." The authors certainly "trust maps." But we do not trust all maps in every circumstance in every aspect. All trust is partial. That is, we do not trust all maps to do all things well: an orienteering map will not tell us much about hospital beds per capita; a bedrock geology map will not tell us about road construction. More generally, we tend to segregate what we trust different people for, *including* elements of personal trust. That is, we know that our friends and colleagues have strengths and weaknesses, and we use that knowledge to build on trust in others' strengths. As we said earlier, there is curiously little literature on how this nuance to personal trust develops over time, but it seems obvious to us that it does.

Perhaps it has to do with the ways the three kinds of trustees we describe—maps, map sources, and the body of knowledge—overlap and interact. It may make sense to

think of them using a cartographic metaphor of map layers. In a literal sense, you may for example entirely trust the political boundaries of a choropleth map, but mistrust some aspect of the data presented, or the motives of the presenter. As another example, you may accept that the base map of a metro area is neutral in terms of its social affiliation, but that the locators of "twelve convenient locations" of a business on top of that base have an unambiguous agenda.

This kind of nuanced trust parallels the kind of nuance in the overall loss of trust in the media: people may "trust the media" less than they used to, but some portion of that is our applying critical filters to the news more than our grandparents did. Just as we can learn to get useful information out of a hard-sell salesperson, or make up our own minds somewhere in the middle from a political debate, a kind of brass-nails critical view of maps may be masked by overall trust in the form. That is, because we easily learn in a practical sense how to use an imperfect map to get the information we need, and thus "trust" that map even though its content may not be perfectly current or accurate, we also learn to take for granted that certain kinds of mapped information will be biased.

As we separate the layers of a map into their differentially trustable components, it is worth paying attention to the difference between "trusting maps" and "trusting *a particular source* of maps," which is analogous to "trusting the media" and "trusting *this* news source." Consumers are generally aware of the source through which they receive maps (even if that source is "my friend who posts memes"), and will differentially trust or distrust those sources through experience. People *do* make broad statements about trusting or not trusting "the government" or "the media" or "religion" or any other mass category, but often these broad statements hide a more subtle fact that we still want governance, information, and cosmic context, and do trust some aspects and providers more than others. So when we hear people speak of "trusting maps," it is worth considering how this statement likely breaks down by provider—some map providers are probably more or less trustworthy in the interested public's minds.

We contend that our evaluation of whether—and how much and in what ways—we should trust a map will probably not be thorough. Maps can contain a lot of information of a lot of different kinds, and we will draw our evaluation of function based on the aspects we care about for our purposes. Likewise, we argue that many people are willing to overlook affiliative differences in source if they see the information they are deriving as part of the body of knowledge. So while "neutrality" is an iffy word, in effect there are "our" maps, "their" maps, and maps where we decide affiliation is irrelevant: the affiliation is a neutral part in our view of "with" and "against" regardless of whether the map affects a "neutral" or "objective" point of view.

Moreover, our evaluation will be based on sampling, based on our particular experience and knowledge: we will notice if this particular shape is wrong, and thereby become suspicious about other shapes. We will notice a misspelling, and wonder about spellings we do not know to be correct or not. This is the way particularized social trust is tested too: we do not fact check everything everyone says, but if a source we are otherwise inclined to trust says something that we know to be clearly wrong (or against our subjective sense of what is right), we become more alert for other false information (Schilke 2021).

Finally, our evaluation within a social network will include information from directly trusted sources, somewhat less trusted second-hand sources, even-less-trusted friends of friends of friends, and so on. Networked trust degrades as degrees of separation from personal experience increases (Richters and Peixoto 2011).

There is also a clear and (to us) odd conclusion to this: that map *distrust* is a component of a healthy relationship to maps and to all information. The example of twentieth-century American journalism tells us that nuance is also a kind of tension between trust and distrust, and in keeping at least one eye open for deceit *and* one eye trusting the body of knowledge as a basis for action, we can keep that tension in balance.

CONCLUSION

In this paper we have examined the claim that "people trust maps" and have used that as a catalyst for a deeper cartographic perspective on trust. Specifically, we introduced three key dimensions within which to understand trust in maps. First, the functional avenue pertains to whether the map does what we expect it to do. Second,

the creator avenue emphasizes how source factors into trust. Third, the body of knowledge avenue considers how much of what is shown on maps is a compendium of sorts with established geographic "truths." We also have connected cartographic ideas with the rich discourse of trust in social science, to broadly identify areas of overlap and to make a case for trust in maps having its own special characteristics. In looking at trust in cartography we offered the hope that these findings are applicable and informative to the broader discourse of trust in social science and related fields. Finally, we demonstrated that trust in maps is not a binary concept, as it is variable, evolving, and nuanced.

These three dimensions are supported by an analysis of factors common to trust studies across disciplines, one that outlines several predictors of trust. Trustworthiness, a cumulative value of the trustee's ability to sustain the weight of trust, is one of the fundamental antecedents to trust. But the trustee is not the only factor, and we hope our analysis opens up an understanding of trust as not just dependent on the map or its maker, but also the wider context map use exists within.

We believe that the three dimensions discussed in this paper provide an overall contextual framework for researchers in cartography and GIScience to better understand trust in maps. Our work also highlights the need for a linking of theory and empirical work, and to look at connections between cartography and related disciplines. Several disciplines such as sociology, psychology, etc., have extensively studied trust, and that work can be usefully leveraged. Our hope is that cartography and GIScience researchers can contribute to advancing theory across disciplines. Overall, our work attempts to take a broader look at trust in maps, which we hope will complement recent empirical works that have evaluated narrow, specific questions pertaining to trust and map design, methods, etc. Establishing a foundation by exploring elements of trust in maps ensures that the broader context of trust in maps is examined. In doing so, it helps researchers approach research on trust in maps with a more nuanced understanding that acknowledges the many dynamics of the topic.

THE FUTURE OF TRUST IN MAPS

One of the underlying bases of the geographical body of knowledge is that measurements and drawings of many features of the earth have been made again and again, over time. This article is intended as an initial survey of a topic that, as we have shown, has sources and analogues in many different other fields of inquiry. Any sense of certainty we have shown in our findings is our own. The basis of a firmer and more nuanced sense of how trust in maps works, and how to work with that trust as individuals and as a cartographic community, will be based on this work being repeated, argued with, modified, and maybe eventually replaced. Our hope is that this paper provides a starting point for that discussion. As we work in one of the knowledge fields, cartographers need to keep this repeated inquiry in mind as foundational to what and who we are, lest the idea of that body of knowledge become siloed and institutionalized to such a degree that it is no longer "common." *That*, we think, is a long-term recipe for growing distrust in maps.

At the same time, trust in the body of knowledge is dependent on the overall quality of that body of knowledge, and its permeability by misinformation and disinformation. It is notable that recently, the **Overture Maps Foundation's** project has sought to integrate open source and other public data within a controlled integration environment, and Meta's **Daylight project** seeks to take open-source OpenStreetMap data and filter out disinformation and misinformation to create a public-access but still proprietarily controlled dataset.

We also encourage more work in describing the relationship between heuristic markers of "mapicity" and the underlying knowledge that maps contain. How can we describe this relationship more clearly and in a way that points towards best practices for mapmaking? We feel this question has implications for the wider information and knowledge fields and their public-facing arms: When and how do we "mark" our work as being part of the wider body of knowledge? How can we keep those markers closely related to the actual quality of knowledge? How can we make ourselves and users aware of ways in which those markers can be used to give a "stamp of approval" to misinformation, without tainting the solidly-backed body of knowledge? We do not make any specific suggestions here, but we hope our community and the knowledge fields in general will spend more time thinking about this.

It is equally important to think about trust from the perspective of a practicing cartographer. Some questions to ask yourself are: How do you approach others' trust in your own work? How do you balance encouraging people

to trust your maps, vs. the desire to encourage healthy critique of your maps and other maps? How much do you or your organization "own" your maps, so there is a clear line of responsibility for trustworthiness? How do you personally, and your organization(s) corporately, view trust of your maps—as a kind of "sacred trust," as a marketing opportunity, or more likely a combination of both? How does that balance work? And how does your map relate to the overall body of maps and geographic knowledge? Is that relationship clear to readers?

As we consider codes of conduct for trustworthy mapmaking and/or pursue other ways for ensuring trustworthiness such as providing maps with a seal of approval, we need to survey if our research and practice is actually fostering healthy trust in maps. Gartner (2023) outlines two initiatives for improving the trustworthiness in maps by striving for transparency in things like design decisions and advocating for contextualization (i.e., offering multiple representations for the same data). As these initiatives and others take root, we need to determine metrics and methods to assess whether they are working. Specifically, researchers need a way to measure one's trust in a map, and to identify the specific cartographic elements that have the greatest impact on trust. The rating scale developed by Prestby (2024) presents an initial tool for reliably measuring trust in maps. Determining which elements influence trust is crucial to both establishing guidelines for the creation of trustworthy maps and identifying elements that education campaigns can target to improve mapping literacy.

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