

Disputation on the Power and Efficacy of Cartographic Expertise

Questions for Academic Cartographers and GIS Professionals in the Age of Natural-Language Mapping

For public disputation, criticism, revision, and - one can hope - constructive disagreement.

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ARTICLE TYPE	PUBLICATION DATE	LICENSE
Independent essay / public disputation	20 July 2026	CC BY 4.0

ABSTRACT

Natural-language GIS (NLGIS) and prompt cartography do not eliminate cartographic expertise. They expose which parts of that expertise constitute enduring geographic judgment and which arose from temporary mastery of software interfaces, technical vocabularies, and production procedures. Structured as a public disputation comprising seventy-four questions, this essay examines whether academic cartography and the GIS profession have confused the intellectual substance of mapmaking with the machinery historically required to perform it. The argument does not presume that AI-assisted cartography is accurate, ethical, transparent, or trustworthy by default. Large language models introduce serious concerns involving bias, privacy, copyright, environmental cost, reproducibility, concentrated corporate ownership, and the rapid production of persuasive errors. These risks require shared standards for evaluating cartographic outcomes alongside method-specific audits of provenance, security, uncertainty, and accountability. They do not, however, justify granting human-produced maps a presumption of innocence while treating AI-assisted maps as categorically illegitimate. As natural language becomes capable of directing geographic analysis and map production, cartographic expertise must increasingly justify itself through judgment rather than procedural scarcity, contribution rather than initiation, and public service rather than compulsory mediation. The enduring responsibilities of cartographers remain essential. The essay ultimately calls upon universities, professional organizations, researchers, and practicing cartographers to guide this transition by building open knowledge systems, evaluative standards, educational practices, and public-interest infrastructure. Prompt cartography is not the end of cartography. It is a challenge to decide what cartography is for, whom it serves, and which forms of expertise deserve to survive when the machinery changes.

KEYWORDS

Natural-language GIS; prompt cartography; cartographic expertise; artificial intelligence; democratization of mapmaking

SUGGESTED CITATION

Muehlenhaus, Ian. 2026. "Disputation on the Power and Efficacy of Cartographic Expertise: Questions for Academic Cartographers and GIS Professionals in the Age of Natural-Language Mapping." Prompt Cartography, 20 July 2026. <https://promptcartography.com>.

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Preamble

Cartography has never been a single tool, procedure, profession, or institution. It is a way of helping people understand spatial relationships, geographic patterns, uncertainty, movement, place, and power. Its methods have changed repeatedly.

Originally, cartography was visualized solely in the human brain; mental and cognitive visualizations of space were exchanged via natural language (typically via the development of pre- and post-positional syntax). Eventually, graphicacy was applied to media that could be kept and exchanged beyond a single human's lifetime (e.g., stone etchings, sheepskin paintings). Then, engraving came along, which in turn gave way to photomechanical production. Darkrooms came and went quickly, all things considered, a mere blip in the history of mapmaking, put to rest due to the rise of affordable personal computers (PCs) and increasingly capable geographic information systems and graphical design software applications. Cartographers first interacted with these computer applications via command-line interfaces before hardware evolved to allow for affordable graphical interfaces. In the last decade, the requirement for PC compute has increasingly been replaced by the cloud, which cartographers (and others) can connect to from mobile devices, web-based apps, and via APIs. At each of the above technological transitions, some human cartographic skills receded (e.g., the art of placing map labels or computing proportional symbol sizes mathematically), others emerged (e.g., using an API to load US Census geometries), and the difficulty of distinguishing what cartography is from the temporary machinery through which it was practiced continued.

Large language models and LLM-based agents now introduce another, much more rapid, transition. Natural-language GIS (NLGIS) - in which the human participates in geographical information science almost exclusively via natural-language prompting (Muehlenhaus, 2026) - allows anyone to describe desired geographic analyses, datasets, visual forms, interfaces, and critiques in their preferred everyday language. In many ways, this development brings mapmaking, if not the discipline of cartography, full circle: a human perception of geography can now be expressed completely with words. Except this time, it is expressed to an intelligent system (LLM or AI tool) that collaborates with the human to produce the desired representation. In some workflows, no manual production work - other than typing or speaking - is required to visualize the map.

Prompt cartography extends this NLGIS principle directly to map design: the human uses natural language to frame the purpose, supply context and constraints, direct execution, evaluate the visual drafts, and remains responsible for what the map communicates (Muehlenhaus, 2026). The work is *not* effortless, neutral, or infallible. Neither was any of the cartographic work that preceded it.

The central question confronting our cartographic and GIS communities today, therefore, is *not* whether human expertise still matters. It does. Experience and knowledge about cartography will dramatically improve one's prompt composition, sharpen judgment, establish guardrails that prevent AI from making every decision, expose weak datasets, help one recognize subpar or accidentally misleading designs, and guide revision.

The more consequential issue is whether expertise should continue to function as a socially constructed gate - i.e., whether years of specialized training in proprietary and open-source software, the use of professional terminology (that has a nasty habit of shifting nomenclature depending on the software you are indoctrinated with), and technical initiation (i.e., rites of passage, such as a four-year college degree) should remain prerequisites for meaningful participation in mapmaking.

My belief is that, given the new capabilities LLM agents and AI tools provide, cartography - and geographical information science more broadly - is due for a Reformation of sorts. In that context, I

have composed this essay around a list of fundamental questions to lead critical thought, discussion, and participatory dialogue in our community. Martin Luther once framed 95 propositions for public disputation. His initial goal was reform, not schism. Likewise, though on a much less monumental scale, I want to help cartography by bringing my questions to the fore, not destroy it or be cast out.

Thus, my goal with these questions is *not merely to criticize*, but to kindle a dialogue that forces our community - academics and professionals alike, as well as everyone interested in mapmaking more broadly - to *think critically* about the role of LLMs and AI in cartography rather than merely react to them, which is a natural human tendency, even for me.

Importantly: the following questions *do not* assume that every criticism of artificial intelligence is dishonest. Concerns about accuracy, bias, privacy, copyright, labor, environmental cost, corporate power, and the production of low-quality work are real - as they have been with all technologies used to create maps. Those with concerns about AI in cartography deserve the right to present their evidence and participate in the debate as well. And I hope they do so in thoughtful prose, as opposed to online comments.

However, one point I suggest herein is that concerns about technology in cartography must not target one type of technology in isolation but should be analyzed comparatively against all the other technologies cartography has used and continues to use. LLM and AI shortcomings cannot become sacred objections only when a technology threatens established labor or guild roles, while comparable failures in human and institutional cartography stemming from contemporary technology are treated as ordinary problems to be managed. We cannot suddenly change the rules of cartographic ethics to target those practicing prompt cartography, because they are producing at a faster pace and in the early stages, at times, producing less reliable compositions. Technology improves; human use of technology improves; but only through use, iteration, and innovation. Not by waiting for a technology to magically become "good enough."

The following questions are ideas I have been ruminating on for over a year. I've laid them out in a manner similar to Martin Luther's 95 propositions to the Catholic Church. My questions arise from a lifetime of experience reading, researching, being tested on, building software for, and creating maps using GIS software. In fact, I revisited a large archive of notes from my Ph.D. seminar, *GIS and Society*, and scanned periodicals with marginal notes I still have from my preliminary examination. If a Ph.D. in cartography is a type of ordination, then my position within the discipline is akin to being a minister. It's odd to think about it this way, particularly because I'm an atheist, but the metaphor works well, because the following questions are borderline spiritual for me. What does it mean to be a cartographer moving forward? Can I still belong in a church that is frequently at odds with my personal beliefs?

Let's find out. And perhaps my questions will in turn lead to your own questions, which means we've achieved something together: critical thinking and deliberation. That in and of itself is golden in an era of social media emojis and trolling.

I. What Is Cartography For? - Questions 1-4

Before arguing about who is permitted to call themselves a cartographer, we should probably establish what cartography is and why people have practiced it. This sounds straightforward until one starts looking at the history of the field. Maps have been scientific instruments, administrative records, works of art, legal claims, navigation systems, arguments, interfaces, propaganda, and cultural texts. They have helped people find a grocery store and helped empires imagine that distant territories belonged naturally inside their borders. Any definition sturdy enough to survive all of this must be broader than the tools used to produce a map at one particular moment (Vasiliev et al. 1990; Harley 1992; Wood and Fels 1992; Cosgrove 2005).

Cartographers themselves have spent decades explaining that maps *do not* simply reproduce reality. Maps select, classify, omit, arrange, symbolize, and promote information. Their apparent factuality emerges from a combination of data, design, convention, institutional authority, audience interpretation, and suspension of disbelief (i.e., users often dismiss the fact that maps are not reality). Harley's (1992) and Wood and Fels's (1992) works made this impossible for cartographers to ignore. Preceding even these historic texts, though, is Buchanan (1985). Even before the ascent of digital-based cartography, he argued that *cartographic authorship lies within the framing and demonstration of an argument through design*. Put simply: cartographic artifacts (regardless of medium) are much greater than the sums of their production inputs and techniques.

The cartographer is *not* defined by how a map is produced; they may draw images by hand, use punch cards or high-level programming languages, command-line or graphical user interfaces (CLIs and GUIs), or even create a map from explosives (Mason 2016). A cartographer is defined by the role they played in reframing a spatial argument (or geographic perspective) as a visual artifact for interpretation. Today, though not always, this generally means having a communicative or exploratory intention, determining the limitations of the medium in which they are producing the map (i.e., what it won't include or try to show), determining the final arrangement of visual artifacts, critiquing and rejecting subpar alternative concepts, and accepting responsibility (and attribution) for the result they have thus guided into being.

In sum, natural-language GIS and mapping instigate yet another definitional challenge to our discipline, but not an unprecedented one. The map did not stop being a map when engraving yielded to photography, when darkrooms yielded to GIS, or when static sheets yielded to interactive displays. Cartography did not disappear when software began handling projection mathematics, classification, label placement, and rendering. At the turn of the millennium, Wood's wonderfully impolite declaration that "cartography is dead" was not a wake for mapping; it was a challenge to the institutional assumption that cartography and academic professionalization were the same thing (Wood 2003).

So I begin my questions here, positing we make a simple, almost binary, choice: *is cartography loyal to a production tradition, or to the geographic understanding that tradition was meant to create?*

1. Is cartography defined primarily by the tools and procedures through which maps are produced, or by the geographic understanding, communication, and public usefulness that maps make possible?
2. If a person can express a defensible cartographic intention in natural language, direct an artificial-intelligence system to execute it, and critically revise the result, by what principle is that person excluded from the practice of cartography?
3. Does a map become less cartographic when its creator directs rather than manually performs its construction, or have cartographers always delegated portions of their work to instruments, technicians, software, templates, and machines?
4. Whom does cartography ultimately exist to serve: those who possess its specialized methods, or the people and communities who need to understand spatial relationships?

MY PERSPECTIVE

If we cannot identify what remains essential when the tools change, do we not risk defending the scaffolding of cartography while neglecting the structure it was built to support?

II. By What Authority Is Mapmaking Restricted? - Questions 5-16

A portion of GIS is difficult because geography can be difficult. Spatial relationships are multiscalar, dynamic, uncertain, topological, and often particularly difficult to fit neatly inside clean, socially constructed categories (Lloyd 1997). Yet the entire difficulty of GIS cannot be attributed to the complexity of the world. Some of it comes from the historical arrangements through which computers required people to express geographic intentions: command syntax, menu hierarchies, database schemas, file formats, coordinate systems, proprietary terminology, and tool names that frequently made more sense to software architects than to the people attempting to answer a geographic question. The cognitive load of these systems has always been heavy.

The institutions surrounding GIS grew around these arrangements - symbiotically. Academic programs, laboratories, certification practices, journals, consulting models, government grants, and vendor ecosystems taught generations of users how to translate ordinary geographic intentions into the procedural grammar of computers and the Latin-like vocabulary of GIS. Chrisman (1998) shows how particular academic and institutional origins shaped GIS, while *Ground Truth* placed the technology explicitly inside social, political, material, and economic relations rather than outside them as a neutral technical apparatus (Pickles 1995). At the turn of the millennium, McLafferty (2004) described the "socialization" of GIS, and before that, Rundstrom (1995) had already warned us that formal systems would by default privilege some spatial concepts over others, typically displacing indigenous and other epistemologies. The gate was never made only of software; it was also socially constructed via institutional development, accepted vocabularies, and judgments about whose geographic knowledge counted.

Even inclusive advances for the common good were ensnared in this accidental conspiracy. Graphical interfaces once represented a major democratizing advance for mapmaking. They spared users from memorizing command syntax and replaced it with windows, icons, menus, and pointers (WIMP interfaces). This widened participation enormously, but it also created a new type of expert: someone fluent in the interface. And those experts still had to be trained - degrees in GIS and cartography typically teach both concepts and software now. There is nothing natural or permanent about this arrangement. It's just symbiotic. Natural-language interfaces and NLGIS workflows are rocking the boat of this arrangement and those who benefited most from it are starting to get seasick.

Institutions banking on the GIS-industrial complex could have known for decades that AI was likely to change everything - though no one could have predicted when. Thirty-five years ago, Joshi (1991) situated natural-language processing within a long computational research tradition, while at the turn of the century, Van Dam (1997; 2001) argued that the WIMP (Windows Icons Menus Pointers) interface had stagnated and anticipated that speech, perceptual interfaces, agents, and other forms of interaction better matched human-computer action needs. Geographic researchers likewise explored natural-language queries, grammatical ambiguity, and language-driven GIS long before current LLMs ever entered the scene (Wang 2003; Cali et al. 2011). The shock rumbling through our institutions right now is, perhaps, not due to the technology alone but also to how quickly the disruptive technology arrived on the scene. A metaphor: LLMs are akin to the in-laws pulling up to the house with a moving truck, ringing your doorbell, announcing they are moving in permanently, expecting the largest bedroom, and... what's for dinner tonight?

Many geoscientists have also been researching AI and bringing this work to the fore. For example, GeoNLU explicitly seeks to bridge natural language and spatial-data infrastructures, with accessibility and usability as its central tenets (Naveen, Maheswar, and Trojovský

2024). Jiang and Yang (2024) found that language models could translate many natural-language requests into spatial database queries, while also documenting failures and limitations on more difficult operations. These systems are not infallible geographic minds, obviously. They are translation layers - imperfect, revisable, and increasingly capable - that move some procedural burden away from the human. LLMs and AI will likely continue to become faster and more capable at spatial decision-making and implementation.

Our inquiry, then, is not whether formal terminology, coding, user-interface mastery, and professional education still have value. They do for now. However, it will be the capitalist economy that determines how much value such skills continue to have. The market value of those skills may diminish greatly, I suspect, much as it has for operating a sewing machine or writing long-winded polemics (like this). Our question is whether these now less valuable skills should remain compulsory passages through which everyone must travel before they may investigate a neighborhood, analyze a spatial dataset, or make a defensible map. Leitner et al. (2000) showed over a quarter-century ago that the *form* through which GIS expertise is provided has a direct influence on community autonomy and sustainability. If natural language can reduce reliance on compulsory intermediaries (i.e., us), the profession must explain what public interest is served by preserving socially constructed barriers that no longer arise from geographic reasoning itself.

Thus, my next set of questions:

5. How much of the traditional difficulty of GIS arises from the complexity of geography itself, and how much arises from the historically awkward ways computers, databases, and software have required humans to describe geographic intentions?
6. If a user can accurately request that points be grouped by proximity, that an area be summarized by neighborhood, or that a route avoid hazards, why must that user first know the sanctioned technical names of clustering, spatial aggregation, or network analysis?
7. Does memorizing the location of a tool within a software interface demonstrate geographic reasoning, or only familiarity with the temporary arrangement of one vendor's menus?
8. At what point does technical terminology clarify geographic thought, and at what point does it function as the Latin of a professional guild - useful to insiders, the initiated, but intimidating to outsiders, and unnecessarily protective of institutional authority?
9. If natural language can translate a person's geographic intention into a reproducible analytical workflow, should the quality of the intention and result matter more than the user's knowledge of the intermediate commands?
10. If the public has financed the collection of a dataset, why is practical access to its meaning so often contingent on knowledge of coding, database structures, file formats, projections, APIs, and institutional portals?
11. Can data truly be called open when the legal right to download it exists but the practical ability to find, interpret, clean, join, analyze, and map it remains restricted to a technically initiated minority?
12. Does a university credential certify cartographic judgment, or does it certify that a person successfully navigated a particular rite-of-passage curriculum, set of technologies, and professional culture at a particular moment in time?
13. Why have some of us often treated the ability to execute a complex procedure as equivalent to understanding when, why, and whether that procedure should be used?
14. If natural-language GIS can provide explanations, alternatives, warnings, and critiques while performing an analysis or creating a visualization, might some novices receive more methodological

guidance than users who silently click familiar tools without reconsidering their assumptions?

15. By what authority may a profession claim exclusive ownership over methods that increasingly can be explained, demonstrated, and operationalized in the ordinary languages of the people who need them?
16. If cartographic expertise is genuinely valuable, should it require barriers to remain visible, or should its value become clearer when its principles are made broadly understandable and usable?

MY PERSPECTIVE

geographic complexity deserves respect; interface complexity does not deserve reverence and should be allowed to die off when goodness of fit to purpose no longer applies. There is no sense keeping technology around because generations of us were required to master it. If this were the case, I'd still be using 35mm cameras.

III. Which Professional Assurances Are Actually True? - Questions 17-31

Professional cartography carries inherited credibility. A map produced by a trained cartographer, respected university, government agency, or familiar technology arrives already wearing a small ceremonial robe of authority. Readers may not understand the data, methods, or design decisions, but they recognize the institutional costume. A map made with an unfamiliar technology often receives the opposite treatment: suspicion first, evaluation later - though frequently, "later" never arrives.

Cartographers have known for a very long time that visual and institutional authority can exceed actual reliability. Boggs (1947) called this "cartohypnosis," describing the capacity of maps to induce confidence through appearance and precision. Harley (1992) likewise examined the scientific and cultural rules through which maps present themselves as factual and neutral. Kent (2017) warned against acritical cartography in a post-truth context, while Prestby (2023) synthesized evidence showing that trust in maps depends upon the source, design, reader, task, context, and prior beliefs. Notice accuracy is not the point here. Muehlenhaus (2012) demonstrated empirically that rhetorical map styles can alter trust, recall, and beliefs. None of these human-created mapping issues began when people started prompting maps into creation over the past two years.

Nor does professional production guarantee a single ethical or truthful perspective. Field and Muehlenhaus (2024) ask whether cartographic ethics can be reduced to universal right-and-wrong answers when maps inevitably present situated and competing versions of truth. Postnikov (2002) provides an especially useful historical example: Soviet cartography maintained explicitly different accuracy standards for military and ordinary consumers. The case might be extreme, but the lesson is general. Standards are often attached to audiences, institutions, political priorities, and (always) power. Only post facto are standards presented as though they emerged from cartographic reason alone.

This *does not* give maps created with AI technologies a free pass - they are certainly *not* trustworthy by default. Current research has identified real concerns: inaccuracies, misleading content, unanticipated features, reproducibility problems, commodification, responsibility, privacy, bias, transparency, explainability, and provenance (Kang, Gao, and Roth 2024). These are issues to overcome. They require more institutional input and research, not less. They call for better systems, transparent provenance, and explicit evaluation (Muehlenhaus 2026). They *do not* establish that human-made maps deserve presumption of innocence while AI-assisted maps deserve presumption of guilt. In fact, the same could be said for maps made with any other software, because maps created via coding or a GUI often have zero provenance, are buggy and insecure, and do not necessarily go through a robust evaluation

process. And all of these issues arise before we even get to dataset reliability and map symbolization.

In other words, the *only defensible standard* moving forward is the *symmetrical, holistic evaluation* of all mapmaking tools and procedures. Gartner (2023) argues for strategies that make cartography more trustworthy. Yes, but any such strategies must apply regardless of whether a workflow uses hand drawing, a GUI, Python, a platform template, or an LLM agent. Similarly, Battersby et al. (2014) have documented the distortions and interpretive consequences of using Web Mercator projections. Yet the projection's widespread (mis)use did not cause the discipline to abandon web maps. Experts criticized the projection, developed guidance (that was frequently ignored), and the masses kept building Web Mercator-projected web maps.

In the case of NLGIS and LLM-produced maps, past research on the credibility of sources has demonstrated that prior attitudes and map production labels will shape human evaluation of maps independently of the quality of content being shown (Kumkale, Albarracín, and Seignourel 2010). If prompted maps are labeled AI productions before they are seen, the guardians of cartography will find the evidence they are looking for that AI maps are less trustworthy. That's a convenient feedback loop but bad science. Only controlled and blinded evaluation of maps can truly compare levels of trust. If NLGIS and prompt-produced maps are judged differently *only after their origin* is disclosed - post-testing - then the profession has discovered a social bias, *not a cartographic principle*. One part of the solution may lie in evaluating all maps by shared outcome-based standards while applying method-specific audits to provenance, privacy, reproducibility, security, and environmental cost.

17. Is a map made by a human expert inherently more accurate, ethical, or communicatively effective than a map made through human direction of an LLM, or should both be judged by evidence rather than genealogy?
18. When a human-made map contains projection errors, misleading classifications, inaccessible colors, cluttered labels, or unsupported claims, do we condemn human cartography itself, or do we critique the particular map and improve the process?
19. Is "AI slop" a meaningful category of production, or is slop simply low-quality output that can be produced by people, institutions, templates, automated systems, and conference committees with equal enthusiasm?
20. If critics believe AI-assisted maps are visibly and consistently inferior, why not test that belief through blinded evaluations using explicit criteria for accuracy, clarity, accessibility, ethics, usability, and fitness for purpose?
21. Why is manual execution so often treated as evidence of creativity when creativity has always also involved intention, selection, combination, framing, criticism, revision, and the willingness to discard an attractive but unsuccessful idea?
22. Did cartographers cease to be authors when they stopped engraving plates, drawing lettering by hand, operating darkrooms, programming every function from scratch, or hosting every tile on their own servers?
23. If using a graphical interface did not invalidate maps because the cartographer did not write the underlying code, why should using a natural-language interface invalidate maps because the cartographer did not manipulate the graphical interface?
24. Why was automation celebrated when it replaced repetitive labor, accelerated computation, positioned labels, generalized features, generated tiles, or applied symbols, yet described as dehumanizing when it began translating human language into complete workflows?
25. If an LLM can explain its proposed method, generate an auditable script, preserve the prompt history, and revise its approach under

critique, in what sense is this process necessarily less rigorous than a sequence of undocumented clicks?

26. Are prompts intrinsically vague, or do they merely expose how vague human intentions often were before software forced them into rigid parameters without requiring the user to articulate the larger purpose?
27. Is code automatically precise when it faithfully executes an ill-conceived method, and is natural language automatically imprecise when it clearly states purpose, assumptions, constraints, tests, and expected outputs?
28. Do professionals object to LLM hallucination with equal force when human analysts make unsupported assumptions, copy inherited workflows, misread metadata, select convenient datasets, or confidently repeat methods they no longer fully understand?
29. Why are the probabilistic weaknesses of LLMs treated as disqualifying while the cognitive biases, fatigue, incentives, memory failures, and social conformity of human experts are treated as manageable conditions of professional practice?
30. If all mapmaking combines judgment with imperfect tools, should we not compare complete workflows - including verification and critique - rather than comparing an idealized expert human with an unsupervised machine?
31. If natural-language systems make the cartographer's instructions, revisions, and compromises more visible than many traditional workflows do, might prompt cartography sometimes increase accountability rather than diminish it?

MY PERSPECTIVE

a human signature and an AI label are both poor substitutes for examining the data, reasoning, design, and consequences behind the production of the map itself.

IV. Who Has Paid for the Gates? - Questions 32-44

Professional barriers are usually defended using the language of quality. Their costs, however, are not paid evenly. A national agency, major corporation, or well-funded university can employ GIS specialists, purchase software, maintain infrastructure, commission analyses, and send people to conferences where everyone nods solemnly about access. Small municipalities, schools, neighborhood organizations, journalists, nonprofit groups, and communities confronting local environmental or social problems often operate under rather different conditions.

Research on community GIS made this visible long before contemporary AI. Leitner et al. (2000) found that different modes of GIS provision - consultants, universities, public agencies, volunteers, or internal staff - affected affordability, continuity, autonomy, and the power to define a project. Craig (2004) examined the motivations of influential individuals building spatial-data infrastructures, while McLafferty (2004) showed how GIS became embedded unevenly across institutions and communities. Expertise is *never* neutral. The provider influences what questions seem possible, which datasets appear legitimate, which categories are chosen, and what the resulting map is *allowed* to claim.

Ground Truth remains fundamental because it refused to separate GIS from the material and political interests surrounding its development and use (Pickles 1995). Aitken and Michel (1995) asked who "contrives the real" within GIS and planning. Rundstrom (1995) went further, showing that geographic information systems can suppress epistemological diversity by segregating (i.e., dismissing) local spatial concepts into alien categories. These critiques complicate the simple notion that experts merely translate community requests into neutral technical products. They don't; they also shape the geographic reality that becomes representable - "it from bit," as information physicists have been saying for decades (Wheeler 1990).

Democratization should not be romanticized. Wider access to spatial data and analysis can support community action, but it can also intensify surveillance, privacy loss, misrepresentation, and control. Dobson and Fisher's (2003) warning about "geoslavery" remains an important counterweight, and Onsrud (2003) reminds us that openness and security must often be negotiated rather than maximized independently. Warren (2004) nevertheless identifies a genuine utopian potential in GIS when communities can use it to imagine, contest, and organize their worlds. The technology is neither liberator nor jailer by itself. Power depends upon *who* can use it, under what conditions, with whose categories, and with what recourse when things go wrong.

Natural-language GIS will not dissolve these power relations. In fact, there is a very real chance it will create new dependencies on model vendors, cloud infrastructures, and opaque training systems. Ensuring that LLMs can access open data will be fundamentally important; so will developing smaller, human-designed models for open use. These future needs should draw cartographers more deeply into the work, not drive them back into the comfort of the old barriers.

Language interfaces can immediately reduce one longstanding dependency: the need to communicate every geographic concern through someone initiated into a professional syntax before it can become analysis. The relevant comparison is not between flawless expert control and reckless public access. It is between different arrangements of cost, risk, knowledge, opportunity, and authority - and between who gets to choose among them.

The gates of cartography have never been paid for entirely by those standing comfortably inside them. And the masses are requesting what is theirs.

32. How many local governments, schools, newsrooms, nonprofit organizations, tribal communities, and neighborhood groups have gone without needed spatial analysis because professional mapping services were unaffordable, unavailable, or impenetrable?
33. When communities must hire outsiders to map their own lived experience, who controls the framing, categories, omissions, timetable, and final interpretation?
34. If natural-language GIS allows subject-matter experts to work directly with spatial data, should cartographers welcome the resulting collaboration, or fear the loss of their role as compulsory translators?
35. Can a profession claim to support participatory mapping while treating independently produced, AI-assisted maps from nonprofessionals as presumptively illegitimate?
36. When a small organization, such as a municipality, pays repeatedly for consultants to transform public records into routine maps, is it purchasing essential geographic judgment, or renting access to procedures that could increasingly be directed in ordinary language?
37. If a journalist can use an LLM to find public data, document its limitations, analyze geographic patterns, and build an interactive map within a deadline, should the work be judged by its evidence or dismissed because a specialized production team was not required?
38. If a teacher can help students investigate local environmental inequality without first securing expensive software and a semester of technical prerequisites, what educational value would be protected by preventing that exercise?
39. When a resident can ask where pedestrian injuries cluster, which areas lack shade, or how flood exposure overlaps with housing vulnerability, is the responsible response to teach critical use of the tools or to insist that such questions remain professionally mediated?

40. Who benefits when the public is told that spatial analysis is too dangerous, complex, or sophisticated to attempt without experts, while the same public is continuously subjected to maps made by governments, corporations, campaigns, and media organizations?
41. If access to geographic analysis expands more quickly than formal education can adapt, should the academy construct bridges, standards, and public instruction, or stand at the old gate explaining why the bridge should not exist?
42. How many talented potential cartographers were lost because they disliked coding, could not afford tuition, lacked access to software, were excluded by professional culture, or were told that their way of thinking did not resemble the discipline's preferred technical identity?
43. If natural language permits writers, artists, historians, planners, activists, scientists, and residents to contribute directly to mapmaking, might cartography become intellectually richer precisely because fewer people must first be remade in the image of the traditional trained cartographer or GIS professional?
44. When the burdens of exclusion are borne by those who need maps and the benefits of exclusion accrue to those authorized to make them, can gatekeeping still be described entirely as quality control?

V. What Is the True Treasure of Cartography? - Questions 45-55

When a technology begins performing procedures that once required years of training, a profession is forced into an uncomfortable inventory. What, exactly, was valuable? Was it the knowledge, judgment, and public service-or the scarcity of people able to operate the machinery? This is not a pleasant question, but it is a clarifying one. A profession that cannot separate its intellectual contribution from its inherited workflow risks defending the workflow long after the contribution could travel farther without it.

Cartography's real treasure is substantial. It includes visual literacy, geographic reasoning, data criticism, map history, rhetoric, uncertainty, scale, classification, generalization, projection, interaction, accessibility, and the knowledge that every representation highlights certain relationships while silencing others. Dondis (1973) demonstrated that visual communication has an alphabet, lexicon, and syntax that can be taught rather than guarded as mystical taste. Field (2018) demonstrates the depth and breadth of practical cartographic judgment, while Harley (1992), Wood and Fels (1992), and Pickles (2004) show why that judgment must include power, omission, and the production of geographic knowledge - not merely attractive and clear symbolization.

The geovisualization literature likewise expanded the discipline beyond static map production. MacEachren and Kraak (2001) defined a research agenda incorporating representation, computational knowledge construction, interface design, cognition, and usability. Dykes, MacEachren, and Kraak (2005) continued this movement toward exploration, interaction, analysis, and linked forms of geographic reasoning. In retrospect, early geovisualization already loosened the connection between cartographic expertise and the manual production of a finished map. The treasure increasingly lay in directing systems through which people could explore spatial evidence.

Natural-language systems allow portions of cartographic knowledge to be externalized into prompts, schemas, examples, critiques, knowledge graphs, and reusable standards. This does not capture all tacit expertise; no serious examination can claim that it does. It does, however, allow knowledge that once traveled slowly through apprenticeship and professional socialization to arrive at the moment of decision. The expert's value then shifts away from remembering commands and toward framing difficult questions, designing trustworthy knowledge systems, identifying bad

assumptions, exposing uncertainty, and teaching judgment. That is not the death of expertise. It is the end of expertise's exclusive franchise and perhaps the beginning of its wider public usefulness.

Thus, the next round of questions...

45. Is the true treasure of cartography found in proprietary and open-source software, specialized vocabulary, professional scarcity, publication prestige, and mastery of procedures - or in the ability to help people understand spatial relationships?
46. Are projections, classifications, visual variables, uncertainty, generalization, scale, hierarchy, and geographic ethics valuable because experts possess them, or because these ideas improve maps when anyone can apply them?
47. If a cartographic principle can be translated into clear language, reusable prompts, design schemas, evaluative rubrics, and accessible examples, does its wider use diminish the principle or fulfill its purpose?
48. Should knowledge developed in publicly funded universities remain dependent on tuition, journal access, conference travel, professional networks, government and corporate grants, and years of tacit apprenticeship before it can influence ordinary mapmaking?
49. If the profession's accumulated wisdom can be encoded into open knowledge stores that help LLMs recommend better projections, safer privacy practices, clearer legends, and more honest uncertainty, why would cartographers resist such translation?
50. Does externalizing tacit expertise into prompts and schemas cheapen that expertise, or reveal how much of its authority previously depended on remaining difficult to articulate and transfer?
51. If a novice can retrieve the relevant cartographic knowledge at the moment of decision, is the novice pretending to be an expert, or using a reference system in the same way experts have always used books, colleagues, templates, and precedents?
52. When execution becomes easier, does the enduring work of cartography not become more visible - i.e., defining map intent, critiquing dataset validity, anticipating user interpretation, testing alternatives, openly disclosing uncertainty, and accepting responsibility for the final product?
53. If experts no longer receive economic value merely for remembering commands and performing routine procedures, might their more meaningful value lie in building better standards, knowledge systems, critiques, and public institutions?
54. If natural-language GIS separates cartographic reasoning from the machinery once required to execute it, should the discipline defend the reasoning or the machinery?
55. Is the democratization of mapmaking a threat to cartography, or a threat only to arrangements that made cartographic participation unnecessarily scarce?

AUTHOR'S PERSPECTIVE

When the technology becomes easier to operate, we have to look in the mirror and be honest: did we value the technology for the privilege it bestowed upon us as experts or what the technology allowed people to understand?

VI. What Do the Guardians Owe the Public? - Questions 56-66

Universities, professional associations, journals, conferences, public agencies, and software companies are not innocent spectators watching technological change drift past the window. They decide what receives funding, what enters curricula, which methods appear legitimate, which risks receive institutional attention, and which forms of labor deserve protection. GIS itself emerged through university laboratories, public agencies, defense and planning institutions, research programs, commercial vendors, and professional networks. Its authority was built, not divinely issued (Chrisman 1998; Pickles 1995; McMaster and McMaster 2002).

The responsibility of these institutions is not to cheer every new model release like a teenager waiting outside an electronics store (or with a full digital shopping cart). AI-assisted cartography introduces real dangers. Research has identified the real concerns already discussed. However, concentrated model ownership may be more dangerous than any single technical shortcoming. The professional guild of human cartographers and GIS experts could soon be replaced with a far smaller group of platform companies - the ones that survive the inevitable bubble pop. Castells (2000) has already provided a wide framework for understanding how networked infrastructures reorganize and shift power. Meanwhile, Beck's concept of *Risk Society* reminds us that modern institutions increasingly spend their time distributing, measuring, and arguing over risks their own technological modernization has wrought (Beck 1992). And rarely do they find easy solutions - once unleashed, the technology drags the institutions along, not the other way around.

Yet risk is not a magical veto word. Refusing a technology creates risks alongside adopting it. Communities may remain dependent on expensive intermediaries. Students may graduate into disappearing workflows. Public standards may be written by companies because universities declined to engage. Crampton (1995) argued that GIS ethics must move beyond internal judgments of correct professional behavior toward examination of the broader assumptions and institutions framing GIS. Curry (1995) likewise emphasized the inconsistency and contingency of GIS ethics, while Onsrud (1995) attempted to identify harmful conduct in practical terms. Field and Muehlenhaus (2024) extended this discomfort by asking whether universal cartographic ethics are workable when truth is situated, contested, and perspectival. (They think not.) The point is not that ethics at all scales are impossible. It is that ethical authority requires humility, context, and transparent reasoning - not merely a code written by people who already possess institutional standing.

The constructive path begins with governance - particularly provenance and replicability. Echoing what Gartner (2023) called for before OpenAI released ChatGPT, when done well, AI-assisted workflows can be more transparent, replicable, and trustworthy than many conventional workflows (Muehlenhaus 2026). Prompt cartography workflows, for example, can be designed to generate provenance documentation at every step, including attribution for creative inspiration and sources, documented data transformations, openness about uncertainty, and human accountability. The trick will be for the cartographic and GIS educators to make the leap from rehearsing the fiction that routine procedural execution and human conceptual knowledge will remain our profession's moat. It's time to start educating human agents (i.e., students) on how to collaborate with, direct, test, critique, and audit LLM and AI mapmaking systems. Our discipline has done it before, not that long ago. Earlier web-cartography educators had to confront the difficulty of keeping curricula aligned with rapidly changing technologies (Donohue et al. 2012). The pace of change has increased; the obligation of GIS and cartography educators has not, however.

Environmental and social scrutiny must also be applied consistently. AI's material demands deserve serious study, including compute, energy, water, and hardware. Information growth presents

an additional concern (Vopson 2020). But again, consistency is important. Was the equivalent lifecycle thinking applied to cloud GIS, satellite systems, device turnover, travel to global conferences on the cartography of sustainable development, large data infrastructures, and the professional practices already considered normal? The guardians of cartography earn legitimacy by comparing risks (economic, environmental, societal, ad infinitum) honestly, building public-interest alternatives, and preparing people to use new systems responsibly. They do not earn it by standing outside the transition, shouting “ethics,” and leaving the infrastructure to corporations. We’ve witnessed how this plays out over the last 20 years.

AUTHOR'S TAKE

Institutions cannot claim guardianship over cartographic quality while declining responsibility for the conditions under which the next generation will make maps.

56. What obligations do universities have when technologies begin performing the very tasks around which degrees, courses, laboratories, and professional identities have been organized?
57. Should GIS and cartography programs teach students to compete with LLMs at routine execution, or to direct, evaluate, audit, improve, and govern systems capable of performing that execution?
58. Should professional organizations establish transparent standards for AI-assisted cartography, or is it easier to preserve moral authority by condemning practices they have not attempted to evaluate systematically?
59. If journals and conferences claim to advance cartographic knowledge, how much space and funding should be devoted to reproducing familiar techniques under new terminology, and how much to genuinely risky ideas that may unsettle the profession itself?
60. If an institution celebrates innovation only when innovation strengthens its existing structure, is it cultivating discovery or managing reputational change?
61. Why are ethical principles such as sustainability, accessibility, inclusion, transparency, and public participation so often praised in declarations but treated as negotiable when democratizing technologies disrupt professional status?
62. If environmental cost is invoked to reject LLM-assisted work, will the same lifecycle accounting be applied to global conferences, cloud GIS, satellite infrastructures, institutional computing, large-scale tile services, and the perpetual replacement of hardware?
63. If copyright, provenance, bias, privacy, and labor displacement are genuine concerns - and surely they are - why are they not being answered with auditable standards, public-interest infrastructure, disclosure rules, and education rather than generalized contempt toward LLMs and AI?
64. Will universities and professional societies help build open cartographic knowledge systems for the public, or leave that work to corporations and later lament that corporate systems encode corporate priorities?
65. If natural-language GIS risks replacing one guild with a smaller group of AI-platform owners, is retreat from the technology responsible, or does responsibility require active participation in shaping alternatives?
66. What does a conference devoted to automated cartography (i.e., AutoCart) mean by automation if it welcomes machines that accelerate cartographers but distrusts machines that empower noncartographers?

AUTHOR'S TAKE

Ethically, I must continue promoting what I perceive to be most just and beneficial to society at large, rather than stop merely to prolong my career, minimize disruption, or avoid discomfort among those who vehemently disagree with me.

VII. The Shrewd Questions of the Cartographic Laity - Questions 67-70

By this point, the dispute no longer depends upon pretending that every AI-assisted map is good, every critic is self-interested, or every technological transition ends happily. None of that is true. The sharper argument begins when our profession’s own principles are followed to their logical conclusions. If maps should be judged critically, why should a production label determine the verdict before evaluation? If expertise consists primarily of judgment, why should delegating execution destroy expertise? If public data are genuinely public, why should practical access depend upon specialist mediation? If automation has long been a cartographic ambition, why does automation become illegitimate when it moves beyond the control of cartographers?

This is the point where Denis Wood’s provocation becomes useful rather than merely entertaining. His claim that “mapmaking is freeing itself from the dead hand of academia” was intentionally over-the-top, but it named an institutional fear that has not vanished, perhaps only become more entrenched (Wood 2003, 4). Familiar technologies are permitted to possess flaws requiring management; unfamiliar technologies are often declared invalid because they possess flaws at all. Human maps are treated as a sample containing good and bad work; AI maps are often collapsed into a contaminated category. Ethical, environmental, and labor arguments are applied urgently to emerging systems but less consistently to infrastructures already embedded in professional life. These asymmetries do not prove conspiracy or bad faith. They do, however, deserve answers.

So let’s ask...

67. If AI-assisted maps are obviously inferior, why are gatekeeping, ridicule, and declarations of illegitimacy needed when fair comparison should be sufficient to expose their weakness?
68. If automated cartography was sincerely desired, why is one of the most powerful forms yet developed treated less as fulfillment than as trespass?
69. If ethical risk grows as mapmaking becomes accessible, why is the solution exclusion rather than widespread education in provenance, uncertainty, privacy, rhetoric, and verification?
70. If academic and professional institutions refuse to guide this transition constructively, by what authority will they later condemn the standards, platforms, and practices that emerge without them?

VIII. No False Peace - Questions 71-74

The final questions reject a comforting compromise: the belief that natural-language GIS can be added to existing software as one more cheerful toolbar while everything important remains unchanged.

Large language models represent more than a product category. They make ordinary language increasingly capable of directing computational work. They bring ordinary language closer to becoming a seamless interface between human intention and computational action. This transition rests on decades of natural-language processing and human-computer interface research, accelerated dramatically by transformer architectures (Joshi 1991; Van Dam 1997; Vaswani et al. 2017). Current geospatial research makes the direction increasingly difficult to dismiss. GeoNLU seeks natural-language interaction with spatial-data infrastructures (Naveen, Maheswar, and Trojovský 2024; Jiang and Yang 2024; Mansourian and Oucheikh 2024).

There should therefore be no false compromise in our discipline's answers based on compulsory mediation. Human experts remain needed - as teachers, historians, critics, directors, auditors, researchers, and architects of trustworthy geographic knowledge. Natural language can relocate rather than abolish cartographic judgment: people frame intent, define constraints, retrieve knowledge, critique outputs, and remain accountable for what maps communicate (Muehlenhaus 2026). What experts may no longer be is mandatory at every point of execution.

This is not a prediction that all traditional GIS will vanish or that every map will be generated through conversation. Interfaces accumulate rather than march neatly into extinction. But once people learn how to describe meaningful geographic goals in ordinary, everyday language and receive usable, inspectable workflows and maps in return, our profession and discipline cannot restore the old barriers through ridicule. We can help build open standards, improve literacy, preserve cartographic knowledge, and govern the transition. The alternative is to continue defining cartography against the growing number of people now able to practice and redefine it through action.

The final questions that *must* be answered:

71. Can the discipline preserve its present hierarchies merely by adding LLMs to existing software while refusing the deeper consequence that natural language may become the primary interface to geographic work?
72. Will cartographers describe the coming transition as a temporary fad until the moment its workflows become ordinary, its old barriers appear absurd, and the opportunity to shape it has passed?
73. May experts continue to contribute, teach, criticize, design, and lead - while relinquishing the assumption that others must first receive their permission to make maps?
74. If defending the public's right to investigate, analyze, and represent geography through natural language is called heresy, should we not ask whether the alleged heresy is against cartography itself, or only against the guild that temporarily claimed authority over it?

AUTHOR'S POSITION

The remaining choice is not between cartography and natural-language mapping. It is between a cartography that helps direct the transition and a guild that mistakes resistance to the transition for defense of the discipline.

Closing Declaration

Some readers will call these questions naïve. Others will call them inflammatory, technologically deterministic, anti-professional, or heretical. Such judgments are welcome if they are accompanied by arguments and evidence.

Heresy against cartography would mean abandoning geographic thought, visual clarity, ethical considerations, uncertainty, provenance, accessibility, and care for the people represented on maps. Nothing here asks for that abandonment.

Quite the opposite: these questions ask whether those principles can finally be separated from the expensive, exclusionary, and historically temporary mechanisms through which a professional class has often controlled their application.

I love cartography too much to confuse it with a software license, a credential, a publication record, a conference hierarchy, a set of memorized commands, or an organization's claim to compulsory mediation. Human experts will remain valuable. They may become exceptional directors, teachers, critics, auditors, knowledge architects, and stewards of public geographic reasoning. What they may no longer remain is mandatory.

Change is often difficult, but it rarely represents an end. I view the rise of NLGIS and prompt cartography as a fresh beginning. Cartographic and GIS expertise may command less market value, but experts can still carry it forward; it retains personal and communal value. It will indubitably prove useful when building new forms of expertise, knowledge, and AI technologies that advance mapmaking.

Prompt cartography is not the end of cartography. NLGIS is not the end of geographical information science. They merely present us with the reality that cartography's language, methods, and accumulated wisdom are now usable by far more people. This development does not abolish expertise - it makes portions of that expertise available to a much wider public. It challenges traditional, human-only expertise to justify itself through contribution rather than scarcity, judgment rather than initiation, and public service rather than control.

If that is heresy, I am prepared to be called a heretic. I am never going back to 2023.

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