International Cartographic Association
Association Cartographique Internationale

Visualizing States Across Reference Cartographic Designs

Zhaoxu Sui [a]

[a] *GeoGraphics Lab, Department of Geography, The Pennsylvania State University, zxs5236@psu.edu*

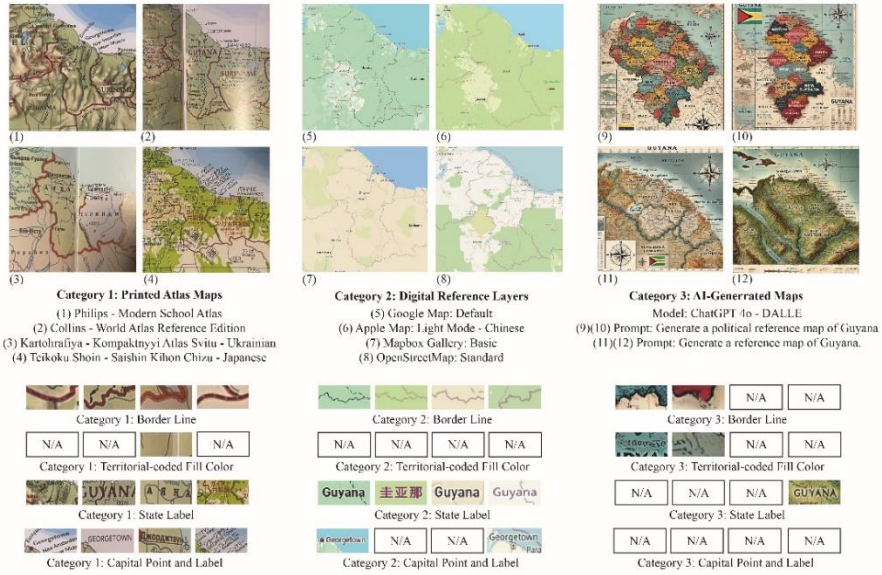
Keywords: state, territorialities, cartographic design, borders, toponyms, digital maps

Abstract:

Cartographers often use state borders, territorial-coded fill colors, toponyms (place names), and capitals to describe the political states (countries) on maps. Those representations, practiced and disseminated by European cartographers for centuries (Biggs, 1999), have become dominant ways for map users to perceive states. However, as critical cartographers have pointed out, these cartographic representations are manifestations of state political power, often reflecting static, structuralized, and homogeneized spatiality (Massey, 2005). In response, researchers have attempted to challenge state-specific aspects through experiments with feminist, indigenous, situationist, and queer approaches to cartography. In these literatures, representations of state and territorial presence intersect with topics such as mobility, sentiment, erasure, imagination, racialization, and coloniality. While these alternative lenses on cartographic power and representation portray a multifaceted cartography as a process fulfilling state narratives, less attention has been given to situating these critical narratives against specific visual cartographic design in reference maps.

Furthermore, in recent decades, we have witnessed the proliferation of digital maps across the web and via portable digital devices. In these contexts, maps are usually regarded as highly expressive tools that can provide multi-scalar representations, dynamic animations, and participatory engagement. Cartographers have also focused on the ability for digital reference layers to advance user-centered designs, increase visual interactions between maps and map-users, and to propel viral dissemination across social platforms (Roth, 2013; Robinson, 2019). Despite the optimistic potential of digital map layers to emphasize dynamic and pluralistic notion of space, homogenous cartographic design featuring traditional state borders, territorial-coded fill colors, toponyms, and capitals persists. While reference map designs could be well optimized and justified for their utilities in major contexts, it remains a challenge to evolve reference map design principles with regards to their representations of states and non-state political and territorial relationships.

In this study, I collected and categorized 150 maps obtained from 1) printed atlases, 2) digital reference layers, and 3) AI-generated images, with n=50 for each group. These maps focus on Guyana, a state characterized by complex integrated political and territorial relationships among surrounding states, indigenous territories, natural reserves, and disputed territories. By quantitatively analyzing map elements and visual variables applied to 1) border lines, 2) territorial-coded fill-colors, 3) state labels, 4) capital points and labels, and 5) disputed territory representations, this study aims to synthesize the variations in general design patterns employed in cartographic representations of this political region (Figure 1).



Abstracts of the International Cartographic Association, 10, 277, 2025
32nd International Cartographic Conference (ICC 2025), 17–22 August 2025, Vancouver, Canada.
https://doi.org/10.5194/ica-abs-10-277-2025 © Author(s) 2025. CC BY 4.0 License.

Figure 1. Sampled workflow of Maps and Layers Covering the Researched Area, categorized through printed atlases, digital reference layers, and AI-generated images. Some state-specific cartographic elements, including border lines, territorial-coded fill colors, state labels, and capitals are extracted for further visual-variable-based analysis.

Group	Border lines	Border lines on disputed territory	Territorial fill color	Fill colors on disputed territory	Label	Label on disputed territory	Capital Point	Capital Label
Atlas Maps	50	11	12	0	50	6	34	38
Online Reference Layers	40	19.5	1	0	21.5	0	12.5	4
AI Images	42	0	36	0	49	0	11	19

Table 1. Preliminary analysis result with numbers of map images showing state-specific cartographic elements, categorized across three groups with equal sample size. Value of 0.5 is given to online reference layers showing up a specific cartographic element only under certain zoom levels.

Table 1 shows my preliminary analysis result. My analysis indicates that the use of state-specific map elements has declined in digital reference layers, along with a reduction in the complexity of visual variables. For example, under similar scales, digital layers tend to depict state borders using simpler, thinner, solid stroke, compared to printed atlases. Furthermore, digital reference layers rarely use color-coded polygons to emphasize state sovereignty, a practice still observed in various printed atlases. Additionally, certain digital reference layers lack distinct designs to signal capital cities. AI-generated maps, on the other hand, commonly practice border lines, color-coded polygons, and country labels. However, AI images across my sample do not signal disputed territories at all. Also, cartographic designs generated by AI are highly dependent on the input prompts.

The result of this work is expected to be used in perception-related research and user-centric research. By documenting how map users perceive state-specific cartographic elements, such as the designs of border lines and state labels, we will be able to conceptualize how these design choices shape users' perceptions of spatial relationships with states. As digital and AI-generated maps increasingly reach diverse groups of people with different ontological and epistemological understandings of space, a careful evaluation on the influence of statecraft on map design decisions can help us reveal which design choices are most common across prevalent platforms and formats. These findings provide opportunities to conduct more novel approaches to critical geopolitics on reflecting geopolitical narratives (Moore, 2014). Within the field of cartography, such knowledge can also provide valuable insights into alternative representations on decentralizing, individualizing, and pluralizing representations in the next generation of reference maps.

References

Biggs, M. (1999). Putting the State on the Map: Cartography, Territory, and European State Formation. *Comparative Studies in Society and History*, *41*(02). https://doi.org/10.1017/S0010417599002121

Massey, D. B. (2005). *For Space* (1st edition). SAGE Publications Ltd.

Moore, A. W., & Perdue, N. A. (2014). Imagining a critical geopolitical cartography. *Geography Compass*, 8(12), 892-901.

Robinson, A. C. (2019). Elements of viral cartography. *Cartography and Geographic Information Science*, *46*(4), 293–310. https://doi.org/10.1080/15230406.2018.1484304

Roth, R. E. (2013). Interactive maps: What we know and what we need to know. *Journal of Spatial Information Science*, *6*, 59–115.

https://doi.org/10.5194/ica-abs-10-277-2025 © Author(s) 2025. CC BY 4.0 License.