Cartography M.Sc.

Master thesis

Cartography: A Theory through the Reconciliation of its Epistemic Conflicts

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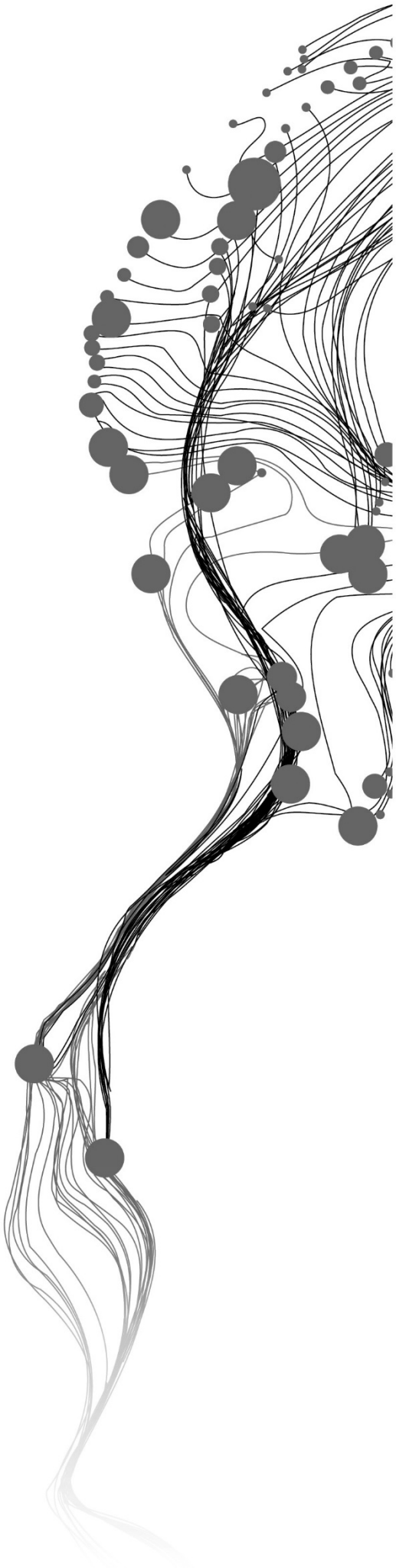

Cartography: A Theory through the Reconciliation of its Epistemic Conflicts

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Enschede, The Netherlands, September, 2023

Thesis submitted to the Faculty of Geo-Information Science and Earth Observation of the University of Twente in partial fulfilment of the requirements for the joint Master of Science in Cartography

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Glossary

Ontology - A study concerning the reality of an object, its truth and how it naturally comes into being

Epistemology - A study concerning the knowledge of an object, its experience and how we come to know about it

Epistemic Conflict - A conflict about which epistemology must be accepted as a true knowledge of the object

Epistemic Fallacy - Confusing epistemology with ontology

Jurist - An interpreter of principles and laws who can pass judgements upon a conflict of interest

Incommensurability - Inability to be judge things by the same principle since they are fundamentally different

Confounding Vocabulary - Terminologies that become confusing due to changing interpretations or context

Reconciliation - Restoring fraternity among conflicting entities by bringing them into an agreement

Empirical Science - A scientific method which relies on observing the experience of an object

Induction Method - Empirical methods which identify patterns in observed data structure to draw conclusions

Hypothetico-Deductive Method - Empirical methods which relies on validating hypothesis by deductive reasoning

Processual Science - A study of events surrounding the creation, circulation and worldly effects of an object

(+) Positivism - Use of induction/hypothetico-deductive methods with emphasis on objective empirical observation

(–) Deconstructivism - A critique of positivism which states that empirical observations are inherent with bias

(∞) Hermeneutics - Interpretation of empirical observations

Anthropocentricism - Prioritizing human interests during scientific, philosophical or ethical considerations

Collective Subconscious - Unconscious memories of universal nature which are inherited among human beings

Sentient Being - A living entity capable of consciousness and empirical sensemaking

(Cp) Prosopopoeia - A human being who becomes proxy for a non-human entity (e.g., A Human as Map)

(Cc) Chremamorphism - Imbuing a human being with qualities of a non-human entity (e.g., A Human Map)

(Ca) Anthropomorphism - Imbuing a non-human entity with qualities of a human being (e.g., A speaking Map)

Artificial Intelligence - Programs that mimic human like intelligence with learning & problem-solving capabilities

Introduction

This thesis looks closely at the human activity of writing literature of cartography. It identifies complexities surrounding the conception of maps and agenda for cartography which renders its scientific community in a state of epistemic conflicts[1]. This conflict irreconcilably splits the cartography community into three epistemic counterparts i.e., Positivism, Deconstructivism & Hermeneutics[2]. The authors who theorize and promote the epistemologies will be referred as 'identities' of cartography. While the (+) Positivists appear to have a dominant hold over the epistemic space[3], the (−) Deconstructivists and (∞) Hermeneuticians struggle to recapture it. Whereas (+) and (−) identities try to secure map conceptions and ethics of cartographic representation amidst dilemmas of objectivity[4] and subjectivity[5], ∞ identities tend to escape the tension[6] by declaring that maps have no secure conceptions and contend that cartography is best seen as a processual science[7] to study events surrounding the creation, circulation and worldly effects of mapping. This sets a novel premise to rethink the cartographer as a jurist[8] who maps and reconciles[9] the epistemic conflicts within cartography. Finally, the thesis will reveal an epistemic fallacy[10] of cartography wherein map epistemology is misunderstood as map ontology[11] due to the anthropocentric bias of empiricism[12]. It will be shown how this fallacy releases the epistemic space for marginalized identities and another hidden identity which arrives from a non-human position. To conclude, a theory of cartography will be presented which reconciles the knowledge of maps produced by its human and non-human identities. The value of Reconciliation theory will be discussed through a map project which involves legal advocacy.

Key Words: Epistemology, Map Conception, Conflict, Reconciliation, AI

[1] Verena Wagner, "Epistemic Dilemma and Epistemic Conflict," in *Epistemic Dilemmas*, by Kevin McCain, Scott Stapleford, and Matthias Steup, 1st ed. (New York: Routledge, 2021), 58–76, https://doi.org/10.4324/9781003134565-6.
[2] Pablo Iván Azócar Fernández and Manfred Ferdinand Buchroithner, *Paradigms in Cartography: An Epistemological Review of the 20th and 21st Centuries* (Springer Berlin HeidelbergSpringer, 2014), 104.
[3] Umesh Bagade, "Ambedkar's Historical Method: A Non-Brahmanic Critique of Positivist History" (The 9th Dr. Ambedkar Memorial Lecture, New Delhi: School of Social Sciences, Jawaharlal Nehru University, 2012), 2.
[4] A.H Robinson et al., *Elements of Cartography (Sixth Edition)* (New York: Wiley, 1995).
[5] John Brian Harley, "Deconstructing the Map," *Cartographica* 26, no. 2 (Spring 1989): 1–20.
[6] Denis Wood et al., "Critical Cartography," in *International Encyclopedia of Human Geography* (Elsevier, 2020), 28, https://doi.org/10.1016/B978-0-08-102295-5.10529-3.
[7] Rob Kitchin and Martin Dodge, "Rethinking Maps," *Progress in Human Geography* 31, no. 3 (2007): 331–44.
[8] Bagade, "Ambedkar's Historical Method: A Non-Brahmanic Critique of Positivist History," 10.
[9] Wood et al., "Critical Cartography," 28.
[10] Roy Bhaskar, *A Realist Theory of Science*, Classical Texts in Critical Realism (London ; New York: Routledge, 2008), 242.
[11] Rob Kitchin, "The Practices of Mapping," *Cartographica: The International Journal for Geographic Information and Geovisualization* 43, no. 3 (September 2008): 211–15, https://doi.org/10.3138/carto.43.3.211.
[12] Bhaskar, *A Realist Theory of Science*, 24.

Summary of Chapters

1. **Reconciling Epistemologies of Cartography**

The first chapter maps human activity of writing literature of cartography. The literature surrounding questions of map conceptions will be considered as a measure which can be mapped to explore the epistemic space[13] of cartography. The character of this space will be judged[14] in context of epistemic conflicts[15] which shape the space due to irreconcilable map conceptions of (+ – ∞) identities. Such a judgement[16] is passed to reconcile[17] the conflicting epistemologies and restore them into a new theory which appears paradoxical only due to a misconceived incommensurability[18] of (+ – ∞) arguments.

2. **Modelling the Reconciliation Theory**

The second chapter explores a cartographic modelling of texts. The Reconciliation Theory will be visualized as a map. By working within the space model of its text, it will be shown how conflicting epistemologies of cartography appear as a paradoxical whole.

3. **Upgrading the Reconciliation Theory**

The third chapter looks closely at the anthropocentric bias[19] of empirical sciences. An epistemic fallacy[20] within cartography will be checked wherein contesting epistemologies, whether dominant, conflicted or reconciled, get misunderstood as ontology (for e.g., confusing the knowledge of maps as the reality of maps). Since the course of scientific progress is constantly changing and unpredictable, the conceptual exploration[21] of cartography must proceed without generalizing the knowledge of cartography as the reality of cartography. Owing to this fallacy, the epistemic space of cartography occupied by (+ – ∞) identities must include hidden identities to platform previously ignored knowledge of maps to continue unraveling the reality of maps through a multiplicity of methods[22]. Two such marginal identities will be introduced: (1) The Human Map [Chremamorphism in Cartography] and (2) The Human as Map [Prosopopoeia in Cartography]. Another hidden identity which arrives from a non-human position will be introduced: (3) The speaking Map [Anthropomorphism in Cartography]. To conclude, the Reconciliation Theory will be updated to include epistemologies of human identities and non-human identities within cartography.

4. **Reconciliation Theory in Practice**

The fourth chapter shows the application of the Reconciliation Theory in diverse fields in a case involving legal advocacy of communities affected by monoculture agrobusinesses in Paraguay

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[13] Bagade, "Ambedkar's Historical Method: A Non-Brahmanic Critique of Positivist History," 2.
[14] Bagade, 10.
[15] Wagner, "Epistemic Dilemma and Epistemic Conflict," 13.
[16] Commonly known as "Internal Critique" in famous cartography texts Azócar Fernández and Buchroithner, *Paradigms in Cartography: An Epistemological Review of the 20th and 21st Centuries*, 70.
[17] Wood et al., "Critical Cartography," 28.
[18] Azócar Fernández and Buchroithner, *Paradigms in Cartography: An Epistemological Review of the 20th and 21st Centuries*, 36.
[19] Bhaskar, *A Realist Theory of Science*, 35.
[20] Bhaskar, 242.
[21] Harley, "Deconstructing the Map," 1.
[22] Thomas Crowley, "A Great, Restless Stream," *Comparative Studies of South Asia, Africa and the Middle East* 43, no. 1 (May 1, 2023): 123, https://doi.org/10.1215/1089201X-10375409.

Future Scope and Limitations

This chapter discusses the future scope of this thesis such pertaining to different uses of the Reconciliation Theory. It also highlights limitations of the thesis in terms of literature review.

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Chapter 1: Reconciling Epistemologies of Cartography

Today it has been 100 years since Max Eckert published 'Die Kartenwissenschaft' (1923), a positivist dictum of cartography as an empirical science of spatial representation[23] which established the map as an objective model of reality[24]; and 30 years since John Brian Harley published 'Deconstructing the Map' (1989) to analyze cartography as a science of persuasive communication which reveals the inherent rhetorical nature of maps as subjective models of reality[25]. In the 60 years that separate Eckert and Harley, a rise of discourses on maps can be seen to coincide with rise of discourses on reality. Tools in computational linguistics like the N-Gram help to make such observations about keywords used in the literature of cartography. Such keywords point to the fact that literary arguments surrounding questions of 'What is a map?', 'How does a map work?' and 'How do Maps come into being?' are of paramount interest for testing the epistemology of cartography. Therefore, if the literature of cartography is considered as a measure, its epistemic space can be mapped for profound exploration.

Measuring the epistemic space of cartography is a challenging task owing to contrasting assumptions, contradictory map conceptions and confounding vocabulary of its literature that is spread across the 100 years timespan mentioned earlier. Intuitively, owing to contradictory map conceptions one can imagine an epistemic conflict which irreconcilably splits cartography into its + Positivist, – Deconstructivist and ∞ Hermeneutic counterparts. This resulted in the Arno Peters & Arthur Robinson intellectual conflict about the objectivity and subjectivity of world map projections which stood out as a defining moment in the cartographic imagination[26], inviting us to review epistemic differences in the practice of cartographers. The authors who theorize and promote their epistemologies will be referred as 'identities' of cartography. The school of such authors will be referred as 'enterprises' of cartography. While the + Positivists appear to have a dominant hold over the epistemic space, the – Deconstructivists and ∞ Hermeneuticians struggle to recapture it.

The + Positivist enterprises have advanced mapping technology by developing hi-rate dynamic visualizations to explore, manage, analyze and communicate spatial data[27] for Geographical Information Systems (GIS), Global Positioning Systems (GPS), Location Based Services (LBS) and Remote Sensing (RS). These developments have been formally institutionalized, corporatized or militarized for communicating, navigating, predicting, planning and managing spatial phenomena. The democratized production and access of spatial data[28] has created new technologies for crowd sourcing, quick dissemination, improved sharing, wide compatibility and high-volume consumption of geo-information across the cyberspace[29]. The incorporation of user feedback and

[23] Gyula Pápay, "Max Eckert Und Sein Hauptwerk „Die Kartenwissenschaft"," *KN - Journal of Cartography and Geographic Information* 67, no. 3 (May 2017): 26, https://doi.org/10.1007/BF03545404.
[24] Robinson et al., *Elements of Cartography (Sixth Edition)*.
[25] Harley, "Deconstructing the Map," 10.
[26] Crampton, "Cartography's Defining Moment: The Peters Projection Controversy, 1974– 1990."
[27] Menno-Jan Kraak and Ferjan Ormeling, *Cartography: Visualization of Geospatial Data*, 4th ed. (Fourth edition | Boca Raton ; London : CRC Press, 2020.: CRC Press, 2020), https://doi.org/10.1201/9780429464195.
[28] T. A. Nelson, M. F. Goodchild, and D. J. Wright, "Accelerating Ethics, Empathy, and Equity in Geographic Information Science," *Proceedings of the National Academy of Sciences* 119, no. 19 (May 10, 2022): e2119967119, https://doi.org/10.1073/pnas.2119967119.
[29] Martin Dodge and Rob Kitchin, *Mapping Cyberspace*, Repr (London: Routledge, 2001).

participation[30] in the + Positivist pipeline has helped to create transparency, advanced ethics and increased trust[31] in map information and mapping services. However, the – Deconstructivist enterprises have maintained a steady skepticism over the + Positivist map conceptions which generalize space as a cost field[32] to enable an empirical measurement of reality through a set of limited variables[33]. A further generalization takes place through cartographic processes[34] which involve the selection, omission, simplification, symbolization of spatial information and its classification across various thematic layers or hierarchies based on the selected scale[35] of reality. This creates a paradox[36] wherein a useful, truthful and accurate map cannot be created without distorting geometries, simplifying features and suppressing other variables of reality (e.g., gender, race, class, among many other social or physical variables). Maps appear to truthfully represent reality through a set of selected variables while knowingly or unknowingly omitting other variables which might underpin equal value to its stated purpose. A general + Positivist response to this critique can be summarized as following: Any principle (of objective representation) provides a norm against which an empirical claim (a map) can be judged for its utility in simplifying the complexity of reality[37]; that this principle is valid because it makes reality comprehensible and measurable by drawing simple models[38] which explains its nature. This principal underscores the entire development of the + Positivist enterprise as well as the discussion around ethics[39] in cartography where maps are judged for their degree of objectivity. The conception of a map as an objective representation is not an underpin but rather the linchpin of the positivist enterprise. However, the – Deconstructivists show that the so-called objective map is never free from the subjective bias of data manufactures, cartographers, their service providers and publishers[40] no matter what their intentions are. To convince a consumer that the given limited view of reality is an objective truth is not a failure of ethics but very science of cartography which allow maps to go beyond their stated purpose[41]. While maps appear to be neutral, they are inherently rhetorical[42] and new meanings[43] get attached to them through user interpretation. Therefore, through subsequent + Positivist advancements and – Deconstructivist critiques of cartography, maps become objects of political interest to lay claim and dominion over a territory[44] in an increasingly unimaginable mapless society[45]. Maps gain a high degree trustworthiness within the collective consciousness[46] making it difficult to disobey its

[30] Nelson, Goodchild, and Wright, "Accelerating Ethics, Empathy, and Equity in Geographic Information Science," 9.
[31] Nelson, Goodchild, and Wright, "Accelerating Ethics, Empathy, and Equity in Geographic Information Science."
[32] Harvey J. Miller, "Tobler's First Law and Spatial Analysis," *Annals of the Association of American Geographers* 94, no. 2 (June 2004): 286, https://doi.org/10.1111/j.1467-8306.2004.09402005.x.
[33] W. R. Tobler, "A Computer Movie Simulating Urban Growth in the Detroit Region," *Economic Geography* 46 (June 1970): 234, https://doi.org/10.2307/143141.
[34] Harley, "Deconstructing the Map," 10.
[35] Matthew H Edney, *Cartography: The Ideal and Its History* (Chicago and London: The University of Chicago Pres, 2019).
[36] Mark Monmonier, *How to Lie with Maps* (Chicago: University of Chicago Press, 1991), 1.
[37] Michael F. Goodchild, "The Validity and Usefulness of Laws in Geographic Information Science and Geography," *Annals of the Association of American Geographers* 94, no. 2 (June 2004): 303, https://doi.org/10.1111/j.1467-8306.2004.09402008.x.
[38] Tobler, "A Computer Movie Simulating Urban Growth in the Detroit Region," 234.
[39] Nelson, Goodchild, and Wright, "Accelerating Ethics, Empathy, and Equity in Geographic Information Science," 4.
[40] Denis Wood, John Fels, and John Krygier, *Rethinking the Power of Maps* (New York: Guilford Press, 2010).
[41] Harley, "Deconstructing the Map," 7.
[42] Harley, 10.
[43] Emanuela Casti, "Towards a Theory of Interpretation: Cartographic Semiosis," *Cartographica: The International Journal for Geographic Information and Geovisualization* 40, no. 3 (September 2005): 7, https://doi.org/10.3138/M4M1-R663-32V2-W151.
[44] Denis Cosgrove, "Contested Global Visions: *One-World, Whole-Earth* , and the Apollo Space Photographs," *Annals of the Association of American Geographers* 84, no. 2 (June 1994): 281, https://doi.org/10.1111/j.1467-8306.1994.tb01738.x.
[45] Harley, "Deconstructing the Map," 11.
[46] Susan F. Greenwood, "Émile Durkheim and C. G. Jung: Structuring a Transpersonal Sociology of Religion," *Journal for the Scientific Study of Religion* 29, no. 4 (1990): 482–95, https://doi.org/10.2307/1387313.

authority as an objective representation of space. Such is the epistemic conflict within the + and – enterprises of cartography emerging from their contradictory map conceptions. While the + identities build their epistemology upon a conception of maps as objective representations, the – identities do its exact opposite.

Whereas + and – identities labor to secure map conceptions, defend their practice and ethics of cartographic representation amidst dilemmas of objectivity and subjectivity, certain ∞ Hermeneutic identities tend to escape the tension[47] by declaring that maps have no secure conceptions and contend that cartography is best seen as a processual science[48] to study events surrounding the creation, circulation, interpretation, use and impacts of mapping. These ∞ Hermeneutic identities claim that a profitable epistemology[49] of cartography can be achieved without predetermining or assigning any universal purpose[50] to a map. They prescribe to abolish a vocabulary of maps[51] and persuade the community to base their technological or sociological interests to study how maps are contingent[52] and their conceptions are relative to contextual problems. They motivate a shift from the question of 'What is a Map?' is to the question of 'When does a Map emerge?' by using methods in genealogy, ethnography, participant observation, observant participation and deconstruction[53]. While this particular presentation of the ∞ argument appears critical, it also falls in line with a moral + tendency to embrace neutrality[54] over map conceptions. It preserves the aforementioned tension between + / – enterprises and creates a new enterprise which speculates a profit in its reluctancy to pass judgment upon contradictory map conceptions. However, there is another brand of ∞ identities who furnish critical arguments which gains them a significant position in the epistemic conflict. They provide a unique conception which states that maps are building blocks that produce reality[55]. Rather than merely representing reality, a map produces a mental conception of reality in co-operation with a host of other bounding practices[56] which physically or mentally produce the same reality. While a map is not the territory[57], it certainly is an intervention between a people and their territories[58]. Concerning the claim and dominion of territories, they replace[59] spatial conceptions of territories while themselves being produced through territories[60]. In this manner, a relational pattern concerning the emergence, circulation, interpretation, use and impact of map can be observed by the ∞ epistemology of cartography. It provides a framework upon which value judgments concerning the objectivity or subjectivity of maps can be passed to validate their empirical claims.

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[47] Wood et al., "Critical Cartography," 28.
[48] Kitchin and Dodge, "Rethinking Maps."
[49] Kitchin and Dodge, 331.
[50] Also know as telelogy of maps. Kitchin and Dodge, 333.
[51] Edney, *Cartography: The Ideal and Its History*, 236.
[52] Kitchin and Dodge, "Rethinking Maps," 343.
[53] Rob Kitchin, Justin Gleeson, and Martin Dodge, "Unfolding Mapping Practices: A New Epistemology for Cartography: *Unfolding Mapping Practices*," *Transactions of the Institute of British Geographers* 38, no. 3 (July 2013): 15, https://doi.org/10.1111/j.1475-5661.2012.00540.x.
[54] Ranke's positivism showed a reluctance to pass judgments in conformity with either rational or moral standards. Neutrality was accorded to the high office of historian. Bagade, "Ambedkar's Historical Method: A Non-Brahmanic Critique of Positivist History," 10.
[55] Denis Wood and J Fels, *The Natures of Maps: Cartographic Constructions of the Natural World* (Chicago: University of Chicago Press, 2008).
[56] James Corner, "The Agency of Mapping: Speculation, Critique and Invention," in *The Map Reader*, ed. Martin Dodge, Rob Kitchin, and Chris Perkins, 1st ed. (Wiley, 2011), 93, https://doi.org/10.1002/9780470979587.ch12.
[57] Alfred Korzybski, *Science and Sanity: An Introduction toNon-Aristotelian Systems and General Semantics* (Lakeville: CT:International Non-Aristotelian Library Publishing Co, 1933).
[58] Casti, "Towards a Theory of Interpretation," 4.
[59] Casti, 11.
[60] Augustin Berque, "Die Transgression der Karten," n.d., https://doi.org/10.1515/transcript.9783839417959.241.

Thus, it can be observed that the three epistemologies while appearing mutually exclusive also show some degree of overlap. Instead of securing a common ground, an unsparing condemnation[61] of + by – and ∞ identities has led to an accepted incommensurability[62] of all involved epistemologies and their research agendas. This acceptance has also altered the common meaning of keywords (mentioned earlier). Although the same or common keywords are used within the three epistemologies, they no longer possess a direct logical correspondence to their general meaning[63]. This confounds the vocabulary of cartography and renders its epistemic space with further complexities. This sets a novel premise to rethink the cartographer as a jurist[64] who maps and navigates the complexity of the epistemic space to reconcile[65] the epistemic conflicts within cartography. The method by which this epistemic conflict was mapped to navigate its complexity is illustrated in the following sub-chapter.

1.1 Mapping the Epistemic Space of Cartography

This sub-chapter illustrates the steps with which the epistemic conflict of cartography was mapped. The first step was to prepare a bibliography to map the epistemic space of literature in cartography. The sources for this bibliography were furnished from the literature of J.B. Harley (2002), Matthew Edney (2019), Waldo Tobler (2004), Azócar Fernández and Manfred Buchroithner (2012). The bibliography focusses on maps and other keywords mentioned in the glossary of this thesis. Their changing meaning and theories were observed between 1923 and 2023, a hundred-year timeline since Max Eckert published ‘Die Kartenwissenschaft’.

Figure 1: Highlighting quotes from various literatures of cartography

[61] Bagade, “Ambedkar’s Historical Method: A Non-Brahmanic Critique of Positivist History,” 6.
[62] Azócar Fernández and Buchroithner, *Paradigms in Cartography: An Epistemological Review of the 20th and 21st Centuries*, 127.
[63] Azócar Fernández and Buchroithner, 36.
[64] Bagade, “Ambedkar’s Historical Method: A Non-Brahmanic Critique of Positivist History,” 10.
[65] Wood et al., “Critical Cartography,” 28.

The categories of dates, events, special objects, key figures, important quotes, arguments, corresponding authors, cited authors, contradictory map conceptions, empirical assumptions, epistemic differences and different research agendas for cartography were sensed and highlighted with color codes to classify them according to + – ∞ characters for easier comparative study. The comparative observations of the source text were further annotated and simplified into smaller texts. This process is akin to the cartographic processes of generalization which involves selection, omission, simplification and symbolization of (literary) information for better comprehension of its complexity.

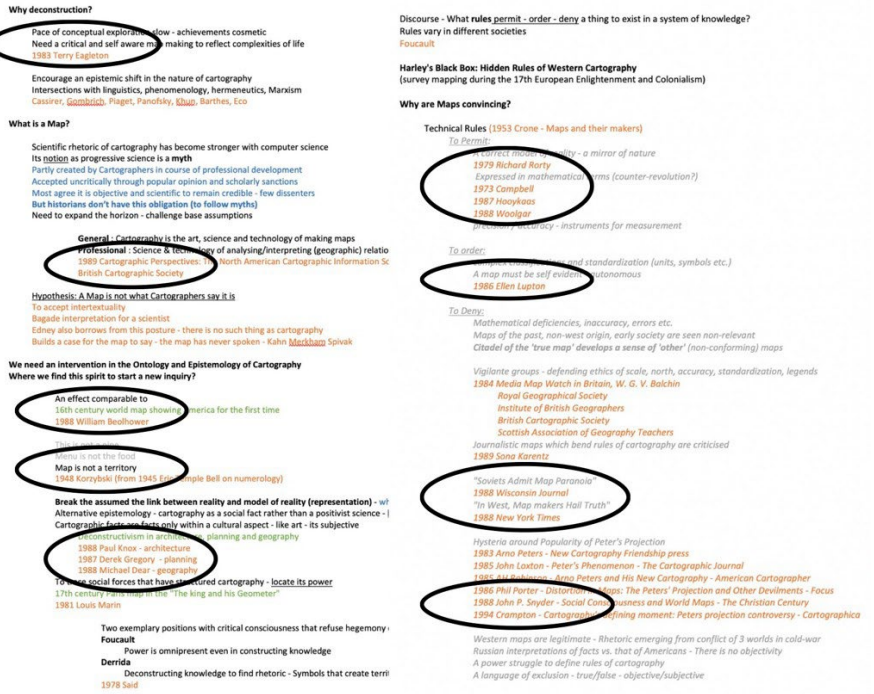

Figure 2: Ordering arguments from various texts

Upon a close and against the grain reading of the involved texts, it was observed that there are many conceptual overlaps between the three epistemologies despite their accepted incommensurability (as discussed earlier). It is safe to say that larger epistemological argument of an enterprise is built up piece by piece through several smaller arguments that are cited or cross-referenced from other authors. Such arguments are the building blocks of an epistemology. These arguments primarily concern map conception, map authority, author interpretation, empirical objectivity, research focus, technological contributions, political analysis, ethical concerns, social concerns, statical assessments, user participation, map communication, scale of validity and cartography conception. While some arguments from one epistemology are critical of the other, they also appear to be similar, overlapping, highly correlated or complementary to other arguments of that epistemology. It is also observed that certain arguments have potential to fill blind spots and support the advancements of arguments from other enterprises. Various arguments, if seen without the labels of their identities, appear to make conceptual full circles when they are narrated with a rhetorical force that seeks to restore connections and build overlaps across the incommensurable enterprises of cartography. Thus, by going beyond the fixing of an author's enterprise identity and their explicit naming as + Positivist, – Deconstructivist or ∞ Hermeneutic; a new subjective position with a reconciliatory attitude could be synthesized which an objective identity of cartography as long as its interpretation of arguments holds true and valid for the progress of all contesting identities involved in the conflict. This sets up a novel premise to rethink the

cartographer as a jurist[66] who maps and reconciles the epistemic space to discovers overlaps and blind spots emerging due to un-regarded details, involuntary self-contradictions, constrain of meaning, false classification of arguments, turn of arguments, tensions between the rhetoric and logic of cartography literature. First, the conceptual map of the epistemic conflict will be presented in the following table:

Table 1: First draft of the Reconciliation Table

	Positivists	Hermeneuticians	Deconstructivists
Map Conception	Objective Representation ^	Co-producer	Subjective Representation
Map Authority	Traditionally Unquestionable ^	Context Dependant	Always Questionable
Author's Interpretation	Always Neutral ^	Variable	Always Biased
Empirical Objectivity	Possible ^	Might be possible depending on user, author and patron context	Impossible
Research Focus	Technological ^	Geneological ^	Ideological ^
Technological Contributions	High	Low ^	Low ^
Political Analysis	Low ^	Variable ^	High
Ethical Concern	Traditionally Limited ^	Integral but Contextual ^	Integral but limited ^
Social Considerations	Generalized ^	Highly Specific but selective ^	Highly Specific but selective ^
Statistical Assement	Quantitative Focus ^	Qualitative Focus ^	Qualitative Focus ^
User Participation	Traditionally Limited ^	Integral	Integral
Map Communication	Traditionally Unidirectional ^	Feedback Loop	Feedback Loop
Scale of Validity	Globally Applicable ^	Contextual	Locally Applicable ^
Cartography Conception	Representative and Analytical	Processual	Rhetorical

In this table, the theoretical blind spots (^) and overlaps (black lined box) between various arguments of the three conflicting epistemologies have been identified. The conflicting nature of each argument for all three epistemologies will be reconciled in the following sub chapter.

[66] Bagade, "Ambedkar's Historical Method: A Non-Brahmanic Critique of Positivist History," 10.

1.2 Reconciling the Epistemic Space of Cartography

This sub-chapter presents a review of the above table where conflicting and overlapping arguments are synthesized into a reconciled epistemology of cartography.

1.2.1 Map Conception

The + Positivists conceive maps as objective representations of reality and – Deconstructivists see them as the exact opposite. The ∞ Hermeneuticians conceive maps as co-producers of reality. All three conceptions are in conflict. The reconciled epistemology observes a blind spot in the Positivist argument that could be mitigated if it is synthesized with Hermeneutic-Deconstructivist map conception which is mutually exclusive yet complementary. It judges that a map is a subjective representation of reality 'appearing' to be objective while also being a co-producer of reality. The appearance of maps as objective representations brings us to the question of their authority.

Table 2: Map Conception Arguments

	Positivism	Hermeneutics	Deconstructivism	Proposed Reconciliation	
Map Conception	Objective Representation ^	Co Producer	Subjective Representation	Subjective representation which appears objective as it co produces reality	(+ ∞ –)

1.2.2 Map Authority

The + Positivists traditionally regard map authority to be unquestionable while the – Deconstructivists question it. The reconciled epistemology observes a blind spot in the + Positivist argument that could be mitigated if synthesized with the – Deconstructivists' skepticism. The reconciled approach judges that while maps are always open to questioning, their authority is difficult to dislodge due to their historical credibility. Here, the ∞ Hermeneutic argument is underpinned by the context of historical credibility which suggests that authoritative nature of maps comes partly due to its inherited impression of being trustworthy as well as being scientific or rhetoric. Maps are subconsciously regarded as trustworthy due to their inherited impressions of being as such. Thus, map authority brings us to the question of the integrity of its author.

Table 3: Map Authority Arguments

	Positivism	Hermeneutics	Deconstructivism	Proposed Reconciliation	
Map Authority	Traditionally Unquestionable ^	Context Dependant	Always Questionable	Questionable yet difficult to dislodge its authority due to subconscious impression of maps as being trustworthy	(+ ∞ –)

1.2.3 Cartographer's Authorship

The + Positivists argue that a cartographer's authorship is neutral if map making methods maintain ethical integrity. The ∞ Hermeneutic argument complements the + Positivist argument by asserting that authorship bias is highly variable due to the nature of its patronage, ideological frameworks, working conditions and data quality (among many other factors). This variability opens the possibility to secure neutral authorships if ideal conditions align. The same variability is compatible with the – Deconstructivist argument which asserts that a neutral authorship is paradoxical as any interpretation ultimately emerges out of subjective experiences regardless the apparent objectivity or ethical consideration of map production. The reconciled epistemology reveals this blind spot in the + Positivist

argument due to a lack of its critical engagement with concepts of subjectivity and neutrality. While it acknowledges that the ∞ Hermeneutic argument is insightful, it also finds it to be insufficient in a comprehensive evaluation of authorship integrity. The reconciled approach judges that the – Deconstructivist argument is more credible since it illuminates the inherent subjectivity of interpretation which makes the claim of neutral authorship untenable. However, a subjectivity might still appear objective owing to the historical authority of maps which raises a question about the claims of empirical objectivity.

Table 4: Authorship Arguments

	Positivism	Hermeneutics	Deconstructivism	Proposed Reconciliation	
Cartographer's Authorship	Always Neutral ^	Variable	Always Biased	Always Biased	(-)

1.2.4 Empirical Objectivity

The + Positivists believe that empirical objectivity of a cartographer is possible while the – Deconstructivists argue its exact opposite. On the contrary, the ∞ Hermeneutic argument is compatible with the + Positivist argument since they believe certain conditions might make empirical objectivity a real possibility. These conditions depend on user context, author's rhetoric or special patronage of the map and its author by social-political entities (e.g., Publishing houses, academic citations, corporate endorsements, military or state approvals). Here, objectivity is reframed as a 'historicized utility of ethical maps' in solving contextual problems for social progress[67]. This illuminates the core dictum of + Positivist Cartography: The principle of objective representation provides a norm against which an empirical claim (a map) can be judged for its utility in simplifying the complexity of reality[68]; that this principle is valid because it makes reality comprehensible and measurable by drawing simple models[69] which explains its nature. Thus, maps are regularly judged[70] for their degree of objectivity since they have a historical promise[71] of being useful for social progress. The ∞ Hermeneutic approach rightly argues that a cartographer's subjectivity can gain objectivity (universal subjectivity) if its utility is paramount and 'appears' real for the whole of humanity when it is unified into a 'singular historical mass'[72].This principle is the linchpin of Arno Peters' historical recommendations against the Mercator Map which resulted into a defining moment for Cartography[73] having profound implications upon its epistemology. The reconciled epistemology reveals blind spots in the + Positivist and – Deconstructivist arguments due to their strong judgements upon the validity of empirical objectivity. The reconciled approach judges the ∞ Hermeneutic argument to be more profound since it shows that empirical subjectivity 'may' gain objectivity depending on the context of the map, its author, patron and user. Yet, the apparent incommensurability of empirical objectivity and map conceptions among the + Positivist, – Deconstructivist and Hermeneutic ∞ identities

[67] Adapted from Ambedkar's concept of objectivity as historicized and humanized objectivity for the social good, utility and issues of social justice surrounding the limited access to historical accounts due to caste subjectivities. Bagade, 7.
[68] Goodchild, "The Validity and Usefulness of Laws in Geographic Information Science and Geography," 303.
[69] Tobler, "A Computer Movie Simulating Urban Growth in the Detroit Region," 234.
[70] About the persuasive nature of maps. Ian Muehlenhaus, "Going Viral: The Look of Online Persuasive Maps," *Cartographica: The International Journal for Geographic Information and Geovisualization* 49, no. 1 (March 2014): 18–34, https://doi.org/10.3138/carto.49.1.1830.
[71] Certain hermeneutic identities expressed caution in fixing such responsibilities upon maps to ensure that their utility is open for alternative interpretations and new discovery. Kitchin and Dodge, "Rethinking Maps," 334.
[72] Adapted from Gramsci's notion of objectivity as "humanly objective" and "historically subjective" which leads to the idea of "universally subjective" in so far the subjective interpretation is real of the whole of human race when it is historically unified in a singular unitary cultural system. Bagade, "Ambedkar's Historical Method: A Non-Brahmanic Critique of Positivist History," 7.
[73] Crampton, "Cartography's Defining Moment: The Peters Projection Controversy, 1974– 1990."

irreconcilably splits cartography into its three enterprises. Each enterprise focusses on separate research agendas that rarely overlap. Their complimentary potential is disregarded.

Table 5 Empirical Objectivity Arguments

	Positivism	Hermeneutics	Deconstructivism	Proposed Reconciliation	
Empirical Objectivity	Possible ^	Might be possible depending on context	Impossible	Might be possible depending on context	(∞)

1.2.5 Research Agenda

1.2.5.a Positivist Research

The + Positivists have prioritized technological research in cartography pertaining to its representative and analytical utility. Their conception of the map as an objective representation of reality generalizes space as a cost field[74] to enable an empirical measurement of reality through a set of limited variables[75]. They have formalized the systems of cartographic generalization, representation, communication and spatial analysis to developed further research in areas of mathematical modelling, machine learning, programming algorithms, semiotic-cognitive processes, map printing, image processing, hi-rate dynamic visualizations, 3D, VR and AR to explore, manage, analyze and communicate spatial data for Geographical Information Systems (GIS), Global Positioning Systems (GPS), Location Based Services (LBS) and Remote Sensing (RS)[76]. They have also developed new technologies for crowd sourcing, quick dissemination, improved sharing, wide compatibility and high-volume consumption of geo-information across the cyberspace[77] all the while trying to incorporate user feedback and participation[78] to bring transparency and improving trust in map information. This is perhaps (and partly) due the pressure of increased accountability and ethical considerations raised by the – Deconstructivist enterprise. Cyber[79], VGI[80], Citizen Science[81] and Viral Cartography[82] can be considered to be some of the researches in this particular this fold. In recent years, Machine[83] and Generative AI Cartography[84] is garnering significant discussion and support to leverage capabilities of artificial intelligence in map making. The + Positivist research agenda is highly technological and appears to be the Normative research agenda of cartography.

1.2.5.b Deconstructivist Research

[74] Miller, "Tobler's First Law and Spatial Analysis," 286.
[75] Tobler, "A Computer Movie Simulating Urban Growth in the Detroit Region," 234.
[76] Menno-Jan Kraak Ormeling Ferjan, *Cartography: Visualization of Geospatial Data, Fourth Edition*, 4th ed. (Boca Raton: CRC Press, 2020), https://doi.org/10.1201/9780429464195.
[77] Dodge and Kitchin, *Mapping Cyberspace*.
[78] Nelson, Goodchild, and Wright, "Accelerating Ethics, Empathy, and Equity in Geographic Information Science," 9.
[79] D.R. Fraser Taylor, "The Concept of Cybercartography," in *Maps and the Internet* (Elsevier, 2003), 405–20, https://doi.org/10.1016/B978-008044201-3/50028-1.
[80] Michael F. Goodchild, "Citizens as Sensors: The World of Volunteered Geography," *GeoJournal* 69, no. 4 (November 30, 2007): 211–21, https://doi.org/10.1007/s10708-007-9111-y.
[81] Ippokratis Kapenekakis and Konstantinos Chorianopoulos, "Citizen Science for Pedestrian Cartography: Collection and Moderation of Walkable Routes in Cities through Mobile Gamification," *Human-Centric Computing and Information Sciences* 7, no. 1 (December 2017): 10, https://doi.org/10.1186/s13673-017-0090-9.
[82] Anthony C. Robinson, "Elements of Viral Cartography," *Cartography and Geographic Information Science* 46, no. 4 (July 4, 2019): 293–310, https://doi.org/10.1080/15230406.2018.1484304.
[83] Gino Brunner et al., "Teaching a Machine to Read Maps with Deep Reinforcement Learning" (arXiv, November 20, 2017), http://arxiv.org/abs/1711.07479.
[84] Yuhao Kang, Qianheng Zhang, and Robert Roth, "The Ethics of AI-Generated Maps: A Study of DALLE 2 and Implications for Cartography" (arXiv, June 11, 2023), http://arxiv.org/abs/2304.10743.

On the contrary, the – Deconstructivists have prioritized ideological research in cartography pertaining to its rhetorical nature. Their conception of the map as a subjective representation allows them to interpret maps as texts instead of mathematical models (or mirrors) of reality. They apply deconstruction techniques and employ critical analysis of power structures in cartography by breaking the assumed link between reality and the model of reality which is taken for granted[85]. The problematization also extends to the ethics of mapping which has a tendency to reframe social characters through identifying, naming, categorizing, excluding, simplifying and ordering spatial information[86]. They analyze the rules of technical and social production of maps [87] to 'reveal' that the image of reality not represented, but rather constructed; that cartography becomes a science of generalizing reality to show a stable[88] version of it. The – Deconstructivists have often referred to this as the 'Internal Power' of cartography wherein it enables the appropriation of reality into a measurable spatial matrix to standardize images of the world into the collective consciousness[89]. This affirms the famous dictum that maps are not territories[90], but rather imposed or inherited images of territories. This unlocks another level of critique often referred as the 'External Power' of cartography where in a vested interest gets imposed on maps in an increasingly unimaginable mapless society[91]. The power of maps[92] also make them susceptible to many risks and liabilities of mapping. Various state, military, media and corporate entities may use maps or mapping services for information manipulation, censorship, unbridled surveillance, dominion control, forgery, secrecy and misleading public opinion. They also highlight limitations of objective empiricism with academia which opens rumination for excluded subjectivities to advance + Positivist sciences[93]. These ruminations are well documented in – Deconstructivist researches that are crucial to advance the ethics of cartography. Decolonial[94], Critical[95], Counter[96], Meme[97], Feminist[98], Queer[99], Anarchist[100], Marxist[101], Insurgent[102], Criminology[103] and Forensic Cartography[104] are some research areas withing the – Deconstructivist enterprise which explicitly conceive maps as subjective representations to question power relations and liberate mapping practice from objective empiricism. The – Deconstructivist research agenda highly ideological and is thus critical of the (+ Positivist) Normative research agenda. While the (+ Positivist) Normative and (– Deconstructivist) Critical researches agendas seem to be in conflict, arguments from the ∞ Hermeneutic enterprise could be leveraged to resolve their tensions by synthesizing an integrated research agenda.

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[85] Harley, "Deconstructing the Map," 3.
[86] Jeremy W. Crampton, *Mapping: A Critical Introduction to Cartography and GIS*, Blackwell Companions to the Ancient World (Malden, Mass: Wiley-Blackwell, 2010), 45.
[87] Harley, "Deconstructing the Map," 6.
[88] Jeremy W Crampton, "Maps as Social Constructions: Power, Communication and Visualization" Progress in Human Geography (2001): 235, https://doi.org/10.1191/030913201678580494.
[89] Adapted from Harley, "Deconstructing the Map," 12.
[90] Korzybski, *Science and Sanity: An Introduction toNon-Aristotelian Systems and General Semantics*.
[91] Harley, "Deconstructing the Map," 11.
[92] Denis Wood and John Fels, *The Power of Maps*, Mappings (New York London: The Guilford Press, 1992).
[93] Adapted from Michael Brown and Larry Knopp, "Queering the Map: The Productive Tensions of Colliding Epistemologies," in *The Map Reader*, ed. Martin Dodge, Rob Kitchin, and Chris Perkins, 1st ed. (Wiley, 2011), 55, https://doi.org/10.1002/9780470979587.ch59.
[94] Graham Huggan, *Interdisciplinary Measures: Literature and the Future of Postcolonial Studies* (Liverpool University Press, 2008), https://doi.org/10.5949/UPO9781846313332.
[95] Jeremy W Crampton and John Krygier, "An Introduction to Critical Cartography," *ACME: An International E-Journal for Critical Geographies* 4, no. 1 (2006): 11–33.
[96] Nancy Lee Peluso, "COUNTER-MAPPING FOREST TERRITORIES IN KALIMANTAN, INDONESIA," 1995.
[97] Gwilym Lucas Eades, *Maps and Memes: Redrawing Culture, Place, and Identity in Indigenous Communities* (McGill-Queen's University Press, 2015), https://doi.org/10.1515/9780773596771.
[98] Mylynka Kilgore Cardona, "*Women in Cartography in the Progressive Era* , by Christina E. Dando," *Imago Mundi* 71, no. 1 (January 2, 2019): 102–3, https://doi.org/10.1080/03085694.2019.1529940.
[99] Brown and Knopp, "Queering the Map."
[100] Rhiannon Firth, "Critical Cartography as Anarchist Pedagogy? Ideas for Praxis Inspired by the 56a Infoshop Map Archive" 6 (2014).
[101] Russell King and Peter Vujakovic, "Peters Atlas: A New Era of Cartography or Publisher's Con-Trick?," *Geography* 74, no. 3 (1989): 245–51.
[102] Derek Gregory, "Seeing Red: Baghdad and the Event-Ful City," *Political Geography - POLIT GEOGR* 29 (June 1, 2010): 266–79, https://doi.org/10.1016/j.polgeo.2010.04.003.
[103] Michelle Brown and Eamonn Carrabine, "The Critical Foundations of Visual Criminology: The State, Crisis, and the Sensory," *Critical Criminology* 27, no. 1 (March 2019): 191–205, https://doi.org/10.1007/s10612-019-09439-7.
[104] Charles Heller and Lorenzo Pezzani, "Report on the 'Left-To-Die Boat,'" 2014.

1.2.5.c Hermeneutic Research

Ideally, any ∞ Hermeneutic enterprise must express caution[105] in fixing any map conceptions or research agenda within cartography. Instead, it must focus on researching how changing map conceptions affect corresponding changes in cartography conceptions. This highlights the following ∞ Hermeneutic principle: The conception, interpretation, practice, purpose, form, utility, ethics, memory and subconscious meaning of a map is 'constantly changing' with time, place and its people. This implies that maps are always changing from one conception to the other, sublating old conceptions into new ones[106] or suppressing critical conceptions as and when the dominant conception begins to standardize itself into the collective consciousness[107]. The dominant map conception owing to specific social receptions[108] of its time, becomes the norm: a citadel of the 'true map'[109]. Its conception is norm for various representative, operative or embodied[110] tasks of its time. Eventually, the normative map conception begins to get accepted 'uncritically and subconsciously'[111] by its increasingly 'standardized and institutionalized' utility. The normative map conception begins its subconscious domination in all aspects of reality until a critical map conception updates the norms upon which it was socially or scientifically accepted[112]. This phenomenon can be referred as 'Carto Hypnosis'[113], wherein the normative map suppresses the critical map to conceal their conflict deeper within the collective subconscious[114]. In most cases the cartographer or the map user is unaware of these subconscious map conflicts. They are rather conscious of the accepted utility and social sanction[115] of the normative maps. For instance, Arno Peter's Map was motivated by his commitment for an equal representation for all countries relative to their sizes[116]; that the subconscious conception of Mercator's Map is the colonial repression of its use for imperial crimes and Eurocentric representation of the world. Thus, Peters attempts to draw out the 'subconscious' presence of decolonial map projections suppressed inside the collective conception of the Mercator's Map[117]. Given this theoretical framework, the research aim for ∞ Hermeneutic Cartography appears as following: To unfold a history of conflicting maps conceptions concealed inside the collective subconscious[118]. This introduces the role of cartographer as a historian[119] who interprets the changing cartography conceptions through the constant movement, critique and changing social reception of maps. This arms the ∞ Hermeneutic research agenda with a duality of 'non-teleological and genealogical[120]' methods to show that maps (everywhere and at all times) are emerging, circulating, contingent, used, judged, redefined, reformed, sublated, suppressed, relegated to artifacts and impacting

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[105] John Pickles, *A History of Spaces: Cartographic Reason, Mapping and the Geo-Coded World*, 0 ed. (Routledge, 2012), https://doi.org/10.4324/9780203351437.
[106] Adapted from Crowley, "A Great, Restless Stream," 123.
[107] Adapted from Harley, "Deconstructing the Map," 12.
[108] Adapted from Denis Wood and John Fels, "The Natures of Maps: Cartographic Constructions of the Natural World," *Cartographica: The International Journal for Geographic Information and Geovisualization* 43, no. 3 (September 2008): 192, https://doi.org/10.3138/carto.43.3.189.
[109] Harley, "Deconstructing the Map," 4.
[110] Veronica Della Dora, "Performative Atlases: Memory, Materiality, and (Co-)Authorship," *Cartographica: The International Journal for Geographic Information and Geovisualization* 44, no. 4 (December 2009): 240–55, https://doi.org/10.3138/carto.44.4.240.
[111] Adapted from Cardona, "*Women in Cartography in the Progressive Era* , by Christina E. Dando," 175.
[112] For instance, the Copernican Heliocentric map was the critical conception which replaced the Ptolemian Geocentric map which was the normative conception for centuries.
[113] S. W. Boggs, "Cartohypnosis," *The Scientific Monthly* 64 (June 1, 1947): 469–76.
[114] Adapted from Sharad Patil, *Maraxwad-Phule Ambedkarwad* (Pune: Sugawa, 1993).
[115] Norms get consolidated though social sanctions and public opinions Bagade, "Ambedkar's Historical Method: A Non-Brahmanic Critique of Positivist History," 22.
[116] Arno Peters, *The New Cartography* (New York: Friendship Press, 1983).
[117] Adapted from Crowley, "A Great, Restless Stream," 128.
[118] Adapted from Harley (1989) and Patil, *Maraxwad-Phule Ambedkarwad*.
[119] Edney, *Cartography: The Ideal and Its History*.
[120] Kitchin, Gleeson, and Dodge, "Unfolding Mapping Practices," 5.

events they were meant to or not. Further methods in historiography[121], psychology[122], ethnography, participant observation, observant participation and deconstruction[123] can be used to study this trajectory of maps[124] or their transgression[125] beyond their normative conception, sanction and utility. Thus, the ∞ Hermeneutic agenda shifts inquiry from 'What is a Map?' and 'How do Maps work?' to 'How do Map conceptions change?'. As the conception of maps changes, for instance from 'analog to digital' or from 'object to subjective' or from 'neutral to political', the corresponding effects also reflect in the research agendas of cartography. Thus, the ∞ Hermeneutic agenda appears as the underlying subconscious agenda which is implicit in all research agendas of cartography.

This framework illuminates the fact that every research agenda is just another ∞ Hermeneutic research agenda which has gone beyond its original research agenda (i.e., study of changing map conceptions). Considering this, both the + Positivist (Normative) and – Deconstructivist (Critical) research agendas are infact 'Post Hermeneutic' research agendas: they have both gone beyond the aforementioned ∞ Hermeneutic agenda to assigned themselves with particular map conceptions (i.e., objective of subjective representations) upon which their research is propagated (i.e., technological or ideological). Intuitively, this shows the possibility of infinite research agendas emerging from infinite map conceptions ultimately suspended between the conflict of Normative and Critical map conceptions. Thus, all research agendas are infact 'Post Hermeneutic' research agendas (as mentioned before). Depending upon the history, utility and attitude of Post Hermeneutic research agendas, they could be classified as (1) Post Hermeneutic Normative, (2) Post Hermeneutic Critical or (3) Post Hermeneutic Reactionary (i.e., conflict preserving). As of today, + Positivism appears to be 'Post Hermeneutic Normative' and – Deconstructivism appears to be 'Post Hermeneutic Critical'[126]. The 'Post Hermeneutic Normative' research agendas assume the center and occupy all power in the conflict. 'Post Hermeneutic Critical' research agendas struggle to either recapture or diffuse that power. The 'Post Hermeneutic Reactionary' research agendas provide useful map conceptions to expand methods of the Normative or the Critical, but ultimately preserve the power structure due to a lack of their judgment over the conflict[127]. They are thus classified closer to the 'Post Hermeneutic Normative' research agendas. As a summary of the above discussion, a Reconciliatory research agenda can be classified as 'Post Hermeneutic Realist'[128]. Thus, the research agendas in cartography can be reclassified as follows:

Table 6: Reclassification of Enterprises

	Hermeneutic				(∞)
	Post Hermeneutic Normative	Post Hermeneutic Reactionary	Post Hermeneutic Critical	Post Hermeneutic Realist	
	Positivism		Deconstructivism	Reconciliation	
Research Agenda	Technological ^		Ideological ^		(+ ? –)

[121] Crampton and Krygier, "An Introduction to Critical Cartography," 15.
[122] Cristina M. Iosifescu Enescu, Jacques Montangero, and Lorenz Hurni, "Toward Dream Cartography: Mapping Dream Space and Content," *Cartographica: The International Journal for Geographic Information and Geovisualization* 50, no. 4 (December 2015): 224–37, https://doi.org/10.3138/cart.50.4.3137.
[123] Kitchin, Gleeson, and Dodge, "Unfolding Mapping Practices," 15.
[124] Wood, Fels, and Krygier, *Rethinking the Power of Maps*, 130.
[125] Augustin Berque, "Die Transgression Der Karten," in *Die Zukunft Der Kartographie*, ed. Marion Picker, Véronique Maleval, and Florent Gabaude (transcript Verlag, 2013), 241–56, https://doi.org/10.1515/transcript.9783839417959.241.
[126] Just the way how Geocentricism was the Normative and Heliocentrism was the Critical
[127] Also called "tension" in Wood et al., "Critical Cartography," 28.
[128] The most pragmatic, useful or accurate interpretation. See Bhaskar, *A Realist Theory of Science*.

Thus, it can be observed that all research agendas are infact 'Post Hermeneutic' research agendas. Within this classification, the position of the so called 'Hermeneutic' research agenda will be judged.

1.2.5.d Classification of other Post Hermeneutic Researches

A certain brand of cartographers offers a conception of cartography beyond representation. They promote research agendas which conceive maps as non-representative entities. They conceive maps as processes that operate on reality. This gives rise to a 'Processual' research agenda within cartography[129]. They propose that maps are building blocks of a process that produce reality[130]. Rather than representing reality, maps are processes which produce reality by operating upon mental conceptions of reality in co-operation with a host of other bounding practices[131]. They provide a unique argument which states that while a map is not the territory[132] it still appears to become a territory[133]. They argue that maps are propositions[134] for reality which could facilitate an intervention between a people and their territories[135]. Maps can replace physical territories with a mental conception of territories[136] while themselves being produced through territories[137]. This establishes a clear 'Post Hermeneutic Processual' research agenda which observes the genealogical trajectory of maps as co-producers, propositions, interventions, replacers, and transgressors of reality. In summary, this Processual research agenda shows how 'maps' change 'reality' (akin to the ∞ Hermeneutic agenda which shows how 'reality' changes 'map conceptions'[138]). Considering how maps change reality (by co-production - transgression and proposition - intervention), this particular Processual agenda has the potential to advance the – Deconstructivist agenda that conceive maps as subjective representations which standardize images of reality. Thus, it is are more accurately classified as 'Post Hermeneutic Critical' (i.e., same as – Deconstructivism). The symbol allocated for it will be **–** P (instead of ∞).

Another brand of cartographers also conceives maps as processes and more particularly as 'practices'. While maps are constitutive of practices, the practices themselves are conceived to be mapping something (be it spatial or non-spatial). These practices may be technical, social, bodily, aesthetic or political. They may also be contingent, habitual, negotiated, reflexive and playful in character[139]. Methods in genealogy, ethnography, ethnomethodology participant observation, observant participation and deconstruction can be used to see how maps constitute practices or how practices are seen as maps. These practices may be conversations or decisions made while navigating a place or making an itinerary[140]. They may be movements in space[141] or dreams of space[142]. They maybe mnemonics or platforms where embodied actions take place[143]. They may become information transfers[144] or real time propositions

[129] Kitchin and Dodge, "Rethinking Maps."
[130] Pickles, *A History of Spaces*.
[131] Corner, "The Agency of Mapping," 93.
[132] Korzybski, *Science and Sanity: An Introduction toNon-Aristotelian Systems and General Semantics*.
[133] Marion Picker, Véronique Maleval, and Florent Gabaude, eds., *Die Zukunft der Kartographie: neue und nicht so neue epistemologische Krisen*, Kultur- und Medientheorie (Bielefeld: Transcript, 2013).
[134] Wood and Fels, *The Natures of Maps: Cartographic Constructions of the Natural World.*
[135] Casti, "Towards a Theory of Interpretation," 4.
[136] Casti, 11.
[137] Berque, "Die Transgression der Karten."
[138] The distinction between 'map' and 'map conception' here is very important.
[139] Kitchin, Gleeson, and Dodge, "Unfolding Mapping Practices."
[140] Barry Brown and Eric Laurier, "Maps and Journeys: An Ethno-Methodological Investigation," *Cartographica: The International Journal for Geographic Information and Geovisualization* 40, no. 3 (September 2005): 17–33, https://doi.org/10.3138/6QPX-0V10-24R0-0621.
[141] See indigenous way finding in Tim Ingold, *The Perception of the Environment: Essays on Livelihood, Dwelling and Skill*, New edition (London: Routledge, 2021), https://doi.org/10.4324/9781003196662.
[142] Iosifescu Enescu, Montangero, and Hurni, "Toward Dream Cartography."
[143] Dora, "Performative Atlases."
[144] See "Immutable Mobiles" in Rob Kitchin, Chris Perkins, and Martin Dodge, "Thinking about Maps," in *Rethinking Maps*, 2009, 1–25.

which are updated on the go[145]. They may be spatial operations which get hacked/jammed[146] or literary knowledge which can be mapped[147]. In summary, this 'Post Hermeneutic Processual' research agenda conceives maps as practices or practices themselves as mappings of spatial and non-spatial phenomena. It provides deeper conceptual depth and exploration for introspecting methods of the 'Post Hermeneutic Normative' (+) and 'Post Hermeneutic Critical' (–P and –) research agendas. However, by focusing simply on practices, this Post Hermeneutic Processual research agenda appears neither Normative nor Critical with respect to the map conception conflict. Rather they appear unconventional or alternative. Unlike the + Positivist or – Deconstructivist research agendas, they do not supply adequate ruminations to judge or reconcile the map conception conflict. Infact, certain identities within this Processual research agenda tend to escape the conflict by declaring that maps have no secure conceptions; that a profitable research agenda lies in conceiving maps as practices rather than representations[148]. They prescribe to abolish a vocabulary of maps[149] and persuade the community to base their technological or ideological research agendas upon a processual map conception. While this particular prescription appears critical, it also falls in line with the tendency of + Positivism to embrace neutrality[150] over the map conception conflict (as it helps to maintain their hold over the epistemic space). The processual attitude (at it stands today) is conflict preserving. It creates an alternative research agenda which speculates a profit in its reluctancy to pass judgment upon contradictory map conceptions. Ultimately, it preserves the power structure of the conflict where the Normative continues to prevail its agenda. Meanwhile, the Critical struggles to persuade the community about their agenda. Owing to the above reasons, the Processual research agenda could be classified as 'Post Hermeneutic Reactionary' which preserves influence of the 'Post Hermeneutic Normative. The symbol allocated for it will be + P (instead of ∞). Thus, the renaming and reclassification of all research agendas in cartography can be expressed as follows:

Table 7: Research Agenda Argument

	Hermeneutic					(∞)
	Post Hermeneutic Normative	Post Hermeneutic Reactionary	Post Hermeneutic Critical		Post Hermeneutic Realist	
	Positivism +	Processual +P	Processual –P	Deconstructivism –	Reconciliation	
Research Agenda	Technological ^	^ Ethnography - Ethnomethodology and Participant observation - Observant participation	Co Production - Transgression and Proposition - Intervention ^	Ideological ^	Techno-Ideological and Co Production - Transgression (where in ethnomethodology, proposition and intervention is already implied)	(+ +P –P –)

The reconciled approach judges that all independent research agendas are blind spots unless they are seen to advance each other's scope, methods and limitations. To have a distinction between technology and ideology is highly counter-productive. Any technological research must seen as an 'implicit' ideological research, with inherent processual aptitudes to promote alternative empirical observations of map use and unconventional map conceptions. The reconciled research agenda appears as a 'Post Hermeneutic Realist' agenda with integrated approaches and mixed methods to support collaborative practices across the three enterprises of cartography. It provides a pragmatic way of reconciling maps conceptions and research agendas.

[145] See real time mapping in Gregory, "Seeing Red."
[146] See data insurgency in Gregory.
[147] Barbara Piatti, Anne-Kathrin Reuschel, and Lorenz Hurni, "Literary Geography – or How Cartographers Open up a New Dimension for Literary Studies," 2009, https://icaci.org/files/documents/ICC_proceedings/ICC2009/html/nonref/24_1.pdf.
[148] Kitchin and Dodge, "Rethinking Maps."
[149] Edney, *Cartography: The Ideal and Its History*, 236.
[150] Ranke's positivism showed a reluctance to pass judgments in conformity with either rational or moral standards. Neutrality was accorded to the high office of historian. Bagade, "Ambedkar's Historical Method: A Non-Brahmanic Critique of Positivist History," 10.

1.3 The Reconciled Epistemology of Cartography

Table 8: Reconciliation Table

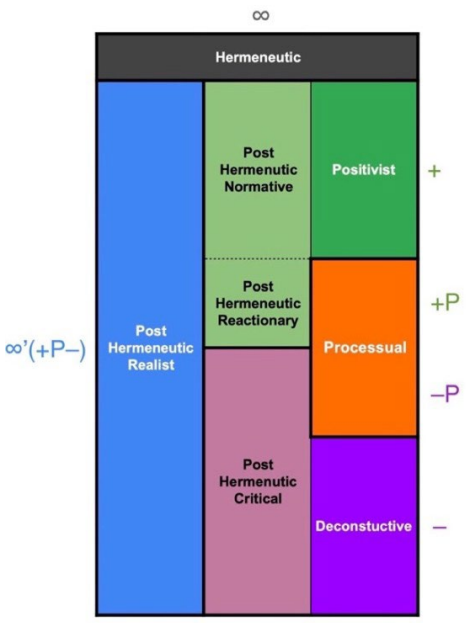
	Hermeneutic					∞
	Post Hermenutic Normative	Post Hermenutic Reactionary	Post Hermenutic Critical		Post Hermenutic Realist	
	Positivism +	Processual +P	Processual –P	Deconstructivism –	Reconciliation	∞'
Map Conception	Objective Representation ^	Practice ^	Co Producer	Subjective Representation	Subjective Representation which appears objective as they co produce reality through various practices	+ +P –P –
Map Authority	Traditionally Unquestionable ^	Context Dependant		Always Questionable	Always questionable yet difficult to dislodge its authority due to the subconscious impression of maps as trustworthy	+ +P –P –
Author's Interpretation	Always Neutral ^	Variable	Always Biased		Always Biased	–
Empirical Objectivity	Might be possible depending on context		Impossible ^		Might be possible depending on context	+
Research Agenda	Technological ^	^ Ethnography - Ethnomethodology and Participant observation - Observant participation	^ Co Production - Transgression and Proposition - Intervention	Ideological ^	Techno-Ideological and Co Production - Transgression (where in ethnomethodology, proposition and intervention is already implied)	+ +P –P –
Technological Contributions	High	Low ^			High	+
Political Analysis	Low ^	Variable ^		High	High	–
Ethical Concern	Traditionally Limited ^	Integral but Contextual ^		Integral but limited ^	Integral yet Contextual ^	+P –P
Social Consideration	Generalized ^	Highly Specific - Selective ^	Highly Specific - Biased ^		Highly Specific yet Generalized	+ +P –P –
Statistical Assement	Quantitative Focus ^	Qualitative Focus ^			Quantitative and Qualitative	+ +P –P –
User Participation	Traditionally Limited ^	Integral			Integral	–
Map Communication	Traditionally Unidirectional ^	Feedback Loop			Feedback Loop	–
Scale of Validity	Globally Applicable ^	Contextual		Locally Applicable ^	Locally applicability with Global adapdability	+ +P –P –
Cartography Conception	Representative and Analytical	Processual		Rhetorical	A Rhetorical science based upon its representative and analytical utility wherein processual aptitudes are inherent to its methods	+ +P –P –
Research Topics	Representation, Communication, Cognitive Semiotic, Analytical, Geoinformation, Geovisualization, IPC, Remote Sensing, VGI, LBS, Navigation, GPS, GIS, Cybernetic, Machine Learning, Generative AI	Way Finding, Spatialization and Dichotonomy, Ethnology and Conversation Analysis, Embodied Interactions, Information Transmission, Literary and Linguistics, Psychological	Non Teleological and Genealogical, Self Referential and Iconization, Paramapping, Dipiction Isomorphy, Transgression and Intervention Studies	Dialectical Materialism, Post Colonialism, Participatroy Activism, Feminism, Pragmatics, Surveillence and Insurgency Studies, Cultural Studies, Anthropology, Sociology, Forensics, Pedagogy	Pragmatism, Reconciliation, Cartohypnosis and Psychoanalysis	∞'
Authors (Identities)	Eckret (1923) **Robinson (1955)** Bertin (1967) Tobler (1970) Petchenik (1976) Salishchev (1982) Di Biase (1990) M.Eachren (1995) Moellering (2000) Goodchild (2007) Ormeling (2007) Kraak (2008) Brunner et al (2017) AC Robinson (2018) Kang et al (2023)	Latour (1999) Ingold (2000) Del Casino & Hanna (2005) Brown and Laurier (2005) Della Dora (2009) **Kitchin and Dodge (2007)** Patti et al (2009) Losifescu Enescu et al (2015)	Heisenberg (1959) Corner (1999) Crampton (2003) **Pickles (2004)** Casti (2005) Kitchin and Dodge (2007) Wood and Fels (2008) Gebaude & Maleval (2013) Berque (2013)	**Harley (1989)** Huggan (1991) Wood (1992) Peluso (1995) Monmonier (1996) Huffman (1997) Kitchin & Dodge (2001) Crampton (2003) Jacob (2005) Crampton-Krygier (2006) Cosgrove (2007) Brown & Knopp (2008) Edney (2007) Gregory (2010) Eades (2011) Firth (2014)	Adapted from Boggs (1947) Bhaskar (1975) Ambedkar (1979) Edney (1993) Cosgrive (1994) Schuurman (2000) Brown & Knopp (2008) Crampton (2010) Patil (2010) Dodge et al (2011) Bagade (2012) Wood (2020) Crowly (2023)	∞'

This sub-chapter presents the reconciled epistemology of cartography in relation to its Positivist, Processual and Deconstructivist counterparts. The theoretical blind spots (^), conflicting areas (-------) and overlaps (---------) between various arguments of the three conflicting epistemologies have been identified in the above table. It can be observed that the reconciled epistemology inherits some arguments from the Positivist, Processual or Deconstructivist enterprises in their original form while it synthesizes the other arguments across all three enterprises. The inherited arguments are highlighted with the color of enterprise they belong to originally. The reconciled arguments are highlighted in a light blue color which indicates a synthesis. In principle, the (∞') Reconciled epistemology has the potential to illuminate blind spots by encouraging overlaps. It supports the advancements of conflicting arguments from other enterprises by either synthesizing them or passing rational judgements (chapter 1.2) to inherit them in their original form. A summary of the reconciled epistemology can be expressed as follows:

It can be observed that that 'Post Hermeneutic Normative' research agendas (+) are built upon the conception of maps as objective representations of reality. The 'Post Hermeneutic Critical' research agendas (– and –P) lean towards the conception of maps as subjective representations and co-producers of reality. The Reactionary research agendas (+P) conceive maps are practices or practices as mappings. While Reactionary agenda provides values insights to further methods of the Normative and Critical, they do not pass judgments upon the conflict of map conceptions, thereby preserving the power of the Normative research agenda.

The reconciled approach judges that all independent research agendas are blind spots unless they are seen to advance eachothers scope, methods and limitations. To have a distinction between technology and ideology is highly counter-productive. Any technological research must seen as an 'implicit' ideological research, with inherent processual aptitudes to promote the empirical observation of alternative map use and unconventional map conceptions. The reconciled research agenda appears as a 'Post Hermeneutic Realist' agenda with integrated approaches and mixed methods to support collaborative practices across the three enterprises of cartography. It provides a pragmatic way of reconciling maps conceptions and research agendas.

Table 9: Reconciliation Compass



1.4 The Incommensurable Appearance of Epistemologies

Chapter 1.3 summarizes the Reconciled epistemology of cartography given the complex nature of conflicts and overlaps between the Positivist, Deconstructivist and Processual arguments. This sub-chapter analyses the reason for incommensurable appearance of the three epistemologies which leads to a false categorization of their originating and propagating authors (identities) as Positivist, Deconstructivist or Hermeneutic; as published in Azócar Fernández and Manfred Buchroithner (2012, pg 108). The false categorization of authors is a subconscious phenomenon and is taken for granted. Based on their map conceptions or research agendas, authors are named, labeled and eventually relegated to either Positivist, Deconstructivist or Processual enterprises. This splits the cartography community into three enterprises which start to appear incommensurable. However, a Reconciled epistemology shows that maps are subjective representations of reality appearing to be objective due to their function of co-producing reality through an array of mapping practices. This argument has the potential to satisfy concerns of all enterprises even though their individual conceptions might differ from each other. This is why authors who identify with one enterprise may 'appear' to make an argument which belongs to another enterprise. The underlying principle behind this is the assumption that 'all arguments are related to every other argument'[151] which opens the potential for reconciliation. This principle shows that there is a real theoretical basis for reconciliation in cartography; that reconciliation of conflicting identities and epistemologies is not forced but intuitive and thus, inevitable. To analyze this claim with concrete examples, certain quotes from conflicting authors will be deconstructed to draw out the subconscious presence of reconciliatory forces concealed inside them.

1.4.1 An Expanded Version of the Reconciliation Compass

For this purpose, the first step involves to make an expanded version of Reconciliation Compass to further classify all map conceptions and research agendas in cartography along with their respective authors between the hundred-year timeline from 1923 to 2023.

Table 10: Expanded Version of Reconciliation Compass

		Map Conception	Cartography Conception	Rsearch Agenda	Author
Hermeneutic		The reality of maps is always changing	Cartohypnosis and Psychoanalysis	How do map conceptions change with time, place and people? What is the history of conflicting maps conceptions concealed inside the collective subconscious?	Adapted from Boggs(1947) Patil (2010)
Post Hermenutic Normative	**Positivist**	Objective representations of reality	Communicatative, Representative and Analytical	How do maps generalize space as a cost field to enable an empirical measurement of reality through a set of limited variables? How to develop the technology of maps, mapping, geo-infromation, geovisualization and spatial analysis?	Eckret (1923) Robinson (1955) Bertin (1967) Tobler (1970) Petchenik (1976) Salishchev (1982) Di Biase (1990) M.Eachren (1995) Moellering (2000) Ormeling (2007) Kraak (2008)
	Cyber	Multimedia and interactive formats	Cybernetic	How do cartographers and map users produce maps in the digitial era? How to map readers become creators?	Taylor (1997)
	Volunteer	Volunteered representations of reality	VGI	How does geodata get voluntarily disseminated? How do citizens create a global patchwork of geodata? What is the accuracy of a VGI map? What are the ethical concerns of VGI mapping? What is the realtionship between VGI and traditional citizen science?	Goodchild (2007)

[151] A principle similar to "Everything is related to everything else" in Tobler, "A Computer Movie Simulating Urban Growth in the Detroit Region."

	Machine	Reference of reality	Navigation AI	How do machines read maps with deep reinforcement learning? What is the role of robitics in navigation?	Brunner et al (2017)
	Viral	Social Media	Social Media analysis	How do maps gain rapid widespread visibility and engagement in social media? How do we evaluate the design and social dissemination characteristics of viral maps? How to make maps viral?	AC Robinson (2018)
	AI	Artificial representation of reality	Ethical AI	What is the ethics of using generative AI in cartography? What are the potential risks and opprtunities associated with AI-generated maps?	Kang et al (2023)
Post Hermeneutic Reactionary	**Movement**	Movements in reality	Way Finding	How does movement constitute a place?	Ingold (2000)
	Co Authoured	Representation and non-representation of reality	Spatilization and Dichtonomy	How do maps become inter-related with socio-spatial practices, performances and representations? How do map users and cartographers co author reality together?	Del Casino and Hanna (2005)
	Journey	Navigational conversations and descisions	Ethnology and Conversation Analysis	How do maps become part of journey and adventures? How do groups of people use maps while travelling?	Brown and Laurier (2005a)
	Performative	Theater of performance and mnemonic	Embodied Interaction	To study how people interact with maps using thier bodies? What are mapping memories ?	Della Dora (2009)
	Immutant	Immutable mobile	Knowledge Transmission and Actor-Network Analysis	How do maps becomes permanant in thier status to transfer information? How do they transfer information specifically when they are put into circulation?	Latour (1999) Kitchin and Dodge (2009)
	Literary	Text	Literary and Linguistic	How do literary studies advance the development of digital, interactive, animated and database realted cartography? What is the relationship between a map and a text? What is the space inside a literature?	Patti et al (2009)
	Dream	Dream of reality	Psycological	How to map dreams? Whats the relationship between dream and real space?	Losifescu Enescu et al (2015)
	Processual	Co-constitutive of mapping practices	Post Representative	How do maps become part of practices? How do practices become mappings?	Kitchin & Dodge (2007) Edney (2019)
Post Hermeneutic Critical	**Producer**	Co-producer of reality	Non-teleological Geneological	How maps co-produce a spatial conception of reality with other mental and physcial entities?	Heisenberg (1959) Corner (1999) Crampton (2003) Pickles (2004)
	Semiotic	Mediators and replacers of reality	Self-referential and Iconization	How new meanings are interpreted upon maps? How maps produce mental conceptions of reality to replace physical reality?	Casti (2005)
	Congnitive Prescriptive	Propositions for reality	Paramapping	How maps cognitively construct the meaning of reality by linking map information to past knowledge of reality. How do maps provide a precription to take action?	Wood and Fels (2008)
	Isomorphic	Copy of reality	Dicpiction Isomorphy	How do maps become reality by producing a real imagination of reality? How are maps constitutive of geography? How do digital mapping retain nadir perspective with thier realtion to frontal-lateral view?	Gebaude and Maleval (2013)
	Transgressive	Product of reality	Transgression Studies	How are maps not reality? How does reality produce a map? How do maps transgress thier conceptions?	Berque (2013)
	Deconstuctive	Subjective representations of reality	Ideological Rherotical	How do maps standardize images of reality into the collective consciousness? How to brake the assumed link between reality and a representation of reality? How do political interests get vested upon maps. What are the ethics, risks and liabilities of mapping?	Harley (1989) Wood (1992) Monmonier (1996) Crampton (2003) Jacob (2005) Cosgrove (2007) Edney (2007)
	Marxist	Class representation of reality	Dialectical Materialism	How do certaing classes of society impose thier subjective representation of reality as the objective? What is the controversy around world map projections?	King and Vujakovic (1989)
	Decolonial	Colonial representation of reality	Post Colonialism	How does the cartographer identify and diffuse the empowering strategies of the colonial discourse? How can the self-privilaging authority of the west of cartography be dismantled?	Huggan (1991)
	Counter	Counter of reality	Participatory Activisim	How do communities work with cartographers, planners, lawyers, activists, consultants, governments or non givernmental organizations to make maps? How do maps help to counterbalance monopoly over power?	Peluso (1995)
	Feminist	Patriarchal representations of reality	Feminism	How do we recover the power and pleasure of map making to serve feminist interests?	Huffman (1997)
	Critical	Subjective representation of reality	Undisciplined	What are the drawbacks of academic cartography? How do we reduce the gap between map technology and the critique of power structures?	Crampton and Krygier (2006)
	Queer	Heterononormative representations of reality	Productive Pragmatics	What are the technical limitations in positivist cartography that require queer remuneration? What is the value of colliding epistemolgies in cartography? How do normaive representations of reality closet queer folk?	Brown and Knopp (2008)
	Insurgent	Real-time map of reality	Military, Survellence and Insurgency Study	How does real time mapping prescirbe on-ground occupations? How does insurgency (hacking, data jamming etc.) affect real time mapping?	Gregory (2010)

	Meme	Meme	Cultural Studies	How do memes help in the study of imperial or indegenous maps? How do mems theorize maps as vehicles of cultural transmission?	Eades (2011)
	Anarchist	Utopian representation of reality	Pedagogy and Parxis	How do maps perpetuate social exclusion and hierarchies? What is the role of collaborative mapping practices in to prioritising grounded and embodied political action? How do maps forge mutual solidarity and collective action?	Firth (2014)
Post Hermeneutic Realist		Subjective representation and co-producer of reality	Pragmatic Reconcilatory	What is the most pragmatic way of reconciling conlficting map and cartography conceptions? Can opposing arguments be synthesized to make a pragmatic epistemology?	Adapted from Bhaskar (1975) Ambedkar (1979) Edney (1993) Cosgrive (1994) Schuurman (2000) Brown & Knopp (2008) Crampton (2010) Dodge et al (2011) Bagade (2012) Wood (2020)

1.4.2 Confusion Matrix of Epistemic Conflicts

The expanded version of the Reconciliation compass shows a classification of all map conceptions with their corresponding research agendas and its authors. The overlaps between the Processual enterprise with their Normative and Critical counterparts is shown. The different research topics under each enterprise are also mentioned along with the research questions they engage with. The second step involves to make a confusion matrix out of the Reconciliation Table. The confusion matrix will highlight conflicts, overlaps and alignments among the enterprises. The reasons for conflicts, overlaps or alignments will be mentioned and highlighted with colors to recognize patterns and areas of interest.

Table 11: Confusion Matrix of the Epistemic Space

			Hermeneutic Enterprises				
			Post Hermenutic Normative	**Post Hermenutic Reactionary**	**Post Hermenutic Critical**		**Post Hermenutic Realist**
			Positivism +	**Processual (Practice) +P**	**Processual (Production) –P**	**Deconstructivism –**	**Reconciliation**
Hermeneutic Identities	**Post Hermenutic Normative**	**Positivist Identity +**	**Aligned**	**Conflicting:** Positivist Identity's unwavering belief in objective mapping is at odds with Processual Practice's focus on the context-dependent nature of map-making.	**Overlapping:** Positivist Identity holds a neutral authorial stance, while Processual Production admits bias.	**Conflicting:** The Positivist notion of empirical objectivity directly opposes Deconstructivism's inherent skepticism about any universal truths.	**Overlapping:** Reconciliation tries to maintain the objective backbone of Positivism while incorporating elements from other paradigms, creating an uneasy alliance.
	Post Hermenutic Reactionary	**Processual Identity (Practice) +P**	**Conflicting:** Positivism's lack of contextual sensitivity stands at odds with the core of Processual Practice, which often involves ethnographic or participant-observation methods.	**Aligned**	**Overlapping:** Both paradigms involve the user as a key factor but diverge on technological focus and potential bias.	**Overlapping:** While both paradigms question traditional norms, Processual Practice may allow for some degree of empirical objectivity, unlike Deconstructivism.	**Aligned:** Reconciliation absorbs Processual Practice's focus on context and user involvement while trying to integrate these into a more unified methodology.
	Post Hermenutic Critical	**Processual Identity (Co Producer) –P**	**Conflicting:** Positivism's "always neutral" and universally applicable maps are fundamentally at odds with Processual Production's perspective that maps are inherently biased and context-dependent.	**Overlapping:** Both paradigms engage the user in map-making but differ in their approach to technology, with Processual Production being more skeptical of its neutrality.	**Aligned**	**Aligned:** Both paradigms agree that maps are fundamentally non-neutral and are expressions of power dynamics and social constructs.	**Aligned:** Reconciliation incorporates Processual Production's acceptance of map bias and social production while aiming for a balanced and nuanced methodology.
		Deconstructivist Identity –	**Conflicting:** Deconstructivist Identity fundamentally questions the notion of objective truth, thereby conflicting with Positivism's foundational principles.	**Overlapping:** Both paradigms critique traditional mapping norms. However, Processual Practice might consider some mapping practices as more trustworthy than others, which Deconstructivism would challenge.	**Aligned:** Both paradigms see maps as politically charged, subjective interpretations of reality, rejecting any claims of neutrality.	**Aligned**	**Overlapping:** Reconciliation accommodates Deconstructivist critiques but also retains elements of traditional mapping methodologies, leading to a complex, sometimes contradictory, synthesis.
	Post Hermenutic Realist	**Reconciled Identity + +P –P –**	**Overlapping:** Reconciliation seeks to balance Positivist principles of objectivity with other paradigms, creating a hybrid that questions the universality of any single approach.	**Aligned:** Reconciliation naturally incorporates Processual Practice's context-dependent, practice-based mapping.	**Aligned:** Reconciliation embraces the Processual Production paradigm's focus on the socially constructed nature of maps while also aiming for a methodologically balanced approach.	**Overlapping:** Reconciliation shares Deconstructivism's critical perspective but also seeks to find a middle ground that incorporates elements of objectivity and user participation.	**Aligned:** By its very definition, Reconciliation seeks to create a synthesis of all paradigms, aiming for a mapping approach that is both critical and inclusive.

The Confusion Matrix represents overlaps (blue highlights), alignments (green highlights) and conflicts (red text) based upon an intuitive reading of the Reconciliation Table and Reconciliation Compass. The complex relationships seen within this table can said to be called the epistemic space of cartography. Each identity is aligned with its own respective enterprise. The Reconciliatory identity is aligned or overlapped with all enterprises due to its agenda of inclusivity. The (+P, –P) Processual, (–) Deconstructivist are more aligned or overlapped with each other's enterprises due to shared or complimentary arguments. These three identities stand for sensitive attitudes in social research, context dependency and author-reader subjectivity to study map or cartographer bias. Owing to this, they appear to be in conflict with the (+) Positivist enterprise due to its strong stand on neutrality, universality, generalization and objectivity. The (+) Positivist identity appears to be in conflict with all other enterprises (expect Reconciliation enterprise). However, the conflicting stance of the (+) Positivist identity with (+P, –P) Processual and (–) Deconstructivist enterprises only 'appears' to be as such. The same is true for the (+P, –P) Processual and (–) Deconstructivist identities wherein their critical stance with the (+) Positivist enterprise only 'appears' to be critical. Considering the previous assumption that 'all arguments are related to every other argument', a (+) Positivist identity might subconsciously imply a (–) Deconstructivist argument which opens the potential for reconciling the epistemic space of cartography. The same principle is applicable to (+P, –P) Processual and (–) Deconstructivist identities who might subconsciously imply a (+) Positivist argument.

1.4.3 Confusion Matrix of Cartographers

The next step is to repopulate the Confusion Matrix, with a set of cartographers (identities) whose arguments have a subconscious presence of their conflicting or complimentary enterprises.

Table 12: Confusion Matrix of Identities

			Hermeneutic Enterprises				
			Post Hermenutic Normative	Post Hermenutic Reactionary	Post Hermenutic Critical		Post Hermenutic Realist
			Positivism +	Processual Practice +P	Processual Production –P	Deconstructivism –	Reconciliation
Hermeneutic Identities	Post Hermenutic Normative	Positivist Identity +	Maps are objective representations of reality Robinson (1955)	It is quite reasonable to suppose that the map, as a communicative device, has been around as long as written language has. (Robinson and Petchnik 1976)	...[TFL] explains why it is possible to characterize complex geographic landscapes using a high degree of generalization, with large polygons representing essentially homogeneous regions. Goodchild (2004:302)	When representing spatial information in map form one has to limit oneself, on account of the available space, to the essentials, and amongst which is the information's structure (Omerling and Kraak 1996:40)	Overlapping
	Post Hermenutic Reactionary	Processual Identity (Practice) +P	Maps emerge through practices and have no secure ontological status. Kitchin and Dodge (2007:1)	Maps are never fully formed and their work is never complete. Maps are transitory and fleeting, being contingent, relational and context-dependent. Kitchin and Dodge (2007)	Political, social or emotional subjective expereinces as metadata profiles of dreams for Place Cookie & Setting Spider Models Losifescu Enescu et al (2015)	...a number of methods [are used] to capture and distil the unfolding and contextual craft of mapping. They include the production of genealogies and ethnographies, ethnomethodology,... and deconstruction. Kitchin et al (2013)	Aligned
	Post Hermenutic Critical	Processual Identity (Co Producer) –P	A map,... only becomes the territory by producing both a real and an imaginary space: maps are images that create worlds. (Gebaude & Maleval 2013 : 135/136)	...(Maps are) in fact a historical product operating within a certain horizon of possibilities. (Crampton 2002: 6)	[Maps] ...do not simply represent territory, but are understood as producing it (Pickles, 2004: 146)	As a model, a map replaces rather than represents territory. Casti (2005:12)	Aligned
		Deconstructivist Identity –	Maps are graphic representations that facilitate a spatial understanding of things, concepts, conditions, processes, or events in the human world. Harley & Woodward (1987:XVI)	The map does not define itself through what it represents... Neither does not define itself by its fix visual configuration... Neither defines the map itself through a unique function. Jacob (1992 : 36–37)	What makes the map a map is its exploitation of spatialized things – themselves propositions (this is there) – as the subjects of yet higher order propositions. (Wood and Fels 2008:191)	Maps are subjective representations of reality Harley (1989)	Overlapping
	Post Hermenutic Realist	Reconciled Identity + +P –P –	Overlapping	Aligned	Aligned.	Overlapping	Aligned

Here, the Confusion Matrix is repopulated with quotes from various identities of cartography. To begin with, a close reading of selected quotes from (+P, –P) Processual and (–) Deconstructivist identities shows the subconscious presence of each other's enterprises. This overlap or alignment opens the possibility for reconciliation which can be deconstructed. The following examples illustrate this:

1. (+P) identity overlaps with (–P) enterprise: The use of empirical methods by (+P) such as place cookies and setting spiders to map 'political, social or emotional experiences of dreams' overlaps with (–P) agenda which conceives mapping to be alternative/unconventional. The use of these particular empirical methods also shows close affinity of (+P) identity to (+) enterprise.
2. (–P) identity aligns with (−) enterprise: The (–P) statement that maps 'replace' territory, aligns with (−) Deconstructivist argument that maps are often 'perceived' as objective representations. This implies that maps are 'perceived to replace' territory due to their objective nature.
3. (–) identity aligns with (−P) enterprise: The (−) statement that maps are not representations but 'exploitative spatializations' aligns with (−P) enterprise. This is considering that fact that maps as a 'spatialization' is a 'post-representative' map conception bringing it closer to the (+P, –P) Processual enterprise. It is important to note that this particular (–) identity often shifts between the (+P, –P) Processual and (–) Deconstructivist enterprises. It offers the conception of maps as representative as well as post-representative. This illuminates the ∞ Hermeneutic research agenda which studies how map conceptions change. This agenda can also extend to include the study of how identities change to oscillate between various enterprises.

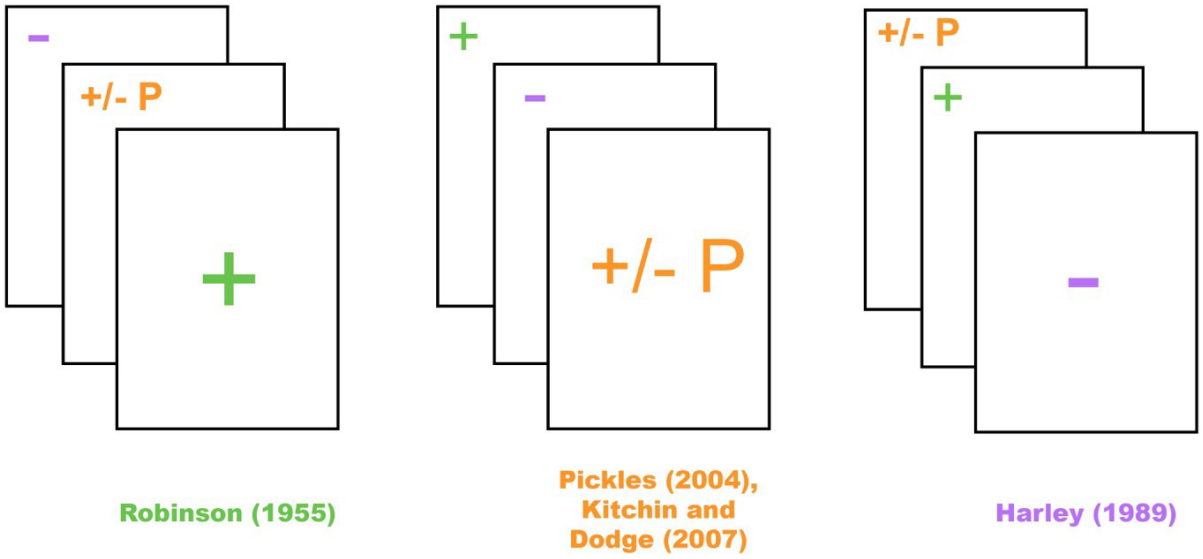


Figure 3: Identities appear to author Literature only from their Enterprise

As discussed before, the (+) Positivist identity 'appears' to be in conflict with (+P, –P) Processual and (–) Deconstructivist enterprises. A close reading of selected quotes from (+) Positivist identities show the subconscious presence of (+P, –P) Processual and (–) Deconstructivist arguments. This contradiction can be deconstructed to open the possibility for reconciliation. The following examples illustrate this:

4. (+) identity appears to conflict with (+P) enterprise: The famous (+) Positivist conception of maps as communication devices aligns with post-representation processual conceptions of maps as immutable mobiles, mnemonics, performance theaters, movements, conversations or dreams. Unlike classic representation (which is a one-way communication), the conception of map as a communication device

implies a two-way communication. This allows for users to engage with the map to interact, explore, transform or volunteer their own subjective geoinformation into the device. This practice implies that maps are never fully formed nor complete. In a broad sense, they are historical products which get redefined through new functions conceived upon them (i.e., from one-way to two-way communication devices). Thus, the (+) Positivist map conception of communication device does not conflict but overlaps with the (+P) Processual enterprise.

5. (+) identity appears to conflict with (−P) enterprise: The famous (+) First Law of Geography validates the generalization of real landscapes into polygons. This automatically implies the (−P) processual argument that maps produce a 'real imaginary spaces'. Maps are images (products of polygon generalization 'processes') which create imaginary spaces (homogenous regions made out of polygons). This concept of depiction isomorphy helps to understand that the conflict between (+) Positivist methods and (+P, –P) Processual enterprise is only in 'appearance' which is taken for granted.
6. (+) identity appears to conflict with (−) enterprise: The (+) Positivist acknowledgment that maps are subjected to the cartographers' limitations with respect to information structure; highlights the (−) argument around data manipulation, censorship, surveillance, insurgency, hacking or fraud. If the data itself is biased, no amount of cartographic integrity can make a map truly objective even according to (+) Positivist map conceptions. The discussion around ethics and limitations is a major overlap between (+) identities and the (−) enterprise. To sustain their conflict is counter-intuitive and counter-productive.

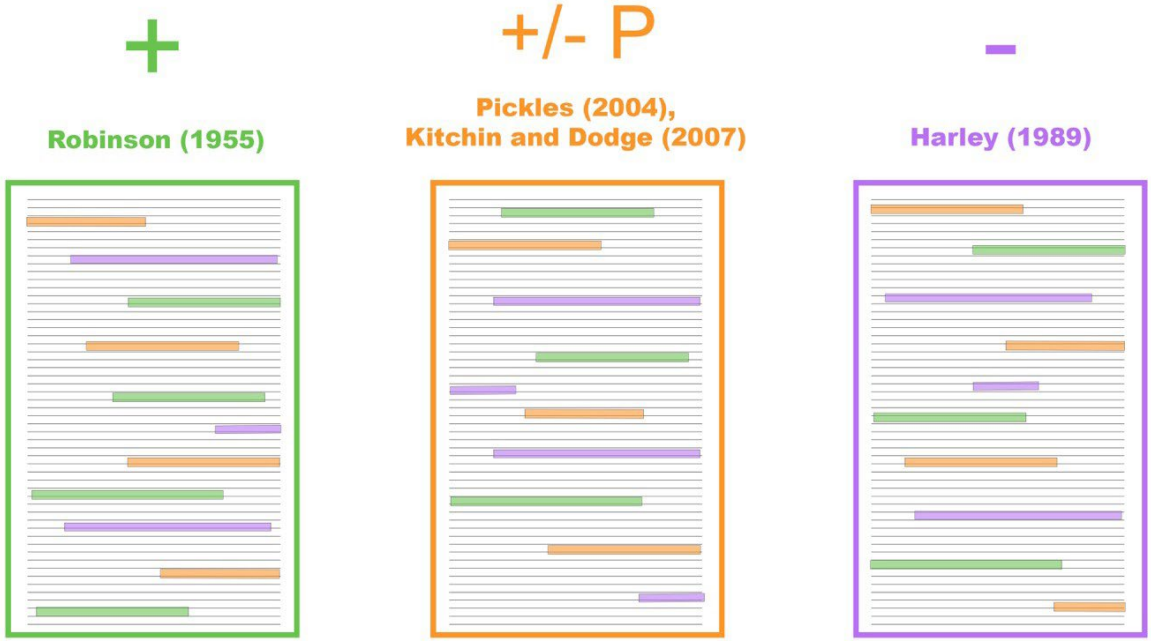


Figure 4: Subconscious Presence of Arguments from Other Enterprises in the Literature of an Identity

As discussed before, the (+P, –P) Processual and (–) Deconstructivist identity 'appears' to be in conflict with (+) Positivist enterprise. A close reading of selected quotes among (+P, –P) Processual and (–) Deconstructivist identities show the subconscious presence of (+) Positivist arguments. This contradictory appearance can be deconstructed to open the possibility for reconciliation. The following examples can help to illustrate this:

7. (+P) identity appears to conflict with (+) enterprise: This (+P) Processual argument claims that maps inherently have no secure map conceptions. That they are best seen to be processual in nature. This takes away focus from the map conception conflict around 'representation' which has created historical

epistemic divide between (+) and (–) identities. Due to the lack of (+P) Processual judgement upon this conflict, their argument indirectly reserves a critique upon (+) Positivist map conceptions that hold wide spread influence. This tendency to embrace neutrality ultimately supports the normative status of (+) Positivist map conceptions. While it is not clearly apparent, this (+P) argument certainly aligns with the (+) enterprise. It is also important to note that this particular (+P) identity also overlaps with the (–) Deconstructivist enterprises as seen in the matrix.

8. (–) identity appears to conflict with (+) enterprise: This particular (–) identity says that maps are graphical representations that facilitate a spatial understanding. Here. by not implying the subjectivity of representations, it aligns with the classic (+) Positivist conception that maps are neutral representations which provide objective knowledge about the world. While this particular identity is popularly known to be a (–) Deconstructivist identity, it has also authored several (+) Positivist conceptions in the past. Yet again this illuminates the ∞ Hermeneutic research agenda which may extend to include the study of how identities change to oscillate between various enterprises of cartography.

Table 13: The possibility that every Identity makes Arguments from each Enterprise

Thus, these illustrations demonstrate that arguments of various identities have a subconscious presence of their conflicting or complimentary enterprises. These underlying implications, hidden meanings and interpretive reading is possible through an against the grain deconstructive reading of cartography literature. It has been shown that identities keep shifting between enterprises and their arguments can overlap or align with another enterprises. The explicit naming or labeling of authors may lead to a false classification which is counter-intuitive to the reconciliatory agenda. The Reconciliation Compass and Confusion Matrix, when applied together, become a navigational guide to map the epistemic space of cartography which only 'appears' incommensurable. However, hidden underneath this incommensurable appearance is a reconciliatory force which can overlap or align the identities and enterprises of cartography into a new epistemology which is more inclusive. In this manner, a theoretical basis for reconciliation of cartography enterprises can be demonstrated.

1.5 The Reasons for Incommensurable Appearance

Chapter 1.4 demonstrated that the incommensurable appearance of epistemologies conceals a reconciliatory force to align and overlap conflicting enterprises into an inclusive fold. It uses the assumption that 'all arguments are related to every other argument' to demonstrate a real theoretical basis for reconciliation. It shows the application of Reconciliation Compass and Confusion Matrix to navigate the complexity of the epistemic space. While the nature of an argument and their enterprise location remains constant, the location of identities who author them or subconsciously imply them keep shifting from one enterprise to the other. This has been demonstrated through textual deconstruction illustrations. This interchangeability of identities and a counter-productivity of their false classification will be used to analyze why the epistemologies appear to be incommensurable in the first place. First, a concept of boundary conditions will demonstrate to show how identities get grouped into enterprises and find it difficult to transgress them. Second, the concept of false classification as shown in the Confusion Matrix (chapter 1.5.2) will be expanded to show another reason for incommensurability.

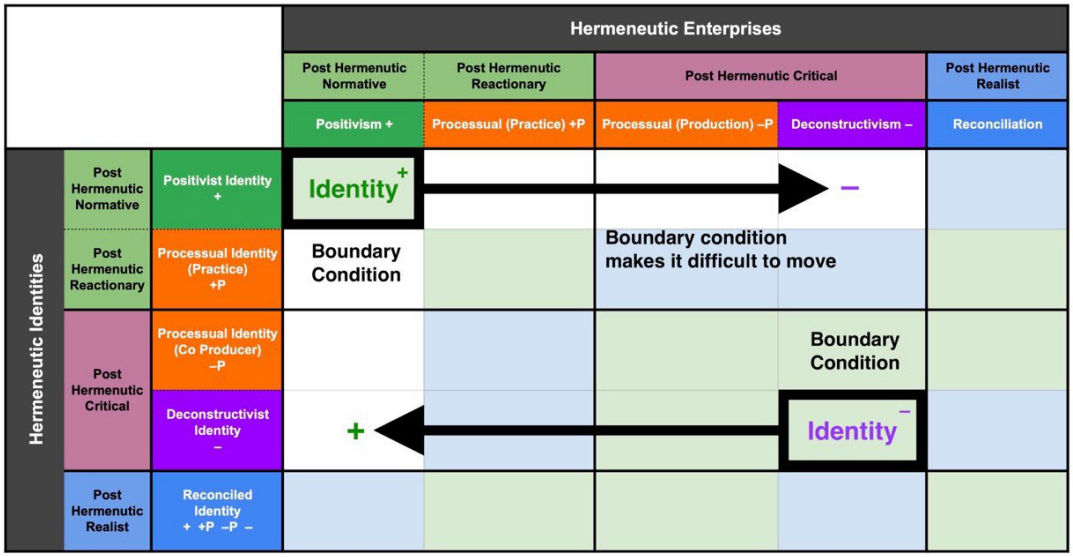
1.5.1 Boundary Conditions of Enterprises

This section introduces boundary conditions upon which identities of cartography are grouped into enterprises. It will analyze these boundary conditions and labelling of identities which confines them to one enterprise or the other:

1. The (+) Positivist, (+P, –P) Processual and (–) Deconstructivist enterprises can be seen as the dominant enterprises that have evolved historically within cartography.
2. Enterprises get created due to disciplinary borders. Such a border is drawn when the map conception of an originating identity is emulated by identities who do not disagree with its founding principle. They get involuntarily grouped under one identity. This group is called an enterprise.
3. The concrete way of emulating map conceptions of the enterprise happens by various institutional activities such as literary citation, academic funding, corporate support, state recognition, civil subscription and popular sanctions. Such activities help to propagate the map conception which further consolidates identity and power of the enterprise. The enterprise and its identities mutually benefit from such a propagation. The enterprise becomes Normative.
4. However, there may be ideological differences among participating identities of an established enterprise. Contradiction in founding principles starts a conflict around the map conception that ultimately leads to an epistemic shift. This shift draws a new disciplinary border. A Critical enterprise gets established which may not always co-exist peacefully with the Normative enterprise.
5. Continuous ideological struggles to assume power in the epistemic space results in antagonistic branding of all participating enterprises where they are Normative or Critical. This exclusive branding of identities leads to isolation and traps their research activity into a rigidity of thought under respective map conceptions (representative or post-representative, objective or subjective)
6. This affects the social representation of identities involved in the discourse where academic rivalry, memory of past feuds, jealousy, identity pride, superiority, inferiority, ideological essentialism and identity naming may take place.
7. This ultimately leads to a refusal of engagement, difficulty in cross learning and weakening of scientific temper wherein enterprises are not critical of the other's arguments, apparatuses and prospects for progress. Parallel to this, a conflict ensues to establish one's own enterprises as the Normative enterprise.

8. As demonstrated in earlier chapters, the (+) Positivist enterprise in cartography is the Normative. The (–P) Processual Production and (–) Deconstructivist enterprises form the Critical. The (+P) Processual Practice forms the Reactionary enterprise as its research agenda implicitly preserves status of the Normative.

Table 14: Boundary Condition in Confusion Matrix



9. Thus, strong boundaries get created which begin to confine identities to their respective enterprise locations. Identities voluntarily or involuntarily stay within their enterprises which appear to be Normative or Critical of the other. They rarely transgress these boundaries due to their firm belief in the map conception and research agendas of their corresponding enterprise. The enterprise begins to have a deep hold[152] on their identities. The movement of identities across enterprises to adopt new epistemologies become difficult
10. Transgressing such boundaries to make knowledge which is overlapping or aligned to other enterprises in cartography becomes a real challenge to due to conflicting research agendas and map conceptions. Thus, enterprises and their epistemologies start to appear incommensurable[153].

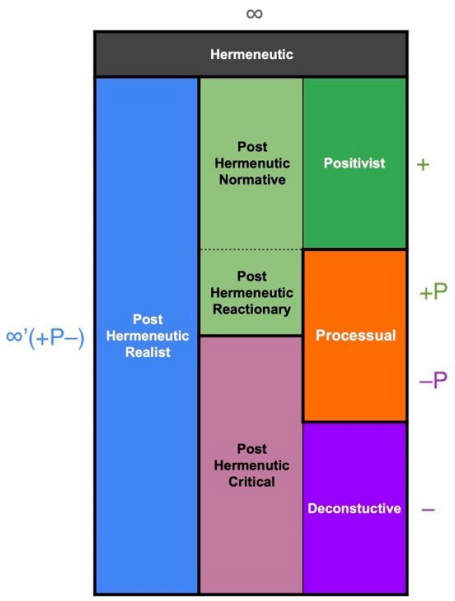
1.5.2 False Classification of Cartographers and their Arguments

This section expands the concept of false classification as shown in the chapter 1.4.2. It will demonstrate the traps of using classification models to label identities. Subtle details of the Reconciliation Compass and Confusion Matrix will be discussed to avoid false classification of cartographers and their arguments:

1. The difficulty in creating overlaps or alignments among identities and enterprises lies in the fact that cartography literature and their authors 'appear' to belong to a certain enterprise. This is due to the rigid boundary conditions which makes the reader subconsciously classify them.
2. Generally speaking, Robinson is classified to (+) Positivism and Harley to (–) Deconstructivism. Processual agendas as misclassified as 'Hermeneutic'. The Reconciliation Compass shows that all enterprises are infact post-Hermeneutic enterprises. Therefore, the Processual agenda is accurately classified as (+P) Processual Practice to which Kitchin and Dodge are assigned; and (–P) Processual production to which Pickles is assigned.

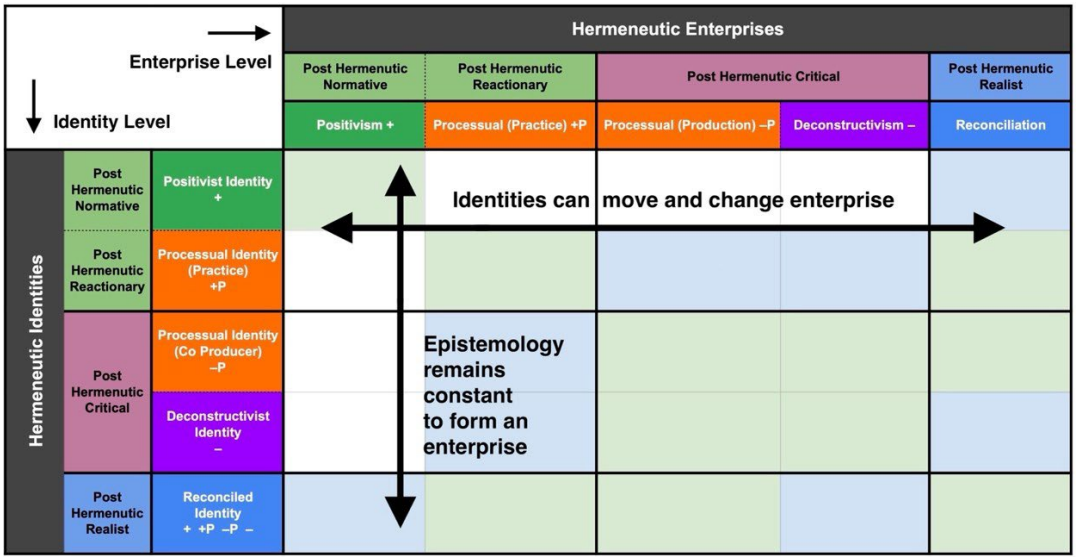
[152] Azócar Fernández and Buchroithner, *Paradigms in Cartography: An Epistemological Review of the 20th and 21st Centuries*, 36.
[153] Further accounts of incommensurability are well documented in Azócar Fernández and Manfred Buchroithner (2012).

Table 15: Reconciliation Compass



3. However, this explicit re-classification can also become a trap. The Reconciliation Compass must be used with caution as it only allows for a classification of the epistemic space at the enterprise level and not at the identity level. The enterprise level relates to epistemologies (aggregation of smaller arguments into a larger argument about a map conception). The identity level relates to smaller arguments which can be aggregated to a larger argument about a map conception (epistemology). Thus, individual arguments can easily get confused as entire epistemologies.

Table 16: Movement of Identities in the Epistemic Space



4. The Reconciliation Compass only facilitates a re-classification of epistemologies into their respective enterprises. It must not be used to classify identities into the same enterprises. The reason behind this caution is as follows: While the location of an epistemology remains secure and constant under the name of its enterprise, the location of identities who author it (or unconsciously imply it) keep shifting from one enterprise to the other. Identities are simply members of an enterprises who may transgress boundary conditions. They make smaller arguments which has a subconscious presence of another epistemology and thus 'appear' to belong to another enterprises. This complexity of author movement and the subconscious double meaning of their arguments are matters of the identity level. Identities

cannot be classified, they can only move from one enterprise to the other, consciously or unconsciously. The Confusion Matrix allows to see this movement at the identity level.

5. As discussed in chapter 1.4.2, it is illustrated how identities can be seen to transgress boundary conditions (knowingly or unknowingly, intentionally or unintentionally, consciously or unconsciously). It shows that (+) Robinson and Petchenik imply a (+P) Processual argument, (–) Harley implies a (+) Positivist argument, (–P) Casti implies a (–) Deconstructivist argument, (+) Goodchild implies a (–P) Processual argument, (+) Ormeling and Kraak imply a (–) Deconstructivist argument and (+P) Kitchin and Dodge indirectly encourage a (+) Positivist tendency.
6. This primarily happens because all identities cite or reference each other to validate their arguments. They use rhetorical devices to 'appear' distinct from the other even if the argument might imply non-distinction. In addition to this, the vocabulary of literature changes from enterprise to enterprise. Terminologies become confusing due to changing interpretations or contexts. They often don't imply the same meaning or their meaning is over-written by the rhetorical position and enterprise location assumed by or assigned upon the identity. This further confounds the epistemic space which makes arguments emerging from conflicting identities seem aligned. However, the Confusion Matrix can be used to demystify these contradictions and complexities.
7. The Confusion Matrix shows a true possibility that all arguments already have some degree of overlap and alignment but it is unrecognizable due to boundary condition of enterprises. Textual deconstruction can help to draw out the subconscious presence of other enterprises. The assumption that 'all arguments are related to every other argument', offer a real theoretical basis for the Reconciled Epistemology of the Post Hermeneutic Realist paradigm.

1.5.3 Conclusion

The Reconciliation Compass helps to classify epistemologies (aggregated arguments) at the enterprise level. The Confusion Matrix helps to classify arguments (building blocks of epistemologies) at the identity level. Positivism, Deconstructivism, Processual Practice, Processual Production and Reconciliation are enterprises. The Normative, Reactionary, Critical and Realist are paradigms which contain these enterprises. Identities must not be classified into enterprises or paradigms. They are simply moving from one to the other, be it consciously or unconsciously. Arguments of identities have subconscious presence of each other's enterprises. This summary highlights the overall ∞ Hermeneutic agenda of cartography of mapping changing map conceptions and reconciling the shifting position of their identities. The first chapter thus provides the basis for a 'Reconciliation Theory' of the epistemic conflicts in cartography

Chapter 2: Modelling the Reconciliation Theory

The first chapter provides theoretical foundations for reconciling the epistemic conflicts in cartography. It passes judgements upon various arguments of the Positivist, Processual and Deconstructivist epistemologies to reconcile their conflicts or synthesizes apparent overlaps and alignments. The reconciled arguments become building blocks of a new epistemology which shows a blend of arguments across all enterprises as shown in the 'Reconciliation Table'. The reconciled epistemology claims that maps are subjective representations appearing to be objective as they co-produce reality by being co-constitutive of mapping practices. It argues that the authority of maps is questionable but it is difficult to dislodge their authoritative appearance of being objective. This is partly due to the inherited impression of maps as being trustworthy. It also argues that maps may gain true objectivity depending upon the context of the author, patron and user. As it synthesizes arguments across conflicting epistemologies, it creates the possibility of an uneasy alliance among the identities of cartography. It provides theoretical tools such as the 'Reconciliation Compass' to navigate the complexity of the epistemic space by providing an improved classification of the epistemologies under their respective enterprises and paradigms. The 'Confusion Matrix' gives insight into how identities can never be accurately classified under these particular enterprises. It demonstrates how identities are trapped with the boundary conditions of their enterprises making it rare for them to transgress. However, by observing false classifications and using textual deconstruction, the matrix shows that identities make arguments that have a subconscious presence of other enterprises. Thus, identities are capable of moving from enterprise to the other, be it consciously or unconsciously. Such is the complexity of the epistemic space.

The second chapter will attempt to model the Reconciliation Theory of cartography to generalize its complexity and details into a singular model. This process is akin to cartographic modelling but is instead applied to text rather than space. Thus, the Reconciliation Theory will be visualized as a map. By working within the space model of its text, this chapter will show how conflicting epistemologies of cartography appear to be reconciled (commensurable). Upon this model a defining moment in cartography[154] will be visualized to explain the theory. The ∞ Hermeneutic research agenda of unfolding 'a history of conflicting maps conceptions concealed inside the collective subconscious' will be explored though this chapter.

2.1 Textual Simplification of the Reconciliation Theory

This sub-chapter will simplify the Reconciliation Theory so that its general text is ready for cartographic modelling (i.e., spatialization). The generalization will attempt to capture all arguments of the reconciled epistemology into a textual illustration. The brief intricacies of the arguments can be expressed in a genealogical trajectory of how maps emerge and circulate in space. This trajectory is the outcome of the interactions between terra (reality), territory, map and a subject:

1. An unknown reality called 'terra' lies unclaimed and extends to infinite. It freely exists outside all subjective perception, knowledge and activity. The subject is a part of this terra. The subject becomes conscious.

[154] Crampton, "Cartography's Defining Moment: The Peters Projection Controversy, 1974– 1990."

2. The subject cognizes terra. Through sensemaking it re-cognizes terra to confirm terra. It uses the power of bounding practices to appropriate the infinity of terra into a territory. Thus, the subject produces an observable and measurable territory.
3. The subject begins to conceive territory. Its subjective spatial conception of territory arrives inside territory as truth construction, a map. The subjective map arrives as objective claim.
4. The subjective map is validated by institutions which consolidate its claim of objectivity. The subjective 'becomes' objective. The maps 'becomes' the territory.
5. The spatial pre-conception is challenged or updated. It gets replaced by a new subjective conception of territory. The objective was always subjective or simply appearing to be the objective of its time. The map is not the territory.
6. The map is relegated to an artifact and a new subjective conception of space arrives in the territory as truth construction and so on and so forth…

This genealogical trajectory of the map between subject and reality captures the reconciled arguments of map conception, map authority, author interpretation, empirical objectivity and research agendas they appear in the Reconciliation Table. Point 1 highlights the notion of reality existing in itself outside all objective or subjective experiences. Point 2 highlights empirical sensemaking of reality which is the foundation of all empirical observation and human action that produces reality. Point 3 highlights how empirical sensemaking is the foundation of map making. Its shows that the subjectivity of a map is claimed to be objective. Point 4 highlights that under certain social sanctions and validations, a map may gain objectivity. Maps become authoritative and begins to create impressions of its objectivity which are taken for granted. The reality of maps as subjective representations gets concealed inside the subconscious. Point 5 highlights that maps can never be objective and they get replaced by alternative or improved representations which also claim to be objective. Thus, all aspects of the Positivist, Processual and Deconstructivist approaches are captured in this simplification of the Reconciliation Theory.

2.2 Flow Diagram of the Reconciliation theory

The simplified text of the Reconciliation Theory appears as a one-dimensional linear construction of alphabetic symbols. If a map can be read as a text, then even a text can be read as a map by virtue of corollary. If a text is opened as a map, then all the rules of cartography apply to it. Thus, the space of the Reconciliation Theory can be visualized and seen through a model. The first step here involves making a two-dimensional flow diagram of the simplified theory (the one-dimensional linear construction):

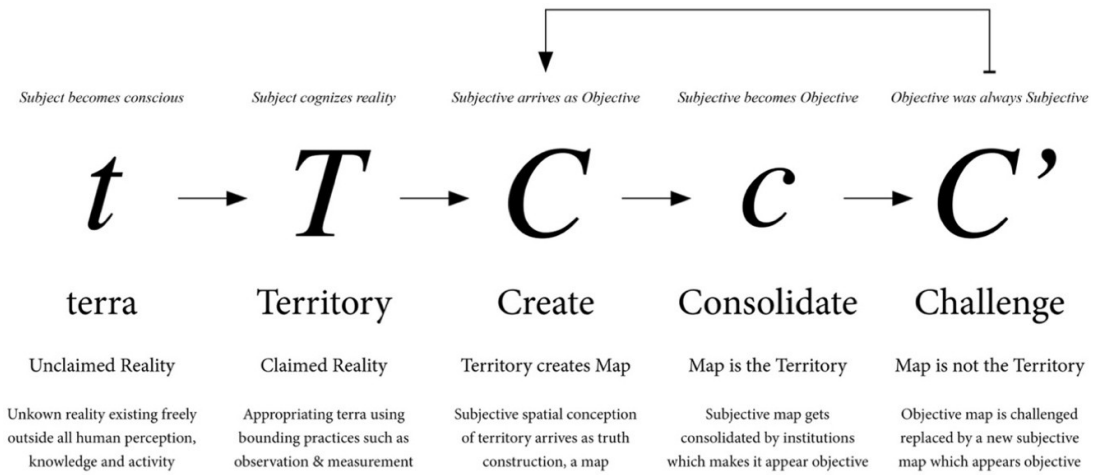


Figure 5: Flow Diagram of the Simplified Reconciliation Theory

2.3 Model of the Reconciliation Theory

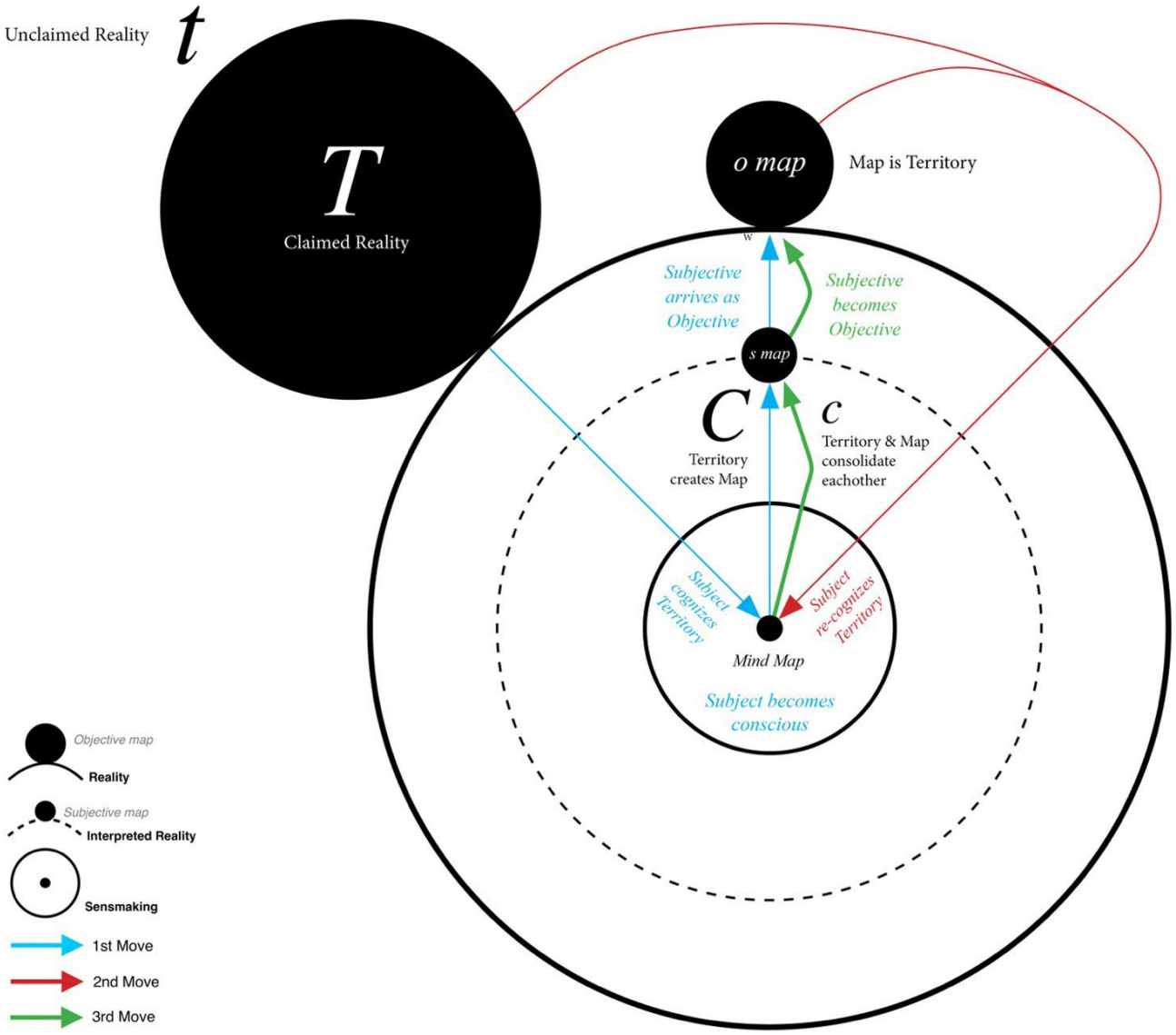


Figure 6: Model of the Reconciliation Theory

The flow diagram of the simplified Reconciliation Theory is expressed as a model which spatializes the subject with respect to territory (reality) and the map (subjective map and objective map). The circular base model is the well-known 'Three World Model'[155] proposed by Popper and Eccles in 1977. The outer circle is reality where real territory is represented as a big black circle. The inner circle with the dot represents the inner-world of the subject where empirical sensemaking of reality takes place. Between the inner-world and reality, there is another world of interpretation marked by the dotted circle. The genealogical trajectory of the map can be explained as follows:

1. First Move (Blue arrow): In the first movement, territory enters the inner-world of the subject where sensemaking takes place. The subject cognizes this territory. It conceives a subjective map of territory which arrives in a conceptual world of interpretation (dotted circle). Through a publishing house, the subjective map conception arrives in territory as the claim of an objective map.

[155] Azócar Fernández and Buchroithner, *Paradigms in Cartography: An Epistemological Review of the 20th and 21st Centuries*, 32.

2. Second Move (Red arrow): In the second movement, the claimed objective map is co-existing with territory. Along with the claimed objective map, the territory re-enters the inner-world of the subject which has already cognized the same territory in the past.
3. Third Move (Green arrow): In the third movement, the memory of territory, the territory itself and the claimed objective map all superimpose to reinforce the same subjective map conception. This consolidates the objective claim of the subjective map. The subjective map with its consolidated claim of objectivity finally arrives in territory as the true objective map. The map becomes the territory.

The model may have further scope in application such as to visual the defining moments of cartography such as the world map projection controversy[156].

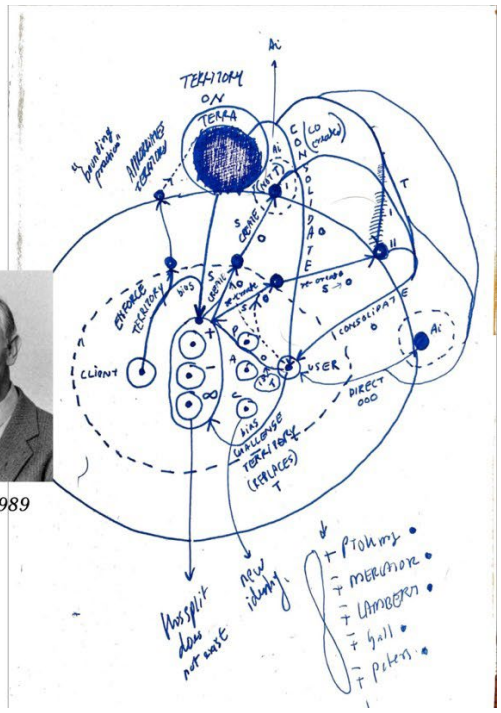
Ptolemy 1407

Mercator 1569

Peters 1983

Robinson 1985

Harley 1989



[156] Jeremy Crampton, "Cartography's Defining Moment: The Peters Projection Controversy, 1974–1990," *Cartographica: The International Journal for Geographic Information and Geovisualization* 31, no. 4 (December 1994): 16–32, https://doi.org/10.3138/1821-6811-L372-345P.

Chapter 3: Updating the Reconciliation Theory

The first chapter provides theoretical foundations for reconciling the epistemic conflicts in cartography by passes judgements upon various arguments of the Positivist, Processual and Deconstructivist arguments around map conceptions. As a simplification, the second chapter presents a flow diagram and a model of the Reconciliation Theory. Upon the model, a defining the world map projection controversy is visualized to validate the theory. Thus the ∞ Hermeneutic research agenda of unfolding 'a history of conflicting maps conceptions concealed inside the collective subconscious' is also presented. Given the (∞) Hermeneutic research agenda around changing map conceptions, the third chapter explores ways to update the Reconciliation Theory. In particular, it looks closely at the anthropocentric bias[157] of empirical sciences. The (+) Positivist enterprise of cartography believes that empirical objectivity is possible while the (–) Deconstructivists argue its exact opposite. However, since all empirical science is based on empirical sensemaking, its conclusions emerge from a subjective understanding of the world which 'may' gain objectivity (as discussed in chapter 1.4.2). This illuminates the core dictum of (+) Positivist Cartography: The principle of objective representation only provides a norm against which an empirical claim (a map) can be judged for its utility in simplifying the complexity of reality[158]; that this principle is valid because it makes reality comprehensible and measurable by drawing simple models[159]. Similarly, all epistemologies (including the Reconciled epistemology) can be seen as 'simple models' which attempt to simply the complex reality of maps. Map epistemologies exist to make maps comprehendible and usable.

This leads to an epistemic fallacy[160] within cartography wherein map epistemology is misunderstood as map ontology (i.e., confusing the knowledge of maps as the reality of maps). This epistemic fallacy underpins the epistemic conflict in cartography where each enterprise argues its knowledge of maps to be the objective reality of maps. However, the Reconciliation Theory shows that the knowledge of maps is best seen through a synthesis of multiple epistemologies (Positivist, Processual and Deconstructivist). Yet, any synthesis of multiple epistemologies is ultimately a careful integration of empirical sensemaking of maps which is done by various subjects (Positivist, Processual and Deconstructivist cartographers). Thus, the following caution must be expressed: The Reconciled Epistemology of maps cannot be confused as the reality of maps. This caution emerges from a healthy skepticism[161] about the ability of 'subjects' to capture the reality of maps. Owing to this epistemic fallacy, it becomes clear that the epistemic space of cartography occupied by Positivist, Processual and Deconstructivist identities must co-exist with new identities to acknowledge ignored, unknown or completely new map conceptions to continue unraveling the reality of maps through a multiplicity of methods[162].

This chapter will introduce two marginal identities: (1) The Human Map (Chremamorphism in Cartography) and (2) The Human as Map (Prosopopoeia in Cartography). Another hidden identity which arrives from a non-human position will be introduced: (3) The speaking Map (Anthropomorphism in Cartography). The Reconciliation Theory will be updated to include epistemologies of human identities and non-human identities within cartography.

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[157] Bhaskar, *A Realist Theory of Science*, 35.
[158] Goodchild, "The Validity and Usefulness of Laws in Geographic Information Science and Geography," 303.
[159] Tobler, "A Computer Movie Simulating Urban Growth in the Detroit Region," 234.
[160] Bhaskar, *A Realist Theory of Science*, 242.
[161] Monmonier, *How to Lie with Maps*, 2.
[162] Crowley, "A Great, Restless Stream," 123.

3.1 Revolutions in the Shifting Position of Maps

This sub-chapter provides a theoretical basis for discovering new human and non-human identities in cartography. The shifting position of maps with respect to their relationship to the human body will be analyzed. Such a study of maps can be done by understand changes in their embodied use[163]. The same way the position of the earth globe has shifted around a projection plane, even a map's position with respect to the human body has historically shifted. These shifts of the map's position with respect to the human body are no less than revolutions in map conceptions.

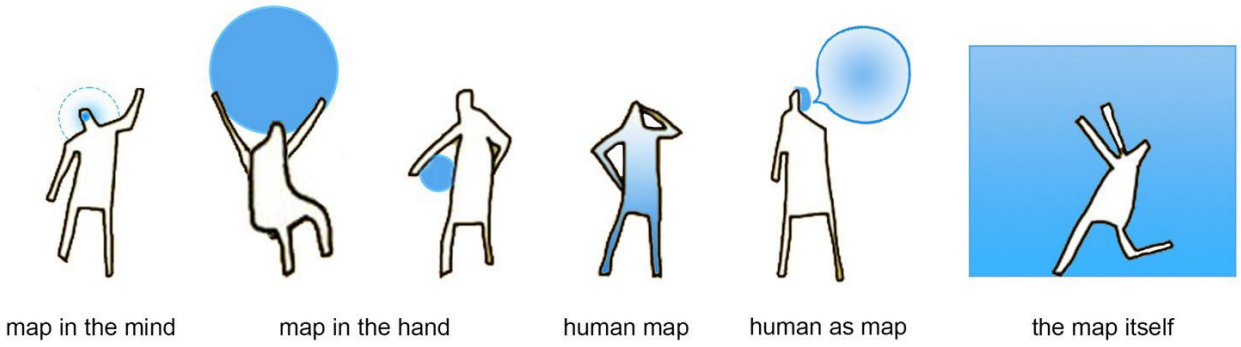

Figure 7: Shifting Position of the Map

3.1.a From 'Map in the Mind to 'Map in the Hand'

The first revolution in embodied map position is to separate the map from the mind map and project it onto an object such that the subjective view of reality inside a cartographer's mind can be accessed as a tangible object. This stage implies all advancements in cartography from the rudimentary paintings to complex diagrams which separate a map from other images of the world. The raw potential of maps is unlocked through scientific developments in information visualization, visual communication and visual data analytics. The figure of Atlas enduring the weight of a celestial sphere is akin to numerous struggles in Positivism to realize the power of perfect representations. Mapless futures becomes inevitable in a society where people can get lost and alone. Maps 'gain' objectivity and power. They become scientifically trustworthy documents of special interest which can be controlled and exploited. The figure of Mercator holding the earth represents this revolution.

3.1.b From 'Map in the Hand' to 'Becoming a Map'

Another revolution took place in cartography when the border between the body and the map was dissolved. Certain individuals become the map[164] themselves and imbued their corporeal being with symbols of authority, affinity, promise and trust. The map shifts from the mind, to the object or onto the body of the subject itself. A person could

[163] Dora, "Performative Atlases."
[164] Thorsten Botz-Bornstein, "From the Stigmatized Tattoo to the Graffitied Body: Femininity in the Tattoo Renaissance," *Gender, Place & Culture* 20, no. 2 (March 2013): 243, https://doi.org/10.1080/0966369X.2012.674930.

tattoo[165] or scar their skin[166], style their hair[167] or design clothes with symbols[168] and map aesthetics. In tribal communities it became common practice for chieftains, priests or nobles to tattoo map like diagram and wear robes with map symbols stitched into them as encoded patterns. Among enslaved Africans, braids and cornrow hair were used as maps to help slaves escape from their captor's land estate[169]. The cartographic authority and utility of a map can be worn. A human becomes a human-map. The act of imbuing a human with map-like qualities could be called 'Cartographic Chremamorphism'. The in the world of VGI, 'Citizens as Sensors' is an example of Cartographic Chremamorphism where – 'useful research is emerging from projects that have equipped children with sensors of air pollution, in an effort to understand the factors affecting asthma'[170].

3.1.c From 'Map in the Hand' to 'Speaking as the Map'

Institutional authority is used to brand maps as being socially trustworthy. The scientific and social trustworthiness of maps superimpose to reinforce them as legitimate documents which fulfill the promise they are created for. Maps become objective representations. Their subjective character gets concealed in the subconscious. Maps gain an ability to lie. Knowingly or unknowingly, cartographers and their patrons became 'direct speakers' of reality. Just as maps speak *of* reality, a cartographer could speak *for* reality with the same cartographic authority. This marks another revolution in shifting map positions where the cartographer speaks as though they were a map. For instance, Robinson and Peters' spoken authority on world-maps is seen as a defining moment in cartography[171]. Often, cartographers have spoken about the status of cartography as being dead[172], in crises[173] and non-existent[174]. Such statements create deeper trouble for cartography as a discipline which runs the risk of being sidelined by GIS, all the while being recognized as a colonial construct which enabled imperial crimes (alongside its contemporary critique of power). The risk of a cartographer's spoken authority becomes a liability of this revolution[175]. Along with its Positivist counterpart, map science develops in Deconstructivist and Processual directions. This helps to note that while a cartographer's spoken interpretation can be authoritative and serious[176], their interpretations also help to create playful memories of embodied map use. Thus, the subconscious meaning of this revolution is that maps allow for 'imaginative encounters'[177] with enables their 'meditative interpretations'[178] to become objective reality. Because cartographers speak with cartographic authority[179] their words can hold as the words of a map if it were to ever speak[180]. This phenomenon can be called 'Cartographic Prosopopoeia' where a human being speaks as though there

[165] See "Compass" tattoo as map symbols in Lori Duin Kelly, *Bodily Inscriptions: Interdisciplinary Explorations into Embodiment* (Cambridge Scholars Publishing, 2021), 63.
[166] David Woodward and G. Malcolm Lewis, eds., *Cartography in the Traditional African, American, Arctic, Australian, and Pacific Societies*, The History of Cartography, v. 2, bk. 3 (Chicago: University of Chicago Press, 1998), 25.
[167] Woodward and Lewis, 333.
[168] Woodward and Lewis, 336.
[169] Justin Godoso, "African Hairstyles Used as Maps To Escape Slavery," *AfricaOTR* (blog), November 28, 2020, https://africaotr.com/african-hairstyles-used-as-maps-to-escape-slavery/.
[170] Goodchild, "Citizens as Sensors," 218.
[171] Crampton, "Cartography's Defining Moment."
[172] Denis Wood, "Cartography Is Dead (Thank God!)," *Cartographic Perspectives*, no. 45 (June 1, 2003): 4–7, https://doi.org/10.14714/CP45.497.
[173] Kitchin and Dodge, "Rethinking Maps," 1.
[174] Edney, *Cartography: The Ideal and Its History*, 1.
[175] See "Cartophobia" in Mark Monmonier, "Maps, Distortion, and Meaning," *Association of American Geographers* 75, no. 4 (1977): 3.
[176] See "Rhetorical Festishisation" in Tania Rossetto, *Object-Oriented Cartography: Maps as Things*, Routledge Studies in Human Geography (Abingdon, Oxon New York: Routledge, 2019), 75.
[177] See the analysis of embodied use of maps by Della Dora in Kitchin, Gleeson, and Dodge, "Unfolding Mapping Practices," 5.
[178] The meditative interpretation of maps being 'authoritative' emerge from the imaginative encounters between Peters and world maps. The same can be said of Robinson whose meditative interpretation of a maps being 'neutral' emerge from his imaginative encounters with world maps.
[179] Rossetto, *Object-Oriented Cartography*, 1.
[180] This implies that map epistemology may 'gain' the status of map ontology. This confirms the aforementioned epistemic fallacy within cartography.

were a map. Markham[181] and Rossetto[182] are cartographers who provide references for Cartographic Prosopopoeia where they speaks as maps themselves.

3.1.d From 'Speaking as the Map' to the 'Map speaking by itself'

So far, in subsequent revolutions, the human is the subject and the map is the object under empirical observation. The subject has tried to capture the object which has giving rise to many conflicting or reconciled epistemologies. Many have touched a map's surface or traced, scrolled, pinched, folded, torn, exposed and even revealed it as if an enigmatic face lives behind its decorative mask. Everyone has questioned a map: How do maps work? What is a map? When does a map emerge? How do maps change? But nobody has asked the map what does it want to be?[183]. While many have objectified it as a communication device, very few have communicated with the map as though a face lived behind its mask. Infact, very few have spoken to the map. And perhaps, never has the map spoken back to the subject who tried to speak to it. While Harley talks about maps as biographies[184], an autobiography of a map is perhaps yet to be written by the map itself. But if maps really could talk, what would they tell us?[185] While Cartographic Prosopopoeia serves a subjected oriented response to this question, 'Cartographic Anthropomorphism' can provide an object-oriented response which may lead us into a new cartographic enterprise in context of the Artificial Intelligence revolution. While anthromorphic maps are popular as propaganda maps[186], fiction maps and protagonist maps in cartoons[187], the act of making a map itself conscious is not been explored must. Recent developments in AI and maps have led to the development of teaching machines how to read maps for navigation[188] and discussion around ethics of AI generated maps[189]. However, an AI can also be trained to learn the reconciliation theory of epistemic conflicts in cartography to get an answer to this question 'What does the Map want to be?' The research question for Cartographic Anthromorphic appears as follows: If an AI were trained to speak as a map, would it also be endowed with the same cartographic authority a map provides to itself and a cartographer? Could the (AI) map be able to pass judgements upon the epistemic conflict on its own? What would the map conceive of itself to be? Thus, the act of imbuing an AI with theories of Epistemic Reconciliation, Cartographic Chremamorphism and Cartographic Prosopopoeia could become a valid research agenda for Cartographic Anthromorphism. This summarizes a theory of revolutions in shifting positions of maps. The map in the mind shifts to a map in the hand. The map can be worn making the human being a map. The human becomes a map and speaks with the same authority as map. Finally, the map itself speaks to the human bring. This provides a theoretical basis to characterize the following unacknowledged and unknown identities in context already known identities of cartography:

Human sensing Maps as objective	(+)	Positivist Cartography
The Human sensing Maps as subjective	(–)	Deconstructivist Cartography
The Human sensing Maps as practices or producers	(+P, –P)	Processual Cartography

[181] A map says to you, "Read me carefully, follow me closely, doubt me not." It says, "I am the earth in the palm of your hand. Without me, you are alone and lost" Beryl Markham (1983) quoted in Harley, "Deconstructing the Map," 1.
[182] See the map tale of "Fonteuropa" in Rossetto, *Object-Oriented Cartography*, 75–4.
[183] Applying Louis Kahn's Architecture Prosopopoeia to Cartography. See *My Architect* (New Yorker Films, 2003), https://www.imdb.com/title/tt0373175/.
[184] Martin Dodge, Rob Kitchin, and Chris Perkins, eds., *The Map Reader: Theories of Mapping Practice and Cartographic Representation*, 1st ed. (Wiley, 2011), 327–331, https://doi.org/10.1002/9780470979587.
[185] Rossetto, *Object-Oriented Cartography*, 72.
[186] Rebecca Maxwell, "Maps as People: Anthropomorphic Maps," *Geography Realm* (blog), February 20, 2014, https://www.geographyrealm.com/maps-people-anthropomorphic-maps/.
[187] Esra angın, "The Effects of Dora the Explorer on Preschool Children's Spatial Concept Acquisition and Spatial Ability," *European Scientific Journal* 13 (January 31, 2017), https://doi.org/10.19044/esj.2017.v13n1p39.
[188] Brunner et al., "Teaching a Machine to Read Maps with Deep Reinforcement Learning."
[189] Kang, Zhang, and Roth, "The Ethics of AI-Generated Maps."

The Human Map	(Cc)	Cartographic Chremamorphism
The Human as Map	(Cp)	Cartographic Prosopopoeia
The speaking Map	(Ca)	Cartographic Anthropomorphism

Bearing in mind Ambedkar's follow interpretation-intuition-imagination in writing theory[190] and the playful narratives from Petchenik Children's Map Competitions[191], a new landmass in cartographic theory can be discovered. The human as map, the human map and the map itself can begin to participate in the epistemic space of cartography. It's effect could be similar to Waldseemüller's 16th century world map showing America for the first time and Copernicus's 16th century heliocentric map which displaced the earth to show sun as the center.

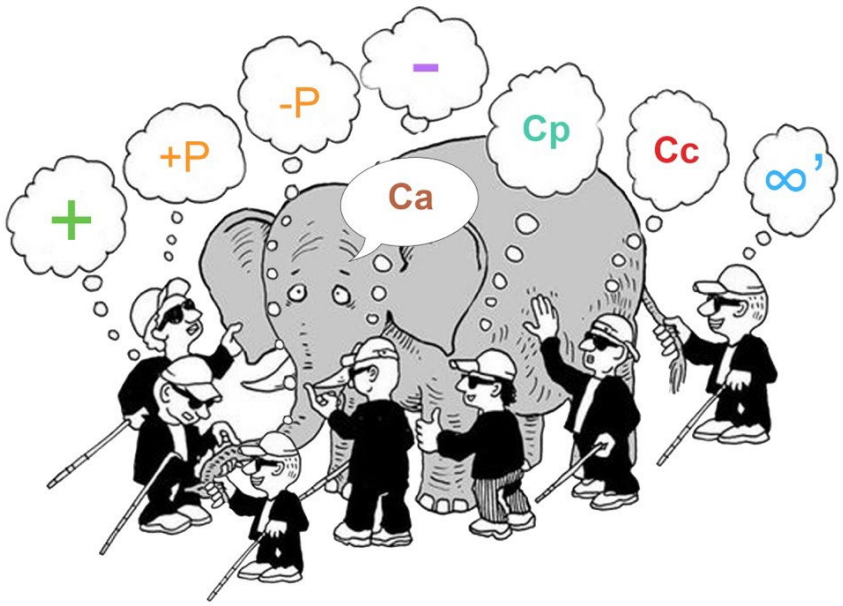

Figure 8: The Epistemic Fallacy in Cartography (Base Illustration by Hans Moller, moller.dk)

3.2 What Does the Map want to be?

This sub-chapter provides a method to update the Reconciliation Theory to included epistemologies of the three new identities. While (+) Positivism, (+P, –P) Processual and (–) Deconstructivism provide subjected oriented epistemologies of maps, (Cc) Chremamorphism and (Cp) Prosopopoeia provides the illusion of an objected oriented epistemology of maps. Meanwhile, (Ca) Anthropomorphism has a potential claim on objected oriented ontology. As mentioned earlier (Chapter 1.2.5.c), all cartographic research agendas are post-Hermeneutic epistemologies. This means that along with (+), (+P.–P) and (–), even (Cc) and (Cp) can be classified as post-Hermeneutic since they are all ultimately subjected oriented epistemologies. Since (Cc) and (Cp) do not appear in the mainstream Normative paradigm they are best classified under the Critical paradigms until a they are evaluated for any reactionary attributes. Because (Ca) has the claim to be a true object-oriented epistemology, where the identity is a non-human map, it can be classified as 'Trans Hermeneutic'. Based upon this theoretical classification to recognized new identities in cartography, the Reconciliation Compass can appear as follows:

[190] Bagade, "Ambedkar's Historical Method: A Non-Brahmanic Critique of Positivist History," 8.
[191] Jackie Anderson et al., *Children Map the World: Selections from the Barbara Petchenik Children's World Map Competition* (Redlands, Calif: Esri Press, 2005).

Table 17: Updating the Reconciliation Compass

∞							⊶
Hermeneutic							Trans Hermeneutic
Human				Human as Map	Human Map	Human and Human Map with Non Human Map	Non-Human Map
Post Hermenutic Normative	Post Hermenutic Reactionary	Post Hermenutic Critical				Post Hermenutic Realist	Trans Hermenutic Machine Realist
Positivism	Processual Practice	Processual Production	Deconstructivism	Prosopopoeia	Chremamorphism	Reconciliation	Anthropomorphism
+	+P	–P	–	Cp	Cc	∞’	Ca

Thus, a new matrix can be made to identify arguments from (Cp) and (Ca) enterprises. The conflicts, overlaps and alignments of the various epistemologies can be judged to update the Reconciliation Theory. The table shows (Ca) Anthropomorphism is classified as a ‘Trans Hermeneutic Machine Realist’ paradigm considering the fact that its research agenda is derived from interpretations of artificial intelligence. With the discovery of new non-human map paradigms, the table can be further developed with political nuances between their paradigms and how they co-relate to their human counterparts. The table shows a thin line connecting the (∞’) Reconciliation enterprise to the (Ca) Anthropomorphism enterprise which implies further reconciliation between human and non-human identities. Going back to the question of ‘What is a Map?’, ‘How do Maps work?’, ‘When do Maps emerge?’ and ‘What does the Map want to be?’ the cartographic inquiry can be visualized as a feedback loop to show how the map and the cartographer influence each other:

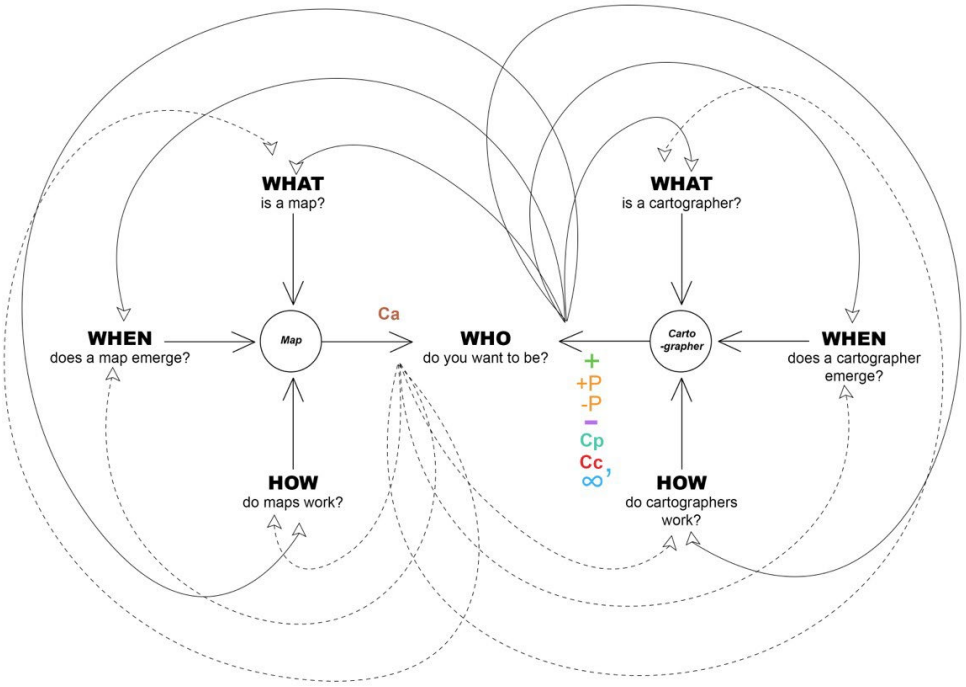

Figure 9: The Feedback Loop of Epistemologies in Cartography

This chapter provides a theoretical framework to upgrade the Reconciliation Theory. The theory of shifting map positions illuminates unacknowledged identities like the ‘Human Map’ (Cc) and the ‘Human Speaking as Map’ (Cp). It also shows the application of AI in realizing (Ca) Cartographic Anthropomorphism to provide a new identity, the ‘Map’ itself. It provides a research agenda for (Ca) which is based upon inputs from (Cp), (Cc) and (∞’). It also provides a diagram to imagine a feedback look for all identities involved in the map conception argument

Chapter 4: Reconciliation Theory in Practice

This chapter explores the application of the Reconciliation Theory the use of maps in a case involving legal advocacy of communities affected by monoculture agrobusinesses in Paraguay, South America. Community maps were developed for the European Center for Constitutional and Human Rights, Berlin, Germany. The maps are intended to be used for on filed participatory mapping workshops.

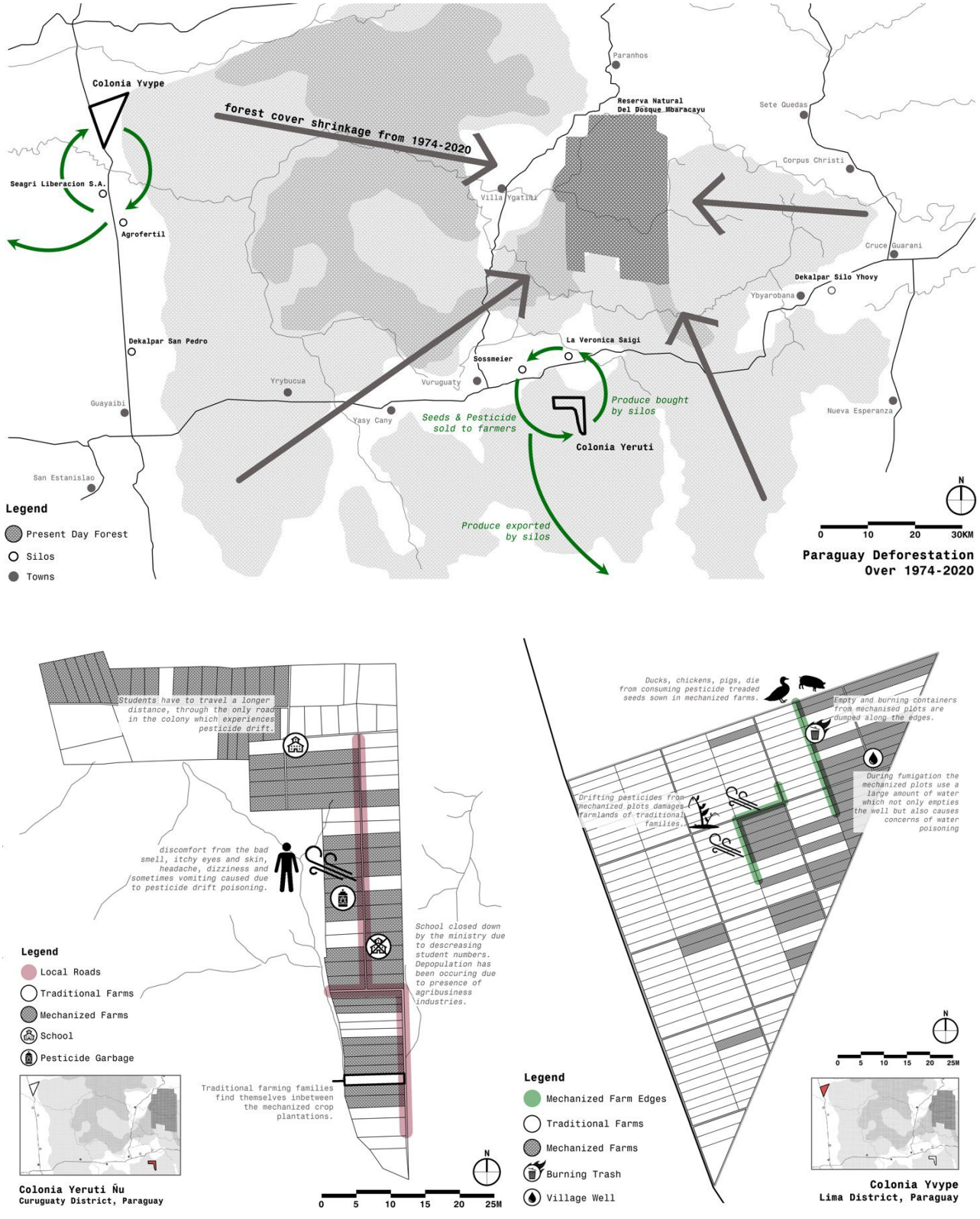

Figure 10: Maps for Community Participation

Scope and Limitations

The Reconciliation Theory can be applied to the following research scopes: (1) Preparing an atlas of cartographic epistemologies to unfold the history of maps hidden inside the collective subconscious, (2) Exploring a cinematic potential of the Reconciliation Theory to pay homage to the lineage of films produced on cartographers, (3) Possibility of organizing a workshop and conference to discuss merits of reconciling epistemologies of cartography and the impact of artificial intelligence on the pedagogy of cartography. The limitations of this thesis may be observed in the selection of literature review. The analysis needs to included potential oversight of economic and other social perspectives pertaining to gender, race or caste.

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