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Does cartographic education need an epistemology? Traditions and transitions in Brazilian school cartography

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Abstract

Knowledge philosophies have been a constant theme in cartography for the last three decades and have resulted in a lively debate on a variety of approaches (modern, postmodern post-processual and post-representational) in the field. These discussions have not had a significant impact on theories and methodologies in cartographic education. Teaching about and with maps embraces well-established ideas, but is reticent to accept alternative modes. This article seeks to analyze cartographic views and epistemologies in the context of school cartography in Brazil in order to point out traditions, transitions and trends that consolidate easy-to-follow principles, but may curb a diversity of approaches in the subfield at the same time. I argue that teaching with maps requires a broader debate about adjustments and innovations beyond the taken-for-granted standards. For this purpose, I will briefly discuss epistemologies in the context of scientific cartography and then, based on the existent substantial bibliography on cartographic education in Brazil, outline specific traditions that have laid the foundations for today's school cartography in the country. Obstacles and challenges for the development and improvement in teaching are identified, with the intention to rethink common practices and experiment alternative or complementary forms and modes in the classroom. The revision and reformulation of specific principles, concepts and themes can strengthen an inclusive, diversified and pluralistic vision in cartographic education that can serve as a useful tool for citizenship cartography in Brazil.

Keywords: Cartographic epistemologies. School cartography in Brazil. Theories and methodologies for map studies.

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Resumo

A educação cartográfica precisa de uma epistemologia? Tradições e transições na cartografia escolar brasileira

Filosofias do conhecimento têm sido um tema constante na cartografia nas últimas três décadas e resultaram em um debate animado sobre uma variedade de abordagens (moderna, pós-moderna, pós-processual e pós-representacional) na disciplina. Essas discussões não tiveram um impacto significativo sobre as teorias e metodologias na educação cartográfica. O ensino sobre e com mapas adota ideias bem-estabelecidas, mas está reticente em aceitar modos alternativos. Este artigo busca analisar epistemologias e visões cartográficas no contexto da cartografia escolar no Brasil para apontar tradições, transições e tendências que consolidam princípios fáceis de seguir, mas que podem coibir a diversidade de abordagens na subdisciplina ao mesmo tempo. Eu argumento que o ensino com mapas exige um debate mais amplo sobre ajustes e inovações além dos padrões tidos como certos. Para essa finalidade, discutirei brevemente epistemologias no contexto da cartografia científica e, a seguir, com base na bibliografia substancial existente no Brasil, delinearei tradições específicas que criaram as fundações da cartografia escolar atual no país. Identificam-se obstáculos e desafios para o desenvolvimento e aprimoramento do ensino, com a intenção de repensar práticas comuns e experimentar com formas e modos alternativos e complementares em sala de aula. A revisão e reformulação de princípios, conceitos e temas específicos podem fortalecer uma visão inclusiva, diversificada e pluralista na educação cartográfica que possa servir como instrumento útil para uma cartografia cidadã no Brasil.

Palavras-chave: Epistemologias cartográficas. Cartografia escolar no Brasil. Teorias e metodologias para o estudo de mapas.

Zusammenfassung

Benötigt die kartographische Ausbildung eine Epistemologie? Traditionen und Transitionen in der brasilianischen Schulkartographie

Wissensphilosophien sind seit drei Jahrzehnten ein konstantes Thema in der Kartographie und haben zu einer lebhaften Debatte über eine Vielzahl von Ansätzen (modern, postmodern, postprozessual und postrepräsentativ) in diesem Bereich geführt. Diese Diskussionen hatten keinen signifikanten Einfluss auf Theorien und Methoden in der kartographischen Ausbildung. Der Unterricht über und mit Karten umfasst etablierte Ideen, ist jedoch bedächtig, alternative oder andere Methoden zu akzeptieren. Dieser Artikel versucht kartographische Ansichten und Epistemologien im Kontext der Schulkartographie in Brasilien zu analysieren, um Traditionen, Übergänge und Trends aufzuzeigen, die leicht zu befolgende Prinzipien festigen, aber gleichzeitig eine Vielfalt von Ansätzen in dieser Teildiziplin eindämmen können. Ich argumentiere, dass der Unterricht mit Karten eine breitere Debatte über Angleichungen und Innovationen erfordert, die über die als selbstverständlich gesehenen Standards hinausgehen. Dazu gehe ich kurz auf Epistemologien im Kontext der wissenschaftlichen Kartographie ein und skizziere dann spezifische Traditionen anhand der vorhandenen umfangreichen Bibliographie zur kartographischen Ausbildung in Brasilien, die die Grundlage für die heutige Schulkartographie des Landes gelegt haben. Ich identifiziere Hindernisse und Herausforderungen für die Entwicklung und Verbesserung des Unterrichts mit der Absicht, gewöhnliche Praktiken zu überdenken und alternative oder komplementäre Formen und Modi im Unterricht zu erproben. Die Überarbeitung und Neuformulierung spezifischer Prinzipien, Konzepte und Themen kann eine inklusive, diversifizierte und pluralistische Vision in der kartographischen Ausbildung stärken, die als nützliches Werkzeug für eine Staatsbürgerkartographie in Brasilien dienen kann.

Schlüsselwörter: Kartographische Epistemologien. Schulkartographie in Brasilien. Theorien und Methoden für Kartenstudien.

Introduction

Since the mid-1990s, school cartography has been consolidating itself as an important subfield of geography education in Brazil.[1] This trend is confirmed by an impressive number of academic publications, research on maps in education, and the organization of specialized events on a regional, national, and international level. There is a growing general interest in the topic sparked by the relevance of map knowledge for teaching and the need to reflect on cartographic representations as powerful visual tools in the classroom and in society in general.

In the Brazilian case, which stands out as an international example of a burgeoning research area, cartographic education was constructed and defined through diverse geographical and transdisciplinary ideas and philosophies at the interface between the sciences and education. These influences determined and continue determining theoretical underpinnings, methodological approaches, modes of "doing" geography, and teaching about maps. However, like any other field of knowledge in academic and scientific environments, school cartography is not an immutable body of know-how, but subject to the dynamics of an ever-changing world that requires an adaptation and adjustment to societal demands and transformations. These changes are guided by epistemological questions and questionings, new paradigms, and methodological innovations that result in new ways of thinking and practicing cartography in educational settings.

The aim of this paper is to reflect on the state of art of existing traditions in cartographic education in Brazil in order to point out critical aspects and obstacles that curb a diversified, pluralistic, and multicultural form of teaching and learning about, with, and through maps. Are there genuine and specific epistemologies for cartographic education or have these knowledge philosophies been derived from scientific or educational theories? To what extent has cartographic education changed or remained the same in the second decade of the 21st century? What is its degree of adaptability and its capacity to change? Can different cartographic epistemologies exist in education? Or, more radically, does school cartography need an epistemology at all?

I do not intend to answer all the questions above, but would like to use them to stimulate further studies. For this reason, this text is an exploratory essay rather than a thorough analysis. My intention is not to revolutionize or subvert the subfield and replace one specific approach with another, but to make an invitation to rethink maps in theory and practice and create options and possibilities for alternative and complementary "cartographies" that are as valid and important as the predominant discourses and epistemologies in school cartography. For this ambitious task, I divided the text into four sections. In the first two parts, I will discuss epistemologies in general and in the context of cartography and cartographic education. The third section deals with the traditions and trends in Brazilian school cartography. The last

part critically assesses the current situation, points out the limits of theories, practices, configurations, and contents, and calls attention to the potential renovation and innovation of the use of maps in cartographic education.[2]

Starting point for this reflection is the proposition that any area or subarea of knowledge in the social sciences, natural sciences, and the humanities is characterized by conflicts, tensions, agreements, and disagreements that define its directions. Whereas disciplines like informatics, communication studies, and geographic information science (GIScience) may undergo drastic or immediate changes due to new technologies or methodologies, other fields remain relatively stable as in the case of hard sciences (e.g., chemistry or physics) or formal sciences (mathematics).

Thomas Kuhn's impactful book "The Structure of Scientific Revolutions" (KUHN, 1962) can be considered one of the most frequently quoted works in the debate on epistemology and transformations in science. Kuhn attempted to develop a scientific model to understand paradigmatic shifts between periods of "normal" and "revolutionary" science that provoke the emergence of new forms of thinking and "doing" research and result in a renovation or even a reversal of directions, methods, and contents in a discipline.

In the case of cartographic education, the term "revolution" may sound far too dramatic to describe the trajectory and present situation of the subfield in Brazil which is characterized by established traditions rather than ruptures, breaks, or tidal changes. A central question is whether cartographic education "as it is" in Brazil is prepared to face the country's social, economic, and political reality and can cope with educational needs.

The blind men and the elephant

What is epistemology? Instead of presenting a definition, the Australian philosopher Stephen Hetherington (2019) uses a parable from ancient India as an example to show the relativity, partiality, and incompleteness of knowledge. The story is about a group of blind men who comes across an elephant for the first time. Guided by touch (though they may have smelled or heard the animal too), each blind man starts to pat parts of the elephant that are in his reach. One of them touches the trunk and describes the pachyderm as a fat snake; another man grabs the ear and thinks it is a fan; yet another imagines the feet as a tree trunk; the elephant's flank turns into a wall; the tail a thick rope; the tusk a lance (figure 1).

Figure 1: Blind monks examining an elephant

Japanese version with blind monks by 17th-century genre painter Hanabusa Itchô, reprint from 1888, Library of Congress, public domain (https://www.loc.gov/resource/cph.3g08725/)

Each man gains a different impression of the animal and insists that his version is the only true story, though all the accounts are partial and do not provide a complete image of an elephant. Hetherington understands this story as a questioning of the nature of knowledge and our limits and limitations to grasp it, since each individual has a distinct personal idea about a topic. He writes

> Imagine asking different people, '*What* is knowledge?' This is not the same question as 'What is *known*?' In epistemology, our aim is not to compile a list of instances of knowledge – what you know, what your mother knows, etc. Such a list could include useful data, as we seek to understand what knowledge is. But it is not our ultimate goal. Instead, we want to push our thinking beyond any such list. We wish to discover what *makes* anything on that list an instance of knowledge: *why* is your knowledge knowledge? What makes *anyone's* knowledge knowledge? (HETHERINGTON, 2019, p. 2, emphasis in original).

The central questions are: What makes knowledge knowledge, how this is accepted (or rejected) in specific groups or academic communities, and how personal knowledge becomes collective knowledge? How are specific worldviews consolidated? Metaphorically, researchers can be blind or blinded when it comes to scientific discourse and feel obliged to follow particular methodologies and theories, sometimes due to peer pressure. Epistemologies are frequently followed, but rarely questioned.

A researcher may ask the following questions: How does current geographical knowledge differ from knowledge during colonial times or from spatial ideas in Argentina? What changes have happened in

the practices and contents of cartographic education in Brazil? How were maps conceived during the phase of the quantitative revolution in Brazilian geography or among critical geographers in the 1970s?

In recent years, the debate on epistemology in Latin America has gained more importance in post-colonial studies, with the intention to create and support true Latin American approaches that are not based on Eurocentric philosophies and reflect regional philosophies, or, in the words of the Portuguese sociologist Boaventura de Sousa Santos, epistemologies of the South (SANTOS, 2014). These ideas aim to expose the predominance of exclusive Western epistemologies that eliminate reflections of regional, cultural, and political contexts in the production and reproduction of knowledge. This regional standpoint raises yet another question: What would be the nature of a Latin American epistemology for cartographic education?

Cartographic epistemologies

The trajectory of cartographic thought from antiquity to the technology age of the 21st century is not very different from other fields. Cartography constructed, destructed, obstructed, and deconstructed its scope, procedures, and identities by undergoing changes concerning the meaning, function, and use of maps. Cartographic epistemologies do not only refer to the development of techniques and the application of methods. They dig deeper into how society conceives maps as a form of understanding the world. In other words,

> Philosophical thought concerning the nature of maps is of importance because it dictates how we think about, produce and use maps; it shapes our assumptions about how we can know and measure the world, how maps work, their techniques, aesthetics, ethics, ideology, what they tell us about the world, the work they do in the world, and our capacity as humans to engage in mapping (KITCHIN; PERKINS; DODGE, 2009, p. 1).

J.B. Harley (1989) affirms that models of a cartographic epistemology have been in force in Europe since the 17th century when "European map makers and map user have increasingly promoted a standard scientific model of knowledge and cognition" (HARLEY 1989, p. 4) that still occupies a central position in present-day cartography. Harley uncovers the discourse of a normative science that prescribes "good" practices, defines "correct" mapmaking, identifies (and rejects) "non-maps", and separates the representation on paper from reality:

> The object of mapping is to produce a 'correct' relational model of the terrain. Its assumptions are that the objects in the world to be mapped are real and objective, and that they enjoy an existence independent of the cartographer; that their reality can be expressed in mathematical terms; that systematic observation and measurement offer the only route to cartographic truth; and that this truth can be independently verified (HARLEY, 1989, p. 4).

Publications on cartographic epistemologies concentrate their analysis on the second half of the 20th century, when cartography consolidated itself as an academic discipline and science at universities and when cartographers developed and adapted models of communication, representation, and visualization for

research on maps (KITCHIN; PERKINS; DODGE, 2009; CAUVIN; ESCOBAR; SERRADJ, 2010; FERNÁNDEZ; BUCHROITHNER, 2014). Cartography upgraded from a set of techniques to a serious science. For the Austrian cartographer Erik Arnberger, with the definition of its scope and methods, cartography gained the status of a formal science (*Formalwissenschaft*) that, different from geography, stresses forms over contents. Arnberger writes that "Cartography is the science of the logic, methodology, and technique for the construction, production, and interpretation of maps and other cartographic forms of expression that are adequate to evoke a spatially correct idea of reality (ARNBERGER, 1970, p. 10, translated from German).[3]

Cauvin, Escobar e Serradj (2010, p. 12-23) propose three approximate phases for the development of scientific cartography since the 1950s. In the period between 1950 and 1975, questions about the potential of maps as a communication tool were among the central research themes linking information theory to cartography. The cartographer changed his (very rarely her) role from "producer" or "manufacturer" of maps to a "communicator", with an emphasis on graphic design, cognitive psychology, and incipient ideas about cartographic education (CAUVIN; ESCOBAR; SERRADJ, 2010, p. 14). Particular attention was paid to the formal aspects of cartography, especially to the modes and forms of communication, conceiving the use of symbols, shapes, and colors as a type of visual grammar, not unlike languages and their norms.

From the mid-1970s to the mid-1990s, computers and technological innovations began to play an essential role on all levels of map-making. Software to process large databases and interpret satellite images became more widespread and popular. At the same time, the main focus in map production shifted from the mapmaker to the map user and "his or her way of evaluating the information transmitted by the map, and (…) what he or she retains from the map. The map thus becomes a 'tool' for reflection for its users" (CAUVIN; ESCOBAR; SERRADJ, 2010, p. 18).

Though the model of cartography as a positivist, normative science was a dominant discourse in the field, it also raised criticism. Post-modern map scholars like J.B. Harley (1989) and Denis Wood (1992) began to question the objective status of maps as mirrors of the world and conceived them as cultural texts or ideological arguments that could only be understood in the context of the society that produced them, linking maps and mapmaking to social aspects, critical theory, and ethics.

Cauvin, Escobar e Serradj (2010) describe the third phase of scientific cartography (from about 1995 to 2009) as a time of increasing influence of information technologies and networks that resulted in a stronger emphasis on GIScience and geovisualization, a term promoted by the American geographer Alan MacEachren (1994) to refer to the interactive and visual analysis of data through computer interfaces, map animation, multimedia, and other tools to improve visual communication and thinking, user participation, and decision-making. MacEachren (2004) affirms that cartographic representations remain essential

components of this new cartography, but the concept of the map has evolved "into a multimedia and multimodal interface to geospatial information (generated on demand where it is needed) and the boundaries between map and image or between real and virtual world blur" (MACEACHREN, 2004, p. iii).

Kitchin, Perkins and Dodge (2009) use a different, more philosophical approach to the history of modern cartography by stressing map theories and epistemologies rather than technological advancements. Taking into account more recent ideas about maps, they flesh out two distinct currents: representational and post-representational cartography. Representational refers to a maps-as-truth approach that aims "to accurately capture relevant features and their spatial relations and to represent a scaled abstraction of that through the medium of a map. Maps seek to be truth documents; they represent the world as it really is with a known degree of precision" (KITCHIN; PERKINS; DODGE, 2009, p. 4). The reduction of errors in the representation and the effectiveness of "good" map design became central questions, and communication models and cognitive and semiotic approaches served as theoretical and methodological support. The questioning of normative cartography, labeled as social constructivist critique and sparked by Harley in the 1980s and early 1990s is also part of this cartographic epistemology since the idea of representation remained the focus point. Maps came under scrutiny as social constructions inserted in a broader context of society, economy, and politics.

Post-representational cartography addresses maps beyond the "straightjacket" of representational thinking by conceiving them as processes, practices, or even movements, prioritizing the term mapping over map to point out its dynamic nature: "Mapping can then be conceptualized as a suite of cultural practices involving action and affects. This approach reflects a philosophical shift towards performance and mobility and away from essence and material stability (KITCHIN; PERKINS; DODGE 2009, p. 17). Maps are understood as creators of meaning (ontogenetic) rather than having a meaning by themselves (ontological), resulting in

> a shift in cartographic theory from seeking to understand the nature of maps (an ontological project) to examining the practices of mapping (an ontogenetic project). This move denies maps any ontological security as representations of reality and instead posits that they are always in the state of becoming, brought into being through embodied, social, and technical practices to solve relational problems such as plotting, planning, navigating, and so on (KITCHIN; DODGE; PERKINS, 2011, p. 6).

It would require a separate paper or even a book-length study to discuss all the aspects, perspectives, and thinkers of post-representational cartography which go beyond the scope of geography. Maps can be inscriptions, performances, unstable and complex texts, unfolding practices in constant becoming, rhizomatic tracings, or simply "things", to mention just a few conceptions (for a brief overview, see FERNÁNDEZ; BUCHROITHNER, 2014, p. 87-99).

Cartographic education does not accompany the pace, alterations, and novelties in science. Almost thirty years ago, Gerber (1992, p. 201) wrote that "much of the mapping skills work in schools relies heavily on cartographic thinking that is at least twenty years old". In other words, new trends in scientific cartography have not automatically provoked changes in education. The knowledge transfer from university to school is not immediate, and only specific ideas and methods may effectively be used in the classroom. Established, easy-to-follow methodologies and theories tend to "live" longer whereas alternative and complex approaches struggle with their acceptance. For example, post-representational cartographies are admittedly dense and may not be easily transferable to cartographic education, whereas the simplistic conception of a map as mirror of reality is frequently endorsed without questioning.

Up to date, there have not been many publications that specifically address epistemologies in cartographic education (for an exception, see PADOVESI; OLIVA, 2013). Reflections are either linked to scientific conceptions of cartography or educational frameworks and do not blend or merge these approaches. School cartography based on a scientific approach frequently shows little concern with pedagogy and "how-to-do" strategies for the classroom, whereas epistemologies driven by educational theories may "overpedagogize" learning processes and neglect the map as central focus. Though taking children as "object" of study is indisputably essential, cartographic education or "educational cartography" (WIEGAND, 2003) may run the risk of being downgraded to merely pedagogical questions without exploring principles and processes of map-making and map reading:

> Much of the literature on maps in education is about children's ability to read, interpret and use them [maps]. That is to say, research and discourse starts with children's understanding and misconceptions, not the map itself. Indeed, much research on children and maps is not primarily about maps at all but uses them as vehicles for exploring other constructs such as place knowledge or spatial thinking (WIEGAND, 2003, p. 344).

In a book-length study on learning and teaching with maps, Wiegand (2006) elaborates further on his critique and affirms that

> map-related pedagogy is poorly developed. The evidence for children and young people's learning with maps is fragmented and there are few comprehensive accounts written specifically for teachers. Many teachers, even geography teachers, regard maps (and especially small scale maps) as being unproblematic for learners (WIEGAND, 2006, p. 2).

These concerns raise further questions on where the "home" of cartographic education is located. Is this part of geography, educational studies, or cartographic science?

Epistemological traditions in Brazilian cartographic education

For how long has cartographic education been a theme and an object of study in Brazil? It is not possible to identify a key text, a specific event, or a debate as inspiration to discuss maps in geography

education. Though maps have been central elements in Brazilian textbooks for a long time (BOLIGIAN; ALMEIDA, 2012), the decades of the 1930s and 1940s can be considered a key period for the initiation of debates on cartography and education sparked by national educational plans and policies, and the creation of the Brazilian Institute of Geography and Statistics (IBGE) in 1936.

A starting point for the analysis of epistemological traditions in Brazilian school cartography is the annotated bibliography on "cartography and education" compiled by Archela and Simielli (2009). The list includes more than 200 Brazilian references to journal articles, dissertations, and abstracts from proceedings or annals of academic events between 1941 and 1999. Though this source is outdated since it does not include publications from the last 20 years, it allows to gain insights into the emergence and growth of cartographic education in Brazil and loosely define specific phases in history.[4]

The bibliography only lists a small number of articles from the period between the 1940s and 1960s. Most of the texts were published (or republished) in the *Boletim Geográfico*, which was one of the official journals of the IBGE with wide circulation in the country. In these articles, cartographic education was content-driven, and themes such as geographical locations (CLOZEL, 1946), block diagrams (QUINTIERE, 1947), and school atlases (WEIS, 1959; PINTO, 1964) were discussed for different educational levels, from elementary school to higher education without much concern about pedagogical principles. For example, José Clozel, a school teacher and administrator from the State of São Paulo and editor of the *Educação* journal, published a lesson plan on latitude and longitude, which he considered "one of the most difficult points to understand in the geography program for 4th-grade primary school students" (CLOZEL, 1946, p.1151). For him, the success of an active learning lesson on this topic depended exclusively on the teacher because

> It behooves the teacher to prepare the spirit of the class in order to awaken a lively interest in the subject to be discussed. Once this objective is achieved, the task will be greatly facilitated because, instead of passive listeners, the students will be eager to see their previous and skillfully sharpened curiosity satisfied (CLOZEL, 1946, p. 1151).5

It was only in the 1970s and 1980s when educational theories and methodologies gained more attention in Brazilian education. Works of foreign educators were translated more widely or brought to the country by Brazilian scholars who had direct contact with these researchers or their original studies. Swiss educator and psychologist Jean Piaget introduced a multiple-stage model for cognitive development and spatial learning of children (PIAGET, 1936) that was easily adapted to geography, cartographic education, and spatial thinking (PIAGET; INHELDER, 1948).[6] An example of this pedagogical turn in geography education is the work of the late geographer Lívia de Oliveira who blended Piaget's theory with a humanistic approach and/or environmental perception (for example, OLIVEIRA; MACHADO, 1975; OLIVEIRA, 1978). In the 1980s, several doctoral dissertations that focused directly on geography

education were defended and had a considerable and long-lasting impact on teaching and learning geography (e.g., PAGANELLI, 1982; SIMIELLI, 1986; see also LE SANN, 1989).

Parallel to this trend, the semiology of graphics, originally proposed by the French cartographer Jacques Bertin (1967), was introduced to Brazil and accepted as a rigorous and unambiguous scientific method for map-making and map reading. Translations from the French (e.g., BERTIN, 1980; BERTIN; GIMENO, 1982; BONIN, 1982) helped spread the principles of this cartographic approach. Teixeira Neto (1982, p. 125) considered the semiology of graphics a "true tool for research, experimentation and application, accessible to everyone". He affirmed that "in order to be efficient, the construction of the map must obey the laws of visual perception" and highlighted the value of the map and this specific method as "efficient, dynamic, modern, pedagogical instruments in the reach of students and teachers" (idem, ibidem).

In the 1990s, cartographic education took off as a growing subarea of study at Brazilian universities. Owing to the decisive contributions in the previous two decades mentioned above, studies on maps and education spread in a snowball fashion and became increasingly popular, resulting in publications, involvement of teachers, graduate, and undergraduate students, and the organization of national and international events in the country (ALMEIDA; ALMEIDA, 2014).

Challenges in Brazilian cartographic education

As in any other knowledge field, there are dominant discourses and configurations in cartographic education that provide directions to researchers, teachers, and students. In this section, I will outline several challenges in Brazilian school cartography in order to draw a possible "road map" for the future. These reflections should not be read as a radical critique but rather as an incentive for a broader debate on rules, norms, and guiding principles in the subfield.

Geography as a school subject in Brazil

Similar to many other countries, geography in Brazil does not occupy a key position in basic education. As a subject in social studies, geography is directly competing with history. In addition to its low status as a school subject, the image of the discipline conveyed in society is frequently simplistic and distorted. Maps are taken as symbols of geography, mere emblems, or location devices, but are not explored as forms of visual communication.

Education and/or cartography?

At the interface between education and science, Brazilian school cartography cannot be easily assigned to a specific field of knowledge. At universities, cartographic education is commonly inserted into teacher certification programs (*licenciatura*) in geography that include both content-driven and pedagogical

disciplines in their curriculum. As a result of this hybrid coursework, on the one hand, students learn about educational theories and methodologies in general and are required to sign up for credits of professional experience in the classroom in their specific area before graduation. On the other hand, university courses related to cartography (e.g., general cartography, thematic cartography, GIS) are frequently offered without an educational context and exclusively deal with contents and not with how-to-do strategies. In Brazil, it is common that the classes are taught by engineers, agronomists, geologists, or geographers who were trained in scientific cartography but not in education. As a result of this lack of dialogue, there are tensions and ruptures between contents and practices on different educational levels, from pre-school to higher education.

Cartography as a language

The semiology of graphics is commonly recognized as the predominant methodology to teach about maps, map-making, and map symbology and gained a status similar to a cartographic law or language. Jacques Bertin developed his ideas about the visualization of spatial data as a scientific approach to maps, not as a methodology for school cartography. This means that the semiology of graphics is undoubtedly sound from a scientific point of view that seeks an objective visual grammar for map communication. However, its rigor and rules do not leave space for exceptions or creativity and can be a challenge in the classroom. Despite an impressive volume of publications on map symbology, there has not been a debate on strengths and weaknesses and possible updates to adjust Bertin's framework to online cartographies and more recent conceptions of the map.

Is the cartographic curriculum for education up-to-date?

A comparison between cartographic contents of the past and the present reveals that specific topics in cartography have been mandatory in geography education. Principles such as scale, geographic coordinates, projections and cartographic conventions are still relevant, but may need repacking or repackaging in the sense of critically analyzing their meanings for education.

New technologies – new maps

School cartography in Brazil is not completely adjusted to the new virtual world in which computers and handheld devices have become the main channels of communication. Geography textbooks and lessons still evoke the paper map as main resource without exploring the potential of digital maps, map animations, and other materials available online or on the computer screen. The user-centered and interactive nature of Web 2.0, combined with new spatial media has resulted in "maps 2.0" (CRAMPTON, 2009) with no resemblance to the traditional paper maps (GARTNER, 2009). Mapping can now be based on crowdsourced data, voluntary GIS, or even geographical imagination systems (BERGMANN; LALLY, 2021).

These new cartographies have not only resulted in different map forms and formats, but also in different modes of engagement with maps, compared to the linear communication models of the past that reduced cartographic communication to a simple transmission between sender and receiver. The map user can find himself/herself inside a map now and is invited to navigate through a map on a screen, zooming in or out on specific places or features and retrieving further information by a simple mouse-click.

Social relevance of maps

In addition to the new technologies for map-making and mapping, maps are increasingly used for social projects, as in the case of community or participatory mapping, frequently labeled as social cartography. Alluding to Milton Santos's (1987) idea of citizen space, cartographic activism or citizenship cartography in education entails the critical use of maps and mappings to read and transform space for a better world and could turn school activities into useful contributions to a neighborhood, a specific part of the population, or society in general (SEEMANN; CARVALHO, 2017).

Conclusion

The aim of this article was to briefly discuss the trajectory of cartographic education in Brazil as a field of knowledge based on specific epistemologies and configurations that, at the same time, can guide teaching and learning practices and curb a more diverse intellectual landscape when these principles gain the status of prescriptions and rules that are "cast in stone". Though this analysis has only scratched the surface of this theme and left many of my initial questions unanswered, I would like to reiterate my main argument: multiple philosophies are needed for school cartography to explore the full potential of maps as an important form of visual communication. More attention should be paid to the map itself, not only as a scientific object, but also as a material or digital cultural artifact. In this context, epistemologies should shift from how knowledge and truth claims are generated *about* maps to a map-centered approach that sets as its task to understand how knowledge and truth claims are generated *through* maps as vehicles of information about the world (BITTNER; GLASZE, 2018, p. 121).

Changes begin with the questioning of individual practices and taken-for-granted theories and methodologies, not to start a revolution, but to grasp the meaningfulness of maps in education and daily life. Ultimately, my reply to the initial provocative question raised in the title of this article is that epistemologies (in the plural form!) for cartographic education are necessary, but due to their density and complexity, nothing speaks against occasionally drawing, reading and mapping before discussing theories. Rethinking (school) cartography is necessary, but sometimes we could just start with a simple map.

Notas

[1] In Brazil, it is common to use the terms *educação cartográfica* and *cartografia escolar* as synonyms. However, it is important to stress that the former expression refers to educational practices beyond classroom settings, whereas the latter focuses more narrowly on teaching-learning processes at school. In this article, I will use both terms interchangeably, since I do not intend to focus on specific settings or contexts. Neither term is of frequent use in other languages such as English, Spanish, or French, though the word *Schulkartographie* is very common in Germany.

[2] This critical assessment is both an inside and outside view of Brazilian cartographic education due to the author's active involvement in the debates in Brazil and the contextualization of his reflections on an international scale.

[3] Original text in German: "Kartographie ist die Lehre von der Logik, Methodik und Technik der Konstruktion, Herstellung und Ausdeutung von Karten und anderen kartographischen Ausdrucksformen, die geeignet sind, eine räumlich richtige Vorstellung von der Wirklichkeit zu erwecken".

[4] This section does not include more recent material since my intention is to examine the genealogy of school cartography, i.e., the principles and theories that have guided studies and practices in the subfield. The focus of this essay is not on the current developments in Brazilian cartographic education, but on the traditions that have shaped school cartography decisively. There is a number of recent bibliographical reviews on specific topics: cartographic epistemologies (GIRARDI, 2011), cartographic symbology (ESTEVES, 2020), cartography in basic education (DUARTE, 2016), and inclusive perspectives (SENA; CARMO, 2020).

[5] Original text in Portuguese: "Convém ao mestre preparar o espirito da classe a fim de lhe despertar vivo interesse pelo assunto a ser ventilado. Conseguido esse objetivo, terá sua tarefa extremamente facilitada porque, ao invés de ouvintes passivos, estarão os alunos ansiosos por verem satisfeita sua curiosidade prévia e habilmente aguçada".

[6] Piaget's studies on children's intelligence and representation of space were only translated to Portuguese decades after their original publication in French (PIAGET, 1970; PIAGET; INHELDER, 1993). Though Piaget's cognitive development theory is still widely used as a reference, other national and international educational scholars (Vygotsky, Paulo Freire) have become equally influential references in Brazilian geography education.

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