MAKING OF: A CARTOGRAFIA DE CONTROVÉRSIAS E AS PESQUISAS EM PROJETO MAKING OF: THE CARTOGRAPHY OF CONTROVERSIES AND PROJECT RESEARCH

RODRIGO DAS NEVES COSTA, GISELLE NIELSEN AZEVEDO, ROSA RIBEIRO PEDRO

PT | EN

Rodrigo das Neves Costa is an architect and Ph.D. in Architecture. He is a Project Coordinator of the permanent staff of the Oswaldo Cruz Foundation - Fiocruz, and researches on Project and Project Theory, Theory of Architecture, Architecture and Science, and Social Studies in Science and Technology. arqrcosta@yahoo.com.br

Giselle Nielsen Azevedo has a degree in Architecture and a Ph.D. in Production Engineering. She is an Associate Professor at the Faculty of Architecture and Urbanism at the Federal University of Rio de Janeiro, Brazil, and the Graduate Program in Architecture at the same institution. She is the leader of the Environment-Education research group - GAE, where she guides and develops research on School Architecture, Educational Territories, Post-Occupancy Assessment, Place Quality, and Environmental Perception. gisellearteiro15@gmail.com

Rosa Maria Leite Pedro has a degree in Psychology and a Ph.D. in Communication. She is a Full Professor at the Institute of Psychology at the Federal University of Rio de Janeiro and at the Graduate Program in Psychology at the same institution. He is the leader of the Contemporary Culture research group: subjectivity, knowledge, and technology, guiding research on psychosocial, historical, and collective processes, with an emphasis on subjectivity, technologies, and surveillance. rosapedro@globo.com

Abstract

Some buildings evidently can provoke debates, polemics, and disputes. Such divergences are often irreconcilable and lead to public debates. Thus, controversy is a term that adequately describes the design practice, and its capacity to articulate and concentrate debates allows us to explore the potential of design as a research observatory. By subverting the traditional concept of method, the cartography of controversies enables the observation of how the design practice handles the differences in the creation of architectural objects, increasing their

complexity as research objects. This paper intends to demonstrate the usefulness of this method for design research. As such, we consider the design practice as a way to articulate debates and disputes and highlight its compatibility and potential to the method. Subsequently, we present the cartography of controversies, demonstrating how it enables more complex research objectives. We also discuss the construction of cartography devices and representations, presenting ways to achieve a balance between the simplicity required for representations and the richness desired for the object. Finally, we present a brief cartographic experiment to illustrate the use of the method during the design analysis.

Keyword: Design, Design practice, Method, Cartography of controversies

1   Introduction

Some architecture and urban planning designs can provoke debates, polemics, and disputes between divergent arguments and perspectives. There are countless examples, such as Cidade das Artes, Museum of Tomorrow, and the renovation of the Mário Filho Stadium - Maracanã - for the 2018 World Cup. Projects are capable of catalyzing and concentrating debates as they provide visibility and materiality to the issues under dispute. Much of the architectural design practice requires coordinating differences, which can lead to public debates. In this context, the design practice often involves the management of controversies.

Venturini (2010, p. 261) believes that controversies are "situations where actors disagree or, rather, agree to disagree". In this sense, they situate between the impossibility of ignoring divergent positions and the agreement for mutual coexistence. A fundamental aspect of the design research practice involving controversies is the search for events in which the collective coexistence is present in its most complex form while considering multiple and heterogeneous factors. Mapping out controversies allows us to observe important issues and, above all, divergent perspectives regarding a common issue. The ability that the design practice has to articulate such debates is precisely the element that enables great research possibilities.

However, if on one hand, investigating controversies can be a way to achieve a level of complexity in research objectives, on the other hand, it also hampers the process of dealing with the investigative practice itself. Controversies are often confusing and, consequently, difficult to manage. Venturini (2010), considers that students who partake in the cartography of controversies are like animals raised in zoos and then placed in their natural habitat: there is an immediate feeling of euphoria and, soon after, a sense of perplexity. At the beginning of controversies, there are mixed arguments and a lack of clarity or order. The emphasis on controversies creates a tension between the simplification required to enable an understanding and the inherent complexity of the research objects. While controversies enable the complexity of the objective, they also increase the challenge of research representation[1] .

In this sense, the cartography of controversies represents a variation regarding the traditional meaning of the method, increasing the complexity of the research object. It does not follow an organized set of steps to develop a route towards a previously established destination. There is a methodological inversion because, by emphasizing controversies, cartography provides visibility to an unexpected reality that makes the journey and objective walk hand in hand (Pedro, 2010). Controversies explore coexistence in its most complex form, which is full of disputes, disagreements, and contradictions. Expanding the complexity of the architectural design practice to the research object is a question of method in which the cartography of controversies can contribute.

Through this perspective, this paper intends to demonstrate how the cartography of controversies can be useful in design research. To achieve this, we propose understanding the design practice as a means for articulating controversies, highlighting their potential regarding the research method. Subsequently, we present the cartography of controversies, emphasizing the usefulness of investigating the design practice through its own means for the observation of architectural objects under development. In the third section, we argue about the importance of building devices and the challenges of cartographic representation, presenting ways to overcome them. Finally, we present a brief cartographic experiment to illustrate how the method can be used during a design analysis.

2   Designing to articulate controversies

The multiple and integrated nature of the design practice is quite well-known. Mapping out design processes demonstrates several interactions and influences that can also be called internal and external restrictions (Lawson, 2011). Whenever we consider one of these elements – legal zoning, a budget review, a protest, a

resistance towards some material, or a new client – the design must be renegotiated, generating a new integrated design (Latour, Yaneva, 2008). There are several negotiations, variations, and interferences during the process until it becomes stable, albeit temporary. That is, a lot of work is necessary to reach an arrangement capable of incorporating different solution requirements. Many versions may be discarded during this process.

The interaction among different requirements is often irreconcilable during the design process. It is not just a matter of multiplicity but also divergence, which can lead to public debates in some cases. However, these situations represent the actual coexistence of different actors with different views – and their disagreements – as well as the need of inhabiting a common space that represents the design practice (Yaneva, 2012). The design practice must articulate differences and, consequently, it involves controversies.

Controversy, as a term, refers to "the sciences and technologies that have still not been stabilized, closed or 'black boxed' [...] a general term to describe shared uncertainty" (Venturini, 2010, p. 260). Controversies are marked by instability, debates, and disagreements. Although they are very different when it comes to content, they have common characteristics that define them: diversity of actors, alliances and opposition movements that change, deceptions about the apparent simplicity, disputes between actors, and conflict harshness (Venturini, 2010). We must consider disagreements through a broad perspective. Controversies begin when actors discover they cannot ignore each other and end when they reach a mutual coexistence agreement. When there is something between these two extremes, it is a controversy.

Therefore, design and controversy have a lot in common. Both involve multiple factors and heterogeneous actors with the confrontation of divergent arguments at the same time and space. This allows their definition as "hybrid forums", that is, spaces of conflict and negotiation between actors (Callon, Lascoumes, Barthe, 2001). The actors involved are hybrid – ranging from people to construction materials – and the issues addressed can range from timelines to state policies. Hybrid forums are spaces where groups can meet and discuss different issues. The design can also be considered a forum for debating controversies, a place where the design practice is a specific means of conducting[2] them. The controversy perspective in the design practice allows us to explore a more complex setting.

Another useful connection between design and controversies is that, besides operating as a forum for discussions and operation focused on research objectives, the design practice concentrates and organizes debates and represents a possibility to track and record controversies. Design can be conceived as navigating through a field of controversies: a sequence of versions, successes, and failures; a journey of unstable definitions and knowledge; a set of building materials and technologies; a meeting to assess user concerns (Latour, Yaneva, 2008). Buildings can promote and concentrate debates as they provide materiality to disputes, which, consequently, facilitate the identification of controversies. The recognition of the design practice as an observatory for controversies allows us to explore its potential as a research method.

3   The cartography of controversies

Let's imagine we need to visit a new area, such as when we arrive in a different neighborhood and walk around to find a certain address. As the neighborhood is a new place for us, we walk slowly, paying attention to buildings, street names, shops, cars, landmarks, and people passing by. This is how cartography suggests a change in the research conduction, subverting the traditional sense of the method, which is defined by the etymology of the word: *meta* - objective and hodos - *path* (Passos, Barros, 2015). In the classical approach, research is a predefined path to reach a goal presented beforehand (Latour, 2004). The definition of a hypothesis about the object of study is the materialization of previous concepts regarding the objectives, which condition the steps to follow during the research process. On the other hand, cartography proposes a methodological inversion[3], transforming *meta-hodos* into *hodos-meta*. It is about walking to get to know a place instead of getting to know a place to be able to walk through it; more of a trail than a rail.

Since there are different cartographic methods, we selected the cartography of controversies for this paper. Initially developed by Bruno Latour in Paris in the 1990's – and currently taught and used at various universities around the world –, the method can be defined as an "exercise of crafting devices to observe and describe social debate especially, but not exclusively, around technoscientific issues" (Venturini, 2010, p. 258). To a certain extent, it is a procedure derived from the Actor-Network Theory[4], sharing common principles but without as many theoretical complications. However, the Cartography of Controversies and the Actor-Network Theory are not different approaches. Instead, they are two means of expressing the same ideas, supported by the same bases, whereas the first one is more conceptual and the latter is more operational.

Through this perspective, working with cartography involves observing and describing. Observing means being as open as possible, which takes place through multiple points of view. Describing refers to the art of mapping

out objectives, processes, and practices, tracing the complexity of the phenomena without replacing specific aspects with generalist views (Yaneva, 2012). In the cartography of controversies, the description is based on the situations represented according to the dynamics of the actors and the spaces and times they generate. Although observing and describing are common activities in traditional research methods, the cartography of controversies provides them with new meanings.

Along with the distinction between the trail and track, Latour compares cartography to a travel guide. He considers that the main advantage in comparison to a "method discourse" is that the guide does not get confused with the territory it represents. It can "be read or forgotten, relegated to a backpack, smeared with butter and coffee, scribbled, deprived of some pages that will light the barbecue fire" (Latour, 2012, p. 38, our translation). This allows for variations, unexpected factors, and changing routes. There is, once again, a clear distinction compared with the traditional scientific method, considered the hypothetical-deductive aspect. Cartography is closer to a research strategy than a set of steps to follow.

The cartography of controversies has some fundamental ideas. Venturini (2010) argues that in the cartography of controversies there are no definitions to learn, premises to honor, hypothesis to demonstrate, procedures to follow, or a correlation to establish. It is an *ad hoc* procedure, built on a case-by-case basis, in which the method monitors the movements that occur. Another relevant aspect is that objectivity is not achieved by the supposed idea of becoming distant from the object of study but by multiplying points of observation. Numerous and partial perspectives towards phenomena will lead to more objective and impartial observations (Venturini, 2010). This is related to the acknowledgment that participants can be as informed as researchers, representing a redistribution of knowledge. It is not enough to restrict actors to the role of informants during the observation of practices. They must have the ability to develop their theories as specialists (Latour, 2012). Cartography allows the investigation of objects by their own means, its construction by the actors themselves with the simultaneous emergence of the method and object during the research practice.

How can the cartography of controversies particularly help us with the design research? First, it allows us to disregard some preconceived ideas. By mapping out controversies, we can produce descriptions of architectural objects, practices, and processes, avoiding a metaphysical analysis (Yaneva, 2012). Mapping out controversies stimulates us to understand architecture simultaneously as technical and social realms, avoiding previous separations. It focuses on architectural experiences, the roughness of controversies, and the language of the actors instead of theoretical frameworks of interpretation and closed types or categories. The cartography of controversies is an investigation that fosters the visualization of the intricacies of collective actions in architecture.

But why searching for controversies? This is not where things are the most confusing and difficult to understand? Yes, and that is why controversies are so promising. If cartography is complex, it is because collective life itself is complex (Venturini, 2010). The moments of disagreements and debates make us understand collective life as it develops in practical terms. Controversies involve all types of actors and demonstrate a dynamic social perspective. They emerge from the debate about stable issues, which consequently generates conflicts. The construction of a shared world often occurs due to a clash of conflicting worlds (Venturini, 2010). Following the design development process provides a kind of making of that allows us to visualize movements and their related controversies, reaching greater complexity. The cartography of controversies invites us to look behind the scenes of the object construction: the "grey box"[5] instead of the "black box". It is about investigating architecture in action, during the creation process, and at its raw state. However, achieving such complexity also leads to representational challenges.

4   Cartographic representation

The approach towards the object of the study provided by cartography can cause confusion and disorientation. The act of not subjecting the object to a pre-established theoretical framework provides fewer certainties in the research process. Following the actions of the actors can lead to endless connections and difficulties regarding the materialization of research (Latour, 2012). Controversies are inevitably turbulent and confusing, and their management can be a challenge due to the great amount of information or application of different tools. The cartography of controversies generates difficulties for the materialization and organization of research.

However, having a more open attitude towards the object of study does not mean a lack of accuracy. The cartographic proposal requires research instruments. The success of cartography, as a method, always requires essential procedures embodied by devices (Kastrup, Barros, 2015). The development of devices is a fundamental task in cartography to fulfill the object of study, providing unique forms of existence. This is normally related to ontological politics, whereas certain devices produce certain versions of the object (Mol,

1999). The attention to the creation of these devices is also the recognition of the method and object as simultaneous creations.

There are some definitions for the term device from the cartographic research perspective. Without referring specifically to research, Michel Foucault (1979, p. 244, our translation) defines a device as

> a decidedly heterogeneous set that includes discourses, institutions, architectural organizations, regulatory decisions, laws, administrative measures, scientific statements as well as philosophical, moral, philanthropic concepts. [...] A device is the network that can be established between these elements.

Foucault considers the concept of the term device is connected to a way of doing, particularly related to the connections generated by a set of elements. Based on this concept, Deleuze (1990, p. 155, our translation) states that devices are "machines to make see and make speak", made of "different types of segments". He highlights four types of segments with different functions: visibility, enunciation, strength, and subjectivity. Based on his perspective, devices give existence to objects. A similar notion by Latour and Woolgar (1979) considers the concept of inscription devices. Dealing with the scientific method, they use the expression to characterize the devices used to materialize the phenomena studied by scientists through machines or scientific articles. In this case, these are the devices that make the scientific fact real but certainly not neutral. The notions have similarities and differences as well. Foucault's perspective considers the composition of the device, while Deleuze shows us how the device can be useful to provide materiality to practices. Latour, on the other hand, emphasizes the policy of devices by acknowledging its agency capacity.

During cartographic research, we searched for devices that highlight complexities. We previously discussed ways of understanding the design practice in a more complex way based on notions of controversy. Thus, we propose to understand research devices as ways to provide a specific, partial, and temporary visibility to this complexity, recognizing its agency capacity. The composition of different kind of devices – ways of providing visibility – enables to fulfill a more complex objective. Devices must be combined through a type of kaleidoscope, allowing the representation of the object in different images that, according to the movement performed, can produce different combinations. However, this issue introduces a crucial research challenge involving the cartography of controversies: representation.

The achievement of complex objectives requires practices that can do so, which also considers visibility. The challenge of cartographic representation resides in balancing out the simplicity required to understand maps and the complexity desired to understand the object (Venturini et al., 2015). That is, it provides maps that are rich in detail but difficult to read or maps that are easier to read but does not have substantial content. There are some important points to consider regarding this. First, it is necessary to understand there is not research without representation: the observation and representation occur simultaneously during research practice. However, there is a subtlety regarding the role of representation in cartography. To avoid simplifications, we must consider that representations are not absolute. In other words, the map does not get confused with the territory but each representation is a means of making it exist (Venturini, 2012). This means that the whole is greater than the sum of its parts: different representations are maps adjusted successively. It is about considering the representations as partial and temporary views that make the object exist in a particular way without, however, exhausting it.

It is necessary to admit that representations are dynamic phenomena. Dealing with non-stable elements in the cartography of controversies, the map "is a drawing that follows and arises at the same time of transformational movements" (Rolnik, 2007, p. 23, our translation). There is always a provisional, functional design until the imposition by new cartographies – landscapes and reliefs. Cartography provides a series of photographs linked to the dynamics of controversies, accentuating their contingent, temporary and uncertain[6] aspects (Pedro, 2010, p. 89), as it proposes to investigate objects in action (Latour, 2011). The movement involves going from final products to the production, from stable and "cold" objects to unstable and "hotter" objects. When we work with cartography, we face an object-process. It is essential to understand the changes implemented by the actors during the construction of the artifacts (Latour, 2011). The object of study in cartography is subjected to constant changes and, by following and describing the practices, it is possible to increase complexity. Thus, cartography is based on risk reports, as the representations follow each other[7] .

Another fundamental aspect is the way representations are presented. Venturini (2015) considers that it is not a matter of making the map as complex as the investigated territory or as simple as compromising this relationship. The author shares the concept of the atlas to overcome this challenge. Instead of a very complex map, the ideal strategy would be to unite different maps as a type of atlas that can reverberate the complexity of the territory. In this sense, cartography is more as a movement or way of connecting representations, like a decomposition located halfway between a single and very complex object and a very simple one.

Finally, if cartography can be considered a means for moving around the territory, it is important to think about how to move through the confusing environments of controversies. Some movements that allow us to access different layers of controversy – in line with the atlas concept – as Venturini (2010, p. 270) points out:

> 1. From statements to literature. [...] The first task of social cartography is to map this web of references, revealing how dispersed discourses are woven into articulated literatures [...]
>
> 2. From literature to actors. Statements are always part of larger networks comprising human beings, technical objects, natural organisms, metaphysical entities and so on. [...]]
>
> 3. From actors to networks. Actors are always composed by and components of networks. [...]
>
> 4. From networks to cosmoses. [...] most actors and groups aspire to some kind of stability. [...] Only by roaming from cosmos to cosmos, can social cartographers perceive the full extent of their controversies. [...]
>
> 5. From cosmoses to cosmopolitics. Take any philosophical, religious, artistic, scientific or technical truth and you will find a controversy. Sometimes disputes are temporarily silenced by the fact that some cosmos has prevailed over the others or by the fact that actors have found a resisting compromise, but no agreement, no convention, no collective reality has ever come without discussion. This does not mean that we could never inhabit a peaceful world, that we could never align our visions, that we could never agree on truth.

5   A quick cartographic experiment

When passing through Barra da Tijuca, in Rio de Janeiro, you may see Cidade das Artes (see figure 1). Located at the meeting point between two road axes designed by Lúcio Costa – the Ayrton Senna and Americas avenues –, the cultural complex houses various artistic and cultural modalities. However, neither the monumentality of the building or the signature by the renowned French architect Christian De Portzamparc were able to eliminate its controversial image. A quick search on Google reminds us that: the building, which would be delivered in 2004, was only completed in 2013 after several interruptions; the cost, initially estimated at BRL 80 million, reached BRL 600 million; and its name changed twice. Such elements evidently disclose the controversies articulated around the project.

Figure 1: Cidade das Artes (City of Arts). Panoramic view. Source: Authors´collection, 2020.

On the internet, we can identify a retrospective and gradual analysis of the debates. Through pieces of information provided – news, architectural articles, and other non-specialized critics, scientific papers, and photos – we can observe discussions involving the design and its controversies. The design, initially called the City of Music, was commissioned to Christian De Portzamparc by the former mayor of Rio de Janeiro, César Maia. The main objective was to build the headquarters of the Brazilian Symphony Orchestra. The extensive program focused on the needs pointed out by the conductor and other musicians of the orchestra besides

some requests from the mayor himself (Magalhães, 2012). Designed in 2002, the result was a monumental building (ArchDaily, 2013, our translation):

> the building is a small city on a large elevated structure and built on a huge terrace that is ten meters high – from where you can see the mountain and the sea – it floats over a public park and a tropical and water garden [...].

However, the design process involved a series of controversies related to specific themes enhanced by the construction process slowdown. At first, people questioned the very existence of the design. Residents of Barra da Tijuca argued the building was inconceivable since the neighborhood's priority was the construction of Metro Lines 4 and 6, whose planned integration station would be located on the same site (Rodrigues, 2008). Then, the design process competed for resources with other existing design processes in the city, such as the constructions for the 2007 Pan American Games, which became a priority (Magalhães, 2012). The scale of the design was intensely discussed as it was associated with high investments and constructive challenge.

Another controversy debated was the technical capacity to implement the design. On one hand, some people argued that a Brazilian architect should have been hired, preferably through a public hiring process, as mentioned by the Parliament Inquiry report created to investigate the project (Magalhães, 2012). On the other hand, the choice of the renowned architect rested on Christian De Portzamparc's recognized competence and his work on previous music venues, such as the *Cité de la Musique*, in Paris.

The design of the building was a controversial subject. Christian De Portzamparc conceived the building, in his own words, as a great reference to Brazilian modern architecture. Cidade das Artes is a large house, a balcony to view the city, and a tribute to the archetype of Brazilian architecture (ArchDaily, 2013). Otávio Leonídio (2009, p. 185, our translation) considers that it represents "a way of reprocessing a certain modern tradition", which generated challenges for Brazilian architects to deal with the project. The method for approaching Brazilian modernism adopted by De Portzamparc – a critical distance – diametrically opposes to the reverence defended by some Brazilian architects, resulting in strong reactions towards the project. Once again, the controversy in dealing with a specific theme – in this case, the Brazilian modern architecture – is evident and based on divergent arguments.

This cartographic experiment provides an example of how designs can raise debates with different views, leading to controversies. From a quick survey, we assembled a map – quite temporary and incomplete – of some issues under dispute and opened these "black boxes". We identified the following actors: Christian De Portzamparc, César Maia, the Brazilian Symphony Orchestra, the City of Music in Paris, the Barra da Tijuca Master Plan, the landscape, the local residents, the construction technology, the Project for the Expansion of the Subway, the 2007 Pan American Games, the community of architects, the city council, the ensemble of modern Brazilian architecture. Each actor was active in the design process – to a greater or lesser extent – and contributed to debate the highlighted themes: the purpose of the project, its priority regarding the city's needs, the technical capacity of the designer and the type of contract, the appropriate cost for the work, the architectural design, and the landscape.

The cartography of controversies also revealed different approaches to the mentioned themes. The dispute regarding the technical capacity to develop the project is evident between arguments that defend the need for specific expertise in the program and arguments that value knowledge concerning the specific project situation. It was possible to observe the opposition between the adoption of a more explicit reference to modern architectural design or not. The controversy gathers and exposes different arguments on various topics. Finally, we can see how aspects related to the design practice - such as the contract process, location, scale, construction technology, or form - promoted discussions about the purpose, technical capacity, and even Brazilian modern architecture between these different actors in an inseparable mix of social and technological dimensions.

6   Conclusion

To achieve greater complexity in objects of study, we must use methods capable of dealing with the project in practical terms. Thus, we propose to understand the design as a means for articulating controversies. By emphasizing not only multiple factors but also disagreements inherent to the design practice, there can be a complex configuration involving actors, themes, views, and arguments. As we saw, expanding the design complexity as an object of study is, in fact, a question of method in which and the cartography of controversies can contribute. This perspective also explores the potential visibility that the project provides – as an observatory for controversies – due to its capacity to promote and concentrate debates. At this point, the cartography of controversies is a method capable of fostering objects of study more aligned with the project specificities – prioritizing the practice and complexity of social life – while searching for controversies related to the objects under construction.

Subsequently, we presented the issues of cartography representation, offering possible interpretations that are neither too simplistic, with a lack of information, nor too complex, becoming incomprehensible. Through the atlas and kaleidoscope concepts, it is possible to carry out and present cartography through different layers or maps, providing different interpretations. We presented clues to guide actions in the cartographic territory. Through a small cartographic experiment, we provided an example of how a set of controversies related to the design process were discussed. Through a quick survey, we built a map, identifying how some issues confronted different arguments and views, mixing social, technological, and functional aspects.

In a broad sense, the cartography of controversies can be a useful method for research projects by providing spatial coordination for disputes and presenting observations regarding such disputes. And yet, monitoring controversies as they evolve makes it possible to unfold political dimensions normally hidden from architecture and considered stable or guaranteed, opening the "black boxes". In this sense, the architectural role as an applied social science is a matter of method, as it requires the use of instruments capable of encompassing the mix between aspects that are usually positioned at opposite ends: material, objective and technological elements on one hand; and immaterial, social and subjective elements on the other hand.

References

ArchDaily. Cidade das Artes / Christian De Portzamparc. *Archdaily*, 9 Dez. 2013. Available at: www.archdaily.com.br/br/01-158494/cidade-das-artes-slash-christian-de-portzamparc ;. Acesso em: 25 abr. 2020.

Callon, M., Lascoumes, P., Barthe, Y., 2001. *Agir dans un monde incertain: Essai sur la démocratie technique*. Paris: Seuil.

Deleuze, G., 1990. ¿Que és un dispositivo? In: Deleuze, G. *Michel Foucault, filósofo*. Barcelona: Gedisa, p. 155-161.

Ferreira, F., 2008. Rizoma: um método para as redes? *Liinc em Revista*, 4(1), p. 28-40.

Foucault, M., 1979. *Microfísica do poder*. Rio de Janeiro: Graal.

Kastrup, V., Barros, R. B. D., 2015. Movimentos-funções do dispositivo na prática da cartografia. In: Passos, E., Kastrup, V., Escóssia, L. D. *Pistas do método da cartografia: Pesquisa-intervenção e produção de subjetividade*. Porto Alegre: Sulina, p. 76-91.

Latour, B., 2004. *Políticas da Natureza*. Bauru: EDUSC.

Latour, B., 2011. *Ciência em ação*. São Paulo: UNESC.

Latour, B., 2012. *Reagregando o social: uma introdução à teoria ator-rede*. Salvador: EDUFBA.

Latour, B., Woolgar, S., 1979. *Laboratory life: the construction of scientific facts*. Beverly Hills: Sage Publications.

Latour, B., Yaneva, A., 2008. Give me a gun and I will make buildings move: An ANT's view of architecture. In: Geiser, R. *Explorations in Architecture: Teaching, Design, Research*. Basel: Birkhäuser, p. 80-89.

Lawson, B., 2011. *Como arquitetos e designers pensam*. São Paulo: Oficina dos Textos.

Leonídio, O., 2009. Cidade da Música do Rio de Janeiro: a invasora. *Arquitextos*, São Paulo, year 10, n. 11.01, Vitruvius, Aug. 2009. Available at: www.vitruvius.com.br/revistas/read/arquitextos/10.111/32 . Acesso em: 25 abr. 2020.

Magalhães, L. E., 2012. Assim se passaram 10 anos. *O Globo*, Rio de Janeiro, Caderno RIO, 14 Dec. 2012, p. 12. Available at: https://acervo.oglobo.globo.com/em-destaque/cidade-das-artes-no-rio-acumula-mais-de-uma-decada-de-gastos-polemicas-8975715 . Acesso em: 25 abr. 2020.

Mol, A., 1999. Ontological politics: A word and some questions. In: John, L., Hassard, J. *Actor Network Theory and After*. Malden, Oxford: Blackwell Publishing, p. 74-89.

Passos, E., Barros, R. B. D., 2015. A cartografia como método de pesquisa-intervenção. *In*: Pasos, E.; Kastrup, V., Escóssia, L. *Pistas do método da cartografia: Pesquisa-intervenção e produção de subjetividade*. Porto Alegre: Sulina, p. 17-31.

Pedro, R. M. L. R., 2010. Sobre redes e controvérsias: ferramentas para compor cartografias psicossociais. In: Ferreira, A., Freire, L., Moraes, M., Arendt, R. *Teoria Ator-Rede e Psicologia*. Rio de Janeiro: Nau, p. 78-96.

Rodrigues, P., 2008. Queremos o metrô linha 4: basta de apatia e comodismo. *Administradores*, 19 Jun. 2008. Available at: https://administradores.com.br/artigos/queremos-o-metro-linha-4-basta-de-apatia-e-comodismo . Acesso em: 25 abr. 2020.

Rolnik, S., 2007. *Cartografia sentimental*. Porto Alegre: Sulina.

Vinck, D., 1995. *Sociologie des Sciences*. Paris: Armand Colin

Venturini, T., 2010. Diving in magma: how to explore controversies with actor-network theory. *Public Understanding of Science*, 19(3), p. 258-273.

Venturini, T., 2012. Building on faults: how to represent controversies with digital methods. *Public Understanding of Science*, 21(7), p. 796-812.

Venturini, T., Ricci, D., Mauri, M., Kimbell, L., Meunier, A., 2015. Designing Controversies and Their Publics. *Design Issues*, 31, p. 74-87.

Yaneva, A., 2012. *Mapping controversies in architecture*. Surrey: Ashgate.

---

1 We understand that representation is part of the research and, therefore, it must occur during the process. In addition, representations are necessary cognitive resources to handle great amounts of information, considering that they are always temporary and partial views. We propose to investigate devices that can fulfill this complexity despite imperfections.

2 It is important to highlight that designs need to solve controversies in order to progress, even if temporarily. Although we cannot state that all cases involve controversies, we can consider that designs normally involve controversies, at lower or higher levels.

3 Cartography is not based on previous versions of the reality, but it handles the object and knowledge as emerging effects of the research process, prioritizing how the investigation takes place instead of previous knowledge (Passos; Barros, 2015). This perspective of the reality is closer to the ontological policy notion, whereas Mol (1999) defends that the reality is structured upon practice.

4 The actor-network theory (TAR) is a set of theoretical and empirical aspects that describes the social relations through a network effect, as an alternative to traditional Sociology, based on the translation concept primarily. (Latour, 2012). The concept was created by a group of sociologists, in 1980, primarily connected to the Center for Innovation Sociology at the MINES Paristech, lead by Bruno Latour. Although Michel Callon and John Law are considered co-authors of the TAR model, their studies are related to Society, Technology, and Science.

5 In science and technology sociology, the black-box term is used to describe a fact or technical well-established artifact. This means that it is not the object of controversies and questions, but is considered data. When a technique is not completely established as a black box, we call it a grey or translucent box (VINCK, 1995). Controversies are debates that consider scientific or technical knowledge that is still not entirely stabilized - grey boxes -, that still hold controversies, questions and debates that have not become black boxes yet.

6 This is a crucial point during the search for representation and visualization methods that consider the temporary and changing aspects of the controversies in architectural designs.

7 It is important to highlight the relationship between tracing and cartography, in the sense that they operationalize each other. Although apparently contradictory, cartography is only possible through successive temporary traces. (Ferreira, 2008; Pedro, 2010). It is as if the traces are part of the various photos in a video, which would be cartography itself.