

Another Measure of Space-Time In Mediatization

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Abstract

We describe the systemic-discursive construction of the calendar of the people of the Tiquié River, in the Amazonian northwest, through digital product analysis. For this, we discuss the multiterritorialisation, in the words of Rogério Haesbaert (2004), of the region of the Negro River and the measure of space-time (SANTOS, 2006) of the natives, which dates back to the pre-colonial period of the South America. Theoretically, we are based on the Social Systems Theory (LUHMANN, 1995, 2005), the concept of mediatization of society (FAUSTO NETO, 2006; VERÓN, 1997) and the semiology proposed by Eliseo Verón (2004, 2013). The discursive productions point to complex binds that are constructed through the intersection of social systems and discourse worlds so distinct - indigenous, scientific and mediatized.

Keywords

Space-time; Mediatization; Semiology; the Amazon.

Initial Notes

The process of mediatization engages different measurements of space-time in modern times. In this article, we investigate the understanding of the indigenous peoples who live by the Tiquié River in the northwest Amazonian region between Brazil, Colombia and Venezuela, which is home to 31 peoples from four language families, remnants of pre-colonial South America. For this population, the year is divided into several stations, according to the passage of constellations in conjunction with the identification of ecosystem processes. Particularly, we analyze the digital product¹ developed through the couplings among indigenous researchers, *Instituto Socioambiental*² ("Socio-environmental Institute"), and the *InfoAmazonia*³ platform, which resulted in a complex interactive infographic which contributes to debate about the indigenous space-time measurement.

Therefore, we investigate the production of systemic-discourse of the concept of space-time of the indigenous peoples of the Tiquié River, in northwestern Amazon. This work is part of a more comprehensive study (FLÔRES, 2017), whose aim was to understand the mediatized problems about the transnational Amazon, as reported in the *InfoAmazonia* database platform. The present research was developed as a case study, based on the proposition of communication as an evidential discipline (BRAGA, 2008). In addition, we had a conference call interview with the journalist Gustavo Faleiros, coordinator of *InfoAmazonia*, the platform responsible for creating the digital product.

As a theoretical-methodological framework, we use the semiology developed by Eliseo Verón (2004, 2013) to identify discursive conditions and grammars of production of the discursive objective. The systemic-discourse construction of the calendar of the peoples of the Tiquié River was analyzed in the light of concepts from the Social Systems Theory (LUHMANN, 1995, 2005), the theoretical perspective of mediatization (VERÓN, 1997; FAUSTO NETO, 2006; GOMES, 2006) and the space-time notions of geography (HARVEY, 1992; SANTOS, 2006; HAESBAERT, 2004).

Time, Space and multiterritorialities

The relationship between nature and society is structured on the notion of space as defined by Milton Santos (2006). Specifically, the sense of space takes

¹ Website (in Portuguese): <<https://ciclostiquie.socioambiental.org/pt/index.html>>. Accessed on March 23, 2017.

² ISA is a Civil Society Organization of Public Interest, founded in 1994, with a focus on social and environmental issues. Website: www.socioambiental.org

³ Database platform on the problems of the Amazon forest. Website: www.infoamazonia.org

into account human activity in the natural environment on different scales - cartographic, on a quantitative basis; and geographical, from local to global, on a qualitative approach. In this respect, the geographic space must be understood as hybrid (SANTOS, 2005) because it integrates material and symbolic processes, involving a set of social relations, foundations and temporalities.

The problem of space must also be apprehended together with the notion of time. After all, while the former determines where events occur, the latter defines when they occur. Therefore, events are the element that unifies both of them; they happen at a given moment, thus creating time, and geographically exist in one place, hence creating space. For this reason, space and time are inextricably linked: "The idea of time is inseparable from the idea of the objects and their value" (SANTOS, 2006: 103, our translation). However, the (moral and physical) duration of things cannot be known in advance, "only ex post".

At the beginning of everything, only physical events were universal. This holds true both for the formation of the universe with the *Big Bang*, as well as for the climate of our planet. As pointed out by Milton Santos (2006: 105), "the so-called continental, regional and local climates have a global behavior. Human facts had local incidence first. Their relevance expanded slowly" (our translation). As a result, from a historical point of view, it took thousands of years to record geographically large events which affect mankind, e.g., those witnessed in contemporary times. Therefore, only today "one can truly speak of global historical events" (our translation).

This problematization of the relation between space and time gained a new scale with David Harvey (1992), for whom the latest information, communication and transportation technologies have resulted in the compression of time-space in the contemporary world. This *post-modern condition* focuses mainly on cultural aspects, coupled the new forms of movement of capitalism. The characteristics of Fordism, e.g., economies of scale, monopolized capital, universalism, etc., would be linked to "modernity", while capitalism with flexible accumulation or in the post-Fordist era, with small-batch production, fictitious capital, individualism and the like, would be linked to "post-modernity" (HAESBAERT, 2002: 69).

In addition to the semantic link of these concepts, which are understood in a hybrid manner (SANTOS, 2005), this promiscuous relationship is highlighted in the unification present in the expression of time-space, in the view of Harvey (1992), thus refuting any tradition which dissociates time and space.

I mean to signal by that term processes that so revolutionize the objective qualities of space and time that we are forced to alter, sometimes in quite radical ways, how we represent the world to ourselves. I use the word 'compression' because a strong case can be made that the history of capitalism has been characterized by speed-up in the pace of life, while so overcoming spatial barriers

that the world sometimes seems to collapse inwards upon us (Harvey, 1992: 240).

Among the "internal analytic categories" (SANTOS, 2006: 12) the concept of space, pressured in the new capitalist conditions (HARVEY, 1992), is territorial configuration, understood by a portion of the geographic space suitable and interspersed by relations of power. To put it another way, it is a spatial area bounded by the human domain. According to Santos (2005), the territory is not a concept *a priori*, but it becomes a concept through the movement of those who make use of it. In other words, "is the use of the territory, not the territory itself, which makes it the object of social analysis" (Santos, 2005: 255, our translation).

In the critical view of geographer Rogério Haesbaert (2004: 79), in order to take account of the hybrid dimensions of territory, understood through "imbrication of multiple relations of power, from the more material power from economic and political relations to the more symbolic power of the more strictly cultural order", these dimensions need to be linked with an integrative theoretical perspective. However, whether in geography or in related disciplines, approaches have historically sought to highlight chains which are commonly one-dimensional.

For Haesbaert (2004: 76-77), they are organized into two perspectives: (1) the materialistic perspectives, with naturalist conceptions (territoriality reduced to the biological character), which are economically-based (especially for Marxists, for whom production is the foundation for understanding territorial relations) and legally and politically-based (material foundations of the State); and (2) the idealist perspectives, a more traditional one (territory as area of power relations), another understanding of territory as a network (centered in both movement and connection) and, also of a multi-scale nature, (territory as a hybrid of the material and the ideal, in multiple spheres).

The author therefore stresses the concept of "territory based on the understanding of space as a hybrid - hybrid between society and nature, between politics, economy and culture, and between materiality and "ideality", in a complex interaction of space-time" (HAESBAERT, 2004: 79, our translation). In this sense, the notion of territory transcends the meaning of region, because it involves different forms of appropriation of spaces, on different scales of space and time. Thus, territoriality is seen as both setting and stability as "controlled mobility", an example of the "territory-network of large transnational corporations" (HAESBAERT, 2002: 135, our translation), where the connection of the points is the focus.

According to the geographer, there has been growing debate on these new frameworks for territory, in recent years, in different areas, as regards "the

destruction of territories, i.e., deterritorialization⁴, without making it clear which conception of territory is behind this process" (HAESBAERT, 2002: 130, our translation). Some authors state that deterritorialization has led to the end of geography, as linked to the neoliberal project. For Haesbaert, the material geographical base shows the fragility of the discourse of pure deterritorialization. The movement itself that deterritorializes necessarily implies territorialization in other bases. In this sense, "the relationship between networks and territories is permanent and inseparable" (HAESBAERT, 2002: 133, our translation).

Arguments of the fragility of pure deterritorialization include ecological issues (deforestation, erosion, pollution, greenhouse effect), access to new natural resources (linked to biodiversity), demographic problems (spread of epidemics), issues of accessibility control and the new "territory-based national-regionalist struggles" (HAESBAERT, 2004: 23). In Haesbaert's view, the great dilemma nowadays is the multitude of territories, under continuous territorialization, as a network and as a rhizome. In his words,

Multiterritoriality (or multiterritorialization if, in a more coherent manner, we wish to emphasize it as action or process) implies the possibility of accessing or connecting several territories, which can be either through "concrete mobility", in the sense of physical movement, or "virtual", in the sense of engaging different territorialities even without physical movement, as in new experiences of space and time, enabled through the cyberspace (HAESBAERT, 2004: 343, our translation).

Within the complex global scenario, there emerges "the combination of a multiplicity of territories or, for those who enjoy neologisms, contemporary glocalization" (HAESBAERT, 2004: 347, our translation). In addition to a set of local events that are subject to global interference, glocalization "indicates a combination of elements in a new dynamic where they can no longer be recognized strictly neither as global nor as local, but rather as an qualitatively different amalgam" (our translation). Therefore, this is one of the processes which makes multiterritorialization most evident.

In this scenario of social complexification, in which we assume a hybrid concept of space-time issue and the emergence of multiple material and symbolic territorialities, the issue of communication plays a key role in mediating all these processes. This means that social and technical instances in contemporary times are increasingly challenged by logics formerly confined to the domain of the media. Hence the concept of mediatization needs to be discussed in order to shed light on these complexities.

⁴ Deterritorialization emerged in studies of philosophers Gilles Deleuze and Félix Guattari. In the realm of geography, the field which claims knowledge about territories only appeared at the beginning of this century, as stated by Haesbaert (2002).

Mediatization and discursive couplings

The increasing social and territorial complexity gradually stimulates the shift from an instrumental society to the immersion in a complex cross-influence of the media, as stated by Antonio Fausto Neto (2006, 2013). In this point of view, there is a shift from a functionalist scenario, where the media were considered to play a supporting role in the social dynamics, referred to as society of the media, to the confirmation of a perspective that identifies in social relations overlaps of communicational logics, practices and operations that affect other social systems⁵ in distinct structural couplings. With these couplings, a system is able to use procedures of others to operationalize their communicative processes (LUHMANN, 1995: 223), as well as promote dialog with elements of its environment with other systems, whether social or mental (LUHMANN, 1997).

Within the theoretical angulation of the processes of mediatization of society, the social dimension is inseparable from technology in processualities of mutual influence which potentiate the manifestation of a new communicational structure in contemporary times. Therefore, it goes beyond the instrumental vision of a general multitude of technological devices; it emphasizes that it is also a social practice (GOMES, 2006), conveyed by non-linear mutual influence between institutions, media and individual actors (VERÓN, 1997) that foster the emergence of a new socio-technical-discursive scenario (FAUSTO NETO, 2010).

According to Pedro Gilberto Gomes (2006), this process is not just about a enhanced techno-interaction, but, particularly, a new way of being in the world. The very social need of realization through the phenomenon of the media sees mediatization as a "hermeneutic key to understanding realities. After all, in the contemporary world, "if one aspect or fact is not mediatized, it does not seem to exist" (GOMES, 2006: 121). For the author, these mediatization dynamics trigger the emergence of cultures that are independent of the territorial memory, thus expanding the exercise of citizenship. Glocalization and multiterritorialization (HAESBAERT, 2004) corroborate this argument.

As Fausto Neto (2006) explains, the potentiation of mediatization brings tension to the semantic processualities in contemporary society hence these dynamics occur in relational operationalities and, concomitantly, cross-sectionally. Said another way, subjects of different social systems take ownership of rules, logics and media techniques for use in their interactions.

⁵ According to German theorist Niklas Luhmann (1995, 1997), social systems are the functionally different manner whereby society is structured. Their main function is to reduce complexity that stems from the environment. This epistemologically complex option goes beyond the limits of functionalist thought through its "Operational constructivism" (Luhmann, 2005: 22).

In this way, these new sociotechnical relations which originate in mediatization eventually override the concept of social bond, especially the concept relative to the territorial dimension. Thus, we look particularly at mediatization as regards the operation of discursive operations stimulated by this context. In this perspective, semiology is an appropriate theoretical-methodological tool, because the object analyzed falls within the scope of the discursive materiality encouraged by this new social, technical and territorial environment.

To understand the complexity of discursive processes, it is important to briefly comment on the transition of the society of the media into the society in the process of mediatization (FAUSTO NETO, 2013). The former is marked by a functionalist formulation that was about the movement of senses as a "service-activity", avoiding the whole disagreement inherent in this process. Functionalism favored the "what for" the structure, in which the means of communication (as a mere "zone of transportation") and the receiver were mutually "contaminated", which limited the analysis in notions of cause and effect (FAUSTO NETO, 2013: 43). Therefore, for years, studies in communication found that the senses produced would be strictly linked with the intentions of the sender of the message, without any kind of symbolic negotiation between production operations and discourse recognition⁶.

In the latter perspective, with the new communicational structure, the functionalist concept of 'zone of passage' is disregarded as there emerges the instability caused by circulation between production and recognition (VERÓN, 2004). For Fausto Neto (2013: 47), circulation becomes the "generator of couplings" and the "cause for discontinuities" in these instances. The interactional complexity in the scenario of mediatization is increased by shorter distances between production and recognition generated by the interrelation between techniques and social practices. These contacts set up "new sociotechnical relations", i.e., "new forms of couplings" between systems and environment, which transform practices and discursive organizations (FAUSTO NETO, 2013: 48).

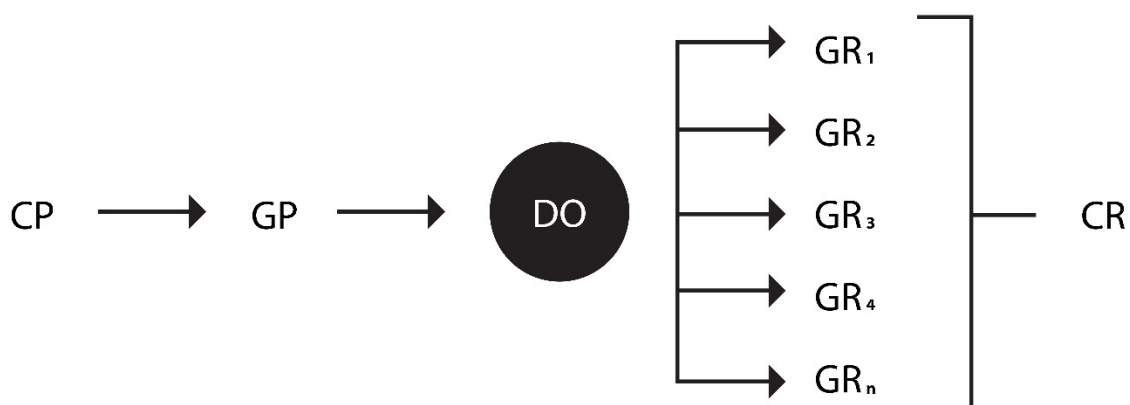
The approach of theories of discourse is shifted from the point of view of the enunciator and their intentions to the problematization of the issue of the observer of the senses. The speaking subject ceases to be the focus in studies on production and starts to be recognized in a more complex environment, that of discursive circulation. As problematized by Verón (2013), production and recognition hubs are also crossing social discursivity. They are no longer circumscribed in distant relationships. The subject ceases to control their own speech, as well as the effects

⁶ It is worth noting that the "theories of complexity" approach (Fausto, 2013: 47) does not restrict the notion of discourse to the spectrum of language. "What is produced, what circulates and what produces effects within a society are always discourses" (VERÓN, 2004: 61). This explains why *discourse* and *text* are not treated as synonyms.

manifested in the interlocutor. "The functionalist conviction - whereby language would be at the service of a consensual project - is thus refuted" (FAUSTO NETO, 2013: 45, our translation).

In the transition from the 1970s to the 1980s, when researchers began to be interested by the processes of recognition, Verón (2013: 293) introduced a scheme which mapped the chain of *semiosis* into a specific product, which he referred to as the discursive object (*object-discourse- OD*). Such empirical materialization of signs would allow semiological analysis to be made. The properties were generated from a production grammar (PG), which reallocated the OD as "a member of a class", because PG, in principle, would be capable of generating an unspecified number of discursive objects.

Figure 1 - Diagram of the semiosis of a discourse object



Source: (VERÓN, 2013: 293).

Therefore, ODs set rules and principles, organized into PGs. They operate as devices of enunciation, which awaken the senses of another, the receiver of this discourse, who uses their perceptions to determine other grammars - recognition grammars (RG). Thus, each enunciated product is comprised of PGs, which influence the production and permeate the product with marks that allow its reformulation. RGs produce other grammars which, by means of marks included in the recognition discourse, can also be rebuilt.

According to Verón (2013), PGs formalize operations that focus on features identified, but they do not explain the latter. In this sense, he postulates the

existence of conditions of production (CP), which would account for the presence of PGs of the *semiosis* under analysis. The process of mediatization encourages couplings with RGs, which schematize the plurality and the non-linearity of circulation which are made possible through conditions of recognition (CR). It is worth stressing that discourse is always indicative of production of sense in the space-time dimension.

The reduction of components of clauses-units - characteristic of linguistics - is what differentiates it from discourse analysis, which does not limit the approach and emphasizes the context introduced. Therefore, the analysis of discourse consists in the description of operationalities. If a textual surface is composed of discursive marks, they will be traces of underlying discursive operations, which "should be rebuilt (or postulated) from the marks on the surface" (VERÓN, 2004: 65, our translation), present in a heterogeneous object immersed within the interdiscursive network of social production. Based on the discussion of the concepts relative to mediatization and semiology, we now move on to the analysis of the discursive object.

Multiterritorialization of the Amazon: another concept of space-time

The largest proportion of the indigenous population in Brazil lives in the region of the Upper Negro River, in the northwest Amazon, on the border between Colombia and Venezuela. Historically, the peoples of the Negro River had their first contact with the Portuguese in the mid-16th century in expeditions to capture slaves, a practice that lasted until the 19th century. However, even before that, a portion may have already been linked with Dutch settlers, particularly in the region of the Middle Negro River, also by means of slave trade expeditions. As a result of the invasions in this period, epidemics of smallpox and measles have devastated part of the population. According to Dominique Buchillet (2013), given the growth of attacks for forced labor, the Upper Negro River has served as an area of refuge for many indigenous people because it was a far-away region.

More recently, with the post-colonial demarcation of borders, the indigenous social system was subjected to several new types of reterritorializations, originating from militarization, schooling and industrialization in Brazil. According to Aloisio Cabalzar (2013), during the National Integration Plan of the military regime in the 20th century, construction works in two roads have changed even further the local territorial division as a result of the establishment of the military and the incentive

to trade. Many communities have also been weakened as members left to start working in mines and forests were cleared for pastureland for cattle, donated both by the army and Salesian priests who settled in the Upper Rio Negro.

The indigenous lands of the regions of the Middle and Upper Negro River received approval in 1997, in an area of 106,000 km²; they are currently the largest protected areas in Brazil. One consequence was the drastic reduction in deforestation to 0.61% per year between 2000 and 2014, a quite different percentage from the 16% increase recorded between 2014 and 2015 throughout the Amazon (INPE, 2016). On the other hand, the Upper Negro River is currently the third region in Brazil with the highest proportional incidence of mining activity: 38.9% of the territory is used for mining purposes, especially gold mining.

More than 26,000 people live in indigenous territories in the Upper Negro River, a number that corresponds to 40.3% of the entire population of the region. In 2003, there were approximately 15,600 inhabitants, an average increase of 6% per year (INSTITUTO SOCIOAMBIENTAL, 2015). In this way, we underline the multiterritoriality extracted in this space of land which integrates both a symbolic-cultural order of the various indigenous communities that date back to pre-colonial times and materialistic aspects such as naturalist, legal-political and economic conceptions, which are territorial features explored by Haesbaert (2004).

Figure 2 - Map of the Tiquié River, in northwest Amazon



Source: Prepared by the authors, based on *OpenStreetMap*.

Inserted in the territories of the Upper Negro River, the Tiquié River flows across the region. It is 380 km long, and 84.5% of it is in the Brazilian territory. Its

drainage capacity is approximately 5,700 km². The source is located in Gran Reguardo del Vaupés, in Colombia, and flows into to the Uaupes river, one of the main tributaries of the Negro River. The languages of the people who inhabit the banks of the Tiquié belong to two families: the nadahup languages, of the Hupda and Yuhupda peoples who live by the tributaries on both sides; and the eastern tukano languages, of the Tukano, Desana, Tuyuka, Miriti-tapuya, Bará and Yebamasa peoples, established in the main course of the river (EPPS & SALANOVA, 2012).

The indigenous peoples of the Tiquié River have a different concept of space-time (SANTOS, 2005, 2006). According to Walmir Cardoso (2007), they note that, during the year, constellations (*ñokoa wametise*, in tukano) move from east to west, then they apparently disappear over the horizon, which determines the phenomenon referred to in astrology as *sunset*. For the indigenous culture of the Tiquié River, this is the reference that signals the beginning of winters, which bear the name of the constellations that disappear at a certain time. Their longhouses are built in reference to the movement of the stars.

The intervals between longer rainy periods and floods (*poero*), understood as summers (*kumã*), are named according to the cycles of fruit cultivation, as ingá (*mere kumã*), pupunha palm (*erus kuma*), umari (*wamu kuma*) and cucura (*kuma*); and edible insects, such as caterpillars (*home kuma*) and leaf-cutter ants (*mehkã kuma*), while short summers (intervals between rain showers) are named after the current constellation. Thus, the seasons expose a series of natural phenomena, linked with the performance of different activities. The integrated relationship between all cycles "is an astronomical, ecological, socio-economic calendar and a ritual" (AZEVEDO *et al.*, 2010: 58, our translation).

According to Ignacio Valencia (2010: 30), a makuna from igarape Machado, the indigenous people are connected with the animal world and vegetable world as they share the same space. Therefore, following the constellations is "the very method that we have to manage our territory" (our translation). In his words,

We commonly follow the constellations to measure time and what is happening in every season of the year. That is why our ancestors looked at the constellations, and they said what time they were and what time they came, and according to that, they knew what was happening in the jungle, with animals, fish, man and river. When is there an abundance of wild fruit, edible and inedible species, in the forest? Or of edible and inedible animals? Or of edible and inedible fish? With his knowledge, man offers proper management to the territory, so that the whole forest works in balance (VALENCIA, 2010: 24).

The year for the indigenous peoples of the Tiquié River begins with the season *Aña* (brown-banded snake), mainly associated with floods, in the period corresponding to the months of October and November (possibly until December) in

the Gregorian calendar. These floods are accompanied by "lesser abundance of fish, the main source of protein in the diet of riparian dwellers. At that time, in light of the floods of the river, bothrops leave their dens to search for food" (CARDOSO, 2007: 157). The stellar body of *Aña* is equivalent to the area of the constellation of Sagittarius, in the Greco-Roman tradition.

After the season of pit viper, in mid-December, comes *pamō* (tatu), a region corresponding to the stars Tarazed, Altair and Alshain. This constellation is accompanied by heavy rain and thunderstorms. For the indigenous culture of the Tiquié River, the armadillo in the sky is also identified by a male tradition in which elderly men sit down and talk with other men at dusk about the *sacred flutes*. According to the myth, "the flutes were stolen of men by women, who then began to play them and to do everything that men did, for example, fishing, while men started to do women's chores, such as preparing food and harvesting cassava" (PIEADADE, 1999: 95, our translation).

With the constellation *pamō* setting in the west, and *mhuã darsia* (pike cichlids and shrimp) move close to the sunset. According to a study of Cardoso (2007: 170), stars of the constellation of Aquarius represent pike cichlids, and those of the Piscis Australis and Eridanus constellations represent shrimp. Both constellations have weak intensity, which is reflected in the minor importance and volume of floods in that period, between February and March. According to the myths, shrimp helped to hide the sacred flutes, which were subsequently recovered by men, while pike cichlids encouraged women to play them. As punishment, they were both thrown towards the sky for such acts of transgression (EPPS & OLIVEIRA, 2013).

With the departure of shrimp, the mustache of *yai* (jaguar) touches the horizon, thus announcing the arrival of a long flood. This period of rainfall is proportional to the size of the constellation which, as well as the pit viper, is divided into mustache, head (Cassiopeia constellation), body (Cassiopeia, Andromeda and Perseus) and tail (Perseus). Precisely, in native language, they are named *yai siokha poero* (flood of the brightness of the jaguar), *yai duhpoa poero* (flood of the moustache of the jaguar), *yai ohpu poero* (flood of the body of the jaguar) and *yai pihkoro poero* (flood of the tail of the jaguar). The jaguar disappears at the end of March, when *ñohkoatero* (set of stars, in tukano) becomes the reference.

Figure 3 - Cycles for the indigenous peoples of the Tiquié River

Tukano	Português	Área de referência do céu dos não índios	Mês do calendário juliano-gregoriano em que a constelação está se pondo no rio Tiquié (aproximado)
<i>Mhãã</i>	Jacundá	Estrelas do Aquário	Fevereiro: início a meados do mês.
<i>Dahsiã</i>	Camarão	Estrelas do Aquário, principalmente	Fevereiro: início a meados do mês.
<i>Yáí</i>	Onça	Estrelas da Cassiopéia e Perseu, principalmente	Março: até primeira quinzena (barba e início da cabeça da onça); segunda quinzena de março (corpo da onça). Rabo da onça se põe até meados para final de abril, bem junto das plêiades.
<i>Ñohkoatero</i>	Conjunto de estrelas	Plêiades	Abril: meados para o final do mês.
<i>Waikhasa</i>	Jirau de peixes	Hyades	Abril/Maio: final do mês de abril até meados de maio.
<i>Sioyahpu</i>	Cabo de enxó	Órion	Maior: meados para final do mês.
<i>Yhé</i>	Garça	Cabeleira da Berenice	Agosto e setembro: se põe toda a constelação.
<i>Aña</i>	Jararaca	Escorpião/ Sagitário	Novembro: meados desse mês, eventualmente até dezembro.
<i>Pamo</i>	Tatu	Águia/ Golfinho	Dezembro.

Source: (AZEVEDO et. al., 2010: 60).

According to Cardoso (2007), this is the same classification of the stars of the Pleiades among non-indigenous people. Because of their close angular proximity, these seven stars visible to the naked eye and commonly found in other cultures around the world. In addition to this set of stars, another set identified is *Wai khasa* (fish jirau, a type of fishing trap), with stars of the constellation of Taurus, time of cold weather with long snow, winds and storms. The third set is *Sioyahpa* (cable curved wood of an instrument with a blade used to chop wood), located in a part of the constellation of Orion. The tukanos associated this constellation with a myth about cutting the head of the pit viper. This is an abundant season when fish migration occurs.

As a result, around August, we observe the constellation *yhé* (Heron), marked by a strong period of summer which makes it difficult to catch fish. In parallel with it, the constellation *Sipé Phairó* (large-anus pit viper) begins to set on the horizon, which also justifies the reduction of fish supply, because according to the tukano indians, they go into the anus of the pit viper and disappear from the rivers. At that moment, it is almost October, and the cycle of the Tiquié River restarts.

The systemic-discursive construction

Beginning in 2005, a research study with indigenous communities of the Tiquié River in Brazil and Colombia aimed to understand space-time in that region. The initiative was coordinated by anthropologist Aloisio Cabalzar, from ISA, an organization that has maintained a permanent team of researchers on site since 1998. After the first meetings across communities, a team of approximately 40 indigenous people was set up. They are called Environmental Management Indigenous Agents (AIMAs), with partial dedication to research. ISA has provided four houses, fitted with solar energy panels, computers and a meeting room. In addition, the researchers received scholarships, instruments of labor and fuel for driving around.

A total of eight indigenous peoples participated; they are linked to 26 communities of the Tiquié River and its tributaries. Each researcher wrote a diary about the phenomena that occurred at the time of sunset of each constellation, with seven variables of socioeconomic and environmental observations: (1) heavy rains; (2) river level, navigation conditions, extent of flood and ebb tides; (3) name of the station in the indigenous language; (4) plant phenology; (5) cycle of fish and animals; (6) reproduction, behavior and migration of mammals and birds; and (7) reproduction of insects and amphibians. Other records which were documented were the daily life of the community, labor activities of residents, community meals, rituals, festivals, diseases and hunting, fishing and planting activities (AZEVEDO *et al.*, 2010).

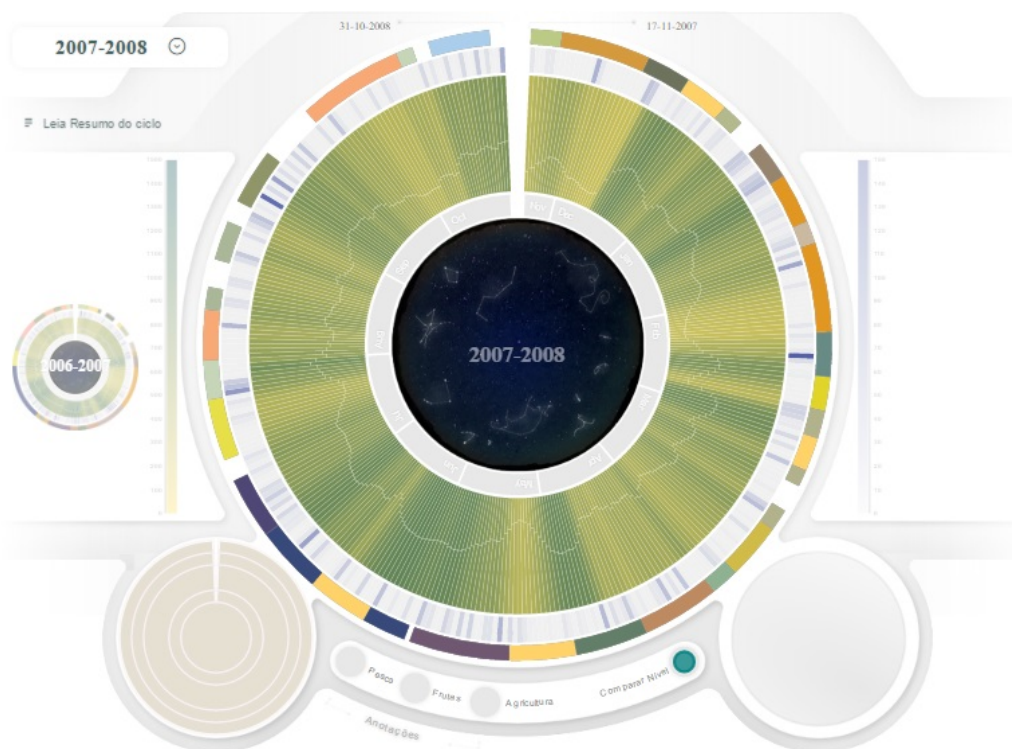
The indigenous diaries were handwritten. Subsequently, the data of the three biennia (2005-2006, 2006-2007 and 2007-2008) were screened, stored and processed in digital spreadsheets by the team of researchers from ISA. After tabulation was completed, the team of *InfoAmazonia* was contacted to create a digital product, because it had worked previously with ISA in the *Atlas Amazon Under Pressure*. According to Gustavo Faleiros, coordinator of *InfoAmazonia*, the transition of the diaries to spreadsheets took a long time to complete because of the complexity of the data, the last year of collection and the publication of the website, in mid-2011.

So, when they needed to make this calendar, Beto and Ricardo, founders of ISA, they thought of us and asked us if we could help the researchers who were in this project to create a digital product with the data that they had in the calendar. (...) One of the developers who were involved in the project got deeply involved: Hebert Valois, who was very interested. He began to make the calendar with a great deal of care. And then at the end he ended up being hired by ISA. He worked at ISA for one more year to finish the design and everything else. So it was good thing. But then we started to feel so excited about the project, we thought that the data were incredible, the story was incredible. We decided to make a video, and we even financed the production of the video to post it

on the platform later, and Hebert, hired by ISA, created the whole website, and we collaborated with the visual design... So, I collaborated with a few hints and our developers, Vitor and Miguel, helped with the database and visualization components. It was a very nice project [Gustavo Faleiros]⁷.

From the diaries to the spreadsheets; from the spreadsheets to the Internet. Inserted in the portal of ISA, the digital product of the calendar of the indigenous peoples of the Tiquié River brings together five layers of information in a circular shape, similar to the *volvella* (BRASWELL-MEANS, 1991), an instrument that dates back to the 16th century used to illustrate astronomical calculations. In this work, the page brings together five explanatory sections: "Upper Negro River: Northwest Amazon", "Annual cycles", "Collaborative Research", "Management of the World" and "Indigenous Peoples of the Amazon and Climate Change". As reported by Faleiros, there are also two videos (one on the annual cycles and another on the management of fish in the Tiquié River) and a map of the communities in the region.

Figure 4 - Digital Product of the calendar of the Tiquié River



Source: Instituto Socioambiental. Cycles of the Tiquié River. Available at: <<https://www3.socioambiental.org/teste/ciclostiquie/>>. Accessed on March 25, 2017.

The constellations of the Tiquié River are arranged at the center. By pointing the cursor to a specific direction, the selected constellation appears in the bottom right circle, with the name in tukano and Portuguese. The second layer shows the

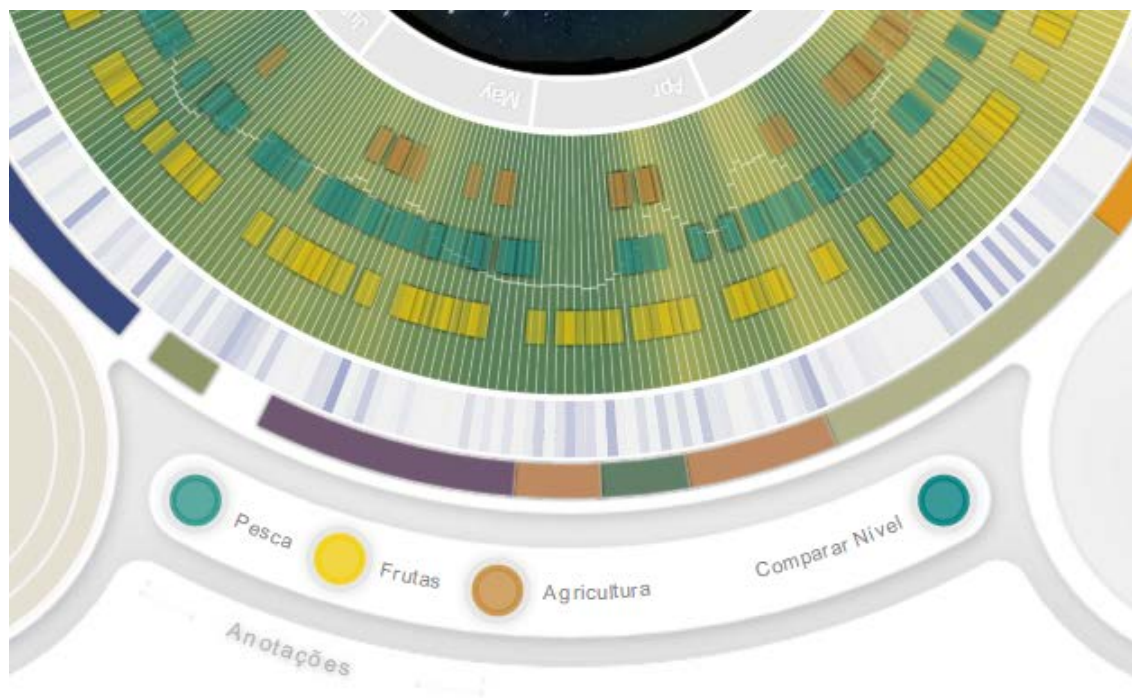
⁷ Interview made on October 14, 2016.

corresponding months in the Gregorian calendar, beginning in the second half of November and ending in October. The third layer shows the river level. Each track represents one day of the year. The dark green ones represent rainy periods, while the light green ones represent the dry seasons. On the left side, a rule is enabled with the centimeters on each date.

The fourth layer shows data on rainfall in the region. When this layer is selected, a ruler in millimeters is highlighted on the right. Just as in the previous layer, the shades (in this case, blue) represent the intensity of rainfall in each period. The fifth and last layer indicates the name of the seasons, according to the indigenous culture of the Tiquié River. Another relevant aspect is the biennia, which can be changed both in the miniature calendars on the sides and in the upper left corner. In the latter area, the tool provides a summary of the cycle for the sake of intelligibility by means of more straightforward and concise language, as an example of how the system of the media can reduce complexities, as problematized by Luhmann (2005).

One last mechanism, called "Notes", emerges from the calendar. It is located at the bottom of the digital product and offers four options: "Fishing", "Fruits", "Agriculture" and "Compare level". While the first three refer to notes, the last one reports a line that crosses out the timetable and illustrates the river levels. In the other options, after they are selected, layers with the corresponding colors appear in the cycle and indicate that, for a given topic, observations are available. For example, the color of "Agriculture" is brown. When we move the cursor to the color palette on December 22, 2006, the following note will appear on the top right corner: "cut down shrubland". In other words, at that time, the indigenous people were preparing the land for planting. The following figure shows these options in more detail:

Figure 5 - Indigenous notes about the cycle of the Tiquié River



Source: Instituto Socioambiental. Cycles of the Tiquié River. Available at: <<https://www3.socioambiental.org/teste/ciclostiquie/>>. Accessed on March 25, 2017.

In this sense, at these levels there is great caution to explain what is said discursively, since the data are processed in multiple instances. These materialities seek to produce effects of senses that contrast with and, at the same time, complement each other. Precisely, semiologic intersections (VERÓN, 2004, 2013) can be found in the relations between the languages of digital product (Tukano and Portuguese) or the different interpretations of space-time (indigenous or Gregorian). Therefore, it involves the intersection of various complexities: logics of the natives (own language and space-time concept), the scientific logic of data (explored by researchers at *Isa*) and the logics of mediatization (the intelligibility sought by *InfoAmazonia* in the design of the calendar) These complexities connect systemically, hence generating more discursive complexities at the end of this flow.

For astronomer Walmir Cardoso⁸, who has worked directly with indigenous people in the preparation of this research, the timing of the cycles of the Tiquié River goes beyond the mere observation of the phenomena observed in indigenous culture, because it is another measurement of space-time, different from the one we are accustomed to. “We have another story of space-time [...]. It is a

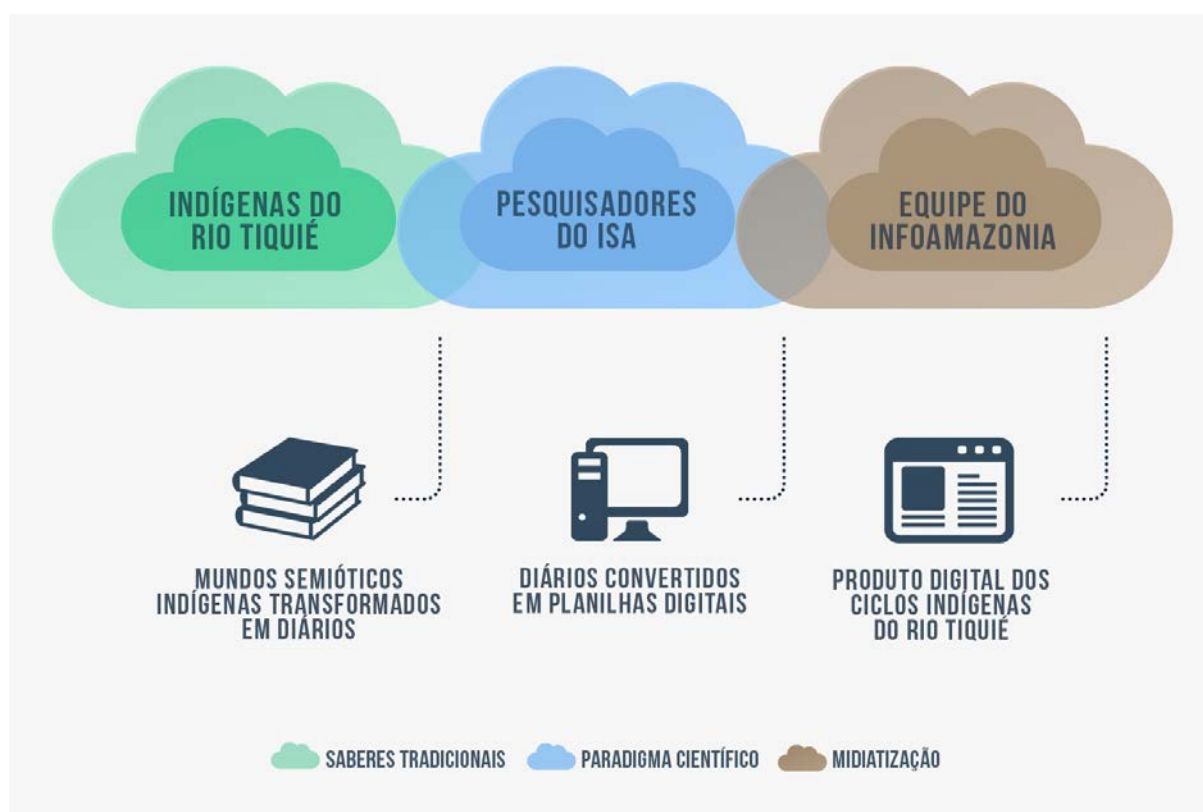
⁸ INSTITUTO SOCIOAMBIENTAL. Annual cycles of Indigenous Peoples in the Tiquié River. Interview, Nov. 17, 2015. Available at: <<https://www.youtube.com/watch?v=Z11qly8DW48>>. Accessed on Nov. 25, 2016.

translation, but it is the creation of a third space of dialog where it is clear that we are building an area of conversation, an area of common growth" (our translation).

This singular space of dialog engages three different social systems (LUHMANN, 1995), the indigenous, the scientific and the mediatic ones, each with logics, characteristics and operationalities of their own. The first brings together what Enrique Leff (2011) refers to as traditional knowledge, with values that bypass technological rationality. The second includes what he calls modern knowledge, originating from dominant scientific paradigms⁹. In turn, the mediatic system procedurally affects the discursive dynamics of the other systems; it is a new way of being in the world (GOMES, 2006), thus highlighting the multiterritorialities this process (HAESBAERT, 2004).

This complex systemic-discourse construction can be represented in the following analysis flow chart:

Figure 6 - Flow diagram of the systemic-discursive construction of the calendar



Source: Prepared by the authors.

The first movement of the flowchart illustrates how the indigenous system (activated, in that case, by the indigenous people of the Tiquié River), inserted and

⁹ Paradigms are "scientific universally recognized achievements that, for some time, provide model problems and solutions for a community of practitioners of a science" (Kuhn, 1998: 13, our translation).

interpenetrated systemically (LUHMANN, 1995) by the so-called traditional knowledge (LEFF, 2011), connects with the scientific system, where the researchers of *ISA* are immersed in a systemic matrix entitled scientific paradigm (KUHN, 1998). In these implications, the indigenous semiotic worlds are transformed into diaries, which contain the first production grammars for the discursive object (VERÓN, 2004, 2013).

In the second flow, these data are digitized and resignified scientifically in spreadsheets so that they can be used later for construction of mediatized discursive fragments. Again, these processualities leave marks of these paths. The last coupling occurs between the scientific system and the process of mediatization, designed analytically by the systemic prism. *InfoAmazonia* lies within this socio-technical-discursive scenario (FAUSTO NETO, 2010) The precedent discursive implications are converted into typically mediatic logics, techniques and operationalities which, at the end of the flowchart, paradoxically generate more complexities which are materialized into the discursive object.

Final Remarks

At first, the systemic-discourse analysis focused on the conditions of production of the concept of space-time in the Tiquié River, particularly on the territorial and socio-environmental history of the region. We approached the indigenous concept of space-time, which has been built and preserved over the centuries and, nowadays, immersed in mediatization processes and procedures. Based on such identification, we analyzed, through the prism of semiology of the social discourses, the calendar built systemically by three separate instances.

The multiterritorialization of the Amazon forest, according to the perspective of Haesbaert (2004), is taken as discursive support. This geographical information is resignified into a digital product by actors located in far-reaching spatial relations (MILTON SANTOS, 2006), which reterritorialize another concept of space-time in discursivities settled in couplings encouraged by movement in times of mediatization (FAUSTO NETO, 2013). The discursive marks identified in the meaningful materiality of the discursive object (VERÓN, 2004, 2013) which was analyzed resume the image appeal of the text-image relationship, activate different semioses and - with efforts to make these discursive universes intelligible - seek to reduce complexity (Luhmann (2005) by departing from the indigenous, scientific and mediatized worlds.

In this way, the calendar of the peoples of the Tiquié River engages multiple knowledge, articulates traditional knowledge with modern science and entwines different times - "cosmic, physical and biological" (LEFF, 2010: 211). We have

added media temporality. Based on a complexity that protects itself in otherness, these socio-discursive implications point to an interpretative unit which paves the ground for a new thinking about the forms of interaction in the world, interspersed by mediatization, which cross-sectionally articulates nature, technique and culture.

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