Rethinking Xinguano Kinship:
Elements for Computational Analysis of a Multiethnic Network

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Abstract

The existence of kinship relationships across the entire Upper Xingu has been recognized as a key element of interethnic relations in this region since the time of the expeditions by Karl von den Steinen, in this region. The pattern of long-term repetition of marriages has seemingly contributed to the development of structurally very similar terminological systems among the Upper Xingu indigenous peoples (distinguishing them from their other neighbors) and to the generalization among them of a "relatives" condition. Although almost all monographs on the region have devoted some space to kinship, in general, and forms of marriage, in particular, there are few detailed studies on the subject, and available genealogical data are even more scarce. The objective of this article is to resume the discussion on the role of marriages in the

production of Upper Xingu sociality based on the analysis of a genealogical network documented among the Kalapalo, one of the Carib-speaking peoples of the Upper Xingu. By implementing the computational tools, PUCK and Pajek, the goal is to describe this network by focusing on the types of marriage circuits that occur and their relative frequencies. This descriptive exercise has two specific objectives: 1) study how the results relate to already proposed models on Xinguano kinship and 2) examine the marriage circuits formed by interethnic alliances in order to better understand their actual frequency and question the extent to which these circuits intercorrelate. Thus, I expect to develop a model of this network according to its intrinsic properties and to provide a more concrete view of the marriage dynamics in the Upper Xingu based on the Kalapalo case.

Introduction

Anyone who has spent time in the Upper Xingu must have realized the centrality of kinship ties among the peoples of that region. It is practically impossible that any Xinguano person has no kinship relations in almost all villages, regardless of the linguistic grouping to which they belong. In the Upper Xingu area — as my interlocutors have told me countless times — *everyone is a kin*. On the personal scale, it is always possible to evoke a kinship relationship with someone to ask for something: a ride, fish, objects. Among close people, kinship ties are usually kept implicit, and are emphasized when wanting to show affection, when wanting to have a serious conversation (making it clear that the subject should be considered according to the ideal behavior expected for the relationship), or when wanting to "mourn together" the death of a loved one. Among people who are related but have sporadic social interaction, kinship terms are usually used more frequently. At a feast with guests from various peoples, it is common to find many cousins, uncles, parents, grandparents, etc. and publicly mark the recognition of these relations through the use of appropriate vocatives. On trips, knowing how to recognize distant relatives can mean the difference between getting a ride or having to travel on foot. In the scale of relationships between groups, kinship is also key to organizing the various social systems engendered in multi-community rituals, which mobilize distinct images of consanguinity and affinity (Novo and Guerreiro 2020). In short, it is very difficult to understand life in the Upper Xingu without understanding how kinship operates on a multiplicity of scales.

In the history of Xinguano ethnology, kinship has received very heterogeneous attention. The description of terminological systems, marriage practices and residential logics has been at the center of several ethnographies, especially of the first generation of researchers who conducted fieldwork in the area between the 1950s and 1970s (Oberg 1953; Murphy & Quain 1955; Becker [Basso] 1969; Dole 1969; Gregor 1977; Galvão 1979). Between the late 1970s and the 1990s, kinship studies in the region changed significantly, being progressively redefined by issues related to the fabrication of the person and to ritual life (Viveiros de Castro 1977; Menezes Bastos 1978, 1990; Seeger et al. 1979), with the notable exception of the works of Coelho de Souza (1992, 1995) on terminologies and their possible matrimonial correlates. In the 2000s, Upper Xingu ethnology saw a profusion of monographs on the most diverse subjects — arts, rituals, politics, shamanism, health, education, territoriality —, each of them addressing "kinship" in a

more or less specific manner (Barcelos Neto 2002, 2008; Mello 2004; Piedade 2004; Novo 2008; Franco Neto 2010) —, but, again, with some exceptions that recovered the centrality of kinship to thinking about politics (Heckenberger 2005; Fausto 2007; Guerreiro 2008, 2011). In recent years, some works have once again undertaken more dedicated reflections on the subject, this time focused on the role of kinship in indigenous philosophies (Guerreiro, 2015a; Vanzolini 2015; Guerreiro and Novo 2020); in ritual practices (Guerreiro 2015a, b; Fausto 2017); in issues such as pregnancy, childbirth and the sociality of children (Monachini 2015, 2021; Regitano 2019); in the relations between kinship and monetarization (Novo 2017); and in the relations between kinship and the construction of indigenous socialities in urban spaces (Horta 2018). It is necessary to note the fundamental work of Mutua Kuikuro Mehinaku (2010), who clarifies important ideas about the Kuikuro concept of "kin" and makes an unprecedented analysis of the role of interethnic marriages for the "mixture of people and languages" that characterizes the region.

However, some (so called) "classic" kinship issues insist on not disappearing. One night, I was lying in my hammock while one of the men who lived in the house where I stay among the Kalapalo repaired his motorcycle. Because he was working near my hammock, and perhaps because he realized that the noise of the tools would make my sleep more difficult, he decided to start a conversation. "Brother-in-law," he told me, "why are the whites different?" Without understanding the question well, I asked: "different how?" To my surprise, his question evoked an old anthropological issue: the possibility or impossibility of cousin marriage. "I want to know why whites don't marry their cousins," he said. "You know that, for us, marrying a cousin is a good thing, but we don't have many cousins we can marry. You, whites, are different: you have many cousins, but you don't marry them!"

My interlocutor made a point of clarifying the root of the issue, explaining that the difficulty in finding a suitable cousin to marry lies in the fact that many women that the whites would call cousins are, for the Kalapalo, sisters or are "very close" cousins, "equal to sisters." The whites, on the other hand, who supposedly could easily find a wife among their many cousins, create a new problem for themselves by avoiding this type of marriage and finding themselves obliged to seek for wives amid a world of strangers. We were two men talking, but the same kind of issue affects Kalapalo women. That same interlocutor told me that sometimes it was necessary to carefully analyze all relationships connecting two people who would like to get married, giving me the example of his own marriage. His wife would be, on her maternal side, his "mother" (a cousin of his mother, in fact), while on her paternal side she would be a "true cousin" (what anthropologists call a "cross-cousin"). Kinship on the maternal side would make marriage impossible, but as it was a genealogically distant relationship, both allow themselves to read their relationships prior to marriage as relations between cross-cousins, which makes the union acceptable.

This conversation illustrates how issues related to kinship terminologies and matrimonial possibilities are not mere anthropological inventions, as is suggested by the secondary place that these issues have come to occupy in the discipline after the criticisms of Schneider (2004). On the contrary, they are issues that permeate people's daily lives, and the Kalapalo express a set of contemporary concerns related to them: they are concerned about the impact of population growth on the marriage system, which seems to imply the risks of an "exaggerated exogamy,"

marked by the weakening of respect and cooperation between affines; they note the effects of money on marriage choices; and they fear the transformations of kinship relations influenced by life in urban spaces. In short, "kinship," however it is defined, is far from being an issue of the past, being, for the Xinguano peoples, an issue of the present and the future — which is reason enough for it to be revisited.

In this article I propose an exploratory analysis of marriage practices as they occur in a genealogical network collected among the Kalapalo, one of the Carib-speaking peoples of the Upper Xingu. Although kinship studies permeate the history of Xinguano ethnology, they are marked by a scarcity of genealogical data. Some of the main hypotheses were devised on the basis of limited (sometimes impressionistic) data, or were devised on the basis of third-party data and could not be tested thoroughly. Galvão (1979), Oberg (1953) and Dole (1969), for example, do not present genealogical data (although Dole mentions having collected a genealogy of 5 generations dating back to 1905); Gregor provides only one or another genealogical fragment as illustration; Zarur (1975) and Viveiros de Castro (1977) present genealogies, but these are limited by the effects of depopulation (the Aweti, at the time, were reduced to 19 adults and the Yawalapíti to 86 people). Basso's data on the Kalapalo are among the few that enable a more detailed study of marriage practices; however, as her genealogy is segmented into household groups and not all interpersonal relationships are recorded, analyzing the data is difficult. From the 1980s onwards, genealogies became increasingly rare, with the important exception of the work of Mehinaku (2010), in which the author presents an extensive genealogy of the main Kuikuro village. In short, in almost 150 years of Xinguano ethnology, we have scarce genealogical data for in-depth analyses. This article aims to help fill this gap by providing the analysis of a network that may, in the future, be submitted to the analysis of other researchers and even serve as a basis for the expansion of genealogical research in the region[1].

It is certain that the limited genealogical data in the literature are also due to some factors that are not controllable by researchers. In addition to the prohibition on the names of affines and recently deceased people as noted by Gregor (1977), which hinders genealogical research, the demographic disaster of the epidemics left gaps in memory that are difficult to repair. There is also a certain "genealogical amnesia" associated with the relative sufficiency of knowledge of only two ascendant generations to trace relevant kinship relationships in everyday life. In general, knowing the kinship terms that grandparents or parents use to refer to others is sufficient to determine a relationship without having to recall any genealogical path. However, this is not to say that reassembling genealogical relationships is not important in several situations. For the closest relatives, knowing genealogical paths is important to define possibilities of payments for specialized knowledge or activities, to gather wealth for the payment of engagements, or to enable the preservation of names through their transmission. There are also cases in which two people with distant ties who want to get married need to do some "disambiguation" of their relationships to be sure that marriage is possible. For chiefs, finally, maintaining this information in more detail is important both to legitimize their position and to question the claims of their rivals.

[1] The database on which this article is based will, in the future, be made available for online access at the Unicamp Research Data Repository (REDU). The Repository can be accessed at: http://redu.unicamp.br.

In short, collecting genealogies in length and depth in the Upper Xingu is difficult work, but it still often piques people's interest. Ascertaining why a relative was a cousin of one's father, or why someone has a distant brother in a people in which they have no other relatives, has always been the reason for much curiosity of youth when listening to their elders. If applying kinship terms correctly is enough to navigate the universe of relatives, knowing the *paths* between relatives was a cause for excitement, as if it were a kind of revelation. A young man once told me that he would like to make a genealogy of the entire Upper Xingu to show how they were all related, as he thought it would help reduce the gossip and the aggression of sorcerers. Another young man also insisted that I should make "really complete" genealogies because it would be a means of telling the history of his people "like a document or a book." Today, there seems to be a consensus that marriage options for young people are restricted (personal communication from Veronica Monachini 2022). Young people make a great effort to identify, among their desired partners, genealogical paths that make a marriage possible, an exercise which is not very distant from that which we will conduct next — different in method, certainly, but perhaps not in relation to the nature of issues.

The following materials will be subjected to exploratory analysis, as it will not be based on previously formulated questions, but will seek to systematize the main characteristics of an empirical genealogical network so as to base analysis on them, to examine how the data relate to the literature and devise new questions. The focus will be on marriage practices, which will be analyzed according their correlations with the Kalapalo kinship terminology. The Xinguano alliance system is at the basis of the formation of local groups and was fundamental to the very formation of the Xinguano complex, which makes its detailed understanding an important step to clarify aspects of the socio-political dynamics of the area in the long term. In addition, the dynamics of marriages is fundamental for understanding diverse contemporary processes, such as the political organization of villages and sets of villages, the territorial distribution of local groups, flows of people, ritual dynamics, and migratory processes inside and outside the Xingu Indigenous Territory.

Apparent paradoxes

The approaches to the Xinguano kinship are marked by a series of uncertainties and paradoxes. Galvão was the first to describe in detail the kinship terminology of some of the peoples of the region, having surveyed lists of kinship terms for the Aweti, Mehinaku, Trumai, Nahukua, Yawalapíti and Kamayurá. His comparison enabled him to include the kinship system among the main "cultural traits" of what he had defined as a cultural area, the "uluri area" (a reference to the piece of female attire used to cover the pubis). As general traits of the terminology, Galvão notes the existence of a distinction between parallel and cross relatives in G^{+1}, but which would be annulled in G^{0}: both parallel and cross-cousins would be called "brothers" and "sisters." Crossness would be reintroduced in G^{-1}, with children of same-sex cross-cousins being called "sons and daughters" and children of opposite-sex cross-cousins called "nephews and nieces," which would be in line with the assimilation of cross-cousins to siblings observed in G^{0}. This characteristic of G^{0} led Galvão to consider the Kamayurá and Xinguano terminology as of the "Hawaiian" type, despite the crossness in G^{+1} and G^{-1} (Galvão 1979: 39).

Also working among the Kamayurá, and having collected terminologies for the Aweti, Kala-

palo, Kuikuro, Wauja, Yawalapíti and Trumai, Oberg defines Xinguano kinship terminologies[2] as "bifurcate merging" (Oberg 1953: 43), noting the occurrence of consanguineous terms for all relatives of G^{+2} (grandfathers and grandmothers) and G^{-2} (grandchildren and granddaughters); the existence of distinct terms for parallel and cross relatives in G^{+1}, $G^{ø}$ and G^{-1}; and the importance of distinguishing between older and younger siblings in $G^{ø}$. According to Oberg, unlike Galvão, the difference between parallel and cross ones would not be annulled in $G^{ø}$.

The issue becomes more complex when Gertrude Dole presents a description of Kuikuro terminology in which she finds characteristics of bifurcate merging systems in conjunction with the assimilation of cross-cousins to siblings (Dole 1969). Faced with this apparent paradox, Dole proposes the classification of the Kuikuro terminology as a new type, that of "bifurcate generation," for which she presents a historical explanation. A supposed local exogamy system, regulated by cross-cousin marriage, would have imploded due to the depopulation that occurred since the first contacts with non-indigenous people. The population reduction would have produced a new endogamic pattern, ending a supposed original difference between cross/foreign and consanguineous/co-resident cousins. With that, the very distinction between parallel and cross relatives would have become obsolete (Dole 1969: 113).

Basso, working among the Kalapalo, was the first to conduct a more detailed study of a Xinguano kinship system, discussing aspects of its terminology, the system of attitudes, marriage practices and being the first to present more robust genealogical data (Becker [Basso] 1969; Basso 1973a, b, 1975, 1984). Going beyond the generic label of "bifurcate merging systems," she described the Kalapalo terminology as being of Dravidian type, because in addition to the distinction between parallel and cross relatives in the three central generations, some of the terms for cross relatives would also be applied to affines (there being a single vocative for "maternal uncle" and "father-in-law" and another for "paternal aunt" and "mother-in-law"). She recognizes, however, that unlike classical Dravidian systems, the Kalapalo have separate affinity terms, and close cross-cousins tend to call one another "siblings."

Zarur (1975), among the Aweti, and Gregor (1977), among the Mehinaku, identified terminologies with the same general characteristics. Zarur (1975) describes a terminology similar to that of the Kamayurá, but disagrees with Galvão (1979) regarding the assimilation of cross-cousins to siblings. Zarur (1975) insists on the importance of distinguishing between a reference terminology, in which the distinction between parallel and cross-cousins exists unequivocally, and a vocative terminology, in which the distinction is erased by the vocatives for "brother" and "sister." Thus, it is suggested that the terminology of the Aweti (and possibly of the other Xinguano peoples) should not be framed in the "Hawaiian" type, as Galvão does, but in the "Iroquois" type – without, however, detailing the reasons for choosing this label instead of, for example, "Dravidian" (Zarur 1975:16). Gregor, among the Mehinaku, describes a terminology similar to that identified by Zarur, in which the existence of specific terms of reference for cross-cousins is eclipsed by the use of vocatives for brother and sister (Gregor 1977: 267).

This oscillation between the marking and the eclipsing of crossness in the generation of Ego, or between "bifurcate merging" or "generational," Dravidian or Iroquois terminologies, was as-

[2] Oberg defines the Xinguano kinship system – in the singular – as one of the "non-material traits of the culture" of "the entire uluri area" (Oberg 1953: 7).

sociated with a confusion of the same proportions regarding marriage practices. Both Oberg and Galvão recorded among the Kamayurá an ideal of cross-cousin marriage, but which rarely occurred in practice (Oberg 1953: 44; Galvão 1979: 28)[3]. Dole presents a very negative view of the Kuikuro system that, according to her, would not be able, or even strive, to maintain alliances between families or kinship groups through marriage (Dole 1984a; 45), and describes a state of "general disagreement over marriage rules" (ibid.: 48). The only more or less consensual idea regarding the high value of local exogamy would contrast with her own data, which shows a strong tendency to endogamy (about 75% of marriages are endogenous in relation to the village [ibid.: 49]). The only existing rule would be *proscriptive*: one should not marry people from the nuclear family, parallel first cousins, parents' siblings, children of siblings, grandparents or grandchildren. Dole concludes that, in the absence of fixed categories of spouse-givers and spouse-takers, the Kuikuro would not even have a marriage alliance system (ibid.: 59).

Among the Aweti, Zarur (1975) describes cross-cousins as preferred spouses, but states that this would be a "loose" definition. Given the expansiveness of kinship classifications, in addition to "de facto" cross-cousins, other possible spouses would be classificatory cross-cousins, namely people who consider themselves to be cross-cousins due to some "fictitious" kinship relationship between their parents, and unrelated people who, because they are all in principle relatives of some kind, would be considered cross-cousins (ibid.: 23).

Among the Mehinaku, according to Gregor, people say that first-degree cross-cousins are "real relatives" (Gregor 1977: 268) and, therefore, too close for marriage. In addition, the husband of a cross-cousin becomes a brother-in-law, showing that close cousins should ideally treat one another as siblings. Close cross-cousins would only be "a little bit" eligible for marriage. Gregor also notes that an ideal form of marriage would be the exchange of sisters, as it would generate a balance between sibling groups and it would be possible to circumvent the weight of asymmetric affinity relationships (ibid.: 275).

Again, Basso provides a more complex view of the relations between the terminological system and marriage practices. According to her, the application of one or another classificatory grid (of "bifurcate merging," with crossness in the three central generations, or "generational", annulling the crossness) would depend on *social distance* (Becker [Basso] 1969; Basso 1973b, 1975, 1984). According to Basso, the Kalapalo would have a preference for marriage to distant relatives, who would manifest greater potential for establishing relations of affinity, or *affinibility*. Ego could *consanguinate* their relatives by using a "generational" terminology that marks the lack of *affinibility*, or reveal their cross-position, suggesting a potential for the alliance. With that, Basso demonstrates that there are not two distinct terminologies, nor contradiction among the previous ethnographic records, nor would it be necessary to resort to a conjectural history to explain this apparent paradox. Both generational and bifurcate-merging classification would be expressions of a same marriage system, which favors unions between distant relatives and allows contextual reclassifications of relationships. Preferred spouses would be people situated on the periphery of Ego's kindred, and the ideal form of marriage would be the "brother-sister ex-

[3]This preference for cross-cousin marriage might seem contradictory according to the terminology collected by Galvão (1979), which turns cross-cousins into germans. However, as he himself notes, such unions would be possible – albeit very rare – because there would be a "recognition" of crossness in the first ascendant generation of the spouses.

change," allying two pairs of siblings symmetrically.

Basso's argument about the Kalapalo was fundamental to the development of debates about affinity in the Amazon in the 1990s. Viveiros de Castro (2002) proposed that Amazonian kinship systems would be variations of Dravidian systems; that is, ego-centered systems based on the opposition between consanguines and affines and on the transmission of affinity relations. However, unlike the symmetrical systems of southern India described by Dumont (1975), Amazonian systems would be concentric, and the opposition between consanguinity and affinity would be subject to a hierarchical principle based on notions of social distance. At the pole of greater social proximity, consanguinity would encompass the relations of affinity, whereas, at the pole of greater social distance, affinity would be the encompassing term. This more distant pole would not comprise the real affines (who tend to be attracted to the pole of consanguinity by social proximity), but the Others, the foreigners, the enemies, the representatives of an "affinity without affines" (Viveiros de Castro 2002). Halfway between these two poles would be those that could be transformed into actual affines. The result of applying this distance gradient is a fracture in affinity which is divided between real affinity (produced by marriage and which, due to social proximity, is attracted to the consanguinity pole); virtual affinity (or terminological affinity); and potential affinity (pure affinity, which, while external to kinship, encompasses it). This logic would explain the tendency of some Amazonian terminologies to apply consanguinity terms to effective affines and virtual affines (cross relatives), or even (as, seemingly, is the case in the Upper Xingu) to use generational terminologies. In the latter case, it would be possible to distinguish between "strong" variations (expressing some form of exogamy) and "weak" variations (which restrict "*hawaiianization*" to a portion of the terminological field, preserving crossness in certain positions or contexts, and continue to allow the marriage of cousins). This would at first explain the potential of Xinguano terminologies to assimilate cross-cousins to siblings, the low occurrence of marriages between close cross-cousins, and the tendency to seek affines in the outer boundaries of the kindred.

The Xinguano systems for which we have the most data (Kalapalo, Kuikuro, Mehinaku, and Kamayurá) clearly present Iroquois terminologies, with important distinctions from Dravidian ones[4]. In Dravidian terminologies, children of same-sex cross-cousins are cross-kin, whereas, in Iroquois terminologies, children of same-sex cross-cousins are parallel. According to Trautmann and Barnes (1998), in Dravidian terminologies, or with "Type A" crossness calculations, such classifications derive from the existence of a positive rule of marriage between bilateral cross cousins. In Iroquois systems, or with "Type B" calculations, the cousin marriage rule would be violated by these classifications and would not be present. The classification of children of opposite-sex cross-cousins as "nieces" and "nephews" implies that, in fact, first-degree cross-cousins are treated as siblings. Thus, Dravidian and Iroquois terminologies could be seen as distinct types, depending on the presence or absence of a cross-cousin marriage rule. In addition, more than just manifesting a "lack," Iroquois terminologies present something that Trautmann identifies as one of their key characteristics: the effective neutralization of crossness in different positions of the terminological grid, producing a set of variants of terminologies with "Type B" cal-

[4]The discussion on the similarities and differences between these terminological types will not be resumed here. For an in-depth discussion, see Trautmann & Barnes (1998), Viveiros de Castro (1998) and Silva (2010).

culations (Trautmann 2012: 41).

Both Coelho de Souza and Viveiros de Castro argued that the Xinguano systems could be framed in the Amazonian Dravidianate despite having "Type B" crossness (Coelho de Souza 1992, 1995; Viveiros de Castro 1993a, 1998). This argument is largely based on the comparative work of Taylor (1989, 1998) among the Achuar, Aguaruna and Kandoshi peoples. Taylor demonstrates the existence of a group of transformations in which Dravidian terminologies, with "Type A" calculations (Achuar), and Iroquois terminologies with "Type B" calculations (Aguaruna and Kandoshi), coexist between close groups. She also demonstrates how Iroquois terminologies are able to convey affinity relationships. While first-degree cross-cousins would be assimilated to siblings, *their children* (among the Aguaruna) or *grandchildren* (among the Kandoshi) would be ideal spouses since they were sufficiently "distant." Such systems would operate through a *sociological* opposition between consanguines and affines, while in Dravidian systems this opposition is also terminological. Systems such as Aguaruna and Kandoshi (which she directly compares to those from the Upper Xingu) would be "rich-formula Dravidian systems" which convey affinity relationships but delay the redoubling of alliances by one or more generations.

Alliance systems such as that of the Aguaruna would be what Viveiros de Castro (1998: 357) called "Type B restricted exchange systems." According to him (ibid.: 356), such systems would work through the exchange of sisters in non-consecutive generations and, due to their ego-centered character, "would be multibilateral exchange systems, in which each 'unit' sees all others distributed as real or potential affines, so that in a system of this type the Dravidian circularity disappears and allies of allies can also be allies of Ego" (Guerreiro 2008: 101). Considering the documented engagement practices among the Kalapalo and Kuikuro, and Gregor (1977)'s information about the Mehinaku, which all seem to favor the union between children of opposite-sex cross-cousins, Coelho de Souza (1995) suggests that the Xinguano alliance system can be framed in this hypothetical model. As I have noted on a different occasion, it would then be plausible to try to approximate systems such as the Mehinaku, Kuikuro and Kalapalo with Taylor's Aguaruna variant. However, this approximation would still be partial as it disregards marriages not arranged between relatives as well as marriages between unrelated people, which seem to be the majority of the marriages. In addition, although this hypothesis was formulated in the 1990s, it has not yet been tested with robust data, and little is known about the concrete characteristics of the Xinguano kinship network.

Therefore, there are many open questions about the most elementary aspects of the Xinguano kinship system. Taking as a starting point the prevalence of Iroquois terminologies, what, concretely, is the role of cross-cousin marriage in an empirical genealogical network? Is it possible to confirm the hypothesis that the system would favor the marriage of children of opposite-sex cross-cousins? Would there be any statistically explicit "ideal distance" between spouses? Is it possible to observe the "Iroquois alliance" model, as conceived by Viveiros de Castro (1998), in its concrete operation? What is the role of interethnic marriages in this network, and what does it enable us to learn about the position of the Kalapalo in relation to their neighbors?

Materials and methods

The method used here combines genealogical research in the field, review and systematization of published genealogical data, and includes the use of two free *software*, Puck and Gephi, pro-

grams The former is a tool for the storage and processing of kinship data (Hamberger et al. 2009), while the latter is a tool for the visualization and analysis of networks (Bastian et al. 2009). Puck was used to extract basic information of the network and to perform a marriage census according using criteria that allows the identification of possible marriage patterns. The census produced by Puck was then exported in a format that can be read by Gephi, which was used to manipulate the possibilities of grouping of variables and, thus, enable the visualization of structural properties of the network.

The use of computational tools for the description and analysis of kinship systems is a widely documented methodology (Héritier 1981; White et al. 1999; Hamberger et al. 2009, 2014; Hamberger 2011). Computerized methods have been used by Brazilian researchers for some time, based on MaqPar ("Kinship Machine"), a software program developed by Marcio Silva and João Dal Poz for the purpose of identifying and classifying the various types of marriage rings existing in a genealogical network (M. F. da Silva 2004; Dal Poz & Silva 2008, 2009; Pires 2009; Ferreira et al. 2014; Bueno 2015; Ramires 2015; M. Silva 2016, 2017). For this work, Puck was chosen for several reasons: for enabling a refinement and reduction of data at the production stage of the marriage census; for enabling the correlation between the database and different network manipulation and visualization software; for directly exporting networks of interest for analysis, such as alliance networks and circuit intersection networks; and also for functioning on multiple operating systems, facilitating future comparisons with the same database, or with other data bases by researchers working on different platforms.

The genealogical corpus that is the basis of this article is the result of ongoing field research that I have conducted in the Kalapalo Aiha village since 2006, and of the compilation of genealogical data available from other sources, namely: Ellen Basso's doctoral thesis, where the author published complete genealogies of Aiha residential units collected in the late 1960s (Becker [Basso] 1969); a genealogy produced by Marina Cardoso with data collected in Aiha between 1999 and 2004, which Marina Pereira Novo and I helped to systematize (M. D. Cardoso et al. 2007); a genealogy surveyed by Diogo Henrique Cardoso in the Kalapalo Apangakigi village between 2016 and 2017 (D. H. Cardoso 2018); and a demographic census of the entire Upper Xingu carried out by Indigenous Health Agents in 2017 (SESAI 2017). This census enabled the extraction of genealogies for almost all current Kalapalo villages, and then these genealogies were merged into a single database.

The primary data records relationships of filiation and marriage, with the other relationships (such as siblingship, for example) derived from the former. The network was organized in a spreadsheet divided into two tabs. One is called "Kinship Relationships," which lists each individual, his or her gender, parents, and spouses. Each individual is given a unique number, and their parents and spouses are also identified by their respective numbers. The other tab, called "Attributes," contains a list of all identification numbers and associates, to each of them, a diverse set of non-genealogical attributes, such as the condition of being alive or having died, the people with whom they are identified, villages where they resided at different times of the data collection, the house in the village where they resided in a given year, whether they are a chief or not, among other positions. In the end, the data were anonymized. Figures 1 and 2 illustrate how the data were organized in each folder.

	Id	Gender	FatherID	MotherID	SpouseID	SpouseID_2	SpouseID_3	SpouseID_4
2	1	M	384	385	2			
3	2	F	386	373	1			
4	3	F	1	2	17			
5	4	M	1	2	331			
6	5	M	1	2	362			
7	6	F	1	2	326			
8	7	F	1	2	322			
9	8	F	1	2	381			
10	9	F	1	2	322			
11	10	F	1	2				
12	11	F	17	3	18			
13	12	M	17	3				
14	13	F	17	3				
15	14	M	5	362				
16	15	F	322	7				
17	16	M	381	8				
18	17	M	343	344	3			
19	18	M	297	298	11			
20	19	F	18	11				
21	20	F	17	3				
22	21	F	17	3				

Kinship Relations | Attributes | +

Figure 1: Example of organization of entries in the "Kinship Relationships" spreadsheet.

	A	B	C	D	E	F	G	H	I	J	K
1	Id	Etnia1	Etnia2	Nascimento	Falecimento	Vivo	Chefe	Aldeia_nascimento	Aldeia_1999	Aldeia_2006	Aldeia_2010
2	1	Kalapalo		15/07/1952		1	1		Aiha	Aiha	Aiha
3	2	Kalapalo		15/07/1959		1	1		Aiha	Aiha	Aiha
4	3	Kalapalo		02/07/1977		1	1		Aiha	Aiha	Aiha
5	4	Kalapalo		28/07/1980		1	1		Aiha	Aiha	Aiha
6	5	Kalapalo		09/04/1983		1	1		Aiha	Tanguro	Aiha
7	6	Kalapalo		20/09/1987		1			Aiha	Aiha	Aiha
8	7	Kalapalo		26/02/1990		1			Aiha	Aiha	Aiha
9	8	Kalapalo		15/08/1993		1			Aiha	Aiha	Aiha
10	9	Kalapalo		12/09/1996		1			Aiha	Aiha	Aiha
11	10	Kalapalo		29/07/1999		1				Aiha	Aiha
12	11	Kalapalo		08/05/1996		1			Aiha	Aiha	Aiha
13	12	Kalapalo		16/05/1999		1			Aiha	Aiha	Aiha
14	13	Kalapalo		11/03/2002		1			Aiha	Aiha	Aiha
15	14	Kalapalo				1				Aiha	Aiha
16	15	Kalapalo		20/12/2004		1				Aiha	Aiha
17	16	Kalapalo		11/12/2013		1					
18	17	Kalapalo		15/07/1970		1	1		Aiha	Aiha	Aiha
19	18	Kalapalo		09/06/1993		1			Aiha	Aiha	Aiha
20	19	Kalapalo		20/02/2014		1					

Figure 2: Example of organization of entries in the "Attributes" spreadsheet.

For the file to be read by Puck, it needs to be saved in the following format: "FILE_-NAME.bar.xls." After being imported into Puck, the software will present the database according to "individuals" or "families," displaying the relationships between the entries and the attributes linked to each person. Initially, the software was used to obtain a report to identify possible gaps and biases in the data *corpus*, such as the distribution of the sexes, the genealogical completeness of the network (as shown in Figure 3) and the relative rate of known agnatic, uterine or cognatic ascendants in each generation. This information provides awareness of some limitations of the corpus, an important step to avoid data interpretations being distorted by biases resulting from properties of the material itself.

Then, a marriage census was carried out, seeking to identify, count and classify marriage cir-

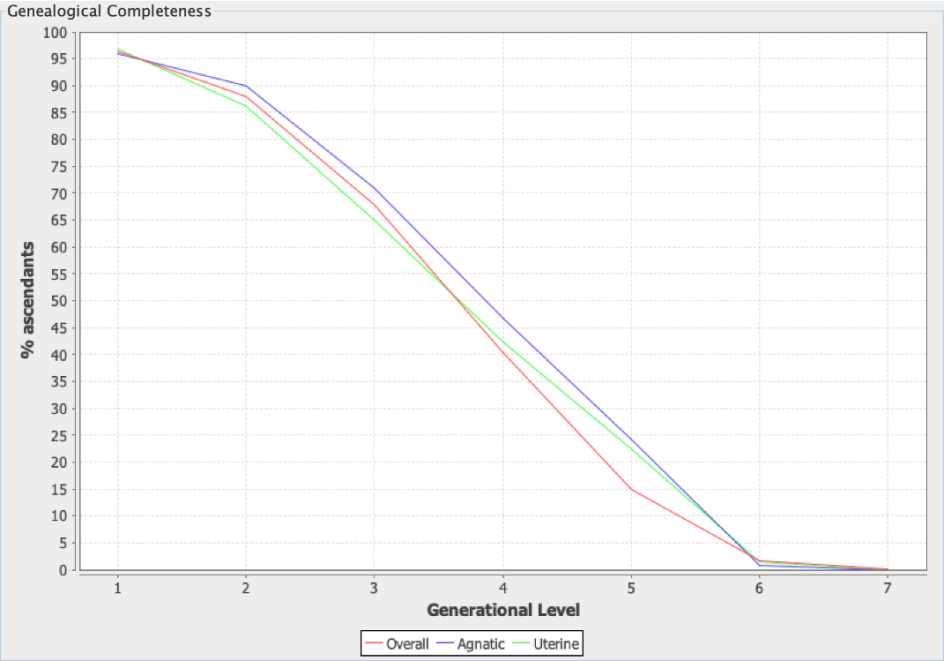

Figure 3: Network genealogical completeness by generation.

cuits. For any two people (Ego and Alter) between whom a relationship exists, there is at least one genealogical path. When the path between Ego and Alter is "closed" by a marriage relationship, and is composed exclusively of cognatic links or affinity relations, I have a marriage circuit (Hamberger et al. 2014: 569). The interest in marriage circuits is due to their possible effects on the network. While each new affiliation relationship increases the number of people in a network, it does not necessarily increase its connectivity, with each new marriage relationship extending the network's connectivity and, therefore, having an impact on its structure. And just as each marriage choice is influenced by each person's position in the network at a given time, each new marriage impacts possible future marriage choices, which is therefore one of the main drivers of the self-generative quality of a kinship network (Hamberger et al. 2014).

Two elementary criteria for the classification of marriage circuits are *order* and *depth* (Hamberger 2011). The order defines the number of marriage relationships that compose a circuit. Thus, order-1 circuits have only one marriage, as in the union of a man with his MBD or of a woman with her FZS; order-2 circuits have two marriage relationships, as in the union of a man with his BWZ or of a woman with her ZHB; and so on. Order-1 circuits connect cognates[5], while order-2 circuits represent the redoubling of an alliance; that is, the reconnection of two groups of consanguines previously allied with each other (marriages with the consanguine of an affine);

[5] I treat as "cognates" people with common ancestry to avoid possible misunderstandings regarding the classification of relatives by the Kalapalo, since not all cognates are necessarily classified as consanguines (such as, for example, cross relatives in certain contexts in which they can be "affined," or the effective affines that result from marriage between relatives: male cousins and female cousins transformed into spouses, uncles and aunts transformed into in-laws, etc.). The emphasis on cognation draws attention to the genealogical data, whose relation with indigenous classifications poses an additional problem for the analysis of matrimonial relationships and their effects on social organization.

order-3 circuits represent the reconnection, by marriage of three consanguineous groups (or marriage with the "consanguine of the affine of an affine"), and so on.

Every circuit also has a *depth*, which refers to the maximum number of generations of the consanguineous chains of the circuit. Thus, circuits with maximum depth 1 connect individuals linked by relatives of up to one ascending generation, as in marriages with MBD or FZS; circuits with depth 2 connect individuals linked by relatives of up to two ascending generations, as in marriages with MFBSD or FFBDS; and so on.

For the census, I had Puck list only order-1 and order-2 circuits, with respective depths of 4 and 2. For order-1 circuits, which connect cognates, it is interesting to examine the greatest possible genealogical depth. As these circuits tend to be less numerous than the others, analyzing them in greater depth and detail is feasible and, in a context such as that of the Kalapalo, in which marriage between distant relatives is favored, the comparison between the different types of order-1 circuits and their respective genealogical depths is relevant. On the other hand, order-2 circuits are much more numerous, and for practical reasons must be restricted by their generational depth. A census that searched order-2 circuits with depth greater than 2 generations would produce an immense result, thus making data processing difficult. Finally, the search for order-3 circuits was left aside at this point because, being very numerous and complex, they would produce a volume of data that could not be analyzed here.

Puck was also used to generate some networks from the census to be manipulated in Gephi: a) a subnetwork in which peoples are treated as social units, in order to analyze the density of kinship relationships among them and b) a network of intersection of marriage circuits (Hamberger et al. 2014) in order to analyze interdependent relationships between the circuits found in the census. The following sections present the results of applying this methodology.

The data[6]

The network has 1,107 individuals, with 580 men and 518 women. Some individuals of unknown sex (9) were inserted into the network to represent genealogical relationships that could not be completely reconstructed. The dataset presents 320 marriages, of which at least 285 (89.06%) generated children (but this number is certainly higher, since several couples – especially those deceased, or those living in villages outside the scope of this research – may have children that were not documented in the field). The network has a marriage density of 2.61%

[6]Due to having a small-scale society and due to the network under analysis having – like any object of this nature – gaps and biases, the data and their interpretations should always be considered with caution. There is a set of simulation techniques for controlling data of this type (Menezes et al. 2016), but which are still experimental and, because they are based on different assumptions and procedures, they produce very different results, making it difficult to build objective controls. The explorations of such methods would far exceed the limits of this article, and therefore I chose to conduct a data reading restricted to the most salient characteristics of the network. Future research may provide relevant contributions by exploring the possibilities of controlling the material through the available computer simulation techniques. The future comparison of networks built among peoples with similar terminological systems may also provide empirical control resources, in addition to simulations.

and a filiation density[7] of 15%. It has a genealogical depth of 7 generations[8], but genealogical completeness decreases considerably from the fourth ascending generation.

The overall genealogical completeness (i.e., the percentage of known fathers and mothers) for the first and second ascending generations is 96.36% and 88.01% respectively, falling to 67.99% in the third generation. In the fourth generation, it decreases even more (40.35%), reaching very low levels for the fifth (14.92%), sixth (1.64%) and seventh (0.06%) generations. Genealogical memory though, hardly extends beyond the grandparents' generation, which means that the most complete information reaches the great-grandparents of the younger generation in the network. From then on, most of the information we have is about chiefs and their families, who for political reasons tend to maintain a more detailed genealogical memory.

As previously described, a marriage census was carried out to identify order-1 and order-2 circuits, with a depth of 4 and 2 generations, respectively. According to Table 1, a total of 396 circuits were found, comprising just over half of the couples in the network (51.56%). Of these, about a quarter are of circuits between cognates (24.49%), with the vast majority (75.51%) being order-2 circuits.

Table 1: Overall Marriage Census Results

Marriage Census Results
396 CIRCUITS (maximum depths = [4, 2, 0])
124 circuit types (average frequency = 3.19)
165 couples involved (51.56% of 320 couples examined)
276 individuals involved (24.93% of 1,107 individuals examined)
97 order-1 CIRCUITS (maximum depth = 4) (24.49 %)
43 types of circuits (34.68%) (average frequency = 2.25)
62 couples involved (37.58%), 19.38% of all couples
108 individuals involved (39.13%), 9.76% of all individuals
299 order-2 CIRCUITS (maximum depth = 2) (75.51%)
81 circuit types (65.32%) (average frequency = 3.69)
161 couples involved (97.58%), 50.31% of all couples
269 individuals involved (97.46%), 24.3% of all involved

[7] The "marriage density" and "filiation density" values are obtained, respectively, by dividing the number of marriages or of filiation relationships by the total possible relationships between two individuals. Such values represent the relative prevalence of marital and filiation relationships in the composition of the network as a whole.

[8] If I consider that the average interval between two generations is between 20 and 25 years, I can assume that this genealogy dates back to the first half of the twentieth century or the end of the nineteenth century.

Order-1 circuits: Marriages between cognates

The four-generation limit for the survey of circuits between cognates was used due to the following factors: the Kalapalo ideal is that "close" cousins should not marry; previous research has suggested the possibility of the prevalence of marriages of second cousins (Guerreiro 2008, 2011); and genealogical completeness from the fourth generation onwards is low. Under these conditions, a four-generation depth seems ideal to build a reliable enough census, comprising marriages of first, second and third cousins.

The census found 97 order-1 circuits divided into 43 types. They comprise 62 couples, being 19.38% of all couples in the corpus and 37.58% of couples in the census. There are only 12 marriages between first-degree cross-cousins, representing 3.75% of total marriages and 12.37% of circuits between cognates. This confirms previous ethnographic reports that suggest that marriages between close cousins would be infrequent.

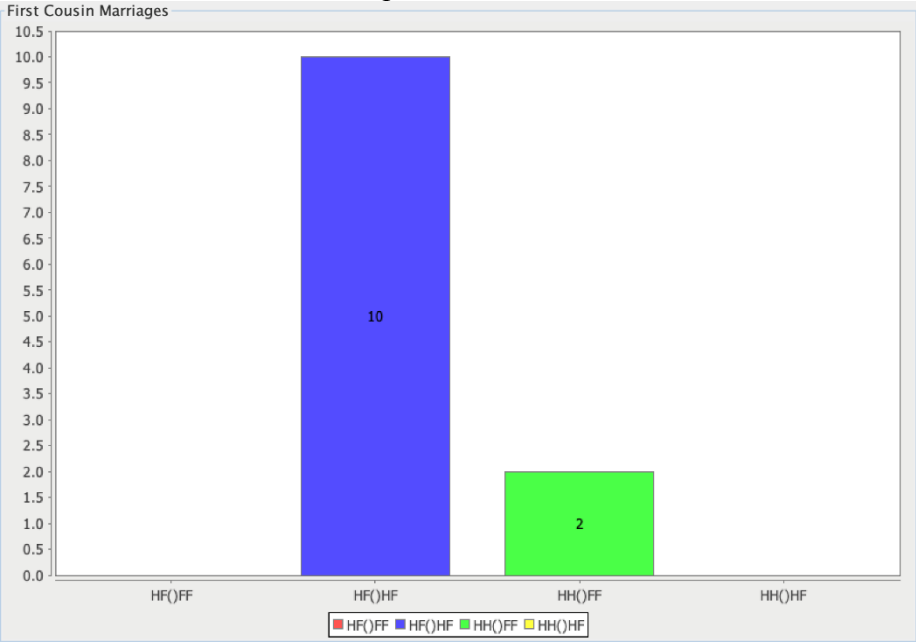

Figure 4: Marriages between first cousins, according to the positional notation exported by Puck. HF()HF equals a man's marriage to his MBD, and HH()FF equals a man's marriage to his FZD. For details on the notational position, see Barry (2004) and Hamberger et al. (2009).

All 12 marriages between first cousins occurred between cross-cousins, and there is a notable discrepancy between the number of marriages with MBD (10) and FZD (2). Comparing these numbers with how many chains of each type exist, there is a considerably higher "preference rate[9]"for the MBD circuit (3.56%) compared to the FZD circuit rate (0.97%), which suggests that

[9]This rate, also called "*closure rate*," represents the percentage of unions that actually occur in relation to the total number of genealogical paths of a given type identified by the census. Thus, a preference rate of 3.57% means that, of all the paths linking a man to an MBD or a woman to an FZS existing in the network, 3.57% are "closed" with a marriage relationship between Ego and Alter forming a marriage circuit (Hamberger et al. 2009).

such discrepancy should not be random. This would be in line with the Kalapalo's ideas about cross-cousin marriages, according to which when a man marries a cousin, the daughter of the maternal uncle would be preferred. This idea is particularly marked in arranged marriages, in which a woman arranges for her son the daughter of a brother or cousin (Basso 1984; Guerreiro, 2011). Other groups seem to prefer the patrilateral female cross-cousin (such as the Kamayurá and Kuikuro, according to Galvão (1979), and Fausto (nnnn, personal communication), but there are no data available for comparison.

Marriages between second cousins are more frequent, totaling 33 circuits – 34% of the circuits between cognates (see Table 2).

Table 2: Marriage Circuits Between Second Cousins

Circuit Types	# Circuits	% Circuits	Preference Rate	# Couples	% Couples	% Total Couples	IROQ
MMZSD	8	8.25	6.67%	8	12.9	2.5	#
MMBSD	5	5.15	3.40%	5	8.06	1.56	#
MFBSD	4	4.12	2.99%	4	6.45	1.25	#
FMBDD	4	4.12	2.37%	4	6.45	1.25	#
MFBDD	3	3.09	2.86%	3	4.84	0.94	=
FFBDD	2	2.06	1.92%	2	3.23	0.63	#
MFZSD	2	2.06	1.92%	2	3.23	0.63	#
FMBSD	2	2.06	1.19%	2	3.23	0.63	=
FFZDD	1	1.03	1.79%	1	1.61	0.31	#
MFZDD	1	1.03	0.97%	1	1.61	0.31	=
FMZSD	1	1.03	0.40%	1	1.61	0.31	=

The table lists each type of circuit, absolute and relative numbers, preference rate, and how many couples in the network are comprised. They are also indicated as cross (#) or parallel (=) according to the Iroquois calculation. Among second cousins, marriages with matrilateral cousins are more frequent, occurring 19 times and representing 19.58% of order-1 circuits. The most frequent type of circuit is marriage to an MMZSD, a matrilateral female cross-cousin. With 8 occurrences, it has the highest preference rate of 6.67%. It is followed by two other circuits (MMBSD and MFBSD), that correspond to marriages with matrilateral female cross-cousins, occurring, respectively, 5 and 4 times, with preference rates of 3.4% and 2.99%. Marriage to MFZSD is less frequent, occurring only twice with a 1.92% preference rate. Marriages with patrilateral female cross-cousin are less frequent overall, with 7 circuits of 3 types, and only 7.21% of order-1 circuits. Most of these marriages were with FMBDD (4 occurrences, with a preference rate of 2.37%), FFBDD (2 occurrences, with a preference rate of 1.92%) and FFZDD (1 occurrence, with a preference rate of 1.79%).

If I group the circuits linking children of cross-cousins, on the one side, and children of parallel cousins, on the other side, we note 12 marriages of the first type and 14 of the last, which appears to be a reasonably equivalent distribution. This suggests that, perhaps, opposite-sex cross-

cousins in fact play a structural role similar to siblings with regard to creating marriage possibilities for their children.

It should also the occurrence of 7 circuits (7.21%), grouped into 4 types, which represent marriages between parallel relatives according to the Iroquois calculation, should be noted These cases will be discussed later.

There are also several circuits of oblique marriages: 15 circuits (15.46% of order-1 circuits) grouped into 11 types, in which male Ego marries a woman of the first descending generation, and 6 circuits (6.18%), of 3 types, in which Ego marries a woman of the first ascending generation.

There are 9 circuits of 7 types in which marriages occurred with women classified as "nieces" (FFBDDD, FMZDDD, FFZDDD, MFBSDD, FMBSDD, FMZSDD and MMBDDD, all terminologically equivalent to ZD). None of them are particularly frequent, but marriage to MMBDDD has a higher preference rate (5%) than the others. Also it should be noted the way the Kalapalo consider this type of union. Marriage to a "true" ZD is prohibited, but marriage to more distant relatives classified as ZD (Oberg 1953:44) is possible under certain conditions. It is considered a "bad marriage" because, according to the Kalapalo, it "messes things up" with regard to kinship classifications. They consider it "wrong" for a sister or cousin to become their mother-in-law. Still, if a man wishes to marry a classificatory ZD, it is possible to seek the consent of the future mother-in-law to determine if she would be bothered. In some cases, this type of marriage is explicitly seen as an alternative to a cross-cousin marriage that was not possible due to the age gap between the ideal partners. Thus, if a man has a much older female cross-cousin, her daughter can be seen as a potential wife. In these cases, there is an *ad hoc* generational shift, with the

Table 3: Circuits Between Cognates, 3 Ascending Generations

Circuit Types	# Circuits	% Circuits	Preference Rate	# Couples	% Couples	% Total Couples	IROQ
FMMZSSD	6	6.19	2.45%	6	9.68	1.88	=
MMFBSDD	5	5.15	5.49%	5	8.06	1.56	=
MFMZSDD	3	3.09	1.92%	3	4.84	0.94	=
FMFBDDD	2	2.06	2.94%	2	3.23	0.63	#
MFMZDSD	2	2.06	1.16%	2	3.23	0.63	#
MMMZSDD	2	2.06	1.94%	2	3.23	0.63	=
FFFBSSD	1	1.03	0.72%	1	1.61	0.31	=
MFFBSSD	1	1.03	2.63%	1	1.61	0.31	#
MMFBDSD	1	1.03	0.85%	1	1.61	0.31	#
FFMZSDD	1	1.03	0.58%	1	1.61	0.31	#
FMMBSDD	1	1.03	2.08%	1	1.61	0.31	#
FMMZDSD	1	1.03	2.33%	1	1.61	0.31	=
MMMBSDD	1	1.03	3.03%	1	1.61	0.31	=
MMMBDDD	1	1.03	4.00%	1	1.61	0.31	=

younger woman (a niece) also coming to be called "cousin."

When we start to observe circuits between cognates (see Table 3) with a greater generational depth, there seems to be a slightly higher frequency of marriages between parallel relatives: 6 types of circuits represent unions between cross relatives, and 8 between parallel relatives. Third-degree cross-cousin marriages are not very frequent and are surpassed by the total number of marriages between parallel relatives (8 vs. 20). One of the most frequent circuit types (MMFBS-DD) along with its higher preference rate (5.49%), represents precisely the marriage with a parallel female cousin.

It seems that at this genealogical depth, crossness loses its importance. In fact, the third ascendant generation is more or less when the reckoning of genealogical relationships begins to fade, and people consider themselves as "relatives from afar" or even as unrelated.

At this point, it is important to introduce the concept of "circuit intersection network" as a means of trying to understand how the various types of circuits are related and what may be at stake in marriages with parallel relatives. A circuit intersection network treats each type of circuit as a node, and the relationships between two nodes imply that at least one marriage relationship is shared between both. When circuits intersect, we can understand how apparently strange cases can be clarified in a broader context that is difficult to apprehend with the naked eye. The frequent intersection of some circuits may reveal the existence of encompassing circuits or intergenerational trends in the network (Hamberger et al. 2014). The intersection network of the order-1 circuits can be represented as shown in Figure 5.

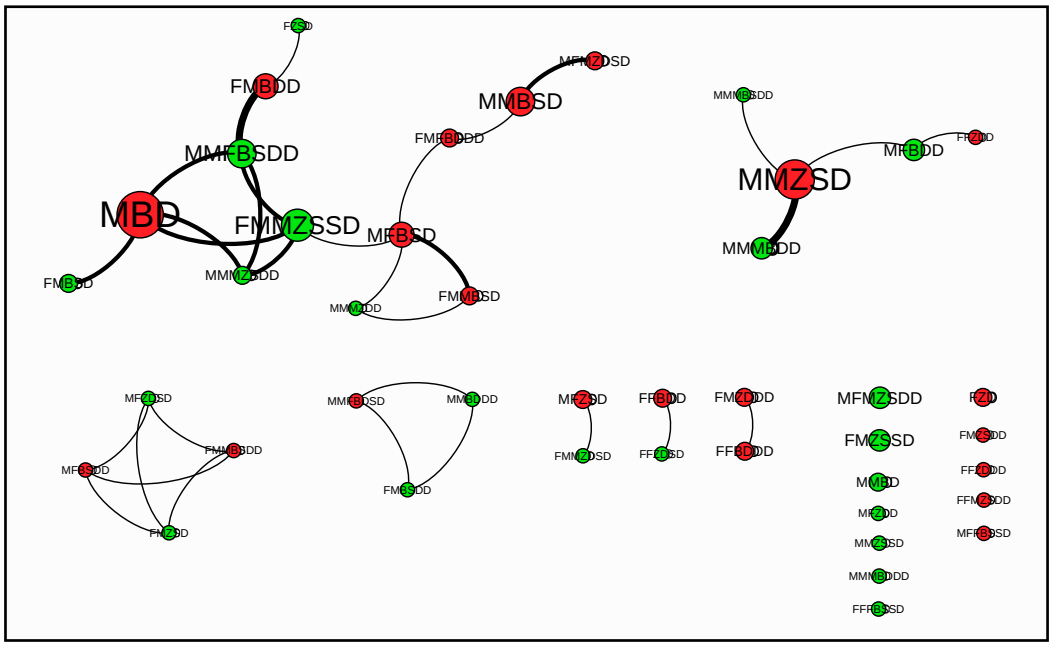

Figure 5: Order-1 circuit intersection network, depth 4.

Red and green nodes represent cross and parallel circuits, respectively, following the Iroquois logic of the Kalapalo terminology. The network can be divided into seven independent components, each being a grouping of circuits connected to one another (but not connected to the cir-

cuits of the other components). The difference between the components is significant, with a main component (upper left corner) that aggregates 13 types of circuits, while the other components gather 5 types or less. The largest component also comprises almost all of the most frequent types of circuits (larger nodes), except MMZSD (core of the second largest component), and has a majority of cross circuits (7). Interestingly, 4 of the parallel circuits that compose it intersect with the MBD circuit. In contrast, the FZD circuit appears alone and does not intersect with any other circuit, as well as with 3 other circuits that are terminologically equivalent to marriage with an FZD. The number of parallel circuits "disconnected" from the network is also higher in relation to cross circuits without connections.

I note that some of the parallel circuits connect to cross circuits of lower generational depth. Consider, for example, the two parallel FMBSD circuits in Table 2. Although the men have married women they would call "sisters" following this genealogical path, when analyzing these marriages in more detail, we see that both circuits intersect with MBD circuits, implying that these wives are also matrilateral cross-cousins from the point of view of their husbands. For both types of circuits to intersect, there needs to be an intergenerational trend. This intersection is only possible if a man and his father have each married a first-degree MBD.

Among the 3 MFBDD circuits (marriages to a "sister"), 2 intersect with others. One of them intersects with an MMZSD circuit (marriage to a matrilateral second-degree female cross-cousin) and another with a FFZDD circuit (marriage to a patrilateral second-degree female cross-cousin). Only one does not intersect with other circuits in the network, but this could be due to gaps in the data. For the single occurrence of an FMZSD (=Z) circuit, this circuit intersects with three others: MFBSDD (=ZD), MFZDSD (=D) and FMMBSDD (=FZD). These intersections demonstrate that at least some marriages occur between relatives who, following a given path, are parallel, as can be seen with marriages between cross relatives following an alternative path.

The circuit intersection network also helps clarify some of the oblique marriages. Some of them intersect with other circuits, which are sometimes preferred by couples as a means of classifying their relationship before marriage. For example, marriages with MFBSDD (1) and FMBSDD (1) are also cross-cousin marriages: to an FMMBSDD (=FZD) in the former case, and to an MMFBDSD (=MBD) in the latter case. There are some marriages with women classified as "daughters," but at least one of them intersects with a terminologically appropriate circuit: a marriage to FFZDSD (=D) also involves marriage to FFBDD (=FZD). Finally, there are some marriages of a man to a woman of the first ascending generation, and they all intersect with other circuits that show cross-relationships between spouses: two of the marriages to an FMMBSD (FZ) also involve marriages to an MFBSD (=MBD); three of the marriages to an MMMBDD (=M) also involve marriages to an MMZSD (=MBD)[10]; and marriage to an MMMZDD (=M) is also involves marriage to an MFBSD (=MBD). The other oblique circuits do not intersect with other order-1 circuits, and further analysis of their relationships with circuits of other orders would be necessary, but that is beyond the scope of this article.

Now let us focus on the third-degree parallel cousin marriages in Table 3. Of the 6 marriages with an FMMZSSD — a "sister" — two of them are also marriages with an MBD, and another is

[10] This case refers to a man married with three sisters. Since sororal polygamy is seen as the repetition of an alliance, the three unions were treated as a single case.

with an MFBSD (=MBD). The other three only intersect with order-1 parallel circuits (MMFBSDD=Z and MMMZSDD=Z), but I have no data allowing me to analyze them further. It should be noted that some of the parallel circuits also have intersections with shorter cross circuits, such as FMMZDSD (=Z) and MFZSD (=MBD) marriages. This suggests that most marriages represented by such circuits should be better understood from the perspective of the circuits of lower generational depth with which they intersect, and that perhaps marriages between second-degree cross-cousins are in fact the most relevant ones when considering marriages between cognates.

Order-2 circuits: Redoubling of alliances

The census of order-2 circuits with depth 2 found 299 circuits (75.51% of the total), distributed among 81 types (65.32% of the total). Almost all couples that are part of some circuit participate in at least one order-2 circuit. Compared to the 37.58% of couples participating in order-1 circuits, it is clear that the redoubling of alliances forms the largest part of the analyzed network[11]. The most frequent type is marriage to the wife's sister (WZ), representing 7% of the circuits. It also has the highest preference rate: 5.72%. In second position, there is the repetition of the brother's marriage; i.e., marriage to a sister of the brother's wife (BWZ; 4%), and the preference rate of this circuit is not particularly high (2.25%). However, considering only the frequency of each type of circuit would not be the best strategy, as several can be considered equivalent both through the terminology and from the indigenous point of view. If I take all marriages that are terminologically equivalent to BWZ, the number almost doubles (21 marriages, a 10% rate). If I also decide to treat all first cousins as siblings, as seems usual, the numbers would be even higher (60 marriages, a 23.07% rate).

Among the order-2 circuits, it is important to examine closer what is considered the most common type of alliance in the Amazon, namely restricted exchange in a number of ways. According to Viveiros de Castro, the most common forms of alliance in the region would be marriage to the FZD and sister exchange (Viveiros de Castro 1993b, 2002; Viveiros de Castro & Fausto 1993). Both present great variation but can be seen as trends of restricted exchange in contexts in which the number of partners is not reducible to 2, as was originally described by Lévi-Strauss (2003). Among societies that favor sister exchange, some allow, or even prefer, the repetition of this type of marriage with each generation, making it overlap the marriage of cross-cousins. However, others prefer the exchange of sisters with distant relatives or non-relatives, dissociating this form of alliance from the marriage of cousins. In the Upper Xingu, ethnographies have already noted how sister exchange is a valued form of marriage, regardless of whether or not it is articulated with the marriage of cousins (Becker [Basso] 1969; Viveiros de Castro 1977; Coelho de Souza 1992).

The Kalapalo have a term to describe the relationship between men who marry each other's sister: *togopitsohoi*[12]. Becoming *togopitsohoi* means "becoming even" and can also be used to talk about people who exchanged objects, who paid off a debt, or who had an aggression compensated by a payment. The root of the word is *ogopi*, which means "go back" or "return", and is

[11]Indeed, this is possibly a general property of kinship networks, and not only of the networks analyzed here.

[12]It would be possible to segment the word as follows: *t-ogopi-tsoho-i*, RFL-return-INSTNR-COP (following SANTOS, 2007). The root "return" (*ogopi*) is preceded by a reflexive prefix (*t-*), followed by an instrumental nominalizing suffix (*-tsoho*) and a copula (*-i*).

also related to *opi*, "give back," "respond," "pay," "turn," or "alternate." Although the term can be used to refer to a pair of women married to each other's brothers, Kalapalo women do not use it. Men also consider this possible use as inappropriate because, according to them "the man is the one who makes the marriage."

The ZHZ circuit, itself, is not the most frequent: it occurs 7 times (2.34% of circuits) and does not have a high preference rate (1.28%). However, the numbers change if I follow the Kalapalo terminology and treat together several other types of marriage that leave men *togopitsohoi* (see Table 4). There are four types of circuits that, although genealogically distinct, are equivalent to ZHZ: MZDHZ, FBDHFBD, MZDHFBD, and MZDHMZD. Together, they total 19 circuits (6.34%), but the numbers can increase even more if we consider something specific to the Kalapalo terminology (also noted by Gregor (1977) among the Mehinaku): the husband of a man's female cross-cousin is also a brother-in-law (just as the reverse occurs from the female perspective). This is an effect of the contextual neutralization of the crossness in G∅ that characterizes the terminology, making men married to each other's female cross-cousins to consider themselves *togopitsohoi* in the same way as those who exchanged sisters. In other words, cross-cousins that mediate this type of relationship are converted into siblings. If we take the set of these circuits as the expression of a more complex, "Iroquois" form of the restricted exchange derived from the sisters exchange model, it would represent 15.04% of the circuits.

Table 4: Circuit Types in Which Men Consider Themselves *Togopitsohoi*, "Even"

Circuit Types	# Circuits	% Circuits	Preference Rate	# Couples	% Couples	% Total Couples
FZDHZ	8	2.68	2.12%	9	5.59	2.81
ZHZ	7	2.34	1.28%	12	7.45	3.75
MBDHMBD	7	2.34	1.23%	11	6.83	3.44
MBDHZ	4	1.34	0.70%	6	3.73	1.88
MZDHZ	3	1.0	0.85%	5	3.11	1.56
FBDHFBD	3	1.0	0.58%	4	2.48	1.25
MZDHFBD	3	1.0	0.89%	4	2.48	1.25
MZDHMZD	3	1.0	1.12%	5	3.11	1.56
MBDHFZD	3	1.0	0.86%	5	3.11	1.56
FBDHZ	2	0.67	0.38%	3	1.86	0.94
MBDHZD	2	0.67	0.45%	4	2.48	1.25

Other circuit types also seem to suggest some relationship with the principle of restricted exchange, but by different means (see Table 5).

Table 5: Intergenerational Marriages in Which Men Consider Themselves *Togopitsohoi*, "Even"

Circuit Types	# Circuits	% Circuits	Preference Rate	# Couples	% Couples	% Total Couples
ZDHZ	10	3.34	1.95%	12	7.45	3.75
FBDHZD	8	2.68	1.88%	11	6.83	3.44
MZDHZD	6	2.01	1.65%	7	4.35	2.19
ZDHM	5	1.67	1.97%	9	5.59	2.81
BDHZ	3	1.0	0.75%	6	3.73	1.88

The most frequent circuit in Table 5 is marriage to ZDHZ. Considering that spouses of nephews and nieces are affines (daughters-in-law and sons-in-law), this represents a marriage with a son-in-law's sister. This circuit can be thought of in relation to marriages to FBDHZD or MZDHZD (a brother-in-law's daughter), or to MBDHZD (a brother-in-law's niece). In all of these cases, men can also consider themselves *togopitsohoi*, implying that such relationships can be seen as "intergenerational alternatives" to sister exchange and its variations (just as marriage to a ZD can be an alternative to marriage with a female cross-cousin). What they all have in common is that they are marriages between a man and a consanguine close to an affine of the same sex.

There is still a set of circuits that do not seem to be directly linked to any restricted exchange principle, but that deserve attention (see Table 6).

Table 6: Redoubling of Alliances Between Pairs of Siblings

Circuit Types	# Circuits	% Circuits	Preference Rate	# Couples	% Couples	% Total Couples
FZHBD	A	1.67	2.07%	8	4.97	2.5
MZHZD	4	1.34	1.76%	7	4.35	2.19
MBWZD	3	1.0	1.42%	5	3.11	1.56
MBWBD	2	0.67	0.57%	4	2.48	1.25
MZHBD	2	0.67	0.94%	4	2.48	1.25
MBDHZD	2	0.67	0.45%	4	2.48	1.25

In all of these, there are two pairs of siblings initially linked by a marriage, and then reconnected in the next generation by a marriage between the children of the siblings not allied in the previous generation, as shown in Figure 6.

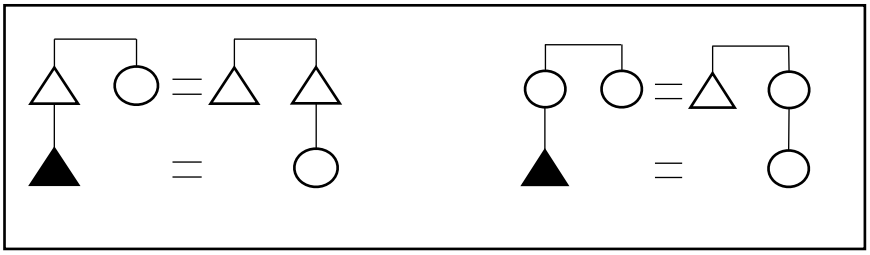

Figure 6: Left: Marriage to an FZHBD. Right: Marriage to an MZHZD.

It seems that this form reconnects two pairs of siblings in consecutive generations, but on the condition that the spouses responsible for the reconnection are not descendants of the original couple. It would be necessary to carry out a census with greater generational depth to investigate whether this type of alliance is repeated at greater intervals of time.

Having come this far, it would be desirable to analyze the network of intersection between order-1 and order-2 circuits in order to investigate how these circuits that gravitate around the restricted exchange "in the Iroquois fashion" connect to marriages between cognates. However, were I to do so, there would be no room for such an analysis, so it must be done in the future.

Interethnic marriages and relations

Despite all the descriptions since Von den Steinen (1940, 1942) noting the existence of interethnic marriages, there is little concrete data on the subject. The only work to address the subject in depth is Mutua Mehinaku's master's dissertation (2010), which discusses macro and micropolitical issues, as well as affective and pragmatic issues involved in interethnic marriages, with all of these based on the marriages of the author's own maternal grandfather and parents. Mehinaku demonstrates the centrality of this type of marriage to the production of a "mixed" (*tetsualü*) Upper Xingu, in which such marriages were, and continue to be, the main paths for the circulation of people, languages and knowledge. In the older literature, Sutherland (1968) attempted to compile scattered data in order to produce a global overview of a set of "intertribal exchanges" of which marriages would be a part. She summarized in tables what was, at that time, available about the Kamayurá, Aweti, Wauja, Yawalapíti, Mehinaku, Kuikuro and Trumai, and hypothesized that while intraethnic marriages would tend to symmetrical alliance, interethnic marriages would manifest a trend to asymmetry (ibid.: 161). Dreyfus (2020 [1970]) also questioned whether it would be possible to identify, based on the marriage terminologies and practices, the existence of some global structure of interethnic alliances, but ended up recognizing that there would be no means to investigate that issue at that time (ibid.: 270).

This section seeks to deepen such a discussion based on the Kalapalo genealogy. It is important to note that the following data should not be taken as representative of the Kalapalo as a whole (as field research in more villages would certainly provide more insight into the relationships), nor can they be extrapolated to the entire Upper Xingu. My objective here is to provide an empirical and measurable overview of how, over the course of the generations that constitute this particular genealogy, an expressive segment of the Kalapalo population has built kinship relationships with people from other groups.

Most people in the network are identified as Kalapalo, representing 73.89% of the corpus. There is no information on 33 individuals (2.98% of the total). Of the remainder, the Carib-speaking peoples are the most present: 9.94% of Kuikuro, 4.43% of Matipu and 4.43% of Nahukua, or 18.8% of the total. Next come the Yawalapíti and Mehinaku, with 20 and 12 individuals respectively (representing only 1.81% and 1.08% of the total). The Kalapalo say that they have old relations with the Mehinaku, as their traditional territories were once close and some history masters say that the Kalapalo territory was, in fact, ceded to them by those Arawak-speakers. In turn, the relationship with the Yawalapíti goes through at least two main paths. On the one hand, the Kuikuro's alliance with the Yawalapíti had impacts on the Kalapalo's marriage possibilities, and it is often the Kalapalo's kinship with their Carib-speaking allies that leads

them to seek wives from the Arawakan people. On the other hand, the marriage of two Kalapalo women to the great chief Aritana Yawalapíti (who tragically died a victim of COVID-19) opened a cycle of marriages of some Kalapalo with Arawakan women that seem to gravitate around this alliance.

The participation of other groups in the network is much smaller. Also from the Carib-speaking world, there are the Angaguhütü (6 people, 0.54%), a group that almost became extinct in the 1920s, took refuge among the Kalapalo and only recently has again been recognized as a people; and the Hukuingi (1 person, 0.09%), a group closely related to the Nahukua represented as anthropophagic in accounts and about whom very little is known (Guerreiro 2015). The Kamayurá, Wauja and Aweti together compose only 0.81% of the network.

This demographic distribution is replicated, as would be expected, when I examine interethnic marriages (see Table 7).

Table 7: Distribution of Interethnic Marriages in the Network

Kalapalo marriages to:	Total	% of interethnic marriages	% of total marriages
Kuikuro	32	35,96	8,84
Matipu	20	22,47	5,52
Nahukua	20	22,47	5,52
Yawalapíti	9	10,11	2,49
Mehinaku	3	3,37	0,83
Angaguhütü	2	2,25	0,55
Kamayurá	2	2,25	0,55
Aweti	1	1,12	0,28
Total	**89**	**100**	24,58

As observed, the network is mostly endogamic from an ethnic point of view (75.42% of marriages); however, about a quarter of marriages occur with people from other peoples[13]. The majority of interethnic marriages occur with the Kuikuro (35.96%), Matipu (22.47%) and Nahukua (22.47%), representing 80.9% of the Kalapalo's alliances with other peoples. This network of alliances is shown in Figure 7.

The nodes represent peoples and the lines represent marriage relationships. The thickness of each line indicates its relative weight in the set of the network, that is, thicker lines indicate more frequent marriage relationships. Numbers indicate the number of women from one people married to another, and line colors indicate their ethnic origin. For example, note the relationship between Kalapalo and Nahukua expressed in two lines, one red (color of the "Kalapalo" node) and one yellow (color of the "Nahukua" node). This shows that 18 Kalapalo women married

[13]It must be recognized that the identification of individuals to a given people can undergo variations, as many people consider themselves, or are considered by others, as "mixed" (for a detailed discussion of this topic, see Mehinaku 2010). However, for the purposes of this article, I considered the identifications obtained in the field or are present in other ethnographic documents.

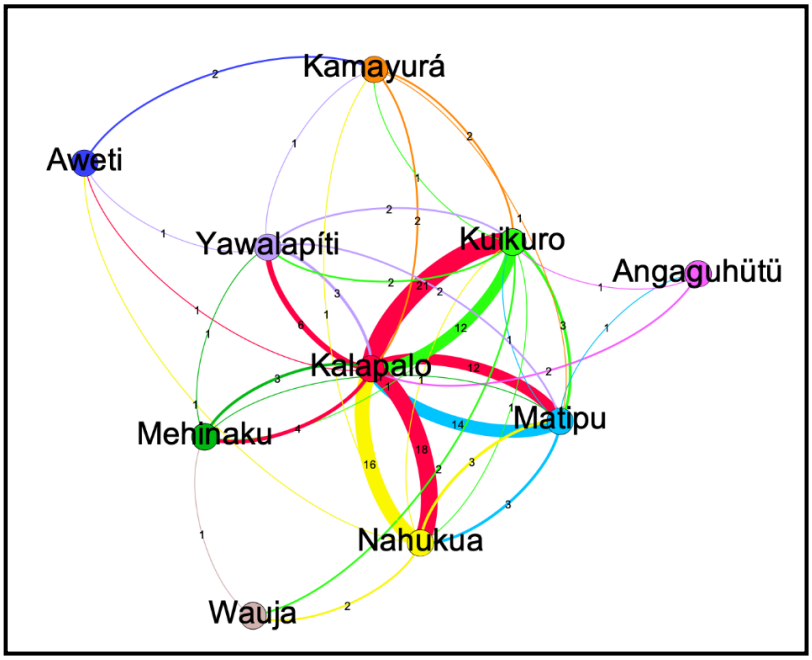

Figure 7: Kalapalo network of interethnic alliances.

Nahukua men (red line), and 16 Nahukua women married Kalapalo men (yellow line).

It is clear that there is a "Carib subsystem" (Franchetto 1998, 2017) interconnected by marriage relationships, to which peoples such as the Yawalapíti and Mehinaku are linked with certain proximity. The other peoples orbit on the periphery of this core, but it should be noted that these positions are only relative to the network. The existence of more data collected in other Kalapalo villages or with these peoples, would probably produce another scenario.

Finally, it is also worth analyzing the flow of wives among these peoples from a quantitative point of view. Considering the "Carib-speaking core" around the Kalapalo, it is interesting to note that most relationships between peoples seem to tend towards a certain balance, with one notable exception: there is a far greater flow of Kalapalo wives towards the Kuikuro than the other way around. The Kuikuro are the most linguistically distant from the Kalapalo and, in regional politics, they have marked rivalries, rarely allying in intercommunity rituals (unlike the Matipu and Nahukua, who often participate in feasts with the Kalapalo as if they formed a single people). It is possible to imagine that the tension of this political relationship and the asymmetry in marital relationships may have some kind of pattern, but I have no elements for examining this hypothesis at the moment.

It must be said that this way of seeing relationships is somewhat arbitrary. Although people often refer to interethnic marriages through references to the spouses' peoples of origin, it is likely that this apparent exogamy actually hides a certain "kinship endogamy," expressed in the search for spouses among distant relatives, or in the redoubling of an interethnic alliance of close relatives. Investigating the extent to what this is, or is not, the case would require a future, detailed analysis of interethnic marriages, identifying whether they participate in marriage circuits, what types they are and whether or not they differ from those prevalent in marriages between

individuals of the same people.

In any case, it is clear that what I call "Kalapalo genealogy" is only that to a certain extent. This genealogical network, despite its limitations, is almost a microcosm of the Upper Xingu world. At the same time, the importance of languages in the formation of an "endogamic nexus" among Carib-speakers is also clear. It is difficult to precisely establish the reasons, but the data also suggest that intergroup marriage relationships tend toward balance, with a marked exception between the Kalapalo and Kuikuro, who occupy positions of strong rivals in the Carib subsystem.

Discussion

Data analysis enables us to make some general considerations about the Kalapalo (and possibly Xinguano) kinship system and raise questions for future investigation. First, it is clear that marriages of first-degree cross-cousins are indeed rare. It is also evident that, among marriages between cognates, marriages between second cousins are more frequent, with a significant presence of marriages of children of cross-cousins of the opposite sex. These results seem to confirm the hypothesis that Iroquois terminologies, such as the Kalapalo terminology, would be compatible with a distant cross-cousin marriage system, and that avoiding the marriage of first cousins would be associated with the fact that they can be treated as siblings. Marriages between third cousins are also present, but the number of marriages between parallel relatives is higher, which suggests that, at this genealogical distance, crossness may no longer be so important – third cousins are already considered "very distant relatives," or even non-relatives. Also in relation to cousin marriages, it is worth noting the prevalence of marriages with matrilateral female cross-cousins, both among first and second cousins. Marriages with patrilateral female cross-cousins are present, but, in addition to being less numerous, these appear more isolated when we observe the marriage circuit intersection network – that is, they seem to have a lower interdependence relation in comparison to other circuits and, therefore, a more limited impact on the network structure. Understanding their structural implications would require an in-depth analysis in the future at the intersections between order-1 and order-2 circuits.

However, marriages between cognates do not form the most numerous set of circuits identified in our census, which are order-2 circuits – that is, the redoubling of alliances. The data on these types of marriages provide a more complex view of what the literature often calls "sister exchange," and "restricted exchange," in general. In addition to the common forms of marriages between two pairs of brothers and sisters, including parallel cousins, the concept of *togopitsohoi* by which the Kalapalo express this type of alliance extends to marriage relationships involving pairs of cross-cousins of the opposite sex. This, once again, makes clear how cross-cousins can function as siblings in an alliance system and not only when we consider marriages between cognates. Each marriage opens an expressive universe of marital possibilities for men and women as the male and female cross-cousins of their brothers-in-law and sisters-in-law become possible spouses. It is as if the restricted exchange expressed in this type of alliance operated in an expansive regime: virtual/terminological affines of effective affines become potential affines among themselves.

It is possible to imagine that this characteristic of the system must have played an important

role in the formation of interethnic alliances and, consequently, in the expansion of the scale of kinship relations that characterize the Upper Xingu multiethnic complex. A single marriage between two persons from different peoples is capable of causing the virtual/terminological affines of each spouse see one another as possible marriage allies. This perspective, in turn, creates possibilities for new relationships on different planes: on an ego-centered plane, through new marriages in which men seek to "become *togopitsohoi*" through new interethnic marriages and, on a collective plane, invitations to rituals in which potential affines play key roles as guests.

Despite the frequency of marriage between children of cross-cousins, it was not possible to observe the "minimum model" of the Iroquois alliance in operation, with four pairs of siblings allying symmetrically in non-consecutive generations (Viveiros de Castro 1998) – at least not within the limits of the genealogical depth investigated. On the other hand, it was possible to identify several forms of alliance that are considered, from an indigenous conceptual point of view, as "restricted exchange" (that is, they make spouses *togopitsohoi*; i.e., "even"), but that expanded, with each generation, the set of allies through a restricted exchange that always assumes a third ally. We are, it seems, in the universe of "inclusive restricted exchange" (Viveiros de Castro 1993a; Viveiros de Castro & Fausto 1993). This outward drive of the alliance causes a high degree of indeterminacy of the system, which could hardly be characterized as an elementary system. Perhaps it is more appropriate to characterize the Upper Xingu system as "semi-complex," at least for two characteristics already raised by Lévi-Strauss: one would be the coexistence of a diversity of elementary formulas and another would be the apparent preeminence of an *interdiction* (no marriage between close relatives) that, once overcome, opens a wide universe of choices, in which restricted exchange seems to be an ideal, but operating in a logic that refuses any mechanical modeling. Or perhaps it is worth thinking about it according to the distinction between structures and regimes proposed by Viveiros de Castro: the *structure* is elementary (restricted exchange), but the *regime* of its operation is not, thanks to the introduction of *time* (and the elements of indeterminacy it brings) as an indispensable factor for the dynamics of the system (Viveiros de Castro 1993b: 134-135).

In the South American context, the Kalapalo case presents similarities with other systems of Iroquois terminology. As among the Aguaruna, there is a clear importance of marriage between children of cross-cousins; and, as among the Kandoshi, there is also a significant presence of marriages of third cousins but without crossness seeming to play such an important role (Taylor 1998: 206-207). There are also similarities with the "virtuous formula" of marriage among the Enawenê-Nawê for whom "residual affines" (grandchildren of effective affines linked by a sister exchange) could arrange the marriages of their children – that is, the marriage of third cousins (Silva 2022). However, as Silva notes, his data do not enable verifying the possible recurrence of this formula given the great scarcity of marriages between cognates – only 8, of which 3 would be marriages between third-degree cross-cousins (ibid.: 4). The Kalapalo also have a virtuous formula in which a woman chooses for her son a wife who is the daughter of a man she calls "brother" or "cousin," implying that they are also unions between cross-cousins of, at least, second degree. However, it is a practice in disuse and I have little data for it. In all of these cases, it is confirmed that forms of neutralization of the opposition between parallel and cross kin (Trautmann 2012) are accompanied by an extension of the time interval over which a given al-

liance can be replicated among the descendants produced by the original relationship. These are systems that open emphatically to time and to the multiplication of partners.

As is evident, there are still many gaps and paths to be pursued. It would be important to investigate in detail whether there are variables that interfere with marriage choices, such as the condition of being chief of the spouses or their parents, and whether there are different patterns in interethnic marriages. It would also be important to investigate whether the patterns identified so far among the Kalapalo are replicated among other groups in the region. Although it is not possible to give answers now, what has been presented here may provide a starting point for future deepening of kinship studies in the region.

In addition, the methodology used here may be adapted for the research of other issues. For example, it would be possible to use this database as a basis for documenting and surveying relations of transmission of specialized knowledge (such as songs, prayers and ceremonial speeches), and to research how they intersect with diverse kinship relationships; to identify how kinship dynamics influence current territorial dynamics in which we observe a rapid proliferation of small villages; to evaluate possible relations between kinship and certain dimensions of regional politics, such as the occupation of political and professional positions; to research the relations between kinship, residential patterns and multilingualism; or, the trends identified may be useful for understanding the current issues that affect young people when they think about ``their marital and familial future.'' Leaving the Upper Xingu, it would be important to carry out two comparative forms of analysis. One would enable a more in-depth analysis of the points of convergence and divergence among South American Iroquois systems. Another would be a comparison of the concrete marriage practices of these systems with those found in other empirical networks of Dravidian systems in order to improve the understanding of their differences. In short, there is still much work that lies ahead.

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