MaqPar

A Homemade Tool for the Study of Kinship Networks[1*]

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The computer tool under development we are presenting here was devised within an ongoing investigation program aimed at studying the kinship networks of some Amerindian people[2]. Named with the acronym *MaqPar*, which comes from the Portuguese expression *Máquina do Parentesco* (or, "kinship machine"), the main purpose of this tool is to simplify the operations of its potential users: ethnographers interested in documenting and describing the genealogical networks of the people they study. A significant part of these users suffers from the syndrome Michael Fischer diagnosed as technofobia in his book *Applications in Computing for Social Anthropology* (Fischer, 1994). The tool, besides scanning genealogical networks in search of certain phenomena, provides more friendly alternatives to the reader of ethnographic monographs than those genealogical diagrams published in appendices, which take so much effort to prepare and present information which is almost illegible unless the reader resorts to magnifying glasses. We are convinced that this type of figure composed by countless tiny circles and triangles connected by inextricably entangled lines that seem undecipherable to the ordinary reader may be replaced by a few tables in the great majority of the cases. Finally, the tool makes some basic tasks of kinship analysis automatic,

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providing its potential users with the alternative paths connecting two married people within the same genealogical network, orderly numbering his/her connecting kin and assigning the corresponding kintype to each of these paths, besides providing other relevant information such as degree of laterality, generational distance, degree of crossness between *ego* and *alter* (Dravidian or Iroquois), as well as the number and types of genealogical connections involved, and so one.

Created in SQL language and MS-Access environment, its architecture inescapably reflects the limits not only of the application used to develop it, but also of its authors' computational skills. Nonetheless, we are convinced that the simplicity of the operations needed for handling it may encourage its use by a greater number of users who may be interested in a scanning of the genealogical networks they are dealing with in their field research, a task of *impossible complication* (Goldenweiser 1913) without the support of computer resources. The present version of the tool (2.7) privileges the matrimonial **paths**, **rings**, and **implexes**[3] of a given genealogical network we take as empirical manifestations of marriage exchange. They are **consanguineous marriages** or **relinking marriages** of two kinds: **between consanguineous** or **affinal kin**[4].

Definitions

Let us focus on the definitions employed in the development of the tool and on some observations regarding data entering and exit. Assigning an absolute number (**Ind**) to each person in the network is a formal requirement for treating genealogical networks. Basic genealogical data are stored in two tables. In one of them [(001INDIVIDUO)], each line stands for one person and provides information on sex, filiation, year of birth and death. In the other [(002CASAMENTO)], an absolute number is assigned to each marital union (**NCasm**), followed by the numbers of the individuals that make up the couple [(**husband (Ind), wife (Ind)**)].

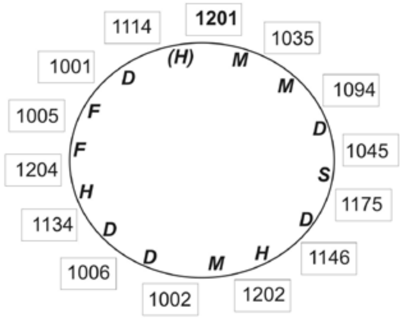
3 We borrowed the word "implex" ("implexo") from old-guard genealogists, but not its usual meaning. For them, the "implex" coefficient (IG) of a given genealogical tree is the difference between the number of the theoretical ancestors (NTA) of a person and the number of his/her real ones (NRA) in a given generation. So, IG = (NTA - NRA) / NTA.

4 In this text, we use a neutral definition of "consanguinity" and "affinity", this last being defined as any chain of kinship relations containing at least one marriage relation (H or W). The first is defined negatively in relation to this property.

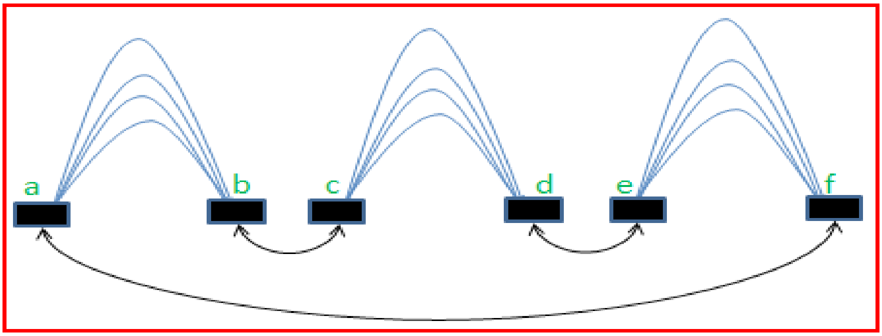
The empirical network of alliances produced in these tables is understood as a finite set of vertices (individuals) and lines (kinship connections). A **connection** corresponds to an immediate filiation (F, M, S or D) or marriage (W or H) relation, in terms of its social recognition, so that each connection may be expressed by the ordered pair of individuals (*ego*, *alter*) and the type of kinship tie they have. A route C is formed by a sequence of connections relating any two individuals within the same network by means of individuals who are linking kin. A **path** P is a route oriented from *ego* to *alter*, in which no ties (connections relating an individual to him/herself) or cycles in which the same individual is repeated along the path are admitted. In short, not only *ego* and *alter*, but all connecting kin composing a given path must be different among themselves. Alternative paths may commonly be traced between two individuals chosen from a given genealogical network.

For example, in the genealogical network of the Waimiri-Atroari people (Silva, 2009), there is a path that involves the individuals 1201; 1035; 1094; 1045; 1175; 1146; 1202. The connections between them are ♂MMDSDH.

A **ring** is a closed-circuit in a given kinship network:



An **implex** is the set of all rings involved in a given set of ordered couples:



In order to consider elementary, semi-complex and complex systems in the same theoretical plan, we suspect that we should abandon a genealogical transcription of the marriage exchange. The notion of implex is a first step in this direction.

In the present version, the tool recognizes the consanguineous marriages of two people, **a** and **k**, in paths having one to ten filiation connections. Thus, it involves sequences from two to eleven individuals, corresponding to a total of twenty thousand, four hundred and eighty types of consanguineous sequences, which we consider more than enough for our purposes. Thus, for example, for a given ♂ *ego*, the tool is capable of listing from an unlikely marriage to a daughter (W = D, that is, a sequence having only one connection) to a marriage to a cousin of the fifth canonical degree or of the tenth civil degree (W = FMFMFDSSDD[5], for example, a sequence having ten connections).

More precisely, if **a**, **b**, **c** ... **k** are individuals in a network in which **a** is *ego* in a sequence having **k** as *alter*, following a path that may or may not "**(x)**" include connecting kin, and **a** and **k** are married (connection represented by the sign =), then:

Consanguineous Marriage (for MaqPar, A1C1)
a = k and **a (b) (c) (d) (e) (f) (g) (h) (i) (j) k**

In other words, for every **a** and for every **k**, from the generation G-10 to G+10, there is a **consanguineous marriage** (which *MaqPar* names **A1C1**) if: **a** is spouse to **k** and the path from **a** to **k** is made up only of filiation relations (F, M, S, D).

The tool also points out all repetitions of consanguineous alliances, a and k', in paths from zero to ten filiation connections which are connected by a marriage relation and another path of the same type. Thus, the tool finds, for example, the marriage of a man to his sister's husband's daughter (♂ZHZ) or of a woman to her sister's husband's male cousin (♀MMZHFFSS) (MMZHFFSS). Thus,

5 In order to avoid ambiguity, we did not use kintypes B and Z for calculation. Instead, we used FS, MS and FD, MD, respectively.

Relinking of consanguineous alliance (for MaqPar A2C1 or A2C2)
(A2C1): **a = k'** and **a (b) (c) (d) (e) (f) (g) (h) (i) (j) k = k'** or **(A2C2):** **a = k'** and **a (b) (c) (d) (e) (f) (g) (h) (i) (j) k =** **a' (b') (c') (d') (e') (f') (g') (h') (i') (j') k'**

A2C1: For every **a** and for every **k**, from the generation G-10 to G+10, and for every **k'**, there is the **relinking of a consanguineous alliance** (A2C1) if: **a** is spouse to **k'**, **k'** is spouse to **k** and the path from **a** to **k** is made up exclusively of filiation connections (F, M, S, D). A2C2: For every **a** and for every **k**, from the generation G-10 to G+10, and for every **a'** and for every **k'**, from the generation G-10 to G+10, there is the **relinking of a consanguineous alliance** if: **a** is spouse to **k'**, **a'** is spouse to **k** and the paths from **a** to **k** and from **a'** to **k'** are made up exclusively of filiation connections (F, M, S, D) and none of the connecting kin between **a** and **k** appear as connecting kin between **a'** and **k'**.

Finally, the tool is capable of listing a second set of relinking of alliances we believe to be equally relevant to what we have just described. We are now dealing with the relinking of the alliance of an affinal kin, a phenomenon inflected by the multi-bilateral exchange. Formally, such repetitions correspond to three paths from zero to ten filiation connections, connected by two relations of affinity. Let us imagine, for example, the marriage of **a = k''**, where **a** is brother to **k**, who is married to **a'**, who is sister to **k'**, who is married to **a''**, who is brother to **k''**. In general terms,

Relinking of affinal alliance (for MaqPar A3C1, A3C2 and A3C3)

(A3C1)

a = k'

and

a (b) (c) (d) (e) (f) (g) (h) (i) (j) k = a' = k'

or

(A3C2)

a = k"

and

a (b) (c) (d) (e) (f) (g) (h) (i) (j) k =

a' (b') (c') (d') (e') (f') (g') (h') (i') (j') k' = k"

or

(A3C3)

a = k"

and

a (b) (c) (d) (e) (f) (g) (h) (i) (j) k =

a' (b') (c') (d') (e') (f') (g') (h') (i') (j') k' =

a" (b") (c") (d") (e") (f") (g") (h") (i") (j") k"

So that (A3C1) for every **a** and for every **k**, from the generation G-10 to G+10, and for every **a'** and for every **k**, from the generation G-10 to G+10, there is the **relinking of an affinal alliance** if: **a** is spouse to **k', k** is spouse to **a', a'** is spouse to **k'** and the paths from **a** to **k** are made up exclusively of filiation relations (F, M, S, D) and none of the connecting kin between any of the consanguineous sequences appear in any other; or

So that (A3C2) for every **a** and for every **k**, from the generation G-10 to G+10, and for every **a'** and for every **k'**, from the generation G-10 to G+10, there is the **relinking of an affinal alliance** if: **a** is spouse to **k", a'** is spouse to **k, k'** is spouse to **k"**, and the paths from **a** to **k** and from **a'** to **k'** are made up exclusively of filiation relations (F, M, S, D) and none of the connecting kin between of any of the consanguineous sequences appear in any other; or

So that (A3C3) for every **a** and for every **k**, from the generation G-10 to G+10, and for every **a'** and for every **k'**, from the generation G-10 to G+10, and for every **a"** and for every **k"**, from the generation G-10 to G+10, there is the **relinking of an affinal alliance** if: **a** is spouse to **k", a'** is spouse to **k, a"** is spouse to **k'**, and the paths from **a** to **k,** from **a'** to **k'** and from **a''** to **k''** are made up exclusively of filiation relations (F, M, S, D) and none of the connecting kin between of any of the consanguineous sequences appear in any other.

Data entering

Primary information on the individuals is organized on the Table 001INDIVIDUO of the following type:

001INDIVIDUO

Ind	Nome	Sexo	Pai	Mae	Nascm	Obito
1166	Makîma	m	1022		1907	1987
1167	Wanakta, Abtxe	m	1056		1917	
1168	Yudye, Kwaxi	m	1059		1925	1989
1169	Ewepî	m	1019		1927	
1170	Awane	m	1003		1927	1987
1171	Weripeki	m	1029		1932	
1172	Pauna	m	1001		1942	
1173	Yîmahpa	m	1040		1942	
1174	Weheri	m	1032		1947	
1175	Kîrîpaya	m	1046		1951	
1176	Ketna	m	1167		1952	

Besides this information, 001INDIVIDUO may store other information relevant for each case, such as "agglomeration", "region", village", "house", "Group", "Faction", "Clan", "Lineage", "Moiety", "Names", "Place of Birth", etc..

The primary information on the Table 002CASAMENTO are the following:

002CASAMENTO

NCasm	Marido	Esposa	AnCasm	AnSep	Obs
1	1001	1002			
2	1003	1004			
3	1005	1108			
4	1007	1106			
5	1008	1010			
6	1012	1014			
7	1012	1016			
8	1012	1101			
9	1013	1015			
10	1013	1016			

A person may be entered more than once on the Table 002CASAMENTO, which indicates polygamous, sequential or extra-marital unions with socially recognized children. In this case, each of these events will be assigned a different **NCasm**. The occurrence of ethnographic contexts with a significant amount of multiple fatherhood has suggested the experimental interest in reformatting the Table 001INDIVIDUO of *MaqPar* so that not the people would be numbered, but their filiation relations, which would make it possible to observe the effects of the phenomenon of multiple fatherhood over the global economy of marriage alliances observed in a given network. In this case, one individual would be defined as a cluster of filiation relations and so the Table 001INDIVIDUO would be exactly of the same type as the Table 002CASAMENTO, as lines would correspond to relations in both cases.

The kinship machine from within

Readers who are familiar with the MS-Access application are aware of the fact that a database consists fundamentally of somehow related **tables**, where the registers considered relevant are stored, and of **queries**, which are interventions defining the groups of register used to perform a certain operation (selecting, adding, excluding, etc.). As mentioned above, *MaqPar* defines the entering of genealogical registers organized on two Tables (001INDIVIDUO and 002CASAMENTO). Besides these, some other tables have been created for storing the data produced by consultations and which recursively serve as a basis for new consultations.

The purpose of the majority of the queries is to find relations between a given individual and an immediate kin (F, M, S, D, H, W), registering a **route**, setting a **path** and attributing a **kintype**. Firstly, consultations build all primary connections for each individual and generate route, paths and the respective kintypes from one to ten (C)onsanguineous connections and one (A) marriage connection. The (C)onsanguineous connections are registered on Tables Tab101 to Tab110 and the (A)ffinal linkings are registered on Table Tab101X, and then stored in Tables 003-1 e 003-2. The four next steps connect paths C and A, consecutively generating paths 2CA, 3CAC, 4CACA and 5CACAC (respectively producing Tables Tab20__, Tab30__, Tab40__, Tab50__, then stored in Tables 003-3 to 003-6). Thus, the tool produces all paths and then chooses only those in which the first and the last individual are married, describing the paths, rings and implexes privileged here. This characteristic of the device is important because it allows choosing not only married individuals, but also the set of marriageable within which ego effectively marries, as explained below.

In all the steps we have described, devices have been created to prevent the duplication of individuals in a given path and the generation of badly formed paths, describing generational zigzags. In other words, if a connection is ascending (F, M) or isogenerational (H, W), the next connection may either remain ascending or isogenerational, or become descending (S, D). On the other hand, if a connection is descending (S, D), the next connection may only be descending (S, D) or isogenerational (H, W).

Previous Connection / Following Connection:

Pre	Fol	Pre	Fol	Pre	Fol	Pre	Fol	Pre	Fol	Pre	Fol
F	F M W S D	M	F M H S D	H	F M W S D	W	F M H S D	S	W S D	D	H S D

Table 1: Scheme of the MapPar filter to prevent generational zigzags when building paths.

The batch of the following queries operates on Tables 003-1 to 003-6 and is confronted with the table of marriages, generating the tables of genealogical paths, rings, and implexes considered below: BC (Z01Enlace-C) [Z01 Consang.Marriage], RA1 (Z04Reencad-CAC) [Z04 RelinkingCAC] and RA2 (Z06Reencad-CACAC) [Z06 Relinking-CACAC], finally consolidated on the exit Table (Z-ALIANCAS).

Data exit

For each person of a given network, *MaqPar* provides a list of all relevant paths connecting this individual to his/her spouse(s) on the exit Table (Z-ALIANCAS). Each of these paths provides the following information:

Module	Module of marriage matrix: 1C, 2CA, 3CAC, 4CACA, etc…
Cycle	Class of Ring
Ego	Individual (ego)
SxEgo	Sex of Ego
Alter	Individual (alter)
SxAlter	Sex of Alter
Percurso [Path]	Sequence of individuals from Ego to Alter (his/her connecting kin)
Parente [Kin]	Sequence of primary connections in the Ego to Alter Path
Consg1	Sequence of primary connections in the 1st Consanguineous Path

Afim1 [Affinal1]	Sequence of primary connections in the 1st Affinal Path
Consg2	Sequence of primary connections in the 2nd Consanguineous Path
Afim2 [Affinal2]	Sequence of primary connections in the 2nd Affinal Path
Consg3	Sequence of primary connections in the 3rd Consanguineous Path
Etapas [Steps]	Sequence of the types of consanguineous and affinal kinship, according to the respective ordering codes: A1 - C1 - A2 ...
Tipo-seq [Type-seq]	Sequence of types of kin (in standard portuguese language)
Ger-seq	Sequence of the generational distances of each step: G+1 : G 0 : G -1
Lat-seq	Sequence of lateral distances
Cnx-seq	Sequence of the total of primary connections in each step: 4- 2- ...
Cnx-tot	Total of primary connections

A subsidiary table is associated with this Alliance-table to calculate the degree of Dravidian or Iroquois crossness in paths registered in consanguineous fields [**Consg1**], [**Consg2**] and [**Consg3**] and to transform all FS, MS, FD and MD kintypes into B and Z, respectively and from traditional to Barry's notation, like:

Parente	Consg1 BZ	Afim1	Consg2 BZ	Consg1 Barry	Consg1 Barry BZ	Consg2 Barry	Consg2 Barry BZ
MFFSDDHFMDD	MFBDD	H	FZD	HFH(H)HFF	HFH()HFF	HH(F)FF	HH()FF
MFMSDDHFMDD	MFBDD	H	FZD	HFH(F)HFF	HFH()HFF	HH(F)FF	HH()FF
MFFSDDHFFDD	MFBDD	H	FZD	HFH(H)HFF	HFH()HFF	HH(H)FF	HH()FF
MFMSDDHFFDD	MFBDD	H	FZD	HFH(F)HFF	HFH()HFF	HH(H)FF	HH()FF

Finally, a last query identifies and creates a table of the marriages (**NCasm**) involved in each of the paths having more than one marriage.

Before examining the material produced by this tool, we would finally like to point out some of its characteristics, corresponding to *ad hoc* devices imposed by MS-Access itself and by the limits of common personal computers. In short, they all aim at guaranteeing minimally satisfactory performance for the tool. One of them is, for example, the creation of queries extracting only the registers effectively relevant for describing the genealogical network's figures on focus from the ethnographic registers of the table of individuals. Only married individuals or individuals having children are generated and stored in Table 003-oVertices [003-oVertices), and the remaining consultations are to be performed based on this selection.

A second group of queries deletes the tables produced by the previous ones which will no longer be used by the tool. Thus, for example, by connecting Tables C and A, the device creates a Table CA which, on its turn, is recursively connected to Table C, generating a Table CAC, and so on. When the Table CAC is generated, the Table CA is deleted. Thus, when the exit Table Z-ALIANCAS is ready, all other tables that served for its creation are deleted, except for data entering Tables 001INDIVIDUO and 002CASAMENTO. These procedures have the purpose of preventing the tool from growing too rapidly and in exaggerate proportions, to the point of locking the tool when it is performing the task of processing data.

In this current version (2.7), these and other *MaqPar* devices are made automatic by macros. In view of the profile of its potential users, ethnographers interested in exploring the kinship networks of the communities they study, but – we repeat - having little interest in computer subjects, we have tried to simplify the use of the tool as much as we can. There is a summary below:

When opening *MaqPar*, a form called *Control Panel* is shown on the screen. The user is supposed to follow the steps below:

1 Press buttons (Clean Tables) and (Clean Alliances) to zero storage devices;
2 Check whether Tables 001INDIVIDUO, 002CASAMENTO and Z-ALIANCAS are empty;
3 Insert his/her data into the adequate forms or directly into base Tables 001INDIVIDUO and 002CASAMENTO;
4 Press button 1 to prepare initial tables;
5 Press button 2 to perform all network scanning operations;
6 Press button 3 to prepare final tables.

In case the user is interested in processing data again, just press buttons 5 and 6. Then check, add, delete or correct registers (step 3). Then just repeat the subsequent steps. In case the user is interested in analyzing a new genealogical network, it will be of course necessary to delete not only all registers (step 1), but also those on Tables 001INDIVIDUO and 002CASAMENTO before inserting new data.

Finally, it is worth noting a mechanism created for this current version, which we call batch processing. The tool seems to operate without major problems for shallow and rarefied genealogies. However, in more profound networks having many rings and implexes it is almost impossible to scan the network only once, at least in common PCs, of average performance, equipped with five- or ten-year-old versions of MS Access and operational system, as is the case of the computers of the majority of our potential users. The operations generating the wished genealogical paths cause the database file to be immensely inflated. Files smaller than 10 Mb, for example, may inflate to the point of becoming one or two hundred times their original size when executing the operations defined in the queries. We call it inflate and not grow because what makes it bigger are not the new data it produces, but the very operations for producing these new data, as the file may almost regain its previous size by a simple compacting operation. In the common PCs where we performed the tests of our tool, we observed that MS Access is systematically locked when the size of the database file (.mdb) reaches about 2 Gb.

Aware of the profile of its potential users and their computer resources, we have glimpsed a solution to this impasse which is weird, but somehow efficient. As in *MaqPar* scanning operations exhaust the paths of a given individual before initiating the calculations of the paths of the following individual, orderly displayed on Table 003-0Vertices, we decided to process batches of five, ten, fifteen and twenty individuals each (according, respectively to the models 4G, 3M, 2P 1I), an operation that is to be patiently followed by file compacting. This is certainly not a very elegant solution in computer terms, but it is absolutely indispensable. Between the processing of two batches, it is fundamental to use the MS Access manual compacting tool which, for reasons unknown to us, may not be made automatic as is the case for the other operations of the application. We suspect that the mere fact that this procedure is part of the menu of the software even in more recent versions corresponds to one of those inconvenient bugs that have not yet been solved by Bill Gates.

The processing of batches of ten individuals each, interposed by manual compacting, means, in practice, after pressing button 2 (step 5) then choosing the option *Ferramentas > Utilitários de banco de dados > Compactar e corrigir banco de dados [Tools > Database utilities > Compact and correct database]* from the MS Access menu. Then it is necessary to press button 2 and compact again, and so on, until all individuals displayed on Table 003-0Vertices have been processed. In very complex networks having a large number of genealogical implexes, two exits may also be tried if the computer is locked in the middle of the processing of a batch: Processing individuals one by one and, *in extremis*, dehabilitating macros 401ComplTab401X-405X and 501ComplTab501-510, which produce the paths corresponding to the relinkings of affinal alliances (4CACA and 5CACAC). We will be grateful to whoever helps us to find a more elegant solution to this impasse.

A brief analysis of the material produced by *MaqPar*

The computer tool we present is one of methodological requirements of our research on Amerindian alliance systems. To date, we have concentrated our efforts to create it. Only very recently has the tool been considered minimally trustable. This means that we had very little time to interpret the phenomena it has revealed. Therefore, we have to admit that the sensation we have when we take a look at the long lists of marriage strings described in a given genealogical network, frequently does not seem to be very distant from the sensation one has when he/she uses a microscope for the first time and observes a myriad of tiny beings of various aspects, interacting one with the other. You can only be sure that they are there. In view of that, what follows corresponds merely to a first attempt at focusing on these phenomena. As we said in the beginning of this paper, our purpose is to present a working tool. However, it is also necessary to provide some general information on the material for which the tool was created.

The 226 Amerindian people located in Brazil correspond to small-scale societies. There are more or less updated demographic information on about 212 (94%) of this total. In this universe, the majority (52%) has a population of over three digits; 17% has a population of two digits and 28% has a four-digit population. Only 6% have a population of over 10,000 people. In this scenario, the great majority of these societies is not much interested in cultivating deep genealogical memories. In many of them it is even forbidden to utter the name of the deceased; in others, names are repeated to the point of inextricable entanglement of the ancestrals from the generation of parents.

In this paper, we will consider data from two of these peoples. Among the Enawene-Nawe, for example, rarely does an individual know (or is willing to inform) the clan to which his/her maternal deceased grandmother belonged. Moreover, if the individual's name is X, for example, he/she will say that his/her deceased father was called father-of-X, that his/her grandfather was called grandfather-of-X, and so on. Among the Waimiri-Atroari, for example, not only is it extremely impolite to utter the name of the deceased, but it should also be taken into account that the present population of the villages is the product of severe processes of depopulation and population rearrangement occurring until the 1970's, which is translated into expressive rarefaction and shallow genealogical networks. Perhaps, in comparison with other regions of the world, the accumulated Amerindian *corpus* tends, in short, to seem too shallow and very little connected, building networks formed by a reduced number of individuals and of relations. So, our tool has been designed for a material having exactly these characteristics.

Let us observe the material generated by it for one of the cases our research aims at exploring as a demonstration: The genealogical corpus of the Enawene-Nawe (EN), an Aruak-speaking people from South Amazon concentrated on a single village located to the Northwest of the State of Mato Grosso. The EN has a population of three digits. One of the authors visited the EN for the first time in 1993, when there was a population of 245 people. This number has almost doubled over the last 15 years: They are 481 in 2008. Presently, 68% of the population is less than twenty years old and only 6% is over fifty. Considering the universe of people born from 1975 on, who are today 33 years old or less, the mean age of a man when he has his first child is 18 years old; that of a woman is 16. There are no married men aged less than 15 and married women aged less than 13. The oldest single man is 21 years old; the oldest single woman is 18.

The EN are divided into nine patriclans which are, on their turn, segmented into lines. The patriclans include members that classify themselves as kin even if the memory of those who are alive may not trace back the collateral ties that unite them genealogically. Lines, on the contrary, are genealogical sets defined by specific male ancestors. The EN kinship terminology is an Iroquois variant (Silva 2008). In this context, no type of marriage preference for terminologically determined kin is observed.

Let us examine this genealogical corpus:

Enawene-Nawe	
Individuals - Total	639
Individuals providing information on filiation	90%
Marriages – Total	140
Men who have married more than once	8
Men who have married more than twice	1
Women who have married more than once	4
Women who have married more than twice	1

Relinking Marriages

Module	Paths	Implexes
1C	28	7
2CA	0	0
3CAC	4224	266
4CACA	178	36
5CACAC	213954	4472

Each of the 218.448 paths listed by *MaqPar* for the EN genealogical corpus[6] is followed by a set of fields on some of its aspects. Let us observe one of them, chosen at random, among the 3350 alternative paths connecting the couple Ego 1317f / Alter 1273m.

Cycle A3C3 (Module 5CACAC) = *Ring formed by 6 chains of kin: Consg 1 + Afim1 + Consg2 + Afim2 + Consg3 + Afim 3, of a given path connecting Ego to Alter:*

Path from Ego 1317f to Alter 1273m (Ego + Linking Kins + Alter);

Ciclo [Cycle] Modulo [Module]	Ego	SxEgo	Alter	SxAlter	Percurso [Path]
5CACAC	1317	f	1273	m	1317; 1011; 1179; 1493; 1411; 1409; 1214; 1223; 1226; 1188; 1187; 1497; 1459; 1506; 1507; 1037; 1098; 1166; 1165; 1158; 1440; 1153; 1156; 1273

Kintype = Kinship relation between Ego and Alter analyzed as a chain of consanguineous (ConsgX) and affinal (AfimY) sequences:

Parente [Kintype]	Consg1	Afim1 [Affinal1]	Consg2	Afim2 [Affinal2]	Consg3
FMFMSDSSWMFFSSSSWMFMSDS	FMFMSDSS	W	MFFSSSS	W	MFMSDS

6 For the purposes of this paper, we are not taking account for 2CA and 4CACA paths.

Steps = coding the types of sequence (Tipos-seq) displayed on the chain:

Etapas [Steps]	Tipo-seq[Type-seq]
2004 - A12 - 3013 - A12 - 2003	primo III - conj - sobrinho III - conj - primo II [cousin III – spouse – cousin III – spouse – cousin II]

Generational distance (Ger-seq), lateral distance (Lat-seq), number of connections (Cnx-seq) of each of the sequences of the chain and number of total connections (Cnx-tot). By definition, affinal sequences (W, H) have generational distance = 0, lateral distance = 1 and number of connections = 1:

Ger-seq	Lat-seq	Cnx-seq	Cnx-tot
G0 : 0 : G-1 : 0 : G0	4 - 1 - 3 - 1 - 3	8 - 1 - 7 - 1 - 6	23

Sequence of marriages observed in the total path:

NCasm1	NCasm2	NCasm3
198	166	184

In case the user is interested, an additional *MaqPar* device calculates the degree of Dravidian (Drav) and Iroquois (Iroq) crossness for consanguineous sequences (P = parallel; X = cross) and replaces the segments FS / MS, FD / MD respectively by B¸ Z:

Consg1	Ego-sex	Drav	Iroq	Consg1 BZ
FMFMSDSS	m	P	P	FMFBDSS
Consg2	Ego-sex	Drav	Iroq	Consg2 BZ
MFFSSSS	f	P	X	MFBSSS
Consg3	Ego-sex	Drav	Iroq	Consg3 BZ
MFMSDS	f	P	P	MFBDS

Parente [Kin]	Parente [Kin] – BZ
FMF**MS**DSSWMF**FS**SSSWMF**MS**DS	FMF**B**DSSWMF**B**SSSWMF**B**DS

Now, let us observe some implexes of the EN corpus below :

Cycle A2C2, Module 3CAC = Repetition of Consanguineous Alliance, Marriages 107 (1067m, 1068f) and 182 (1146m, 1305f)

Modulo [Module]	Percurso [Path]	Parente [Kin]	NCasm1	NCasm2
3CAC	1068; 1061; 1460; 1153; 1145; 1146; 1305; 1090; 1499; 1585; 1503; 1199; 1067	FFSDSWFFFFDS	107	182
3CAC	1067; 1199; 1504; 1585; 1499; 1090; 1305; 1146; 1145; 1153; 1460; 1061; 1068	MMSSSDHMFFSD	107	182
3CAC	1067; 1199; 1504; 1585; 1499; 1090; 1305; 1146; 1145; 1153; 1440; 1061; 1068	MMSSSDHMFMSD	107	182
3CAC	1068; 1061; 1440; 1153; 1145; 1146; 1305; 1090; 1499; 1585; 1504; 1199; 1067	FMSDSWFFFMDS	107	182
3CAC	1068; 1061; 1440; 1153; 1145; 1146; 1305; 1090; 1499; 1585; 1503; 1199; 1067	FMSDSWFFFFDS	107	182
3CAC	1067; 1199; 1503; 1585; 1499; 1090; 1305; 1146; 1145; 1153; 1460; 1061; 1068	MFSSSDHMFFSD	107	182
3CAC	1067; 1199; 1503; 1585; 1499; 1090; 1305; 1146; 1145; 1153; 1440; 1061; 1068	MFSSSDHMFMSD	107	182
3CAC	1068; 1061; 1460; 1153; 1145; 1146; 1305; 1090; 1499; 1585; 1504; 1199; 1067	FFSDSWFFFMDS	107	182
3CAC	1146; 1145; 1153; 1460; 1061; 1068; 1067; 1199; 1503; 1585; 1499; 1090; 1305	MFFSDHMFSSSD	182	107
3CAC	1146; 1145; 1153; 1440; 1061; 1068; 1067; 1199; 1504; 1585; 1499; 1090; 1305	MFMSDHMMSSSD	182	107
3CAC	1146; 1145; 1153; 1460; 1061; 1068; 1067; 1199; 1504; 1585; 1499; 1090; 1305	MFFSDHMMSSSD	182	107
3CAC	1305; 1090; 1499; 1585; 1503; 1199; 1067; 1068; 1061; 1440; 1153; 1145; 1146	FFFFDSWFMSDS	182	107
3CAC	1305; 1090; 1499; 1585; 1503; 1199; 1067; 1068; 1061; 1460; 1153; 1145; 1146	FFFFDSWFFSDS	182	107
3CAC	1146; 1145; 1153; 1440; 1061; 1068; 1067; 1199; 1503; 1585; 1499; 1090; 1305	MFMSDHMFSSSD	182	107
3CAC	1305; 1090; 1499; 1585; 1504; 1199; 1067; 1068; 1061; 1440; 1153; 1145; 1146	FFFMDSWFMSDS	182	107
3CAC	1305; 1090; 1499; 1585; 1504; 1199; 1067; 1068; 1061; 1460; 1153; 1145; 1146	FFFMDSWFFSDS	182	107

Cycle A3C3, Module 5CACAC = Repetition of Affinal Alliance, Marriages 107 (1067m, 1068f), 179 (1172m, 1163f) and 119 (1007m, 1145f)

Modulo [Module]	Percurso [Path]	Parente [Kin]	NCasm1	NCasm2	NCasm3
5CACAC	1067; 1199; 1159; 1163; 1172; 1168; 1007; 1145; 1153; 1460; 1061; 1068	MDDHMSWFFSD	107	179	119
5CACAC	1067; 1199; 1159; 1163; 1172; 1167; 1007; 1145; 1153; 1440; 1061; 1068	MDDHFSWFMSD	107	179	119
5CACAC	1067; 1199; 1159; 1163; 1172; 1167; 1007; 1145; 1153; 1460; 1061; 1068	MDDHFSWFFSD	107	179	119
5CACAC	1067; 1199; 1159; 1163; 1172; 1168; 1007; 1145; 1153; 1440; 1061; 1068	MDDHMSWFMSD	107	179	119
5CACAC	1067; 1518; 1159; 1163; 1172; 1167; 1007; 1145; 1153; 1460; 1061; 1068	FDDHFSWFFSD	107	179	119
5CACAC	1067; 1518; 1159; 1163; 1172; 1168; 1007; 1145; 1153; 1440; 1061; 1068	FDDHMSWFMSD	107	179	119
5CACAC	1067; 1518; 1159; 1163; 1172; 1168; 1007; 1145; 1153; 1460; 1061; 1068	FDDHMSWFFSD	107	179	119
5CACAC	1067; 1518; 1159; 1163; 1172; 1167; 1007; 1145; 1153; 1440; 1061; 1068	FDDHFSWFMSD	107	179	119
5CACAC	1068; 1061; 1440; 1153; 1145; 1007; 1168; 1172; 1163; 1159; 1199; 1067	FMSDHMSWMMS	107	119	179
5CACAC	1068; 1061; 1440; 1153; 1145; 1007; 1167; 1172; 1163; 1159; 1518; 1067	FMSDHFSWMFS	107	119	179
5CACAC	1068; 1061; 1440; 1153; 1145; 1007; 1168; 1172; 1163; 1159; 1518; 1067	FMSDHMSWMFS	107	119	179
5CACAC	1068; 1061; 1440; 1153; 1145; 1007; 1167; 1172; 1163; 1159; 1199; 1067	FMSDHFSWMMS	107	119	179
5CACAC	1068; 1061; 1460; 1153; 1145; 1007; 1167; 1172; 1163; 1159; 1199; 1067	FFSDHFSWMMS	107	119	179
5CACAC	1068; 1061; 1460; 1153; 1145; 1007; 1168; 1172; 1163; 1159; 1518; 1067	FFSDHMSWMFS	107	119	179
5CACAC	1068; 1061; 1460; 1153; 1145; 1007; 1168; 1172; 1163; 1159; 1199; 1067	FFSDHMSWMMS	107	119	179
5CACAC	1068; 1061; 1460; 1153; 1145; 1007; 1167; 1172; 1163; 1159; 1518; 1067	FFSDHFSWMFS	107	119	179
5CACAC	1145; 1153; 1440; 1061; 1068; 1067; 1518; 1159; 1163; 1172; 1167; 1007	FMSDHFDDHFS	119	107	179
5CACAC	1145; 1153; 1440; 1061; 1068; 1067; 1518; 1159; 1163; 1172; 1168; 1007	FMSDHFDDHMS	119	107	179
5CACAC	1145; 1153; 1460; 1061; 1068; 1067; 1199; 1159; 1163; 1172; 1167; 1007	FFSDHMDDHFS	119	107	179
5CACAC	1145; 1153; 1460; 1061; 1068; 1067; 1518; 1159; 1163; 1172; 1168; 1007	FFSDHFDDHMS	119	107	179
5CACAC	1145; 1153; 1460; 1061; 1068; 1067; 1518; 1159; 1163; 1172; 1167; 1007	FFSDHFDDHFS	119	107	179
5CACAC	1145; 1153; 1440; 1061; 1068; 1067; 1199; 1159; 1163; 1172; 1167; 1007	FMSDHMDDHFS	119	107	179
5CACAC	1145; 1153; 1460; 1061; 1068; 1067; 1199; 1159; 1163; 1172; 1168; 1007	FFSDHMDDHMS	119	107	179
5CACAC	1145; 1153; 1440; 1061; 1068; 1067; 1199; 1159; 1163; 1172; 1168; 1007	FMSDHMDDHMS	119	107	179
5CACAC	1007; 1168; 1172; 1163; 1159; 1199; 1067; 1068; 1061; 1440; 1153; 1145	MSWMMSWFMSD	119	179	107
5CACAC	1007; 1168; 1172; 1163; 1159; 1199; 1067; 1068; 1061; 1460; 1153; 1145	MSWMMSWFFSD	119	179	107
5CACAC	1007; 1168; 1172; 1163; 1159; 1518; 1067; 1068; 1061; 1440; 1153; 1145	MSWMFSWFMSD	119	179	107
5CACAC	1007; 1168; 1172; 1163; 1159; 1518; 1067; 1068; 1061; 1460; 1153; 1145	MSWMFSWFFSD	119	179	107
5CACAC	1007; 1167; 1172; 1163; 1159; 1199; 1067; 1068; 1061; 1440; 1153; 1145	FSWMMSWFMSD	119	179	107
5CACAC	1007; 1167; 1172; 1163; 1159; 1518; 1067; 1068; 1061; 1460; 1153; 1145	FSWMFSWFFSD	119	179	107
5CACAC	1007; 1167; 1172; 1163; 1159; 1518; 1067; 1068; 1061; 1440; 1153; 1145	FSWMFSWFMSD	119	179	107
5CACAC	1007; 1167; 1172; 1163; 1159; 1199; 1067; 1068; 1061; 1460; 1153; 1145	FSWMMSWFFSD	119	179	107
5CACAC	1163; 1159; 1518; 1067; 1068; 1061; 1440; 1153; 1145; 1007; 1167; 1172	MFSWFMSDHFS	179	107	119
5CACAC	1163; 1159; 1518; 1067; 1068; 1061; 1460; 1153; 1145; 1007; 1168; 1172	MFSWFFSDHMS	179	107	119
5CACAC	1163; 1159; 1199; 1067; 1068; 1061; 1460; 1153; 1145; 1007; 1167; 1172	MMSWFFSDHFS	179	107	119
5CACAC	1163; 1159; 1199; 1067; 1068; 1061; 1440; 1153; 1145; 1007; 1168; 1172	MMSWFMSDHMS	179	107	119
5CACAC	1163; 1159; 1199; 1067; 1068; 1061; 1460; 1153; 1145; 1007; 1168; 1172	MMSWFFSDHMS	179	107	119
5CACAC	1163; 1159; 1199; 1067; 1068; 1061; 1440; 1153; 1145; 1007; 1167; 1172	MMSWFMSDHFS	179	107	119

The *Tetris* effect…

To conclude, we would like to point out to an aspect that seems important to us when thinking of our empirical networks of consanguinity and affinity.

Genealogical networks are essentially historical phenomena, which implies, among other things, the distribution of their lines and vertices in a temporal dimension. Such a perspective brings forth that fundamental aspect of the phenomenon that has been emphasized in Hamberger, Houseman, Daillant, White & Barry 2004. Each new marriage of a network is partly conditioned by the marriages that have preceded it and somehow contributes to determine subsequent unions. As Pierre Bourdieu has already observed on the marriage strategy of peasants in Béarn, each marriage is only "*one moment of a series of material and symbolic exchanges*" that marks the history of a given family (Bourdieu, 1972: 1120). Thus, the deviation of genealogical networks would then be submitted to what we started to call its *Tetris* effect. As many of us know, *Tetris* is a classic puzzle game with very simple rules. During a match, pieces with different formats fall randomly one by one from the top of a window. Each piece falls until it reaches the window sill, and as soon as this happens, the contours of the sill are immediately altered or, to be more exact, that piece becomes part of its relief. In view of a set of possible falls, the player has constantly to choose the place where the new piece is going to fit by taking into consideration a set of possibilities somehow determined by his/her previous choices and which, once made effective, starts determining the possibilities for fitting the next pieces. The guiding image of Tetris inspires us to face the theme of the drift of genealogical networks. The thing now is how to make this metaphor productive.

Before presenting how we tentatively deal with the subject, we should mention that we are still far from having a computer solution for it, and we are not even convinced that it is worth investing greater programming efforts to create a probably very complex device capable of observing and describing the tetris effect of our genealogical networks. Anyway, we would like to expose a tentative proposal of a method within which *MapPar* will doubtlessly be of help. Let us go back to the EN case.

Among the EN, although no type of marriage preference for terminologically determined kin is observed, the favorite and most frequent form of marriage is the exchange of sons and daughters, not to be repeated in consecutive generations and performed between two couples from different patriclans.

We should also take into consideration that the EN are a strictly endogamous people and in this context there are no polyandrous or polygynous marriages and that divorce is almost inexistent, which makes our experiment easier. Moreover, it is worth noting that data suggest that the minimum age for a man to get married is 15 years old. This age is reduced to 13 years old among women. On January 1st, 2008, the EN had 22 single young men aged 15 years old or more and 16 single young women aged 13 years old or more:

a) 22 Single marriageable men on 01/01/08:

Ind	Clan/Line	Sex	Age	Pai [Father]	C/L F	Mae [Mother]	C/L M
1166	AH1	m	19	1164	AH1	1165	KL2
1260	AH1	m	17	1164	AH1	1165	KL2
1265	AH1	m	16	1007	AH1	1145	KL2
1365	AH3	m	16			1134	AH3
1268	AW1	m	18	1147	AW1	1148	KL5
1293	AW1	m	18	1041	AW1	1084	KL6
1234	AW2	m	21	1230	AW2	1231	KL1
1322	AW2	m	18	1230	AW2	1231	KL1
1323	AW2	m	15	1230	AW2	1231	KL1
1361	AW3	m	15	1127	AW3	1128	AH3
1301	KH1	m	19	1206	KH1	1207	ML1
1126	KK3	m	21	1122	KK3	1123	AH3
1334	KK3	m	16			1013	KK3
1289	KL1	m	14	1074	KL1	1075	AH2
1327	KL1	m	16	1223	KL1	1225	AW2
1336	KL2	m	16	1061	KL2	1062	AW5
1121	KN1	m	20	1116	KN1	1117	KK1
1283	KN1	m	18	1116	KN1	1117	KK1
1280	KN1	m	17	1101	KN1	1102	KK1
1284	KN1	m	15	1116	KN1	1117	KK1
1306	LH1	m	16	1090	LH1	1091	AH4
1246	ML1	m	18	1190	ML1	1191	KL3

b) 16 Single marriageable women on 01/01/08:

Ind	Clan/Line	Sex	Age	Pai [Father]	C/L F	Mae [Mother]	C/L M
1277	AW1	f	14	1085	AW1	1104	KN1
1364	AW3	f	14			1129	AW3
1100	KH1	f	19	1037	KH1	1097	KN1
1354	KK3	f	16	1122	KK3	1123	AH3
1333	KK3	f	18	1217	KK3	1218	AW2
1346	KK3	f	14	1016	KK3	1051	AW5
1328	KL1	f	14	1223	KL1	1225	AW2
1253	KL2	f	16	1158	KL2	1159	MR1
1297	KL3	f	18	1178	KL3	1179	KK4
1318	KL3	f	15	1011	KL3	1205	ML1
1343	KL4	f	13	1017	KL4	1069	MR1
1276	KN1	f	15			1081	KN1
1248	ML1	f	15	1190	ML1	1191	KL3
1349	MR1	f	17	1067	MR1	1068	KL2
1350	MR1	f	14	1067	MR1	1068	KL2
1315	MR1	f	15			1018	MR1

During 2008, some marriages will certainly occur and unite some of these men and some of theswe women. Thus, let us randomly choose the single male 1327, from patriclan KL (Kailore) and line 1:

Ind	Clan/Line	Sex	Age	Pai [Father]	C/L F	Mae [Mother]	C/L M
1327	KL1	m	16	1223	KL1	1225	AW2

We know that this man may not marry either women from his own (patri) clan or women from his mother's patriline. Thus, a subset of 5 women from the universe of 16 single women on January 1st, 2008 is prohibited to him:

Prohibited marriages:

Ind	Clan/Line	Sex	Age	Pai [Father]	C/L F	Mae [Mother]	C/L M
1328	KL1	f	14	1223	KL1	1225	AW2
1253	KL2	f	16	1158	KL2	1159	MR1
1297	KL3	f	18	1178	KL3	1179	KK4
1318	KL3	f	15	1011	KL3	1205	ML1
1343	KL4	f	13	1017	KL4	1069	MR1

In previous years, the siblings of 1327 married as follows:

Marriages of siblings:

B/Z-sex	B/Z Ind	CL B/Z	B/Z conj [spouse]	B/Z conj [spouse] CL
f	1229	KL1	1089	AW1
m	1226	KL1	1188	KK2
f	1228	KL1	1189	KK2
m	1227	KL1	1106	KN1
f	1224	KL1	1103	KN1
m	1326	KL1	1348	MR1

Then, on January 1st, 2008, our 1327 had effectively 11 marriage possibilities, being the chances greater for women of his same age or younger...

Ind	Clan/Line	Sex	Age	Pai [Father]	C/L F	Mae [Mother]	C/L M
1364	AW3	f	14			1129	AW3
1100	KH1	f	19	1037	KH1	1097	KN1
1354	KK3	f	16	1122	KK3	1123	AH3
1333	KK3	f	18	1217	KK3	1218	AW2
1346	KK3	f	14	1016	KK3	1051	AW5
1248	ML1	f	15	1190	ML1	1191	KL3

Ind	Clan/Line	Sex	Age	Pai [Father]	C/L F	Mae [Mother]	C/L M
1277	AW1	f	14	1085	AW1	1104	KN1
1276	KN1	f	15			1081	KN1
1349	MR1	f	17	1067	MR1	1068	KL2
1350	MR1	f	14	1067	MR1	1068	KL2
1315	MR1	f	15			1018	MR1

which corresponds to a remarkably small number of possibilities. *Maqpar* is capable of generating all the paths that connect our single male 1327 to each of his potential spouses. Moreover, this resource also allows us to identify others genealogically very close kins, like for example 1st degree cross cousins, which are also prohibited.

The experiment we have performed with a presently single male may be performed for the previous years, by randomly choosing a man or a woman who is presently married. We may know the year he got married based on data entering Tables (001INDIVIDUO and 002CASAMENTO). We may also define the set of single men in this same year and finally confront the marriage possibilities and impossibilities of this individual in that year in relation to his effective marriage based on the paths *MaqPar* is capable of generating between these individuals. Based on this procedure, we may perhaps grasp the *tetris* effect of the EN network with some neatness.

We conclude this paper with another metaphor. The networks generated by our computer tool may be somehow similar to Lowland South American graphic motifs, as interpreted by Anne-Christine Taylor[7]. The graphic motifs found in body painting, ceramics, textile, and on the skin of animals and spirits are firstly cognitive devices, in other words, machines for producing knowledge. Like the Amazonian shamans in relation to the graphic forms glimpsed in dream, we have the same expectancy of sense in relation to the graphics produced by our machines. We know that they are there and there is certainly meaning out there. But differently from the shamans, we do not know neither how nor what we may see through them yet.

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