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Introduction

Read´s research program for describing the "generative logic" of distinct kinship terminologies in a homogeneous framework has proved its fruitfulness in different ethnographic domains, ranging from North American kinship to Dravidian terminologies, and more. Applied now to the so-called Omaha systems, the framework suggests a new taxonomy of kinship terminologies, in which Thonga kinship terminology – until now a type specimen for the Omaha terminology, based on Junod´s ethnography – is separated from Fox kinship terminology, another type specimen of the Omaha, as described by Dorsey, and Morgan before him. Read´s thesis, therefore, subverts Lounsbury´s subdivision of "Omaha" taxon in four varieties, among which "Type I" was instanced by the Fox terminology, while Type III had Thonga data as a standard representative. According to Read, on the other hand, Fox and Thonga are not "Omaha" varieties at all; they are instead "whale and fish", resulting from different structural principles. Read´s thesis also challenges another anthropological accepted wisdom: the role of crossness and affinity in the logic of so-called bifurcate-merging systems such as Iroquois and Omaha (Trautmann and Whiteley 2012).

On the methodological side, Read´s approach corroborates the view according to which the semantical/ontological aspects of kinship language and its pragmatic-performative uses can be isolated from its the "internal" computational dimension. In this sense, his approach coincides with Lounsbury´s views. However, Read´s framework differs from Lounsbury´s approach in two points, namely, the use of vernacular terms as far as possible instead of kin types, and the requirement of "culturally grounded rules" to justify formal schemata. A more fundamental difference between Lounsbury´s and Read´s views is the role of a cognatic terminological in Lounsbury´s formalism – where generation and gender play a symmetrical role in kinship expressions -- as opposed to the priority of an agnatic terminology in Read´s schemata, to which gender change is appended as a secondary feature.

One might wonder about the relevance of such issues to wider anthropological disputes. It is an unfortunate turn of events that Claude Lévi-Strauss, who made a major contribution to give kinship issues a main place social theory, with his "alliance" approach as an alternative to the "descent" theory (or rather as a complement to it), also opposed Lounsbury´s calculus on the grounds of its "formalism". Lévi-Strauss rejected also Vladimir Propp´s generative analysis of folk-tales for the same reason, although both Lounsbury and Propp qualified as representatives of a structural approach in generative format amenable to everyone´s usage. Lévi-Strauss´s goal was a single grand theory that would simultaneously account for kinship terminologies, kinship ontologies and marriage rules/frequencies – or rather, a theory that would be supported by evidence from all these domains. This was "a bridge too far", to employ the idiom of the Second World War. For these domains, although empirically overlapping, are independent of each other.

The program

> "The goal of the formal analysis is to determine the logic by which the structure of the Thonga kinship terminology shown in Figure 1 with its skewing of male, matrilateral kin terms, can be generated —or, alternatively, that *there is no such logic upon which the terminology is based*."

It is not my intention to refute Read´s representation of the logic underlying Thong kinship terminology, expressed in diagrammatic form, but, rather, to suggest that there is more than one way to represent it. Let me therefore recapitulate three methodological steps proposed by Read as appropriate to the analysis of a wide range of kinship terminologies.

First, a lineal structure of male term**s** is generated. Then, female terms are generated by means of a *female self* transformation applied on male terms. The *female self* transformation has no empirical correspondence to a *kinship term.* I assume that it acts by changing the male origin (*male self*) into its opposite-sex sibling´s *self*, the *female self* , taken now as the origin.

Thonga terminology is distinguished from other terminologies, according to Read, because the *female self* transformation is the *only* "female generator". This means, if I understand the argument correctly, that the *female self* is not further composed with kinship terms such as

"♀*mamana*♀" or "♀*tatana*♂", to generate terms as ♀*mamana*♀*makwana*♂ = ♀*kokwana*♂. For, along Read´s analysis, from the point of view of a "female speaker", the only possible composition is ♀*female self*♀*female sex*♀ = ♀*female sex*♀. The "female self" is a dead end.

This argument brings the term *mamana* ("mother") into question.

For it would seem that, from a female point of view, ♀*mamana*♀ could be iterated with itself, producing ♀*mamana*♀*mamana*♀ = ♀*kokwana*♀. Furthermore, ♀*mamana*♀´s reciprocal ♀*ñwana*♀, could be iterated to produce ♀*ñwana*♀*ñwana*♀ = ♀*ntusulu*♀. Finally, from the "female self" point of view, ♀*mamana*♀*ñwana*♀ =♀*makwabu*♀. These operations, composed with each other, generate a terminological matriline isomorphic to its male counterpart, where in particular ♀*mamana*♀*ñwana*♀ includes ♀*"female self"*♀ as a particular case of *makwabu* (*"sibling"*).

If this argument is right, it means that the terminology allows the expression of a "matriline" of "female terms" from the female point of view in the same way as a "patriliny" is generated from the male point of view".[i] This point is confirmed by the symmetry between Omaha and Crow as the effect of a change in the point of view – or, in geometrical language, of changing the origin of coordinates.

Against this alternative analysis, Read argues that ♂*mamana*♀ ("my mother", male speaker) does not act as a generator, and should be analyzed as ♂*tatana*♂*nsati*♀ (♂"father´s wife" ♀). This is Read´s point:

> "Thongan terminology excludes the mother relation as a primary generating concept" (Read 2018: 41),

because

> "... the affine kin term product, (kokwana (´opposite sex sibling´) [is the product of] nsati (´wife´) of tatana (´father´)". (Read 2018: 42).

This argument explains the ♀*mamana*♀ relation as being the product ♂*tatana*♂*nsati* ♀. In kin types, this means replacing ♂M♀ with ♂FW[ii] because the only "female generator" is ♀Z♀[iii] According to this analysis, Thonga terminology identifies culturally a "step mother" (a father´s wife) with a "mother" – by *equating* "mother" with "step-mother" as in American Kinship terminology. But there is more, because in American kinship terminology the "mother" term generates a "mother´s brother" category (an *uncle*), while in the Thonga case Read´s excludes this possibility. "Mother" seems to lead to nowhere in Thonga terminology according to Read.

This move has ethnographic justification in some patrilineal societies where a "mother" is a "father´s wife", a point supported by Junod´s ethnography in a sense. However, Read´s rejection of *mamana* as having a "procreation" meaning is contradicted by Junod´s strong emphasis in the *mamana´s* (a man´s father´s wife) role of producing legitimate offspring to the man´s lineage. This means that the "procreative" power of *mamana* is of the essence. For, if the father´s wife (♂*natsi*♀ from the father´s point of view) leaves her husband, or cannot bear children to his lineage, the husband can claim another wife for whom his lineage has already paid the *lobolo*, or bride-wealth. The "potential wives" can be "wife´s younger sister" or a "wife´s brother´s daughter". The second possibility is expressed terminologically by Lounsbury´s Type I Omaha rule, phrased as an affine rule by Kohler (1897:106-07, 134-35; cf.1975).

After this general outline of my argument, I comment in detail the "core structure of male terms", looking for its underlying mathematical structure (see also Appendix I).

> "The first layer is a core structure of ascending kin terms generated using primary ascending kin term(s) identified as the generating term(s) for the ascending structure ... we generate the Thonga terminology by first generating the structure of ascending and descending male terms shown in the kin term map of male terms displayed in Figure 2" (Read, p. 12)

I understand Read´s stance as expressing a commitment to Radcliffe-Brown´s "unit of lineage" principle. This commitment is consistent with Read´s rejection of Lounsbury´s "cognatic" analysis. I will now go into the role of the "female terms" in more detail, since it plays an essential role in this issue.

Read, as already mentioned, uses as a "female generator", the "female self" concept. From the male point of view, this theoretical term is expressed as ♂self female♀, transporting the 'ego" place to a "female" origin. From that origin, "self female" becomes ♀self female♀, which is a dead end since it behaves as an identity (that is, ♀self female♀self female♀ = ♀self female♀).

As an application of Read´s procedure, I give the generation of ♂*rarana*♀ as a "*female self*" version of ♂*tatana*♂. That is to say: ♂*tatana*♂female self♀ = ♂*rarana*♀ ([♂F♂Z♀] = *ranana*). In the usual representation, using vernacular terms, the natural derivation would ♂*tatana*♂*makwabu*♀ = ♂*rarana*♀, where ♂*makwabu*♀ (♂Z♀) stands for the context-bound use of the sex-neutral *makwabu* term.

On the other hand, the ♂*mamana*♀ term (♂M♀ = ♂ZM♀ by standard notation and half-sibling rules) – given the exclusion of ♂*mamana*♀ as a generator – must be expressed by Read as ♂*tatana*♂*nsati*♀ = ♂*mamana*♀ (♂FW = ♂M). Here, however, ♂*nsati*♀ is not a "female self" term, but an *affine* term for "wife" . And by this path we are led to the existence of *two* generators to extend the "male core": the "*female self*" (a dead end) and the "*opposite-sex affine*" (♂*nsati*♀, ♂FW♀) as the linkage between the male patrilineage and its affine (wife-giving) lineage.

The postulated primacy of the "male core" has as an important corollary: the elimination of "crossness" and "affinity" as explanatory constructs.

For crossness and affinity amount to the ordered alternance of "generation" and "sex" terms, as in F♂Z♀S♂ and M♀B♂D♀ in the case of crossness, and, in the case of affinity, ♂S♂Z♀M♀B♂ = ♂WB, and ♀D♀B♂F♂Z♀= ♀HZ. Indeed, these relations cannot be represented as female replicas of male terms, that is to say, as the result of a single "♂female self♀ transformation of a "♂male self♂.

And, if a man´s father´s sister [♂FZ] = *rarana* can be represented formally as a "female replica" (i.e. an opposite-sex sibling) of a "male term" [(♂F)♂Z♀] = *rarana*, a man´s "mother´s brother" [♂MB] = [♂FWB] = *kokwana* is **not** a female replica of a "father" [iv]. The reason is that [♂FWB] has the form [(♂F)(♂W♀)(♀B)], or, according to the chosen parsing (cf. Tjon Sie Fat 1998 on the role of non-associativity),

(♂*tatana*♂*nsati*♀*male self*♂) = (♂*tatana*♂*nsati*♀)(♀*makwabu*♂) = [♂MB^{+}♂] = *kokwana*

(♂*tatana*♂*nsati*♀*male self*♂) = (♂*tatana*♂)(♂*nsati* ♀*self*♂) = [♂FWB^{-}] = *malume.*

In this analysis, I added the signs "+" and "-" to express relative age differences. It is hard to see how *kokwana* results from the action of ♂*female self*♀ in a male term ♂*tatana*♂, without the intervention of ♂*nsati*♀. But ♂*nsati*♀ cannot the female transform of ♂*tatana*♂ because ♂*tatana*♂*female self*♀ = ♂*rarana*♀.[v]

The conclusion to be drawn is that Read´s options were: either to exclude ♀*mamana*♀ as a female generator, and including ♂*nsati*♀ as an affine generator, or accepting ♀*mamana*♀ as a female generator, and then generating ♂M♀ = ♂Z♀M♀ = ♂FW♀ as the product ♂*mamana*♀ = ♂*makwana*♀*mamana*♀= ♂*tatana*♂*nsati*♀.

Kokwana

I will focus now on the term *kokwana,* the centerpiece of Read´s argument, since this is a term affected by "skewing rules" that Read discards as unnecessary for explanatory purposes. According to Junod, *kokwana* is primarily a term for ♂FF, extended to ♂FM, and equivalent kin types subject to same-sex sibling rules. This class is labelled by Read as *kokwana-a*, which can be represented as ♂*kokwana* (♂,♀). Next, the *kokwana-a* class {♂FF, ♂FZ, ...} is further extended to *kokwana-b* {♂FF, ♂FZ, ♂MM, ♂MF} and equivalent kin types.

Kokwana-b is thus the union of the agnatic lineage and of the uterine lineage as the G^{+2} generation. In a third step, *kokwana-b* is further extended to a larger class *kokwana,* by adding the "mother´s brother". We obtain therefore: **kokwana** = *kokwana-a* U *kokwana-b* U {♂MB}. This means: **kokwana =** {♂FF,♂ FM; ♂MF,♂ MM; ♂MB} where all terms equivalent to the terms within brackets by same-sex sibling rules are supposed to be included within the brackets.

The point now is: how is this *last* extension of *kokwana* justified? And, in particular, how is [♂MB] = *kokwana* obtained as the action of the "female self" on the male core, without appealing to an *affine* transformation? According to the above chain of extensions, this conclusion requires first, the terminological identification of a father´s father with a father´s sister; then the transformation of a father´s sister into a *mother´s* mother (a "father´s wife´ mother); and finally, the transformation of a *mother´s mother* into a *mother*. But this is the "Omaha" Type III Rule according to Lounsbury, in the form ♂MM → ♂MZ.

To anticipate my conclusions, I think that Read rightly pointed out that Lounsbury´s rules do not fully account for the differences between Fox and Thonga "skewness" – even allowing for Lounsbury´s distinction between Type I Omaha rule and Type III Omaha rule. However, I see the source of the anomalous behavior or *kokwana* in the combination of *relative age* and *affinity*, rather than in the agnatic *lineage* structure with a single "female generating term", as Read does.

How is the *kokwana* term, with its meaning as ♂MB subsumed under ♂MBF explained by a "female self" transformation of a "male lineage core"? I will follow Read´s explanation of the logic underlying this use of *kokwana* in Tsonga kinship terminology. The following quotation is Read´s explanation, with number added between brackets, to distinguish the different statements contained in the explanation as well as the inferences that connect them:

> "The term *kokwana* denotes, essentially, "ancestral relatives of my parents," a grouping that can be conceptually divided into those ancestral to my father (*kokwana-a*) and those ancestral to my mother (*kokwana-b*). **[1]** Mother's brother is included in the latter because **[2]** the only candidate for *ñwana* ('son') of *kokwana-b* is ***kokwana*** (see Figure 6) **[3]** if we think of *kokwana-b* as being determined by *tatana* ('father') of *mamana* ('mother') = *kokwana-b* ('maternal grandfather'), **[4]** with *kokwana* ('mother's brother') included in the covering term *kokwana* **[5]** by virtue of *ñwana* ('son') of *kokwana-b* = *kokwana* **[6]** (that is, *kokwana* as a covering term, includes all instances of *kokwana*, namely *kokwana-a*, *kokwana-b and kokwana*), then there is no genealogical oddity" (p. 22, brackets added).

The task at hand is to obtain the inclusion of "mother´s brother" at G^{+1} in the *kokwana-b* term at G^{+2} (implying ♂MB = ♂MF), from the assumption of a male lineage (agnatic) structure with a "single female term", with the role of an absorbing term. I must say that I struggled hard to follow the reasoning. I will break down the argument in separate statements, to make clear my understanding of it, without claiming that I fully understood it. The first statement [1] says that "mother´s brother" (♂MB) is included in *kokwana*-b, which means that *kokwana-b* = {♂FF, ♂FZ} U {♂MB}. This is so because, given the definition of *kokwana-b* as{♂FF, ♂MF}, the equivalence class of ♂MB is included in the equivalence class {♂FF, ♂MF}. This implies that ♂MB ≡ ♂MF, and since ♂MF = ♂FF, ♂MB is included in the equivalence class of ♂FF in virtue of the transitivity of the "same-sex sibling" relation.

This is a consequence of Lounsbury´s Type III Omaha Rule (Corollary).

But instead of taking this equivalence as an axiom (as Lounsbury did), Read justifies it by a series of assertions. First, [2] says that "son" of ♂MF is ♂MB: ♂MFS = ♂MB. This inference is a consequence of Lounsbury´s "merging rule". Next, [3] says that the equivalence class of ♂MF (*kokwana-b*) is the product of the equivalence classes of ♂M (♂*mamana*♀) and ♀F♂ (♀*tatana*)., that is to say, that ♂MF = ♂MF. This is a mere tautology. Therefore, the weight of the explanation falls on [4] and [5]. Now, [4] says that "mother´s brother" is equivalent to "mother´s father" and "father´s father" (*kokwana*) (♂MB= ♂MF), and this is a re-statement of Lounsbury´s Type III rule. Next, [5] says that ♂MBS = ♂MB, a re-statement of [1]. Finally, [6] says that *kokwana* = {♂FF, ♂MF, ♂MB}. And this is of course the same as [1].

If these translations make sense, then the whole reasoning is circular. Instead, I believe that the real point is to reiterate that [♂MB {♂,♀}] = ♂*kokwana* {♀,♂} is not generated through ♂*mamana*♀*makwana*♂ (♂MB♂), nor as ♂WB in a "affine" version (i.e. through ♂*tatana*♂*nsati*♀), which would amount to generating ♂*kokwana*♂ through a ♂*tatana*♂ followed by an affine link (♂*nsati*♀). The circuitous alternative is to generate ♂MB {♂,♀} = ♂*kokwana* {♂, ♀} by a detour through ♂FF = ♂MF = ♂MB, i.e. to as an extension of ♂*kokwana* to include the "only female product": ♂*female*♀ and ♂*female*♀*mother*♀ read as ♂*father*♂*wife*+♀ = ♂FWB = ♂MB. I have here used a mixed notation – keeping in mind that the whole point of Read´s approach is to circumvent the ♂MB path, subsuming it under ♂FWB and including ♂FWB in ♂FM.

I suppose therefore that Read´s intention is to argue that *kokwana* (in the sense of ♂MB) is "generated" through the extension of the "primary" meaning of *kokwana-a* (♂FF♂) to *kokwana-b* (a "neutral term" including ♂FF, ♂FM, ♂MF, ♂MM), and then extending this class to all relatives linked to ♂MF♂ by the iteration of ♂*ñwana*♂ ("son of") and of ♂*tatana*♂ ("father of"). This amounts to extending the *kokwana-b* category to the entire mother´s father´s lineage. Here is the catch: this lineage was previously reduced to the single "female self" term.

This being the case, there is no "generation difference" at the mother´s side to be cancelled by a "skewing rule", since no "mother lineage" gets started in the first place. As stated above, the whole argument looks me very much like a re-statement of Radcliffe-Brown´s unity-of-lineage thesis, which makes complete sense given the Lounsbury´s attack on Radcliffe-Brown´s thesis.

In Read´s model, the contrast between the two theories (Radcliffe-Brown´s lineage-model and Lounsbury´s cognatic model for terminological structures) is phrased as the contrast between a structure generated by a single generator "father" which generates a "male lineage" with an added "single female generator" as a terminal symbol, i.e. as an absorbing term (the "same-sex female sibling" operator, generating a degenerate lineage consisting of a single female term), and a cognatic language in which "generation" germs and "sex changing" terms alternate as in Lounsbury´s model.

In my view, the interpretation of *mamana* is a stumbling block in the elimination of "skewing" in the "logic" of Tsonga´s kinship terminology. I should add the problem posed by the term *malume* (at G^{+1} generation from ego´s point of view) and by *nsati* and *kokwana/namu* (at G^0 generation from ego´s point of view). For, assuming a man´s terminological path to his *kokwana* (of either sex) as *tatana´s wife´s siblings*, this could be either *kokwana* or *malume* to the *tatana´s* son, according to relative age considerations. Avoiding this route, in favor of the circuit which goes through ♂FF → ♂FZ → ♂MZ →♂MZS does not solve the problem, for it left unresolved the relative-age issue.

For *mamana* is, from the father´s point of view, not just *nsati* ("wife"), because their younger siblings can be either *namu* (potential or "presumptive" wives, or "presumptive" brother´s-in-law) -- supposed to replace the actual *nsati* in case of divorce or absence of children by virtue of the *lobolo* payment --, or older wife´s siblings, *kokwana*, "wife givers'. This link cannot be recovered by the circuitous path which leads from ego to his MB through FF → ♂MB →♂MBS.

This point brings to the fore the role of *malume*, which occupies the same genealogical place as *kokwana*. Here, the relevant point is that *kokwana* (a *father´s wife´s older sisters* or *older brothers,* i.e. a father´s *mukonwana*) is identified to *kokwana-b* (♂MF). This identification is a consequence of Lounsbury´s Type III Omaha rule (corollary). On the other hand, *malume* (♂MB, or properly speaking a *father´s wife´s younger sisters*, a father´s *tinamu*) must be identified with (♂MBS). And this is a consequence of Lounsbury´s Type I Omaha Rule (corollary).

I conclude that relative age and affinity should be part of the explanation of *kokwana* and *malume*, and, simultaneously, of *mukonwana* and *namu* (which are the same "genealogical positions", addressed from the point of view of son and father respectively).[vi]

That *kokwana* and *malume* can be formally generated by Lounsbury´s Type III and Type I rules is an interesting point, because it means that Lounsbury´s four Omaha types do not account for the Thonga case. Another, and more important conclusion is that *relative age* and *affinity* have an explanatory role that cannot be dismissed in explaining *kokwana.*

As a balance of my argument, let me point out what I see as positive contributions resulting from Read´s research program. First, he points out the limitations of Lounsbury´s taxonomy of "Omaha" systems -- it does not cover all possibilities. Secondly, it asserts the role of "culturally" determined rules over the "internal rules" – in the Thonga case, the role of relative age (as expression of hierarchy) and of bride-wealth (*lobolo*) is a paramount example of such culturally determined rules. As a contrast, I mention Central-Brazil instances of Omaha-like terminologies in which "skewing" is linked to the transmission of names (Coelho 2012, Lea 2012).

Cognatic x agnatic

I define a "cognatic" formal language as language which generates expressions by means of a "same-sex genitor" generator term and its inverse, together with an "opposite-sex sibling term" without a precedence rule. And an "agnatic" formal language is a language which generates expressions by means of a "male same-sex generator" and its inverse. According to Read, kinship terminologies of "patrilineal" societies (a sociological feature) can be represented as an "agnatic" core that is then transformed either into a 'female copy' isomorphic to the primary male terminology, or into a "female" degenerate copy with a single term, as in the Omaha instance. On the other hand, for all I can see, Thonga´s kinship terms could as well be generated by means of the ♀*mamana*♀ from a female point of view.

The role of self

The syntactical role of "self" in the logic of kinship terminologies seems to be a feature of Western terminologies that distinguishes them from "classificatory" terminologies in Morgan´s sense, that is to say, from terminologies which have a merging rule. Let me expand this argument. The "self" term, if I understood it right, distinguishes a speaker from his or her siblings, from the point of view of the external observer, since it is not a kinship term. It is characterized by its syntactical behavior. For instance, in English kinship terminology the two following equivalences are valid:

*parent**self = *parent*

*parent*sibling* = *uncle* or *aunt*

as well as their reciprocals:

self**child* = *child*

*sibling*child* = *nephew* or *niece*.

From these equivalences, the following inequalities follow:

self ≠ *sibling*

lineal ≠ *collateral.*

If this analysis is correct, kinship terminologies that distinguish *self* and *sibling* and kinship terminologies that merge *self* and *siblings* belong to different classes – identified by Morgan with the "descriptive" and "classificatory" labels.

On the algebraical side, the inequality *self* ≠ *sibling* results in the impossibility of unique inverses for *parent* or *child*, while the equality *self* = *siblings* results in the existence of inverses for *parent* and *child.* I put the case in the form of statements. In English kinship terms:

*parent*child* = {*self* , *sibling*} = {*lineal*, *collateral*}

*child*parent* = {*self*, *spouse*} = {*lineal*, *affine*}

These examples show that there is no unique inverse for "parent" or "child" in English kinship language, because the products can be either *lineal* or *collateral* relatives, according to the occurrence of *self* or *sibling* as intervening terms. On the other hand, in classificatory terminologies (i.e. having "same-sex sibling identification" rules and "half-sibling rules"), the following equations hold:

(*same-sex*) *parent** (*same-sex child*) = *same-sex sibling*

(*same-sex child*)*(*same-sex parent*) = *same-sex sibling*

(*opposite-sex*) *parent**(*opposite-sex child*) = *same-sex sibling*

(*opposite-sex child*)*(*opposite-sex parent*) = *same-sex sibling.*

In Thonga kinship terminology, accordingly, there is a unique inverse for "same-sex parent" (♂*tatana*♂) which is "same-sex child" (♂*nwana*♂), and for "opposite-sex parent" (♂*mamana*♀) which is "opposed sex child" (♀*nwana*♂). In these expressions the inverses are not lexically marked for gender. The corresponding algebraic expressions are:

$f f^{-1} = e$ *tatana*nwana* = *makwabu*

$f^{-1} f = e$ *nwana*tatana* = *makwabu*

♂$s f f^{-1} s =$♂e ♂*mamana*♀*nwana*♂ = ♂*makwabu*♂

♂$f^{-1}s\ sf$ =♂ e ♂*nwana*♀*tatana*♂ = ♂*makwabu*♂

To conclude this argument, I suggest that “self” is not a universally valid meta-kinship category. In particular, it is not syntactically adequate to the logic of classificatory terminologies, where the set of “same-sex siblings” is the set of objects on which “kinship operators” act: namely “identity” (*e*), “opposite-sex sibling” (*s*), “same-sex ascending generation” (*f*) and “descending generation” (f^{-1}), as well as their products, subject to additional constraints that lead to the rich spectrum of “classificatory systems”. [vii]

Crossness and on affinity

In a paper dated from 2010 I outlined a version of Lounsbury´s Omaha and Crow rules (Type I) from male and female points of view, expressed as transformations “crossness” (Barbosa de Almeida 2010c). These expressions are intended to show how crossness and affinity are structural consequences of “bifurcate” rules, and how kinship rules can be expressed in terms of them. I quote directly from this unpublished paper.

> “... this apparently special case [♂FZD → ♂ZD, ♀MBS → ♀MB] is sufficient to generate all of Lounsbury's Omaha Type I derivations, when combined with the classificatory rules (C-rules) which are a generalization of Lounsbury's Merging Rule and Half-Sibling Rule” (Almeida 2010c).

> “The Omaha Type I Rule, from the male point of view, is identical to the Crow Type I Rule expressed from the female point of view (the both transform a “same-side, same-sex cross-sibling” into a “same-side, same-sex cross-uncle”). And the Omaha Type I Rule, from the female point of view, is identical to the Crow Type I Rule expressed from the male point of view (both transform a “opposite-side, same sex cross-sibling into a same-sex genitor”)” (Barbosa de Almeida 2010c)”.

Models

If the above comments have any pertinence, they imply that Read´s model, as any other model, encapsulates theoretical assumptions which are not supported uniquely by facts: among them, the privileged role of a “male point of view” and the secondary role assigned to sex difference, not to mention the absence of the female point of view in the terminology, and the special role bestowed to the “self” category. The choice is not between Read´s logic or “no logic at all”, but between different models which should be judged on their empirical consequences. The underlying issue is that models are inevitably underdetermined by facts – which is another way to say that there is more than one way to account for empirical data (Duhem 2007[1904]:27, 31); Quine 1961[1953]:38,41-43).

I would like to mention, in this context, Read´s point on Lounsbury´s lack of 'explanatory´ content, in the sense that Lounsbury´s rules only describe *how* things happen, not *why* they happen. Read invokes Newton´s laws of movement in support of his point. However, Newton´s laws do not explain *what* gravity *is,* but only *how* bodies move when interacting with each other, a point made by Newton himself, who in *Opticks* manifested his perplexity on how anyone could be satisfied with the idea of instantaneous action at infinite distances, implied in his laws of movement. Newton´s laws produce predictions according to laws – and this, if an analogy holds, what one should expect from Lounsbury´s rules: to predict the use of kinship terms according to rules.

Lounsbury´s rules were phrased as rewriting rules, which are mechanical actions on a string of symbols. However, this computational system is supposed to have empirical relevance. This exigence is expressed in the following way. Given a dictionary which *translate primary vernacular kinship terms* in the formal language of kin types (B, Z, F, M, W, H), the same result is obtained, either by calculating with vernacular terms and then translating the result into the formal language, or by translating the vernacular terms into the formal language and calculating in it. In short: the translation of the product of terms (obtained in the vernacular language) must be the product of the translation of terms (in the formal language). In order to make this precise, it is of course necessary to specify precisely the rules of the formal language.

This model-construction applied to kinship "logic" should not be mistaken with the grammatical rules of a language, a point already made by Morgan. For instance, English kinship expressions are formed from left to right (e.g. *father´s sister*, abbreviated as FZ), while Portuguese and French kinship expressions are formed from right to left (*irmã da mãe, soeur de mère*). [viii] Notwithstanding, francophone and anglophone anthropologists understand each other on the structure of kinship terminologies. The same happens in mathematical notation, where the composition of functions f and g (first apply f, then apply g on $f(x)$) is noted as $g(f(x)) = gf(x)$ in Calculus books, while it is written as $(x)fg$ in some algebra books (cf. Herstein 1975:11). Read favors the Calculus style, with coincides with French and Portuguese syntax. It goes without saying that grammatical difference is irrelevant from the point of view of mathematical structure – which is to it as deep structure is to surface structure in linguistics --, just as the use of parenthesis-free Polish notation or the more usual parenthetical notation does not affect the expression logical laws.

The point here is that it is desirable to put arguments about 'kinship logic´ in mathematically neutral forms, as opposed to the use of English vernacular terms. This remark applies in the first place to Lounsbury´s formalization, which, by using the "kin type notation", invites the mixing of the structure of English kinship terms with its use as a formal language. This mixing-up was intended to facilitate understanding. But it was also a consequence of Lounsbury´s own interpretation of his basic symbols as expressions of universal components of the human family, from which all composite terms were supposed to be "extensions".

The formal language proposed by Trautmann, unfortunately without adhesion among specialists, with the notable exception of Tjon Sie Fat (1998), is an improvement on Lounsbury´s system for three reasons: it uses formal symbols (not "kin types" as abbreviated English terms), it is relational (it is independent of a particular "ego", being "coordinate-free"), and it is componential (it has semantic content). It is also algebraic. Ultimately, Trautmann´s symbolism reduces all relations expressible in kin type language to products of two basic relations: the siblingship operators ("same-sex, same-generation sibling" $C_{=}^{0}$ and "opposite-sex, same-generation sibling" $C_{\neq}^{0}$) and the generation operators ("same-sex, ascending generation consanguine" $C_{=}^{+1}$ and its inverse "same-sex, descending generation consanguine" $C_{=}^{-1}$). In Trautmann´s calculus, the product should be non-commutative, since $(C_{\neq}^{0})\ (C_{=}^{+1}) = C_{\neq}^{+1}$ (e.g. ♂ZM = ♂M) while $(C_{=}^{+1})\ (C_{\neq}^{0}) = A_{\neq}^{+1}$ (e.g. ♂FZ = ♂Mother´s Affine). In algebraic style, the non-commutativity is expressed as $sf = fsa$ or as $sf = -fs$ (cf. Barbosa de Almeida 2010a).[ix]

I substituted the *e* for Trautmann´s operator $C_{=}^{0}$, by analogy with algebraic use of *e* for the identity operator, and *s* for Trautmann´s operator $C_{\neq}^{0}$; and I employed the symbol *f* for Trautmann´s operator $C_{=}^{+1}$ and the symbol f^{-1} for its inverse $C_{=}^{-1}$. By composing these symbols -- each of them expressing a *single* difference -- , *all* kin type expressions can be expressed, which makes evident the group-theoretical character of "merging rules" and "half-sibling" rules which are diagnostic of "classificatory terminologies". This fact is veiled by using symbols borrowed from English kinship language.

Kinship as indigenous mathematics

Non-Western cultures have applied mathematical operations to social relations as well as to handicrafts, navigation and tool-making. Kinship terminologies are another instance of indigenous mathematical thinking. Morgan proposed as the object of a new science the comparative study of "plans" common to kinship terminologies, independently from their linguistic expressions, as Trautmann has brilliantly argued (Trautmann 2008, cf. Almeida 2010). However, to describe these "plans" – or structural patterns --, it is necessary to use abstract representation – just as abstract group theory brought to light the structural features common to several domains of mathematics and physic, as well as to crystallography and decorative patterns.

Lévi-Strauss famously deconstructed the concept of totemism as a single phenomenon, by splitting it in the overlapping domains of terminologies, taxonomies, and marriage practices. This insight opened the way for his later focus on *pensée sauvage* as possessing a non-written taxonomy, an idea which he traced back to Émile Durkheim and Marcel Mauss. In an analogous way, it is safe to say that "kinship", rather than a single object, is an overlapping zone of at least three different domains of human life, namely: descent/marriage rules, cosmological-ontological systems, and computational-mathematical calculi. From this point of view, the question about "what kinship is" has at least three different answers, mutually compatible because not really dealing with the same subject-matter: namely, social norms (e.g. Leach´s "kinship as language for transmission of landed property"),ontology (e.g. Sahlins´ "mutuality of being") and ethnomathematics (e.g. Lounsbury´s rewriting rules, Trautmann´s calculus, André Weil group-theoretical models and Tjon Sie Fat´s generalization of them).

This is an occasion to comment on a frequent misunderstanding regarding "rewriting rules", which consists in seeing them as a gimmick without theoretical relevance. This misunderstanding evokes Malinowski´s "mock-algebra" characterization of studies of kinship terminologies.

However, unknown to Malinowski, Emil Post proposed rewriting rules in the 1920s as the foundation of all possible computational processes, and therefore of logic and mathematics, a view which is equivalent to the concept of Turing machines.[x]

Lounsbury, as himself admitted, sacrificed elegance and simplicity for the sake of communication, by using the kin type language familiar to anthropologists. However, his generative approach was in the spirit of Emil Post of computation.

This is how Post´s theory leads to a problem in kinship theory. Assuming that "rewriting rules" are given, and defining A and B as equivalent if they can be transformed into each other by applications of rewriting rules, then, in Post´s own words,

> "Thue´s problem is then the problem of determining for arbitrarily given strings A, B ... whether, or no, A and B are equivalent" (Post 1947). xi

Conclusions

This is my first point: *classificatory features of kinship terminologies* can be best represented as the *group structure* organization of kinship-and-marriage terminologies among primitive societies, where the *group operating on a set* is generated by generation and sex changes acting on the set of *same-sex-sibling* categories. This group structure accounts for the "merging rules" (Lounsbury) and "same-sex sibling rules" (Trautmann and Whiteley 2012). The second point is this: constraints on this general *classificatory structure* produce varieties such as "Hawaiian" (with a commutative product for generation and sex) and "bifurcate" (where the product of generation and sex is not commutative), as well as other varieties, among which Crow-Omaha terminological calculus.

Read´s program, among other significant innovations, revealed the implied 'self´ term in American kinship language – a clue to distinguish Western kinship terminologies from others where the opposition "self"/"same-sex sibling", and even "self/sibling" (as in the Thonga case), although culturally recognized, does not have a central role in the terminological structure.

In other words, Read´s logic of the American terminological structure is framed on the opposition of "self" to the class of "same-sex siblings", an opposition which results in the separation of "lineal" and "collateral" same-sex relatives. This move blurs Morgan´s distinction between 'classificatory" (i.e. where the *merging* rule is the diagnostic feature) and "descriptive" (where "merging rules" do not apply), as well as the pertinence of the "crossness" concept for comparative purposes. Read´s thesis has wide theoretical implications, and my extended comments on it is a tribute to its far-reaching implications.

Appendix I: A formal representation

I will reconstruct one aspect of Read´s "male core" model, with the goal of making explicit its underlying mathematical structure. The "male core" structure is founded in three structural features: the "same-sex merging property" (to use Trautmann´s expression), the male generator feature, and the "generation-merging" rule. I will show that underlying mathematical structure is isomorph to the free group generated by a single element; which is isomorph to the chain of integers plus a "compactification" rule to impose an upper limit and a lower limit on it.

The "male core" structure is generated in two stages. In the first stage, the "same-sex ascending generator" ♂*tatana*♂ (with its inverse) generates a group which is the smallest set which contains ♂*tatana*♂, its inverse ♂*ñwana*♂, and all products of ♂*tatana*♂ and ♂*ñwana*♂, as well as the identity element, which in Read´s model can be represented as ♂*self*♂.[xii] The set of all compositions of ♂*tatana*♂ and ♂*ñwana*♂ (where ♂*tatana*♂*ñwana*♂ = ♂*male self*♂, and ♂*male self*♂ acts as the identity element) produces the image of a "free" group with infinite generations. An additional rule is introduced to "compactify" this infinite "male lineage". The result is the finite "lineage" segment of 5 generations:

♂*ntukulu*♂ < ♂*ñwana*♂ < ♂*nhondjwa* $^{+}$♂/♂*nidjisana*$^{-}$♂ <♂*tatana*♂ <♂*kokwana*♂

As for the product rules, it suffices to know that ♂*nhondjwa* $^{+}$♂/♂*nidjisana*$^{-}$♂$^{-}$ acts as the identity element ♂*self*♂, and that ♂*kokwana*♂ and ♂*ntukulu*♂ are inverses to each other, as well as ♂*ñwana*♂ and ♂*tatana*♂. Pairs of inverses are to be erased as well as the identity element *e* except when occurring alone. The following products are to be computed after all possible cancellations are made:

♂*tatana*♂*kokwana*♂ = ♂*kokwana*♂, and ♂*ñwana*♂*ntukulu*♂ = ♂*ntukulu*♂.

This is an algebraic description of Read´s Figures 2 and 3, without the "female self" operator. I think it useful to represent this concrete structure as an abstract structure.

To this end, I use the symbol *f* for same-sex, ascending generation, covering both ♂*f*♂ or ♀*f*♀ (♂*tatana*♂ or ♀*mamana*♀), and the symbol *e* for same-sex sibling, covering ♂*e*♂ and ♀*e*♀ (♂*makwabu*♂ and ♀*makwabu*♀) and playing the algebraic role of an identity element. All these terms have inverses: the inverse of *f* (♂*tatana*♂, ♀*mamana*♀ is f^{-1} (♂*ñwana*♂ and ♀*ñwana*♀

respectively), and the *e* is *e* (♂*makwabu*♂, ♀*makwabu*♀). The symbol e^+ stands for "older same-sex sibling" (♂*nhondjwa*♂, ♀*nhondjwa*♀), with inverse e^- (♂*ndjisana*♂, ♀*nidjisana*♀).

With this abstract representation, we realize that the male core has the algebraic structure of the free group generated by a single element *f* different from the identity. The group is a set and an operation: the set is composed by all products of *f*, its inverse f^{-1} and the identity *e*, and the operation is the concatenation subject to the cancellation rule: all pairs of *f* and its inverse f^{-1} are replaced by *e*, and all occurrences of *e* are erased except if *e* is isolated. The cancellation process condenses all merging rule when this abstract group is interpreted as a genealogical chain. It is easy to check that the result set is an infinite chain isomorph with the set of integers with the usual sum. This is the structure of an infinite succession of same-sex sibling groups.

This is represented as:

$$L_\infty = \{\dots f^{-n}, \dots, f^{-3}, f^{-2}, f^{-1}, e, f^1, f^2, f^3, \dots, f^n \dots\}$$

There is no infinite set of kinship terms, just as there is no infinite number system among non-literate societies. And just as these societies usually have named numbers up to a (small) finite number, the unilinear kinship chain must be must be "compactified" to yield a manageable finite chain with a maximum and a minimum.

In kinship terminologies such as Tsonga and others, the compactification is produced by means of a rule that makes $f f^2 = f^2$ and $f^{-1} f^{-2} = f^{-2}$. This can be called a "forgetting rule" (Almeida 2010), and it reduces the lineage chain to five generations.[xiii]

The *free group generated by* {♂*f*}, with the added "forgetting rule", is isomorphic to the "male core" in the sense of Read (Figure 3), generated by ♂*tatana*♂. The following lines make this clear.

♂L_2 = {♂f^{-2},♂ f^{-1}, ♂*e*,♂ *f*, ♂f^2}

♂L_2 = {♂*ntukulu*♂, ♂*ñwana*♂, ♂*nhondjwa*♂/♂*ndjisana*♂, ♂*tatana*, ♂*kokwana*♂}.

Note that ♂*tatana*♂ is already lexically marked as a "male term" (i.e. implying a male alter), while all other terms are lexically unmarked both for speaker and for alter.

The concatenation rules for vernacular terms are mirrored in the rules of the abstract group structure. In particular, ♂*tatana*♂*tatana*♂ = ♂*kokwana*♂, and ♂*tatana*♂*kokwana*♂ = ♂*kokwana*♂ (by a forgetting rule). The pair *nhondjwa/ndjisana* plays the role of ♂*self* $^+$♂/♂*self* $^-$ ♂.

I expect that this representation captures the gist of Read´s Figures 2 and 3. The point was to outline the mathematical structure underlying the “male core”, which is that of a chain. This suggests that non-literate societies have mathematical models for social organization.

I consider now the free group generated by the set $\{f, s\}$, endowed with the concatenation operation, and with the added “forgetting” rule

f K = K, f^{-1}K = K if in the sum of indices n in “f^{n}” is 2 or -2.

This is the set of all sequences of “s”, “f” and “f^{-1}” in any order, with all pairs ss, ff^{-1} and $f^{-1}f$, erased, plus the identity e, having at most length 2.

These strings alternate generation change and sex change, and this alternation capture both the concept of “crossness” and of “marriage”. The reason for this is that the string $fsf^{-1}s$ (read ♂FZS, ♀MBD) expresses “crossness”, while the string $f^{-1}sfs$ (read ♂SZMB♂= ♂WB, ♀DBFZ = ♀HZ) conveys “marriage”.

This structure is easily ordered by generation, a “generation number” being the sum of the exponents of all occurrences of f and f^{-1}). All kintypes can be represented in this universe. As examples, ♂FZS♂ corresponds to ♂$fsf^{-1}s$ with length 0. The sex of a string is “same-sex” (♂) or “opposite-sex” (♀) according to whether the parity of “ss” is even or odd.

Such a construction generates an infinite structure isomorph to that of kintypes (reduced by merging rules). Generation rules (“compactifying” the generational length) and Dravidian or similar rules further reduce the set of expression to a finite set.

For example, one Dravidian rule makes $fsf^{-1}s$, (symbolized by **x)** its own inverse, which means that **xx** = e (♂FZS = ♂MBS for a male speaker). Another Dravidian rule identifies **x** = **a** (cross cousins are affines). The rules reduce all expressions to the four expressions: e, s, a and as with $a = x$ (Barbosa de Almeida 2010a). Additional generations rules reduce the number of distinct generations.

The fact that every kin expression (as expressed in kin types or in the proposed algebraic version) which is not reduced by classificatory rules or by generation-merging rules has the form of a cross expression (an expression alternating “same-sex generation changes” and “opposite sex siblings”) supports the suggestion made by Trautmann: that a set of special rules distinguishing Iroquois, Dravidian, Crow-Omaha, and Jinghpaw are as many variations of the theme of crossness.

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[i] I quote Read on these points. First, on the role of the ‘male terms´ structure as a privileged origin:

“...we generate the Thonga terminology by first generating **the structure of ascending and descending male terms** shown in the kin term map of male term displayed in Figure 2, (Read 2018: 24)

“For our purposes here, we will only outline the generative logic for **the structure of ascending and descending male terms ..**. our focus is on generating the Thonga terminology from this structure so as to determine whether the skewing property of this terminology arises from its generative logic.” (Read 2018: 25).

Second, on the “female self” as incapable of generating a linear structure:

“... we find that the so-called skewing arises for **a simple reason**, namely only the male-marked terms arise through a generative logic that begins with male self, *tatana* (´father´) and *nhondjwa* (´ascending brother´) as primary, generating terms, whereas, in an asymmetric manner, the only generating term for the female marked terms is *self*. **This is the logic of a terminology that structurally only recognizes patrilines**” (Read 2018: 41)

“... there is no lineal generational structure for the female kin terms since the sole female generating term is *self* and *self* is an identity element among female kin terms, so self of self = self... Thus, what is referred to as skewing is, in the case of the Thonga terminology, is the *absence of a generational structure*. (...) The absence of structure means that **female marked terms defined through products of *self* with male terms need not structurally preserve generation differences**.” (p. 41).

[ii] “...the absence of a generative structure for female terms indicates that the **Thongan terminology excludes the mother relation as a primary generating concept**” (p. 41) “... rather than the kin term relation of the uterine nephew to his maternal uncle being determined through the consanguine kin term product, *kokwana* (´opposite sex sibling´) of *mamana* (´mother´), it is given, instead, by the affine kin term product, (*kokwana* (´opposite sex sibling´) of *nsati* (´wife´)) of *tatana* (´father´)”. (Read 2018: 42, boldface mine).

iii "... the absence of a generative structure for female terms indicates that the **Thongan terminology excludes the mother relation as a primary generating concept**" (p. 41) "... rather than the kin term relation of the uterine nephew to his maternal uncle being determined through the consanguine kin term product, *kokwana* (´opposite sex sibling´) of *mamana* (´mother´), it is given, instead, by the affine kin term product, (*kokwana* (´opposite sex sibling´) of *nsati* (´wife´)) of *tatana* (´father´)". (Read 2018: 42, boldface mine).

iv Running the risk of redundancy, I will go back to the distinction between *rarana* and of *mamana*. While *mamana* is lexically a "female self" (not requiring any transformation), *rarana* must be transformed by the ♂male♂female♀ operator, i.e. by the "opposite-sex sibling" operator. This is the "consanguine/affine distinction. I now quote Junod from the French translation of the second edition of his book:

"L'un de mes informateurs, en me décrivant ces deux catégories de parents par alliance, me dit: Les *bakoñwana* (femmes) sont celles qui vous procurent des épouses; les *tinamou* (femmes) sont celles qui vous procurent des enfants, car ce sont vos femmes présomptives. Même si vous ne les épousez pas, leurs enfants vous appelleront (Junod 1927/1936:224).

v This case brings to the fore Tjon Sie Fat´s argument on the role of non-associativity in kinship terminologies. I rejected this point in the context of Dravidian terminologies, but I acknowledge its relevance in the relative-age context.

vi According to Junod, wife´s older sisters are assimilated to the ascending generation and thus forbidden as potential wives (they are a man´s *mukonwana*), while his wife´s younger sisters, are potential wives (*namu*). This distinction is paralleled in the man´s in-laws, who are ambiguously addressed as *mukonwana* (assimilated to fathers-in-law, called as *kokwana* by his son) and as *namu* (brother-in-law), called as *malume* by his son. Thus, a father´s *namu* is called *malume* by his son, who also calls *malume* his *malume´s* son (this is Lounsbury´s Rule I – Corollary). Junod´s explanation of *kokwana* in the second edition of his treatise adds much information on affine relations. He discards Frazer´s list, and instead organizes his exegesis as a taxonomy which divides kinship terms into a "father´s side" and a "mother´s side" (*bukonwana*), further divided in "relatives by mother" and "relatives by marriage". Recall that a man´s *mukoñwana* and *namu* are his son´s *kokwana* and *malume.* Note also that *kokwana* and *malume* have, according to Junod, distinct reciprocals – at least in old usage – and should therefore be treated as distinct relationships. The pairs are *kokwana/ntukulu* and *malume/ mupsyana.*

vii The relative-age structure creates a linear order within the "same-sex sibling" category. This ordering has a significant role in Thonga terminological calculus.

viii Portuguese and Spanish call *brother* and *sister* by a common root (*irmão/irmã, hermano/hermana*) while English and French have *brother/sister,* and *frère/soeur* to distinguish male siblings from female siblings. *irmãos*" or "brothers").

ix The non-commutative propriety of kinship terminologies when expressed in relational (algebraic) form is the main technical point in Almeida 2010. It should be noted that "Hawaiian" product, on the contrary, is commutative, as it obeys the rule $fs = sf$, as in the following instances: [♂FZ] = [♂ZM] and [♀BF] = [♀MB].

x The mathematical structure of kinship terminologies – as distinguished from their semantic interpretations -- was early on recognized by Bertrand Russell, who expressed a famous proof of the set-theoretical Berstein-Schröder theorem in the language of the (unilinear) ancestor-descendant relation, which also models the structure of the integers.

xi In Almeida 2010 I set out to prove that that every kinship expression composed of primary "same-sex genitor" and "opposed-sex sibling" and their reciprocals is reducible to four categories per generation, namely *e, s, a, as,* standing for "same-sex sibling", "opposite-sex sibling", "same-sex affine", "opposite-sex affine", assuming two "Dravidian axioms" expressing formally the equivalence "wife-givers" and of "wife-takers" and the equivalence of "in-laws" and "cross-cousins". I gave two different proofs, one based on induction on the length of expressions, and another based on theorems of Group Theory that say that every permutation is the product of transpositions (the permutation of just two symbols), and that the parity of a permutation (odd parity meaning "affine" and even parity meaning "cross") is the same whatever the sequences of transpositions is used (rules can be used in whatever order). This seemed to be a solution for the problem of Thue in the case of "Dravidian systems" But there is a catch: the "Dravidian transformations require the introduction of a "parity" symbol in its rules. It is this circumstance which, according to Post, accounts for the possibility of solving the "word problem

[xii] The relation between ♂*self*♂ and ♂*nhondjwa*♂/♂*ndsijana*♂ (*male same-sex sibling*) in Read´s model has crucial theoretical significance and should be the subject of a separate analysis.

[xiii] Another major method for limiting the generation length of the universe of kin words is to impose a modulus-n rule, i.e. a modular arithmetic for generation counting. Thus, Cashinahua terminology generations are counted modulus 2, which means that ff = e. According to Ruth Vaz, some variants of Dravidian terminologies have the same rule, which also holds for Allen´s "tetradic model" of Allen. There is evidence that the Kariera terminology has a generation system modulus 4, which means that f 4 = e. Mathematically, this means that in these terminologies the set of kinship terms, together with a composition law, is isomorphic to a free group subject to the equation f n = *e*.