Reconstructing the Proto-Polynesian Terminology: Kinship Terminologies as Evolving Logical Structures

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Abstract
The kin term product calculations used by culture-bearers to compute kin relationships from kin terms without reference to genealogy are the basis for the structure of a kinship terminology and its underlying generative logic. The details of that logic account for differences in the structural forms for kinship terminologies. The structural form of the Polynesian kinship terminologies, like that of other classificatory (i.e., bifurcate merging) terminologies, derives from a structural logic in which a sibling term is a generating element. When a sibling term is a generating element, differences in the patterning of sibling terms arise from different ways in which structural logic for the reciprocity of sibling terms is implemented. These differences in implementation of sibling term reciprocity are used to construct, in analogy with a language tree, a kinship tree based on the different structures for sibling terms in the Polynesian terminologies. The kinship tree has two root structural forms for sibling terms. One structural form matches that for sibling terms in the Anuta, East Futuna, West Futuna, Luangiua, Nanumea, Takuu, Tikopia, and Tuvalu kinship terminologies. The other matches the structural form for sibling terms in the Pukapuka and Pileni terminologies. In contrast, the Proto-Polynesian terminology derived using the methods of historical linguistics has a root structural form for the sibling terms matching that found among the East Polynesian language kinship terminologies. These differences in analytical results are discussed and a possible way to reconcile them is developed.

Introduction
In his 1991 Marett Memorial Lecture at Exeter College, Thomas Trautmann observed that even though “anthropology has something quite distinctive to say about human history,” nonetheless “Social anthropology has drawn back from active construction of schemata of human social development over very long duration” even though it has not rejected the “developmental concepts … that gave
anthropology its start in life.” He went on to observe that a culturally grounded theory of the evolution and development of kinship systems is both a way to “synthesize the contents of ethnological time” and “is wanted … for in inventing the study of kinship, anthropology invented itself” (1992:392, 393). In this chapter, kinship terminologies will be taken as an appropriate domain for exploring the developmental aspect of kinship systems identified by Trautmann. The focus will be on kinship terminologies as these are integral to what we mean by kinship due to the fact that “kinship terminologies are a system of cultural ideas that formalize an ‘intuition’ of kinship” (Leaf 2010, email communication). By kinship, it should be noted, is not meant a single, specific aspect of a human society, but refers to the range of concepts, ideas and behavior that, to one degree or another, reflect and relate to the social relations individuals have with one another. As culture-bearers, we have an intuitive understanding of kinship and “this intuition is not just the recognition of one kind of fact, but rather the recognition of complex ongoing situations that include the facts of reproduction and associated emotional bonding and dependencies, but are not limited to them” (Leaf 2010, email communication).

We will consider the developmental aspect of kinship systems by focusing on a single region in which we can identify time-based structural changes in the formal aspects of the kinship terminologies for the populations in that region. Terminologies from the Polynesian region will be used for this purpose since the broad pattern of pre-historic populations moving into this region, as well as the genetic relations among the Polynesian languages, have already been worked out from archaeological, genetic and linguistic data. Methodologically, we will first delineate the formal structure of the Polynesian kinship terminologies in the ethnographic present. Then we will identify an implied, temporal pattern of structural changes from the ethnographic past that accounts for the differences in the present-day terminology structures. Next, following a suggestion by Ilia Peiros, we will construct a kinship tree of genetic relations among these kinship terminologies in analogy with a language tree. To do this, we will use methods analogous to those employed in historical linguistics for developing a language tree depicting genetic relations among related languages. We can then compare the kinship tree with a language tree for the same populations so as to assess whether the cultural systems of language and kinship change in parallel. If not, then our understanding of kinship terminology structure cannot simply
be subsumed under the study of linguistic structures (pace Jones 2010). We will conclude with a comparison of changes in the structural and linguistic aspects of the same terminologies so as to enrich our understanding of the factors influencing the development of kinship terminologies through time. This will increase our understanding of the time-based development of kinship systems.

The research reported in this chapter is not the first to consider changes in the structure of kinship terminologies in the Polynesian region. Murdock (1968, 1970) included the Polynesian region in his study of the relationship between patterns for the classification of sibling terms in kinship terminologies and language boundaries. Epling et al. (1973) developed a classification of Polynesian sibling kin terms based on binary dimensions such as sex, parity, or relative age and worked out an evolutionary sequence for changes in the sibling terms, assuming changes take place one character state at a time. For example, a terminology that currently has a relative age difference for same-sex siblings could drop the age difference in one evolutionary step regardless of the character states for the other dimensions for the kin terms. Marshall (1984) expanded the data base to include what he referred to as Oceanic Island populations, mainly Melanesian, Micronesian and Polynesian populations. Like Epling et al. (1973), he assumed terminologies are a sum of independent traits with evolutionary change constrained only by a single change in character state at each step in the evolutionary sequence. However, terminologies are systems of interconnected, not independent, kin terms and both the character states for the terminology and change in those states are constrained by the generative logic underlying the structure of the kinship terminology. Thus to identify the temporal pattern for structural changes in the Polynesian terminologies we must begin by making evident the generative logic and differences therein among the Polynesian kinship terminologies.

Generative Logic of Terminologies

We will identify the generative logic of the Polynesian terminologies by viewing a terminology as a system of conceptually interconnected kinship terms (Read 1984, 2001, 2007; Leaf and Read In Press). The system of interconnections constitutes a kin term space whose form is determined by the structural logic embedded within a terminology. A kin term space and the more familiar genealogical space jointly form a kinship space of kin relations upon which a kinship system is based. As Robert Parkin has noted,
when kin terms are viewed as defining categories it follows that “category and genealogy represent
different forms of knowledge about kinship ... if there is any universal here ... all speech communities use
both category and genealogy ... in explaining kinship to themselves and to others, depending on the
context” (2009: 164, 165, emphasis added; see also Parkin 1996; Read 2001b).

Formally, we can display the structure of a terminology in the kinship space through a kin term
map based on the interconnections among the kin terms using natural language representations
(Kronenfeld 2006b). These representations can be expressed directly using algebraic formalism, thus the
algebraic formalism derives from the cultural knowledge embedded in the terminology rather than being
imposed. This differs from unconstrained formalisms such as componential analysis and rewrite rule
analysis that impose formalisms over an assumed kinship terminology structure and so only provide
descriptive accounts (Keen 1985; Read 2000, 2001a; Leaf and Read In Press). In this way, the algebra
formalism makes it possible to deconstruct the terminology structure using cultural knowledge embedded
in the terminology in order to determine whether, and in what way, the structure has an underlying
generative logic. If so, we can then identify the primary kinship concepts from which we may generate
the terminology structure through the computations that are part of the generative logic embedded in that
structure.

The cultural knowledge is made evident through the kin term computations invoked when two
persons compute their kin relation to each other by kin terms they use to refer to a third person. For
example, consider three native English speakers. If the first of these three persons (properly) refers to the
third person by the kin term uncle and that person (properly) refers to the second person by the kin term
child, then the first person will recognize that he or she would (properly) use the kin term cousin for the
second person; that is, we have, as part of cultural knowledge, the kinship term computation child of
uncle is cousin. This cultural knowledge is formally embedded in a kinship terminology through the
interconnections among the kin terms in the kin term space and is not derived from the properties of a
genealogical space. A genealogical space, by itself, does not serve as a singular foundation for
uncovering the structural logic of a kinship terminology. Instead, we must consider the conceptual
foundations for genealogy in what we will refer to as a family space.
Family Space

The two forms of kinship knowledge identified by Parkin reflect the fact that kinship relations are conceptualized in two different ways using the culturally concepts of parenthood, childhood and siblinghood (possibly with sex marking) derived from (but not necessarily equivalent to) the facts of reproduction, along with the cultural concepts of husband and wife derived from marriage as a cultural institution. These concepts are logically prior to kinship relation concepts (Keen 1985) and make up what we can refer to as a family space (see Figure 1). Within the family space, the concept of self acts as a “center point” for structurally defining parent/child, wife/husband, brother/brother, sister/sister, and brother/sister as pairs of reciprocal, relational concepts. The concepts of brother and sister, though, unlike the other concepts, are structurally incorporated in the family space in one way in some societies and in a different way in other societies. This difference will be critical, as we will see below, for making a formal distinction between Lewis Henry Morgan’s categories of descriptive and classificatory terminologies, with the latter characterizing the Polynesian terminologies.

The first way that the brother and sister concepts are embedded in the family space -- and a way familiar to English speakers -- is with the brother and sister positions being linked directly to the mother and father positions by the son and daughter concepts (see Figure 1, Family Space (A)), thus making brother and sister into 2nd order concepts in contrast to the 1st order mother and father concepts (Keen 1985). Under this embedding, brother and sister are indirectly linked to self through brother conceptualized as son of (mother or father) of self and sister conceptualized as daughter of (mother or father) of self.

In the second embedding, brother and sister are concepts directly linked to self (see Figure 1, Family Space (B)). That ego and alter are siblings under this embedding implies they share the usage of the concept of ‘parent’, or more precisely, ego conceptualizes the genealogical parent of alter as ‘parent’ and alter conceptualizes the genealogical parent of ego as ‘parent’ even if a genealogical parent of ego is not the same person as a genealogical parent of alter. For example, the Kaluli of New Guinea, with this embedding of brother and sister concepts in the family space, say “I call so-and-so brother [nao] because my father called his father brother” (Schieffelin 1976:53). For the Kaluli, male speaker calls both his father and his father’s brother by the same term, nawa (‘father’), hence he refers to both the father of his
Genealogical Space

Elements (Concepts and Positions)
Reference position: self
Family positions based on cultural concepts of reproduction: father, mother, son, daughter, brother, sister
Family positions based on marriage concepts: husband, wife

Structural Equations

♂sf = ♀sf ("man's son's father is that man")
♂sm = ♀dm = ♀w ("man's son's mother is that man's wife")
♀dm = ♀sm ("woman's daughter's mother is that woman")
♀df = ♀sf = ♀h ("woman's daughter's father is that woman's husband")
Monogamy: ♀hw = ♀ and ♀wh = ♀
Polygamy: ♀wh = ♀
Polyandry: ♀hw = ♀

Structural Rules (Genealogical tracing)
Trace: (1) upwards, (2) downwards, (3) upwards + downwards or (4) downwards + 1 step upwards
Structural Representation
Genealogical grid, based on both the additional genealogical relations b and z and the structural equations: fs = ms = b, fd = md = z, sf = df, sm = dm, bz = z, zb = b, sb = s = db and sz = d = dz.

Kin Term Space

(terminology specific)

Elements (Kin Terms)
Primary terms (Terminology specific)
Self, Parent, Spouse (English terminology)

Binary Product (o) for two elements at a time
Used to define kin term product for kin terms
(Terminology specific implementation)

Structural Equations (English terminology):
Reciprocal Definition Equation
Child o Parent = Self
Spouse Definition Equation
Spouse o Spouse = Self
Affinal Equations
Spouse o Child o Parent = Child o Parent o Spouse
Affinal Restriction Equations
Parent o Spouse o Child = 0
Parent o Parent o Spouse = 0

Structural Rules (English Terminology)
Sex Marking of Kin Terms
Kin term K is sex marked if Spouse o K is a kin term or Spouse o K' is a kin term, where K' is the reciprocal term for K

Structural Representation
Kin term map
Figure 1: Relationship of Family Space to Genealogical Space and Kin Term Space, and the relationship of these two spaces to the Kinship Space. The Family Space consists of positions determined by the cultural concepts of father, mother, son, daughter, brother and sister grounded in biological reproduction and the concepts of wife and husband grounded in the cultural construct of marriage. Two ways, labelled (A) and (B), that the brother and sister positions are embedded in the Family Space are shown (lines indicate parent/child or spouse relations). The Genealogical Space is based on the interpretation of the concepts of the family space as genealogical relations and is constructed through recursive use of the parent/child relations. The Kin Term Space is based on the interpretation of the concepts of the family space as primary kin terms over which a kin term product is culturally defined and through which new terminological positions are constructed, subject to structural equations that determine the form of a particular terminology structure. The structure of the kinship terminology, as elicited from culture-bearers (Leaf 2006; Leaf and Read n.d.), can be expressed in using a kin term map (see Figures 3 - 5). The Genealogical Space and the Kin Term Space jointly form the Kinship Space through (1) cultural instantiation of the primary kin terms as categories of genealogical relations and (2) instantiation of all other kin terms through products of the categories of genealogical relations corresponding to the representation of a kin term as a product of primary kin terms. The Kinship Space encompasses the Family Space, the Genealogical Space, and the Kin Term Space as an integrated system that provides the conceptual basis for the culturally defined kin relations upon which kinship in human societies is based.

patrilateral parallel cousin -- a (genealogical) cousin he refers to as nao (‘brother’) -- and to his father by the term nawa even though the two fathers are not the same person. Consequently, in contrast to the sequence from self to father to brother for the first embedding that makes brother a 2nd order term, this sequence of conceptual relations from self to brother to father makes brother a 1st order term (Radcliffe-Brown 1950; pace, Keen 1985). Ethnographically, we have extensive evidence for brother and sister concepts being embedded in this second way in a family space in Polynesian societies through the primacy of the brother/sister relationship (see ethnographic reports in Marshall 1983).

Genealogical space
Two spaces can be constructed from the relations making up the family space (see middle part of Figure 1), each involving a different computational logic. The first is the genealogical space of genealogical pathways, or lines of ascent and descent, using the mother, father (or parent) and son, daughter (or child) positions interpreted as each defining a genealogical relation. For example, a genealogical mother relation is defined between ego and person A when A is in the mother position with respect to ego in the instantiation of the family space that includes ego. We may denote this genealogical pathway by the statement, A is ego’s (genealogical) mother.

A genealogical pathway, P, formed in this manner from ego to person A can be extended recursively by taking A, the output of the genealogical pathway from ego, as the new input for forming a
genealogical pathway and then forming a genealogical pathway from A to a person, B, linked to A through a position in the family space for A. For example, when A is ego’s mother and B is A’s father, we can form the genealogical pathway from ego to B by first going from ego to A and then from A to B. We denote this pathway, in this example, by the statement, \( B \) is ego’s mother’s father. Extension of genealogical pathways through recursion can also be viewed as concatenation of genealogical pathways.

From the time of W. H. R. Rivers, the pathways in a genealogical space have been used to ethically define kin terms from a kinship terminology by linking a genealogical pathway from one person to a second person with the kin term that would be used by the first person to refer to the second person and then grouping together all those genealogical pathways linked with the same kin term as the definition of that kin term. However, it is not always possible to make kin term definitions in this manner. Consider the terminology used by the !Kung san, a hunter-gatherer group in the northwestern part of Botswana. In their terminology, kin term reference by ego for a person A outside of the scope of the family relations depends on the genealogical relation of A to the name-giver for ego (Marshall 1976). This dependency of the kin term relation on the name-giver relation highlights the problem with trying to reduce kinship knowledge to properties expressed using genealogical relations. It is not with genealogical relations and concatenation of genealogical relations, but with computations using kin terms, making up a kin term space where we find the cultural kinship knowledge embedded in a kinship terminology (see middle, right side of Figure 1).

**Kin Term Space**

The *kin term space* is determined by the structural logic underlying the computations that users of a terminology make with kin terms without necessary reference to genealogy. Consider our previous example for the relations among the English kin terms *uncle*, *child* and *cousin* expressed using the product, *child of uncle* is *cousin*. The product for the kin terms *child* and *uncle* that results in the kin term *cousin* expresses the cultural knowledge English speaking users have of their kinship terminology system as a system of interconnected concepts.

The ethnographic literature is replete with ethnographic examples showing how kin term relations are computed in this manner using products of kin terms (see references in Read 2007). For example, Levinson (2002) makes the computation explicit for Rossel Island in Papua New Guinea:
“Kinship reckoning on Rossel does not rely on knowledge of kin-type strings . . . . What is essential in order to apply a kin term to an individual X, is to know how someone else, of a determinate kinship type to oneself, refers to X. From that knowledge alone, a correct appellation can be deduced. For example, suppose someone I call a tîdê ‘sister’ calls X a tp:ee ‘my child,’ then I can call X a chênê ‘my nephew,’ without having the faintest idea of my genealogical connection to X.” (p. 18)

Dousset (2005) observes, for Aboriginal Australia, that this kind of reckoning by one person enables kin relations to all community members to be worked out: “When two foreigners can both trace their classificatory relationships towards a third person, the remaining relationships among all other members of the community can be deduced from this set” (p. 22).

We will refer to culturally salient computations made in this manner as kin term products (first defined in Read 1984). Kin term products provide a means through which new kin term concepts are generated, such as the English kin term concept, cousin, generated (as noted above) by the kin term product of the kin term concepts child and uncle in the English kinship terminology: child of uncle is cousin. We can define formally a kin term product for the kin terms in a kinship terminology as follows: If ego (properly) refers to alter 1 by the kin term L and alter 1 (properly) refers to alter 2 by the kin term K, then the kin term M used (properly) by ego to refer to alter 2 is the kin term product of K and L, written “K of L is M,” or more formally, K o L = M, where “o” stands for the binary product that connects K and L to M. (By a binary product over a set of elements [e.g., the terms in a kinship terminology] is meant a computation acting on two elements [e.g., two kin terms] at a time from that set of elements and yielding an element in that set of elements as the outcome of the computation. For example, multiplication is a binary product over the natural numbers since for any two natural numbers we may compute another natural number by forming the multiplicative product of the two natural numbers.) The definition for the kin term product expresses the way people on the ground compute kin relations (Kronenfeld 2006a) without reference to, and even without knowledge of, the genealogical relations involved.
The definition can be graphically represented as in Figure 2. In Figure 2, ego refers to alter 1 by the kin term L (e.g., uncle for users of the AKT), alter 1 refers to alter 2 by the kin term K (e.g., child for users of the AKT) and ego refers to alter 2 by the kin term M (e.g., cousin for users of the AKT) so, as a product of kin terms, K o L = M (e.g., for users of the AKT, child of uncle = cousin). Whereas the genealogical space has to do with relations among persons determined through recursively defined computations based on the positions making up the family space, the kin term space has to do with relations among kin terms derived from the family space and based on kin term products. Read (2001b) makes explicit the cultural knowledge and systematicity underlying the kin term products: “The kin term product … depends upon informant knowledge for its calculation. Kin term products are thus culturally specific and convey cultural concepts about how the kinship relations identified by the terms in the terminology may form a system of relationships” (p. 95).

**Figure 2**: Graphical illustration of a kin term product. The product of the kin terms K (e.g., English son) and L (e.g., English uncle) is the kin term, M, ego properly uses for alter 2 (in this case, cousin, for English speakers). Modified from Read and Behrens 1990.

*Kinship space*

The *kinship space* for the users of a kinship terminology is formed by integrating together the kin term space and the genealogical space through the genealogical definitions of kin terms (bottom part of
Figure 1) derived from the logic of the kin term space (see Read 2001; Bennardo and Read 2005, 2007; Leaf and Read In Press for details on the deducing the genealogical definition of kin terms from the kin term space). Within the kinship space, relationships between pairs of individuals can be expressed, for English speakers, either by a kin term expression such as *he is my uncle* or by a genealogical pathway such as *he is my father’s brother*, which makes explicit the distinction between category and genealogy referred to by Parkin.

The kinship space, then, consists of both a conceptual system based on the logic and properties of a genealogical space generated through genealogical tracing and a conceptual system having to do with the logic and properties of a kin term space generated through computations with kin terms using the kin term product. Neither of these (left and right sides of the middle portion of Figure 1) can be reduced to, nor derived from, the other.

**Terminology Structure and Kin Term Maps**

Now consider the terminology structure with form expressed by a kin term map constructed using kin term products. In the kin term map, each kin term is a node and nodes are connected in accordance with kin term products as follows. We begin the kin term map with a node labeled *self* that acts as the “center” of the kinship terminology structure. *Self* is a concept common across all terminologies (either in neutral or in sex marked form) and its instantiation is the person taken as the reference person; e.g., ego for purposes of abstracted genealogical tracing. Next, primary kin terms are identified for the relations within the family space, such as the kin terms parent, child, and spouse in English. Beginning with self, products are taken with each primary kin term. Each time a kin term is identified through a kin term product, such as *parent of self is parent* in English, a node labeled with the resulting kin term (in this case, *parent*) is entered in the kin term map. Also entered in the map is an arrow (with a distinctive arrow for each primary kin term) pointing from the initial kin term to the kin term resulting from the kin term product of the initial term with the primary kin term represented by the arrow. To continue the *parent of self* example, an arrow specific to the *parent* kin term will point from the *self* node to the *parent* node, indicating that *parent of self is parent*. From the *parent* node the same kind of arrow points to the *grandparent* node, indicating that *parent of parent is grandparent*.
This procedure is continued until one of four kinds of conceptual boundaries (*contra* Good 1996:n18) are reached: (1) kin terms products continue indefinitely in a fixed pattern (e.g., *parent*, *grandparent*, *great grandparent*, etc. in English), (2) the product does not give rise to a kin term (e.g., there is no kin term for *parent of parent-in-law* in English), (3) the product maps back to a kin term already in the structure (e.g., *child of cousin is cousin* in English), or (4) the product maps around to make the structure circular (e.g., ‘father’ of (‘father’ of ‘father’) is ‘son’ of ‘son’ in the Australian Kariera terminology [Radcliffe-Brown 1913]). Figure 3 shows a kin term map for the American kinship terminology and Figure 4 shows a contrasting kin term map for the Shipibo terminology (the Shipibo are a horticultural group in the eastern part of Peru). Just from the kin term map alone, structural differences in the kinship terminologies are immediately apparent.

![Kin term map](image)

**Figure 3**: Kin term map of the American kinship terminology based on the generating kin terms parent, child and spouse.
Kin Term Map for the *Proto-Polynesian Terminology

Both the American and the Shipibo terminologies are from societies with the family space as shown in Figure 1(A) and both societies have what Morgan referred to as descriptive terminologies.

Descriptive terminologies are those in which the sibling concepts are computed from the parent and child concepts; viz., in the English/American terminology, brother is son of parent and sister is daughter of...
Contrasting with the descriptive terminologies are classificatory terminologies in which there are no collateral distinctions in the terminology and so a kin term product such as son of grandfather would be father and not uncle, for example, if the American/English terminology were a classificatory terminology. Classificatory terminologies such as the Polynesian terminologies correspond to the second family space (see Figure 1 (B)) in which sibling is also a core concept (in addition to parent and reciprocally child, each possibly sex marked) connected directly to self, thus the terminology has irreducible, 1st order, sibling terms. This implies that sibling concepts are primary kin terms (along with parent terms) from which other kin terms are constructed (Read and Behrens 1990; Bennardo and Read 2005, 2007; Read 2007; Read and Leaf In Press).

The distinction we are making here is between terminologies such as the American and the Shipibo terminologies in which parent terms are primary and sibling terms are derivative and classificatory terminologies in which sibling terms are primary in addition to parent terms. Accordingly, we expect that the kin term map for a classificatory terminology such as the reconstructed *PPN terminology will have a substantially different topology, or blauplan, than is the case for a descriptive terminology.

Table 1: Proto-Polynesian Kin Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>*tupuna</td>
<td>‘grandparent’</td>
</tr>
<tr>
<td>*tama(na)</td>
<td>‘father’, ‘brother’ of ‘father’</td>
</tr>
<tr>
<td>*tina(na)</td>
<td>‘mother’, ‘sister’ of ‘mother’</td>
</tr>
<tr>
<td>*tuʔa-tina</td>
<td>‘brother’ of ‘mother’</td>
</tr>
<tr>
<td>*masaki-tanga</td>
<td>‘sister’ of ‘father’</td>
</tr>
<tr>
<td>*tuaka(na)</td>
<td>‘elder same-sex sibling’</td>
</tr>
<tr>
<td>*tahina</td>
<td>‘younger same-sex sibling’</td>
</tr>
<tr>
<td>*tuaʔaʔane</td>
<td>♀ ‘brother’</td>
</tr>
<tr>
<td>*tua-fafine</td>
<td>♂ ‘sister’</td>
</tr>
<tr>
<td>*tama</td>
<td>♀ ‘son’</td>
</tr>
<tr>
<td>**fosa</td>
<td>♂ ‘son’</td>
</tr>
<tr>
<td>*tamaʔa-fine</td>
<td>♀ ‘daughter’</td>
</tr>
<tr>
<td>*ʔo-fafine</td>
<td>♂ ‘daughter’</td>
</tr>
<tr>
<td>**faka-fotu</td>
<td>♀ ‘child’ of ‘brother’</td>
</tr>
<tr>
<td>*ʔilamutu</td>
<td>♂ ‘child’ of ‘sister’</td>
</tr>
<tr>
<td>*makupuna</td>
<td>‘grandchild’</td>
</tr>
</tbody>
</table>
The linguistically reconstructed *PPN classificatory terminology is given in Table 1 and its kin term map is shown in Figure 5. As expected, the structure of this kin term map has a completely different blauplan than the kin term maps for the American and the Shipibo terminologies. The division of the kin term map into a set of male (and neutral) marked kin terms and a set of female (and neutral) marked kin terms connected via the male self and the female self nodes is characteristic of classificatory terminologies (see Bennardo and Read 2005, 2007; Read 2007). Elsewhere, Read has demonstrated that genealogically framed classificatory equations such as $f = fb \neq mb$ and $m = mz \neq fz$, the equations used to define bifurcate merging (classificatory) terminologies, derive logically from having a sibling term as one of the primary, generating terms, along with a general procedure for the generation of a kinship terminology from its generating terms and structural equations (see Read and Behrens 1990; Bennardo and Read 2005, 2007; Read 2007; Leaf and Read In Press for details). Due to the importance of having a sibling generating term (hereafter, sibling generator) as one of the generating terms for a classificatory terminology, the focus will now be on structural properties that are the consequence of having a sibling generator in a kin term map.

Read has detailed the general procedure for generating a kinship terminology structure from the generating terms for a kinship terminology in Bennardo and Read (2005, 2007), Read (2007), and Leaf and Read (In Press); for our purposes here, only the first part of the procedure is needed. The generation of a terminology structure begins by identifying the term (or terms) that generates a structure of ascending kin terms of a single sex (including neutral terms) such as self, parent, grandparent, … in the American kinship terminology). For the consanguineal terms in the *PPN terminology, the generating terms for the structure of ascending male (including neutral) terms are male self, *tama(na) (‘father’), and *tuaka(na) (‘elder same-sex sibling’). Note the inclusion of *tuaka(na) as an ascending term since a person referred
to as *tuaka(na) by ego is reproductively prior to ego, hence *tuaka(na) identifies an ascending position with respect to self. Its reciprocal, *tahina, will be a descending term.

From the term *tama(na), we generate the ascending sequence, male self, *tama(na) (‘father’), and *tupuna (‘grandparent’) = *tama(na) of *tama(na), which is structurally analogous to the English...
sequence self, parent, grandparent = parent of parent …, except that further extension of the sequence for the proto-Polynesian terminology simply repeats the term *tupuna due to the kin term product *tama(na) of *tupuna is *tupuna. The ascending term *tuaka(na) (‘elder same-sex sibling’) only generates the sequence male self and *tuaka(na) due to the kin term product *tuaka(na) of *tuaka(na) is *tuaka(na).

Altogether, the ascending structure of male terms for the kin term map of male terms for the *PPN (see left side of Figure 5) is generated by *tama(na) (‘father’) and *tuaka(na) (‘elder same-sex sibling’), along with the following structural equations:

1. *tama(na) of *tuaka(na) = *tama(na) (‘father’ of ‘elder same-sex sibling’ is ‘father’),
2. *tuaka(na) of *tuaka(na) = *tuaka(na) (‘elder same-sex sibling’ of ‘elder same-sex sibling’ is ‘elder same-sex sibling’) and
3. *tama(na) of *tama(na) of *tama(na) = *tama(na) of *tama(na) of *tama(na) (‘father’ of ‘father’ of ‘father’ is ‘father’ of ‘father’ of ‘father’).

Note that Equation (1) expresses the second way for embedding a sibling term in the family space discussed above (see Figure 1(B)) and Equation (2) structurally defines *tuaka(na) to have the sibling term property of being self-reflexive. Together, these two equations structurally define *tama(na) to be a sibling term. Equation (3) provides an upper bound for generating new ascending terms.

Next, a descending structure isomorphic to the ascending structure is constructed by forming a set of generators and structural equations isomorphic to the generators and structural equations for the ascending structure. For the *PPN, the isomorphic generating set consists of male self, **fosa (‘son’ (ms)) and *tahina (‘younger same-sex sibling’) and the isomorphic structural equations for Equations (1) - (3), respectively, are:

4. **fosa of *tahina = **fosa (‘son’ of ‘younger same-sex sibling’ is ‘son’),
5. *tahina of *tahina = *tahina (‘younger same-sex sibling’ of ‘younger same-sex sibling’ is ‘younger same-sex sibling’) and
6. **fosa of **fosa of **fosa = **fosa of **fosa (‘son’ of ‘son’ of ‘son’ is ‘son’ of ‘son’ of ‘son’).

Note that Equation (4) lays the foundation for the classificatory aspect of the proto-Polynesian terminology since whenever an equation is part of the terminology structure, then the reciprocal of that
equation is also part of the terminology structure (Read 1984; Read and Behrens 1990; Read 2007). This means that since Equation (4) is part of the descending structure, its reciprocal equation, namely \( *tuaka (na) \) of \( *tama(na) = *tama(na) \) (‘elder brother’ of ‘father’ = ‘father), is also part of the terminology structure and this latter equation is one of the defining equations for classificatory kinship terminologies (see Read and Behrens 1990; Bennardo and Read 2005, 2007; Read 2007; Leaf and Read In Press for details). Equation (5) defines \( *tahina \) to be self-reciprocal and Equation (6) provides a lower bound for generating new descending terms.

The construction continues by introducing a structural equation that structurally makes \( *tama(na) \) and \( **fosa \) into reciprocal terms. Note that properties such as reciprocity of kin terms must be structurally defined since the usage definition of kin term reciprocity, namely K is the reciprocal of the kin term L when ego (properly) refers to alter by L and alter (properly) refers to ego by K, must be expressed structurally since the kin term space is based on relations among kin terms and not relations among persons and usage of kin terms by persons. In general, an ascending generating term L and a descending generating term K are reciprocal terms when they satisfy the equation \( L \) of \( K = self \) since this equation implies (see Figure 2) that if ego (properly) refers to alter 1 by the kin term K and alter 1 (properly) refers to alter 2 by the kin term L, then ego refers to alter 2 by the term self; that is, alter 2 is ego. But if alter 2 is ego, then L must be the reciprocal of K through kin term usage since \( L \) of \( K = self \) now implies that when ego refers to alter (= alter 1 in the definition of a kin term product) by the kin term K, then alter refers to ego by the kin term L and so K and L are reciprocal kin terms. For example, if K = \( child \) and L = \( parent \), then parent of child = self is the equation structurally defining child and parent to be reciprocal English kin terms.

We now apply this structural definition of kin term reciprocity and include the following equation in order to define the ascending and descending generating kin terms \( *tama(na) \) (‘father’) and \( **fosa \) (‘son’) as reciprocal terms:

\[
(7) \ *tama(na) \ of \ **fosa = male self \ (‘father’ of ‘son’ is male self)
\]

We will also include the equation

\[
(7’) \ **fosa \ of \ *tama(na) = male self \ (‘son’ of ‘father’ is male self)
\]
for the following three reasons. First, note that Equation (7') is from the perspective of male self since it is part of the structure of male terms and identifies structurally the fact that the ‘same-sex sibling’ terms *tuaka(na) and *tahina are generating terms and not compounds constructed from ‘son’ of ‘father’ as is the case for brother in the American kinship terminology. Second, from a female perspective, **fosa of *tama(na) becomes ‘brother’ (ws) since the male structure of kin terms and the female structure of kin terms (see below) are joined through interpreting male self in the male structure as ‘brother’ (ws) and female self in the female structure as ‘sister’ (ms), as shown in Figure 5. Third, the structural equation, **fosa of *tama(na) = male self, is consistent with both the fact that **fosa of *tama(na) is not a distinct kin term for a male speaker (since **fosa of *tama(na) = male self and male self is not distinguished as a kin term by having a kin term label) and **fosa of *tama(na) = ‘brother’ (ws) (since **fosa of *tama(na) = male self and male self is ‘brother’ from a female’s perspective). The structure of male terms determined by Equations (1) - (7') is shown on the left side of Figure 5 (see Bennardo and Read 2005, 2007; Read 2007 and Leaf and Read In Press for details).

Next, the structure of female terms is constructed isomorphic to the structure of male terms in the following manner. First, a set of female marked generating terms {female self, *tina(na) (‘mother’), and *tuaka(na) (‘elder same-sex sibling’)} is selected corresponding to the set of male marked generating terms given by {male self, *tama(na) (‘father’), and *tuaka(na) (‘elder same-sex sibling’)}. (Note that *tuaka(na) can appear in both sets since it is a neutral term and so is both male marked and female marked.) Next, Equations (1) - (7') are included as structural equations for the structure of female marked terms, but with any male marked generating term in an equation replaced by its corresponding (that is, isomorphic) female marked generating term. For example, Equation (1) becomes the equation, *tina(na) of *tuaka(na) = * tina(na) (‘mother’ of ‘elder same-sex sibling’ is ‘mother’), in the structure of female marked terms and similarly for the other equations. The structure of female marked terms generated in this manner is isomorphic to the structure of male marked terms and is shown on the right side of Figure 5.

These two structures are then joined, as indicated in Figure 5 by the long, curved arrows between the male self and the female self positions, with male self becoming *tua-naʔane (‘brother’) with respect
to the *female self* position and *female self* becoming *tua-fafine* (‘sister’) with respect to the *male self* position. In other words, from the viewpoint of a female, A, the *male self* position is instantiated with a male, B, such that if A refers to person C by the kin term *tina(na)* or *tama(na)* then B refers to C by the same kin term and vice-versa. This implements the concept of the sibling relation being determined by having genealogical parent in common. An analogous statement applies to a male, A, and a female, B, who is the instantiation of the *female self* position from A’s perspective (see Bennardo and Read 2005, 2007; Read 2007; Leaf and Read In Press for more details).

The reciprocals for the sibling generators, however, are more complex. How the sibling terms *tuaka(na)* and *tahina* are made structurally into reciprocal terms, which justifies their respective translation as ‘elder same-sex sibling’ and ‘younger same-sex sibling,’ is central to identifying structural differences among the Polynesian terminologies as we will now show. First, though, we need to determine the pattern for the sibling generators in the Polynesian terminologies by categorizing the terminologies according to structural properties of the sibling terms.

**Categorization of the Polynesian Terminologies**

Epling et al. (1973) categorized the Polynesian terminologies according to five structural patterns among the sibling terms by using attribute differences (including the absence of an attribute) among these terms. The attribute differences are the polar extremes for three dichotomous dimensions: relative age (older versus younger), parity of sibling with respect to speaker (same-sex versus cross-sex), and sex of sibling with respect to speaker (male versus female). Marshall (1984) expanded the list to eleven patterns so as to accommodate variation in sibling terms throughout the oceanic area. Marshall’s numbering system for the patterns will be followed here.

Four patterns, with two variants on one of the patterns, can be distinguished among the Polynesian terminologies. We first distinguish Pattern 10, the most common pattern among the Polynesian terminologies. Pattern 10 is determined by having terms for ‘elder same-sex sibling’ versus ‘younger same-sex sibling’ and for ‘cross-sex sibling’ bifurcated into male and female terms based on sex of sibling with respect to speaker. Next we distinguish the pattern for the Tongan and other, similar, terminologies. While the Tongan terminology has four sibling terms matching Pattern 10, it differs by having a covering term, *tokoua* (‘same-sex sibling’), for *tao-kete* (‘elder same-sex sibling’) and *tehina*
‘younger same-sex sibling’) (Bennardo and Read 2005, 2007). This pattern does not occur in Marshall’s list and will be called Pattern 12. The third pattern we distinguish is Pattern 3, which has terms expressing the parity difference, ‘same-sex sibling’ versus ‘cross-sex sibling,’ and has two variants: (A) neither ‘same-sex sibling’ nor ‘cross-sex sibling’ is sex-marked, which characterizes all of the Pattern 3 terminologies except Pileni and Pukapuka, and (B) ‘cross-sex sibling’ is sex-marked but ‘same-sex sibling’ is not (Pileni and Pukapuka). Lastly, we distinguish Pattern 1, which has a single ‘sibling’ term and occurs in two Polynesian societies, Kapingamarangi and Nukuoro.

### Table 2: Reflexes of Proto Oceanic Kin Terms

<table>
<thead>
<tr>
<th>Sibling Type Society</th>
<th>//e</th>
<th>//y</th>
<th>xm</th>
<th>xf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proto Oceanic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*toka/*tuqaka</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>vocative *kaka</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*tansi</td>
<td></td>
<td></td>
<td>*mwaqane</td>
<td>*(pa)pine</td>
</tr>
<tr>
<td>Yabem</td>
<td>tua-</td>
<td>??</td>
<td>??</td>
<td>??</td>
</tr>
<tr>
<td>Seniang (10)</td>
<td>tua-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>tesungk (milamp)</td>
<td>mwenengk</td>
<td>venengk</td>
</tr>
<tr>
<td>Easter (10)</td>
<td>tua-ka</td>
<td>taina</td>
<td>tama’aror</td>
<td>tuahine</td>
</tr>
<tr>
<td>Bileki (10)</td>
<td>tua-</td>
<td>tari-</td>
<td>lata-male-</td>
<td>lata-hine-</td>
</tr>
<tr>
<td>Manam (6)</td>
<td>toka/kaka</td>
<td>tari-</td>
<td></td>
<td>marau</td>
</tr>
<tr>
<td>Kiriwina (6)</td>
<td>tua-</td>
<td>bwada-</td>
<td></td>
<td>luguta/luta</td>
</tr>
<tr>
<td>Wogeo (6)</td>
<td>toka-</td>
<td>tei</td>
<td></td>
<td>lu</td>
</tr>
<tr>
<td>Varisi (Choiseul) b (6)</td>
<td>toga-</td>
<td>??</td>
<td></td>
<td>??</td>
</tr>
<tr>
<td>Kove (6)</td>
<td>toa</td>
<td>tari</td>
<td>liu</td>
<td></td>
</tr>
<tr>
<td>Bugotu (Clark 1984) (6)</td>
<td>toga-</td>
<td></td>
<td>tahi-</td>
<td>vavinegna/vavinenggu</td>
</tr>
<tr>
<td>(Clark 1984)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mengen (6)</td>
<td></td>
<td>tato</td>
<td>tai-tai-</td>
<td>ligupiau</td>
</tr>
<tr>
<td>Molima (6)</td>
<td></td>
<td>tuwa</td>
<td>tasi-</td>
<td>nowu</td>
</tr>
</tbody>
</table>
Table 2: Reflexes of Proto Oceanic Kin Terms

<table>
<thead>
<tr>
<th>Language</th>
<th>Reflexes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simbo&lt;sup&gt;b&lt;/sup&gt; (6)</td>
<td>tuganggu</td>
</tr>
<tr>
<td>Navaka&lt;sup&gt;b&lt;/sup&gt; (6)</td>
<td>toak(u) [vavinek(u)]</td>
</tr>
<tr>
<td>Fijian&lt;sup&gt;b&lt;/sup&gt; (6)</td>
<td>tuaka-qu (who)</td>
</tr>
<tr>
<td>Lau&lt;sup&gt;b&lt;/sup&gt; (3A)</td>
<td>sasigu</td>
</tr>
<tr>
<td>Kiribati&lt;sup&gt;c&lt;/sup&gt; (3A)</td>
<td>tari/täde</td>
</tr>
<tr>
<td>East Futuna&lt;sup&gt;a&lt;/sup&gt; (3A)</td>
<td>taina</td>
</tr>
<tr>
<td>Kurtatchi&lt;sup&gt;b&lt;/sup&gt; (3A)</td>
<td>kirår</td>
</tr>
<tr>
<td>Shortlands&lt;sup&gt;b&lt;/sup&gt; (3A)</td>
<td>kai</td>
</tr>
<tr>
<td>Namatanai&lt;sup&gt;b&lt;/sup&gt; (3A)</td>
<td>sahin (female)</td>
</tr>
<tr>
<td>Tanga&lt;sup&gt;b&lt;/sup&gt; (3A)</td>
<td>kisiklik (female)</td>
</tr>
<tr>
<td>Kaoka[?]&lt;sup&gt;b&lt;/sup&gt; (6)</td>
<td>to’o-na</td>
</tr>
<tr>
<td>Mota&lt;sup&gt;b&lt;/sup&gt; (6)</td>
<td>tugui</td>
</tr>
<tr>
<td>Tongan&lt;sup&gt;b&lt;/sup&gt; (12)</td>
<td>ta’okete</td>
</tr>
<tr>
<td>Laravat (type 11)</td>
<td>mamwe sog (male)</td>
</tr>
</tbody>
</table>
and the structural equations identified above can be written symbolically as follows:

\[ A = \{I, F, G\}, \]

and the structural equations identified above can be written symbolically as follows:

\[ (8) \ FFF = FF, \]
\[ (9) \ FG = F, \]
When we generate the structure of ascending female marked terms, the ascending generating set will be \{i, M, G\}, where i is a symbol corresponding to female self, M is a symbol representing the ascending, female marked generating term and we use the same symbol, G, for the sibling term in the ascending structure of female marked terms. The structural equations will be the equivalent of Equations (8) - (10) with male marked generating terms replaced by female marked terms.

**Generative Basis for Sibling Term Patterns**

*Reciprocal Sibling Generators and Pattern 10*

When the descending structure of male marked terms is constructed isomorphic to the ascending structure, one possibility is that a new symbol, call it g, isomorphic to G is used in the generating set for the descending structure along with a symbol S isomorphic to F, so the generating set for the descending structure is given by \(D = \{I, S, g\}\) with structural equations:

\[
\begin{align*}
(11) & \quad SSS = SS, \\
(12) & \quad Sg = S, \text{ and} \\
(13) & \quad gg = g.
\end{align*}
\]

The elements F and S in D become reciprocal elements to each other through the structural equation FS = I; that is, ‘father’ of ‘son’ is male self. Then G and g become reciprocal elements via the equations Gg = I = gG; that is, ‘elder sibling’ of ‘younger sibling’ is male self is ‘younger sibling’ of ‘elder sibling’ in the structure of male terms. This gives rise to Pattern 10 in Table 2 and includes the *PPN terminology, where G = *tuaka(na) and g = *tahina, along with most of the other Polynesian terminologies.*

*Reciprocal Sibling Generators and Pattern 12*

A second way to form the descending structure of male marked terms and reciprocity of the sibling term is to also use the symbol G (‘same-sex sibling’) as an element in the set of generators for the descending structure:

\(D = \{I, S, G\}\).

In this case, the single sibling element G cannot be made into a self reciprocal element via the equation GG = I without losing its distinctiveness as a kin term, for then we would have I = GG = G (but see the
next section for a disjunctive definition interpretation of I = G). Instead, reciprocity for the sibling element G arises in the terminologies in these societies by a conceptual elaboration in which G is also bifurcated into the elements G+ and G- along with the equations G+G- = I = G-G+ that define G+ and G- to be reciprocal elements. As a result, G (‘same-sex sibling’) becomes a cover term for G+ (‘elder same-sex sibling’) and G- (‘younger same-sex sibling’) -- analogous to parent as a cover term in the American kinship terminology for the terms mother and father. This bifurcation procedure accounts for Pattern 12 terminologies, which includes the Tongan terminology. For the Tongan terminology, G = tokoua, G+ = tao-kete, and G- = tehina. The same pattern occurs in East Uvea with G = toko-loua (a cognate of tokoua), G+ = tao-kete and G- = tehina. In Niue G = matakainaanga, G+ = taokete and G- = tehina. The Tokelau society follows the same pattern but with the modification that the ‘elder/younger same-sex sibling’ terms have become ‘eldest/youngest same-sex sibling’ terms.

The construction outlined here for the Tongan terminology has ethnographic corroboration through the fact that in Tonga the tao-kete and tehina terms are used for son of a man’s elder brother and younger brother, respectively, despite the lack of a terminological distinction among ‘father’, ‘elder same-sex sibling’ of ‘father’ and ‘younger same-sex sibling’ of ‘father’ (Biersack 1982). The above construction accounts for this kin term usage (see Bennardo and Read 2005, 2007 for details). Niue, which is linguistically closely related to Tonga, has the same pattern with the term mata-kainaga having translation “a man’s elder brother; man’s father’s elder brother’s son” (Marck 1996a: 5).

Reciprocal Sibling Generators and Pattern 3

A third way to form the descending structure of male marked terms and the reciprocity of the generating sibling terms is through the equation GG = I. This equation, in conjunction with the equation, GG = G, implies G = GG = I as has already been noted. As a consequence, the structure for the male marked terms will have a single term in the 0-generation (rather than the 3 terms shown in Figure 5), hence the identity element I (in the symbolic model for the male structure) plays a dual role: its instantiation either refers to the focal male person or to those who are ‘brother’ to a male focal person. Thus the symbol I has disjunctive meaning since it can be instantiated either as the focal person or as the...
‘same-sex sibling’ of the focal person due to the equation I = G. We will denote this disjunction by the symbol, [I, G], thus indicating that there is an (unnamed) covering concept for I and G.

When a female structure is formed isomorphic to this structure and the two structures are joined through male self having interpretation as ‘cross-sex sibling’ for a female focal person and female self having interpretation as ‘cross-sex sibling’ for a male focal person, there are two ways that the two structures may be combined together. When [I, G] replaces I and [i, G] replaces i in the male and female structures, respectively, then these two nodes in the combined structure will either be labeled ‘same-sex sibling’ (from within a structure) or ‘cross-sex sibling’ (between the two structures; see Figure 6(A)), which gives rise to Pattern 3A. If, however the elements I and i, along with the mapping from G to these two elements, are kept distinct in the male and female structures, then the combined structure will have three kinds of sibling nodes, one of which corresponds to ‘same-sex sibling,’ the second to ‘male cross-sex sibling,’ and the third to ‘female cross-sex sibling’ (see Figure 6(B)), precisely as is the case for the two Polynesian groups, Pileni and Pukapuka, listed under Pattern 3B. Clark [1975] considered Tokelau to also have Pattern 3B, but this ignores the ‘oldest/youngest same-sex sibling’ terms in the Tokelau terminology and so it is included under Pattern 12 here.

**Reciprocal Sibling Generators and Pattern 1**

The fourth pattern arises by using (1) self (that is, a neutral self element) in place of male self and female self, (2) ‘parent’ (P) in place of ‘father’ as the ascending generating term along with ‘child’ (C) as its reciprocal and (3) ‘sibling’ (G) (without sex marking), which becomes self-reciprocal through the equation,

$$(14) \ CP = G;$$

that is, ‘child’ of ‘parent’ is ‘sibling’. That the equation $CP = G$ implies the reciprocal of $G$ is just $G$ can be seen by computing the reciprocal of the kin term product $CP$. The kin term product $CP$ has reciprocal $(CP)^r = P^r C^r = CP = G$, since $P^r = C$ and $C^r = P$, hence $G^r = (CP)^r = CP = G$ and so $G$ is self-reciprocal since $G^r = G$.

This kin term product equation also occurs in the American kinship terminology where the kin terms (not kin types) brother or sister are compounds constructed via sex marking of the kin term product, child of parent. Here, though, $G$ is not a compound term as it is a generating term (and must be a
generating term for the terminology to be a classificatory terminology). The equation does not construct
the sibling term, G, but identifies a relation that holds among C, P and G from which it follows that the
reciprocal of G must be G; that is, G must be self-reciprocal. Altogether, there will just be a ‘sibling’ term

![Figure 6](image_url)

**Figure 6:** Two ways to link isomorphic male and female structures. Symbols are used
instead of kin terms and only the middle three generations are shown for clarity. (A) Equate I = G (male self = ‘sibling’), with neutral covering term [I, G] and i = G (female self = ‘sibling’), with neutral covering term [i, G]. The covering term is used in place of the identity elements I (male self) and i (female self) and so the link between I and i in Figure 5 becomes a link between [I, G] and [i, G]. There are just two 0-generation sibling terms: (1) ‘same sex sibling’ (the reflexive arrow from I or i to G) and (2) ‘cross sex sibling’ (the link between [I, G] and [i, G]). (B) Link the identity elements I and i as in Figure 5. There are three 0-generation sibling terms: (1) ‘same sex sibling’ (same reasons as for A(1)), (2) ‘male cross sex sibling’ (the arrow from the i node to the I node) and (3) ‘female cross sex sibling’ (the arrow from the I node to the I node).
and no ‘same-sex sibling’ or ‘cross-sex sibling’ terms under this construction due to the absence of sex-marked self nodes.

This is precisely the kin term pattern for Kapingamarangi and Nukuoro, the only Polynesian societies with a Pattern 1 terminology. First, unlike all of the other Polynesian terminologies, the Kapingamarangi terminology has the neutral generating term *matua* (‘parent’) with reciprocal term *tama* (‘child’) and the term *matumatua* (‘grandparent’) with reciprocal *tama-tama* (‘grandchild’), a pattern that follows from using P as a generating element (see Figure 3). Sex distinctions only apply to *matua* which is bifurcated by sex marking into *taman(a)* (‘father’) and *tinan(a)* (‘mother’). (‘Grandmother’ is expressed via the kin term product *tina-na matua* and ‘grandfather’ via the kin term product *tamana matua*.) Secondly, it has a single sibling term, *tuahin(a)*. Finally, the term *taman(a)* “May be extended to parents’ brothers and husbands of parent’s sisters,” which simply expresses the classificatory aspect of the terminology, namely GP = P, “but commonly the relationship is simply described ‘brother of my father’ *tuahin toku tamana*” (Marck 1996b: 35). The latter reflects the way that the equation CP = G implies (CP)P = GP (‘sibling’ of ‘parent’); that is, the expression ‘sibling’ of ‘parent’ (or ‘sibling’ of ‘father’) is derived from CP = G and so ‘sibling’ of ‘parent’ is appropriate as a distinguishable relation under the logic of the equation CP = G. Hence the genealogical position, my father’s brother, comes under both (1) the kin term *taman(a)* according to the classificatory equation GP = P derived from sibling as a generating term and (2) the kin term given by the kin term product *tuahin toku tamana* according to the equation CP = G introduced as a means to structurally make the sibling generator into a self-reciprocal term. Similar comments apply to the kin term *tinan(a)*. Marck’s comment, which otherwise might be seen just as expressing an oddity of the Kapingamarangi terminology, reflects in fact the generative logic giving rise to its terminology structure.

Uncertain Pattern

Lastly, the data on Aniwa (Guiart 1961) has, according to Marck 1996b), incomplete specification and analysis. The pattern for Aniwa is uncertain.
Results

Typology for Kinship Terminologies

We will form a typology for these terminologies based on the structural logic leading to the four patterns for the sibling terms in order to show the generative logic underlying each of these patterns and how the patterns diverge from each other through that generative logic. The typology (see Figure 7) starts with an ascending generating set that includes a male parent element (F) and a sibling element (G) for generating the ascending structure. (The generating set could, equivalently, be based on a female parent and a sibling element.). The inclusion of the sibling element identifies the four Polynesian patterns as sharing commonality with other classificatory terminologies but not with descriptive terminologies.

The first split in the typology, Descending Generating Set, uses a contrast between either including an isomorphic sibling element in the set of descending generators distinct from its corresponding element in the set of ascending generators (viz. g in the set of descending generators in lieu of G in the set of ascending generators), or using the same ascending sibling generating element in the set of descending generators.

Next there is a split, Bifurcation, based on the element G being bifurcated into two elements, call them G+ and G-. The bifurcation, when it occurs, happens only when G is both an ascending and a descending generating element.

Following this is the split, Reciprocal Sibling Term Equations, based on the reciprocal equations for the sibling generators. With G an ascending generating element and g the isomorphic descending generating element, the structural equations for defining G and g to be reciprocal elements are Gg = I = gG. When G is bifurcated into G+ and G-, the equations G+G- = I = G-G+ make G+ and G- into structurally reciprocal elements. The remaining terminologies use the equation GG = I to make G into a self-reciprocal element.

The next split, Sibling/Self Distinction, is based on the equation G = I (G = i in the structure of female marked terms) derived from the reciprocal equation GG = I (GG = i in the structure of female marked terms). The opposition expressed in the split is between replacing I and i with G (see Figure 6A) or including both I and G (and i and G) in the structure (see Figure 6B).
The last split in the typology, Parent, Child Equation, is an opposition based on whether the pair of reciprocal equations $GG = I$ and $GG = i$ for male marked and female marked terms, respectively, are
replaced by the single equation CP = G.

The societies corresponding to each branch of the typology are shown at the bottom of Figure 7. With but two exceptions, all of the societies under Pattern 10, which corresponds to the left branch of the typology diagram, are geographically and linguistically East Polynesia societies. All other patterns correspond to the geographical (but linguistically diverse) West Polynesia societies. The exceptions are Rennell and Taumako. The pattern may actually be without exceptions as these two societies may fit under Pattern 12 rather than Pattern 10 for the following reasons (but see below for an alternative interpretation).

Consider Rennell first. Though Marck (1996b) does not list a ‘same-sex sibling’ term for Rennell, it has the term *ma* (‘same-sex sibling-in-law’) and the only other societies with this term are Anuta and Tikopia, each with a ‘same-sex sibling’ term. In addition, Rennell has the term *haihaanaau* (’classificatory siblings’) (Marck 1996b: 112), suggesting a concept of ‘same-sex sibling’ without an older/younger distinction. Immediately adjacent to Rennell is the island of Bellona and the Bellona have a similar term, *hai hanau*, which is used for all for siblings. Altogether, these data suggest that ‘same-sex sibling’ is a sibling term concept in Rennell society, which would make it a Pattern 12 society.

Taumako, the other exception, also has the term “ma ‘HuSi, WiBr, man’s BrWi, woman’s SiHu’” (Marck 1996b:26) and the last two expressions in this gloss have the same form for the gloss of the *ma* term as in the Rennell terminology. In addition, like Tonga and Niue, the ‘older/younger same-sex sibling’ terms are also applied to the son of parent’s older and younger siblings. Marck (1996a) gives “…, man’s father’s younger brother’s son, man’s mother’s younger sister’s son …” for *teina* and “… man’s elder brother’s son, mother’s elder sister’s son …” for *tokana*. Thus the terminologies for both Rennell and Taumako have the kin term properties that occur only in those societies with a ‘same-sex sibling term.’ Consequently, both societies are listed under Pattern 12 in Figure 6 with a question mark. If, in fact, Rennell and Taumako are societies with Pattern 12 terminologies, then we would have a perfect
correspondence between Pattern 10 and East Polynesia with all other patterns corresponding to geographical West Polynesia societies.

Some of the societies grouped together reflect their close linguistic affinity; e.g. Tonga and Niue (Pattern 12) both have Tongic languages; Anuta, Tikopia, and West Futunan (Pattern 3A) are grouped as “Futunic” Outliers; Luangiua and Tuvalu (Pattern 3A) are grouped under Outlier Ellicean (Marck 1996b); Hawai’i, Mangareva and Marquesas (Pattern 10) are grouped under Proto Marquesic (Marck 2000: Figure 1); and Kapingamarangi and Nukuoro (Pattern 4) have languages with a common origin, though today they have distinct languages (Clark 1994). However, there are also exceptions to the correspondence between societies grouped together in the typology diagram and language affinity. East Futuna is under Pattern 3A but linguistically associated with East Uvea listed under Pattern 12 and Tokelau is under Pattern 12 but associated linguistically with Tuvalu listed under Pattern 3A (Marck 1999). Thus for the West Polynesian societies, there is only partial agreement between language affinity and structural affinity of kinship terminologies, in keeping with the conclusions drawn by Epling et al. (1973) and Marshall (1984) despite the use of different ways for characterizing the relationships among the sibling kin patterns.

**Structural Changes in the Sibling Term Patterns**

We now construct a plausible, historical sequence for change in the structural patterns for the sibling terms (see Figure 8). We start with a root structure having all of the structural features shared across the Polynesian terminologies and the sibling term pattern(s) corresponding to this root structure. Then we identify structural transformations that give rise to the other sibling term patterns, with the constraint that a transformation should only make simple structural changes. The sequence of structural changes provides a historical ordering for the terminology types as presented in Figure 7.

All the Polynesian terminologies have: (1) a set of sex-marked generating elements for an ascending structure that includes a sex-marked sibling element, (2) a set of sex-marked generating elements for a descending structure isomorphic to the set of ascending generating elements, and (3) structural equations that define an ascending element and its isomorphic descending element to be a reciprocal pair of elements. The simplest implementation of the generating sets for this common structure is one in which the ascending and descending generating sets differ only with respect to the ascending,
generating element (F) and its reciprocal, descending generating element (S). Accordingly, both the ascending and descending sets of generators in the root structure will have the same sibling generating element, G, along with the reciprocal structural equations GG = I and GG = i that make G a self-

![Diagram](image)

**Figure 8**: Structural changes for the Polynesian terminologies. The root structure has properties shared across all of the terminologies. The root structure leads to two root sibling structures (Pattern 3A and 3B), depending on how the structures of male terms and of female terms are joined. Transformation 1 and Transformation 2 indicate hypothesized evolutionary changes in the root sibling structures. Transformation 1 replaces the reciprocal equation GG = I with either the structural equation CP = G (which gives rise to Pattern 1) or introduces a bifurcated form of G (which gives rise to Pattern 12). Transformation 2 simplifies the bifurcation structure in Pattern 12 by introducing a new element in the set of generating elements, thereby giving rise to Pattern 10.

reciprocal element (see top part of Figure 8).
This structure may be implemented in two ways when a structure of male terms is joined with a structure of female terms, with the latter a structural property common to classificatory terminologies in general. One implementation leads to Pattern 3A when the two structures are joined using the elements [I, G] and [i, G] (see Figure 6A). The other implementation leads to Pattern 3B when the two structures are joined using the male self (I) and the female self (i) elements along with the element G structurally linked to I and i, respectively (see Figure 6B). Neither of these two sibling structure patterns need be structurally prior to the other and both are alternative ways to join the male term and female term structures into a single structure, so Patterns 3A and 3B will both be considered to be root sibling structures as shown in Figure 8.

As noted previously, the equation GG = I, in conjunction with the equation GG = G, implies the potential contradiction that G = I, in which case there is no structural distinction between ‘(male) sibling’ and ‘male self.’ As discussed above, the potential contradiction can be resolved through a disjunctive interpretation of I as either male self or ‘(male) sibling.’ Alternatively, the equation I = G that is the source for the disjunctive interpretation may be removed by Transformation 1 of kin terms as shown in Figure 8. There are two ways Transformation 1 may be implemented: (1) replace GG = I by the equation CP = G (‘child’ of ‘parent’ is ‘sibling;’ see left-middle part of Figure 8), which corresponds to the Pattern 1 terminologies (see Figure 7), or (2) bifurcate G into G+ and G- and replace GG = I by the structural equations G+G- = I = G-G+ (right-middle part of Figure 8), which corresponds to the structure for the Pattern 12 terminologies (see Figure 7).

Consider the first way to realize Transformation 1 by replacing GG = I with CP = G. This transformation can be implemented, beginning with Pattern 3A, in a straightforward way by overlapping the vertical male and female structures in Figure 6A so as to remove the sex distinction between the left and right vertical structures in Figure 6A and then replacing M and F by a single, neutral element, P, and replacing S and D by a single, neutral element, C (the reciprocal element for P). In this modified structure, CP = G. As with the English/American terminology based on generating elements P and C, sex marking can now be re-introduced through bifurcating P into F and M. This method for implementing
Transformation 1 leads to the Kapingamarangi terminology, an exemplar of Pattern 1, as a transformation of Pattern 3A.

The second way that Transformation 1 is realized is by bifurcating G into G+ and G-. This is a simple way to transform Pattern 3B into Pattern 12 since the only structural change for the sibling terms that is involved in going from Pattern 3B to Pattern 12 lies in the bifurcation of the G term. The structure of male elements and the structure of female elements are already made into a single structure in the same way in Pattern 3B and Pattern 12. In both patterns, the I and i elements are linked to join the structure of male terms with the structure of female terms (see Figure 6B and Figure 8 for the way I and i are linked in Pattern 3B and Bennardo and Read 2005, 2007 for the way I and i are linked in the same way in the Tongan terminology as an exemplar of Pattern 12).

In either case, Transformation 1 only involves a simple structural transformation, either from Pattern 3A to Pattern 4 or from Pattern 3B to Pattern 12. Note that directionality is implicit in Transformation 1 as there is no straightforward structural basis for transforming Pattern 10 into Pattern 3A or Pattern 12 into Pattern 3B.

Transformation 2, in which a new element, g, is introduced in the descending generating set (rather than carrying forward the element G from the set of ascending generators and then bifurcating G into two elements, G+ and G-), is a simple transformation from Pattern 12 to Pattern 10 due to the fact that Pattern 12 already has the structural form of ‘elder/younger same-sex sibling’ terms that is part of Pattern 10. Thus the transformation maintains the structure of Pattern 12 sex-marked sibling terms but results in the ‘same-sex sibling’ term dropping out of the terminology, thereby going from the Pattern 12 to the Pattern 10 sibling term structure. This transformation also has directionality since a transformation from Pattern 10 to Pattern 12 would require reforming the generating set for the descending terms so as to replace the generating element g by the ascending generating element G and then bifurcating G into G+ and G-.

Kinship Tree for the Polynesian Terminologies

We can now use the pattern of structural changes shown in Figure 8 to construct a kinship tree. To do this, we first form a proto-terminology structure for each set of terminologies that share the same
Sibling structure. We will refer to a root proto-terminology structure as Proto-Pattern when a set of...

**Figure 9:** Kinship tree for Polynesian societies based on structural patterns for sibling terms. Patterns for the sibling terms are discussed in the text. Connections between Proto-Patterns are based on Figure 8 and the relative time-sequence location from left to right (younger event) to right (younger event) is based on colonization dates in Figure 11.
terminologies all have Pattern n, where n = 1, 3, 10 or 12. Then we connect each Proto-Pattern n in accordance with Figure 8 until we reach the root terminology structure. This procedure leads to the kinship tree shown in Figure 9.

**Discussion**

The kinship tree does not establish relationships among Polynesian languages, but shows how terminology structures are distributed among the Polynesian languages corresponding to the societies listed in Figure 9. The kinship tree groups Tokelau and East Uvea with Tonga and Niue, for example, whereas the Tongan and Niuean languages are grouped under Proto-Tongic but the East Uvean and Tokelauan languages are included under Proto-Nuclear Polynesian (see Figure 10). This difference in the two trees implies that changes in structural properties and linguistic properties of kinship terminologies involve different, though to some extent interrelated, processes. (The processes are interrelated if only because each node in a terminology structure has a kin term label and each kin term label corresponds to a node in that structure.) In brief, language divergence is not the same as kinship terminology structure divergence. The kinship terminology structure for a Proto-language can be maintained when the parent Proto-language diverges into daughter languages, hence different, present-day languages may share the same kinship terminology structure. Or, divergence in terminology structure can occur between different groups with the same languages, and so on.

There is, however, a inconsistency that arises when the two trees are given historical interpretations. To see the inconsistency, we first observe that the *Proto-Polynesian kinship terminology given in Table 1 has a Pattern 10 structure, but the kinship tree implies that it should have a Pattern 3A or 3B structure, a conclusion comparable to that reached by Marshall (1984). From both a geographic location and date of colonization perspective, Patterns 3A and 3B would be the earliest patterns (see Figure 11), followed by Pattern 12, then Pattern 10 and lastly Pattern 1, which is consistent with the proposed sequences of structural changes shown in Figure 8. We, of course, do not know the extent to which terminology structures have been conservative within a single society, and for some islands the original population may have died out and then replaced by a new population without any connection with the earlier population, possibly bringing with it a different kinship terminology system.
and structure. Nonetheless, positing Pattern 10 unequivocally as the root structure (e.g., Blust 1984) is problematic as it requires that somehow changes in terminology structure within a society are also

Figure 10: Language tree for Polynesian languages. Language names are in italics. Individual societies are listed when the language includes several societies with different sibling term patterns. Patterns listed under each Proto-language is the minimal set of patterns needed to account for the structural changes leading to present-day terminologies from that Proto-language. Language tree based on Marck (1996: Figure 2).

patterned between societies in such a manner as to coincidentally yield the clear correspondence between
the hypothesized pattern for structural change and its geographical and temporal distribution shown in
Figure 11. While this possibility cannot be ruled out given our incomplete understanding of the processes
leading to structural changes in kinship terminologies, it is worth exploring the assumptions that have led
to assigning Pattern 10 historically as the root structure. It should be noted that this assignment does not
derive directly from the linguistic tree as “The Comparative Method [of historical linguistics] as such is
not, in fact, historical; it provides evidence of linguistic relationships to which we may give a historical
interpretation” (Fox 1995: 141, emphasis in original).

Assigning Pattern 10 as the root structure for the terminologies, hence historically the earliest, has
the problem noted by Marshall (1984) of this pattern being found primarily in the eastern parts of
Polynesia that were colonized last (see Figure 11). In addition, it does not occur in any of the 11
Micronesian societies in Marshall’s data base of 237 societies (except possibly in the Marshall Islands
[Hage 1999:368, n3]) and Pattern 10 only occurs 17 times out of 137 Melanesian societies listed by
Marshall (1984). Of these 17 occurrences, it is only found in societies on islands around the Bismarck
Sea (6 times) or in the Vanuatu Islands (11 times). Despite this limited occurrence, Pattern 10 is said to
classify the reconstructed Proto Oceanic terminology with sibling terms *taqa(ka) (‘same-sex elder
sibling’), *taci (‘same-sex younger sibling’), *mwaqane (‘female cross-sex sibling’) and *papine (‘male
cross-sex sibling’) (Milke 1938; Blust 1980; Pawley 1981), hence the Melanesian and Micronesian
terminologies must also have Pattern 10 for their root structure despite the pattern’s limited or
nonoccurrence in the Melanesian and Micronesian terminologies.

We need to consider in more detail, then, the evidence for the historical interpretation that Pattern
10 is the root structure for all of the Oceanic terminologies as well as the Polynesian terminologies. We
first consider the evidence for making this assignment for the Polynesian terminologies and then, more
broadly, the evidence for the Oceanic terminologies.

In his authoritative work on Polynesian kin terms, Marck (1996a) comments: “Clark (1975)
reconstructed PPN *tuakana ‘elder same-sex sibling’, *tahina ‘younger same-sex sibling’ *tua-r)a?ane
'woman's brother' and* tua-fafine 'man's sister',” but then goes on to say, “Here we reconstruct PPn
*taʔo-kete ‘same-sex sibling’ and *kawe ‘cross-sex sibling’” (1996a: 218). This creates the anomaly, noted by Marck, of having terms both with and without an ‘older’/’younger’ marking for cross-sex siblings: “It seems that PPn had words for cross-sex siblings in general, the male cross-sex sibling, and the female cross-sex sibling, but this terminological situation may have been inherently unstable, a little redundant perhaps” (1996a:223). Attributing the anomaly to “redundancy” with consequent instability does not resolve the matter as his argument does not account for why there should be redundancy in the first place, especially if redundancy is inherently unstable. In addition, attributing Pattern 10 to Proto-Polynesian (and not just to Proto-East Polynesian) required Clark to argue for “replacement of terms” and “elimination of semantic distinctions” (1975:86) to account for the sibling patterns in modern-day Polynesian languages, but Clark provides no basis for these changes other than as a way to match what is required when Pattern 10 is assigned to Proto-Polynesian.

Clark’s reason for assigning Pattern 10 to be historically the root terminology structure for the Polynesian terminologies is not a strong argument. Essentially, Clark relies on a statistical observation coupled with finding cognates between Polynesian and Melanesian terms. Statistically, he argues: “The system is reflected intact in all the Eastern languages except Easter Island, and in the Taumako outlier dialect (Davenport 1968). The same set of semantic distinctions, but with an unrelated form for term (1) [*tuakana], is found in Rennellese, Tongan, Niue, and East Uvea.” (1975:86). But the East Polynesian languages are late developments in the colonization of this region (see Figure 11) and by themselves do not establish the antiquity of Pattern 10. The comparison with the Tonga, Niue and East Uvea terminologies does not take into account the ‘same-sex sibling’ term that appears in the these

Figure 11: Geographic distribution of sibling term patterns: ■ -- Pattern 10; ● -- Pattern 12; ● -- questionable assignment (see text for details); ▼-- Pattern 3A; ▼ -- Pattern 3B; and ◆ -- Pattern 1. Each pattern (except 3B) corresponds to a distinct geographical subregion as shown by the ellipses. These regions also correspond to the colonization pattern for the western and eastern parts of Polynesia. Colonization in the region (Near Oceanic) for Pattern 3 (solid ellipse, left side of figure, names in normal font style) begins around 3500- 3300 BP with the spread of the Lapita cultural complex (Kirch 2001; Sprigg 1999). Colonization and further spread of the Lapita cultural complex reaches the region (Far Oceanic) for Pattern 12 (dashed ellipse, center of Figure, names in bold) around 3100 BP (Kirch 2000) or 2800 BP (Sprigg 1999). After a hiatus, the region for Pattern 10 (solid ellipse, right side of figure, names in italic) starts to be colonized around 2500 - 2000 BP (Kirch 2000). The region for Pattern 1 (dashed ellipse, left side of figure, names in italic) corresponds to a back migration, possibly from Samoa, dating to around 1000 BP (Kirch 2000).
terminologies, which is the basis for Pattern 12 (and possibly includes Rennell as discussed above). Finally, simply asserting that “Terms (1) [*tuakana] and (2) [*tahina] have widespread cognates in Melanesia with the same meanings” (1975:86) but without working out the pattern of sibling terms in the Melanesian area first does not establish the antiquity of Pattern 10.

Marck attributes the antiquity of Pattern 10 not to the reconstructed terminology based on the East Polynesian terminologies, which he refers to as Proto-Eastern Polynesian, but to the same structural form apparently being the pattern for Proto-Oceanic, which is ancestral to Proto-Polynesian: “Most of the living languages of Eastern Polynesia today have directly and continuously inherited the Pattern 10 system from Proto Oceanic” (March 2011, email communication). According to Marck, then, the antiquity of Pattern 10 for the Polynesian terminologies is shown by it being a pattern carried forward from Proto-Oceanic to the East Polynesian terminologies. In other words, assigning Pattern 10 as the root terminology structure rests on that pattern characterizing the reconstructed Proto-Oceanic terminology. However, expanding the data base to include the oceanic-language Melanesian and Micronesian terminologies listed by Marshall (1984) makes the picture more, not less, complicated.

As can be seen in Figure 12, Pattern 10 occurs either in the terminologies for the western or eastern oceanic societies but not in between despite a west-to-east spread of oceanic languages across Melanesia, Micronesia and Polynesia. Melanesia also has a sibling terminology pattern, Pattern 6, that does not occur in any of the Polynesian terminologies. Pattern 6 has three sibling terms: ‘same-sex elder sibling,’ ‘same-sex younger sibling’ and ‘cross-sex sibling.’ Ann Chowning (1984) has noted that this sibling term pattern occurs in the offshore islands along the north coast of Papua New Guinea and extends into the northwestern part of New Britain on the eastern edge of the Bismarck Sea, thus making it a candidate for being a pattern that occurs early on in terminologies in the Melanesian area. Her suggestion highlights the need to consider the pattern for the geographic distribution of not just Pattern 10, but also of Pattern 6 (defined above) and Pattern 3A, the two most common patterns in the Melanesian area.

These types are primarily distributed along an axis (see left-most regression line in Figure 12) defined by a generally linear pattern of islands extending southeast from the Admiralty Islands off the
north coast of Papua New Guineas to the Vanuatu Islands. The axis also characterizes the west-to-

southeast geographic locations for the Admiralties, St. Matthias, Western Oceanic and Meso-Melanesian,
Southeast Solomons, Temotu, and Southern Oceanic languages. Both Pattern 3A for the Melanesian terminologies and Pattern 6 have similar distributions along this axis except that the Pattern 3A locations are statistically (p < .05) more prevalent above than below this axis. Broadly speaking, the distribution pattern for each of Patterns 3A and 6 is consistent with these terminology structures being part of colonization of this region by Austronesian/Oceanic speaking peoples coming from southeast Asia and Taiwan. Pattern 10 for the Melanesian societies is also distributed along this axis, but only in societies located at its beginning and ending segments, suggesting that it arose for localized reasons rather than as part of the colonization of this region by Oceanic language speakers.

The Polynesian terminologies have a very different distribution pattern. For the Pattern 3A Polynesian terminologies, a regression line for latitude versus longitude is close to horizontal, indicating an approximately west-to-east migration pattern (see short solid line in Figure 12). For these terminologies, Pattern 10 does not co-occur with Pattern 3A and instead only occurs in the eastern part of the Polynesian region. If we regress latitude on longitude for the societies with a Pattern 10 terminology, we obtain an axis (long solid line in Figure 12) that, when extended westward (dashed line in Figure 12) towards the locality where the Polynesian, Pattern 3A terminologies are located, the two regression lines almost meet perfectly, thus showing the very different axis along which the Polynesian colonization took place. The Polynesian groups migrated easterly to the northern part of the Solomon Islands then continued their eastward colonization along an axis heading towards Samoa (including Fiji and Tonga to the south and Tokelau to the north of this axis) rather than the more southeasterly axis that leads to the Vanuatu Islands. This easterly axis continued to the Cook Islands, French Polynesia and Easter Island, as well as north to Hawai‘i. In sum, these distribution patterns for the oceanic terminologies argue against Pattern 10 being the root terminology structure.

Suppose we do not assume that Pattern 10 characterizes the reconstructed Proto-Polynesian terminologies and also that there may be more than a single root terminology among the Proto-Polynesian speakers. Consider what happens if Pattern 3A and Pattern 3B are each sibling patterns for root terminologies among the societies speaking Proto-Polynesian. This leads to a simple and consistent way to account for the geographical location and temporal changes in the structure of the sibling terms that is
also in accord with the well-substantiated linguistic changes in the terminologies. First, Marck’s
reconstruction of “*kawe 'cross-sex sibling’” (Mark 1996a: 218) would apply to Pattern 3A only.
Second, of the two reconstructed terms, *tahina and *tuakana, only *tahina with meaning ‘same-sex
sibling’ (rather than its ‘younger same-sex sibling’ meaning when it is paired with *tuakana) would be the
reconstructed term for Proto-Polynesian due to the apparent time depth and stability of this term (Marck
1996a). Third, *tahina would occur in both Patterns 3A and 3B as we find reflexes of *tahina in both
present-day Pattern 3A and 3B terminologies (see Table 2). This would also account for the fact that the
single term for ‘sibling’ in Nukuoro is a reflex of *tahina (Clark 1975; see Figure 9) since the structural
argument implies that Pattern 1 is a transformation of Pattern 3A. Fourth, although Patterns 3A and 3B
each have a ‘same-sex sibling’ structural position, there is no reason why the linguistic expression for the
‘same-sex sibling’ term cannot differ between Pattern 3A and Pattern 3B, just as not all present-day
terminologies with Pattern 3A have terms for ‘same-sex sibling’ that are cognates. Some Proto-
Polynesian speaking societies with Pattern 3B may have had the term *taʔo-kete, in keeping with
Marck’s reconstruction of “PPn *taʔo-kete 'same-sex sibling’” (1996a:218). This would account for
reflexes of *taʔo-kete in the Pattern 12 terminologies (see Table 2) as a transformation of Pattern 3B.
Fifth, the ‘male cross-sex sibling’ and ‘female-cross-sex sibling’ terms in Pattern 3B would be
*tuanga'ane and *tuafafine, respectively, as suggested by Clark (1975) and discussed in detail in Marck
(1996).

With Patterns 3A and 3B as separate beginning points, all of the current day terminologies are
consistent with both the kinship tree and the language tree once we also include the fact that changes in
terminology structure can occur independently of changes in languages. For example, as part of the
Proto-Tongic and Proto-Nuclear Polynesian divergence, the ancestral societies for Tonga and Niuea
would initially have been societies with Pattern 3B that then transformed into Pattern 12. This
transformation from Pattern 3B to Pattern 12 would also have occurred in the ancestral societies of East
Uvea and Tokelau during their transition to Proto-Nuclear Polynesian speakers, and possibly for Rennell
and Taumako as well. Tonga, Niuea, East Uvea and Tokelau would then have continued with the same
terminology structure, though the ancestral society for Tokelau underwent additional linguistic change

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and linguistically diverged from Proto-Nuclear Polynesia to Outer Ellicean (but without any change in
terminology structure).

The pattern of some societies speaking the same (or closely related) languages having Pattern 3A
terminologies and others having Pattern 3B terminologies would also apply to Proto-Nuclear Polynesian
speakers and to Ellicean Outlier speakers. The disappearance of Pattern 3B in present-day societies with
languages that are part of Proto-Nuclear Polynesian suggests that Pattern 3B was not conservative since
there is a simple transformation from Pattern 3B to Pattern 12. Similarly, the relatively paucity of Pattern
12 among current-day societies suggests that Pattern 12 was also not conservative as there is a simple
transformation from Pattern 12 to Pattern 10. As can be seen from Figure 10, Pattern 3A, however,
appears empirically to be stable as the only transformation is a relatively late change from Pattern 3A to
Pattern 1. On the face of it, though, Pattern 1 is not a likely pattern for sibling terms as it must integrate
together both a primary sibling generating term, $G$, and an equation, $CP = G$, that, by itself, implies the
sibling term is derivative and not primary. Interestingly, both examples of Pattern 1 are in the Ellicean
Outlier language group and all other societies in this group have Pattern 3A, the precursor to Pattern 1. It
appears, based on features of the kinship structure that ensued (discussed above), that this was not as
simple a transformation as from Pattern 3B to Pattern 12 or from Pattern 12 to Pattern 10, hence its
relative infrequency. Finally, the ambiguity of Taumako and Rennell may reflect a recent structural
transformation from Pattern 12 to Pattern 10 (assuming the absence of a ‘same-sex sibling’ term in these
two terminologies is correct) and some aspects of Pattern 12 were carried forward in this transformation.

In sum, assigning Patterns 3A and 3B as distinct root structures for the sibling terms is consistent
with all features of the current Proto-Polynesian reconstructions of the sibling terms except that of the
‘older’/‘younger’ distinction for ‘same-sex sibling’. But the latter reconstruction leads both to an
anomaly in the reconstructed Proto-Polynesian terminology as noted by Marck and to complex patterns of
addition and removal of terms and change in attributes that has little motivation other than what is
required for assigning the ‘older same-sex sibling’/‘younger same-sex sibling’ distinction to the Proto-
Polynesian terminology. If, instead, there are two root Polynesian terminologies based on sibling term
Patterns 3A and 3B due to the two structural forms being variants on the generative logic shown in Figure
6A and 6B, then we have a far simpler reconstruction that accounts for the distribution of kin terms across present-day terminologies without anomalies or positing multiple changes motivated primarily as a way to accommodate the data on the terminologies to the purported reconstruction. The two root terminologies would not need to operate simultaneously within a single society, but instead some of the early Polynesian societies would have sibling Pattern 3A and other societies in the same time period would have sibling Pattern 3B.

There remains, however, Milke’s (1938) reconstruction of Proto-Oceanic (*POC) as a Pattern 10 terminology, which implies that Pattern 10 must be the root terminology. The matter of concern here is not the historical-linguistic methods, but what appears to be Milke’s assumption of a single, reconstructed Proto-Oceanic terminology for all Proto-Oceanic speakers. Other authors (e.g., Blust 1980; Pawley 1981) defer to Milke (1938), so we only need to review the patterning of the sibling terms for same-sex and cross-sex siblings in the terminologies considered by Milke with regard to this assumption.

Milke’s data set consists of the sibling terms from 125 terminologies in groups ranging in location from the northeastern part of Papua New Guinea and eastward through the Oceanic islands. Of these 125 sets of sibling terms, 27 have either uncertain kin terms or do not have at least one term for each of same-sex and cross-sex sibling in his list of kin terms. These 27 sets of sibling terms will not be considered further. Of the remaining 98 sets, 61 have a single cross-sex sibling term regardless of the sex of speaker. Of these, 36 have Pattern 3A and 25 have Pattern 6. Another 12 are Pattern 3B with a single same-sex sibling term and cross-sex terms distinguished by sex of speaker. One group has Pattern 1. Finally, 24 have Pattern 10 and of these, 1 is actually Pattern 6 (Marshall 1984 and references therein) and 2 have Pattern 12, leaving 21 with Pattern 10. Of these, 10 are East Polynesian and 11 are non-Polynesian. Since the 10 Polynesian groups are from the latter migration into eastern Polynesia, they do not provide evidence for the antiquity of Pattern 10. Of the remaining 11 non-Polynesian groups, 9 of them are from the Vanuatu Islands, 1 is from the Huon Gulf near New Britain and the last is from the Marshall Islands.

Altogether, 46 of these terminologies (Pattern 6 plus Pattern 10) have an ‘elder same-sex sibling’/‘younger same-sex sibling’ pair of terms and 33 (Pattern 3B plus Pattern 10) have a pair of ‘cross-sex sibling’ terms distinguished by sex. From these data Milke reconstructed *POC with the pair,
*taqa(ka) (‘same-sex elder sibling’)/*taci (‘same-sex younger sibling’) and the pair, *mwaqane (‘female cross-sex sibling’)/papine (‘male cross-sex sibling’). But putting these two pairs together to form a single terminology assumes that all *POC speakers had terminologies with Pattern 10 sibling terms. Yet Pattern 10 is relatively rare among the non-Polynesian groups in Milke’s data set. In addition, like Pattern 10 for the Melanesian groups in Marshall’s (1984) data set (which only partially overlaps with Milke’s data set), almost all of these terminologies are from groups in the Vanuatu Islands, suggesting that Pattern10 arose as a later development and was not the pattern for the terminologies brought into the oceanic region by the colonizing Austronesian/Oceanic speaking peoples.

In contrast to the above problems that arise with assuming *POC has Pattern 10, positing Patterns 3A and 3B as the root structures for the Polynesian terminologies accounts, as we have seen, for their temporal, geographic, and structural patterns. In addition, Pattern 3B is consistent with the pair of reconstructed *POC cross-sex sibling terms. Pattern 6, which traces back to eastern Papua New Guinea and has been suggested by Chowning (1984) as a possible root terminology structure, is consistent with the pair of reconstructed *POC parallel-sex sibling terms (see terminologies with reflexes of *POC given in Blust 1984). Thus, allowing for *POC speakers to have had more than a single terminology structure accommodates the linguistic data on the morphological form of kin terms, the data on the structure of the kinship terminologies and the geographical and temporal data on the colonization of the Oceanic islands.

Conclusion

Other formal analyses of kinship terminology systems ranging from componential analysis and reduction rules to application of Optimality Theory from phonetics begin by assuming the terminology as a given and consequently “questions about why kinship structures took the forms they did were ignored” (D’Andrade 2003:311). Answering these questions has been central to the argument presented here and provides the basis for constructing a kinship tree. We begin the task of forming answers to these questions by distinguishing between a genealogical space and a kinship term space. This allows us to identify the cultural knowledge of kin term computations through which the structural logic of a kinship terminology is expressed. The cultural knowledge is made evident with a graphic representation of the kinship terminology structure based on the the way the users of terminologies compute kin relations.
directly from kin terms. The structural properties of the graph help us to identify the generative logic -- hence the cultural knowledge -- underlying the kinship terminology that makes it possible for users of the terminology to do computation of kin relations with kin terms. That generative logic is made explicit through the formal analysis of the kinship terminology structure. Not surprisingly, we find reflections of the cultural knowledge embedded in a kinship terminology structure in other cultural domains. As we previously noted, the concept of brothers and sisters as alter egos in the Gilbert Islands mirrors the way a structure of male terms and a structure of female terms are joined to make a single terminology (see Figure 5) through male self and female self each interpreted as ‘cross-sex sibling’ and in the meaning -- male and female -- of the terms used as labels for the male self and female self positions.

To make the logic apparent, it has been necessary to cast it formally, which makes for difficult reading. But behind the formalism, relatively simple ideas are being examined. Stripped to its core, we are asking: What are the basic concepts of a terminology and how are these organized together as a system of ideas? Not surprisingly, the basic concepts are those of a parent, the reciprocal concept of a child, the self-reciprocal concept of a sibling, and the concept of spouse -- concepts fundamental to what is meant by a family based on reproduction and marriage. The formalism makes it evident how a kinship terminology is generated from these basic concepts. The generative process is not fixed in the sense that there may be alternative ways that a structure can be generated, such as whether, in some societies, sibling is conceptualized as a primary concept and used in the generation of a terminology or, in other societies, is derived from other primary concepts, such as brother (sister) is son (daughter) of parent in the English/American kinship terminology. Or, as shown in Figure 6, there may be alternative ways to achieve the same end; e.g., alternative ways to link together a structure of male-marked terms and a structure of female-marked terms to form a single terminology. These alternatives give rise to differences in kinship terminology structures.

Rather than seeing differences between kinship terminologies as arising from a culturally unidentified process of adding or removing terms, attributes, or equations -- the assumption underlying the analyses by Epling et al. (1973) and Marshall (1984) for change in the patterns of the sibling terms in the Polynesian and Oceanic terminologies, the argument of Allen (2008) for a tetradic origin to kinship
terminologies, or the use of phylogenetic comparative methods borrowed from evolutionary biology (Jordan, this book) -- the structural analysis presented here identifies the generative logic behind those changes in their terms, attributes, or equations, hence what structural changes in a kinship terminology would be needed to effect the observed changes in kin terms. From a cultural perspective, one does not transform a classificatory terminology into a descriptive terminology merely by removing equations such as \( fb = f \) and \( mz = m \), for example, since these equations derive from the logic entailed by having a sibling generating term, hence from the cultural knowledge embedded in a kinship terminology. Nor do we transform a terminology merely by users of a terminology promoting or demoting supposedly universal rules as has been suggested by Jones (2010) as a way to apply Optimality Theory borrowed from phonetics to kinship terminologies. For the transformation from a classificatory to a descriptive terminology to take place, there would need to be, on the part of the users of the terminology, minimally a reformulation of the concept of a sibling term as a derivative and not a primary concept. Similarly, one does not change a terminology with a ‘same-sex sibling’/ ‘cross-sex sibling’ distinction into a terminology with a single ‘sibling’ term merely by erasing the ‘same-sex’/ ‘cross-sex’ distinction. There must also be structural changes so that the generative logic now leads to a single ‘sibling’ term rather than a pair of ‘sibling’ terms.

The formalism also makes it possible to separate analytically the structural logic of the terminology from linguistic principles that relate to the morphological form of kin terms, changes in those forms, and instances where a kin term may be added to a terminology for reasons outside the generative logic of a terminology, such as the ‘older’/‘younger’ distinction for ‘brother of mother’ in the Tongan terminology (discussed in Bennardo and Read 2005, 2007). These two kinds of analysis must ultimately be integrated together for us to have a more complete understanding of what we mean by kinship systems and kinship terminologies and how changes in the domain of kinship relate to linguistic changes, in general, and vice-versa. The structural argument presented here regarding the generative logic behind the patterns for the sibling terms makes it possible to work out a plausible sequence for changes in those patterns, which in turn raises questions about some aspects of the linguistic reconstruction of a Proto-
Polynesian kinship terminology and the sequence of changes in kinship terminologies through time implied by that reconstruction.

One cannot just assert that *PPN first becomes, say, a terminology like Anuta by erasing the elder/younger attribute on the same-sex sibling terms and the sex distinction on the cross-sex sibling terms and then this Anuta-like terminology becomes the Kapingamarangi terminology by erasing the sex distinction and the parallel/cross distinction for sibling terms. The posited changes have to take into account the structural changes that are involved for the proposed modification of the sibling terms. Going from *PPN to a terminology such as Anuta implies that the way the ascending/descending terms are generated has to be changed from the generating sets \{male self, ‘father’, ‘elder sibling’\}/\{male self, ‘son’, ‘younger sibling’\} along with the equation ‘elder sibling’ of ‘younger sibling’ = male self = ‘younger sibling’ of ‘elder sibling’ into sets of generating ascending/descending terms given by \{male self, ‘father’, ‘sibling’\}/\{male self, ‘son’, ‘sibling’\} along with the equation ‘sibling’ of ‘sibling’ = male self (for male terms). Then to go from the sibling structure of a terminology like Anuta to Kapingamarangi, another change has to take place in the ascending and descending generators from sex marked ascending generating terms to non-sex marked ascending generating terms and the equation ‘child’ of ‘parent’ is ‘sibling’ has to be introduced. On the face of it, this appears to be an implausible sequence of structural changes. Rather than implausible changes, the combination of the structural analysis and the linguistic analysis presented here leads to a reconstruction in which all of the posited changes are consistent with what we understand about both linguistic aspects of kin terms and structural aspects of kinship terminologies.

The kinship tree and the language tree provide us with different kinds of information about kinship terminologies. The kinship tree takes into account what structural changes are feasible, whereas the language tree integrates the structure with the linguistic domain through changes in the morphological forms of kin terms among related languages. Integrating these two kinds of analyses will lead to a richer, and deeper understanding of kinship and kinship terminologies.

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about family space, genealogical space and kin term space. Critical comments and questions by the editors Ian Keen and Patrick McConvell helped me to iron out some of the rough places in an earlier version of this chapter. E-mail correspondence with Jeff Marck highlighted the need to ensure that the structural analysis is not contradicted by what has already been established by historical linguists working with the Polynesian languages. His comments led to my discovery that Patterns 3A and 3B were both root structures and that has been the key to integrating together the historical linguistic research with the structural analysis research. Any errors in the argument, though, are my responsibility.
References


The idea of constructing a kinship tree analogous to a linguistic tree was suggested by Ilia Peiros as an application of the method for the algebraic, structural analysis of kinship terminology structures that I presented at a meeting with Murray Gell-Mann at the Santa Fe Institute in Santa Fe, New Mexico in summer of 2004. Further discussions with Peiros led to focusing on the Polynesian terminologies to work out empirically the idea of a kinship tree.

The idea of comparing kin term changes with linguistic changes is not new (e.g., Murdock 1968). A comparison of changes in Polynesian sibling terms with language change was made by Epling et al. (1973) based on the assumption that evolutionary change in sibling terminology structure could be expressed through step changes in the binary dimensions older/younger, cross/parallel and male/female for sibling terms. For example, in their argument a terminology with a single, neutral sibling term could change in one step to a pair of neutral parallel and cross sibling terms, or in one step to a pair of neutral older and younger sibling terms. The approach presented here differs by focusing on changes in the underlying structural logic that accounts for the patterning among the sibling terms.

Radcliffe-Brown (1950) considered all the relations in the family space, including sibling relations, to be 1st order relations. This is consistent with a sibling relation conceptualized as a direct relation (see Figure 1B) and not one traced through another person (see Figure 1A) as assumed by Keen (1985).
4 Other authors have also noted that there appear to be two ways sibling is conceptualized. For example, Stanley Witowski (:181, 182) comments: "I considered eliminating the notion of Sb [sibling] and deriving it from underlying PC [parent’s child]. With this analysis, however, I was never able to achieve a simple weighting solution to account for the [Guttman] scale ordering effects ... schemes which attempt to reduce the number of semantic primitives prove unworkable.... the notions of Sp, P, C, and Sb are culturally universal notions, regardless of how they are specifically defined from society to society .... these notions are universal because the relationships that they are predicated on, namely marriage (Sp), parenthood (P/C), and shared parenthood (Sb) are themselves culturally universal." By “shared parenthood” he is referring to the equation, parent of sibling = parent of self. In a similar vein, German Dziebel (2007: 233) distinguishes terminologies where, he suggests, “Ego prefers to think that he shares … common ascent with his siblings” from those he takes to be a latter stage in the evolution of kinship terminologies when “siblings begin to be defined genealogically as parents’ children.”

5 The distinction between the two ways that brother and sister may be embedded in the family space is supported by experimental results showing decreased accuracy and longer time for informants from a culture with the first family structure (American college students) to respond to kinship terminology questions involving siblings versus parents in comparison to informants from Tonga, a culture with the second family structure (details in Bennardo and Read 2010).

6 A related construct is that of the genealogical grid defined as an idealized genealogy and used methodologically for presenting genealogical definitions of kin terms.

7 Though Dousset does not make the connection, the deductions are based on the kin term product of kin terms defined in Read (1984).

8 Note also that the notion of a “relative product” has not been used consistently by different authors. Sometimes it is used to refer to products of kin types, other times to the mathematical product of relations when kin terms are interpreted through the formalism of mathematical relations, and yet other times with a meaning similar to the definition of a kin term product (Read 2010).
9 Dousset (2008) diagrams the kin term calculations in the form of what he refers to as a relational
triangle, using the same graph structure presented here (compare his Figure 3 with Figure 2 in this
chapter) that was introduced in Read and Behrens (1990) for diagrammatically representing a kin term
product and has subsequently been used by Read in numerous publications.

10 Kin term products may be elicited directly from informants in the manner discussed by Murray Leaf
(2006; see also Leaf and Read n.d.) for the Punjabi terminology, or inferred from published information
on kinship terminologies.

11 The interpretation of male self as ‘brother’ (ws) and female self as ‘sister’ (ms) is supported by Robert
Blust’s observation regarding “the use of terms meaning ‘male,’ ‘female’ for the cross-siblings” (1984:
627). Blust attributes the use of such terms as due to “drift,” but that is tantamount to saying he has no
way to account for this meaning of the cross-sex sibling terms. His additional comment that “the terms
for ‘male,’ ‘female’ served as classificatory labels for social groups that were conceptually individualized
(or concretized) through the cross-sibling relationship” (p. 627, emphasis added) reinforces the structural
argument presented here for the interpretation of male self as ‘brother’ (ws) and female self as
‘sister’ (ms). Additional support comes from the Gilbert Islands where “brothers and sisters are alter
egos” (Lambert 1981:190, emphasis added).

12 We use a neutral term since the Polynesian terminologies do not make a sex distinction for the same-
sex parity difference. In other terminologies, including some of the Melanesian terminologies listed in
Marshall (1984:Appendix), ‘same-sex sibling’ may be differentiated into ‘male same-sex sibling’ and
‘female same-sex sibling.’

13 Marck goes on to comment “Similarly, no example comes to mind of a contemporary Polynesian
language that has a term for ‘same-sex’ sibling and also distinguishes same-sex siblings by relative
age” (1996:223); however, the societies listed under Pattern 12 in Table 2 have this combination of
sibling terms.
Blust (1984) gives Tonga, with Pattern 12 derived from Pattern 3B, as a group having cross-sex terms that are reflexes of the pair of cross-sex terms for *POC. East Uvea, with Pattern 12, and all of the Polynesian Pattern 3B terminologies (Samoa, Tukelau, Pukapuka and Pilnei) have cross-sex terms that are reflexes for this pair of terms. Blust also mentions seven Pattern 3A terminologies whose single cross-sex term is a reflex for one or the other of the pair of *POC cross-sex terms and five Pattern 6 terminologies with this same pattern. The other seven Pattern 6 terminologies have a single cross-sex term that is not a reflex of any *POC term. The pattern for the reflexes of the *POC cross-sex terms suggests that Pattern 3A terminologies may be derived from terminologies with a pair of cross-sex terms. This would imply that Pattern 3A is either derived from Pattern 3B, according to the argument presented here, or from Pattern 10 assuming Pattern 10 is the root terminology structure. The Pattern 6 data are more complex and do not easily fit either hypothesis about a root terminology. One possibility is that in the five terminologies with a reflex of a *POC cross-sex term, the ancestral term was replaced by borrowing from a neighboring group having reflexes of *POC terms, but borrowing did not occur in the remaining seven terminologies. This would be consistent with Pattern 6 being one of the root terminology structures for the Melanesian terminologies.