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Permalink

<https://escholarship.org/uc/item/29f4290q>

Journal

Structure and Dynamics, 11(1)

Author

Read, Dwight W

Publication Date

2019

DOI

10.5070/SD9111046054

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WHY CAN HUNTER-GATHERER GROUPS BE ORGANIZED SIMILARLY
FOR RESOURCE PROCUREMENT, YET THEIR KINSHIP TERMINOLOGIES ARE
STRIKINGLY DISSIMILAR?:
A CHALLENGE FOR FUTURE CROSS-CULTURAL RESEARCH

Dwight Read
Department of Anthropology
University of California, Los Angeles
Los Angeles California, USA
dread@ss.ucla.edu

Cross-cultural research involves explanatory arguments framed at the meta-level of a cohort of societies, each with its own historical development as an internally structured and organized system. Historically, cross-cultural research on hunter-gatherer groups initially was in accord with the general anthropological interest in determining the ideational basis for differences in systems of social organization, but more recent work has shifted emphasis to the phenomenal level of factors affecting the mode of adaptation to an external environment. This has left a major lacuna in our understanding of the reasons for cross-cultural differences among ideational systems such as kinship terminologies in hunter-gatherer societies. I address this lacuna in this article through cross-cultural comparison of hunter-gatherer kinship terminologies at an ideational, qualitative level. The means for so doing is first worked out using the kinship terminology of the Hadza, an East African hunter-gather group. Next, comparison of the Hadza and their kinship terminology with two other hunter-gatherer groups prominent in the anthropological literature, along with their kinship terminologies, makes evident a major disjunction between, on the one hand, the similarity of hunter-gatherer societies at the phenomenal level of activities such as food procurement and, on the other hand, striking differences among the same groups at the ideational level of the structural organization of their kinship terminologies. The reason for the striking differences between the ideational and the phenomenal levels is not immediately evident and remains a topic to be addressed in future cross-cultural research.

Keywords: Hadza, hunter-gatherers, kinship, kinship terminology, cross-cultural

1.0 Introduction

Cross-cultural research is aimed at developing explanatory arguments for patterning discerned at the meta-level of a cohort of societies, each of which had its own, largely independent development as an internally structured and organized system (Narroll 1970),

The rationale for this approach from an evolutionary perspective can be seen in the deep history of *Homo sapiens* (see Read 2019), including the historical division of our species into quasi-species; that is, a division into groups with boundaries at the intraspecies level analogous to boundaries at the interspecies level for other organisms, and where group differentiation has a cultural, rather than a biological, basis. Groups that we refer to as different societies, including different ethnic groups, self-identify and differentiate themselves from other, even behaviorally similar groups through internally formulated cultural criteria rather than externally through biological adaptation, as is the case for biological species. We see this in the way hunter-gatherer groups typically distinguish themselves as the “real people” (Bird-David 2017; see also numerous ethnographic examples like this referenced in Read 2012), where the boundary of the set of persons who consider themselves to be the “real people” is coterminous with those who recognize, or can recognize, themselves as kin to one another.

Kinship, as it is culturally framed in hunter-gatherer and other small-scale societies, is universalistic (Barnard 1978) in the sense that social interaction typically takes place among those who are kin, or can recognize that they are kin, to one another and those who are not recognizable as kin may be seen as strangers to be feared, or even seen as enemies (e.g., Hadza women are fearful of the Datoga Nilotic pastoralists [Marlowe 2002]). As Tonkinson (1991[1978]) notes for the Mardu Aborigines of Australia, the domain of moral individuals and the domain of kin are one and the same; that is, it is one’s kin whose behavior is restricted by moral values, hence pre-conditioned for social interaction by knowing (or being able to determine) that individuals are kin to one another according to their understanding of what constitutes the kinship connections expressed through the kin terms making up a kinship terminology. Kinship in this sense, it needs to be made clear, does not derive from biological relatedness determined by having a biological ancestor in common, but from cultural systems of relations expressed conceptually through the kin terms that define, structure and provide organization among those who are kin to one another (El Guindi and Read 2016).

In non-human primate species, as one traces out phylogenetically from the Old World monkeys to the great apes, social interaction at the group level is shaped increasingly through the individualization of behavior, reaching an apogee with the great apes, especially the chimpanzees. The implications of individualized behavior for social interaction are then worked out through face-to-face interaction. Individualization of behavior also signals that processes such as biological kin selection have receded in importance as drivers of behavior, thereby is context specific and the intensity of social interaction within groups has become increasingly important as a determinant of social behavior. Within the chimpanzees, individualization of behavior rivals that of humans (see references in Read 2012), and this has led to increasing dependency on extensive face-to-face interaction as a pre-requisite for social behavior that is more intensively involved than just involving casual social interaction. In turn, increase in individualization of behavior leads to more complex social environments. Increase in social complexity then becomes a driver for expansion of cognitive capacities, indexed, for example, by an increase in the

neocortex ratio in response to coping cognitively with more complex social environments (Dunbar 1992).

Increase in primate social complexity can be ameliorated, though, through changes in the social organization of a primate troop or a chimpanzee community. In the latter, social complexity was reduced by social units decreasing in size from the demographic size for troops in Old World monkey species. As a consequence, a chimpanzee community with 50 - 80 individuals does not act as a single social unit but is loosely organized as a community composed of largely solitary females along with small male social units. Yet even reduction of the size of social units does not seem to have been sufficient for ameliorating the social complexity introduced through increased individualization of behavior since even small units of males are unstable over short time frames (see references in Read 2012), leading to a fission-fusion form of social organization, in sharp contrast with the stability of kin and family-based social units, such as bands or residence groups, in hunter-gatherer societies. This contrast with the stability of hunter-gatherer bands underscores the fact that a profound change occurred during hominin evolution leading to *Homo sapiens* during their respective evolutionary trajectories from an ancestor common to both *Homo* and *Pan*. The change involved a transformational shift from social systems dependent on face-to-face interaction as a primary means to work out social relations among individualistic group members, to the subsumption of individualistic behavior under relation-based social systems, with the latter likely coming fully into play as part of the formation of hunter-gatherer societies that took place during the Upper Pleistocene (Gamble 2010; Leaf and Read 2012; Read and van der Leeuw 2015).

The key to the implementation of this transformation in social systems lies in the expansion of hominin cognitive capacities that enabled our ancestors not only to cognize, in a consciously aware manner, the concept of a relation; e.g., as a way not only to conceptualize the behaviors distinguishing, for example, a mother-own offspring dyad from female-other offspring dyads as occurs with the macaques (Dasser 1988), but also as a way to formulate a conceptual system of relations from a few primary relations that then provides the organizational basis for small scale societies like hunter-gatherer societies. The primary relations are those conceptually forming a Family Space of positions and relations between positions making up a family social unit (see Read, Fischer and Chit Hlaing 2014; Read 2015 for details), with the sibling relation of a family unit understood either as parent's other child or as those offspring who share the same parent, a qualitative difference documented through cross-cultural data on sibling relations (see Witowski 1972:181-182; Dzielbel 2007:233).

Further expansion of cognitive capacities led to conceptualizing systems of relations derived from the primary relations of the Family Space in the form of what we refer to as kinship terminologies (Read 2012; Leaf and Read 2012). Shared conceptualization of a system of kinship relations expressed through the kinship terms making up a kinship terminology makes it possible for group members to express and define the kinship relations they recognize in common in a manner that also makes it possible to compute the kin relation one individual has to another individual by simply knowing the kin term relation each individual has to a third individual (Kronenfeld 1980; Read 1984, 2001, 2007;

Dousset 2005; Leaf and Read 2012). This computational aspect of kinship relations also provides conditions for social interaction to be initiated even when the individuals involved are strangers in a conceptual sense, with the critical implication that engaging in social relationships is no longer dependent on having prior face-to-face interaction before extensive social interaction can take place.

The computational aspect of a kinship terminology also introduces a dynamic character to kinship systems by enabling the relations upon which a kinship system is founded to become the means for expressing the collective identity the group members have to one another— such as hunter-gatherers referring to themselves as the “real people” —, as opposed to what otherwise would be mainly an aggregation composed of a disparate group of individuals without stable, well-defined social units like a chimpanzee community. Concomitantly, a major change that took place in the Upper Paleolithic was a shift from localized, time dependent social units consisting of individuals living together on a day-to-day basis and isolated from other, similar social units, to social systems wherein members of different residence groups could, both behaviorally and conceptually, consider themselves to make up a whole that transcends the boundary of any single, localized residence group (Gamble 2010; Read and van der Leeuw 2015). This also had the consequence of increasing by (at least) an order of magnitude the number of persons incorporated into the same social system, which provides a competitive advantage vis-à-vis social systems consisting of a single, isolated and localized group (Read 1987). This increase in the order of magnitude for the demographic scale of social systems had major consequences for adaptation strategies. From an adaptation viewpoint, the increase meant that the spatial scale over which resource procurement took place also increased by an order of magnitude, thus local spatial variation in resource density could now be averaged out over a much larger geographical region, making it possible for a group to maintain a higher population density, hence to have a competitive advantage over groups operating at a smaller geographic scale. (Read and LeBlanc 2003)

2.0 Hunter-Gatherer Cultural Research: From Ideational to Phenomenal Patterns

Until around the 1970's, cross-cultural research relating to hunter-gatherer groups tended to follow the broader interest in anthropology regarding the cultural basis for the nature and forms of systems of social organization. Research on Australian kinship terminology systems during this time period, for example, provided extensive ethnographic data used, among other things, for theorizing about the relationship of terminologies to forms of social organization (e.g., Lévi-Strauss 1949). More recent cross-cultural research on hunter-gatherers, though, has tended to focus less on matters such as systems of social organization and more on human ecological/biological factors. This has led to emphasizing models aimed at accounting for aspects of hunter-gatherer societies that are complementary with biological accounts, thereby embedding hunter-gatherer research into the framework of biological evolution. This shift can also be seen in how, over the past few decades, research on cultural evolution has shifted from its earlier concern with evolution at the institutional and organizational level of a society considered as a whole (e.g., Spencer 1876; Carneiro 2000), to a focus on cultural evolution expressed at the population level

through change in individual trait frequency, thus making the notion of cultural evolution amenable to modeling based on the principles of biological evolution. The shift to a focus on trait frequency has also involved, for cultural phenomena, a shift from focusing on genotypic transmission of traits to phenotypic transmission, thus leading to models of cultural evolution based on defining cultural traits through what is phenotypically transmitted (e.g., Cavalli-Sforza and Feldman 1981; Boyd and Richerson 1985). In this way, cultural evolution models have been able to utilize a broader evolutionary framework than just that of biological evolution driven by natural selection acting on the fitness consequences of genotype transmission from biological parent to biological offspring through sexual intercourse. At the same time, previous questions regarding the social organization of hunter-gatherer societies and its adaptive consequences that motivated much of the earlier research on hunter-gatherer societies have been supplanted by new questions focusing more on factors affecting systems of adaptation to an external environment and less on the internal organization and functioning of a hunter-gatherer society.

In this shift in the goals of research focusing on hunter-gatherer societies, the Hadza of Tanzania, the Ache of eastern Paraguay, and the !Kung San of Botswana, have played important empirical roles as indicated by the extensive fieldwork that has been conducted in each of these three societies. From a theoretical perspective, much of this work has utilized a human ecology/modeling approach with focus on material and biological parameters. Recent research on the Hadza and the Ache has utilized several theoretical approaches of this sort, including optimal foraging theory (Hill and Hawkes 1983; Hawkes, Hill and O'Connell 1982; Hill 1982; Marlowe 2010), evolutionary life history theory (Hill, Hurtado and de Gruyter 1996), theories regarding cooperative foraging (Hill 1992), food sharing theory (Kaplan and Hill 1985; Gurven et al. 2000, 2001), reciprocal altruism (Allen-Arave, Gurven, and Hill 2008), costly signaling theory (Marlowe 2010, Hawkes, O'Connell, and Blurton Jones 2001), theories of cooperative child care (Crittenden and Marlowe 2008), and theories based on biological kin selection such as the "grandmother hypothesis" (Marlowe 2010; Hawkes, O'Connell; Blurton Jones 1997; Hill and Hurtado 1996).

While this research has increased the richness of our cross-cultural understanding of the behavior of hunter-gatherers, especially with regard to the connections that can be made between behavior and adaptations from a biological perspective (see, for example, Blurton Jones, Hawkes and O'Connell 1996), much of it has been conducted with only minor or peripheral attention placed on earlier research questions that focused more on systems of social organization and of kinship relations. Though current research acknowledges that hunter-gatherer societies are structured around kinship relations that are universalistic in the sense of all members of a hunter-gatherer society being, or can determine that they are, kin related to everyone else in the society (Barnard 1978), this perspective has generally been put into the background. While kinship is still recognized as an important aspect of hunter-gatherer social systems, relatively little attention has been placed on questions such as the reasons why, for example, from a cross-cultural perspective hunter-gatherer societies have kinship terminologies with radically different struc-

tures, hence their social systems are based on different concepts about the organization of kinship relations.

What may be true about a kinship terminology for a hunter-gatherer group in one geographic region does not hold in a different region, even when there is commonality in modes of ecological adaptation. Though we find, for example, within the Australian Aboriginal hunter-gatherer societies a connection between the structural form of an egocentric kinship terminology and a socio-centric form of social organization through what are referred to as section systems, section systems do not occur in hunter-gatherer groups outside of Australia. This difference cannot just be attributed to the section system somehow only being appropriate to a supposedly unique ecology in Australia that does not have its counterpart elsewhere in the world, hence required a unique adaptation, for even within Australia the section systems may be a historically relatively recent innovation (McConvell 1997). Contrariwise, with respect to ecological adaptations, we find striking similarity in how hunter-gatherer groups are organized through membership in residence groups on a daily basis and by criteria through which individuals have rights of access to resources when we compare hunter-gatherer groups in Australia with hunter-gatherer groups in the Kalahari Desert in Africa, yet there is no structural resemblance in the kinship terminologies from hunter-gatherer groups in these two areas (see below).

We have, then, a major lacuna in our cross-cultural knowledge about the origins of structural differences among kinship terminologies. This raises questions about how we proceed with cross-cultural research when we are dealing with conceptual systems for which patterning occurs at the level of a single society rather than with individual traits for which patterning is observed at the level of a population aggregate. Patterning observed in the aggregate, but not necessarily on each individual case, is the rationale for engaging in statistically oriented research, with the latter having become common in cross-cultural studies. For conceptual systems such as kinship terminologies, however, we need to compare terminological differences according to their structural organization and generative logic (see Read 1984, 2001, 2007; Leaf and Read 2012) and at the level of the individual terminology. This also opens up for consideration the possibility that, at the qualitative level, historical contingency may be found to play an important role since qualitative differences are, for the most part, not subject to processes leading to, for example, optimal solutions in the same way this may occur with quantitative traits through adaptation. Instead, we need to work out the structural logic underlying their cultural idea systems (Leaf and Read 2012) so as to identify the concepts that underlie differences at a cultural level and act as a constraint on forms of social organization for the group in question. It has been noted, for example, in a different context, that “the historical English kinship terminology was *uncongenial* for promoting a social system based on the extended family ... [it] was *ill-fitted* for a social system in which kinship ties were a central organizing principle” (Tadmor 2004: 118, 119, emphasis added).

We need, then, to work out cross-cultural comparisons that address differences at an ideational, qualitative level as well as at a phenomenal, quantitative level. As an initial step towards working out methods for addressing the first possibility, I will work out, in the rest of this article, the generative logic of the Hadza kinship terminology, and then

compare it, cross-culturally, with the terminologies of the !Kung San in Botswana and of the Kariera of the western coast of Australia in order to demonstrate the radically different structural forms of the kinship terminologies for these three groups despite substantial similarities in their respective ecological adaptations. I focus on the Hadza terminology due to the availability of extensive, published research on behavioral patterns arising as part of the Hadza adaptation to a hunter-gatherer lifestyle, thus allowing for a comparison between the ideational level of structural pattern in their terminology and the phenomenal level of patterning in their behavior. For this comparison, a statistical sample is not necessary since the structural pattern of a kinship terminology can be observed on a single terminology in isolation.

What I will show is that these three hunter-gatherer societies, even though very similar from the perspective of how they are adapted to a life style based on food procurement, nonetheless have terminologies, hence systems of social relations based on kinship relations identified through kin terms, structured in strikingly different ways. (The Ache will not be considered further as their kinship terminology has not been published.) The ultimate goal is to answer the question: Why the striking difference in terminologies in different hunter-gatherer societies? No solution will be provided, though, as we still lack the evidential basis for relating the structure of a terminology to other aspects of a hunter-gatherer society, despite the role that the former plays in structuring the domain of social relations making up a hunter-gatherer society. Hence I am mainly presenting, in this article, a problem to be addressed in future cross-cultural research, rather than presenting a solution to an old cross-cultural research problem.

3.0 The Hadza Kinship Terminology

I rely here on the account of the Hadza kinship terminology presented in Frank Marlowe's (2010) ethnographic account of the Hadza (see Table), though in many ways the Hadza terminology is only partially presented. For example, the table Marlowe provides for their kin terms lacks grandson or granddaughter terms (though in the text *mama* is given as the term for granddaughter).¹ In addition, other than a brief description of the terminology, the importance of kinship relations as structured through their kinship terminology to their daily life is not discussed, other than in a few comments in other publications. In these other publications, behavior of kin includes the following. According to Marlowe (2004a), the Hadza kinship system is universalistic in the sense discussed by Barnard (1978), so all social interactions involve one's kin. Kin relations affect marriages in that marriages may occur between biological cross-cousins, but marriages involving parallel cousins are rare or nonexistent (Stevens et al. 1977). Post marital residence is multilocal and usually begins with the couple living with the wife's kin, but then may change to living with the husband's kin after the birth of several children (Wood and Marlowe 2011). Maternal grandmothers take on a helper and caretaker role with respect to their daughter's children and this favors co-residence of mothers with daughters who

¹ Kin terms will be italicized. All Hadza kin terms are sex marked. Female marked terms will be presented in red type and male marked terms in blue type. Non-sex marked terms such as *self* will be written in black.

have young children, which appears empirically to often be the case (Blurton Jones, Hawkes and O’Connell 2005). Sharing is expected by kin (and everyone is kin), so even though individuals may prefer to not share, meat from a large kill is shared equally through what Marlowe (2004b) refers to as “tolerated scrounging” since not sharing makes one a bad person, hence a bad kinsman.

Marlowe (2010) provides little information about the kinship terminology beyond a table of kin terms, other than a comment indicating that they have a classificatory terminology and that it appears (incorrectly, see below) to be an Iroquois terminology (Peoples and Bailey 1991; Woodburn 1968). The thinness of the kin term data in Marlowe (2010) can be compensated to some extent by publications such as Edenmayr’s (2004) discussion of sex marking in the Hadza language. He comments that nouns that are masculine occur without a sex marking suffix and, in the case of animals and humans, may be used to refer to a female animal or human through adding the suffix *-ko*. This applies to kin terms as well. Thus, the kin term *ola* is used to refer to son, so the kin term referring to daughter is *olako*, the feminized form of *ola*. A noun form without an added sex marker, he points out, may be used when the sex of the referent is not specified; e.g., *ola* also has the meaning of child. The reverse occurs with a feminine noun, though here the noun with the suffix *-ko* is already the unmarked form of the noun. The suffix can be dropped in the case of a feminine noun without changing its sex marking, so *ayako* (‘mother’) may be reduced to. Instances of the occurrence of the suffix *-ko* in the table of kin terms provided by Marlowe helps clarify his presentation of the Hadza kin terms, especially in cases where the same kin term is used in reference to a male person and to a female person.

Some kin terms, as they stand, are female marked, such as *aya* (‘mother’), the shortened form of *ayako*. Unlike the situation with male terms, when the suffix *-ko* is added to *aya* the modified term cannot be used as a covering term for, in this case, ‘father.’ The term *ayako* and the term *aya* thus have the same meaning (e.g., Marlowe uses *ayako* for ‘mother’ whereas Woodburn [1964] uses *aya* for ‘mother’). However, the presence of the two forms enables a distinction to be made between two different kin term products when both products point to the same node in a kin term map (discussed below). Thus ‘daughter’ of ‘sister’ and ‘mother’ of ‘sister’ point to the same node, ‘mother,’ but ‘daughter’ of ‘sister’ = *aya*, whereas ‘mother’ of ‘sister’ = *ayako*, and this difference avoids the contradiction that otherwise ‘daughter’ of ‘sister’ = ‘mother’ of ‘sister’ would mean the same kin term is used for both of these kin term products.

4.0 Kin Term Products

It is critical to distinguish between the process of forming *relative products of kin types* and the process of forming *computations through kin terms*, with the latter having been identified by numerous ethnographers (see references in Read 2018a), using what Read (1984) has named *kin term products*. Relative products refer to the concatenation of kin types; e.g., the relative product of the kin type, mother’s sister, with the kin type, brother’s son, would be: mother’s sister’s brother’s son, which simplifies to mother’s brother’s son. Kin term products, in contrast, involve computations made with kin terms.

Computations made with kin terms are calculated by culture-bearers without necessary reference to genealogical pathways when determining how one person A is related (in a kin term sense) to another person B; that is, a kin term product involves determining what kin term person A may (properly) use to refer to person B and, reciprocally, the kin term(s) that person B may (properly) use to refer to person A in this situation. As noted by numerous ethnographers, two persons, A and B, who are strangers to one another may determine their kin term relationship to each other by identifying a person C with whom each of A and B has a (known to them) kin term relation to C. To illustrate, suppose that A knows that s(he) may (properly) refer to C by the kin term K and B knows that C may refer to B (properly) by the kin term L. Then by reference to their kinship terminology (that is, by drawing upon their cultural knowledge), A can determine the kin term a person should use (if any) for person B when speaker (in this case, A) refers to C by the kin term K and C refers to B by the kin term L. For example, English speakers know (as part of their cultural knowledge) that if speaker refers to C by the kin term *uncle* and C refers to B by the kin term *child*, then speaker (properly) refers to B by the kin term *cousin*. Thus, the kin term product (for English speakers) of the kin term *child* and the kin term *uncle* is *cousin*; that is, *child of uncle* is *cousin*, or more formally, *child o uncle = cousin*, where *child*, *uncle* and *cousin* are English kin terms and ‘o’ is being used as a symbol to denote that the kin term product (corresponding to “of”) between the English kin terms *child* and *uncle* (in that order) is the English kin term *cousin*.

A kinship terminology in this sense is, for culture-bearers, analogous to a multiplication table when doing multiplication with whole number symbols. By knowing the (binary) products of the number symbols 1, 2, ..., 9 with each other (which is the information provided in the multiplication table), the product of any two whole numbers may be worked out. In a similar manner, a culture-bearer just needs to know the product of each primary kin term (a term used to refer to one of the family relations in the Family Space, see below) with each of the kin terms in the kinship terminology in order to compute the product of any two kin terms. For computations like this, the genealogical kin types categorized by a kin term need not be known; thus, an English speaker knows just from her/his knowledge of her/his kinship terminology that *child of uncle* is *cousin*, whether or not the actual genealogical relations involved (if any, since one of the persons in question might be an adopted child) are known.

What gives the kinship system its power as a system of kinship relations organizing the domain of those individuals recognized as kin is the fact that a kinship terminology makes it possible for the perspective of one person with regard to kin relations with those who are one’s kin to be translated into the perspective of another person with regard to kin relations with those same persons. This has the consequence that, as discussed above, for two strangers, A and B, to compute whether there is a kinship relation between them and if so, what is that relation, just by knowing the kin term relation, if any, each of A and B has to a third person C. Neither the actual biological connections involved (if any) nor the kin type (i.e., genealogical) connection(s) that might be involved (if any) is necessary prior knowledge. In effect, the symbolic system of kinship relations expressed through a kinship terminology makes it possible for any two persons to know whether

Table: Hadza Reference Kin Terms

Kin Type	Kin Term
mother	<i>ayako</i> (<i>aya</i> —Wooburn)
father	<i>bawa</i>
sister	<i>niyeko</i>
brother	<i>niye/mits'i</i>
daughter	<i>olako</i>
son	<i>ola</i>
child's daughter	<i>mama</i>
child's son	<i>no term listed</i>
mother's mother	<i>amama</i>
mother's father	<i>akaye/koku</i>
father's mother	<i>amama</i>
father's father	<i>koko/kuuku?</i>
mother's older sister	<i>ayadzuwako</i>
mother's younger sister	<i>ayako kumiko</i> (<i>younger</i>)
mother's older/younger brother	<i>akaye</i>
father's older sister	<i>ayadzuwako</i> (<i>ayako?</i>)
father's younger sister	<i>aya nakwiko</i> (<i>ayako?</i>)
father's older brother	<i>bawadzua</i>
father's younger brother	<i>bawa nakwete</i>
mother's mother's son	<i>niye/bawa</i> (<i>cannot marry</i>)
mother's mother's daughter	<i>niye</i> (<i>cannot marry</i>)
mother's brother's son	<i>niye/bawa</i>
mother's brother's daughter	<i>niye</i>
father's brother's son	<i>!tabe</i>
father's brother's daughter	<i>niye</i>
father's sister's son	<i>!tale</i>
father's sister's daughter	<i>niye/murunai</i>
father's mother's brother	<i>koko/akaye</i>
father's father's sister	<i>no term listed</i>
mother's father's brother	<i>no term listed</i>
mother's father's sister	<i>amamako/pakachokowako</i>
sister's son	<i>akaye</i>
sister's daughter	<i>maama/aya</i> (<i>cannot marry</i>)
husband	<i>edze/misikana, misika</i>
wife	<i>misikako/edzeyako</i>
wife's sister	<i>site nakwiko</i> (<i>ame?</i>)
wife's brother	<i>ame/nita me</i>
wife's mother	<i>murunai</i> (<i>siteako?</i>)
wife's father	<i>bawa/alai</i> (<i>isanzu?</i>) (<i>siteako?</i>)
sister's husband	<i>ame/nitemekwa</i>
brother's wife	<i>nita mekokwa</i> (<i>ame?</i>)
female ego-sister's husband	<i>ame</i>
female ego-brother's wife	<i>ame/nitakoko sa or ma</i>

Modified from Marlowe 2010: Table 3.1

they are related as kin (that is, whether each has a kin term that may be [properly] used to refer to the other person) without keeping track of extensive genealogical relations and regardless of the actual biological connections involved.

5.0 Kin Term Map

From the time of W.H.R. Rivers and his genealogical method (see *Notes and Queries on Anthropology* [1912]), anthropologists have traditionally expressed kinship terminologies by listing the elicited kin terms obtained when asking for the kin term that may be (properly) used for each of a suite of genealogical relations. Depending on the extensiveness of the suite of genealogical relations, this makes it possible to determine the genealogical relations categorized by each of these kin terms. Consistent with the genealogical method, Marlowe (2010: Table 3.1) presents the Hadza kin terms through a table listing the kin terms and the corresponding kin types and/or kin type products categorized by each kin term. However, this is not the information that we need. Rather, we need to know how the kin terms are interrelated through kin term products using the primary kin terms (that is, the terms for family relations [see Read, Fischer and Chit Hlaing 2014]) for the Hadza kinship terminology. We can work out this information from the data on Hadza kin terms provided by Marlowe, though preferably we would work from kin terms elicited through kin term products directly (see Leaf [2006] and Leaf and Read [2012] for the way kin terms may be elicited directly through using kin term products).

We can express visually the structure formed through computing the kin term products of primary kin terms with kin terms by making a graph in which each node corresponds to a kin term and nodes in the graph are connected by arrows, where a unique arrow form (e.g., an arrow drawn with an open versus a closed arrowhead, a solid line versus a dashed line for the arrow shaft, the arrow colored according to the sex marking of the kin term it represents, and so one) corresponds to each of the primary kin terms. Thus, if P is a primary kin term and K is a kin term, to indicate the outcome of the kin term product, P of K, an arrow whose form corresponds to P would be drawn from the node labeled with the kin term K to the node labeled with kin term L if the kin term product, P of K, yields the kin term L in the kinship terminology system of concern.

For the Hadza terminology, the primary (consanguineal) kin terms, by pairs, are *bawa* ('father') / *ayako* ('mother'), *niye* ('brother') / *niyeko* ('sister') and *ola* ('son') / *olako* ('daughter'). An arrow with a closed, triangular shaped arrowhead and blue or red color (usually pointing upward) will correspond to the parent kin terms *bawa* and *ayako*, respectively. An arrow with a "V" shaped arrowhead and blue or red color (typically pointing downward) will correspond to the child kin terms *ola* and *olako*, respectively. An arrow with a solid triangular shaped, indented base arrowhead, and blue or red color (typically, pointing horizontally) will correspond to the sibling kin terms, *niye* and *niyeko*, respectively.

The kin term products used to draw the structure shown in Figure 1 were inferred from the genealogical definition of kin terms provided by Marlowe (2010) and shown in the Table. For example, for the blue arrow from *ayako* pointing to the kin term, *!tale*, note that Marlowe lists the kin type product, paternal aunt's son for the kin term *!tale*, and for

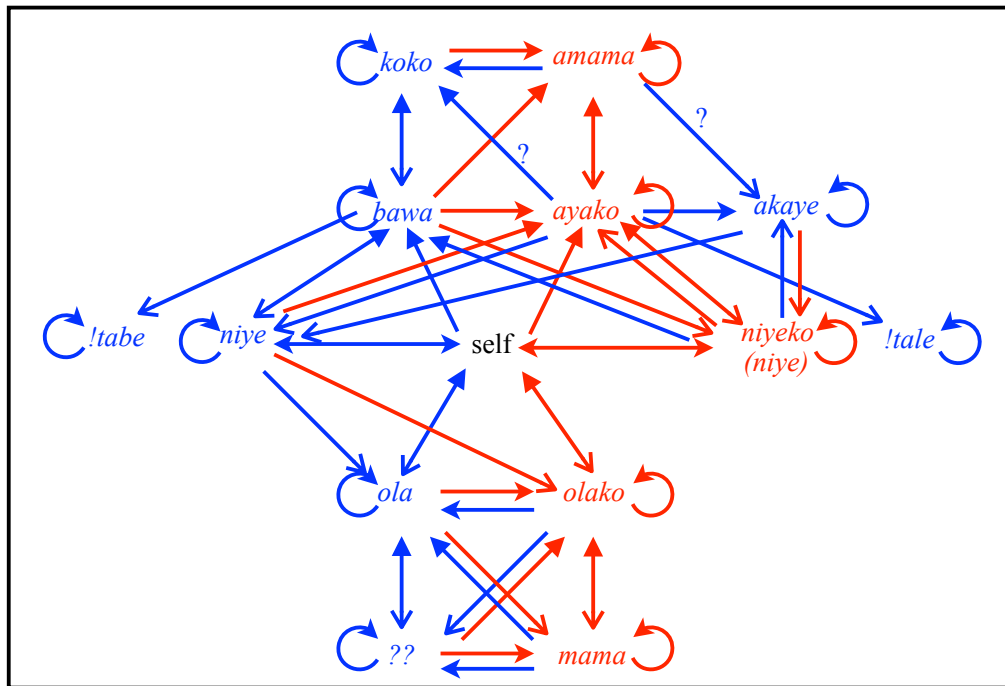


Figure 1: Kin term map for the Hadza kinship terminology based on Table. Arrows with “?” seem likely but corresponding kin term products are not given in the Table.

the kin type father’s sister, we find that (1) Marlowe indicates father’s sister is either *ayaadzuwako* for father’s older sister or *ayanakwiko* for father’s younger sister, (2) Marlowe also indicates with a ? that father’s older sister or younger sister may be the term *ayako*, so it appears that *adzuwako* and *nakwiko* play a role similar to ‘older’ and ‘younger’ with English kin terms, (3) *aya* is the root form for both *ayaadzuwako* and *ayanakwiko* and (4) *aya* is also the root form for *ayako*, so it appears that *ayako* is polysemic and would also have translation as ‘paternal aunt,’ which is what we expect since the Hadza terminology is said to be a classificatory terminology. Thus, we draw a downward blue arrow corresponding to *ola* (‘son’) from *ayako* to *!tale*. (Note that suffixes indicating older/younger have not been included in the kin term map as these suffixes appear to play the same role for Hadza kin terms as do the prefixes ‘older’ and ‘younger’ in English, namely they simply add an attribute to a sibling term and do not, thereby, identify a different kin term.)

Two of the arrow connections are each marked with a question mark since the kin type products for these terms are not provided in Marlowe’s Table 3.1. Thus, *ola* of *amama* may possibly be *akaye* since *akaye* is *niye* of *ayako*, but maternal grandmother’s son is not specified in Marlowe’s Table 3.1 as a kin type for *akaye*. Also, *bawa* of *ayako* may be *koko*, but the kin type product, mother’s father, does not appear in Marlowe’s Table 3.1.

The reflexive kin term products of *niye* (‘brother’) with male marked kin terms and products of *niyeko* (‘sister’) with a female marked kin terms, as shown in the Table,

have been drawn with circular reflexive arrows in Figure 1, but circular reflexive arrows will henceforth only be shown occasionally in kin term maps in order to keep diagrams visually simple. No kin term is listed by Marlowe for ‘grandson,’ but it appears unlikely that there is no ‘grandson’ kin term and so the “missing” kin term is denoted by *??*. Kin type products relevant to products of the primary kin terms with *!tabe* and *!tale* are not given by Marlowe. Presumably, *bawa* o *!tabe* = *bawa* and *ayako* o *!tale* = *ayako*. Further, products of *ola* and *olako* with *!tabe* and *!tale* are not given, but it is likely that *ola* o *!tabe* = *ola* o *!tale* = *ola* and *olako* o *!tabe* = *olako* o *!tale* = *olako*.

The structure determined from the kin term information provided by Marlowe (2010) and shown in Figure 1 is referred to as a *kin term map*, though affinal kin terms have not been included in the kin term map as the information on affinal terms is only partial. The kin term map shown in Figure 1 will be the target structure for working out the generative logic underlying the Hadza terminology. Before working out this generative logic, we first note some of the structural properties that are evident from the kin term map for the Hadza kinship terminology that can be seen in Figure 1

Some properties of the structure shown in Figure 1 are as follows. First, the terminology is not left-right symmetric, thus the domain of male relations is structured differently than the domain of female relations. Second, there is a line of male kin terms (but not a corresponding line of female kin terms) beginning at *koko* (+2 generation) and ending at *??* (-2 generation), with the line formed using kin term products with *ola* (discussed in more detail below). Third, the female marked terms are not consistent with genealogical generations since (a) *olako* (-1 generation) of *niyeko* (0 generation) is *ayako* (+1 generation), rather than *olako* (-1 generation) as might be expected from the male term pattern where *ola* (-1 generation) of *niye* (0 generation) is *ola* (-1 generation), and (b) *ola* (-1 generation) of *niyeko* (0 generation) is *akaye* (+1 generation), rather than being a -1 generation term. Thus, the terminology is skewed for female marked terms. However, though the terminology is skewed for female marked kin terms, suggesting that it is an Omaha terminology, it does not have the full skewing pattern associated with Omaha terminologies (see Lounsbury 1964).

As already noted, the male terms form a simple vertical structure determined by taking products with the kin term *ola* (‘son’): *koko* → *bawa* → *niye* → *ola* → *??*, where each arrow denotes taking the kin term product of *ola* with the kin term at the beginning of the arrow. An analogous structure encompassing 5 generations does not occur with the female marked terms, but there is the vertical structure *amama* → *ayako* → *niyeko* formed by taking kin term products with *olako* (‘daughter’) since *olako* o *amama* = *ayako* and *olako* o *ayako* = *niyeko*. Strikingly, this structure does not continue to the -1 generation, for to do so would require that *olako* o *niyeko* = *olako*, and if so, a man’s daughter and his sister’s daughter would not be referred to by distinct kin relations. Instead, ‘son’ or ‘daughter’ of ‘sister’ maps back to generation +1. As will be shown below, the mapping back to the +1 generation is a consequence of the term *akaye* being a self-reciprocal kin term, a culturally specific feature of the Hadza kinship terminology.

The *-ko* ending on the female marked terms in the middle three generations, *ayako*, *niyeko* and *olako*, and the mapping of each of the terms in the male vertical structure to a corresponding female term, either by products with a female marked *self* or with *niyeko*, suggest a structural split between a vertical line of male terms, on the one hand, and female terms connected to the male vertical line through sibling links, on the other hand, yet there is a vertical line of female terms only for generations 0, +1 and +2. This also suggests the importance of the sibling relation in Hadza kinship, but this is not a topic discussed in Marlowe (2010). We now determine if there is a generative logic for generating the kin term map for the Hadza terminology.

6.0 Overview of the Generative Logic of Kinship Terminologies

The analysis presented here follows the argument for the generative logic of kinship terminology structures laid out in six parts in Read (2007, 2014) and in Leaf and Read (2012). The six parts are as follows.

Part 1: Ascending Structure

The generative logic begins by generating an ascending structure through kin term products that can be thought of as a subspace of the Kin Term Space that is already in place at time of birth and provides the kin term position into which the newborn is (ritually) located. In the case of the Hadza, this means that a Hadza newborn is recognized as having a *bawa* ('father') and an *ayako* ('mother').

Part 2: Descending Structure

An isomorphic descending structure is constructed next, including structural equations that define reciprocity between isomorphically corresponding ascending and descending generating terms, such as *parent* and *child* for English speakers. The descending structure can be thought of as the portion of the Kin Term Space that conceptually begins through the newborn reciprocally being an *ola* ('son') or an *olako* ('daughter'), depending on its sex, and diachronically the occupants of the positions in the descending structure then become the occupants of positions in the ascending structure from the perspective of their progeny as procreation plays out through time. Thus there is an isomorphism between the ascending structure and the descending structure since the distinction is only one of perspective.

Part 3: Sex Marking of Kin Terms

Two procedures discussed in Leaf and Read (2012) for the sex marking of kin terms are: (1) introduce sex marking symbols (this is the sex marking procedure used for the English kinship terminology and other, European descriptive terminologies) or (2) make an isomorphic copy of the ascending/descending structure, with one structure interpreted as being composed of male marked terms and the isomorphic copy being composed of female marked terms.

For the Hadza terminology, a third procedure needs to be introduced for the sex marking of kin terms. This third procedure for the sex marking of kin terms was first un-

covered when working out the generative logic for the skewing property of the Thonga terminology in Zaire, which is said to be an Omaha terminology (see Read 2018b.). A skewing property crosscuts generational distinctions and distinguishes Crow/Omaha terminologies from other classificatory terminologies by the former not having an isomorphism between the structure of male terms and the structure of female terms. Instead, the set of generating terms for the female terms in a terminology like the Thonga terminology only has a female *self* term as a generating term for female-marked kin terms (see Read 2018b) and so the terminology lacks a non-trivial generative structure for female terms. Instead, the female terms are male terms transformed into female terms through kin term products using a female marked *self* term. Thus, rather than forming an isomorphic structure as the means to introduce kin terms with the opposite sex marking of the ascending and generating structure generated in Part 2, they are introduced by taking kin term products of male marked terms using female *self*. This leads to a fundamental asymmetry between the generative elements for the structure of terms of one sex versus the terms of the opposite sex, which accounts for the asymmetry noted above when comparing the male terms on the left side of the Hadza kin term map with the female terms on the right side of the kin term map (see left and right sides of Figure 1).

Part 4: Combined Male and Female Structures

When there is a structure of male terms and a structure of female terms, there must also be a way that these two structures are structurally linked to form a single structure. Having initial structures of male terms and of female terms is common with classificatory terminologies. The primary structural differences among classificatory terminologies such as the Polynesian (e.g., Bennardo and Read 2007 for the Tongan) versus the Australian Aboriginal (e.g., Leaf and Read 2012 for the Kariera) versus the Dravidian (e.g., Read 2010 for a canonical Dravidian) terminologies derive from different ways the two structures can be linked to form a single structure of female and male kin terms.

For terminologies like the Hadza where the only generating term for the terms of the opposite sex (with “opposite sex” being the female sex for the Hadza terminology) is a sex marked *self* term, there is no separate generated structure for the terms of the opposite sex, hence there is no structure of male terms and structure of female terms to be linked. Instead, a single structure is generated through the procedure for generating kin terms of the opposite sex using kin term products, as discussed in Part 3. The lack of a generated structure for the terms of the opposite sex implies that there need not be any correspondence between the structure for the terms of the opposite sex and a genealogical structure; i.e., what is referred to as skewing in the Crow and Omaha terminologies is not due to an (unexplained) collapsing of genealogical generation differences, but simply the absence of a generated structure, hence the absence of kin term products that otherwise would introduce generation distinctions among the terms of the opposite sex. In other words, the absence of an ascending generating term for the opposite sex terms implies that generation will not be part of the structure for the kin terms of the opposite sex. Thus, kin terms of the opposite sex can “violate” genealogical generation differences without violating logical consistency of the kin term structure.

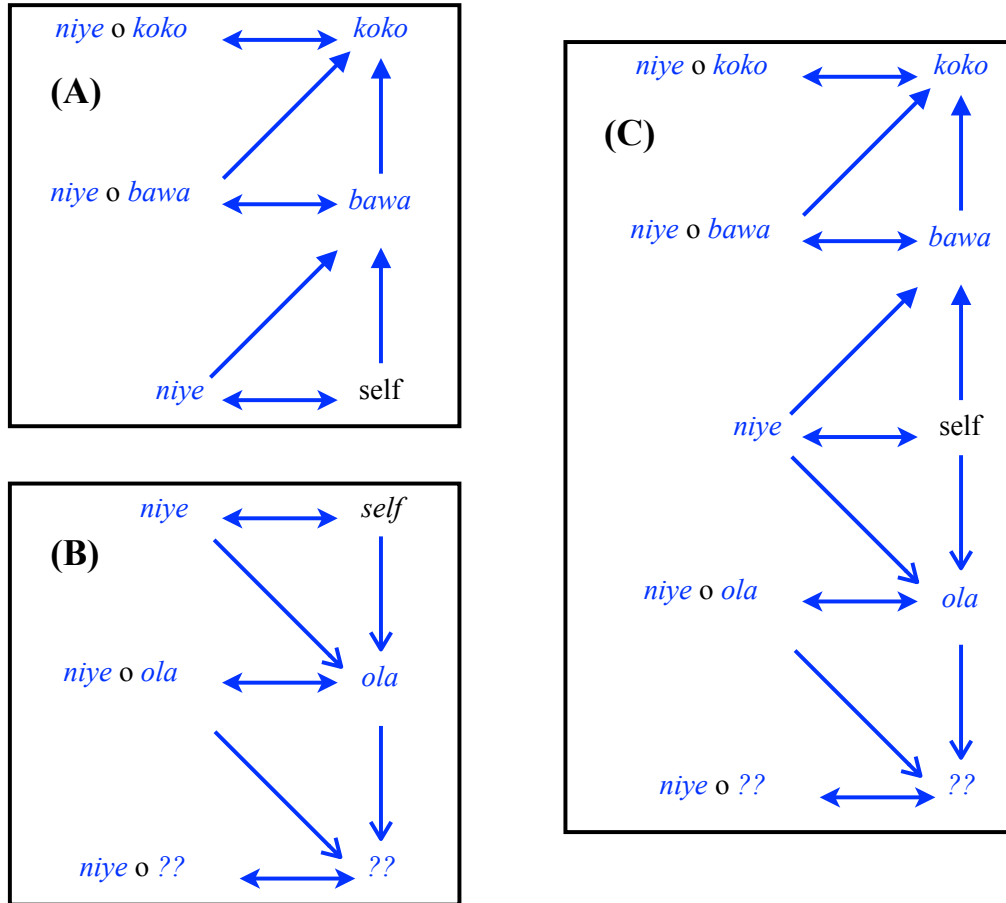


Figure 2: (A) Ascending structure. (B) Descending structure. (C) Combined ascending and descending structure.

As noted above, we find genealogical inconsistency between kin terms and genealogical generation distinctions in the Hadza terminology for the kin term, *akaye* ('brother' of 'mother'), due to the following sequence of kin term product equations: *niye* ('brother') of *amama* ('grandmother') = *niye* ('brother') of *ayako* ('mother') = *ola* ('son') of *niyeko* ('sister') = *akaye*. Genealogically, grandmother's brother is not mother's brother. As we will see, *ayako* ('mother') is not a generating term for the female marked kin terms, so the structural relationship of *ayako* ('mother') to *amama* ('grandmother') in the kin term map is due to the structural relation of *bawa* 'father' to *koko* ('grandfather') being preserved when kin term products with female *self* are formed from these two kin terms to generate the kin terms *ayako* ('mother') and *amama* ('grandmother'), respectively. The presence of an induced, rather than a generated, structural relation between these two terms implies the genealogical relation of genealogical mother to genealogical grandmother need not be (and is not) preserved when taking kin term products of *ayako* and *amama* with the *niye* ('brother') term. A similar comment applies to the kin term product of *ola* ('son') with *niyeko* ('sister') is *akaye*. Thus, overall we find that the term *akaye* refers to individuals in the genealogical -1, +1, and +2 generations.

Part 5: Affinal Terms

Affinal terms are generally introduced through primary spouse generating terms. For the Hadza terminology these are *edze* ('husband') and *edzeyako* ('wife').

Part 6: Local Structural Modifications

Local structural modifications that only affect part of a terminology, rather than global generative properties that affect the entire structure, may be introduced for culture specific reasons, such as 'older/younger mother's brother' in the Tongan terminology that relates to inheritance and not to the generative logic of the Tongan terminology (see Bernardo and Read 2007 for details).

7.0 Generation of the Hadza Terminology

Now consider, in a detailed, stepwise fashion, the generation of the structure for the Hadza terminology. The goal is to determine whether the kin term map shown in Figure 1 can be generated through the procedure outlined above, and if so, what kinship concepts are involved in so doing. To do this, we need to establish the logically valid reduction for each possible kin term product that arises as part of working out the generative logic for the Hadza terminology. This means that the bulk of the following demonstration consists in working out the logically valid reduction for each of the possible kin term products so as to determine whether these products constructed by forming all possible kin term products using the primary kin terms of the Hadza terminology actually reduce to the kin term indicated for that product in the kin term map of the Hadza kinship terminology. The reduction of kin term products will proceed by organizing the products according to the generating step in which they occur, and within a step, according to the kinds of products involved. We begin with the ascending structure.

Part 1: Ascending Structure

The procedure for the generation of the ascending structure for the male terms is essentially the same as for other classificatory terminologies. The male ascending generating term is *bawa* ('father'). The sibling term, *niye* ('brother'), is also a generating term, due to the Hadza terminology being a classificatory terminology (see Read 2007, Leaf and Read 2012, Read, Fischer and Chit Hlaing 2014 for the reasons behind this association between classificatory terminologies and a sibling generating term). So, the set of ascending kin term generators is given by $A = \{self, bawa, niye\}$. In order for *bawa* to structurally be an ascending generating term and *niye* to structurally be a sibling term, the following two equations are needed to structurally define *niye* to be a male sibling term:

Equation (1): $niye \circ niye = niye$ (read: "'brother' of 'brother' is 'brother'")

and

Equation (2): $bawa \circ niye = bawa$, (read: "'father' of 'brother' is 'father'").

Equation (1) introduces the property that sibling terms are reflexive, and Equation (2) introduces the structural relationship between a sibling term and a parent term. The

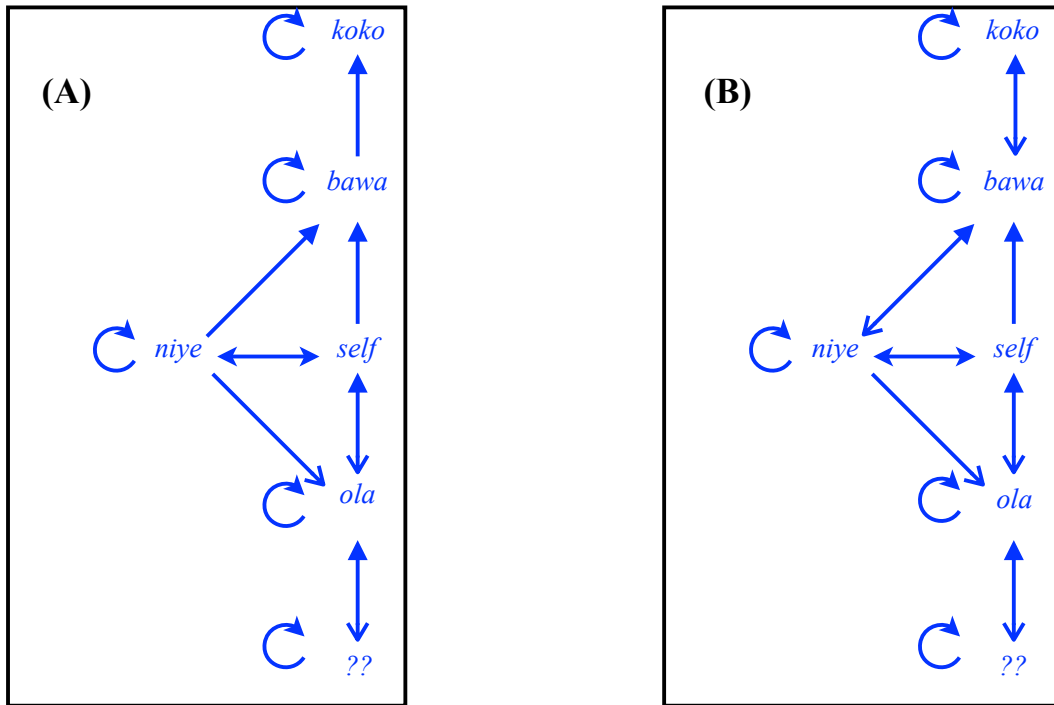


Figure 3: (A) Structure produced by the equations (1) $bawa \circ ola = self$ defining $bawa$ and ola to be reciprocal kin terms, (2) $niye \circ ola = ola$ — the reciprocal of the equation $bawa \circ niye = bawa$, and (3) $niye \circ bawa = bawa$ — the reciprocal of the equation $ola \circ niye = ola$. (B) Structure in (A) with the equation $ola \circ bawa = niye$ also included.

male ascending structure generated by the generating set $A = \{self, niye, bawa\}$ is shown (but without the reflexive arrows being included for clarity of the diagram) in Figure 2 (A). Note that there is, so far, no structural equation for reducing the kin term products, $niye \circ koko$ and $niye \circ bawa$. These products will be considered further when generating the structure determined from the generating set $A = \{self, niye, bawa\}$.

Part 2: Descending Structure

The isomorphic descending structure has generating set $D = \{self, ola, niye\}$, which differs from the general procedure for generating a classificatory terminology by using the same sibling term, $niye$, in both the ascending and the descending structure. This means that there will not be an ‘older/ascending brother’/‘younger/descending brother’ distinction in the terminology, as occurs when the descending sibling term isomorphic to the

ascending sibling term is not the same as the ascending sibling term (see Read 2007, Leaf and Read 2012, Read, Fischer and Chit Hlaing 2014).²

Next, we note that Marlowe (2010) does not list a term for ‘grandson;’ that is, for the kin term product *ola* o *ola*, but presumably such a term exists as the reciprocal of the term *koko*. As noted previously, ?? will be used to denote the missing kin term corresponding to the kin term product *ola* o *ola*.

In order for the descending structure to be isomorphic to the ascending structure, we include the equation isomorphic to Equation (2):

$$\text{Equation (2*): } \textit{ola} \textit{ o } \textit{niye} = \textit{ola}.$$

The structure derived from the set of generators D and Equation (2*) is shown in Figure 2(B).

Part 2 (continued): Combined Ascending and Descending Structure

We may combine the ascending structure and the descending structure into a single connected structure through the *self* term that is common to both structures (see Figure 2C). In the combined structure, we need to determine the kin term product equations for the product of primary ascending generators with descending terms and the product of primary descending generators with ascending terms. Most of these products relate to closure of the combined structure under reciprocity of kin terms. Lastly, we include a structural equation for one remaining product, *ola* o *bawa*, not included under the reciprocity of kin terms.

(A) *Closure Under Reciprocity of Kin Terms*

Closure under reciprocity of kin terms will be discussed in two parts.

(1) We introduce the following equation to make *bawa* and *ola* into reciprocal kin terms (see Leaf and Read 2012 for details):

$$\text{Equation (3); } \textit{bawa} \textit{ o } \textit{ola} = \textit{self} \text{ (read "‘father’ of ‘son’ is self").}$$

² However, there is an implicit structural distinction between *niye* as a member of the set of ascending generating terms $A = \{\textit{self}, \textit{bawa}, \textit{niye}\}$ and *niye* as a member of the set of descending generating terms $D = \{\textit{self}, \textit{ola}, \textit{niye}\}$, namely the implicit difference in the order of births. The term *niye* as a member of the set A of ascending generating terms implies that the sibling referred to by *this niye* was born prior to the person who is the instantiation of the Self position, whereas the term *niye* as a member of the set D of descending generating terms, implies that the sibling referred to by *that niye* was born after the person who is the instantiation of the Self position. In other words, two structurally different positions have been labeled by the same expression. Let us (temporarily) mark the term *niye* by a superscript A or D according to which set, A or D, the term is from; that is according to structurally whether it refers to a position in the ascending structure or in the descending structure. This implies we also have

$$\text{Equation (2')} \textit{ niye}^A \textit{ o } \textit{niye}^D = \textit{self} = \textit{niye}^D \textit{ o } \textit{niye}^A,$$

making *niye* a self-reciprocal term. With this implicit marking of *niye*, Equation (1) indicates that $\textit{niye}^A \textit{ o } \textit{niye}^A = \textit{niye}^A$ and $\textit{niye}^D \textit{ o } \textit{niye}^D = \textit{niye}^D$. When we remove the superscript, the use of the same label for the two structural positions for sibling makes it superficially appear as though we have both the equation $\textit{niye} \textit{ o } \textit{niye} = \textit{niye}$ and the equation $\textit{niye} \textit{ o } \textit{niye} = \textit{self}$, which would imply that $\textit{niye} = \textit{self}$. Once we recognize that two distinct structural positions have been given the same label, the seeming anomaly of sibling reducing to *self* disappears.

This equation also implies that $bawa \circ ?? = ola$ (see upward pointing arrows in Figure 3A from ola and $??$).

(2) Closure of kinship systems under reciprocity of kin terms implies that the terminology will include the reciprocal equation for any structural equation that is already part of the structure being generated. There are two equations, Equation (2) and Equation (2*), for which the reciprocal equation is not the same as the original equation, hence these reciprocal equations for these two equations need to be introduced.

(a) The reciprocal of Equation (2), $bawa \circ niye = bawa$, is composed using the reciprocal of the kin term product on the left side of Equation (2) and the reciprocal of the kin term on the right side of this equation. In order to compute the reciprocal of the kin term product on the left side of Equation (2), we make use of the fact that the reciprocal of a kin term product, $K \circ L$, is the kin term product formed in the reverse order using the reciprocal of each kin term in this kin term product. Formally, if we denote the reciprocal of the kin term product $K \circ L$ by the expression $(K \circ L)^r$, then $(K \circ L)^r = L^r \circ K^r$, where L^r denotes the reciprocal of the kin term L and K^r denotes the reciprocal of the kin term K . Thus, the reciprocal of Equation (2), denoted by $(bawa \circ niye)^r = (bawa)^r$, will be, since $(bawa \circ niye)^r = niye^r \circ bawa^r = niye \circ ola$ and $(bawa)^r = ola$, the following equation:

Equation (2**): $niye \circ ola = ola$ (read: “‘brother’ of ‘son’ is ‘son’”).

It follows from this equation that $niye \circ ?? = niye \circ ola \circ ola = ola \circ ola = ??$ (see reflexive arrows in Figure 3A for ola and $??$).

(b) The reciprocal of Equation (2*): $ola \circ niye = ola$ is shown, by an argument similar to that for Equation (2), to be:

Equation (2') $niye \circ bawa = bawa$ (read: “‘brother’ of ‘father’ is ‘father’”).

This equation also implies that $niye \circ koko = koko$ (see reflexive arrows in Figure 3A for $bawa$ and $koko$).

Equation (2') makes the terminology into what Murdock (1949) refers to as a bifurcate merging terminology; that is, into a classificatory terminology in Morgan's (1871) two-part characterization of kinship terminologies. Equation (2') arises in this manner because the terminology has a sibling kin term as a generating term, hence conceptualizing the sibling relations as a primary relation entails that the generated kinship terminology will be a classificatory terminology.

(B) *Kin Term Product: $ola \circ bawa$ ('son' of 'father')*

If speaker refers to alter A by the kin term $bawa$ ('father') and alter A refers to alter B by the kin term ola ('son'), then speaker will refer to alter B by the kin term $niye$ ('brother'). Thus, we introduce the following equation:

Equation (4): $ola \circ bawa = niye$ (read: “‘son’ of ‘father’ is ‘brother’”).

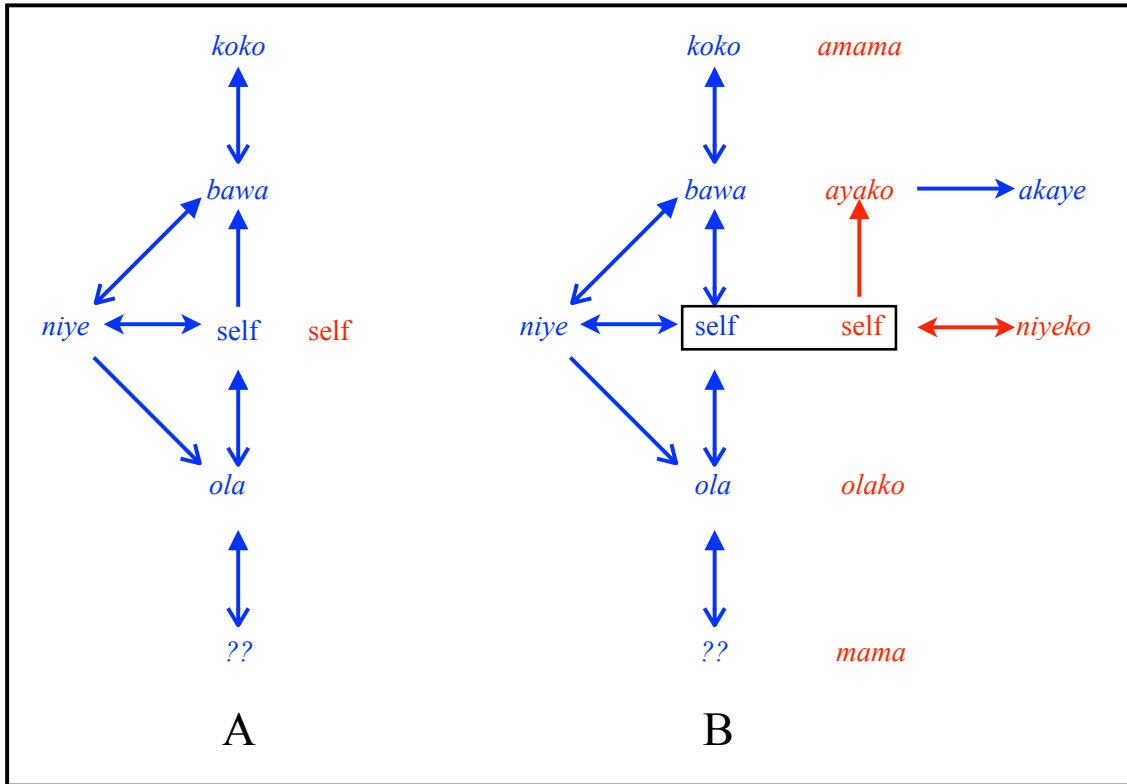


Figure 4: (A) Male structure on the left and the female structure based on the female marked *self* term on the right. (B) Female marked terms generated by taking products of the female marked *self* term with the male terms. Red arrows indicate the primary female kin terms determined from the primary male kin terms. The term, *akaye*, is determined by the kin term product *niye* ('brother') of *ayako* ('mother'). The structure of male terms and the structure of female terms are linked through a neutral *self* term, denoted by a rectangular box, that is a cover term for the two sex marked *self* terms.

This equation places *niye* on a line going from *koko* to *bawa* to *niye* to *ola* to *??* when using the kin term product of *ola* with each of these kin terms. This embeds the structure of a male descent line into the terminology.

The complete ascending and descending structure, incorporating all of the above equations, is shown in Figure 3B.

Part 3: Sex Marking of Kin Terms

The introduction of female marked terms, as discussed above, proceeds by only including the female marked *self* term in the female generating set, namely the set $\{self\}$. The structure generated by this set is a single node labeled by *self* (see Figure 4A). To form female marked kin terms, we take kin term products of *self* with the male marked kin terms. We begin with the generating male terms for the structure of male terms (see Figure 4A) by introducing the following equations that determine the primary female marked terms (see Figure 4B):

$$(1) \text{ self } o \text{ bawa} = \text{ayako} \text{ ('mother')}$$

$$(2) \text{ self} \circ \text{niye} = \text{niye} \text{ko} \text{ ('sister')} \text{ and } \text{niye} \circ \text{self} = \text{niye}$$

and

$$(3) \text{ self} \circ \text{self} = \text{self} \text{ and } \text{self} \circ \text{self} = \text{self}.$$

Part 4: Combined Male and Female Structures (Figure 4B)

We now form products of male marked and female marked kin terms. We begin by determining the structure for the center three female marked terms in Figure 4B and the male marked kin term, *akaye* ('mother's brother'). We do this by first defining the kin term *akaye* as the kin term name for the kin term product of the sex marked terms, *niye* and *ayako*. Thus, by definition, the following equation is part of the kin term structure:

$$(4) \text{ niye} \circ \text{ayako} = \text{akaye}.$$

The arrow from *niye*ko to *self* follows from the following equation:

$$(5) \text{ niye} \text{ko} \circ \text{niye} \text{ko} = \text{self} \circ \text{niye} \circ \text{self} \circ \text{niye} = \text{self} \circ \text{niye} \circ \text{niye} = \text{self} \circ \text{self} = \text{self}.$$

Equations (1) - (5) establish the structure for the center three female marked terms in Figure 4B and for the term *akaye* ('mother's brother').

Next, we show that (neutral) *self* is properly a covering term for the sex marked *self* terms in the structure we are generating; that is, we show that an arrow pointing from the rectangle representing the neutral *self* term to a kin term can also be considered to begin, without inconsistency, at either of the sex-marked *self* terms, and any arrow pointing from a kin term to a sex-marked *self* term can also be considered to begin at the same kind of kin term but of the opposite sex, and end at that sex-marked *self* term, without inconsistency.

We first show this for the four vertical arrows starting at the sex-marked *self* terms enclosed by the rectangular box, by the following four equation deductions:

$$(6) \text{ ayako} \circ \text{self} = \text{self} \circ \text{bawa} \circ \text{self} = \text{self} \circ \text{bawa} = \text{ayako}$$

$$(7) \text{ niye} \text{ko} \circ \text{self} = \text{self} \circ \text{niye} \circ \text{self} = \text{self} \circ \text{niye} = \text{niye} \text{ko}$$

$$(8) \text{ ola} \circ \text{self} = \text{ola} \circ \text{self} \circ \text{self} = \text{ola} \circ \text{self} = \text{ola}$$

and

$$(9) \text{ bawa} \circ \text{self} = \text{bawa} \vee \text{self} \circ \text{self} = \text{bawa} \circ \text{self} = \text{bawa}.$$

Equation (6) says that 'mother' of 'male self' is 'mother'; Equation (7) says that 'sister' of 'male self' is 'sister'; Equation (8) says that 'son' of 'female self' is 'son'; and Equation (9) says that 'brother' of 'female self' is 'brother.'

For the two vertical arrows pointing upward to sex-marked *self* terms, we deduce the following two equations:

$$(10) \text{ bawa} \circ \text{olako} = \text{bawa} \circ \text{self} \circ \text{ola} = \text{bawa} \circ \text{ola} = \text{self}$$

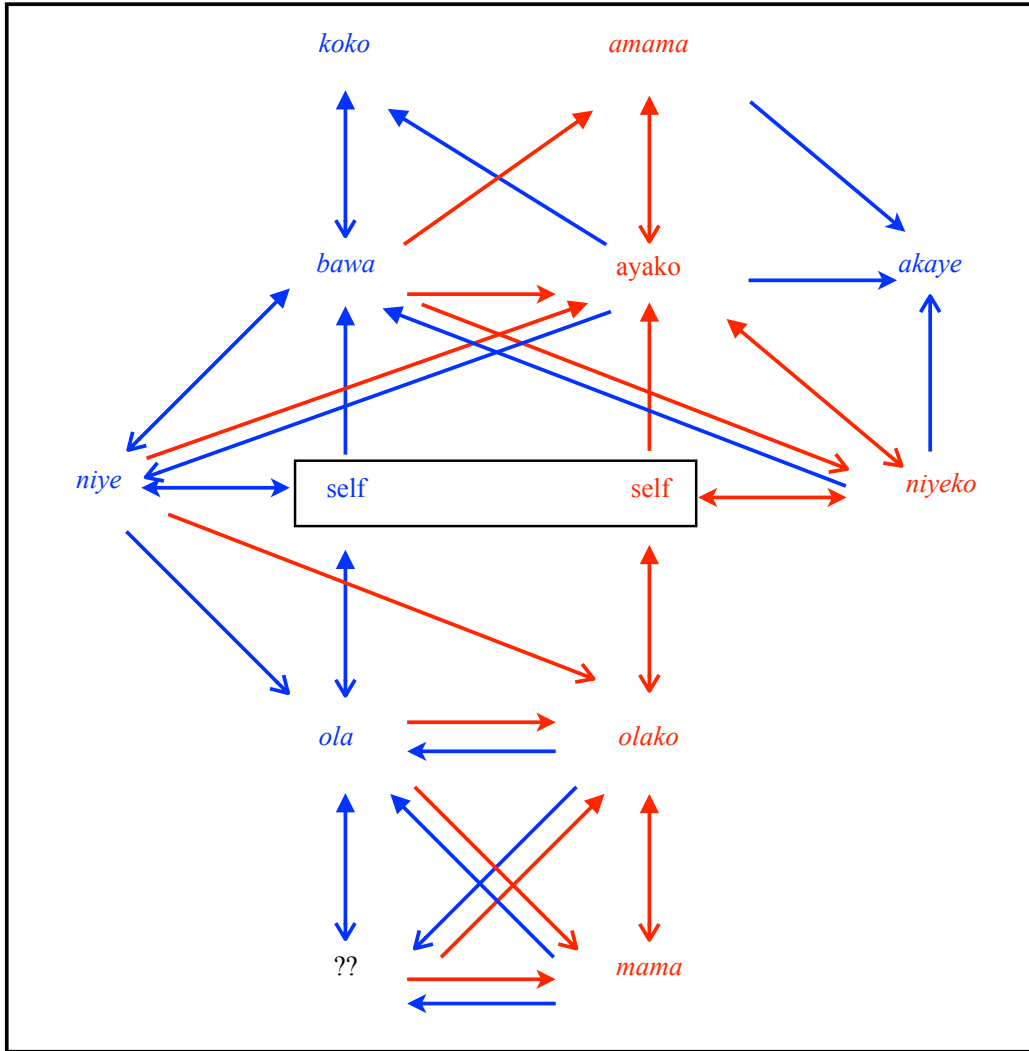


Figure 5: Expansion of Figure 4B based on equation sets I- V. See text for details.

and

$$(11) \text{ ayako} \circ \text{ola} = \text{self} \circ \text{bawa} \circ \text{ola} = \text{self} \circ \text{self} = \text{self}.$$

Equation (10) says that ‘father’ of ‘daughter’ is male *self* and Equation (11) says ‘mother’ of ‘son’ is female *self*.

For the two horizontal arrows pointing to a sex-marked *self* term from *niye* and *niyeko*, respectively, we deduce the following two equations:

$$(12) \text{ niyeko} \circ \text{niye} = \text{self} \circ \text{niye} \circ \text{niye} = \text{self} \circ \text{niye} = \text{niyeko}$$

and

$$(13) \text{ niye} \circ \text{niyeko} = \text{niye} \text{ (shown in a similar manner).}$$

Equation (12) says that ‘sister’ of ‘brother’ is ‘sister’ and Equation (13) says that ‘brother’ of ‘sister’ is ‘brother.’ Equations (6) - (13) establish that a neutral *self* term can be consistently used as a cover term for the two sex-marked *self* terms.

Next we form the female-marked kin terms corresponding to the remaining male-marked kin terms in Figure 4B:

$$(14) \textit{self} \circ \textit{koko} = \textit{amama}, \textit{self} \circ \textit{ola} = \textit{olako} \text{ and } \textit{self} \circ ?? = \textit{mama}.$$

Equation (14) says that female *self* of ‘father’ is ‘mother,’ female *self* of ‘son’ is ‘daughter’ and ‘female self’ of ‘grandson’ is ‘granddaughter.’ Altogether, Equations (1) - (14) establish Figure 4B as the core structure for the male-marked and female-marked kin terms in the Hadza terminology.

The following four deduced equations establish that the female marked terms can also be derived from the male terms through products with *niyeko* (‘sister’):

$$(15) \textit{niyeko} \circ \textit{koko} = \textit{self} \circ \textit{niye} \circ \textit{koko} = \textit{self} \circ \textit{koko} = \textit{amama},$$

$$(16) \textit{niyeko} \circ \textit{bawa} = \textit{self} \circ \textit{niye} \circ \textit{bawa} = \textit{self} \circ \textit{bawa} = \textit{ayako} \rightarrow \textit{aya},$$

(note that Equation (16) shows that ‘sister’ of ‘father’ is located at the ‘mother’ position in the structure, but is kept distinct by the use of the covering term, *aya*, for ‘sister’ of ‘father’ rather than the term *ayako* [‘mother’]),

$$(17) \textit{niyeko} \circ \textit{ola} = \textit{self} \circ \textit{niye} \circ \textit{ola} = \textit{self} \circ \textit{ola} = \textit{olako},$$

and

$$(18) \textit{niyeko} \circ ?? = \textit{mama} \text{ (by an argument similar to that for Equation [11]).}$$

Part 4 (continued): Combined Male and Female Structures (Figure 5)

Next we expand the structure shown in Figure 4B to include kin term products using the primary terms and kin terms not yet included in the above equations. We begin with products of the female marked terms shown in equation sets (I) - (V), below. The corresponding expanded structure is shown in Figure 5.

(I) Products of the ascending and descending primary terms (*ayako* [‘mother’], *bawa* [‘father’], *olako* [‘daughter’], and *ola* [‘son’]) with the *ayako* (‘mother’) term:

$$(19) \textit{ayako} \circ \textit{ayako} = \textit{self} \circ \textit{bawa} \circ \textit{self} \circ \textit{bawa} = \textit{self} \circ \textit{bawa} \circ \textit{bawa} = \textit{self} \circ \textit{koko} = \textit{amama},$$

$$(20) \textit{bawa} \circ \textit{ayako} = \textit{bawa} \circ \textit{self} \circ \textit{bawa} = \textit{bawa} \circ \textit{bawa} = \textit{koko},$$

$$(21) \textit{olako} \circ \textit{ayako} = \textit{self} \circ \textit{ola} \circ \textit{self} \circ \textit{bawa} = \textit{self} \circ \textit{ola} \circ \textit{bawa} = \textit{self} \circ \textit{niye} = \textit{niyeko},$$

and

$$(22) \textit{ola} \circ \textit{ayako} = \textit{ola} \circ \textit{self} \circ \textit{bawa} = \textit{ola} \circ \textit{bawa} = \textit{niye}.$$

(II) Products of the ascending and descending primary terms (*ayako* [‘mother’], *bawa* [‘father’], *olako* [‘daughter’], and *ola* [‘son’]) with the *olako* (‘daughter’) term:

$$(23) \textit{ayako} \circ \textit{olako} = \textit{self} \circ \textit{bawa} \circ \textit{self} \circ \textit{ola} = \textit{self} \circ \textit{bawa} \circ \textit{ola} = \textit{self} \circ \textit{self} = \textit{self},$$

$$(24) \textit{bawa} \circ \textit{olako} \text{ (see Equation [10])},$$

$$(25) \textit{olako} \circ \textit{olako} = \textit{self} \circ \textit{ola} \circ \textit{self} \circ \textit{ola} = \textit{self} \circ \textit{ola} \circ \textit{ola} = \textit{self} \circ ?? = \textit{mama},$$

and

$$(26) \textit{ola} \circ \textit{olako} = \textit{ola} \circ \textit{self} \circ \textit{ola} = \textit{ola} \circ \textit{ola} = ??.$$

(III) Products of the descending generators (*olako* [‘daughter’] and *ola* [‘son’]) with the *amama* (‘grandmother’) term:

$$(27) \textit{olako} \circ \textit{amama} = \textit{self} \circ \textit{ola} \circ \textit{self} \circ \textit{koko} = \textit{self} \circ \textit{ola} \circ \textit{koko} = \textit{self} \circ \textit{bawa} = \textit{ayako}$$

and

$$(28) \textit{ola} \circ \textit{amama} = \textit{ola} \circ \textit{ayako} \circ \textit{ayako} = \textit{niye} \circ \textit{ayako} = \textit{akaye}.$$

(IV) Products of the ascending generators (*ayako* [‘mother’] and *bawa* [‘father’]) with the *mama* (‘granddaughter’) term:

$$(29) \textit{ayako} \circ \textit{mama} = \textit{self} \circ \textit{bawa} \circ \textit{self} \circ ?? = \textit{self} \circ \textit{bawa} \circ ?? = \textit{self} \circ \textit{ola} = \textit{olako}$$

and

$$(30) \textit{bawa} \circ \textit{mama} = \textit{bawa} \circ \textit{self} \circ ?? = \textit{bawa} \circ ?? = \textit{ola}.$$

(V) Products of the ascending and descending primary terms (*ayako* [‘mother’], *bawa* [‘father’]), *olako* [‘daughter’] and *ola* [‘son’]) with the *niyeko* (‘sister’) term:

$$(31) \textit{ayako} \circ \textit{niyeko} = \textit{self} \circ \textit{bawa} \circ \textit{self} \circ \textit{niye} = \textit{self} \circ \textit{bawa} \circ \textit{niye} = \textit{self} \circ \textit{bawa} = \textit{ayako},$$

$$(32) \textit{bawa} \circ \textit{niyeko} = \textit{bawa} \circ \textit{self} \circ \textit{nive} = \textit{bawa} \circ \textit{nive} = \textit{bawa},$$

and

$$(33) \textit{olako} \circ \textit{niyeko} = \textit{niyeko} \circ \textit{ola} \circ \textit{niyeko} = \textit{niyeko} \circ \textit{akaye} = \textit{ayako} \rightarrow \textit{aya};$$

the substitution of *aya* for *ayako* distinguishes the kin term product $\textit{ayako} \circ \textit{niyeko} = \textit{ayako}$ from the kin term product $\textit{olako} \circ \textit{niyeko} = \textit{aya}$.

The kin term product equation, $\textit{ola} \circ \textit{niyeko} = \textit{akaye}$, will be computed next for a male speaker. The computation depends upon the cultural kinship property that *akaye* is a self-reciprocal kin term:

$$(34) \textit{ola} \circ \textit{niyeko} \circ \textit{♂} = (\textit{niye} \circ \textit{ayako} \circ \textit{♂})^r = (\textit{akaye} \circ \textit{♂})^r = \textit{akaye}^r \circ \textit{♂} = \textit{akaye} \circ \textit{♂}, \text{ hence } \textit{ola} \circ \textit{niyeko} = \textit{akaye} \text{ for a male speaker.}$$

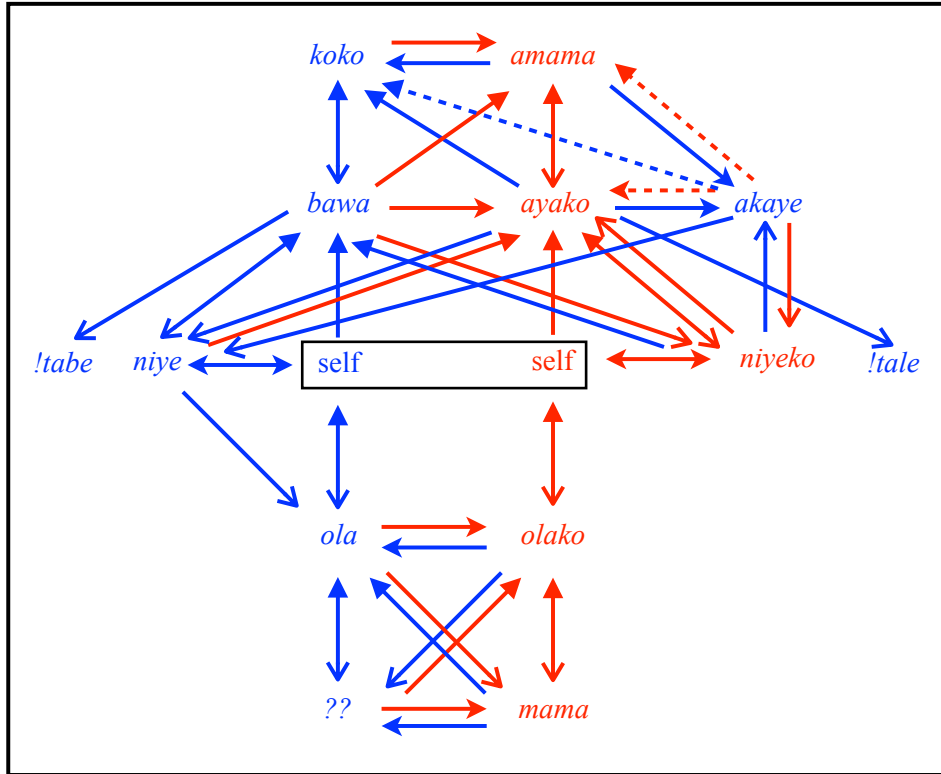


Figure 6: Expansion of Figure 5 by equation sets VI - VII. Arrows with dashed line shafts are predicted connections between kin terms based on kin term products not listed in the Table.

Part 4 (concluded): Combined Male and Female Structures (Figure 6)

Next, we include products of the female primary terms with the male marked terms and products with the kin term *akaye* ('mother's brother') in equation sets VI - VIII. The expansion of the structure shown in Figure 5 by equation sets VI - VIII is shown in Figure 6.

(VI) Products of the female ascending and descending primary terms (*ayako* ['mother'] and *olako* ['daughter']) with the male marked terms:

$$(35) \textit{ayako} \circ \textit{bawa} = \textit{self} \circ \textit{bawa} \circ \textit{bawa} = \textit{self} \circ \textit{koko} = \textit{amama},$$

$$(36) \textit{ayako} \circ \textit{niwe} = \textit{self} \circ \textit{bawa} \circ \textit{niwe} = \textit{self} \circ \textit{bawa} = \textit{ayako},$$

$$(37) \textit{ayako} \circ \textit{ola} = \textit{self} \text{ (see Equation 10),}$$

$$(38) \textit{ayako} \circ \textit{??} = \textit{self} \circ \textit{bawa} \circ \textit{??} = \textit{self} \circ \textit{ola} = \textit{olako},$$

$$(39) \textit{olako} \circ \textit{koko} = \textit{self} \circ \textit{ola} \circ \textit{koko} = \textit{self} \circ \textit{bawa} = \textit{ayako} \text{ (predicted; not listed in the Table),}$$

$$(40) \textit{olako} \circ \textit{bawa} = \textit{self} \circ \textit{ola} \circ \textit{bawa} = \textit{self} \circ \textit{niye} = \textit{niyeko},$$

$$(41) \textit{olako} \circ \textit{niye} = \textit{self} \circ \textit{ola} \circ \textit{niye} = \textit{self} \circ \textit{ola} = \textit{olako},$$

and

$$olako \circ ola = self \circ ola \circ ola = self \circ ?? = mama.$$

(VII) Products with the male-marked term *akaye* ('mother's brother'):

(42) $bawa \circ akaye = bawa \circ niye \circ ayako = bawa \circ ayako = koko$ (predicted; product not given in Marlowe 2010),

(43) $ayako \circ akaye = ayako \circ niye \circ ayako = ayako \circ ayako = amama$ (predicted; product not given in Marlowe 2010),

(44) $ola \circ akaye = ola \circ niye \circ ayako = ola \circ ayako = niye$ (given as *niye/bawa* in Marlowe 2010),

(45) $olako \circ akaye = olako \circ niye \circ ayako = olako \circ ayako = niyeko$ (given as *niye* in Marlowe 2010; may be a misprint since the sex markings of *olako* \circ *akaye* and *niye* do not match),

and

(46) $niyeko \circ akaye = niyeko \circ niye \circ ayako = niyeko \circ ayako = ayako$.

(VIII) Products of the sibling terms *niye* ('brother') and *niyeko* ('sister') with ascending and descending kin terms:

(47) $niye \circ amama = niye \circ niyeko \circ koko = niye \circ koko = koko$

and the Table shows the product *niye* \circ *amama* to be *koko/akaye*, in agreement with this equation,

(48) $niyeko \circ koko = amama$ (see Equation [15]),

(49) $niye \circ ayako = akaye$ (see Equation [4]),

(50) $niyeko \circ bawa = aya$ (see Equation [16]),

(51) $niye \circ olako = niye \circ self \circ ola = niye \circ ola = ola$,

(52) $niyeko \circ ola = olako$ (see Equation [17]),

(53) $niye \circ mama = niye \circ self \circ ?? = niye \circ ?? = ??$,

and

(54) $niyeko \circ ?? = mama$ (see Equation [18]).

Part 5: Affinal Terms

Not enough information is provided in Marlow (2010) to work out the structure for the affinal terms.

Part 6: Local Structural Modifications

Examples are not provided in Marlowe (2010), except for the self-reciprocity of the term *akaye*. Any implications entailed by the self-reciprocity of the term *akaye* for kinship relations, though, are not discussed by Marlowe.

Other Kin Terms: Cousin Terms, !tale and !tabe

The term *!tale* = *ola* o *niye*ko o *bawa* refers to the ‘son of a paternal aunt’ (i.e., to a cross-cousin) and the term *!tabe* = *ola* o *niye* o *bawa* refers to the ‘son of a paternal uncle’ (i.e., to a parallel cousin) (see Figure 6). How these terms relate to other kin terms products is not specified in the list of kin terms in Marlowe (2010: Table 3.1).

8.0 Isomorphism Between Observed Kin Term Map and Generated Kin Term Map

Figure 6 shows the generated kin term map, except that the reflexive kin terms products of *niye* with male marked kin terms and of *niye*ko with female marked kin terms have not been included. Comparison with Figure 1 shows visually that the two structures are the same, excluding the predicted kin terms products shown in Figure 6 since the kin term products represented by these arrows are not listed in Marlowe’s Table 3.1. Consequently, the Hadza terminology has the generative structure presented here. The key parts of the generative structure are: (1) the choice of generators for the ascending terms, namely {*self*, *bawa*, *niye*} for male terms and {*self*} for female terms, (2) the choice of generators for the descending terms, namely {*self*, *ola*, *niye*} for male terms and {*self*} for female terms, (3) the means by which sex marking of kin terms is introduced, namely through kin term products of the female marked *self* term with male marked kin terms, (4) the introduction of a neutral *self* term that serves as a covering term for the sex marked *self* terms and thereby joins the structure of male terms with the structure of female terms into a single structure, (5) the use of *aya* versus *ayako* to distinguish kin term products that reduce structurally to the same node, and (6) the self-reciprocity of the kin term *akaye*.

9.0 Cross-Cultural Comparison

We briefly compare the Hadza terminology cross-culturally with regard to the 6 parts of the generative structure for the other hunter-gatherer terminologies analyzed in a similar manner. For Part 1, the Hadza terminology, like other classificatory terminologies considered to date, has an ascending parental generator and an ascending sibling generator. For Part 2, the Hadza terminology differs from other classificatory terminologies by also using the ascending sibling term generator as a descending sibling term generator. When the descending sibling generator is not the same as the ascending sibling generator, the two sibling generators have interpretation as ‘older sibling’ and ‘younger sibling,’ though a more accurate translation would be ‘ascending sibling’ and ‘descending sibling.’ The latter allows the terms to be applied to persons who do not match the age criterion of older/younger with respect to speaker, as occurs, for example, with the Tongan terminology (Biersack 1982). With regard to Part 3, asymmetry is introduced into the terminology by only using a female marked *self* term as a generating term for the female kin terms. For Part 4, the Hadza terminology differs from other classificatory terminologies by having

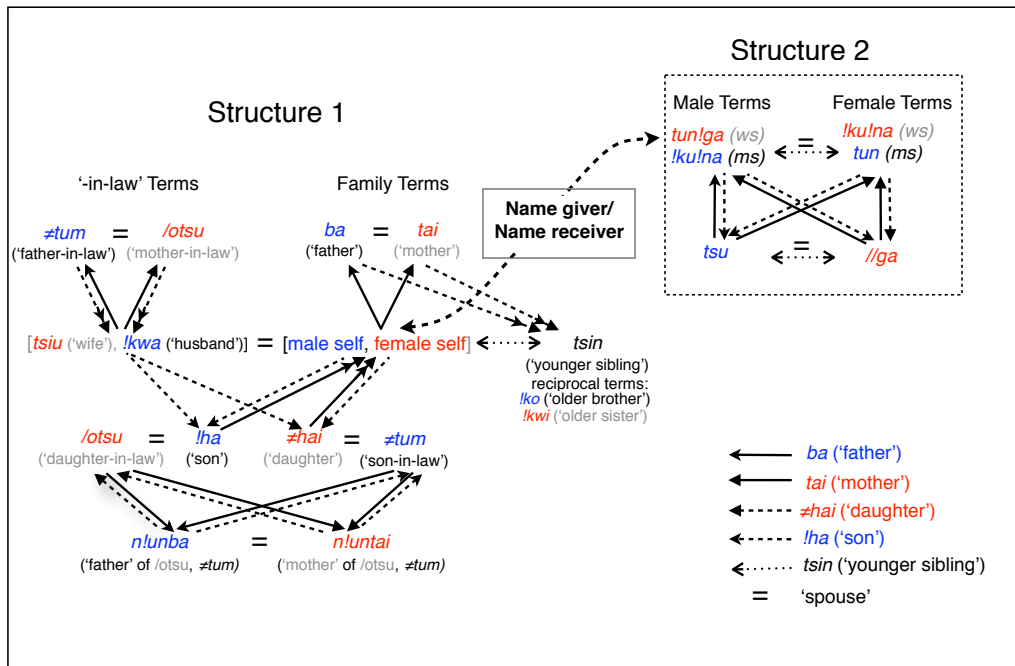


Figure 7: Kin term map for the !Kung San kinship terminology. Structure 1 has the kin terms for the family positions and Structure 2 encompasses all other kin term positions. The two structures are linked by the name-giver/name-receiver relationship. Kin terms are from Marshall 1976.

just a single structure of male terms, with female terms generated through kin term products of the female *self* term with the male marked kin terms, along with a neutral covering *self* term for the sex marked *self* terms. Any properties introduced in Part 6 are culture specific, hence are Hadza cultural kinship concepts embedded into their kinship terminology.

All 6 of these structural properties are culturally salient and are not properties defined through an imposed formalism; that is, the generative logic presented here is part of the ideational system of the Hadza and is not based on an imposed formalism, as is the case for kin term extensions based on the formalism of rewrite rules. Rewrite rules lack cultural salience, as has been shown by Kronenfeld (2009) through his research on the Fanti kinship terminology. The details of the generative logic, namely equations specifying the reduced kin terms corresponding to kin term products, indicate that there is a consistent and all-encompassing logic that underlies the kin terms and the interconnections among them as shown in the kin term map. It is the logical implementation of Parts 1 - 6 for generating a kin term structure that accounts for the properties of the resulting terminology. In other words, Parts 1 - 6 are our representation of their kinship ideas and concepts and so are not an imposed formalism. This means we can make cross-cultural comparisons at the level of the properties expressed in Parts 1 - 6.

Shown in Figures 7 and 8 are kin term maps for the !Kung San and the Kariera terminologies, respectively. Immediately apparent are the striking structural differences between these two terminologies and between each of them and the Hadza terminology.

9.1 Comparison of the Hadza terminology to the !Kung San Terminology

Briefly, the !Kung San terminology (see Figure 7) is composed of two substructures: (1) a substructure (Structure 1) for the relations making up the family positions, including affinal positions based on the Family Space and (2) a substructure (Structure 2) based on the two dimensions of gender and generation, with generation reduced to odd or even generation. Structure 1 consists of primary reference kin terms for those occupying family positions in the Family Space, but kin term products of these primary terms are not used to extend this structure vertically beyond the primary family relations. There are no kin terms, for example for *ba* ('father') of *ba* ('father') or *tai* ('mother') of *tai* ('mother') (see Marshall 1976). Products with affinal kin terms (*/kwa* ['husband'] and *tsiu* ['wife']) provide a horizontal extension of the terminology. Thus, the structure is extended horizontally through spouse, with a substructure centered on spouse (see "'in-law' Terms" in Figure 7) that is similar to the terms for the Family Space centered on self (see "Family Terms" in Figure 7). The terminology is extended further in a horizontal direction by 'parent' kin term products with the 'child-in-law' kin terms (see the *n/unba* and *n!untai* terms in the bottom left of Figure 7). Altogether, in the zero generation we find the kin terms: 'sibling,' self, 'spouse,' and 'parent' of 'child-in-law.' This horizontal dimension is reflected in the genealogical connections among those living together in a dry-season camp associated with a waterhole. Richard Lee (1979) provides genealogies of these camps, showing that they are structured horizontally through sibling, spouse, sibling of spouse, and spouse of sibling of spouse genealogical relations, including parents and offspring.

Extension of kin relations beyond the Family Space occurs through a name giving/name receiving system (Marshall 1976) wherein a newborn is given the name of a close relation. Typically, the first-born son is named for his father's father and the first-born daughter is often named for her mother's mother. The key structural aspect of the naming system is the conceptual identification of a child with his/her name giver, so that the name receiver has a kin world outside of the Family Space centered on his/her name giver. A generation-like kin term structure expresses the kin relations centered on one's name giver, with four positions (see Structure 2) determined through odd and even generation and male or female gender. The name giver/name receiver relation implies that the name receiver reckons kinship relations to the kin terms in Structure 2 as if he/she were his/her name giver; that is odd or even generation is with respect to one's name giver, not with respect to oneself. Vertically, the odd and even generations are connected in an upward direction by taking kin term products with *ba* ('father') or *tai* ('mother') and reciprocally in a downward direction by taking products with *!ha* ('son') and *≠hai* ('daughter'). Horizontally, the terms of the same generational type (that is, both terms are odd or both terms are even generation) are connected by affine products with */kwa* ('husband') and *tsiu* ('wife') and/or sibling products with *!ko* ('ascending/older brother'), *kwi* ('ascending/older sister') or *tsin* ('descending/younger brother or sister').

9.2 Comparison of the Hadza terminology to the Kariëra Terminology

The Kariëra terminology (see Figure 8) is in striking contrast with the !Kung San terminology. As has long been noted, the Kariëra terminology can be viewed as consisting of

four vertical “lines” of kin relations (compare with the single line in the Hadza terminology), and these can be transformed into the sociocentric classes making up the Kariera four-section system, with the later structured through odd and even generation and male and female gender in a manner structurally similar to Structure 2 in the !Kung San termi-

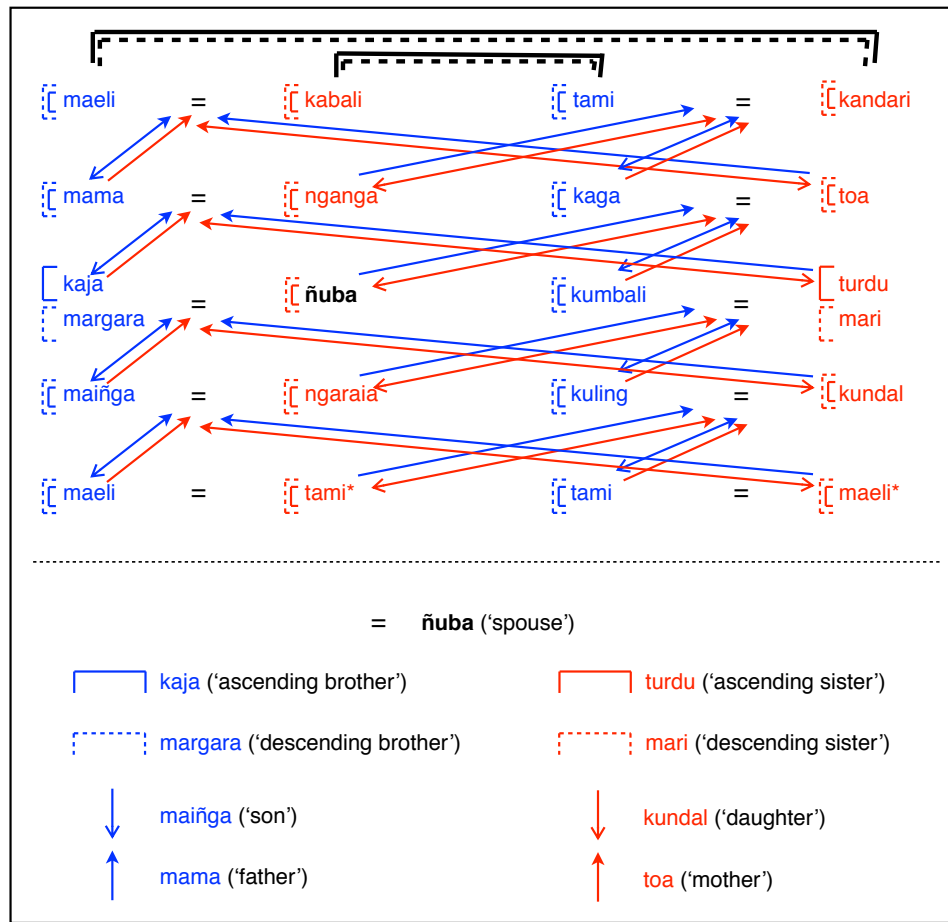


Figure 8: Kin term map for the Kariera terminology from the perspective of a male speaker. Terminology has both parental (*mama* [‘father’], *nganga* [‘mother’]) and sibling (*kaja* [‘elder or ascending brother’], *turdu* [‘elder or ascending sister’]) primary terms. The term *nuba* [‘cross-cousin’] is used structurally for the spouse relation. Horizontal sibling link shown in black since in one direction it refers to ‘brother’ and in the other direction it refers to ‘sister.’ The pairs of terms *tami*/tami* and *maeli*/maeli* indicate that the terms, *tami* and *maeli*, respectively, are each used for two structurally distinct positions having different sex markings. The kin term map is modified from Radcliffe-Brown 1913: Table 1.

nology, but differing in that Structure 2 is egocentric and not sociocentric. A striking feature of the Kariera terminology is the logical connection between the four lines of the terminology and the structural property that *maiŋga* (‘son’) of *nuba* (‘cross-cousin’) is *maiŋga* (‘son’) and *kunda* (‘daughter’) of *nuba* is *kunda* (‘daughter’) (see Leaf and Read 2012 for details), which implies that for logical consistency *nuba* must be the kin term that speaker applies to spouse; thus, the so-called marriage rule of prescribed *nuba*

(‘cross-cousin’) marriage is not so much a prescription for behavior as an affirmation of the kind of marriage that is consistent with the logic of the kinship terminology, namely the marriage of a man to a woman he refers to as *n̄uba* before marriage (and so he refers to her by the kin term *n̄uba* after marriage) makes the marriage consistent with the structural logic of the terminology. When a “wrong” marriage does occur, a man refers to his wife by the kin term, *n̄uba*, after marriage.

9.3 Cross-Cultural Comparison of the Hadza, !Kung San and Kariëra Terminologies

Now we can do a cross-cultural comparison of the three terminologies with respect to Parts 1 - 6.

Part 1: Ascending Structure

The Hadza and the Kariëra terminology use an ascending generating set of the form $A = \{\text{self, ‘male ascending term,’ ‘male sibling term’}\}$ for male terms (and an isomorphic ascending generating set for female terms), whereas the !Kung San terminology does not use a set of generating terms for Structure 1, but simply has primary terms for the positions in the Family Space (both consanguineal and affinal), including a male *self* and a female *self* position. The sibling position is recognized in a descending direction by the neutral kin term *tsin*, and the reciprocal of *tsin* then becomes *!ko* (‘older/ascending brother’) and *!kwi* (‘older/younger sister’), with the sex marking introduced due to the sex marked *self* terms. Structure 2 is generated from the ‘parent’/‘child’ primary terms, along with the structural equation that ‘parent’ of ‘parent’ of ‘parent’ = ‘parent,’ and from the ‘spouse’ term. The primary sibling term, *tsin*, implies that the

!Kung San terminology is a classificatory terminology according to the terminology having a primary sibling term as the marker for Morgan’s distinction between descriptive and classificatory terminologies, but it is not a bifurcate merging terminology due to the lack of kin term products using the primary consanguineal kin terms. This runs counter to, and points out the superficiality of, the usual classification of the !Kung San terminology as an Eskimo terminology based on the fact that there is lack of kin term differentiation, other than sex marking of kin terms, among genealogical cousin relations.

Part 2: Descending Structure

All three terminologies use a descending structure isomorphic to the ascending structure. This is likely a universal property of kinship terminologies. The Hadza terminology uses a descending sibling term that is isomorphic to the ascending sibling terms, hence an ascending/descending (or older/younger) sibling distinction is not structurally introduced. However, older/younger attributes appear to be added to sibling terms in the Hadza terminology in a manner comparable to older/younger sibling in English.

Part 3: Sex Marking of Kin Terms

Sex marking of kin terms is carried over from the Family Space for the !Kung San terminology. Sex marking is structurally introduced through a structure of female terms isomorphic to the structure of male terms for the Kariëra terminology. The Hadza terminol-

ogy differs by the generating term for the female marked kin terms just being a female marked *self* term and so the female marked terms are generated by the kin term product of *self* with male marked kin terms.

Part 4: Combined Male and Female Structures

The male and female structures for the Kariera terminology are linked through the sibling terms (see Leaf and Read 2012 for details). Part 4 does not apply to the !Kung San terminology since Structure 1 does not make use of consanguineal kin term products and the structure of male terms and of female terms in Structure 2 are generated as a single structure through products with spouse terms and with sibling terms. Introducing a neutral *self* term that is a covering term for the male *self* term and the female *self* term joins the male structure and the female structure discussed above for the Hadza terminology.

Part 5: Affinal Terms

The Kariera terminology does not have a spouse term separate from the consanguineal term *n̄uba*. Both the !Kung San and the Hadza terminology have sex marked, primary spouse terms. Differences between the Kariera and the !Kung San terminology with respect to affinal relations have been discussed above. The discussion of affinal terms in Marlowe (2010) is incomplete and so it is not possible to compare the Hadza affine terms with the other two terminologies.

Part 6: Local Structural Modifications

Identification of kinship terminology properties that are local modifications of a generative structure are generally lacking in ethnographic discussions of these three groups. Examples of Part 6 for the Kariera terminology includes the kin term labeling of several of the structural positions in the kin term map that are discussed in Leaf and Read (2012). Local properties of the !Kung San kin terms would include the joking/avoidance relationship associated with the kin terms (see Marshall 1976). One of the local properties for the Hadza terminology has been discussed above, namely the self-reciprocity of the kin term *akaye* ('mother's brother').

The latter suggests conceptual identity between 'mother's brother' and 'sister's son.' This is an identity associated, but not uniquely, with matrilineal kinship systems, yet the Hadza do not have a matrilineal kinship system. The self-reciprocity of the kin term *akaye* suggests the importance of one's 'mother's brother' in Hadza kinship behavior, but this is a topic that has not been discussed in the literature on the Hadza, though a cross-cultural study (Gaulin and Schlegel 1980) suggests, from an investment strategy perspective, that it benefits males to invest in sister's sons in patrilineal societies rather than own children when paternal certainty is low. This also fits in with the "grandmother hypothesis" of maternal grandmothers providing help and care taking to their daughter's children. Gaulin and Schlegel score the Hadza as having low paternal certainty, hence the Hadza fit with their statistical patterning, but they also score the !Kung San as having low paternal certainty, yet the !Kung San do not culturally distinguish the mother's brother in their kinship terminology, thus suggesting that more than just a quantitative relationship be-

tween paternal uncertainty and investment in sister's son is needed for an explanatory argument.

More specifically, we need in-depth ethnographic data regarding the qualitative difference in the terminologies of these two societies, the perceptions the Hadza have about kin relations such as the *akaye* kin term relation, the implications of it being a reciprocal kin term, the lack of a comparable kin term in the !Kung San terminology, and how all of this relates to kinship behavior in a variety of contexts, not just partially complete statistical patterning. For example, as mentioned above, marriages with cross-cousins (but not parallel cousins) occur with the Hadza, but whether these are paternal or maternal cross-cousins is not mentioned, though since *niyeko* ('sister') of *bawa* ('father') is *ayako* ('mother'), it would seem unlikely that there is marriage with paternal cross-cousins as this would make a man's 'mother-in-law' a woman he refers to as 'mother.'

The Kariëra, in sharp contrast with both of these groups, have an explicit prescriptive *ñuba* ('cross-cousin') marriage rule that is logically necessary for the kinship terminology to have four vertical lines of kin terms, each going from Generation +2 to Generation -2, with the latter property common to Australian Aborigine kinship terminologies. Changing 'child' of 'cross-cousin' is 'child' to 'child' of 'cross-cousin' is 'nephew' or 'niece' breaks the four lines of kin terms and changes the Kariëra terminology into an Iroquois terminology, with the latter lacking any logical requirement for a prescriptive 'cross-cousin' marriage rule. Typically, groups with Iroquois terminologies do not have 'cross-cousin' marriage rules. (Note that the Hadza terminology does not have the structural form of an Iroquois terminology, underscoring the fact that Murdock's kinship terminology classification is based too much on superficial similarities that may be the consequence of dissimilar generative processes; see Read 2014 for an outline of an alternative typology of kinship terminologies based on the generative logic of kinship terminologies.) Another qualitative, cultural difference occurs with the !Kung San joking/avoidance characterization of kin terms that plays a central role in !Kung San kinship behavior (Marshall 1976), yet neither has a counterpart in Hadza nor Kariëra kinship relations and behavior.

Rather than providing insights into differences in the kinship foundations of hunter-gatherer societies, comparisons of hunter-gatherer groups have tended to focus on differences in behavioral patterns in isolation from the cultural idea systems that frame behavioral patterns. For example, in their comparison of the Hadza and !Kung San hunter-gatherer groups, Blurton Jones, Hawkes and O'Connell (1996) focus on five behavioral differences: (1) Hadza children collect food for themselves, but !Kung San children do not, (2) Hadza women have higher fertility than

!Kung San women (but see Read and LeBlanc 2003), (3) the Hadza are less responsive as parents than the !Kung San, (4) !Kung San men use traps to catch animals more often than do Hadza men (but see Wood and Marlowe 2014), and (5) Hadza men and women are segregated and in opposition, whereas, they observe, !Kung San relations between the sexes are more egalitarian, though they distinguish between a man's side and a woman's side of the fire in front of a hut, including the notion that a man should not sit where the genitalia of a woman have touched the ground, and vice versa. Even when a

hut is not built, sticks are placed to make clear which is the man's side and is the woman's side of the fire (Marshall 1976).

While each of the differences discussed by Blurton Jones and co-workers is of interest, lacking in their account is any discussion of the cultural or social context in which individual behavior takes place and the constraints this places on behavior. A connection between social context and environmental adaptations by hunter-gatherer groups can be seen clearly in a cross-cultural study of the correlation between a sense of place (SOP) and social cohesion (Thompson 2016). The correlation between SOP and overall social cohesion is high ($r = .95, p < 0.05, n = 25$). However, the Hadza stand out in this sample by having the lowest score for both association with space (SOP = 1.67,) and social cohesion (SC = 1.67), with both scales varying from 1 = *very weak* to 5 = *very strong*, whereas the !Kung San and the Walbiri (as a proxy for the Kariera, who were not part of their sample) have moderate to high value for these two variables. The low value of the Hadza on the social cohesion measure may relate to fissioning being a way to resolve bickering.

10.0 Conclusion

It is not immediately obvious as to why each of these hunter-gatherer groups has such structurally different terminologies, especially since what is needed for an effective adaptation as a hunter-gatherer group in the geographical regions where these groups are located is not substantially different among these three groups. Briefly, there needs to be an organizational system that allows for flexibility in the spatial and distribution of individuals and families in accordance with spatial and seasonal variation in the abundance of food resources so that local population densities can vary in accordance with resource variation for seasonal and stochastic reasons. For so doing, there need to be cultural criteria regarding who has rights to resources in the wild, and how ownership of resources at a group level are transformed into ownership at the individual level. For example, common to hunter-gather groups, including the Hadza (see Marlowe 2004b), is the notion that resources that are small in size, do not have high risk for obtaining them, and do not require special skills, are "owned" by the person who obtains them and are distributed or shared only according to individual interests in so doing and not out of culturally expressed obligation. At the other extreme, resources that come in large units, have risk associated with procuring them (which need not be physical risk, but may be the risk of failure and thus coming back empty handed), and require skills that are variably distributed across individuals, are owned collectively in the wild and subject to cultural rules regarding their distribution, and only become individually 'owned' after being distributed. The specificity of the cultural rules appears to correlate with the degree of risk, so that, in effect, risk is distributed over multiple individuals through cultural specification rather than through reliance on individual decision making about sharing resources. Cross-cultural research has tended, though, to focus, on the way people are mapped onto resources and how resources, when obtained, are mapped onto people, with analytical goals such as determining the extent to which groups have worked out optimal, or near optimal solutions, as discussed by Blurton Jones (2016) for the Hadza. This needs to be complemented with a

focus on the cultural means by which the organization requirements for effective adaptations are achieved through systems of kinship and other cultural institutions (see discussion of the Netsilik Inuit adaptation in Read [2005]). The latter requires a different approach than the former, as it involves working out patterning at the level of the individual society relating to, for example, the cultural idea systems that are involved (see Leaf and Read 2012), which depends on working out those cultural idea systems in detail (see, for example, Read 2011). How this can be done with the kinship terminologies that are central to understand the kinship of hunter-gatherer groups, and how these lead to cross-cultural comparison with regard to patterning discerned at a qualitative, structural level discerned through detailed analysis of individual cases, rather than through a quantitative, phenomenal level statistical analysis, has been the topic of this article.

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