TALK IS NOT CHEAP
KINSHIP TERMINOLOGIES AND THE ORIGINS OF LANGUAGE

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Kinship terminology is a human universal, a kind of cultural knowledge circulated through language. In this paper I explore the possibility that the need for social rules prompted the development of fully syntactic language via kinship terminologies. In other words, kinship terms are at the core of modern language. They require uniquely human cognitive features such as symbolic reference and recursiveness, which in turn require a cognitive capacity beyond that of non-human primates. The conceptualization of kinship types was crucial in the transition from non-human primate to human social organization and the 'invention' of kinship terms facilitated this transition. The heuristics used in kin classification could have provided the decisive cognitive leap that introduced the essential tools for organizing and expanding social relationships and increasing the chances for survival. Thus kinship terms could have been the original nucleus of human language.

Introduction

In *Systems of Consanguinity and Affinity of the Human Family*, L. H. Morgan wrote: "A formal arrangement of the more immediate blood kindred into lines of descent, with the adoption of some method to distinguish one relative from another, and to express the value of the relationships would be one of the earliest acts of human intelligence..." (1997[1871]:10). While a broad range of theories about the origin of language highlight the importance of the social context and often include references to kin, most linguists and biologists are not familiar with the structure of kinship terminologies. What kinship terminology reveals about the human mind is an immensely valuable facet of kinship and another reason why kinship studies should regain centrality in theorizing and not only in cultural anthropology. This is a domain where interdisciplinary research can, and should, converge.

Kinship terminologies are universal systems of classification used by humans to conceptualize and manage their social world of kin. Besides its sociological function, kinship terminologies have linguistic and cognitive functions as well (Greenberg 1990:30). As an object of study, kinship terminology has been approached most often as a way to explain current-day, cross-cultural variation in social organization by to environmental features. Anthropologists and linguists have also reconstructed proto-kinship

terminologies as a way to reveal past sociological patterns. The cognitive component has also been approached through identifying the structural rules that govern the semantic domain of kinship terminologies (see Kronenfeld 2009 for a recent overview).

I have proposed (Milicic 2011) that a kinship terminology is a historical product based on the same cognitive tools found in language, but with more specific cognitive heuristics that make it a good candidate for a cognitive module, at least in a weak sense. The modularity theory of cognition has been advanced by evolutionary psychologists (Cosmides and Tooby 1992, 1994; Sznycer, Tooby and Cosmides 2011; Cosmides and Toobey 2013), through reverse engineering postulating evolved complex systems of highly specialized, domain-specific and content-rich modules, including a kin detection system. I suggest that kinship terminologies have played a crucial role in the rise of languages. I argue that a 'kinship module' includes some general linguistic features such as markedness (Greenberg 1966, 1990), conjunctivity (see Kronenfeld 1996, 2011; Hage 1997, 1999, 2001 for implications of markedness and conjunctivity in kinship terminologies) and recursion (Hauser, Chomsky, and Fitch 2002; Read 2008, 2010, 2012). I hypothesize that syntactic language may have evolved from these core properties of kinship terminologies. Thus once a kinship terminology arose through its functionality of providing a native theory about societal organization, it could have been exapted and applied to other domains through its functionality as a recursive computational device.

That kinship terminologies are subject to changes in both cultural and linguistic domains (see Read 2011) attests to their importance in bridging between those two domains and posits their historical relationship. Since the seminal work of Lévi-Strauss (1949), it has been well established that kinship is "good to think" with and for generating rules for life in social groups. Kinship terminologies, among other things, reflect rules associated with conceptualizing kin and marriage. Kinship and language have been cited as the first complex related to behavioral traits among humans (Chapais 2008:21-22). Although kinship in its embryonic forms is not confined to humans, taken holistically in complex forms such as kinship terminologies, kinship represents a specifically human behavioral complex. I propose that kinship terminologies make use of the cognitive heuristics found in language, provided the origin for the decisive cognitive leap that directly resulted in the novel evolutionary direction for human behavioral and cognitive modernity (Leaf and Read 2012; Read 2012). I will develop here a close connection between the 'invention' of kinship terminologies and the origin of language.

Timing the Origin of Language

The origin of symbolic communication in the archeological record is inferred from fossil remains and artifacts interpreted as symbolic representations. Several authors in the recent volume *The prehistory of language* (Botha and Knight 2009b) take the position that the assorted fossil, archaeological, and biological evidence points to an early emergence of complex language around 500 000 years ago at the earliest, with another possible transition around 250 000 years ago with the speciation of *Homo sapiens* as a distinct taxon. There are very few pre-50 000 BP (Lower and Middle Paleolithic) objects with symbolic representations in the archeological record: simple incisions, notches and piercing per-

haps attest to a slow process of evolving cognition (White 2003), but environmental and demographic factors might have interrupted their production (d'Errico *et al*. 2009). While the evidence for using ochre pigments reaches back to some 164 000 years ago, and even to 250-300 000 years ago, the earliest objects with possible symbolic representations found in Africa are pierced shells from Morocco dated to 82 000 BP, ochre, and pierced beads at Blombos Cave dated to 70 000 BP (Bouzouggar *et al*. 2007; d'Errico *et al*. 2009; Henshilwood and Dubreuil 2009; 2011).

The use of personal adornments such as a necklace of shell beads is interpreted as the ability to take a point of view of another, a capacity that is beyond the cognitive abilities of non-human primates. Therefore the production and use of ornamental beads can be taken as evidence of a distinctly human cognitive capacity to produce a representation of a representation, or recursion. Based on the time spent on grooming, group size and brain size correlations, Dunbar (2009) proposed an earliest date for the appearance of simple language at 500 000 years ago. Inferring from fossil and archaeological evidence, Read (2008) traces the incremental increase of working memory and concludes that technology based on recursion did not appear before 300 000 years BP, with an increase after another 200 000 years at the approximate time of Blombos cave, followed by the abundance of symbolic representations in the Upper Paleolithic.

Researchers have found that the gene, associated with fine-tuning the motoric ability necessary for articulate speech, was established in humans about 200 000 to 100 000 years ago (Enard *et al.* 2002; Fisher and Scharff 2009), or even pre-400 000 years ago, and shared with Neanderthals (Krause *et al*. 2009). Diller and Cann (2009), however, dispute the importance of the FOXP2 for human language, thus countering the theory of a saltatory genetic mutation (Klein 2000) around 50 000 years ago that equipped human language with syntax.

What is Language Good For?

The answers to this question most often cluster around the advantages of communication in a social context, such as referring to, and communicating about, past experiences and future planning. Hauser Chomsky and Fitch (2002:179) see a variety of sub-functions of language as a system of communication:

> The communicative uses can be further subdivided: humans use language in just about every social interaction, including courtship and mating, aggressive interactions with competitors, caring for offspring, sharing information with kin, etc. There can be little doubt that language is useful for communication with other humans, and communication must be one of the primary selective forces that influenced the evolution of FLB [language in a broad sense].

The current consensus is that language evolved in a social context as a part of distinctly human collaborative efforts (e.g., Burling 2005; Hurford 2007; Tomasello 2008). Because of recursive intentionality, an awareness of common goals, and helping others, human communication is distinct from the kind of communication found among the great apes (Tomasello 2008:172-73). Tomasello highlights the importance of a "shared collaborative activity" that starts with infants using pointing and iconic gestures as a form of

collaborative communication effort in the pre- linguistic phase and is eventually transformed into spoken language (2008:161-170). It has been firmly established that the presence of an "other," a role reversal imitation and awareness of shared intentions unlike what is found among other great apes, are crucial to the acquisition of language. Karmiloff-Smith has argued extensively (2000:567) that the human mind is distinguished from other species through its capacity to represent recursively its own representation, or representational re-description, that enables children to be 'theory builders'. In a study of deaf children of hearing parent, Goldin-Meadow, Mylander, and Franklin (2007) concluded that children have a pre-linguistic predisposition for combining words, signs, and gestures. These studies reconcile the nativist and constructivist theories of language as a product of innate structures as well as of acquired knowledge through social interaction.

In contrast to non-human primate hunting literature on human hunting and sharing shows that these activities are based on intentionally planned and shared goals patterns (Melis, Hare, and Tomasello 2006; Tomasello 2008). To plan and coordinate actions requires recursive thinking or intention-reading. Tomasello (2008) has hypothesized that human communication evolved from 'attention getter' apes in group activities to pointing associated with 'mutualism' in genus *Homo*, conventional pantomiming used in reciprocal informing (earlier sapiens) and to cooperative reasoning and norms in sharing necessary for 'cultural group selection' (later sapiens). The last piece in this scenario for the evolution of human communication are arbitrary vocal conventions (Tomasello 2008:239). Recursive mind-reading was the new cognitive step that, in Tomasello's view, was necessary for the understanding of joint goals early on in genus *Homo*. Petitto (2000) has found in her experiments, however, that although similarities exist between gestures and language, infants' gestures are not structured in the same way as language. Her findings show that babies are born with an innate need to search for basic language structure that consists of combinatorial units based on phonotactic and syllabic information. Symbolic gestures appear only after the infants have learned the referent's meaning, "suggesting that the use of symbolic gestures is dependent on their knowledge of language rather than the reverse" (Petitto 2000:116). Thus both gestures and words are rooted in a domain-specific knowledge rather than a general cognitive capacity.

Taking a different approach, Bickerton has placed an emphasis on the classificatory value of language: "Language is not even primarily a means of communication. Rather it is a system of representation, a means for sorting and manipulating the plethora of information that deluges us throughout our waking life" (Bickerton 1990:5). As a classificatory, and consequently, an explanatory device, language is good to describe and explain the world to ourselves and to others. This is abundantly exemplified in the anthropological literature as a 'people's worldview'. Language is a way of introducing order out of chaos through sorting out the huge amount of stimuli into a smaller number of manageable categories and, equally importantly, figuring out the relationships among these categories. Kinship terminologies do the same job in a potentially confusing social context where various forms of relatedness (genetic and otherwise) are not obvious.

Durkheim and Mauss in their classic work *Primitive Classification* (1963[1903]) ask what could be the model for systems that are not found in nature. In their view, the

model is the society itself. According to Durkheim and Mauss, only rudimentary categories are innate - left, right, up/down, back/front. The first logical categories were social categories; the first classes of things were divisions of human society and relationships among them are analogous to the structure of the society. In small-scale societies, or face-to-face communities, kinship categories overlap strongly with social categories and the logical hierarchy is just one aspect of the social hierarchy. Ultimately, thinking is modeled after social organization. Although Durkehim and Mauss did not specifically equate social groups with kinship and were interested in showing that dual organization was the basis of classification systems, the implication is that in a scaffolding manner the relational model found in kinship can be applied to figure out the rest of the world. Taking up their conjecture, N. J. Allen (2000) asked: Could Durkheim and Mauss have been right? Within the framework of the current discourse on cognition, language, and kinship terms, indeed they could have been on the right track.

What were the first categories? This question has been tackled in the Western tradition from Aristotle to the present. One might ask: What are the first categories that a child learns? If we look at the acquisition of spoken language in children, then kinship terms are the first terms taught to children and kinship categories are first learned categories. Importantly, kinship terms are also relational terms. Unlike other primate societies, the human social context also includes rules of behavior, which in turn, require social recognition and categorization. While some awareness of "familial relatedness" exists among non-human primates, assigning social roles such as "spouse" and "parent" is distinctly human (Tomasello 2008:186).

What is Kinship Terminology Good For?

Although there is an agreement on the co-evolution of such traits as larger brain, sociability, and language, what exactly is the connection among the three variables is not entirely clear. Barnard (2009:219) argued that the emergence of language coincided with other forms of communication including human kinship. He proposed a 'multi-revolutionary' model that unfolded from simple language to syntactic language in several stages coinciding with the size of neocortex, group size, social organization, and kinship. "At first language was essentially social, and later it became generalized to communicate much more beyond the social. Art, symbolism, religion, mathematics, and so forth would follow" (Barnard 2009:220). I propose that the fully syntactic language included kinship terminologies and evolved in the third stage coinciding with *Homo sapiens*' increasingly complex social life and in a manner consistent with archaeological evidence of symbolic representations as well as linguistic reconstructions global etymologies of kinship terms (Matthey de l'Etang *et al.* 2011).

Human groups seem to reach a natural limit of about 150 people (but see Read 2012 for a limit of 90 persons) and Dunbar (1993, 2001, 2008) has suggested that this may be an index of the extent of the human ability to process information about those we know as persons (see also Read 2012). Dunbar calculated that this is approximately the number of persons comprising three generations of living descendants of an ancestral pair five generations in the past. The apical ancestral couple would also be the living, oldest

generation who can act as repositories of the community's past, including genealogical information whether true or fictive (in a biological sense) (2008:148). Transmission of cultural knowledge, particularly in pre-literate societies, involves story telling that sends important information down the 'oral pipeline' (Barber and Barber 2004). Presumably the essential prerequisite for such transmission of knowledge, most importantly knowledge involving kin, requires cognitive abilities for the Theory of Mind or 'intentionality'. Normally human cognition can handle a maximum of fifth-order intentionality: I believe that you think, that I know, that you wish, that I understand … X (Dunbar 2008). If the stories are about kin, than a good story teller has to be able to keep in mind relations of relations of relations …. Good memory is essential for story telling and various mnemonic devices are employed for this purpose (Barber and Barber 2004). In contrast, non-human primates are limited mostly to the immediate spatial and temporal context. Stories about ancestors give cohesion and identity to a community and this functionality is neither restricted to pre-literate cultures nor to small-scale societies. On the contrary, it was an integral part of the nation-building process in 19th Century Europe (e.g., Karakasidou 1997 on Greece) and is equally important in the current building of the European Union and European identity (Shore 2002).

Kinship and Kin Recognition in Non-human Primates and the Transition to Human Institutional Forms

The patterns for lumping and splitting in kinship terminologies show that there is no simple one-to-one mapping between human conceptualization of kin categories and genealogical relationships, not to mention the denial of existing biological ties and the invention of so-called fictive kinship where biological ties are nonexistent (for example, see El Guindi on milk kinship, this issue). The views on the transition to distinctly human behavior vary from a continuation of non-human patterns to the phase-driven shifts. Primatologists point out that phylogenetic continuity between non-human primates and humans is manifested in anatomy and by analogy behavioral continuity should also be detectable (but see Read 2012 for a contrary view). The organization of human groups into multiple families, rarely found in other species, probably evolved from promiscuous breeding to stable breeding units. In addition, bilateral kinship–the recognition of both matrilateral and patrilateral relatives–is likely a uniquely human phenomenon. Studies with primates have generally shown that familiarity between siblings is a result of proximity and shared experience with the same mother (Chapais 2008; Sackett and Frederickson 1987; Welker *et al*. 1987), but nothing in non-human primates matches the symbolic recognition of sibling relationships in humans.

Female philopatry is the most primitive and widespread way to form biological kinship groups among non-human primates. With localized groups of females and dispersed males, biological kin recognition is based on proximity and therefore restricted to uterine kin rarely exceeding three generations, while patrilines are fragmentary (Chapais 2008:34). Based on the residence pattern, non-human primates recognize primary biological kin (mother, sibling, offspring) and some secondary relations (grandmother and grandoffspring, offspring and maternal sisters). According to Chapais, agnatic kinship

emerged as a byproduct of the stable breeding bond and preexisting adaptations related to uterine kinship (but see Read 2012 for an alternative scenario). Stable breeding groups and pair bonding would result in paternal recognition. Through female dispersal and pair bonding, stable breeding groups would have been established, with females maintaining relationships with their natal groups and at the same time acting as peacemakers among the affines (Chapais 2008:224). Stable breeding groups and lower level of sexual dimorphism coincide with the mediation of females who would otherwise be at risk of injury (Chapais 2008:225). These behavioral changes occurred at the time of *Homo erectus*, "the primitive tribe"–a pre-linguistic entity in contrast with its later symbolic elaboration. The key factor was the extent to which the dispersed females could maintain relationships without close proximity. This points to the emergence of language and, more importantly, to the symbolic reference that enabled women to maintain contact with absent natal kin. In short, what Chapais calls "exogamy configuration"–stable kin groups, enduring breeding bonds, a dual system of residence (pre-marital and post-marital), incest avoidance among co-resident close kin based on the recognition of both matrilateral and patrilateral kin, wider kinship networks that exceed local groups, opposite-sex sibling bonds, and recognition of affinal relationships–is a bundle of behavioral traits of which only some are found in non-human primates, while humans have all of them. This distinctly human arrangement requires symbolic reference and could have become an institutionalized norm only with the development of language (Chapais 2008:26).

In this scenario, a gradual transition led from ancestral phylogenetic features to human behavioral modernity expressed through rules of social behavior. Read (2012) a, however, argues for a phase-shift transition. Explicit rules are based on more than just kin recognition through face-to-face contact and developmental proximity (Read 2012). Rules that were fundamental to the transition required the symbolic capacity to identify and label kin displaced in time and space. Recently Hill *et al*. (2011) have compiled data from contemporary hunter-gatherer groups. They found that most individuals in residential groups are genetically unrelated yet they maintain wide social networks with dispersed kin through visiting and exchange of vital information.

Kinship Terminologies are Good to Think With

In *Primitive Classification,* Durkheim and Mauss (1963[1903]) tried to show that the first categories of thought were social categories. Leaf and Read (2012) argue that what a child learns through kinship concepts is a precursor for understanding concepts such as social roles in general. Human sociality is tied to cooperation, and language certainly improves cooperation through planning and organization, but some populations of chimpanzees also organize territorial patrolling and cooperate in hunting (Boesch 2002). For example, the tai ichimpanzees' hunt for small mammals with a high level of coordination, although meat sharing with the leaders who get the biggest shares does not involve coordination and planning (Tomasello 2008). It is rather more promising to look at the role of language in sharing the living space, and that is primarily the domain of kin. Kinship terminologies are good to think with: they allow for the conceptualization of categories dividing a social group into marriageable and non-marriageable individuals; they divide

individuals between consanguineal and affinal relatives; they divide generations and assign individuals to moieties, lineages, and kindreds; they provide unbroken connections to apical ancestors and, importantly, create so-called fictive kin by metaphorical extensions.

An ethnographic example from the Mediterranean illustrates the use of kinship categories. In the village of Brusje, located on an island off the coast of Croatia with about 150 permanent inhabitants, all villagers know each other and are aware of their kin ties. If not entirely sure, they employ various strategies to locate an individual mentally within the kin network. The most inclusive category is the village itself in opposition to another village, or the entire island to the mainland. Outside of the village, individuals imply, demand, or expect all kinds of favors from those who were considered to have genealogical ties to the village, requesting and sharing information, and reciprocity through verbal communication, all excellent examples of mutualism. Within the village, individuals were most often identified at the level of the broadest kin category, a 'grapevine' (*loza*). A 'grapevine' is a bilateral, localized kin group with an apical ancestor, male or female, whose name is associated with a house and is added to all individual names since many have identical first and last names (Milicic 1998). There are about 15 'grapevines' with living members. On the level of the extended family, one's place could be identified through the first name since the villagers name their children after father's father and father's mother for the first born boy and girl respectively, and then after mother's father and mother's mother for the second born, extending the same patrilateral/matrilateral sequence to aunts and uncles for the next born, etc. Incidentally, this also identifies cross and parallel cousins, although their Eskimo kinship terminology does not make this distinction. The villagers determine one's position through relation-of-relation calculations; for example, an affinal relative could be identified through the procedure "N. is husband's brother's son", a kin type that does not have an associated kin term. In such a case, both consanguineal and affinal relations were formally calculated in the same way. This was done both egocentrically and from another person's perspective. The reasons for locating individuals within the network were interest in wealth, particularly land ownership and inheritance, to provide connections for jobs or health treatment, often through connections outside of the village and on the mainland, or to gossip most often about marriages, paternity issues, and divorces. An important aspect of this discourse involving kinship is trust. Although this example comes from a modern state society, we can imagine that this most basic human interest in matters of kinship, tinged with or heavily vested in emotions, is not far from what might have taken place in the remote past among our ancestors at the time of the great dispersal some 100 000-60 000 years ago, or even earlier.

Linguistic Reconstruction of Proto-sapiens Kinship Terms and Its Implications

The first verbal articulations acquired by babies make kinship terms the first words and first symbolic meanings in the acquisition of language. Ruhlen (1994) discovered the distribution of the kinship etymon kaka ('mother's brother', 'elder brother', 'grandfather') and subsequently contrary to Jakobson ([1960]1971) Bancel and Matthey de l'Etang argued that kinship etyma *mama*, *papa*, and *kaka* represent not only first nursery

words, but also first words of proto human language (Bancel and Matthey de l'Etang 2002; Bancel, Matthey de L'Etang and Ruhlen 2006; Bancel *at el*. 2011; Matthey de l'Etang *et al*. 2011). The findings led the researchers to an understanding of these terms as a substratum of human protolanguage rather than onomatopoeic words as Jacobson (1960) and Murdock (1959) initially suggested. Bancel *et al*. (2011) point out that the nursery kinship terms are taught to babies rather than being a product of natural babbling. Matthey de l'Etang *et al*. (2011) also suggest that the global semantic and anthropological study of these terms show that sex, age status, and filiation were recognized in the first *Homo sapiens*' kinship system.

Cognition

Hauser, Chomsky, and Fitch (2002) have proposed that the FLN, the faculty of language in the narrow sense, is based on the uniquely human computational mechanism for recursion, the capacity "to generate an infinite range of expressions from a finite set of elements". They argue that "FLN may have evolved for reasons other than language, hence comparative studies might look for evidence of such computations outside of the domain of communication (for example, number, navigation, and social relations)" (2002:1568). They point out that the core recursive aspect of FLN is uniquely human and therefore represents the deepest challenge for a comparative evolutionary approach to language. They did not, however, elaborate how exactly is recursiveness crucial for social relations, which according to these authors fall outside of the domain of communication.

Recursiveness in language allows for an infinite concatenation of sentences and has implications for intentionality. For example, acting on the belief that someone else has a belief is fundamental to intentionality or the Theory of Mind. Number systems are another domain where recursive thinking is utilized. In tool production, recursion is implied in the idea that we can produce a tool that can be used to make a tool, and so on. It is in the domain of kinship where this cognitive tool is of fundamental importance. Recursive reasoning is involved in the conceptualization of a relation and in producing a new concept of relation-of-relation (Read 2012), which of course is essential for producing kinship terms. Generation, sex, and genealogical status are common criteria for distinguishing biological kin among non-human primates, but in addition to those, the linking relative necessary for the production of a relation of a relation, is crucial for structuring human kinship in terms of both broader categories and less inclusive ones.

Kinship terminologies provide both ego-centric and socio-centric perspectives. In the ego-centric perspective, the father/child relation is based on the linking relative, the mother. In so doing, it is first necessary for the concept of self to be defined in relation to others. Read states:

> From an algebraic viewpoint, recursion provides the basis for defining a binary product over the relations used in genealogical tracing. Genealogical tracing proceeds recursively. First the myself position is instantiated and then a genealogical position is instantiated by a person having the specified genealogical relation to the person instantiated as myself. Second, and recursively, the first step is repeated by using a person identified in the first step as the new instantiation for the

myself position. (2011:157).

The importance of the self-position is manifest in children's description of kinship terms. Thus Quechua and Spanish speaking children in Pitumarca, Peru, spontaneously included *ñoqa* ('I', 'Self') in their ego-centric description of kin and kinship terms (Milicic 2011). Cross-cultural variation shows how the capacity for recursiveness is involved in calculating the distance between relatives through different paths in American and Tongan calculations of genealogical distance (Bennardo and Read 2011; Read 2011).

Numerous Piagetan studies show that the ability to define nuclear kinship terms is quite uniformly associated with the stages of cognitive development in children (see Milicic 2011 for an overview). Definitions of kinship terms have been typically used in these studies as an index of cognitive development. The ability to master the definitions unfolds in three stages that also roughly correspond to the child's ability to master different orders of intentionality: second order at 4-5, third order about 6, fourth order about 9, and fifth order about 11 years of age (Henzi *et al*. 2007). There is also evidence that children use complex kinship terms for secondary and tertiary relatives easily and without mistakes at an early age, although they are incapable of providing the exact definitions of these relations. Bilingual Quechua and Spanish speaking children acquire effortlessly the use of non-nuclear kinship terms without being able to fully define their relational properties until age 8-12 (Milicic2011). In contrast, non-human primates do not have the working memory capacity needed for recursive reasoning (Read 2008).

Human kinship implies much more than primary kin recognition and genealogical relationships. It abounds with multiple symbolic meanings that presuppose cognitive abilities far beyond the capacity of non-human primates. The varied classification of kin across cultures often includes the denial and creation of kinship ties where there are no biological relations. Understanding kinship through metaphors is common across cultures. Thus many cultures use metaphors of creeping plants such as 'grapevines' (Milicic 1999) to talk about kin groups. To cite just one of countless examples, Zinari, a winding belt in Greek folk costume metaphorically describes the genealogical distance and the prohibited degrees for marriage. The creation of biologically fictive kinship is often based on metaphorical thought such as blood and oil as contrasting metaphors are used for consanguineal and "fictive" kinship, respectively in Greek understanding of degrees of genealogical relatedness and the degrees of so-called fictive kinship (du Boulay 1984). The capacity for metaphorical thought implies overlap between two semantic domains (Wagner 1986; Lakoff and Johnson 1980; Pinker 2007). Metaphorical thought is based on analogy and analogy is based on similarity of relations and relations of relations that requires recursion.

Language and Darwinian Fitness

It is very difficult to assess quantitatively the direct impact of the faculty of language on fitness. Indirectly, however, some inferences are possible. Pinker (1997) points out the cost of larger brains: risk involved in childbirth, the less efficient locomotion of women, prolonged dependency and learning in children, and the fact that humans react more slowly than other animals. It takes a lot to feed the brain: the brain comprises only 2% of

body weight, but consumes 20% of energy intake. However, the tradeoff makes it worth much more than its weight: the benefits of the design of the human mind outweigh its cost in evolutionary terms (1997:154). Locke (2008) argues that the production of linguistic patterns is cheap, while the benefits are great in terms of fitness. This capacity is helpful in bids or status and mating relationships and "in evolution, may have allowed the content of knowledge and structure to become complex" (2008:647). Thus although the energy investment in the production of unnecessarily complex speech patterns is low, the cost of evolutionary changes to make this possible was quite high.

According to the theory of biological kin selection (Hamilton 1964), signaling and sharing information should primarily take place among biological kin and should be based on trust. Hrdy (2009) argues that humans developed linguistic patterns to ensure trustworthy alloparents. According to Hrdy (2000; 2005; 2009) selection pressures for distinctly human cognitive and emotional capacities stem from our evolutionary past as cooperatively breeding apes. An important part of this behavioral trait is allomothering, the help provided to new mothers. While chimpanzee mothers rarely trust others when it comes to newborns who are shielded from the touch of others, human mothers often rely on allomothering. To make allomothering safe, they must recognize potential helpers not only for the newborns, but also for the weaned infants (Hawkes 2010). Hrdy points out that human brains are specially adapted for sympathetic interactions and forging relationships. At birth a large portion of brain tissue, especially neocortex, is devoted to processing facial expressions, gestures and vocalizations of others motivated by older subcortical sections of the brain that are related to the emotions and memories (2009:40). Theory of Mind is a particularly advantageous skill for efficient mothering and better survival of offspring and is involved in choosing potential alloparents. Therefore humans must have developed a signaling system that will indicate trusted individuals. Non-human primates are good at assessing status of individuals, keeping some track of lineal biological kin and possessing a rudimentary Theory of Mind that they use to form coalitions through manipulations that come under the rubric of the Machiavellian Intelligence hypothesis. But why are humans so much better equipped for mutual understanding (Hrdy 2009:45-47)? An evolutionary solution through "devices for manufacturing kin" (2009:272) and a variety of "linguistic strategies" makes possible to obtain alloparenting from individuals who are not biologically related. The devices range from shared paternity to foster parenting to the varieties of "fictive" kinship systems discussed above, all of which involve language. Recently Cosmides and Toobey (2013) describe the architecture of a kin detection system that, based on proximity cues, computes degrees of relatedness. Exemplified in much of the ethnographic record, kinship terminology turns strangers into kin and is, among its other functions, a linguistic device that creates that illusion of producing potentially trustworthy individuals. Since paternity always has a degree of uncertainty, cheating is also made possible through the use of kin terms.

Although not cheap in evolutionary terms, it paid off to invent kinship terminologies and then to apply them to genealogical relatives as well as metaphorically to non-biologically related individuals. Linguistic labels referring to kin who have an interest in the reproductive success of new mothers would be extremely helpful.

Grandmothers engage extensively in allomothering their daughters' offspring. Presumably grandmothers' investment in their grandchildren is best carried out in a flexible pattern of matrilocal/bilocal residence. A by-product of this could be longer post-menopausal survival, a uniquely human trait. Consequentially, post-menopausal longevity in females, passed on to both sons and daughters in a changing environment with increased aridity and seasonality 2-3 million years ago, might have given rise to the genus *Homo* (O'Connell, Hawkes, and Blurton-Jones 1999; Hawkes, O'Connell and Blurton-Jones 2003; Hawkes 2004, 2010). According to these authors, grandmothering represents the key difference between humans and non-human primates in their diverging life history evolution. Kinship terms, however, applied to the wider social group allowed for an expansion of alloparenting facilitated by language.

Conclusion

The consensus in the literature on cognition is that fully syntactic language is what makes the greatest difference between us and other species. I contend here that the human kinship calculus requires cognitive capacity unprecedented in other species and therefore could be the decisive marker of that difference. Kinship terminologies make use of symbolic reference, markedness, and conjunctivity, and recursion, a special feature found only in human language and beyond the abilities of non-human primates. Language could have developed from kinship terminologies that use these cognitive devices, eventually triggering fully blown syntactic speech. Recursiveness and analogy could also be the model used to conceptualize other domains. Thus a kinship terminology may have been a simple language, the original core for the uniquely human features that have been generalized and applied to manage the complex social relationships important for the cooperative great apes that humans became.

The fossil and archaeological evidence allows for the reconstruction of the co-evolution of brain size, group size, the production of tools that can make tools, and symbols in material culture. Many researchers agree that the transition to symbolic thought took place sometime between 300 000 - 60 000 years ago and that it most likely involved language. All of these innovations coincided with larger group size and larger brains, but also involved a reorganization of the brain that made possible symbolic reference and recursive thinking.

The linguistic reconstruction of nursery kinship terms mama and papa, possibly representing the proto-sapiens vocabulary, give an unprecedented glimpse into the deep pre-history of the human mind. Kinship terms are also the first social categories that require the capacity for symbolic reference and the understanding of a relation of a relation. Symbolic reference is a sufficient condition for language in general, but the conceptualization of a relation of a relation is a necessary condition for the construction of kinship concepts and kinship terminologies.

Deep historical linguistic reconstructions hint at matrilineal or bilateral kinship with uxorilocal or bilocal residence–where maternal grandmothers have the opportunity to invest in their daughters' offspring–as the ancient proto-human form of kinship and social organization. Studies of modern hunter-gatherers confirm the flexible residence

model as well as extensive maintenance of social ties between groups facilitated by kinship terms. Choosing a marriage partner establishes the connection between in-laws, again a uniquely human habit that forges intergroup cooperation and alliances conceptualized through kinship terminologies. It is easy to envision that having symbolic labels for consanguineal and affinal categories of kin would expand the web of relatives as possible candidates for alloparenting. This expansion of potential caretakers is often carried out in many cultures through some form of sponsoring and often involves so-called fictive kinship terms. All of this improves the conditions for the survival of children at critical stages and, among other benefits, increases individual fitness. Thus the 'invention' of kinship terms as the core of language could have been the decisive next step, a cognitive leap from non-human primate societies to proto-human forms of social organization (compare Read 2012). We paid an evolutionary price, but it paid off to start talking.

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