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The generative psychology of kinship
Part 1. Cognitive universals and evolutionary psychology

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Abstract

Human kinship and associated terminology vary a lot across cultures, but many anthropologists have suspected that a common set of principles underlies this variation. I argue that cross-cultural variation in kin classification is produced by a generative psychology built on two broad classes of rules. Some rules declare that kin differing with respect to binary distinctive features should be distinguished from one another, others identify some types of kin as more psychologically basic or prototypical than others. Different kin terminologies draw from the same set of rules, while variation among terminologies in how kin are split and merged results from variation in the ranking assigned to different rules. The rules governing kin classification seem to derive from three universal "primitives" of social cognition — innate schemas of genealogical distance, social rank, and group membership. These schemas may be part of an evolved psychology of kinship. This psychology has homologies with nonhuman primate social cognition; in humans, it is adapted to flexibly regulate the representation of relatedness in the service of individual and group nepotism. A companion paper spells out in more detail how the psychology of kinship generates and constrains known systems of kin classification.

Keywords: Evolutionary psychology; Human kinship; Kin selection; Kin terminology; Optimality Theory

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1. Introduction

Human kinship is a tantalizing combination of cross-cultural variation and cultural universals. Principles for reckoning descent, theories of procreation, definitions of incest, rules of marriage, the balance of amity and rivalry between kin, the nexus between kinship, and other bases of social organization — all vary widely across cultures. Yet, many anthropologists believe that this variation is structured and constrained by universals of cognition and experience.

This study investigates cognitive universals of kinship using tools from linguistics. Anthropologists have long noted that there is great cross-cultural variation in kin classification — in the ways different terminologies distinguish some kin and lump others together — so that the principles of one system often seem illogical from the perspective of another. Yet, this variation is actually quite systematic: Similar systems show up repeatedly in widely separated areas, while many logically possible simple types are rare or nonexistent. I argue that cross-cultural variation in kin classification is produced by a *generative* psychology, in which a wide range of surface variation results from combining a modest number of universal constraints according to a small set of principles. Generative systems are familiar from other areas of science, including chemistry, genetics, and various domains of mental representation including visual perception, phonology, and syntax (Abler, 1989; Baker, 2001; Biederman, 1987; Corballis, 1992; Pinker & Prince 1996). In each of these cases, a modest collection of elements can be combined according to a set of rules to produce a large (sometimes astronomical) number of variants whose properties are novel, and not just a blend or average of the properties of their constituents. Thus, following an analogy with chemistry (Baker, 2001), we could say that the present study is concerned with finding the "atoms" of kin classification, and rules for combining them into compounds. Or, following an analogy with linguistics, that it is concerned with finding an evolved "Universal Grammar" governing culturally specific systems of kin classification.

This study is divided into two papers. The present, less formal paper begins by considering two broad classes of rules involved in kin classification. Some rules declare that kin differing with respect to binary distinctive features should be distinguished from one another. Other rules identify some types of kin as more psychologically basic or prototypical than others, with terms for these taking priority over terms for more psychologically marginal kin. Orthogonal to this division between splitting and lumping tendencies runs another threefold distinction: The principles of kin classification seem to derive from three meta-principles, which can be labeled *genealogical distance*, *social rank*, and *group membership*. I argue that these three meta-principles are universal "primitives" of social cognition: They are the foundation of a generative psychology of kinship that bears the hallmarks of evolution by natural selection. They have evolutionary antecedents among nonhuman primates. And among humans, they are used in different configurations to construct culturally variable representations of kinship that can adaptively regulate individual and group nepotism.

The companion paper turns from the descriptive and evolutionary themes of the first paper to a formal analysis of how a small set of principles can be combined in different ways to

generate empirically known kin terminologies without generating terminologies that are logically possible but nonexistent or very rare. This paper makes use of a powerful new approach to rules of language called Optimality Theory (OT), according to which, approximately, surface variation in language rules results from variation in rankings among a universal set of constraints. OT, applied here to terminologies for aunts, uncles, and cousins, provides a novel analysis of variation and universals that seems to bridge the gaps between earlier informal and formal approaches to kin classification. Together, the two papers constitute an argument against the common claim in cultural anthropology that human kinship systems and kin classifications vary arbitrarily, without respect to biological relatedness or adaptive design.

2. Splitting and lumping kin: distinctive features and markedness

Kin terminologies can be classified according to how they assign different terms to some pairs of kin (e.g., mother's sister ≠ mother in English) while lumping others together under the same or similar terms (e.g., mother's sister = father's sister = "aunt" in English). Terminologies from different cultures that follow similar principles in spitting and lumping kin can be classified as typologically similar even when the specific words used are unrelated. Two phenomena familiar from other areas of linguistics — distinctive features and markedness — operate to keep the splitting and lumping of kin systematic and limit the number of major typologies.

Linguists have known for some time that phonemes — speech sounds, like /b/ or /p/, which are the minimum sounds necessary to distinguish words like "back" and "pack" — are not the most elementary units in phonology. Phonemes can be treated as bundles of binary distinctive features. For example, one such distinctive feature is voicing — vibration of the vocal folds — and many pairs of phonemes, /b/ and /p/, for example, or /d/ and /t/, differ only by the presence or absence of this feature. Distinctive features can not exist on their own, outside of phonemes, but they are not merely a linguists' convention; there is abundant evidence that people attend to them in processing language. Thus, rules of phonology normally apply systematically to phonemes sharing distinctive features, not just to arbitrary collections of phonemes (Miller, 1996, pp. 76–87; Pinker, 1999, pp. 33–41).

Anthropologists have produced similar evidence for distinctive features in the representation of kinship. For example, two binary distinctive features operate among terminologies for mother, mother's sister, and father's sister. Either one can be turned on or off, generating the four major types of aunt terminology, as illustrated in Table 1 Languages with *lineal* aunt terminologies, including English, use a separate term for "mother" (M), while merging mother's sister (MZ), and father's sister (FZ) as "aunt." The distinctive feature active in this case is the contrast between direct or lineal relatives (mother, father, grandmother, etc.) and collateral relatives (aunt, uncle, cousin, etc.) *Bifurcate merging* aunt terminologies activate a different distinctive feature, one that distinguishes maternal relatives (MZ and M, merged as "mothers") from paternal relatives (FZ, distinguished as "aunt"). *Bifurcate collateral* terminologies use both distinctive features and have three separate terms for M, MZ, and

Table 1
Classifying aunts: logical possibilities and psychological constraints

Type	Kin equations	Distinguish lineal and collateral kin?	Distinguish maternal and paternal kin?
Lineal	M "mother" FZ = MZ "aunt"	yes	no
Bifurcate merging	M = MZ "mother" FZ "aunt"	no	yes
Bifurcate collateral	M "mother" MZ "aunt 1" FZ "aunt 2"	yes	yes
Generational	M = MZ = FZ "mother"	no	no
[Non-existent]	M = FZ MZ	sort of	sort of

Kin type abbreviations: M, Mother; F, Father; Z, Sister.

FZ. Finally, *generational* terminologies use neither feature, and merge all three relations as "mother." There is cross-cultural evidence that these two distinctive features are psychologically real, and not just an anthropologists' invention: Logically, there is a fifth possible type of terminology, merging M and FZ and separating MZ. Yet, this type is found nowhere among the world's languages. M and FZ share no distinctive feature with one another that they do not also share with MZ. People are unwilling to invent or reproduce the corresponding terminology, whether or not they are conscious of the distinctive features involved (Greenberg, 1966, 1990; Hage, 1997). (The present discussion ignores aunts and uncles by marriage. The companion paper also considers a further distinction based on age of aunt or uncle relative to parent and offers a more sophisticated treatment of the maternal/paternal distinction in bifurcate systems.)

Kroeber (1909) argued that kin terminologies are built around just eight distinctive features; Fox (1979, p. 136) suggests six. And one school of anthropological linguistics, componential analysis, sought to define kin terms in different languages as conjunctions of distinctive features. But it takes more than a collection of binary switches to account for variation and universals of kin classification; we must also consider evidence that some kin are more cognitively prototypical than others. This evidence comes from the linguistic phenomenon called *markedness*, discussed in Greenberg's (1966, 1990) pioneering work on kin terminology. This work deserves to be better known. As Hage (1997, p. 652) notes "With [a few] notable exceptions [including Nerlove and Romney (1967), Kronenfeld (1974), D'Andrade (1971) and Hage (1997)], Greenberg's work has been overlooked by most anthropologists and is not mentioned in research works or discourses on kinship analysis. This is unfortunate ... because there are certain aspects of kinship terminologies that can only be explained in cognitive–linguistic terms." Greenberg reviews markedness effects in a wide range of languages, drawing on an encyclopedic knowledge of kin terminologies, along with some quantitative analyses. He discusses a number of linguistic phenomena that can be used to identify one member of a pair of kinship terms as

unmarked — prototypical, cognitively basic — in relation to the other, marked term. Some of these phenomena are listed below, illustrated with English vocabulary.

2.1. Markedness sensu stricto

The marked term in a pair may carry an extra morpheme or mark absent in the unmarked term. English examples include "grandmother," which is marked in relation to "mother" because it carries the added mark "grand," and "brother-in-law," which is marked in relation to "brother."

2.2. Syncretization

Distinctions observed in the unmarked form may be ignored in the marked form. Syncretization is found in English cousin terms, which are marked relative to sibling terms. Siblings are normally distinguished by sex, as "sister" and "brother," while the sex distinction is lost in the syncretic form "cousin." Additionally, siblings must be distinguished from siblings' children (nieces and nephews) in English, while this generational distinction is weaker with cousins: Cousins and cousins' children can be lumped together as kinds of cousins.

2.3. Defectivation

There may be no word for the marked member of a pair. Compare sister-in-law, which is acceptable in English, with cousin-in-law, which is marginally acceptable or unacceptable.

2.4. Par excellance expression

The unmarked term, but not the marked term, may also be used to refer to the more inclusive category containing both unmarked and marked members. There seem to be no English examples in the domain of kinship, but the phenomenon is familiar from prefeminist English gender terms, where "man" could refer either to male human being or human being, sex unspecified, while "woman" could refer only to female human being. Similarly, "he" could be used as a generic pronoun, while "she" could refer only to a female. In Portuguese, the same phenomenon is found with some kin terms: "*pai*" means either father or parent; "*mãe*" means only mother.

2.5. Frequency

The unmarked member of a pair is usually used more often than the marked member, although this is not a defining criterion of markedness. Greenberg (1966) shows that in large samples of English and Spanish text, ascending generation terms like "father" and "mother" and their equivalents occur more often than descending terms like "son" and "daughter." At the same time, proximate generation terms like "mother" and "father" are more frequent than generationally distant terms like "grandmother" and "grandfather."

2.6. Implicational universals

Not every markedness relationship listed above holds for every kin category for every language. Another source of information about markedness comes from comparisons across languages. Implicational universals are if–then statements involving markedness relationships that hold across languages rather than within them. For example, "If a language has separate terms for male and female cousins, then it will have separate terms for male and female siblings" is an implicational universal, which implies that cousins are marked in relation to siblings.

3. Generating kin classifications

The discussion of distinctive features and markedness above implies that kin terminologies are built around two contradictory commandments: "Thou shalt preserve information about distinctive features," and "Thou shalt avoid marked terms." These commandments reflect two opposing tendencies in language, toward exactness and economy of communication. Carried to extremes, exactness of communication would mean bestowing a separate kin term on each combination of distinctive features, while economy of communication would mean extending a handful of terms for unmarked, prototypical kin to cover as many other kin as possible. In practice, of course, each language makes some trade-off between these extremes. In some of the earliest work on kin terminology, Morgan (1870) used two labels, *descriptive* and *classificatory*, for these opposing tendencies. For Morgan descriptive systems are those which preserve information about distinctive features, especially the lineal/collateral distinction, while classificatory systems are those which efface such information. Morgan applied these labels very broadly, to whole kinship systems, but it might be more helpful, as Kroeber (1909) argued, to use them to describe splitting and lumping tendencies within systems. In this sense, a system of kin terminology will generally be descriptive along some dimensions and classificatory along others, like English aunt and uncle terminologies, which are descriptive with respect to the lineal/collateral distinction but classificatory with respect to bifurcation.

How do different languages manage trade-offs between descriptive and classificatory tendencies? Consider Table 2, in which these tendencies find expression in an assortment of *constraints*, each indicated by underlining. Constraints are the building blocks — or atoms, to use the analogy with chemistry — of kin terminology. The first column lists a number of *descriptive constraints*, which require that kin differing with respect to various distinctive features should receive different terms. For example, the first constraint in the column requires that lineal and collateral relatives should be distinguished. A terminology violates this constraint whenever it uses the same term(s) for sibling and cousin, for parent and parent's sibling, or for child and sibling's child. The second column lists a number of *classificatory constraints*, organized according to markedness gradients that assign universal or near-universal priorities among them. Classificatory constraints ban separate terms for particular types of relatives. For example, the *No "cousin"* constraint requires that all cousin

Table 2
Generating kinship: constraints, gradients, and schemas

Descriptive constraints	Classificatory constraints and markedness gradients	Constraint schemas or proposed primitives of social cognition
Distinguish lineal and collateral kin (e.g., sibling/cousin; parent/parent's sibling; child/sibling's child)	Collaterals marked (e.g., *No "cousin" ≥ . No "sibling"; No "sibling's child" ≥ . No "child"*)	*Distinguish genealogical distance* (Distant kin marked)
Distinguish adjacent generations (e.g., parent/grandparent; child/grandchild)	Distant generations marked (e.g., *No "grandparent" ≥ . No "parent"*)	
Distinguish consanguineal kin and kin by marriage, half-, or step-kin (e.g., aunt/aunt's husband; sibling/step-sibling)	Affines, etc., marked (e.g., *No "aunt's husband" ≥ . No "aunt"*)	
Distinguish ascending and descending generations (e.g., grandparent/grandchild)	Descending generations marked (e.g., *No "grandchild" ≥ . No "grandparent"*)	*Distinguish social rank* (Low rank marked)
Distinguish senior and junior kin (within generations) (e.g., older sibling/younger sibling)	Junior kin (relative to Ego) marked (e.g., *No "younger sibling" ≥ . No "older sibling"*)	
Distinguish male and female kin (e.g., brother/sister; uncle/aunt)	Female kin marked? (e.g., *No "sister" ≥ . No "brother"*?)	?[a]
Distinguish maternal and paternal kin (e.g., mother's sister/father's sister)	Cross-kin marked (e.g., *No "father's sister" ≥ . No "mother's sister"*)	*Distinguish group membership* (Out-group marked)
Distinguish adjacent patrilines	Maternal patrilines marked	
Distinguish adjacent matrilines	Paternal matrilines marked	

[a] Greenberg suggests that female kin might be generally marked relative to male kin, but the evidence for such linguistic patriarchy in the domain of kinship is actually weak. Of course, there are reasons unrelated to social rank for distinguishing females and males.

types be equated with other kin types — i.e., that there should be no separate term(s) just for cousins or particular cousin types. It does not, however, specify how cousin terms are avoided when they are avoided; this is determined by interactions with other constraints. Classificatory constraints are related to one another by markedness gradients, indicated by inequality signs (≥ .). (The period after the inequality indicates that these are near-universal rather than universal relationships.) The *No "cousin" ≥ . No "sibling"* gradient implies that avoidance or marking of separate cousin terms takes precedence over avoidance or marking of sibling terms — part of the more general rule that collateral kin are marked relative to lineal. We will see below how these gradients help account for universal markedness relationships.

Clearly, the rules in the two columns are potentially contradictory. One cannot simultaneously distinguish cousins from other categories of kin, as demanded by the constraints in the first column, while avoiding separate cousin term(s), as demanded by the *No "cousin"*

constraint. There has to be a way for some constraints to be violated some of the time. One possibility would be to treat each constraint as a binary switch and require that turning on some constraints automatically turns off incompatible ones. But better than an on/off switch is a dimmer switch, which allows some constraints to be turned on more strongly than others. In other words, we can better account for the data by putting constraints in rank order, with higher-ranking constraints overriding lower-ranking ones in cases of conflict. This is the procedure adopted by a new theory in linguistics called OT. The theory is spelled out in more detail in the companion paper; here, I illustrate informally with English terminology for cousins and siblings.

English cousin and sibling terminology corresponds in part to the following ranking of constraints, from strongest to weakest:

1. *Distinguish lineal and collateral kin*
2. *No "cousin"*
3. *Distinguish male and female kin*
4. *No "sibling"*
5. *Distinguish senior and junior kin (within generations)*

Consider the second constraint on the list, *No "cousin"*. On its own, this constraint requires that separate terms for cousins be avoided: Cousins should be equated with siblings (Or other close kin. To keep things simple, I ignore nonsibling kin like parents and parents' siblings for now.) Yet, equating cousins (collateral) and siblings (lineal) violates the first constraint, which ranks higher; thus, the current ranking results in separate terms for cousins and siblings. The second constraint further requires that when different cousin types (e.g., male and female cousins) are not equated with noncousins, they should be equated with one another. The second constraint overrides the third constraint requiring separate terms for male and female kin, which, in turn, overrides the fourth constraint requiring that sibling terms be avoided or merged. The outcome is an absence of sex distinctions among cousins and a brother/sister distinction among siblings. Finally, although many languages have separate terms for older and younger siblings (relative to Ego), the corresponding constraint ranks very low in English — it is essentially inactive — and neither cousin nor sibling terms recognize relative age.

Simply changing the rank order of the constraints without changing the constraints themselves can generate different terminologies. For example, if the first and second constraints are switched, so that avoiding separate terms for cousins takes priority over distinguishing lineal and collateral kin, the resulting terminology will use the same terms for cousins and siblings. Switching the third and fifth constraints generates a terminology with terms for "older sibling" and "younger sibling" but no sex distinctions.

Both cousin/sibling equations and younger sibling/older sibling distinctions are common among the world's languages. This example thus illustrates a major claim of OT applied to kinship: Roughly, different kin terminologies draw from the same small set of constraints. Differences among terminologies in how kin are split and merged result from differences in rank order among constraints. This claim has empirical force: It imposes substantial limits on

possible kin terminologies. Permuting constraint rankings yields many kin terminologies, but there are many logically possible terminologies, like the fifth version of aunt terminology in Table 1, that cannot be generated by any possible constraint ranking. And the number of allowed terminologies is further reduced by gradients that ban some constraint rankings. For example, the *No "cousin"* ≥ *. No "sibling"* gradient means that rankings in which the latter constraint outranks the former will be rare or nonexistent. This precludes a terminology with sex distinctions among cousins but not siblings.

Finally, there is a further level of order in kin classification. In OT, not only do different surface patterns in different languages derive from a modest-sized set of constraints and gradients, but many of these, in turn, derive from an even smaller set of *constraint schemas* or *templates*. I list three such schemas in the rightmost column of Table 2, orthogonal to the distinction between descriptive and classificatory constraints, under the labels *genealogical distance*, *social rank*, and *group membership*.

The schema of genealogical distance states that, along the various axes of genealogical distance, kin at differing genealogical distances should be distinguished and genealogically close kin are unmarked relative to distant kin. Thus, siblings are unmarked relative to cousins, parents relative to grandparents, consanguineal kin relative to affines and step-kin, and so on. The second schema relates to social rank. It states that kin differing with regard to seniority or rank should be distinguished and the more senior or high-ranking individual is relatively unmarked. Thus, parent is unmarked relative to child, elder sibling relative to younger sibling, and so on. Taken to a logical conclusion, the first two schemas imply that the maximally unmarked, absolutely prototypical kin are "mother" and "father." And indeed, this pair of terms, uniquely, is a cultural universal or near-universal and seems to represent a basic starting point — along with "husband" and "wife," if affines are considered — for all or almost all systems of kin classification (Murdock, 1949; Scheffler & Lounsbury 1985; Wierzbicka, 1992).

Greenberg notes the first two schemas (he calls them "meta-principles") in his discussion of markedness. The analysis in the accompanying paper discloses a third, related to group membership, with group members distinguished from nonmembers, and with in-groups unmarked relative to out-groups. This schema is inactive in English kin classification but is often active in societies with lineages, clans, and other corporate descent groups, in which in-group kin have different rights and duties towards one another than out-group kin at the same genealogical distance and social rank.

4. Three primitives of social cognition and the evolutionary psychology of kinship

Where do the rules in Table 2 come from? There is nothing in OT itself to tell us; any answers must derive from elsewhere. (There is an analogy here with economics, which often is concerned with how utility functions influence decision making but not where they come from.) Faced with similar questions, linguists concerned with phonology often appeal to peripheral systems of speech production and perception. The physiology of the vocal tract and motor and auditory psychology account for the distinction between voiced and unvoiced sounds, and for the unmarkedness of single-consonant relative to multiconsonant syllable

onsets, of falling relative to rising intonation at the ends of sentences, of "tick" relative to "thick," and so on. But in syntax and in semantic domains like kinship, constraints operate on relatively abstract features of language not tied to particular articulatory or perceptual mechanisms. Here, universals must derive from universal features of the environment or from the species-typical architecture of human cognition.

In the case of syntax, Chomsky (1986) has famously argued that we can only account for cross-linguistic universals, and for the child's rapid acquisition of syntax in the face of a syntactically impoverished input, by postulating substantial innate knowledge of grammar. Not just with syntax, but with semantics and central cognition as well, there has been a major shift over the last several decades away from the empiricist claim that abstract ideas derive entirely from experience and toward nativism. There is now considerable evidence that infants and children approach the task of learning not with mental blank slates, but with a large fund of innate ideas about the physical, biological and social worlds. Many psychologists and anthropologists now argue that the mind is massively modular — that it contains specialized evolved machinery not just for processing syntax, but also for such tasks as evaluating potential foods (Cashdan, 1994; Rozin & Fallon, 1987), counting things (Dehaene, 1997), recognizing faces (Carey, 1979), and understanding others' mental states (Baron-Cohen, 1995). (Reviews include Barkow, Cosmides, & Tooby, 1992; Jones 1999; Pinker, 1997.)

There are a number of proposals currently on the table about innate concepts of social life that might be relevant to explaining cognitive universals of kinship (Fiske, 1991; Jackendoff, 1994; Wierzbicka, 1992). Of particular interest here is the work of Jackendoff, who proposes three innate "primitives" of social cognition that seem to be used as building blocks in constructing the kaleidoscopic variety of human social systems. He labels them kinship, dominance, and group membership.

> Of course, relationships among particular individuals can't be innate. We have to learn who is kin to us, what groups there are to belong to and who belongs to them, whom we are dominant to, and under what circumstances. And we have to learn how our culture codifies these relationships — for instance, what being someone's kin entitles us to do or prohibits us from doing with them. The idea, though, is that these three kinds of relationships (and possibly others) are very abstract skeletons that help us structure how to behave toward other people and what to expect from them. ... [A]s with language, culture-particular facts are backed up by an innate framework [p. 214].

Although Jackendoff proposes these primitives independently of any evidence from kin classification, they correspond exactly to the three constraint schemas in Table 2. (To reduce confusion, I use the label *genealogical distance* for what Jackendoff calls kinship because the other two schemas are also involved in classifying kin, although they are additionally important in nonkin domains.)

Jackendoff's proposal, seconded here, that these three schemas are innate primitives of social cognition, amounts to turning conventional social theory on its head. In the conventional view, sometimes called the Standard Social Science Model (Tooby & Cosmides,

1992), which goes back at least to Durkheim, individuals acquire social concepts by internalizing them from their social environment. In the alternative view, by contrast, social organization is to a significant degree the externalization of psychological universals. It is owing to innate schemas of sociality that a complex social order is even possible, and variation in the social order is possible only because universal combinatorial principles allow these innate building blocks to be assembled in all sorts of culture-specific configurations. Theories of kinship in anthropology have commonly followed the Standard Social Science Model (Radcliffe-Brown, 1952).[1] Below, I develop an alternative evolutionary approach, with both a phylogenetic and an adaptationist component. I first review the three constraint schemas separately, pointing out likely homologies among nonhuman primates, and then consider the possible adaptive value of having them all work together in the generation of culturally variable representations of kinship.

4.1. Genealogical distance

If we measure genealogical distance by counting links separating kin, then genealogically close kin are normally unmarked relative to genealogically distant kin. Thus, parents, one link away, are unmarked relative to parents' parents, two links away. This relationship between markedness and distance is the opposite of that found with spatial distance, in which great distances are normally unmarked relative to lesser distances. Also — according to Greenberg (1966, 1990) but not investigated here — relatives connected by several different genealogical links, like full siblings, are unmarked in relation to those connected by single or no links, like half-siblings, step-siblings, and siblings-in-law. Not all increments in genealogical distance are registered in all systems of kin classification, but sensitivity to genealogical distance seems to be a generative universal in the representation of kinship.

Many anthropologists have recorded cross-cultural variation in explicit verbalized *theories* of kinship and procreation. But pretheoretical *concepts* of kinship may be more uniform across cultures and even, to some extent, across species. Hirschfeld (1989) cites considerable evidence that young children develop concepts of kinship as an abstract relationship before they learn local theories of procreation. And human ideas of kinship may have antecedents among nonhuman primates. Of course, many organisms respond differently to kin and nonkin, and to close and distant kin. But some primates do more than this: They seem to have not only social relationships with their mothers and other kin but a concept of "mother" and other kin types. Dasser (1988) has demonstrated this with long-tailed macaques. Her subjects could recognize that the relationship between A and her daughter was of the same type as that between B and her daughter. They were able to discriminate mother–daughter pairs from

[1] A notable exception is Lévi-Strauss, who explicitly inverts Durkheim and derives social organization from cognitive universals. From the present perspective, Lévi-Strauss' (1969) work on "The elementary structures of kinship" can be read as one long argument for the importance of a universal schema of reciprocity or balanced exchange in kinship and marital alliance. This schema might be regarded as a fourth primitive of social cognition, or as one expression of the schema of group membership. Exploring this possibility by investigating marriage rules and affinal terminology in the framework of OT is a task for the future.

pairs of nonrelatives, even with pairs spanning a wide range of ages and age differences. Concepts of kinship also seem to be implicated in the common primate phenomenon of "redirected aggression," in which an individual retaliates against an attack on her kin with an attack on the aggressor's kin (Cheney & Seyfarth, 1990, pp. 75–76). The ability to mentally represent mother/daughter and other kin relationships may be a necessary condition for complex multilevel kin-based social systems among Old World monkeys.

4.2. Social rank

Ascending generations are normally unmarked relative to descending ones, and older relative to younger kin within generations. All ascending generations may be set off from all descending ones, or the strongest concern may be for separating adjacent generations. There also is some tendency for males to be unmarked in relation to females, although the evidence is less clear-cut: Patriarchy may be more nearly universal in politics and religion than in the domain of kinship proper. The principle in each of these cases seems to be the idea of hierarchy or social rank. Higher-ranked individuals are normally treated as prototypical (except occasionally when their position is so exalted that they are treated instead as exceptional. For an example of the latter in Oceanic terminology for elder siblings, see Hage, 1997). Jackendoff (1994) argues that while systems of ranking vary greatly across societies, the idea of rank itself is a universal primitive of social cognition. He suggests that the universally understood distinction between requests and orders is a reflection of this idea. Brown (1991, pp. 137–138) and Cummins (1998) provide more arguments for rank as a human universal.

What are the evolutionary roots of concepts of rank? Dominance hierarchies are found in many social animal species (Wilson, 1975, pp. 279–298), and ethologists have amassed evidence for a psychology of dominance and subordination in humans (Eibl-Eibesfeldt, 1989; Salter, 1995). But rank as a primitive of social cognition is more than rank as a fact of social organization. To say that an animal has a mental representation of social rank, we have to demonstrate not merely that she knows where she stands relative to others, but also that she can use the concept of rank to make correct inferences in novel social circumstances. For example, we might want to show that if an animal knows that A outranks B and B outranks C, then she can infer that A will outrank C even if she has never seen A and C together before. Cheney and Seyfarth (1990, pp. 80–84) review evidence of such rank-related social inference among vervets and other Old World monkeys. Their discussion implies that human concepts of social rank have deep evolutionary roots.

4.3. Group membership

Most, but not all, systems of kin classification sometimes draw distinctions between types of relatives who do not differ in genealogical distance or social rank. For example, same-sex siblings may be unmarked compared to opposite-sex siblings, with relative age distinctions observed only among the former. Or different types of aunts may be classified differently depending on the sex of the connecting relative, and similarly for uncles and cousins. The

crucial factor in these cases seems to be membership or potential membership in kin-based in-groups and out-groups, with in-group kin unmarked in relation to out-group kin. Same-sex siblings' children belong to the same matrilineage or patrilineage; opposite-sex siblings' children do not. Mother and mother's sister are both members of Ego's natal matrilineage; father's sister is not.

These phenomena arguably represent the expression in the domain of kinship of a species-typical group psychology. A large literature in social psychology demonstrates the readiness of humans to construct and identify with groups with shared codes of conduct (reviewed by Billig, 1976). At the same time, it is an anthropological commonplace that people regularly construct kin groups whose members have common rights and duties. Behavior toward kin partly reflects one's obligations as a group member, and not just personal sentiments. These obligations may lead to different kin at equal genealogical distance being treated differently depending on what group they belong to (Fortes, 1969; Fox, 1967, 1979; Radcliffe-Brown, 1952). In Radcliffe-Brown's (1952) classic expression, kin terminology often gives verbal emphasis to "the unity of the kin group" and its separation from adjacent groups. In Kelly's (2000) more recent formulation, such kin groups commonly express a logic of "social substitutability," with members treated — ideally and, to some extent, in practice — as interchangeable in marital, economic and political relations. The presence of patrilineal and matrilineal descent groups is strongly correlated with kin terminologies emphasizing patrilineality and matrilineality (Stone, 2000). And even nonunilineal terminologies like Hawaiian, with its mergers of cousins and siblings, may emphasize the unity of a cognatic kin group with respect to outsiders. These correlations between terminology and institutions are not perfect. In some societies, the "groups" distinguished by local kin terminology are purely nominal. In others, socially important groups are not registered in local terminology. But this does not refute the argument that terminologies and social institutions alike reflect a universal group psychology.

Finally, with group psychology as with the other two primitives of social cognition, there are probably homologies among nonhuman primates (Cheney & Seyfarth 1990, pp. 61–62; Jackendoff, 1994), albeit without the normative dimension found among humans.

The evidence reviewed above suggests that we share with many other primates a faculty of social cognition that enables and motivates us to store and process information not only about the individual traits of others, but also about their social relationships, including genealogical connections, social rank, and group membership. But the analysis of kin categories implies that there is more to human kinship. In our species, the primitives of social cognition do not operate independently of one another, but as components of an integrated generative system. Humans, unlike any other primate, use these primitives as building blocks according to the combinatorial principles of OT to construct complex, culturally variable systems of kin classification, and associated institutions and norms. The resulting system gives humans unique flexibility in constructing the mental representations that support kin-based social organization.

What is the adaptive value, if any, of all this machinery? An obvious starting point is the theory of kin selection. Hamilton (1964) demonstrates that natural selection can favor genes that lead an organism to behave altruistically to her kin. Altruism in this case is defined not as a psychological state but in terms of fitness costs to the altruist relative to fitness benefits

to the recipient. Altruism is favored as long as the ratio of costs to benefits is less than the coefficient of relatedness — the expected proportion of the altruist's genes shared by common descent with the recipient, over and above whatever genes she shares with the population at large. The coefficient of relatedness defined by Hamilton shows an evident affinity with the schema of genealogical distance, which is one of the generative principles governing kin classification, and the only one unique to the domain of kinship. While the linguistic evidence can give no quantitative measure of how sentiments toward kin scale with genetic distance (and there must be limits to how much fine-tuning natural selection can do in this respect), the schema of genealogical distance is an obvious candidate for an adaptation for tracking relatedness.

Kin classification would be simpler if genealogical distance were the only schema involved. There would be just a few major axes of variation: Those societies more concerned with kinship would be more "descriptive" with regard to genealogical distance, keeping track of kinship and kin distinctions out to more distant kin. But actually existing systems of kin classification are more complicated than this. Genealogical distance does not always appear "on the surface" in kin terminology because of the way constraints derived from this schema interact with constraints related to rank and group membership. Any adaptationist analysis of representations of kinship should explain why these other schemas, although logically independent of kinship, are nevertheless recruited in the classification of kin.

Turning first to social rank, it is perhaps no great puzzle from an adaptationist perspective why considerations of rank should influence kin terminology. High- and low-ranking individuals generally differ in how much help they can provide for their kin, and potential recipients of kin altruism are understandably more attentive to their superiors than to their inferiors. To phrase the difference in the language of kin selection, we could say that in the domain of kinship the recognition of rank is a recognition of the difference between likely donors and likely recipients of altruism.

The adaptive value of registering group membership in kin classification is a more complicated matter. I briefly sketch one possible explanation here, following an argument set forth at greater length elsewhere that the theory of kin selection may need to be revised to allow for the importance of collective action and group solidarity in our species (Jones, 2000). Social anthropologists have often insisted on the importance of moral codes and a sense of obligation — of "structure" rather than "sentiment" — in human behavior toward kin, and have been skeptical of theories of kinship that seem to put too much emphasis on individual choice and too little on social constraint. (A classic statement — or maybe overstatement — of this position is Needham, 1962.) I have shown that if people act together to help their mutual kin, their effective coefficient of relatedness can be greater than if they act independently. For example, two brothers can be effectively more closely related to a third brother — providing assistance even when the cost/benefit ratio for each is greater than 1/2 — if they can forge an agreement to work together rather than independently in helping this third brother. The same principle — attaining a higher effective coefficient of relatedness by pooling nepotism — works for larger groups of donors as well. I have proposed that among humans assistance toward kin is frequently a matter of socially imposed "group nepotism" rather than individual nepotism. An implication of this line of reasoning is that the

effective coefficient of relatedness often depends not only on genealogical distance but also on the solidarity of the kin group: Anne will be effectively more closely related to Bruce if Bruce's other relatives join her in helping him out. This could explain why people in many societies are willing to adjust their judgements of the closeness of kinship on the basis of group membership and group solidarity.

In summary, systematic variation in kin terminology seems to point toward three primitives of social cognition that are plausibly involved not only in linguistic categorization, but more generally in the adaptive representation of kinship. The schema of genealogical distance may be adapted to track Hamilton's coefficient of relatedness. The schema of social rank may be adapted to track distinctions on the cost and benefit side of the equation between likely donors and recipients of kin altruism. And the schema of group membership may be adapted to track variation in the effective coefficient of relatedness related to "the unity of the kin group."

Where does this leave the evolutionary approach to kinship? In an early polemic, Sahlins (1977) wrote:

> [T]here is not a single system of marriage, post-marital residence, family organization, interpersonal kinship, or common descent in human societies that does not set up a different calculus of relationship and social action than is indicated by the principles of kin selection. [p. 26]

and

> [N]o system of human kin relations is organized in accord with the genetic coefficients of relationship as known to sociobiologists. [p. 57]

Several rejoinders are suggested by the present analysis. First, *particular* kinship systems are at best an indirect reflection of the evolved psychology of kinship. Even if this psychology allows humans to tailor their representations of kinship "space" to fit local conditions, it is not these varying representations and correlated institutions but the underlying generative principles that are possible genetic adaptations. Thus, the analysis above makes a strong case for genealogical distance as one primitive of social cognition, and, *contra* Sahlins, genealogical distance does seem to be largely "organized in accord with the genetic coefficients of relationship as known to sociobiologists." Second, while group membership and group psychology may modify the representation of kinship — expanding some parts of kinship "space" and shrinking others — their effects can probably be accommodated by revising the theory of kin selection to allow for collective action, instead of discarding it.

The study of kin terminology has the reputation of being a recondite corner of anthropology, unintuitive and forbiddingly technical. But the present analysis suggests that underlying the surface complexity of kin classification are a few generative schemas of social cognition familiar to human beings everywhere. And these schemas seem to connect not only with universal intuitions, but also with current understandings of kin selection and the evolution of the mind. Of course, linguistic variation is only one source of evidence regarding the representation of kinship, and conclusions drawn on this basis are necessarily tentative and

provisional. Nonetheless, it is striking how much the psychology of kinship inferred on linguistic grounds looks like a toolkit for generating representations that can flexibly regulate individual and group nepotism.

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