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The universal psychology of kinship: evidence from language

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Kinship is central to social organization in many societies; how people think about kinship should be relevant to social cognition generally. One window onto the mental representation of kinship is afforded by variation and universals in terms for kin. Kin terminologies are commonly organized around binary distinctive features, and terms for some types of kin are consistently linguistically marked. These observations can be formalized in the newly developed framework of linguistic Optimality Theory: permutations in the rank order of a small set of constraints generate basic types of kin terminology without over-generating rare or non-existent types. The result, I argue, is evidence for an innate faculty of social cognition (including several universal schemas of social relationships), apparently shaped by several kinds of genetic kin selection.

Anthropologists take a variety of approaches to kinship. Some are chiefly concerned with its external institutional aspects; some are mostly interested in cultural particulars and indifferent to or skeptical of cross-cultural generalizations. But there is also a long tradition by anthropologists of exploring kinship's foundations in human cognition [1–4]. This tradition has been motivated especially by striking parallels between rules of grammar and rules of kinship and kin terminology that hint at psychological universals underlying and structuring surface variation in kinship systems and categories. As Lévi-Strauss writes, 'the recurrence of kinship patterns… in scattered regions of the globe and in fundamentally different societies, leads us to believe that, in the case of kinship as well as linguistics, the observable phenomena result from the action of laws which are general but implicit…. Although they belong to *another order of reality*, kinship phenomena are *of the same type* as linguistic phenomena' [5] (italics in the original).

Linguists and cognitive scientists often argue that cross-cultural patterns in phonology and syntax are the product of a generative psychology that includes universal innate schemas of phonemes, syllables, phrases, and other linguistic units [6,7]. Here I summarize recent work suggesting that there is also a universal generative psychology of kinship ([8,9] and D. Jones, unpublished, P. Miers, unpublished). The evidence for this comes from cross-cultural regularities in kin terminology, which can be analyzed with the help of a new approach to rules of language called Optimality Theory (OT). The analysis seems to show that the mental representation of kinship depends on the elaboration and combination of a few general schemas of social relationships. These schemas and combinatorial rules dovetail with recent theoretical work on the evolution of human kinship and sociality. Thus, in this domain at least, research on the structure of cognition fits neatly with work on its evolutionary history and adaptive functions.

Patterns of kinship

The 'implicit laws' of kinship invoked by Lévi-Strauss can be illustrated by cross-cultural variation in uncle terminologies. English follows one pattern: Father is called by one word ('father'), Father's Brother and Mother's Brother by another ('uncle'). This scheme can be summarized by the formula (F FB = MB), where F means Father, FB is Father's Brother, MB is Mother's Brother, and the = sign indicates a terminological equation. Anthropologists call this a *lineal* uncle terminology, because the lineal relative (F) is terminologically separated from the two collateral relatives (FB and MB). Other common uncle terminologies familiar to anthropologists include *generational* (one term, F = FB = MB), *bifurcate merging* (two terms, F = FB MB), and *bifurcate collateral* (three terms, F FB MB) [10,11]. Note however that these four terminologies do not exhaust the possibilities. Logically there is a fifth possibility, a two-term terminology merging F and MB and splitting off FB, (F = MB FB). Anthropologists have never bothered to name this terminology because it is found nowhere [12].

The most straightforward explanation for the absence of this fifth terminology will be familiar to students of phonology: kin types, like phonemes, are not indivisible atoms of thought, but are mentally represented as collections of distinctive features. In the present case, the relevant features are the lineal/collateral distinction (lineal F versus collateral FB and MB) and the bifurcate or paternal/maternal distinction (paternal F and FB versus maternal MB). Languages might activate either, both, or neither distinctive feature, thus generating the four kin terminologies above, but no combination of these features generates the nameless fifth possibility. This and other lines of evidence imply that the building blocks of kin categorization include a modest set of distinctive features. Most accounts would include at least lineal/collateral, male/female, relative age (within generations), consanguineal/affinal, and several kinds of generational and bifurcate distinctions [1,13].

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There is a further pattern evident in uncle terms. In many languages, these differ depending on whether the uncle in question is an older or younger brother of the linking parent. But it turns out that we cannot account for the observed distribution of uncle terms merely by introducing a third distinctive feature, relative age, and treating the three features as binary switches. Take for example the common four-term terminology, (F FoB FyB MoB = MyB) where FoB is Father's Older Brother, MyB is Mother's Younger Brother, and so on. Here the relative age distinction is turned halfway between on and off – it is active for Father's Brother, inactive for Mother's Brother. Furthermore, although this terminology is fairly common, the reverse – one term for Father's Brother, two for Mother's Brother, (F FoB = FyB MoB MyB) – is extremely rare [14].

Once again, the explanation will be familiar to students of phonology: across cultures, Father's Brother is linguistically 'unmarked' relative to Mother's Brother. The unmarked member of a pair of expressions is treated differently in ways that indicate that it is more prototypical or cognitively basic. There are many examples from English kin terminology: for example, because siblings are normally distinguished by sex as 'brother' and 'sister', whereas cousins are not, we can say that siblings are unmarked – and presumably prototypical – relative to cousins. Markedness effects are commonly associated with cross cultural 'implicational' (or *if–then*) universals. Thus *if* a language distinguishes cousins by sex, *then* it will distinguish siblings by sex, but not conversely. Similarly *if* a language has relative age distinctions for Mother's Brother, *then* it will have them for Father's Brother, but not conversely. Markedness effects and implicational universals in kin terminology are less familiar than distinctive features to most anthropologists, but their importance was recognized in several pioneeering articles by Greenberg (e.g. [15,16]).

Constraints on kin terms

Distinctive features and markedness effects have long been central to descriptive work in structural linguistics. But with the recent development of linguistic Optimality Theory (OT), they have found a new role as formal generative principles [17–19].

OT, like other generative approaches to rules of language, begins with a speaker facing the problem of producing the appropriate output for a given input – producing, say, the correct regular plural of a noun. According to OT, the speaker mentally evaluates a wide range of potential outputs, selecting the one that achieves an optimal tradeoff between conflicting principles or 'constraints'. Constraints in OT are particularly flexible: a single constraint, depending on its interaction with others, can generate many different surface effects (see also Box 1).

This approach shares some affinities with optimization theories from economics and behavioral ecology. But in OT the 'utility function' being optimized takes the special form of a strict hierarchy: when two constraints are in conflict, the higher ranking takes absolute priority. In other words, constraints act in succession, filtering out randomly generated variation until a single candidate survives as the optimal output. Constraints fall into two broad classes. Some constraints require that input and output be systematically related with respect to some distinctive feature. Others require that different sorts of non-prototypical or marked output be avoided. With this machinery, OT has been very successful in accounting for regularities both within and across languages. Roughly speaking, each language draws from a universal set of constraints to generate its grammar; grammatical variation across languages reflects permutations in the rankings of these constraints.

OT has mostly been developed in the context of phonology and syntax. But it also neatly accommodates the generalizations noted above about distinctive features and markedness in kin classification [8,9]. For example, the four major types of uncle terminology (setting aside relative age distinctions) can be generated by three constraints which require (1) distinguishing lineal and collateral kin, (2) keeping terms for uncles to a minimum (ideally, avoiding them altogether), and (3) (approximately) distinguishing paternal and maternal kin. Potential contradictions among these constraints are resolved by strict ranking. The lineal uncle terminology familiar to English speakers is generated by the constraints in the order given above (see Box 1); varying the order generates the other three major types. Just as important, no ordering of these constraints can generate the fifth, non-existent type of uncle terminology.

This scheme can readily be expanded to accommodate relative age distinctions and associated markedness effects. Given the five kin types, F, FoB, FyB, MoB, and MyB, there are 52 possible uncle terminologies. Yet only seven of these are found at appreciable frequency among the world's languages. In an OT framework, these seven are generated by permutations in the rankings of five constraints: three constraints relating to three distinctive features, and two establishing particular kin types as marked. Furthermore, some of these constraints, plus several others, are also active in terminologies for aunts, cousins and siblings, resulting in predictable interdependencies among terms for these kin types.

Schemas of sociality

The constraints whose interactions generate kin terminology seem to derive in turn from just a few schemas of sociality (Table 1).

(1) *Genealogical distance*. One constraint on uncle terminology states that lineal and collateral kin should not be equated, another that Parent's Brother, but not Father, is marked. These are members of a larger class of constraints requiring that kin at different genealogical distances be distinguished, and that more genealogically distant kin be marked.

(2) *Social rank*. The constraint distinguishing uncles based on relative age is one of a class of constraints separating relatives based on potential differences in social rank.

(3) *Group membership*. The constraints distinguishing paternal and maternal uncles, and making Mother's Brother marked, are members of a class of constraints

Box 1. Optimal uncles

In Optimality Theory (OT), the optimal output for a given input is generated by filtering candidate outputs through a ranked set of constraints until only one survives. For the lineal uncle terminology familiar to English speakers, with one term for Father and another for Father's Brother and Mother's Brother, the associated constraints, in order, are:

1. *Distinguish lineal and collateral kin*
2. *No 'parent's brother'*
3. *Distinguish paternal and maternal kin*

The three tableaus here show how these ranked constraints work.

Three other common uncle terminologies can be generated by permuting the rankings of these constraints. And adding two further constraints – *Distinguish relative age (within generations)* and *No 'mother's brother'* (moveable independently of the *No 'parent's brother'* stratum) – accommodates observed terminologies with relative age distinctions.

Father	*Distinguish lineal and collateral kin*	*No 'parent's brother'*		*Distinguish paternal and maternal kin*
		No 'mother's brother'	*No 'father's brother'*	
Father ✓				
Father's brother	*!		*	
Mother's brother	*!	*		*

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Tableau 1. From Father to Father. The input in the first tableau, shown in the upper left corner, is Father. In the column below are three candidate outputs, Father, Father's Brother, and Mother's Brother, one of which must be selected as the unique 'optimal' output. Across the top, in italics, are the three ranked constraints that will do the selecting. (The second of these, *No 'parent's brother'*, is actually a compound constraint – a 'constraint stratum' – whose components, *No 'mother's brother'* and *No 'father's brother'*, are also shown.) The remaining cells show the results as each constraint evaluates each candidate output. The first constraint, *Distinguish lineal and collateral kin*, requires that input and output both be lineal or both be collateral. Because Father is a lineal relative, the two collateral candidates, Father's Brother and Mother's Brother, violate this constraint, as shown by the asterisks in the corresponding cells. The exclamation marks and the gray shading in the cells to the right show that the violations are fatal. With two candidates removed from consideration, the only survivor, Father, is the optimal output, as indicated by the checkmark.

Father's brother	*Distinguish lineal and collateral kin*	*No 'parent's brother'*		*Distinguish paternal and maternal kin*
		No 'mother's brother'	*No 'father's brother'*	
Father	*!			
Father's brother ✓			*	
Mother's brother		*!		*

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Tableau 2. From Father's Brother to Father's Brother. Here, with Father's Brother – a collateral relative – as the input, the *Distinguish lineal and collateral kin* constraint eliminates the lineal candidate, Father. The next constraint, *No 'mother's brother'*, eliminates Mother's Brother as a candidate, leaving Father's Brother as the optimal output, even though it violates the lower ranking constraint, *No 'father's brother'*.

Mother's brother	*Distinguish lineal and collateral kin*	*No 'parent's brother'*		*Distinguish paternal and maternal kin*
		No 'mother's brother'	*No 'father's brother'*	
Father	*!			*
Father's brother ✓			*	*
Mother's brother		*!		

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Tableau 3. From Mother's Brother to Father's Brother. The constraint *No 'mother's brother'* eliminates Mother's Brother as a candidate, so Mother's Brother also has Father's Brother as its optimal output. The result from the three tableaus is one term for Father and one term for Father's Brother and Mother's Brother – that is, a lineal uncle terminology.

(Note that the order of constraints *within* a stratum doesn't matter. If *No 'mother's brother'* and *No 'father's brother'* were switched around within the *No 'parent's brother'* stratum, both optimal outputs would change to Mother's Brother, but the typological outcome – one term for Father's and Mother's Brother – would be the same.)

Table 1

Schemas of sociality	Some associated constraints
Genealogical distance	*Distinguish lineal and collateral kin** *No 'parent's brother'** *No 'parent's sister'* *No 'cousin'*
	Distinguish near and distant generations *Distinguish adjacent generations* *No 'parent's parent'* *No 'child's child'*
	Distinguish consanguineal and step kin *No 'step sibling'*
Social rank	*Distinguish relative age (within generations)** *No 'younger sibling'*
	Distinguish ascending and descending generations *No 'child'* *No 'child's child'*
Group membership	*Distinguish paternal and maternal kin** *Distinguish adjacent patrilines* *Distinguish adjacent matrilines* *No 'mother's brother'** *No 'father's sister'* *No 'opposite sex sibling'*

The right column lists an assortment of constraints that seem to be at work in generating kin terminologies. Five (with asterisks) are important in terminologies for uncles (see Box 1), others in terminologies for aunts, cousins, siblings, grandparents, or grandchildren. The left column gives three schemas of sociality from which the constraints seem to derive.

requiring that members of different potential social groups be distinguished, with outgroup kin marked. These constraints are often, but not always, especially prominent where kinship systems include unilineal descent groups, with, for example, Father and Father's Brother born into the same lineage, and Mother's Brother into another lineage [11].

Additionally, a fourth schema of 'exchange' or 'reciprocity' would probably be revealed if the analysis were extended to affinal (in-law) terminology.

Here perhaps is the biggest payoff from applying OT to kin terminology: not just the formal analysis of a semantic field, but insight into possible universals of conceptual structure. Schemas of genealogical distance, social rank and group membership (and probably exchange) are, I propose, components of a generative psychology of sociality – cognitive building blocks used not just for labeling kin but for coping with social life more generally (see also Fiske [20] and Jackendoff [21]). This proposal might be compared with findings from another area of semantics: linguists have demonstrated that a few schemas – of objects in space, and of attention, perspective, motion and force – organize a wide swathe of linguistic representation, both concrete and abstract [7,22]. The analysis of kin terms seems to illuminate a different corner of conceptual structure, one grounded not in physical but in social cognition.

Both areas of conceptual structure might be considered as part of human biology – products of evolved 'mental organs' [23,24]. In both cases comparative psychology suggests phylogenetic antecedents. Monkeys and apes are strongly attuned to seeing and grasping the physical world, and their specializations in this area have seemingly been co-opted in the human line to represent more abstract relationships [25]. And monkeys and apes are also intensely social animals, with rich representations of the individual characteristics and

Box 2. The Brothers Karamazov game

In one familiar exposition of the evolutionary theory of kin selection, an individual has the opportunity to behave 'altruistically', that is, to boost a relative's genetic fitness at a cost to her own fitness. In this case, given some further assumptions, natural selection favors altruism as long as the ratio of helper's costs to recipient's benefits (cost/benefit ratio) is less than r, the 'coefficient of relatedness', or fraction of genes identical by common descent in helper and recipient.

But suppose we begin with *two* potential helpers, two brothers, say, who have the option of helping a third (Figure I). The resulting Brothers Karamazov Game is one model of 'group nepotism', where natural selection can favor higher levels of altruism, with higher cost/benefit ratios, when individuals work together rather than separately to help common kin. Group nepotism means that the *effective* coefficient of relatedness governing selection for altruism depends not only on genetic relatedness but also on the level of social solidarity among potential altruists. Group nepotism might be particularly important in our species, where altruism towards kin is often an obligation imposed on individuals by larger groups. The willingness to depart from a purely genealogical reckoning and modify assessments of kinship distance based on group membership and group solidarity might be an expression of this.

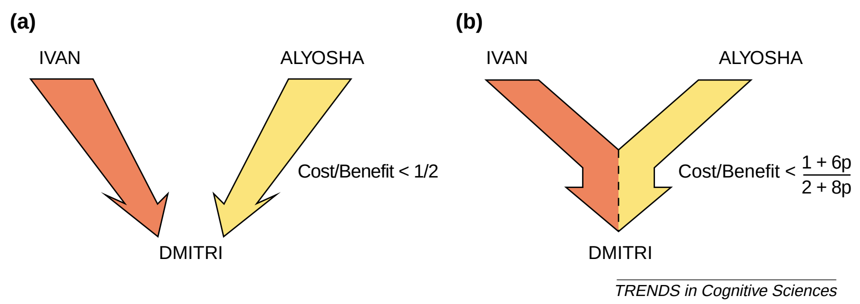

Figure I. **(a)** Helping independently. If Dmitri turns some of the time to Ivan for help and some of the time to Alyosha, and if Ivan and Alyosha decide independently of one another whether to help Dmitri, then natural selection favors altruism as long as the ratio of costs to benefits (C/B) in each case is less than 1/2. As 1/2 is the coefficient of relatedness between siblings, this is just the standard kin-selection result. **(b)** Helping together. Suppose Ivan offers Alyosha a deal: he will provide extra assistance to Dmitri if and only if Alyosha does the same. A gene coding for such 'conditional nepotism' will spread as long as the cost/benefit ratio (C/B) is less than $(1 + 6p)/(2 + 8p)$, where p is the frequency of the gene (between 0 and 1 inclusive). This expression ranges from 1/2 to 7/10 depending on the value of p, so natural selection can favor Ivan treating Dmitri *as if* Dmitri were even more closely related than a brother, provided he can get Alyosha to do the same.

Box 3. Future directions

The present work in this area depends on linguistic evidence for universals of cognition. It needs to be further developed by:
(i) more high-quality evidence regarding the mental representation of kinship across cultures. Some anthropologists claim that explicit verbalized theories of kinship and reproduction vary wildly. But are these theories supported by more uniform psychological dispositions, as suggested here and by other anthropologists [30,32]?
(ii) more high-quality evidence regarding the behavioral and institutional dimensions of kinship across cultures. How is behavior towards kin constrained by social norms, and are norms consistent with 'group nepotism' or other evolutionary theories?

social relationships of their conspecifics. All the social schemas proposed here arguably have their homologs among non-human primates [26], although humans of course have an unmatched capacity for combining and customizing them to construct novel social forms.

Bringing in evolutionary theory introduces a whole new set of considerations; in fact, these considerations initially motivated the present work. Evolutionary biologists have their own theory of kinship: natural selection is expected to shape organisms to advance not only their own survival and reproduction, but also that of relatives who share their genes [27]. This theory of 'kin selection' is strongly supported by research on non-human animals [28], but there are problems in trying to apply it to humans. Consider the analysis of uncle terms sketched above. To a geneticist, Mother's Brother is no more distant a relation than Father's Brother. Yet many kinship terminologies – and not just terminologies but social practice – treat them very differently. Differences in the categorization of relatives at equal genealogical distance, and in associated rights and duties, are a classic and still-important topic in social anthropology [29,30]. These differences might call for revisions in the theory of kin selection to allow for the human aptitude for constructing solidarity groups with shared codes of conduct (Box 2) [31]. Fortunately, here two bodies of formal theory – the semantics of kin classification and the population genetics of normative kin altruism – converge, suggesting that in humans, as in other animals, the psychology of kinship has been sculpted by natural selection.

Conclusion

Kin terminologies show consistent patterns across cultures. They are organized around binary distinctive features (e.g. the distinction between lineal and collateral kin), and show consistent linguistic markedness effects (e.g. Father's Brother is unmarked – cognitively prototypical – relative to Mother's Brother). In the framework of linguistic Optimality Theory, these patterns result from the action of a small set of generative constraints, which generate different types of terminologies when arranged in different rank orders. These constraints in turn seem to derive from a few universal mental schemas of sociality, including schemas of genealogical distance, social rank, and group membership (see also Box 3). These schemas might be part of an evolved faculty of social cognition, consistent with a version of kin-selection theory that allows for socially imposed altruism.

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