Taking Sides: From Coherent Practice to Macro Organization

> "Probably the only way to give an account of the practical coherence of practices and works is to construct generative models which reproduce in their own terms the logic from which the coherence is generated" (Bourdieu 1990:92).

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Is theory in the social sciences necessarily ad hoc, provisional and shifting, mere description of patterns that are conditional on historically contingent outcomes? Or can theorems (provable consequences) provide, to some degree, a more secure grounding or basis for aspects of social theory (e.g., Boyd 1969)? A clarification is in order to see these two views as complementary rather than antithetical. Mathematical theorems are intended to demonstrate the equivalence of different properties of models of some phenomenon, or identify which properties logically imply others. Can this help to identify what properties of a social system are logically related? Surely, whatever one's view of theory, it would be useful to know that if one property is present, then a logically implicated property will also be present, even if only from the way the two properties are defined. When mapped to empirical phenomena, we might also try to understand a general process as a theoretical implication of this sort (following from definitions of first principles) that unfolds in a characteristic time scale, implying a dynamic. Different levels of a given problem might thus be logically and dynamically linked, and models that both apply to the phenomena under study and that show how levels are linked dynamically can provide a theoretical explanation for what we observe.

I. Theorems of a Piece with Theory: Local and Global Properties of Sided Networks

Theorems begin with useful definitions. A network may be represented by a graph with different kinds of relations among its nodes. The nodes may represent individuals (social network), elements of cognition (cognitive networks; e.g., Heider 1946), language, and so forth.

Definition 1. A sideable graph G consists of a set of nodes and two types of edges between pairs of nodes, locative and mediative.

Definition 2. A u-v path in a graph G consists of a set of edges that connect u and v, and where no node in the path is repeated.

These definitions provide a basis for linking the global structure of sidedness with local properties that are accessible to participants in a sided network, even when participants have only local knowledge so that global properties are not necessarily evident to them.

Sidedness (Balance) Theorem (Harary 1953): The following statements are equivalent, and define whether a sideable graph G is sided:

1. Global Rule: the nodes in G can be partitioned into two sets called sides where every pair of nodes connected by a locative edge are on the same side and every pair of nodes connected by a mediative edge are on opposite sides.
2. Local Rule: all paths between two nodes u,v in G are identically sided, where u and v are on the same side when the number of mediative edges in a path is even and on opposite sides when the number is odd.

Proof: Harary (1953), substituting signed for sideable, balanced for sided, positive for locative, and negative for mediative.

Theorems such as the equivalence of local and global definitions of balance, as applied to equivalent definitions of sidedness, may be useful to studies of social and cultural phenomena, to the extent that the models apply. It has long been recognized that given a global structure, if participants are asked to play by the rules, their behavior will be constrained, perhaps prescribed. What is less commonly understood, but now the focus of complexity theory, is how complexly organized phenomena, macro or global structure, can emerge out of simple rules of interaction.

II. Taking Sides

We all have experience taking sides, and understand the elementary form of taking sides in two-sided factions. Binary oppositions are also one of the ways we organize our thinking. Within sides and between them, in this sense of sides, there are two different kinds of relations, one locative (within sides: "serving to indicate or locate the position of something') and the other mediative (between sides: "pertaining to a media or mediation; mediating"). It is useful to have generic terms for these two kinds of relations since there are many kinds of sidedness, such as those shown in Figure 1, which sets out an array of possibilities rather than a definitive typology. In factions, for example, the mediative relation is often considered negative (e.g., enmities) and the locative relation, by contrast, positive (e.g, friendships). Parties are like factions except that the relations are less personal, and are organized around leaders or issues. Here we will illustrate the principles by which factions or parties become polarized or sided, as in a two party system. In matrimonial sides, or dual organization, the subject of our study, the opposition is quite different. Here, those of each side consider themselves like kin, and the mediative relation of marriage between sides is often a positive one as connoted in the term alliance. Locative kin-like relations may even be negative, as where members of the same group are in competition for a limited set of resources. That is the case in the instance of taking sides that we will examine here, the marriage networks of Pul Eliya, as described by Edmund Leach (1961). Matrimonial moieties are a special case of matrimonial sides in which membership in sides is inherited under a unilineal descent rule.

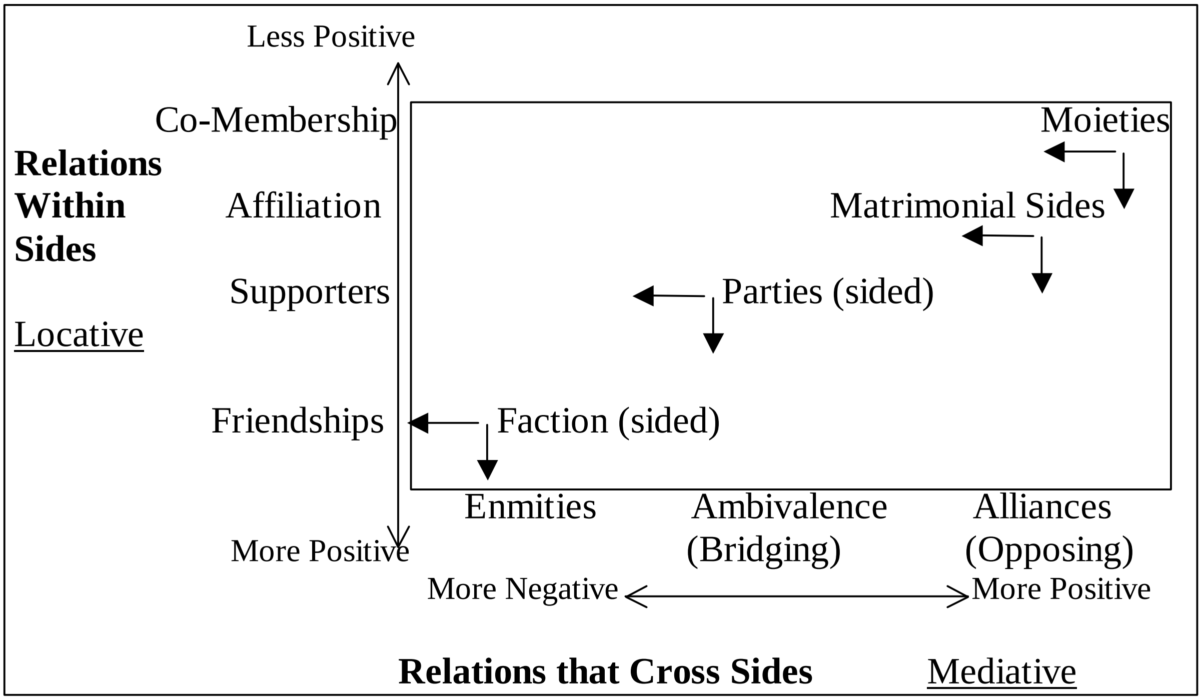


Figure 1: Different Meanings of Relations within and across Sides

The sidedness theorem identifies the intrinsic micro-macro linkages in sided networks. It shows how the micro level of relations among participants or participating elements has implications for the global structure of the network, and vice versa. This will have fundamental importance for understanding kinship as a system of relationships. We should not take the principle of balance as prescribing stability of structure: rather it describes a complex dynamic. We observe U.S. President Bush generating a two-sided world, for example, by his injunction "If you are not with us, you are against us." He aims for stability in a democratic one-regime system, but generates bipolarity. And watching Afghani warriors hugging their former enemies as new friends following surrender, to redraw balanced alliances, we sense just how fluid are the shifting balances of bipolar alignments.

Local Rules and Global Structures for Sides

Figure 2 gives some examples of how the sidedness theorem helps to explain the emergence of the social phenomena of polarization as it appears in different forms: polarized factions, two-party systems, binary logics, and the like. The logic of factions provides the most familiar example (see Figure 1). The local rules are given in composition tables A-C show how each pair of elements, e.g., friend of friend, composes into a new relation, if any. For sided factions, for example, an enemy of an enemy is, if anything, a friend. The composition tables for sided elements in Figure 2 have the properties of associativity, $a\ (b\ c) = (a\ b)\ c$, commutivity, $a\ b = b\ a$ and identity, that is, an identity element I (e.g., friend), such that $I\ x = x$ for all x. The composition table for the purely abstract multiplication of signs (Table C) is a binary logic that has the same structure as sided factions or two-party systems.

Faction Logic (relational)

__of __	**Friendship**	**Enmity**
Friendship	**Friendship**	**Enmity**
Enmity	**Enmity**	**Friendship**

Composition Table A.

Faction Logic (personal)

__of __	**Friend** ●	**Enemy** ○
Friend ●	**Friend** ●	**Enemy** ○
Enemy ○	**Enemy** ○	**Friend** ●

Composition Table B.

Multiplication of Signs (purely abstract)

__of __	+ ——	- ——
+ ——	+ ——	- ——
- ——	- ——	+ ——

Composition Table C.

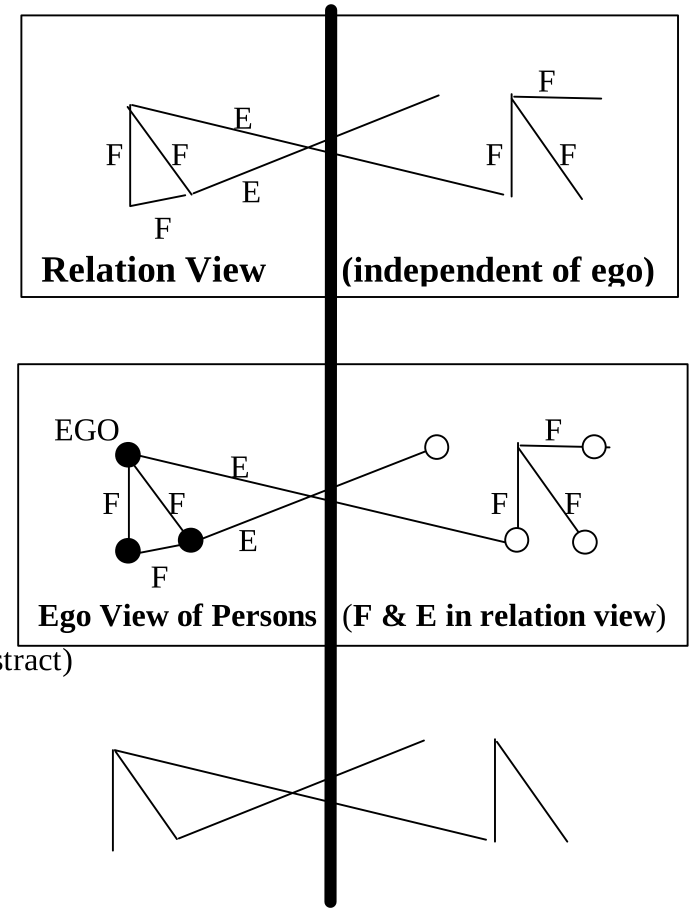


Figure 2: Examples of sidedness from different domains

Note that a <u>decision model</u> that implements a local rule for constructing sided relationships, as in these examples, when followed uniformly, is sufficient for the sidedness theorem to imply a globally sided network.

III. Sides in Kinship Networks: The Social, Decision and Language Models

We begin our study of sidedness in kinship graphs with two definitions in order to restate the sidedness theorem.

Definition 3. A kinship <u>genea-graph</u> G consists of parent-child links (genea-edges) between individuals (genea-nodes).
Definition 4. A u-v <u>genea-path</u> in a genea-graph G consists of a set of genea-edges that connect u and v, and where no genea-node in the path is repeated.

Viri-sided Corollary of the Sidedness Theorem: The following statements are equivalent, and define whether a kinship genea-graph G is <u>viri-sided</u>:

3. <u>Global Rule</u>: the individuals in G can be partitioned into two sides where every son is on the same side as his father and every daughter is on the opposite side of her father.

4. Local Rule: all genea-paths between two nodes u,v in G are identically sided, where u and v are on the same side when the number of parent/daughter links in a genea-path is even and on opposite sides when the number is odd.

The proof follows from the Sidedness Theorem (Harary 1953) by substituting daughter-edge for negative edge and son-edge for positive edge.

Uxori-sided Corollary: Identical to that above substituting uxori-sided for viri-sided and interchanging the terms daughter and son.

The social model of sidedness is defined by the global rule for sidedness.

Restating Local Rules of Sidedness for Kin-Types and Kin terms

Definition 5. V-cross relatives, from the persepctive of a given ego in a kinship network, are those who are cross in the sense of potential affines or marriageable relatives in a viri-sided kinship network. Conversely, in a viri-sided network, pairs of relatives that are not v-cross are unmarriageable. Cross cousins (children of a brother and sister, respectively) are special cases of v-cross relatives.

A decision model consistent with local sidedness in marriage networks is simply to marry within the class of v-cross relatives. A relative is v-cross if the number of female links in the relationship is even. For example, a man's MBD has two female links (M and D). Typically, marriage choices of v-cross relatives are further limited by generation, e.g., men might typically marry cognates (consanguines) in the same, G^0, and adjacent, G^{-1}, generations relative to a common ancestor.

The sidedness theorem states that if the social model of sidedness is implemented relatively perfectly, then the decision model of sidedness – in any of its equivalent forms – is widely implemented to the same degree across individuals. But there are additional implications, because for the decision model of sidedness to be implemented widely across individuals who are linked into the same network, they must also share a common definition or perception of the parts of the network that they have in common.

If we think about how kinship networks are constructed, that pairs of individuals may not be closely connected, that they may be connected by more than one and potentially many paths, that they may have different perceptions of how two individuals are connected, and so forth, it might seem that kinship networks lack the consistency for a mapping from genealogies to graphs to be meaningful. But conversely, where a global structure of sidedness is evident, the local consistencies that might be in doubt are already in evidence. And since we define genealogical networks simply by genealogical parent-child relationships between individuals, there is little room for the slipperiness that might occur if we defined genealogical structures differently in each case. This is not to say that parentage is an irrefutable fact based in biology, but simply that the consistency we look for in a genealogical network is also a consistency of agreement in who is parent of whom, even is parentage is socially or culturally constructed rather than biological.

In making this argument, it is also evident that the global/local isomorphism found in the structure of graphs can be a powerful interpretive heureristic when examining empirical systems where a mapping has to be made from observations to a model of those observations, such as a genealogy. In addition, the theorem provides the ground for the research strategy of starting with global structure rather than starting with the study of individuals and their decision rules. Trying to find out whether two individuals are using the "same" decision rules when each rule may be coded in different ways, is a potential quagmire. It is far simpler to say that their decision rules, however idiosyncratic, are equivalent when they give the same outputs from identical inputs, i.e., when their results are isomorphic. From global structure of a network we may be able to infer certain isomorphic aspects of decisions taken across individuals that contributed to the construction of the network.

Definition 6. V-cross kin terms are kinship terminologies of the Dravidian type (Lounsbury 1964a,b[1], Trautmann 1981, Gould 2000) that distinguish classes of v-cross relatives (affines) as opposed to non v-cross relatives (cognates) in the same (G^0) and adjacent (G^{-1}) generations in which marriage is allowed, in a manner consistent with viri-sides. Similary, u-cross relatives and kin terms are those consistent with uxori-sides.

A language model consistent with local sidedness in marriage networks is simply to marry within the class relatives linked by of v-cross kin terms. Relatives linked by v-cross kin terms are defined as v-cross relatives in the social model, so that the number of female links in the relationship is even, as with the example of MBD.

Note that the decision model for sided marriage may be implemented independently of the language model, but not vice versa. Language models for the application of kin terms require instantiation, e.g., to a kin-type genealogical mapping, and then to individuals, but these mappings are not necessarily unique. Read (2000:1-2) views kinship terminology, for example, "from a perspective of a structured, symbolic system in which there is both a symbol calculus and a set of rules of instantiation giving the symbols empirical content…. The symbol structure is linked to individuals via culturally specified instantiation of symbols. The instantiation rules can change without changing the structure.… one's kin are determined through the symbol structure and its instantiation. A symbol structure can have more than one instantiation, thereby allowing for multiple views of who are one's kin, even if these views are mutually contradictory, as has been noted for some groups."

Figure 3 shows viri-sided networks in the top graph and v-cross relatives in a kinship network in the lower graph recoded in some of the possible lexicons of v-cross kin terms. [2]

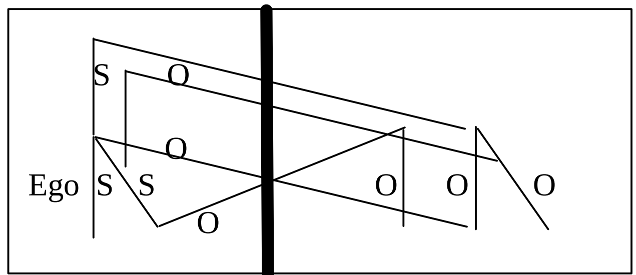
[1] Lounsbury (1964a:fn. 4) was the first to note that the Dravidian type of systems are generally founded on "a mode of reckoning bifurcation that, unlike the Iroquois, takes into account of the sexes of all intervening links." He also refers (1964b:fn. 16) to Dravidian systems as involving "prescriptive affinity," e.g., MBD=W.

[2] Read (2000) shows that kinship terminologies invariably contain equivalence classes that act as identity elements to reference the system to ego, although commutivity is rare, and associativity is sometimes lost. In Kay's model of a v-cross kin-term system, the cross/parallel construction is both commutative and associative; e.g., father is a parallel relative, brother/sister are parallel relatives, and father's sister (parallel of parallel) is also parallel.

Matrimonial Sidedness (Same Opposite)

__of __	S ——	O ——
S ——	S ——	O ——
O ——	O ——	S ——

Composition Table D.



There are no matrimonial cycles within a side, only between opposing sides (this is particularly evident with our p-graph genealogical

Cross/Parallel (viri type)

__of __	Parallel	Cross
Parallel	Parallel	Cross
Cross	Cross	Parallel

Composition Table E for Ego's Generation.

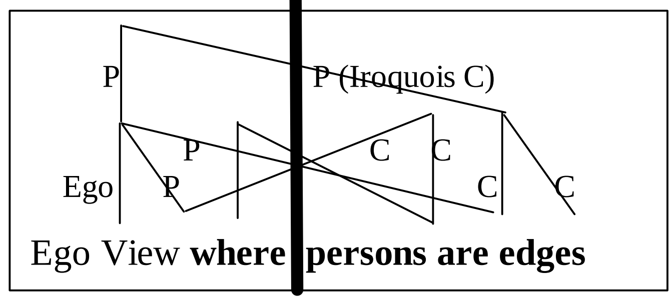


Figure 3: Sidedness recoded as v-cross (C) and v-parallel (P) in kinship terminology

The theoretical linkage between local and global structure in a sided system of marriage of v-cross cognates is given, once again, by the theorem of sidedness. The theorem explains how such a system can have sides, similar to moieties, but lack a descent rule or global coding in linguistic categories for this form of dual organization.

Matrimonial sidedness is equivalent to the anthropological concept of moieties (patrimoiety and matrimoiety) only when same-sidedness is determined and interpreted by unilineal descent, and not simply a statistical property approximated to some degree by a kinship network in the absence of descent rule determinations. In the latter sense, Houseman and White (1998a) provide measurements for the degree to which a network approximates sidedness, irrespective of whether descent rules are involved or whether they are defined, conceptualized, or otherwise codified by members of the network.

Models and Parameters: Sidedness and Dividedness

The Appendix provides definitions will allow us to examine the degree of matrimonial sidedness in different ethnographically described marriage networks, using coefficients of viri-sidedness, uxori-sidedness and dividedness for each network, and for each coefficient, a significance test (see Houseman and White 1998a where these are also defined and applied to twelve ethnographic cases). Before we examine Pul Eliyan sided networks, however, we need to understand why they might exist, and what they might entail at the cultural level. Rather than address these questions on a case-by-case basis, we may profit from the fact that these questions are the ones addressed at the cultural level by the theory of restricted exchange.

IV. The Theory of Sidedness as Restricted Exchange

Matrimonial sidedness is two-sided exchange for which the appropriate cultural models are those of reciprocity in the context of dual or restricted exchange. Lévi-Strauss (1949 [transl. 1969]) is the primary theoretician and model-builder for the study of sidedness in kinship systems. We review his treatment of restricted exchange to introduce the concept of sidedness in this context. He also addresses the question: why two-sided exchange? In a way that explicates the cultural models of two-sided exchange in different ethnographic contexts. While not explicitely mathematical, his theory has the logico-deductive structure of mathematical modeling. It deals with models of elementary systems of kinship, defined as those with a positive rule for which types of marriages are allowed (e.g., those that prescribe marriage with a certain type of relative), although his empirical observations pertain to cases that only approximate such models to a certain degree. His argument is schematized in Figure 4, where the nodes under Cross-Cousin Marriage (CCM) are elementary systems that result from uniform application of cross-cousin marriage rules (MCCM, PCCM, BCCM).[3] If we consider each type of cross-cousin marriage as a mini-network of four couples (the grandparents, the grandchildren who have married, and the two parental couples), each such network fits the definition of sidedness and constitutes a locally restricted exchange; further, in each of these types of marriage, two descent lines exchange women, whether the descent is counted through males or females; and the same can be said, in another perspective, about the exchange of men. The novelty of the theory, however, is that MCCM and PCCM marriage rules, when followed uniformly, imply a generalized system of exchange, that is, a set three or more groups at the global level engaged in marriage exchanges. The theory can be sketched as follows.

[3] The M, P and B in MCCM, PCCM and BCCM stand for matrilateral, patrilateral and bilateral cross-cousin marriage systems, respectively. In an MCCM system males marry their MBD; in PCCM their FZD, and in a BCCM system brothers exchange systems in marriage in successive generations. Most cases that approach uniform marriage rules of these types do so in terms of classificatory kinship relations, where there are also significant numbers of 'true' MCCM, PCCM or BCCM marriages, respectively.

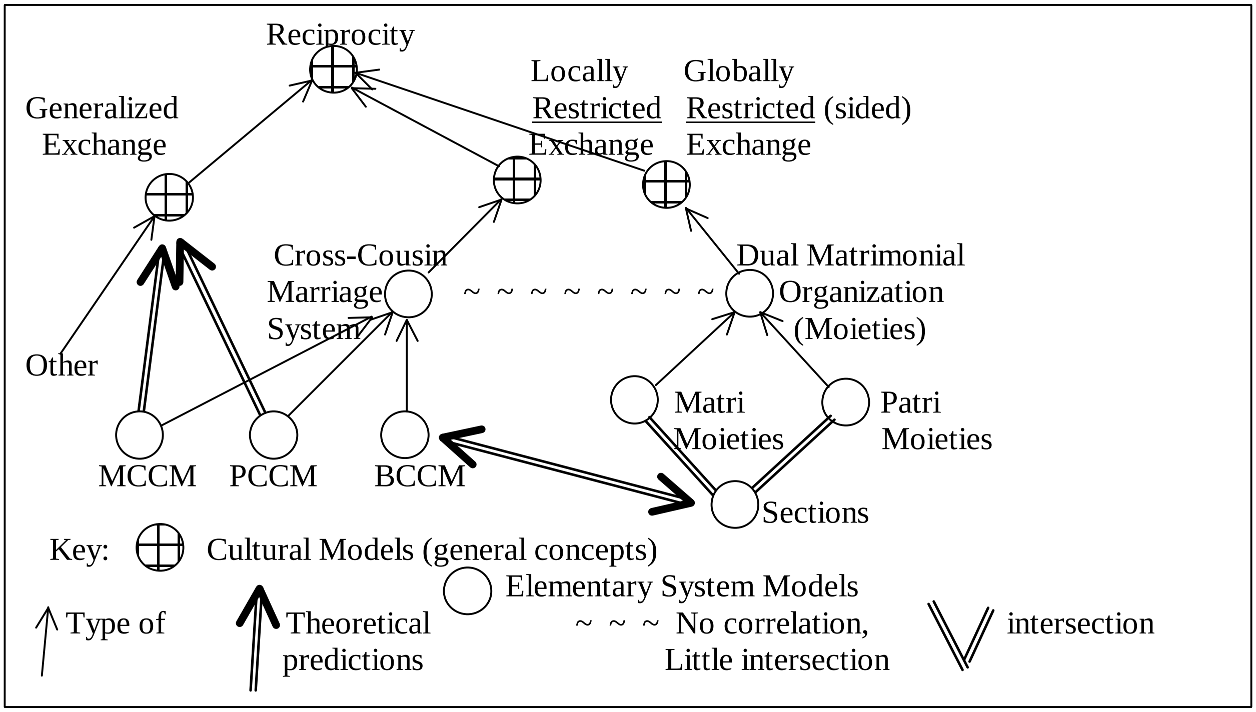


Figure 4: Diagram of the Theory of Restricted (Sided) vs. Generalized Exchange

Lévi-Strauss begins with two axioms and procedes to develop a typology of models.

Axiom 1: Reciprocity is fundamental to exchange.

Axiom 2: The exchange of women, goods, and ideas is fundamental to human society.

Typology 1: He identifies two types of exchange, restricted (between pairs of groups) and generalized (between three or more groups).

Typology 2: He identifies two types of restricted exchange of women, cross-cousin marriage (locally restricted) and dual organization (globally restricted, which applies to dual matrimonial organization or moieties).

Side Comment: Moieties are globally sided, while individual cross-cousin marriages are locally sided.

Model 1 (1969:119): CCM is based on a discriminatory procedure (positive relationships of alliance between the two sides) that applies separately to each individual. Moieties are based on an automatic procedure (unilineal descent) for sorting out individuals into two categories (with negative marriage proscriptions within the same side). The advantages of opposition and correlation of cooperative activities in dual organization are in solving multiple problems by a diversity of specialized forms and contents that have a simple and constant general form (1969:82-83).

Inference: Model 1 should imply that the two types of restricted exchange, local and global, accomplish the same task by different means, and hence should be uncorrelated.

Observation 1: He finds no correlation between the two forms of restricted exchange, CCM and Moieties, confirming Model 1 empirically.

Model 2: He shows that matrilateral cross-cousin marriage (MCCM) implies generalized exchange (following Granet 1939).

Observation 2: This is confirmed empirically by the finding that the numbers of exogamous groups linked by MCCM marriages in societies where MCCM is the predominant rule of marriages is three or greater.

Model 3: He shows that patrilateral cross-cousin marriage type (PCCM) implies restricted exchange only in successive generations (following Granet 1939) and not globally, and hence forms a distinct form or pole of generalized exchange (1969:464).

Observation 3: This is confirmed empirically by the finding that, even in societies where PCCM is the predominant rule of marriages, instead of constituting an overall system, PCCM is “incapable of attaining a form other than a multitude of small closed systems” (1969:445).

Model 4: He shows that bilateral cross-cousin marriage type (BCCM) or direct exchange is possible only in regimes with contrasting rules of residence and descent (e.g., patrilineal and matrilocal or matrilineal and patrilocal, which he calls disharmonic) and hence forms a distinct axis of resticted exchange contrasting with each of the poles in the axis of generalized exchange (1969:218, 464).

Observation 4: This is confirmed empirically by the findings that BCCM systems typically involve no cycles of marriage exchanges between groups beyond A ✍✍ B (1969:465), and that marriage classes (section systems) appear in the majority of cases in which BCCM occurs (1969:441).

Inference: BCCM systems have evolved out of unilateral CCM systems, not conversely (1969:219).

In the framework of Lévi-Strauss, there is no place for sidedness that is not based on moieties and a descent rule.

V. Equivalent Logics of Sided Kinship Term Equivalence

“Instead of arranging societies according to typologies…, we should approach each as a specific combination of principles” which have varying degrees of congruence (Hornborg 1988: 233). The kingraph (Gould 2000:158) in Figure 5 shows Trautmann’s (1981: 229-237) reconstruction of kin terms in proto-Dravidian, arranged so that equivalence classes are contained in boxes, the heavy box contains ego, and the shortest kin type in each class is written within each box. Solid lines connect boxes containing fathers with those of father’s children, and dotted lines connect boxes containing mothers with those of mother’s children. The marriage graph (Weil 1949, Bertin 1967, Guilbaud 1970) shows the same equivalence classes, with individuals in pairs and marriageable pairs connected by an equal sign (e.g., F = M). Here, heavy solid lines go from parental couples to sons in the box below, and dotted lines from parental couples to daughters below. All columns are labeled to whether the number of female relatives linking to ego is even or odd, and by whether the kin types in the column are cross (X), parallel (//) or underdetermined (?) without further data. A characteristic of most Dravidian-type systems is that affines are classified in the same equivalence classes as cognates.

Equivalence classes align with a viri-sided marriage network. To show the potential for generationally skewed marriages in such a network, the marriage graph has extra daughter lines connecting diamonds (alternate marriages) to spheres (parent of the spouse). For example, the diamond in the ego box connected to a wife’s mother Z indicates that ego B (male) could marry a ZD or eZD. Consistent with viri-sided marriage networks, the potential for skewed marriage is replicated symmetrically in each generation, and each kin type in the +2 and –2 generation boxes has appropriate even/odd numbers of female linking relatives.

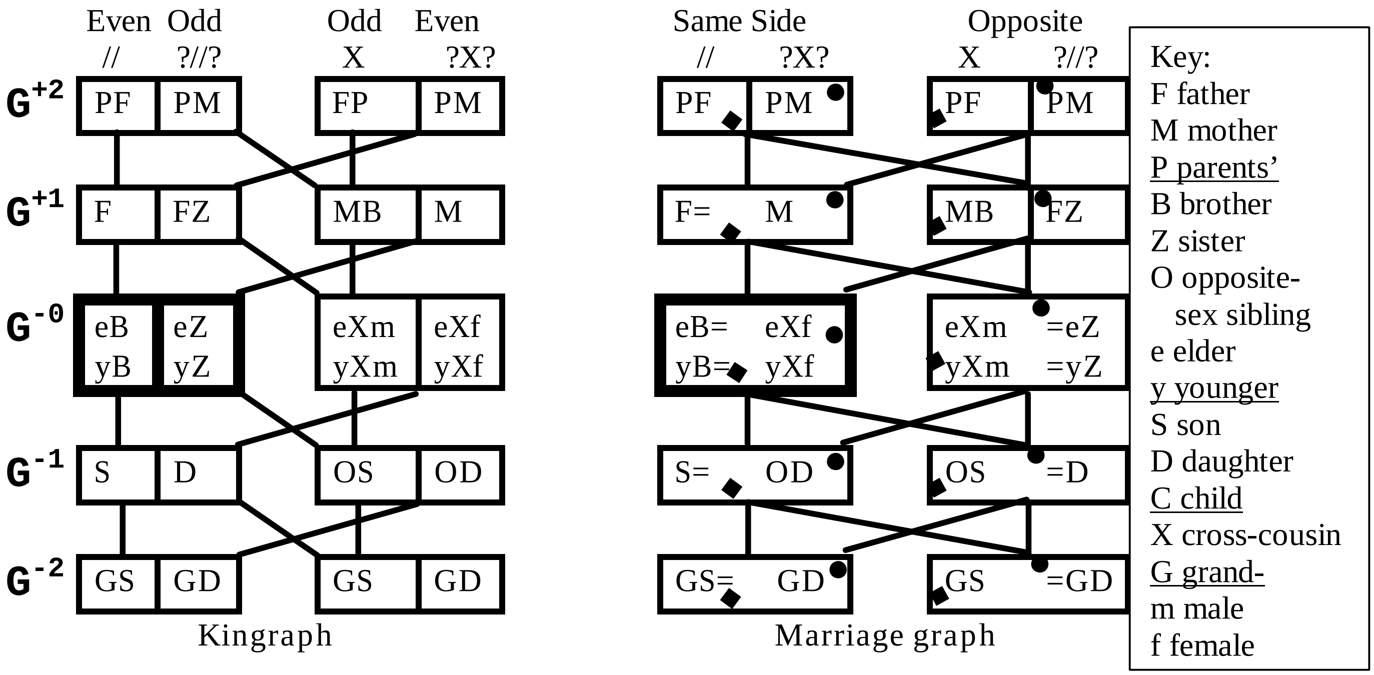


Figure 5: Kinterm Equivalence Sets in V-Cross Proto-Dravidian

In each of the equivalence-class graphs in Figure 5, the first column in each pair of adjacent boxes designates a set either of parallel or cross relatives, but each second column (labeled ?//? or ?X?) is underdetermined and open to alternate interpretations without further data. Column 2 contains FZ (cross?) and sister (parallel?), for example, and column 4 contains M (parallel?) and female daughter of FZ or MB (cross cousin). We know how to reckon sidedness in Dravidian systems, but how is crossness defined? Crossness in kinship terminology operates in two different modes. One is the Iroquois mode in which same sex siblings are parallel and opposite sex siblings are cross, and the cross/parallel distinction among parents carries over to the next generation of cousins. Many analyses of Dravidian confuse or conflate Iroquois and Dravidian, and assume that MB and FZ are automatically cross-relatives.

In a Dravidian viri-sided system, MB/ZD marriage is possible but FZ/BS marriage is not; the opposite is true in a uxori-sided system. Dumont (1953) parses MB in a v-cross terminology as a privileged marriage alliance, “father’s male affine.” Dumont interprets this “privileged alliance” as “heritable” across generations from MB to MBD (both MB/ZD and MBD/FZS marriage are consistent with a viri-sided marriage system), and from fathers to sons (sons would “inherit” the father/MB “alliance” relation). Dumont’s parsing is consistent with FZ as a non-affine of the father (parallel), but an affine of the mother. Trautmann (1981:174) criticizes this argument as privileging “alliances between males,” and notes that FWZ, an affine of the father, is classed with mother as a parallel relative. In a viri-sided marriage network, however, FWZ is an equivalent to M, so Trautmann’s counterexample is beside the point.

Just as Trautmann and Dumont may disagree over what is “truly” cross and “truly” parallel, however, individual societies with Dravidian sidedness may handle these classificatory problems differently. As we see in Figure 5, there are quite different logics that are in many senses equivalent for the same type of Dravidian system. Kay’s (1967) proposal for the Dravidian cross/parallel distinction classifies FZ as parallel and M as cross in a v-cross system.[4] This proposal would resolve potential inconsistencies in the coding of the second and fourth columns in Figure 5, which become // and X, respectively, consistent with Dumont's interpretation.[5] Does Trautmann neglect to mention Kay's proposal because it flies in the face of conventional "Iroquois" assumptions that F and M are parallel relatives, while FZ and MB are cross? Trautmann's (1981:185-88) argument for a generic "crossness" dimension for Dravidian terminologies and his particular construction (pp. 51-60) of generic equivalence classes for Dravidian should be regarded as provisional, since they rest on analysis of a single society, but in any case his work provides a third logic that is also compatible with viri-sided marriage, alternative to those of either model shown in Figure 5.

We can now reconsider Figure 5 as a model of v-cross kinship terminology. The links that change sides, those through females, are coded in two distinct ways: links through female kin of the same or lower generations are parallel (P), links through wives are cross (C), and female kin of senior generations may be coded as either parallel (Dumont) or cross (Trautmann). In either case, the cross kin-term categories contain all the marriageable kin. Even simpler than Kay's (1967) model of Dravidian crossness, however, is a sided computation of marriageability that counts an unmarriageable relative as one with whom, in a viri-sided marriage system, one has an odd number of female linking relatives, or in a uxori-sided marriage system, an odd number of male linking relative. In any case, whichever alternative logic is used to reckon crossness or sidedness, the classification of kin on this dimension is recursive, and knowing the classification of a relative at distance k, it is possible to determine the classification of an adjacent relative at distance k+1.

The equivalence of local and global criteria for sidedness has further consequences, however. First, the local rule for recognizing and describing cross and parallel kin is a social model that is easily understood without reference to kinship terms at all. Second, the implications for rules about marriage choices, such as avoiding marriage with parallel relatives, need not be implemented through kinship terminology, but by application of the social model. Third, if the cross / parallel distinction is also present in the kinship terminology, the language model is simply redundant with the social model. The language model (terminology) is not necessary to

[4] Using a notation where m = male, f = female, + is a child to parent link, - is a parent to child link, and 0 is a parental couple, every even sum of + f or f – female links corresponds to a parallel relative, and every odd sum of + f or f – female links to a cross relative, as for example (starting with the leftmost female f):

f + 0 – m = brother (0) //
f + 0 – f = sister (0) /
f + f = mother (1) X = "Father's Affine" (Dumont) – differs from Trautmann (1981) and Iroquois cross/parallel
f + 0 – m – m = brother's son (0) //
f + m + 0 – m = father's brother (0) //
f + m + 0 – f = father's sister (0) // – differs from Trautmann (1981) and Iroquois cross/parallel
f + f + 0 – m = mother's brother (1) X = "Father's Affine" (Dumont)
f + m + 0 – m – m = father's brother's son (0) //
f + m + 0 – f – m = father's sister's son (1) X
f + f + 0 – m – m = mother's brother's son (1) X
f + f + 0 – f – m = mother's sister's son (2) //

This is the number of females rule for reckoning the cross / parallel distinction. .

[5] In a u-cross system, Kay's proposal treats MB as parallel and F as cross. We can note, however, that there are no good ethnographic accounts of u-cross Dravidian terminologies, however, nor are there any network analyses so far that have identified uxori-sided marriage systems, so there is no reason to doubt Trautmann's reconstruction of proto-Dravidian (pp. 229-237) as a v-cross terminology corresponding to viri-sidedness.

implement choices about not marrying parallel kin, but we would nonetheless expect a v-cross kinship terminology to order and implement the social model at the local level as a construction that is shared across different egos.

Currently, anthropologists and scholars concerned with Dravidian terminologies tend to define them by what they see as their instantiations, or by the most salient characteristics of the societies that have such terminologies. The common formulation is to say that the Dravidian kinship system consists of a cross / parallel distinction in kinship terminology plus symmetric cross-cousin marriage (symmetric alliance). Neither of these two very concrete features are necessary conditions of sidedness. The formula of Dravidian, stated in this way, is only one instantiation of the full potential of a sided system, a concrete metaphor for a system that anthropologists have only poorly understood. It is an imagined instantiation and imaginary "origin" of a social model with much broader implications. Much like what happens with names of newly encountered object: as in calling a photocopier after its exemplar, "the Xerox machine," even if manufactured by Toshiba.

The puzzle of v-cross kin (Dravidian) terminologies, in our view, encompassed in the framework we developed here, is whether and how the crossness present in a purely egocentric kinship terminology is translated into a sided network, if at all. To repeat our theme: the sidedness theorem provides one answer: if the local rule of sided marriages is strictly followed, the marriage network itself will be strictly sided as well. Understanding the mathematical theorem provides a key insight for understanding our ethnographic data. We now turn to reconsider the theory of sidedness in the light of new findings.

VI. Pul Eliya: An Ethnographic Study of Sidedness in Cognate Marriages

None of Lévi-Strauss's models of dual organization (moieties) or elementary structures (MCCM, PCCM, BCCM) apply to Pul Eliya (Leach 1961, Houseman and White 1998b). Located in Sri Lanka, Pul Eliya has a v-cross kinship (Dravidian type) terminology that divides relatives, from the perspective of each ego, into two sides that conform to a viri-sided marriage network, at least for for each ego. We ask three theoretical questions:

(1) Can a globally sided marriage network emerge in a society in which sidedness rules are a purely local phenomena, that is, in the ethnographic context of a Dravidian kin-term system with appropriate marriage prohibitions (a v-cross marriage system)?
(2) Can the local rules for sidedness refer to some other criterion that descent?
(3) To what extent does a local/global correlation or isomorphism hold: only for networks of marriages linked by cognate ties, for densely relinked marriages, for marriages that are only relinked in dispersed subsets?

The sidedness theory would explain (1) how marriage choices that are "merely" viri-sided in governing the choice of spouses for individuals can generate a global sideness structure of dual organization that closely resembles that of matrimonial moeties, but is not based on principles of descent. We will show that the Pul Eliyan marriage network satisfies, to a very high degree, the global model of sidedness. To answer (2) and (3), we need to examine the ethnographic data.

Pul Eliya as an ethnographic case is highly relevant to the general question of the implications of Dravidian kin-term systems for social organization. In South Asia, the consistency of Dravidian kin terms with proto-Dravidian (Trautmann 1981) increases as we move south; the further north the Dravidian society, the more assimilation of Indo-Aryan features. In this context, the Sri Lankan Tamil and Sinhalese kin-term systems are highly prototypical of Dravidian systems. The Tamil are Dravidian language speakers, but the Pul Eliyans are not. Nonetheless, the Sinhalese assimilation to a Dravidian-type kinship system is archaic and deeply prototypical.

To investigate marriage sidedness in the Dravidian heartland, we decided on a rigorous set of questions about observed behavior in a network context. We started our study from a close reading of Edmund Leach's (1961) study of Pul Eliya and the genealogies in his monograph. Since Pul Eliya has a v-cross kinship (Dravidian) terminology and a locally sided marriage rule prohibiting marriage with v-parallel relatives, we thought we should observe sidedness in the Pul Eliyan marriage network if it exists. Further, since the Pul Eliyan villagers had a fair degree of local endogamy, we thought that if a sided network exists it would also form a restricted exchange structure of dual organization. To test these hypotheses by study the network structure, we converted the genealogies shown in Figure 6 to a kinship and marriage network.

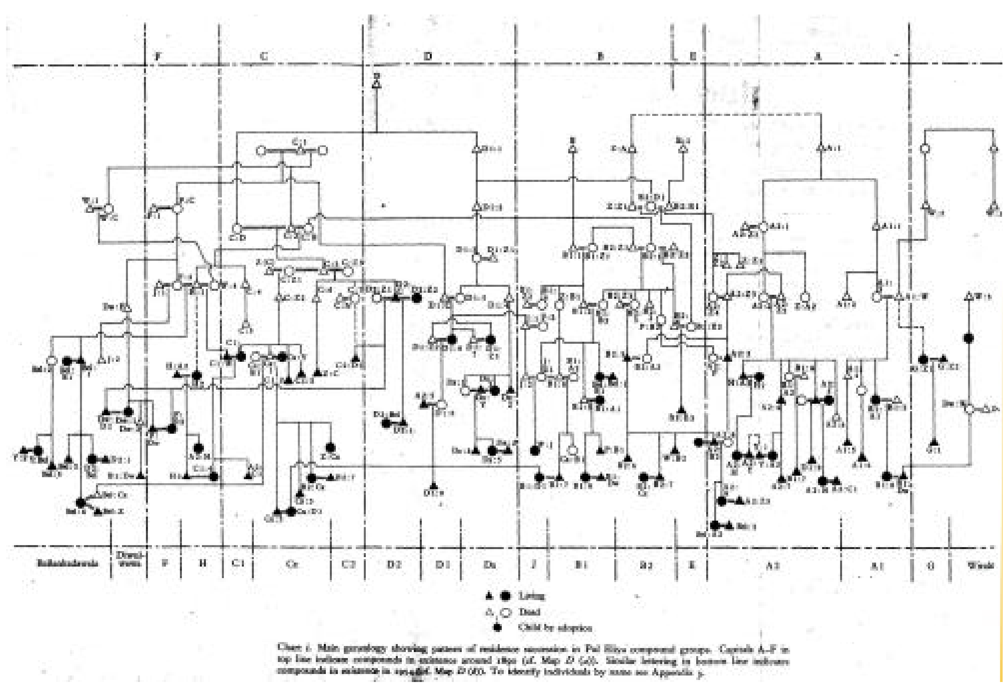


Figure 6: Family genealogies organized by Leach according to compound (or village if outside Pul Eliya)

In considering how to analyze the marriage network, we thought that the local rule for sided marriage might be ambiguous in concrete cases if for no other reason than the fact that people intermarrying in small communities have more than one type of genealogical-cum-marriage tie. If one or more couples broke the sidedness rule, might not that reverberate so that subsequent pairs of relatives would find more inconsistencies? That is, what would happen in trying to reconcile different pathways to a given relative if some are parallel and others cross?

We found in our first examination of the marriage network that there were some exceptions to sidedness in Pul Eliya, but we could not know for certain how people actually resolved this problem in choosing a spouse. Hence we took an experimental approach, and divided the marriage network into two subnetworks that suited our question about reconciling errors.

The first network we examined is shown below, and consists of all those persons in Leach's complete Pul Eliyan genealogy that married cognates, plus all of the linking relatives for each cognate marriage. Our idea was that people might be more clear about which of their cognates were parallel relatives and which were cross. If this were true and if parallel cognates were avoided in marriage, then this subnetwork should be relatively free of errors to global sidedness.

Figure 7 shows the sidedness network for cognate marriages in Pul Eliya. How it is constructed is explained in the Appendix: suffice it to say that the nodes represent actual couples, the red dotted lines represent daughters descended from a parental node above and coupling to a node below that includes the husband in a new marriage, and the black solid lines represent sons descended from a parental node above and coupling to a node below that includes the wife. Blood marriages are circled and if these circles are shaded they marriages are generationally oblique. Couples that are not circled are linking relatives.

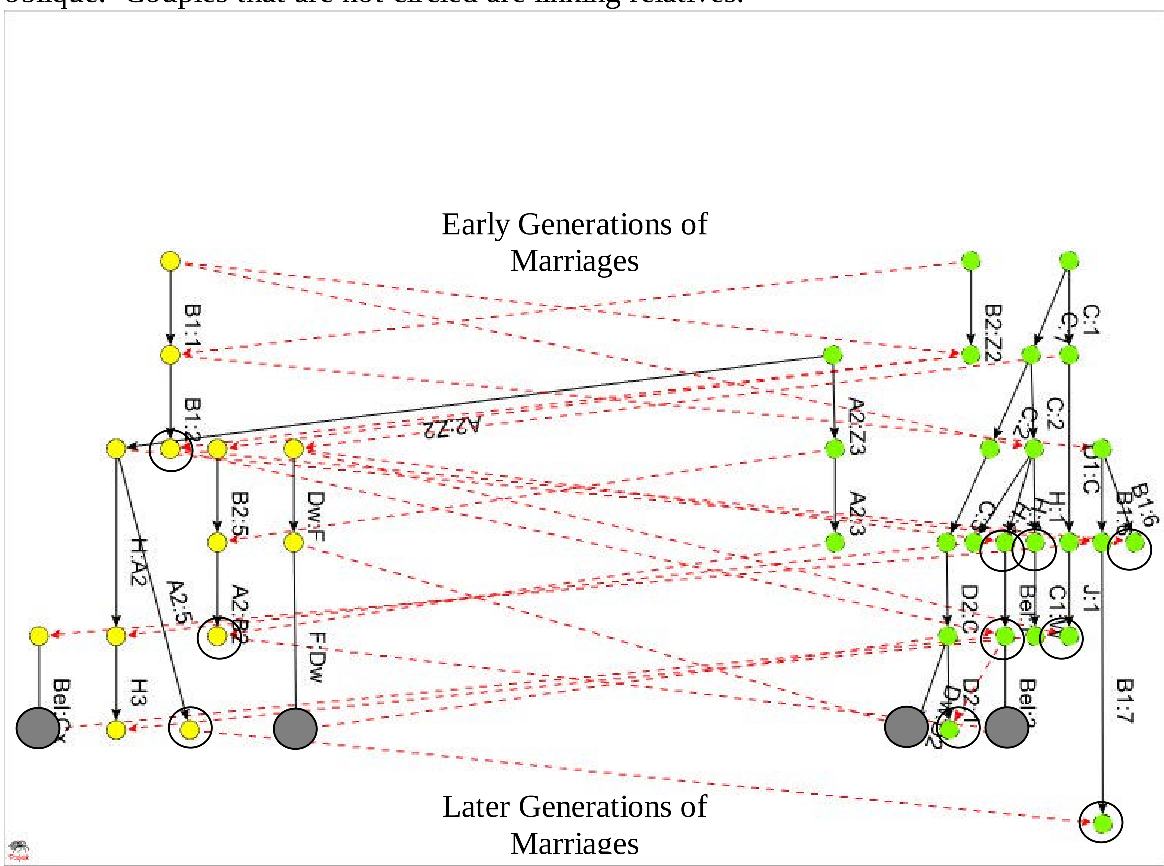


Figure 7: Cognate Marriages (14, circled), each with their connecting couples. Of the 34+22=56 edges in this graph 2 are incorrectly sided. (The four oblique marriages ( ) are viri-sided)

Our first hypothesis was correct. Not only were there only two errors to sidedness in the network of blood kin, but both were exceptions only to a descent-based conception of sidedness. One error is associated with a pair of brothers that by a patrilineal descent rule would be on the same side of a moiety system, but here they marry on opposite sides. They come from a distant village and had no prior kin in Pul Eliya, however, and their marriages do not violate the conception of proper marriages as explained by Leach. The other error was marriage with a parallel fourth cousin whose father came from outside Pul Eliya. The father was properly sided in terms of previous marriages, so this was clearly an improper marriage, but its consequences – that the wife's father be reclassified as an in-law, had little repercussion on the consistency of sides within Pul Eliya since the man resided in another village. The two errors confirmed Leach's ethnographic statements that this was not a system built on descent rules, but on considerations of village of origin, compound residence, and issues of inheritance of compound property as well as strategic alliances. The primary means of forging cooperative labor ties in Pul Eliya, for example, is through brother-in-law links created by marriage alliances.

Exceptions Make the Rules

The intricate exceptions to sided marriage help us to formulate the rules of sidedness. Leach is adamant that Pul Eliyan kinship is cognatic rather than unilineal, a major difference from a system of hereditary moieties. In Pul Eliya, then, sidedness is a statistical tendency, not determined by a rule of descent. But Leach himself never perceived the network sidedness that was implicit in his published genealogical data.

When we put the whole network back together using our cognate subnetwork to help clarify the two distinct sides in the village, we discovered another cognatic phenomena. Typically, compounds are inherited by sons and compound property mostly by males. Some women who were heirs to their compound for the simple reason that they had no surviving brothers, however, appeared to take a position in the structure of matrimonial sides that would be identical to that of the missing brothers, and opposite to that of a woman who has brothers. This is exemplified in Figure 8. Intricate exceptions such as these help us to formulate the rules of sidedness in cognatic societies.

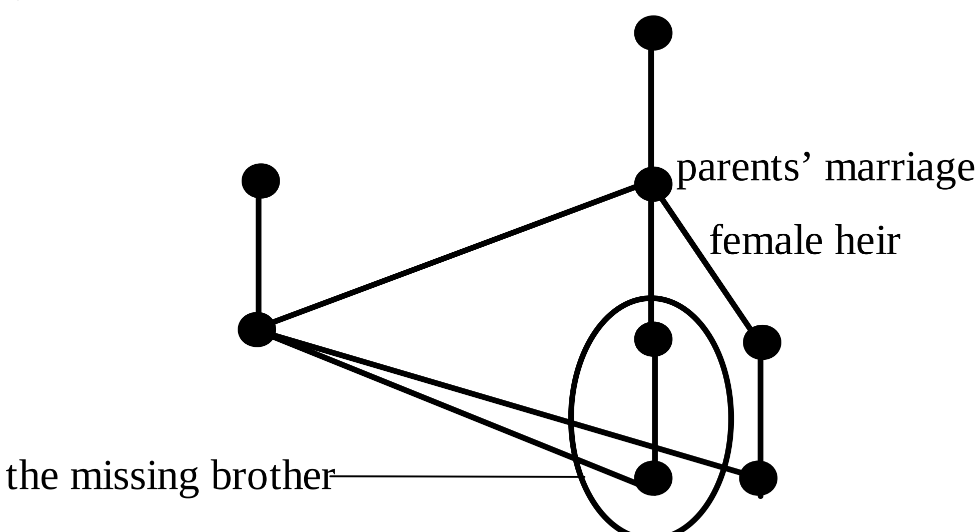


Figure 8: Reassigning Female Sidedness in the Case of Missing Male Heirs

VII. The Current Theory of Sidedness

Houseman and White (1998a,b) apply the definition of sidedness not to mechanical model**s** of marriage rules or moiety system**s** in which sidedness is inherited by unilineal descent, but directly to the graph of the actual genealogical relationships among the members of a community. This method

> visually renders both empirical cases and ideal-type models – the "statistical" and "mechanical" models of Lévi-Strauss's well-known discussion (1969:xxvii ff.) – in the same register, so that they can be directly compared. [Their] conception of "sidedness," … occupies a middle ground between the egocentric structures of the kinship terminology and sociocentric structures of social groups, such as moieties and section systems. (Godelier, Trautmann, and Tjon Sie Fat 1998:14).

For societies in Lowland South America, they

> show the emergent properties of a network of marriages that are effective through their dynamic aspect in the pratique – behavioral practices – of matrimonial alliances, where they find observed regularities that are not a simple effect of a terminological logic and rules of marriage. These constitute, at the level of practice, a sort of primary behavioral regularity [*encodage*], of a complex order. This is precisely demonstrated in that the two researchers, in the course of their analysis, are able to detect a structure of sidedness [*structure à coté*], or bipartite network where a pair of supersets of marriages, connected by agnatic and uterine parental links [which do not imply a principle of unilineal descent], operate so as to organize network configurations of marriage alliances across a range of societies in lowland Amazonia. The authors succeed in creating an empirical sociology of high quality that takes the first steps towards a conceptual and theoretical advance towards a sort of grounded theory (Glaser and Strauss 1967) based on facts established methodologically through carefully controlled working hypotheses (Jean-Luc Jamard 2000:735-736, our translation).

These South American studies identify societies with structural properties that Lévi-Strauss had identified with "elementary structures" but where these properties reside in the kinship networks and not in the rules of descent – in the case of dual organization – or in the rules of marriage – in the case of locally restricted exchange. Further, they find these "elementary" properties in "complex" form of statistical regularities, a possibility not anticipated by Lévi-Strauss. Figure 9 shows the extension to Lévi-Strauss's theory and models, with the addition of the concepts of viri and uxori sidedness defined above. In addition, within the expanded framework of concepts shown in Figure 9, there are new structural models, one having to do with dividedness and the other with V-cross relatives:

Model 4: <u>Dividedness</u>. A kinship network is <u>divided</u> if every cycle of sibling-in-law relationships (e.g., among men) is of even length, and hence divisible into two sets such that siblings-in-law always belong to opposite divides. Formal definitions and a global/local theorem are given in the **Appendix**.

Inference 4: Viri-sided and uxori-sided marriage networks possess dividedness but dividedness does not imply any statistical tendency towards inheritance of divides (whereas sidedness does, but not necessarily through a strict descent rule).[6]

Observation 4: Houseman and White (1997) identify societies in which dividedness is present in the marriage network, but sidedness is not.

[6] Model Parameters: Coef of Dividedness Define on cycles

Model 5: Marriage of v-cross cognates (Definition 5 applied to cognates) is a uniform system of marriage such that every marriage is with a cognate v-cross relative in an appropriate generation (typically G^0 and G^{-1}).

Inferences: When marriages relink into blocks: with (a), marriages into generations G^0 and G^{-1} viri-sides are implied; with (b), marriages only into generation G^0 reversible sides are implied, i.e., viri-sides and uxori-sides coexist; and each of (a) and (b) constitute new elementary systems since there is a positive rule for which types of cognates can be married (those with an even number of female links to ego). What is not shown on the diagram is that when such marriages do not relink into blocks, generalized exchange is also implied.

Terminological inferences: By the sidedness theorem, (a) predicts kinship terminologies that are v-cross (Dravidian: Definition 6) for cognates.

Observation 5: Strong correlation between viri-sided marriage networks and v-cross terminologies is observed in South America (Houseman and White 1998a), and existing evidence points towards such a correlation for Dravidian South Asia.

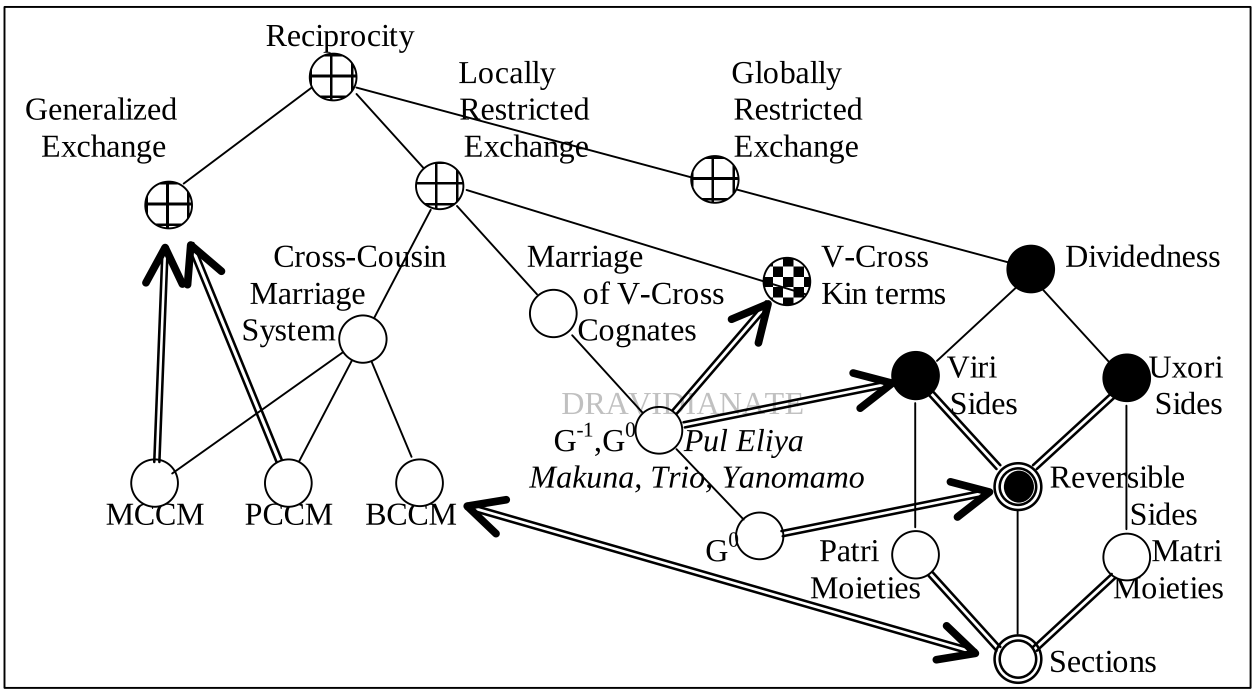


Figure 9: Expanded Diagram of Structural Models in Alliance Theory

Model 6: Marriage of v-cross relatives generally (cognates and affines: Definition 5) is a uniform system in which every marriage with a consanguinal is with a v-cross relative in an appropriate generation (typically G^0 and G^{-1}), marriage with someone unrelated creates a v-cross (affinal) relative, and marriage with a non-cognate follows the rule for viri-sidedness through compound ties of marriage as well as consanguinity. Marriages, that is, are v-cross with affines as well as cognates.

Inference: The generalization of v-cross classifications to non cognates represents the full-blown Dravidian system, which is of a complex rather than elementary type.

The discoveries of Houseman and White (1998a,b; Houseman 1997) are that locally sided v-cross marriages often co-exist with sided marriage networks that (1) lack moieties specified by rules of descent, (2) are compatible with cognatic systems, and (3) give evidence for the relevance of several elementary systems models; while (4) the number of theoretical predictions of the theory is significantly increased and (5) a whole axis of forms are identified that link locally to globally restricted exchange (dual organization).

Is it surprising that Lévi-Strauss missed the significance of v-cross or viri-sided marriage? At the time he wrote (1949), the concept of viri-sidedness was unknown. Do these new findings call for any revision of his theory? Only this: since, among the white circles denoting "elementary structures" in Figure 9, there are interspersed the "complex" statistical structures of viri-sides and uxori-sides, the concepts of "elementary" versus "complex" and the opposition between "statistical" and "mechanical" models might require revision.

Pul Eliyan Sidedness in the Total Marriage Network

Finally, even when we had arranged the sides to take into account the errors with cognates and female heirs, the total network, when put back together, had a much higher rate of errors than did the cognate network. This is shown in Figure 10. We were correct that (a) there was still a strong statistical tendency towards sidedness (p<.0000000001), and (b) marriages between people who were not cognates had more errors to sidedness. This is consistent with our idea that when some errors are present, sidedness might be more ambiguous to determine if people have several distinct kinds of relationships.

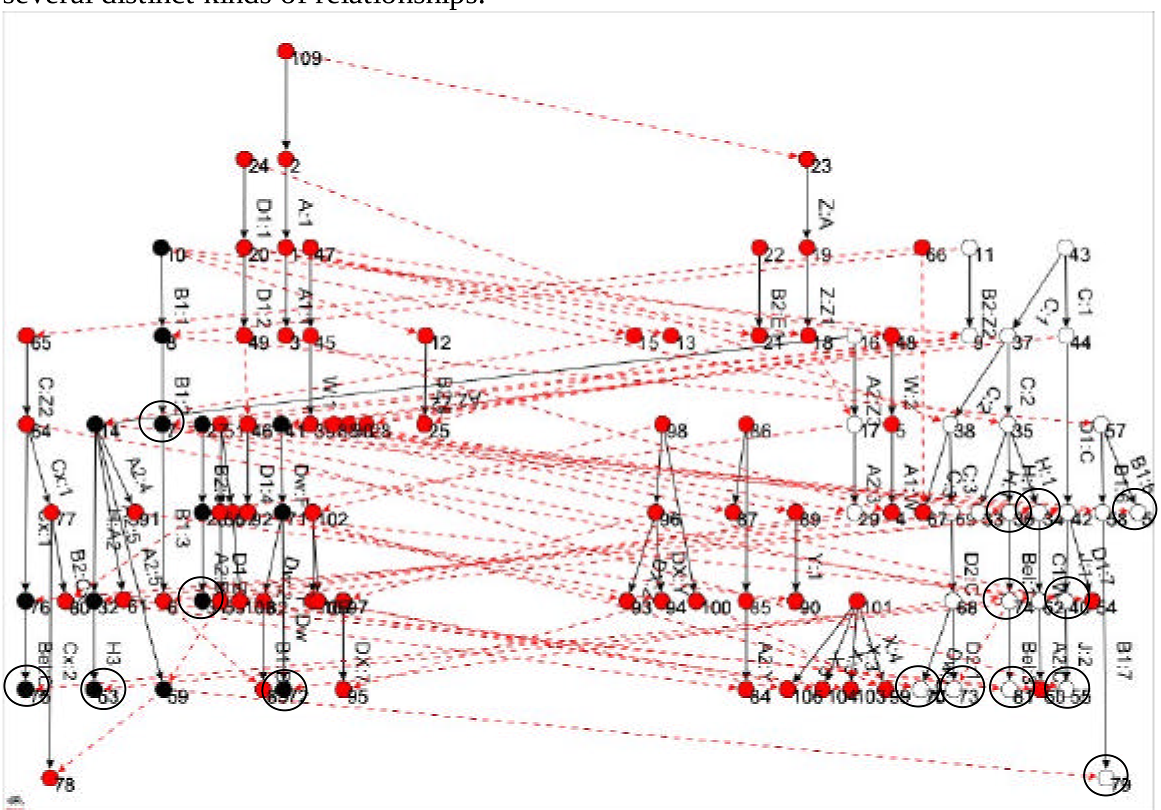


Figure 10: All Pul Eliyan Marriages (14 cognate couples, circled), 7 new errors and 91 new edges added, at a 9% error rate.

We also approached the problem in a rigorous way by a statistical analysis of marriage choices made within the actual network, which confirmed the results we have already seen (White 1999). What is remarkable at the end of all this is (1) that <u>sidedness emerges behaviorally</u> in a cognatic society even in the absence of a descent or hereditary moiety rule, (2) that there is an amazing consistency between the social model for sidedness and the language model, and (3) that there is also a general consistency with a South Asian or Dravidian regional "cultural model" preference for exchange marriages, even if not necessarily in the form of cousin marriages.

Further, in spite of the "messiness" of sidedness in this cognatic society, people are able to make marriage decisions that are statistically consistent with the fact that a local rule for sidedness, if relatively consistent across multiple relationships (as found in a small intermarrying community), is also able to generate a statistical tendency towards global sidedness structures.

How Do Viri-Sided Marriages and V-Cross Kin terms Relate?

Our general hypothesis, as discussed in the context of Figure 9, is that a statistical tendency towards global sidedness structures is a characteristic of societies with Dravidian terminologies generally, and especially in those societies with small intermarrying castes or communities. It is also our expectation, however, that as endogamy is diluted by marriages at greater distances, and as more people are present in the system from greater distances, exceptions to sidedness will proliferate, but the basic structure will replicate in the endogamous cores or subnetworks of such communities.

If these hypotheses are true, it also implies that anthropologists have continued to misunderstand the social, cultural and linguistic construction of Dravidian kinship and of the many other Dravidian-like social structures around the world, and thereby missed a significant opportunity to understand the complex yet mutually sustaining relationships between social models, language models and cultural models, their closely intertwined instantiations, and the extent to which these very different types of models instantiate one another.

We now explore our data further to illustrate some general principles, for which intricate patterns and exceptions may help us to formulate the rules.

What is the relationship between actual marriages and sidedness in Dravidian terminology for Pul Eliya? Table 1 summarizes the data on actual blood marriages in Pul Eliya from the perspective of male speakers in relation to potential spouses. The correlation between properly sided relatives and actual marriages is almost perfect, and statistically significant at $p< 0.000001$). In thirteen of the twenty cognate marriages (eight with cross cousins and five with cross second cousins), it would make no difference if the couple counted sidedness (crossness suitable for marriage) using the even number female rule or an even number of males rule. The cross / parallel distinction can be counted either way for all same-generation relatives. We call these the reversibly-sided relatives, reversible as to the counting rules, both of which agree as to cross and parallel.

For relatives of adjacent generations, however, it makes a huge difference whether sidedness is counted using the even number female rule or the even number of males rule. A couple that is cross (X) by one rule is parallel (//) by the other. Only one marriage is viri-parallel (uxori-cross), and that is a higher generation G^{+1} marriage with parent's distant cousin, shown at the bottom of the table, a 'wrong marriage' by both sidedness and generation..

	V-CROSS KIN TERM SIDEDNESS		
NETWORK SIDEDNESS	**"Marry Cross" (X) Actual Frequency**	**"Don't Marry Parallel" (//) Freq**	**Total in Network**
G^{-0} Reversibly X	MBD 5 FZD 3 2nd cousin 5		40 39 65
G^{-1} Viri X = Uxori //	MMZSSD 1 MMZDDD 1 MFFZDSSD 1 MFMFZSSD 1 MFMBDDDD 1 FFMZDSSD 1	These marriages inflect towards viri-sidedness	13 11 7 8 3 3
G^{+1} Viri X	MFZ (✍) 0		11
G^{-0} Reversibly //		MZD 0 FBD 0 2nd cousin 0	40 42 87
G^{-1} Viri // = Uxori X	These marriages would inflect to uxori-sidedness	FZ 0 MBSD 0 MMZSDD 0 MMBDDD 0	57 25 11 11
G^{+1} Viri // = Uxori X	 MFMBDD 1	FFZ 0 FFBD 0	11 9 9

Table 1: Correlation Between v-Cross/v-Parallel Relatives and Actual Marriages
($p < 0.000001$)

All six G^{-1} marriages inflect towards viri-sidedness, as counted by the number of females rule, and none towards uxori-sidedness. These "inflecting" marriages are with distant cross-kin and are almost as frequent as the first cousin cross marriages that are often taken as markers of Dravidian systems. The exceptional marriages (oblique or "inflecting marriages," so marked in the Table) skew the rule of sidedness towards a viri-sided rule that mimics a patrimoiety. Such marriages, with a classificatory ZD, are very common in societies with Dravidian terminology. Such exceptions make the rule of sidedness in the sense that Dravidian social and linguistic models are inflected away from reversible sidedness and towards viri-sidedness.

For Pul Eliya, then, there is much more consistency between language models and behavior (social models) than would have been expected from the literature on Dravidian systems. In addition, for Dravidian systems in general, we see by paying attention to behavioral detail that it is from the types of exceptions and inflections that we learn the rules of Dravidian systems. Given the possibility of inflection in the uxori-sided direction, we also see that that it is the exceptional behavioral patterns of oblique marriages that are critical to how the "rules" of

Dravidian language and cultural models are constructed, not simply that the sidedness rule allows the possibility of cross-cousin marriage.

IX. Models and Instantiations: How Exceptions Make the Rules

In summarizing our results we will intersperse some new observations and generalizations about the logic of instantiation, particular in terms of how patterned exceptions in the ways that models (cultural, social, decision, linguistic, etc.) at one level tend to carry over into patterned rules evident is models at another level.

I and II. We began this study with the notion that mathematical theorems that link local level behaviors with global structures could help us to develop ethnographic principles about how complex social structures can emerge out of simple rules of interactions, i.e., how the emergence of macro-institutions is constructed, bit by bit, out of local interactions.

III. Our focus was on sidedness, or dual organization, and within that, on sidedness in matrimonial networks. These were defined, and a sidedness theorem was generalized to cover this type of application of a more general network and graph theoretic principle linking local rules of behavior (e.g., friend of friend = friend; parallel relative of a parallel relative = parallel and unmarrriageable). Out of such simple rules we thought to discover global structures that might have gone unnoticed in ethnography without careful study of social networks.

The social model developed for sided structures in marriage networks is global: it measures approximations to network sidedness independently of specific marriage rules, moiety rules, or kinship terminologies. It focused on the network or graph theoretic model of restricted exchange between two groups.

The corresponding decision model for sided marriages is local: it applies to each individual ego as to whether their marriage choice is in perfect confirmity with sideness within their personal, e.g., cognate, network.

At this point the sideness theorem proved decisive: even if we cannot know in detail the decision models of individuals, the theorem tells us that properties of the global structure imply a certain consistency among the decision models that contribute to how the network is constucted at the local level. Because of this globl/local linkages, our approach to sidedness could be top-down, starting with social models, evaluating the consistency of such models at the global level, and turning to individual instances and alternate decision processes when inconsistencies are encountered at the individual level.

The language model we defined for sided kinship terminologies is one that defines equivalence classes among kin terms in a way that is consistent with the social model for sidedness, even if only from an egocentric perspective, and even if there are alternative forms of such models that give the same equivalence classes.

Here, our research encountered an interesting juncture: local cognition and decisions that follow certain consistent patterns are sufficient for global structure to emerge (this much is given by the sidedness theorem) and commonalities can be inferred about local or individual level cognition decision from consistencies at the global level (also given by the theorem). For a global structure of matrimonial sidedness to emerge out of consistent local behaviors, a linguistically-coded and shared decision-making system such as marriage rules that are conditional on categories defined by kinship terms is not strictly necessary. Shared language, however, helps to unify decision-making. And, if decisions and behaviors are consistent across individuals in the same social network, it is axiomatic that cultural sharing is present not only in terms of convergent knowledge but sharing of goals. Hence, some shared cultural models are likely to be present that serve as goal-oriented paradigms for generating behavior. And further, shared cultural models, if they are to be communicated, typically lead to the formation of language models that are useful in this domain of shared discriminations and valuations.

IV. Cultural models were then reviewed at the most abstract level – theoretical models of different types of exchange – and found that the existing theory of cultural models, alliance theory, for example, did not make room for social models of sidedness. Classical anthropological theories were rife with cultural models that would help explain why sidedness might exist, and how dual organization confers benefits upon its practioners, but they did not explain why we might expect a strong correlation between social models of sidedness on the one hand, and language models on the other.

V. We also revisited the language models for Dravidian, two-sided, kinship terminologies. There we found a number of alternate linguistic models that encoded sidedness in different ways, but were all consistent with viri-sided marriage networks.

VI. Bringing all this together as a theoretical context for the ethnographic case of sided marriage networks, we examined Pul Eliyan kinship. A social model of sidedness was evident in the patterns of marriage with cognates. Further, a shared decision model of marriage choice – prohibiting marriage with properly sided cognates – was implied by the social model. Examining exceptional cases where sidedness was inconsistent with a descent rule, we found patterns of exceptions that were:

(1) based on patterned contingencies such as brothers in-marrying from distant villages not being bound to follow sided marriage rules;
(2) based on patterned contingencies or exceptions to normal inheritance rules, such as females inheriting compounds when no brothers were available as heirs;
(3) based on patterned contingencies of exceptions to sidedness occurring with marriages to spouses from outside the local village, and, in general;
(4) consistent with cognatic rather than unilineal descent.

Hence, a decision model that took into account patterned cognatic exceptions to normal patrilineal inheritance and normal virilocal residence was shown to provide a basis for sidedness in local or egocentric choices in marriage that were commensurate with the global tendency to sidedness in the Pul Eliyan cognate marriage networks.

VII. We then revisited the current theory of sidedness in kinship systems, extending the theory of kinship alliances, adding some definitions of new elementary systems based on the social model for matrimonial sidedness, and making predictions about instantiated correlations between these elementary systems and commensurate language models in kin terms. At this point we had the following sequence in mind: a cultural model that contains a shared objective (such as engaging in restricted exchange) has to operate under constraints (in marriage, demography is paramount, e.g., the absence of potential spouses in preferred or normative categories leads to prefererred substitutions) to be implemented in a shared decision model. The decision model generates both a social model as an outcome (e.g., through the sidedness theorem) but also a language model as a means of coordinating appropriate behavior at both the local and global level. Diagrammatically:

Social model
Cultural model ✍ Decision model ✍ ✍
✍ ✍ ✍ ✍
Demographic Model Language model

Just as a logic of exceptions applies to how the cultural model is instantiated in a decision model, a similar logic of exceptions must apply to how the decision model is instantiated in the structure of the language model, since the exceptional marriage patterns will by definition also have been implemented within the structure of the social model. For example, the cultural model of restricted exchange between groups, which implies a goal of implementing reciprocity and hence a certain degree of equality between groups, might also involve a preference for marriage with classificatory cross cousins who treat each other as equals. Demographically, however, potential spouses may not be sufficiently numerous in preferred categories, and substitutions are made. In Pul Eliya, as Leach (1961:203) explains: "Because women begin to bear children soon after puberty, while middle-aged men often marry very young wives, a line of descent traced exclusively through females may quickly become chronologically out of step with a similar line traced through males," so that even classificatory cross cousins of the right age for marriage are rare. This leads to substitution of less-preferred marriages with classificatory cross-nieces, but sufficiently distant if they are collaterals that the "wife=cross-cousin" affinal terminology can be imposed without disrupting preexisting relationships of equality among affines.

Sided kinship terminologies are robust for same-generation relatives as to whether sidedness is counted by the number of female linking relatives or the number of male linking relatives: the two rules will always be equivalent in same-generation marriages. Sided terminologies are sensitive, however, to skewed generation marriages, because only one of the two available rules for counting sex-of-linking-relative can be used (they will give opposite results). Hence, when skewed marriages are present, they are typically those of males marrying generationally younger relatives, and the only terminological rule that can be consistent with the global model of sidedness will be that of viri-sidedness. This explains why viri-sidedness is consistent with the terminology of proto-Dravidian (reconstructed by Trautmann 1981).

The current theory of sidedness contains several surprises. One is that marriage of v-cross cognates constitutes a new "elementary structure" alongside the other elementary structures (MCCM, PCCM, BCCM and matrimonial moieties as a model of dual organization) defined by Lévi-Strauss. A social model of this sort has a prescriptive and a prescriptive rule: never marry a cognate with with an odd number of linking females; always marry a cognate with with an even number of linking females. Following this rule, if everyone marries a cognate, the result (following from the sidedness theorem) will be a globally sided network. In this sense, it is possible to see how, as in the other "elementary structures," it is possible to move from a strictly local rule, universally applied, to a global structure.

How marriage of v-cross relatives generally could constitute a second new "elementary structure," however, is more problemmatic, simply because it no longer posits the necessity of marrying a cognate. Such a system may recruit new members since every marriage with totally unlinked individuals (assuming their network is already sided) imposes the correct alignment of sides. In this system, sidedness is computed not only for cognates, but for affinals, and indeed, for anyone who is remotely connected through a combination of blood or marriage ties. The local rule for determining the sidedness of remote relatives, affinal or cognate, is that opposite-sided relatives eligible for marriage are those with an even number of female links. The practical problem, however, is how individuals can keep track of sidedness in such a system when there may be so many alternate paths of connection, and the paths may be of any length. Pragmatically, we expect that people will trace connections only to a certain length, and they will not examine all possible paths if the number become excessive. Hence, some limiting assumptions must be introduced in the machinery for formulating a local decision rule that governs marriage. But once this is done, pairs of individuals whose relationships are formed beyond these limitations may generate patterns of sidedness that are inconsistent. And once inconsistency is introduced, pairs trying to determine their relative sidedness will find that sidedness on one set of paths will be opposite to sidedness on some other set of paths. Hence it is difficult to see how this could constitute an elementary system of marriage rules, and the introduction of sidedness in kinship terminology is of no help in resolving potential inconsistencies.

One solution to the problem is to see sidedness decisions not as rules but as variable strategies, with the possiblity that the strategies of some subset of actors could impose a tendency towards global sidedness in spite of local ambiguities. This theoreticl solution leads to the consideration of kinship networks with imperfect sidedness not as elementary but as complex – not involving a positive marriage rule – or as semi-complex, where negative rules (prohibitions) so circumscribe choices that, in spite of local ambiguities, the effect is nearly equivalent to positive rules.

A second solution is to consider relationships among relatively close cognates as elementary structural “seeds” within a global network where sidedness calculations can operate relatively unambigously. This proposal has two merits. One applies to the type of situation we see in Pul Eliya, where there is dense relinking within the village, and there is a single large subnetwork that forms a unified elementary structural “seed” for the larger network. Remote affinals only have to regard how the large blocks of cognates are sided to calculate how they themselves are sided in a way that is consistent with these blocks. That appears to be the process that operates in Pul Eliya. In this view, there is a large elementary “seed” that might be considered to have very few errors to viri-sidedness or even to have zero errors to the kind of ambilateral sidedness rules described by Houseman and White (1998b) after reviewing the patterns of cognatic rules for allocating sidedness. Around this elementary block there is a global network with a statistical tendancy towards viri-sides, but with relinked non-cognates having relatively more errors than those in cognate marriages. For those outside the elementary block or “seed,” the marriage rules would have to be considered as strategic and complex (certainly as described by Leach).

A second merit of this proposal applies to the type of situation that applies in many other communities with Dravidian-type kin terms but where marriages are spatially very dispersed. One still gets reports from such communities that blood marriages even with those in distant villages are both common and sided, i.e., that there is marriage relinking in smaller distributed “seeds” of sidedness that relink sides across considerable distances. This type of marriage pattern, unlike that in Pul Eliya, implies what Lévi-Strauss calls a system of generalized exchange: seeds of locally sided restricted exchange that do not form a coherent pattern of dual organization, hence distributed in the looser manner that implies generalized exchange.

What is evident for Pul Eliya, however, is a coherent pattern of dual organization or restricted exchange at the global level, i.e., two global sides within the village itself, and extending even to some of the neighboring villages.

X. Conclusion

Simple rules shared by actors acting somewhat independently and with local rather than complete global information can nonetheless generate coherent global structures. We have found many ethnographic instances where dual organization in the form of sidedness go unnoticed by ethnographers because global labels and descent rules for sides were absent. To understand global structures and institutions that may be at play, unnoticed, in social systems, then, it is not sufficient to look for shared labels attached to the parts of global structure: their structure may reside in patterns of relationships, in their instantiation.

What patterns residing in relationships instantiate, however, is not necessarily a set of local decision rules that are shared and identically labeled, but rather sets of local outcomes of behavior that contribute – in possibly heterogeneous even if structurally equivalent ways – to a global configuration.

It proves critical, then, to look at the structure or logic of instantiation via network or other forms of relational analysis, if we want to discover patterns and principles that do not already come to use nicely packaged and labeled. One of the keys to discovery of patterns and principles that are not already obvious is to look at theorems or processes whereby different levels of analysis are necessarily linked. Micro-macro linkages and principles of emergence may prove central to understanding and explaining social processes, the potential for historical transformations, or archtypical patterns underlying even highly dynamical systems.

Further, if we develop models at different levels – cultural, demographic, decision-making, linguistic and social – and look for their linkages, it is crucial to study instantiation at each level not only in terms of overall patterns (logics of instantiation) but also to study patterns exceptions (logics of exceptions), since these may be key to how patterns at different levels interlock.

Appendix. How we convert Leach's genealogy to a network, why we choose this form of representation, and how it helps to measure degree of sidedness.

Figure 11 shows the conversion process. Simply put, numbered couples (such as those numbered 1-4 in the figure, the linking relatives for a MBD marriage) become the nodes of the network representation, with numbers automatically assigned by genealogical software (White, Batagelj and Mrvar 1999). Individuals (triangles and circles) in the genealogy become lines that connect the marriages (individuals are not numbered in either diagram, only couples). The motivation for the network diagram of links between marriages, the p-graph, is that it is easy to visualize the network structure, and different types of marriages are classified by the kinds of cycles in which they are contained, e.g., the FZD marriage shown in the genealogy is read off the network diagram as a cycle. Relinkings among families that do not involve blood marriages are also read off as cycles. This p-graph representation is described by White and Jorion (1992, 1996), and is stated in equivalent form in Definition 7 below for use in proving the dividedness theorem.

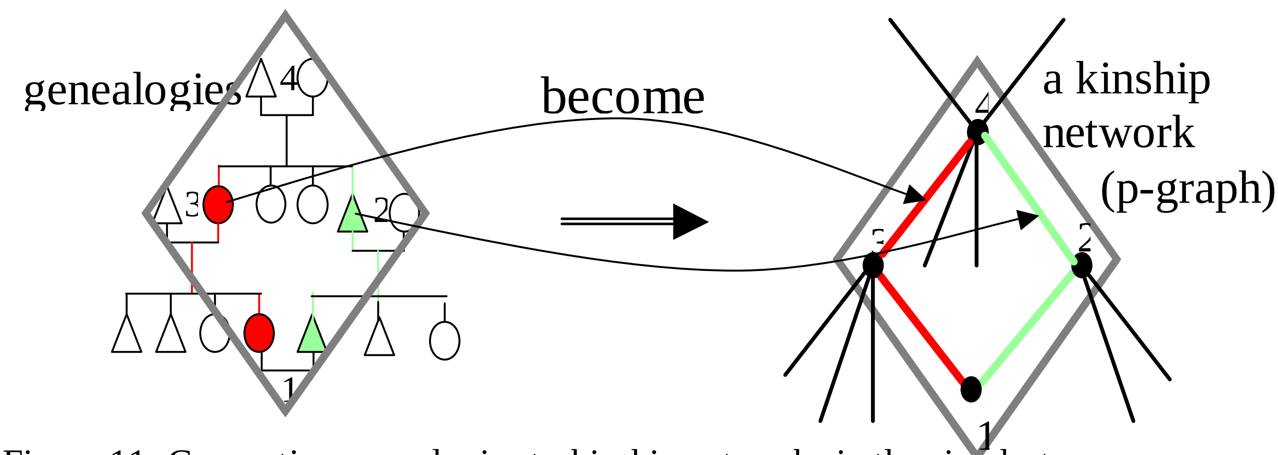


Figure 11: Converting genealogies to kinship networks in the simplest manner

Definition 7. A d-graph or divideable kinship digraph D consists of a set of nodes (corresponding either to single individuals or to couples of opposite sex) and two types of arcs (directed edges) between pairs of nodes, one for a male's link to a parental node and the other for a female's link to a parental node, where each node has at most one arc of each type to parental nodes.

P-graphs, d-graphs and genea-graphs (Definition 3) are equivalent models for kinship networks and for defining sidedness in kinship networks.

Definition 8. A set of k nodes in a d-graph D is encircled if none of them is parental to any other, they can be arranged on a circle such that each successive pair on the circle has a common parent, and each of these k parental nodes is distinct.

Dividedness Theorem: The following statements are equivalent, and define whether a d-graph D is divided:

Global Rule: the nodes in D can be partitioned into two sets called divides where any pair of nodes that are parental to another node are in opposite divides.

Local Rule: No set of nodes is encircled through an odd number of common ancestors.

Proof. Let a set of nodes be encircled through an odd number k of common ancestors. Then there are an odd number k of such nodes that can be arranged on a circle such that successive pairs are opposite in divides, which is a contradiction. Hence for every set of k encircled nodes, k is even, and they can be partitioned according to the global rule. Further, it is evident that given the global rule, for every set of k encircled nodes, k will be even.

A set of k encircled nodes in a d-graph represents k distinct sibling groups for which a set of brother-in-law relations form a circle, and if k is even they partition into divides.

The following corollaries of the sidedness theorem apply to equivalencies between different ways of seeing or defining the properties of phenomena such as kinship networks that involve relationships among elements that can be represented by graphs.

Definition 9. A kinship p-graph P consists of parent-child links (p-edges) between couples or single individuals (p-nodes).

Definition 10. A u-v p-path (u-v path) in a p-graph P consists of a set of p-edges that connect u and v, and where no p-node in the path is repeated.

Corollary A of the Sidedness Theorem: The following statements are equivalent, and define whether a kinship p-graph P is viri-sided:

Global Rule: the couples in P can be partitioned into two sides where every son or son's marriage is on the same side as his parents and the side of every daughter or daughter's marriage is opposite her parents.

Local Rule: all p-paths between two nodes u,v in P are identically sided, where u and v are on the same side when the number of parent/daaughter links in a p-path is even and on opposite sides when the number is odd.

Proof: Follows from the sidedness theorem 1, substituting viri-sided for sideable, daughter edge for mediative edge, and son edge for locative edge.

Similarly for uxori-sided where daughter and son are interchanged.

Equivalence of Representation: For a kinship genea-graph G and p-graph P corresponding to a given genealogy (network of kinship and marriage), the following statements are equivalent:

G is viri-sided.

P is viri-sided.

Similarly for uxori-sided.

Definition 11. A cycle in a p-graph P is a u,v edge (p-edge) together with a u-v path in P containing three or more nodes (p-nodes).

Only those cycles of odd length in a p-graph provide evidence that the graph may not be sided. Every subgraph in P that does not contain a cycle is trivially sided because adjacent edges can be numbered even/odd so that by definition no two even nodes are adjacent and no two odd nodes are adjacent. If a subgraph contains exactly one cycle, there is a 50:50 chance, like a coin toss, that the cycle may be sided. A set of cycles is independent if each contains an edge that is not in any of the others. The number of independent cycles i(P) of a graph P is the cycle rank of P. A cohesive block B of P is a maximal subgraph in which every pair of nodes is connected by cycles, and hence a unit of structural endogamy (White 1999). By the definition of sides (and divides), in a p-graph with perfect sidedness (nodes represent marriages), every cycle must contain at least one link that crosses sides. Only in a graph of imperfect sidedness can a cycle be contained within one of the sides, and where this is the case there is at least one link in the cycle that is of the wrong gender. If there are exactly i(B) independent subgraphs in a block B that contain exactly one cycle, then there are i(B) bits of evidence for or against sidedness, one per cycle, c of them concordant with sidedness and d discordant, where c+d = i(B). The number of independent cycles i(B) in a block B (Gibbons 1985:56) with m edges and b nodes is:

$$i(B) = (m - b + 1) = c + d$$

If we arrange the nodes in B to minimize the number d of discordant edges in B, then

$$d/i(B) = d/(m - b + 1)$$

is the coefficient of sidedness, a ratio of discordant independent cycles to the total number of independent cycles. Like i coin tosses where c and d are the number of observed heads and tails, respectively, the probability of exactly d discordant or non-sided cycles among a total of i(B) independent cycles is solved by the binomial equation:

$$p_d = \binom{b}{d} (1/2)^d (1/2)^{b-d} = \binom{b}{d} (1/2)^b$$

Summing over d or fewer discordances, *the probability of d or fewer errors to sidedness* is:

$$p = \sum_{k=0}^{d} \binom{b}{k} (1/2)^b$$

This is the exact significance test for sidedness.

A similar coefficient and significance test can be defined for dividedness.

XII. References

Augustins, Georges. 2000. À quoi servent les terminologies de parenté? **L'Homme** 154-155: 573-598.

Batagelj, Vladimir and Andrej Mrvar. 2001. "Networks / Pajek: A Program for Large Networks Analysis." University of Ljubljana, Slovenia. http://vlado.fmf.uni-lj.si/pub/networks/pajek/.

-- 1998. "Pajek: A Program for Large Networks Analysis." **Connections** 21:47-57

Bertin, Jacques. 1983[trans. of 1967]. **Semiology of Graphics**, Trans. William J. Berg; University of Wisconsin Press, Madison, Wisconsin, (original: **Semiologie Graphique**, Editions Gauthier-Villars, Paris).

Bourdieu, Pierre. 1990. **The Logic of Practice**. Trans. R. Nice. Stanford: Stanford University Press.

Boyd, John P. 1969. The Algebra of Group Kinship. **Journal of Mathematical Psychology** 6:139-67.

Buchler, Ira R. and Henry A. Selby. 1968. **Kinship and Social Organization**. New York: The Macmillan Company.

Carter, A. T. 1973. A Comparative Analysis of systems of Kinship and Marriage in South Asia. **Proceedings of the Royal Anthropological Institute of Great Britain and Ireland 1973:** 29-54.

Doreian Patrick, and Andre Mrvar. 1996. A Partitioning Approach to Structural Balance. **Social Networks** 18: 149-168.

Dumont, Louis. 1953. The Dravidian Kinship Terminology as an Expression of Marriage. **Man** 53:34-39.

Glaser, Barney G., and Anselm L. Strauss, 1967. **Grounded Theory**. Aldine de Gruyter.

Godelier, Maurice, Thomas Trautmann and Franklin Tjon Sie Fat, Eds. 1998a. **Transformations of Kinship**. Washington, D.C.: Smithsonian Institution Press.

Gould, Sydney H. (David B. Kronenfeld, Ed.), 2000. **A New System for the Formal Analysis of Kinship**. Lanham, Md. : University Press of America.

Granet, Marcel. 1939. Catégories matrimoniales et relations de proximité dans la Chine ancienne. **Annales sociologiques**, Série B, Fasc. 1-3. Paris.

Guilbaud, Georges-Th. 1970. Système parental et matrimonial au Nord Ambrym. **Journal de la Société des Océanistes** 26:9-32.

Harary, Frank. 1953. On the Notion of Balance in a Signed Graph. **Michigan Mathematical Journal** 2:143-46.

Hornborg, Alf. 1988. **Dualism and Hierarchy in Lowland South America**. Stockholm: Almqvist and Wiksell.

Houseman, Michael. 1997. Marriage Networks among Australian Aboriginal populations. **Australian Aboriginal Studies** 2:2-23.

Houseman, Michael, and Douglas R. White, 1998a "Taking Sides: Marriage Networks and Dravidian Kinship in Lowland South America," **Transformations of Kinship**, Pp. 214-243 in Eds. Maurice Godelier, Thomas Trautmann and F.Tjon Sie Fat. Washington, D.C.: Smithsonian Institution Press.

--- 1998b Network Mediation of Exchange Structures: Ambilateral Sidedness and Property Flows in Pul Eliya, Pp. 59-89, in **Kinship, Networks, and Exchange**, Eds. Thomas Schweizer and Douglas R. White. Cambridge University Press.

Jamard , Jean-Luc. 2000. La passion de la parenté. **L'Homme** 154-155: 733-748.

Kay, Paul. 1967. On the Multiplicity of Cross/Parallel Distinctions. **American Anthropologist** 69:84-85.

Leach, Edmund R. 1961. **Pul Eliya**. Cambridge, England: Cambridge University Press.
Lévi-Strauss, Claude. 1969[trans of 1949]. **The Elementary Structures of Kinship**. Boston: Beacon Press.
Lounsbury, Floyd G. 1964a. The Structural Analysis of Kinship Semantics, Pp. 1073-93 in **Proceedings of the 9th International Congress of Linguists**. Horace G. Lunt, Ed. Menasha, Wisc.
--- 1964b. A Formal Account of the Crow- and Omaha-Type Kinship Terminologies. Pp. 351-393 in **Explorations in Cultural Anthropology**. Ward H. Goodenough, Ed. New York: McGraw-Hill.
Read, Dwight. 2000. Formal Analysis of Kinship Terminologies and Its Relationship to What Constitutes Kinship. **Mathematical Anthropology and Cultural Theory** 1 (46 pages). http://www.sbbay.com/MACT/?PG=TOC
Tjon Sie Fat, Franklin E. 1998. On the Formal Analysis of "Dravidian," Iroquois," and "Generational" Varieties as Nearly Associative Combinations. Pp. 59-93. **Transformations of Kinship**, Ed. Maurice Godelier, Thomas R. Trautmann and Franklin E. Tjon Sie Fat. Washington, D.C.: Smithsonian Institution Press.
Trautmann, Thomas. 1981 (2nd Ed 1995). **Dravidian Kinship**. Cambridge: Cambridge University Press.
--- 1987. **Lewis Henry Morgan and the Invention of Kinship**. Berkeley: University of California Press.
Trautmann, Thomas Maurice Godelier and Franklin E. Tjon Sie Fat. 1998**.** Introduction. Pp. 1-26. **Transformations of Kinship**, Ed. Maurice Godelier, Thomas R. Trautmann and Franklin E. Tjon Sie Fat. Washington, D.C.: Smithsonian Institution Press.
Weil, André. 1969[trans. Of 1949]. On the Algebraic Study of Certain Types of Marriage Laws, Appendix to Part One, Lévi-Strauss, Claude. 1969[trans of 1949]. **The Elementary Structures of Kinship**. Boston: Beacon Press. Pp. 221-29.
White, Douglas R. 1999. Controlled Simulation of Marriage Systems. **Journal of Artificial Societies and Social Simulation** 2(3). http://jasss.soc.surrey.ac.uk/2/3/5.html
White, Douglas R., and Paul Jorion. 1996. Kinship Networks and Discrete Structure Theory: Applications and implications. **Social Networks** 18:267-314.

Cover page

Taking Sides: From Coherent Practice to Macro Organization

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January 2002

Outline

Six hard copies and one on diskette, preferably as an MSWord document.

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