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In a recent article Per Hage (2001 The evolution of Dravidian kinship systems in Oceania: Linguistic evidence *J. Roy. Anthrop. Inst. (N.S.)* 7, 487-508) comments: “In Allen’s [1989. The evolution of kinship terminologies. *Lingua* 77, 173-85] world-historical theory, humanity began with a tetradic-Dravidian system based on cross-cousin marriage and defined by alternate generation, prescriptive, and classificatory equations. In the course of time the dominant trend has been towards the irreversible breakdown of these equations in just this order.” Hage goes on to consider Allen’s claim using linguistic data on terminologies in the Oceanic area.

The underlying presumption in Allen’s claim is that kinship terminologies somehow change form by deleting equations (how equations are deleted is not explained) devised by the anthropologist to characterize a structure. The fundamental problem with the claim is that the posited sequence going from a tetradic-Dravidian system to a descriptive system ignores the fact that terminologies are generative structures with a logic underlying the equations used to characterize a structure. Elsewhere (Read and Behrens 1990 KAES, an Expert System for the Algebraic Analysis of Kinship Terminologies. *Journal of Quantitative Anthropology*, 2:353-93.) I have shown how the so-called classificatory equations (f = fb and m = mz, where f, m, b and z are genealogical kin types) arise logically from the generation of a kinship terminology structure when the primitive concepts for the structure are “brother” (or “sister”) and “father” (or “mother”) (where “term” denotes a transliteration of a kin term), whereas a descriptive terminology arises when “brother” (or “sister”) are derived, compound concepts. Thus for the American Kinship Terminology we have the kin term product Brother = Son of Father (Sister = Daughter of Mother) (where I use capitalized words to represent kin terms as opposed to genealogical kin types) and so Brother is a compound term. One cannot “remove” the equations f = fb and m = mz from a classificatory structure to arrive at a descriptive structure. This would be equivalent to saying that one can change from one language to another by removing a grammatical feature.

So-called variations in sibling terms have also been viewed simplistically as if one simply adds or removes features without taking into account the generative structure of the terminology. Thus Epling et al. (Epling, P.J., Jerome Kirk, John Paul Boyd (1973). “Genetic relations of

Polynesian sibling terminologies." *American Anthropologist* 75 :1596-1625) posited an evolutionary sequence going from terminologies with a sibling term to terminologies with sex marked sibling terms to terminologies with sex marked sibling terms plus an older/younger distinction in a step wise fashion. This ignores the way in which sex marking of terms is introduced into a generative structure and the structural logic underlying an older/younger distinction for kin terms.

I will briefly discuss the latter based on a (possibly) universal sequence for the generation of a kinship terminology structure that begins by (1) generating an ascending structure (e.g., for a descriptive terminology a structure such as I, P, PP, PPP, …, where I is an identity element and P is a generating element), (2) forming an isomorphic descending structure (e.g., I, C, CC, CCC, ….) in which the isomorphic elements are structurally made into reciprocal elements via an equation of the form: ascending generator x isomorphic descending generator = I (e.g., PC = I), (3) introducing sex marking by making an isomorphic copy of the ascending + descending structure and forming a structure based on the ascending + descending structure and the isomorphic copy, including appropriate equations for the products of elements from each of these structures OR by bifurcating the generating elements into a pair of sex marked elements (e.g., P → F, M and C → S, D for the American Kinship Terminology), (4) introducing the affinal structure either through introducing a new "spouse" generating element and appropriate equations (e.g., if E is to be a spouse element then the structural equation EE = I must be introduced) or through identifying existing elements as both affinal and consanguineal elements and (5) introducing "rules" that modify the structure locally (e.g., for the AKT sex marking is restricted to kin terms where the product of that kin term with Spouse is a kin term, or the reciprocal of such a kin term). This procedure has been implemented in the computer program Kinship Algebra Expert System (KAES) and KAES can be downloaded from http://kaes.anthrosciences.net/.

Once the structure has been generated it is possible to predict (with 100% accuracy) the genealogical definitions of kin terms, hence we now have a formal proof that the so-called genealogical grid is not the fundamental concept for expressing what constitutes a kinship terminology. Instead, we have two parallel conceptual systems: a system of genealogical tracing (for which the genealogical grid is an idealized form) and a system of kin terms generated in the manner outlined above. These two conceptual systems are linked by a mapping from the kin term structure to the genealogical space generated by genealogical tracing (what Lehman has called the Primary Genealogical Space (Lehman, F. K. and K. Witz (1974). Prolegomena to a Formal Theory of Kinship. In Paul Ballonoff (ed.) *Genealogical Mathematics*. Pp. 112-134. Paris: Mouton).

The classificatory terminologies seem to be structures where the ascending structure is based on the generator set {I, B, F} and the structural equations BB = B (the equation that makes B a sibling generator) and FB = F (and typically an additional equation such as FFF =

FF that limits the number of terms in an ascending direction). The classificatory equation arises from forming the isomorphic descending structure with isomorphic elements {I, B', S} and equation SB' = S isomorphic to the equation FB = F. The equation SB'=S has reciprocal equation BF = F, the equation that makes the terminology a classificatory equation! (In general, if a terminology structure has the equation XY = Z then it also has the reciprocal equation Y'X' = Z', where X' is the reciprocal element for X, Y' the reciprocal element for Y and Z' the reciprocal element for Z. For the classificatory equations we have the equations BB' = B'B = I that make B and B' into reciprocal elements and the equation FS = I that makes F and S into reciprocal elements.)

Thus the so-called classificatory equation is a logical consequence of a general process for the generation of a kinship terminology structure when the generating elements are B and F. Note that in the above construction we introduced the new symbol, B', isomorphic to the symbol B. This is precisely the basis for the older/younger distinction in many classificatory kinship terminologies. That is, the structure logically has two sibling elements, B and B'. The older/younger distinction can be interpreted as the manner in which these two sibling elements (of the same sex) are instantiated. Further, it can be shown that when the isomorphic structure is introduced and thereby we have elements that can be instantiated as male marked terms and female marked terms, we also account for why many classificatory terminologies do not have an older/younger distinction for "opposite sex" siblings. When we make the isomorphic copy of the structure outlined above to form the sex marked elements, we introduce a new symbol, i, isomorphic to I and the symbols I and i become the basis for the kin terms with transliteration "opposite sex sibling, ms" or "opposite sex sibling, fs" (or in some cases "opposite sex sibling:" as a covering terms for I and i).

So we now have accounted for the classificatory equation, older/younger "same sex sibling" and "opposite sex sibling." What about classificatory terminologies that do not make an older/younger distinction? The later arises due to the fact that when we make the isomorphic copy of the structure based on {I, B, F} we have two possibilities for the isomorphic elements: (1) {I, B', S} as illustrated above or (2) {I, B, S}. The first possibility logically arises due to a choice of equations when making F and S into isomorphic elements. We must introduce the equation FS = I, which corresponds to the genealogical tracing that son's father is (male) self when only considering genealogical tracing based on a single sex. But we can also introduce the equation SF = I. which corresponds to the genealogical tracing father's son is (male) self. Or we can introduce the equation SF = B, which corresponds to the other possible genealogical tracing, namely father's son is brother. The first possibility, SF = I logically requires that we introduce a new symbol B' when we make the isomorphic generators for the generating set {I, B, F}, since if we make the isomorphic generating set {I, B, S} and we then tried to introduce the equation BB = I to make B a self-reciprocal element we have BB = B and BB = I which implies B = I. Instead, we must introduce the isomorphic set {I, B', S} and so the older/younger distinction is introduced as discussed above.

If, however, we introduce the equation SF = B instead of SF = I, then this equation defines the reciprocal element for B via the fact that the reciprocal of the product SF is again SF. Thus the reciprocal of B is the reciprocal of SF and the later is SF and since SF = B, the reciprocal of B is B. Hence we can now form the isomorphic set {I, B, S} and we only have a single sibling element B in the ascending + descending structure, hence we will not have an older/younger distinction for the sibling term Brother!

This demonstrates both the analytical power of identifying the generative logic of kinship terminology structures and clarifies aspects of structures that have been attributed to unexplained processes such as adding or subtracting equations, or adding or subtracting attributes that ignore the systemic/generative nature of kinship terminology structures.