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**COMMENT ON VAZ'**

***RELATIVES, MOLECULES AND PARTICLES***

**MAURO W. BARBOSA DE ALMEIDA**

In two previous articles Ruth Vaz described the kinship vocabulary of the Madia Hill region, arguing for the antiquity Dravidian kinship systems in the form found there, and adducing evidence for the prototypical role of Madia Hill kinship terminology (Vaz 2010, 2011). The structural features of this terminology is described, following J. N. Allen (1998), as the original “Big Bang” of kinship terminologies, the remnants of which would be visible in today’s observable kinship terminologies, as isolated symmetry features. These features are the symmetries found in kinship terminologies – particularly those which associate affinity with crossness. The existence of such symmetries interpreted, as if it were, as a cosmic microwave background originating of the original “Big Bang” of kinship terminologies, the ripples of which have spread around the globe since then in the form of several weakened classificatory systems. This is an intriguing suggestion which should not be dismissed out of hand. Madia Hill kinship and marriage system is also described as an efficient self-replicating mechanism of social classification, by analogy with DNA replication. The paper suggests, therefore, two highly interesting analogies: the analogy between kinship terminology with the logic of the “superpartners” model of particle physics (every particle has a superpartners), and the analogy between kinship terminology and the self-replicating mechanism of the DNA molecule. These analogies are supported by deep ethnographical insight of a particular Dravidian system by a native anthropologist.

As an initial note, it may be pertinent to recall that Ruth Vaz’s ethnography is a welcome contribution to a debate sparked by Louis Dumont’s 1953 paper on Dravidian kinship terminologies, which, together with the “most famous footnote of anthropology” in Lounsbury’s celebrated paper, brought the issue of the defining features of the Dravidian kinship vocabularies to the forefront of a lively debate. In opposition to Scheffler’s and Lounsbury’s critique of the bilateral cross-cousin marriage rule as a diagnostic feature of Dravidian kinship terminologies, Ruth Vaz seems to support Trautmann’s vindication and correction of Dumont’s thesis, by providing abundant evidence for the sociological, ontological and terminological importance of cross-cousin marriage rules, and in particular to the FZD marriage rule, for understanding Hill Madia social life in particular and the logic of Dravidian terminology in general. She also seems to side with Trautmann on the historical antiquity and precedence of a Hill Maria variant of the Dravidian kinship terminology. This is the variant which distinguishes four major categories of relatives, partitioned by sex and by the affine/non-affine opposition, not only in three medial

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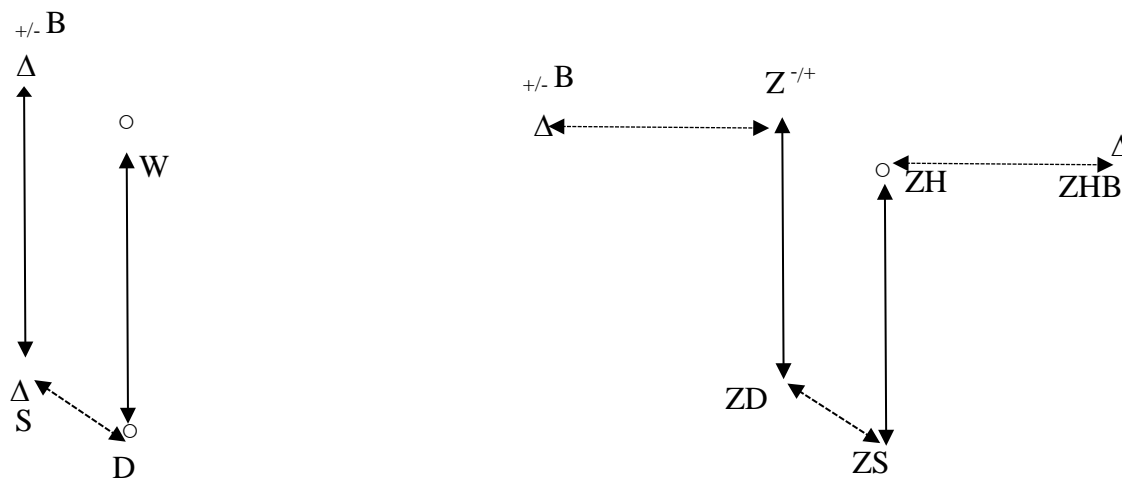
generations ( $G^0$ ,  $G^{+1}$  and  $G^{-1}$ ), but also in generations  $G^{+2}$  and  $G^{-2}$  and also in an indefinite number of additional generations. The merging of cross-cousins with affines (the “horizontal merging of kin in each generational level to form certain categories”), resulting in the fourfold partition of kin terms at each generation, seems to be the ground for the analogy with the DNA replicating molecule. There is, however, an additional and important point. For the “vertical merging of kin through alternate generations” (the so-called “tetradic model” proposed by N. J. Allen) means that kinship terms are also merged along the vertical dimension, so that the potentially infinite succession of generations is converted in a two-generation model. The combination of ‘horizontal’ pairings (the simultaneous pairing of matrilineal with patrilineal cross-cousins, and of cross-cousins with affines) with “vertical” terminological identification of the parent’s generation  $G^{+1}$  with the children’s generation  $G^{-1}$  (and of  $G^{+1}$  with  $G^{-1}$ ) results in a set of eight core kinship terms distributed in two alternating generations, two affine pairings and two sexes, making “an extremely compact and highly symmetric system”.

These symmetries are the underlying reason for the analogy with the “Suzy” model. Replication and symmetry are thus the key guiding concepts in this paper as I understand it, for which the DNA molecule and the Suzy model are metaphors. Ruth Vaz, following N. J. Allen, proposes that this “highly symmetric system”, of which the Madia Hill terminology would be a survival, is at the origin of less symmetrical kin terminologies. There are then two main theses in the paper as I understand it. The first thesis is that kinship terminologies may be represented as sets of symmetries, by analogy with physical and molecular models; the second thesis is that current classificatory kinship terminologies may actually be the historical resultant of successive symmetry breaks of an original super-symmetric structure. A detailed development of this program would be facilitated by a precise definition of symmetry helped by group theory, which has been since the 19<sup>th</sup> century a central analytical tool connecting fields as diverse as the theory of equations and geometry, crystallography, special relativity, quantum mechanics and the classification of decorative patterns. It was also the tool used by André Weil (not to be mistaken with Hermann Weyl) to formalize Lévi-Strauss’ theory of marriage in 1949 (Weil 1949).

As an aside, let me say using elementary group theory was the approach I used in my 2010 MACT paper dealing with a simplified variant of the Madia Hill as described by Thomas Trautmann (1981:196). I distinguished there three sets of symmetry operations as follows. First, classificatory rules, encompassing what is usually described as rules for fusion of siblings, half-sibling and step-parents rules, which imply that kinship terminologies containing such rules have the mathematical structure of a free group generated by “generation” and “gender”: same-sex siblings are here terminologically undistinguishable, being treated as identical particles except for relative age distinctions. The second set of symmetries consists of the two Dravidian rules which reduce kinship terms to four equivalence classes per generation (namely, the rule that identifies matri- and patrilineal cross-cousins, and the rule which merges cross-cousins and affines). In my paper, I proposed as an additional set rules for partitioning kinship terms in affine

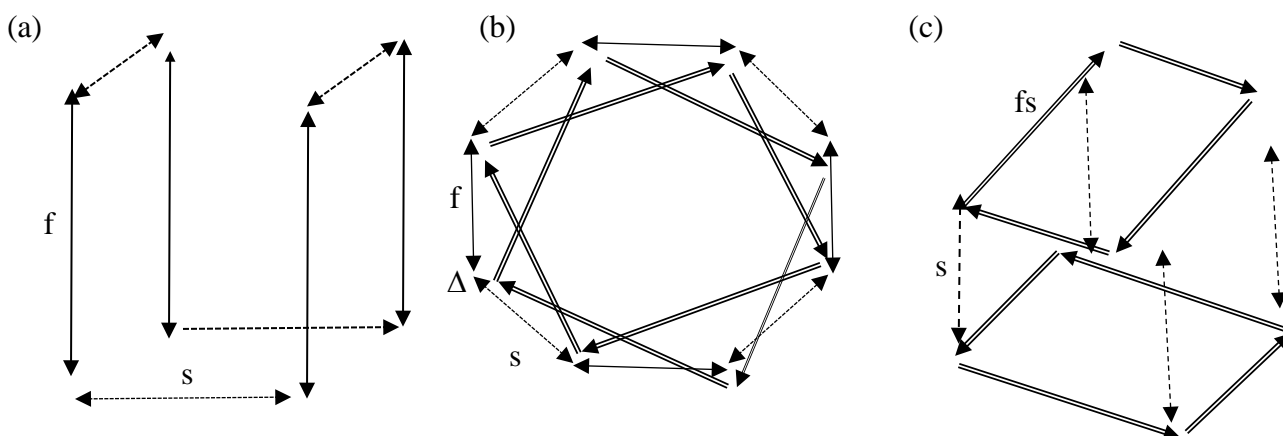


Diagram II



The diagrams I and II are equivalent provided that vertical arrows are read in both senses, as the “alternate generation” equivalence between address terms for ♂F and ♂S imply (in Cashinahua, ♂*epan* work like that, as I guess ♂*baba* in Madia Hill address terminology). Now, the ♂FZD is seen to be terminologically equivalent to a ♂W. This means that diagram I and diagram II are equivalent when turned upside-down. This is a symmetry along the horizontal axis.

This, however, does not imply that ♂MBD is terminologically equivalent to ♂W. In order to close the model and make it “supersymmetrical” a further symmetry is needed: the identification of ♂WB = ♂ZH. This additional identification results in Diagrams III below.



Diagrams III (a), (b) and (c) represent the same symmetries, but diagram (a) and diagram (c) use different generators. Ego may be placed at any point (the diagrams are “sociocentric”). Opposed-sex siblings are linked by dotted lines while same-sex relatives of adjacent generations are linked by solid lines. Diagram (a) is generated by the same-sex genitor-children relationship (solid arrow) and the opposite-sex, same generation relationship (dotted arrow). Diagram (b) shows cycles of length 4 linking successive  $\hat{\sigma}$ FZ relationships. Diagram (c) represent the same structure, now using as generators the  $\hat{\sigma}$ FZ link and the  $\hat{\sigma}$ Z relationships. In mathematical language, these diagrams imply the following interesting theorems: the “tetradic” model is isomorphic to the 8-element non-commutative dihedral group (it is the only non-commutative group with eight elements besides the quaternionic group). This group is described succinctly as the non-commutative group with two generators  $f$  and  $s$  ( $f \neq s$ ), with  $s^2 = e$  and  $f^2 = e$  where  $e$  is the identity, and the additional condition  $fsfs = sfsf$ . The striking fact is that these group equations are the formal expressions of the kinship relations defining the “tetradic” kinship terminology. Diagram (c) indicates that the same group may be represented as the group generated by operators  $s$  and  $h = fs$ , with  $fs \neq sf$ ,  $s^2 = e$ ,  $h^4 = e$ . A perhaps relevant point is that, there is an isomorphism between the group generated by  $f$  and  $s$  (under the conditions above) and the group generated by quantum-theoretical matrices (i.e. Pauli matrices):

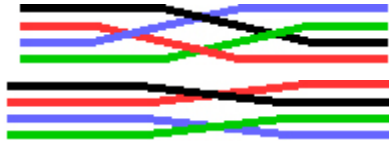
$$f = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \quad s = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}$$

One could also use as generators

$$f = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \quad z = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$$

I mention this because, after my initial adverse reaction to Vaz’s claim about the existence of “isomorphism” between Dravidian kinship calculus and quantum theory, I was baffled by the discovery that, by means of a proper isomorphism, it *is* possible to make quantum-mechanical computations in the language of Dravidian kinship! That is to say, one can find the (non-commutative) product of Pauli matrices  $f$  and  $s$  as follows: translate the matrices into Dravidian kinship words (according to the above scheme), ask a Dravidian speaker (of Maria Hill variant) about it, and translate it back into Pauli matrices!

As an afterword, I suggest that it is also be possible to translate kinship calculations into a language of weaving techniques, by means of the isomorphism between braid patterns and permutations. See the braid patterns below, which generate a commutative four-group (the Klein group) isomorphic to the group of Dravidian kinship terms in one single generation.



These points are offered here without demonstration to express by my sympathy towards the symmetry-oriented approach underlying Ruth Vaz's approach. Without a formal mathematical background, Ruth Vaz reasoned mathematically, as Lévi-Strauss and Trautmann before her, by looking for the mathematical pattern behind empirical reality.

I add a few additional tentative remarks. One first issue is the lack of a clear distinction between a terminological system and cultural-sociological behavior, that is to say, between terminological equations and marriage preferences. In other words: logical structure is not clearly distinguished from statistical fact. Thus, it seems also that FZD and MBD are merged as address terms, while there  $\♂$ FZD and  $\♂$ W are distinguished at the terminological level, while most marriages at Madia Hill follow the FZD preference. These are statistical facts. I suppose it is acceptable to describe Hill Maria kinship terminology as a "supersymmetric" model, and then look at the frequency of practical deviations from the model as the effect of marriage strategies. What is not clear is how a unilateral FZD marriage alone implies the three sets of symmetries present in the "tetradic" model.<sup>1</sup> Ruth Vaz's argument for a historically distinguished role of a FZD marriage rule as opposed to a MBD marriage has an interesting formal interpretation. Assume a classificatory system endowed with the generational symmetry ( $\♂$ FF =  $\♂$ B,  $\♀$ MM =  $\♀$ Z) and bilateral marriage ( $\♂$ FZD =  $\♂$ MBD =  $\♂$ W). We have shown above that the generational symmetry already implies  $\♂$ FZD =  $\♂$ W. Then, the only way to break a *single symmetry* leaving the others standing is to make  $\♂$ FZD  $\neq$   $\♂$ MBD, or, equivalently, to make  $\♂$ W  $\neq$   $\♂$ MBD, while keeping  $\♂$ W =  $\♂$ FZD.<sup>2</sup> In contrast, there is no way to break the  $\♂$ FZD =  $\♂$ W symmetry keeping the generation symmetry standing.<sup>3</sup> As a result, it can indeed be said that the simplest "symmetry break" starting from the "supersymmetrical model" is a two-generation

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<sup>1</sup> The point here is that, as show above, while a two-generation model implies an FZD = W identification, this model, without an additional rule of sister-exchange, results in an open-ended system of alliances. In order to make this horizontally open-ended system behave as a closed system, it seems necessary to close it with the pairing FZD = MBD, or, equivalently, with a WB = ZH equation.

<sup>2</sup> This is another form of the theorem presented in graphic form. Assume a classificatory system with bilateral symmetry ( $a = a^{-1}$ ,  $x = x^{-1}$ ) and generational symmetry ( $f \neq f^{-1}$ ). Then, if bilateral symmetry is broken ( $x \neq x^{-1}$  or  $\♂$ FZD  $\neq$   $\♂$ MBD), only a  $\♂$ FZD unilateral marriage rule ( $a = x$ ) is compatible with the remaining symmetries.

<sup>3</sup> Another theorem in the same family: under the conditions of the previous theorem, is bilateral symmetry is broken in favor of a  $\♂$ MBD unilateral marriage rule ( $a = x^{-1}$ ), the symmetry of generations must be broken too ( $f \neq f^{-1}$  follows).



(classificatory, bifurcate) system with a FZD asymmetric marriage rule (where  $FZD \neq MBD$ ). Thus, Ruth Vaz's argument leads to interesting insights.

Let me now sum up. Essentially, the group-theoretical rules devised by remote mathematical ancestors of the Ramanujan, a paradigm of the mathematical genius of Dravidian Brahmins, have simplified the infinite web of possible kin relationships in a very elegant way. First, by making all same-sex siblings equivalent and using the resulting equivalence-classes to make the same-sex "filiation" relation invertible (going from a genitor's same-sex sibling group to their children's (same-sex) sibling group and going back to the genitor's group are reversible operations). And then, by introducing additional horizontal and vertical symmetries in this structure. Lewis Morgan conjectured that a less symmetrical version of this structure (the Iroquois terminological structure) had a Dravidian origin, having migrated to the Americas by an Asian route. The "Dravidian" alliance symmetries can in fact be found in many lowland Amerindian kinship terminologies, and the particular form of these symmetries exemplified by the Madia Hill system has a strikingly perfect example in the kinship terminology of the Panoan speaking Cashinahua people of southwestern Amazonian, and also possibly in kinship terminologies of the Kariera type. Cashinahua kinship terminology, with its simple and "supersymmetrical" structure, is furthermore embedded in a wholly "tetradic" sociocosmological structure mirroring generational alternance and complementarity of sociocosmic moieties.

I am thus entirely sympathetic to Ruth Vaz's sense of kinship as a seamless whole of logic, metaphysics and sociological pragmatism and also to her defense of Dravidian priority in kinship mathematical reasoning. I also sympathize with her use of traditional *kolam* "concrete" mathematics, techniques in "concrete" symmetry thought. Indeed, I do think that *kolam* graphic art can be made isomorphic with kinship algebra, along the lines suggested above, in the same way as Cashinahua women's *kene* weaving art is a treasure of symmetry models which mathematicians, starting with Galois and passing through Cayley's introduction of the diagrammatic method, spread epidemically through the whole of modern mathematics, physics and molecular biology (Speiser 1943). There is indeed a common ground between molecular-biological symmetries ("DNA model"), quantum-mechanical symmetries ("SUSY model") and *kolam* techniques. As for the *kolam*, the mention of "crystallography" in the title of Andreas Speiser's early book on group theory work hides one of its jewels – the group-theoretical analysis of "surface ornaments" based on Egyptian patterns, of which both Ruth Vaz *kolam* and Cashinahua women's *kene* are outstanding variants. Note that the transposition of "Dravidian" models to South-American ethnography in the last decades (due seminally to Joana Overing, and generalized by Viveiros de Castro) is always accompanied by "symmetry breaks" which lead to a full catalogue of variations on the Dravidian theme including bilateral, matrilateral, patrilateral, avuncular exchange and Iroquois/Crow-Omaha mixings. In fact, against this catalogue of different systems sharing a common "cosmic background radiation" of Dravidian origins, the

Cashinahua stand out as almost pure examples of generational, gender and crossness/affinal symmetries.

I conclude by reiterating the main point: kinship symmetries share a group-theoretical foundation with abstract algebra alongside with general relativity and quantum mechanics, as well as with biology and art from music to painting (Weyl 1939, 1952, 1953). This deep insight risks being obscured by what could be called the somewhat misplaced realism of Ruth Vaz' approach, which taken to the extreme would imply that Dravidian kinship has predictive power for the fields of molecular biology and for particle physics.<sup>4</sup> I apologize for this long digression, motivated by the intention to express my sympathy with the cultural and theoretical motivations of Ruth Vaz,

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<sup>4</sup> I have already indicated that this has a grain of truth, since kinship operations can be represented by Pauli matrices. I restricted myself to two Pauli matrices, although I suspect that the full Pauli group (with 16 elements) can be applied to the issue. Introductory courses on complex matricial computation could use of Dravidian kinship calculations as exercises..

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