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Cultural theory and mathematical anthropology are greatly advanced by careful ethnographic description (e.g., Trautmann 1981), mathematical modeling (e.g., Tjon Sie Fat 1988, Tjon Sie Fat and Trautmann 1998) and conceptual simplification, of which the Barbosa de Almeida (2010) article (BdA) is an excellent example. Trautmann (1981) did a great service in coding the variety of Dravidian kin-term systems in South Asia into a formal descriptive language suitable for comparative purposes. Godelier, Trautmann and Tjon Sie Fat's volume (1998) and its introduction provided a synthesis of ethnographic studies and theoretical viewpoints on understanding Dravidian kinship systems in South Asia in contrast to Iroquois and generation-type systems and Dravidianate systems elsewhere (e.g., Houseman and White 1998a).

BdA's model does a service by clarifying the precise structure of Trautmann's paradigm of Dravidian South Asian (DSA) kin term structure (KTS) as rewrite rules: expressions in an algebra of Dravidian KTS that can be only shortened by rewrite rules. It imposes a "Dravidian cross-cousin marriage rule" expounded at great effort by Trautmann: "I do not hesitate to reconstruct for the Proto-Dravidian kinship system not only a terminology but a rule of social organization" *contra* "Sheffler's [ineffectual] counterargument that the rule and the semantic contrast are not invariable concomitants of one another …. The question is no longer whether a cross-cousin marriage rule is ancestrally Dravidian, but what precise form that ancestral rule took" (Trautmann 1981:235-236). I will refer to BdA's model as "the Trautmann algebra" (Tjon Sie Fat and Trautmann, 1998), so as to expose its weaknesses independently of BdA's model since I would expect that after reviewing the commentaries BdA would modify his current model into a paradigmatic form that accords historically and ethnographically with Dravidian terminological variants. There is no loss here in the value of Trautmann's groundbreaking work, but a significant gain in improving the quality of his model of Dravidian KTS.

Trautmann's is a prescriptive or "mechanical" model (Lévi-Strauss 1969: xxxi, xxxix) of Dravidian cross-cousin marriage preferences at the normative level as a part of a KTS. Trautmann follows the idea of Lévi-Strauss (1969: xxxii) that, whether prescriptive, preferential, mechanical or normative, "a divergence between the theoretical model and the empirical reality is nothing new". Thus, Trautmann might be justified to stick to the generic model elaborated by Tjon Sie Fat and Trautmann (1998) that does not fit the facts, and to reject evidence that counters his model, such as the relevance of widespread ZD and classificatory ZD marriage. Even for

Lévi-Strauss (1969: xxxii), however, "the empirical reality of so-called prescriptive systems only takes on its full meaning when related to a theoretical model worked out by the natives themselves prior to the ethnologists…." This accords with Leaf (2007, 2008) and Read (2008) in their concept of "empirical formalism."

When a mathematical model captures only some stylized characteristics of some phenomena, such as a Dravidian classificatory "cross-cousin" marriage rule, the model does a disservice if it does not also capture the distinctive features of the phenomena modeled. This is illustrated by the contrast between the Dravidian KTS and classificatory Australian systems where $G^{+/-2}$ marriages are a possibility and are actualized. In Dravidian systems $G^{+/-2}$ marriages are not documented as actualized but $G^{+/-1}$ marriages are a possibility and are actualized, unlike Australian systems. In BdA's formalization we are able to see more clearly that the Trautmann paradigm is near-equivalent to that of the Kariera kin-term system, and not distinct: both restrict marriage to G^0 classificatory bilateral "cross-cousins", and disallow both $G^{+/-2}$ marriages and $G^{+/-1}$ marriages, ignoring empirical data to the contrary.

In the decades since Trautmann's 1981 classic study, new ethnographic data on DSA marriage decision rules along with kinship network analyses of genealogies (Leach 1961) that Trautmann did not analyze have provided the basis for a radically improved paradigm (e.g., White 2010, Read 2010.) for Dravidian South Asian (DSA) kinship, well beyond Trautmann's inventory of kin term diagrams. A new DSA paradigm is based on "empirical formalism" focuses on actual marriage-qualification rules used by Dravidian speakers, actual marriage censuses that includes distant consanguineal kin (White 1999 for data in Leach 1961; Houseman and White 1998a for Dravidianate kin-term systems outside South Asia) and formal empirical models of DSA (Read 2010b). The new paradigm includes the classificatory cross-cousin marriage norms of the Trautmann paradigm, but expands to include within it other cross relatives dismissed by Trautmann as extraneous to Dravidian: the ZD marriages listed by Trautmann (1981:218) and the classificatory ZD marriages discovered by White (1999) for Sinhalese. Its logic differs from BdA's formalization of the Trautmann paradigm logic in terms of operators hat correspond to ego and same-sex siblings (*e*), opposite-sex siblings (*s*), same-sex parents (*f*), and opposite-sex parents (f^{-1}), i.e.: $\{e, s, f, f^{-1}\}$. To incorporate the possibility of marriage with a broader range of cross-relatives that includes $G^{+/-1}$ marriages, a new empirical formalism for Dravidian KTS replaces BdF's f with a pair of operators, $\boldsymbol{f}$ and $\boldsymbol{g}$, that discriminate between a male link $\boldsymbol{g}$ and a female link $\boldsymbol{f}$ to a parent. These are the operators used in White and Jorion (1992) and in White (2010).

The logic of this revised model matches how DSA ethnographers describe the rule that Dravidians use to reckon the cross distinction and marriageability: "I understand Telegu and Tamil systems better [than Sinhalese]. And there the sidedness is calculated, so to say, from an agnatic standpoint. So it is female links (mothers of male ascendant) that one looks for" (Lehman, personal communication); Leaf concurs (personal communication). Thus two relatives of opposite gender, if not already one another's kin, decide whether they are cross-sided relative to a shallow common ancestor by each independently counting: 1) their *numbers* of $\boldsymbol{f} = \{\mathbf{f_m}, \mathbf{f_w}\}$ of female (cross) links to the common ancestor: $\mathbf{f_m}$ for the man (including himself) and $\mathbf{f_w}$ for the woman (including herself), and 2) the pair of numbers $\boldsymbol{g} = \{\mathbf{g_m}, \mathbf{g_w}\}$ of male (parallel) links to the ancestor: $\mathbf{g_m}$ for the man and $\mathbf{g_w}$ for the woman. They are *cross*-sided if the combined total of their female links $\boldsymbol{F} = \mathbf{f_m} + \mathbf{f_w} = \mathbf{even}$, as

with ♂MBD, ♂FZD and ♂ZD (where $\mathbf{f_m} = 1$, $\mathbf{f_w} = 1$ and $\boldsymbol{F} = \mathbf{2}$). Their *relative generation* $\boldsymbol{mf} \equiv \mathbf{m} - \mathbf{w} = (\mathbf{g_m} + \mathbf{f_m}) - (\mathbf{g_w} + \mathbf{f_w})$, includes agnates $(\mathbf{g_m} + \mathbf{g_w})$ along with cognates $(\mathbf{f_m} + \mathbf{f_w})$, thus $\boldsymbol{mf} = (\mathbf{g_m} - \mathbf{g_w}) + (\mathbf{f_m} - \mathbf{f_w})$. This calculation of relative generation is very simple for 2 grandparents or 4 pairs of great-grandparents, and becomes harder for the 8x8 pairs of great-great-grandparents. If the relative generation of the male/female pair is in the range $G^{\mathbf{mf}} \in \{G^{+1}, G^{0}, G^{-1}\}$, where $(-1 \leq \boldsymbol{mf} \leq 1)$, they are in the likely age range $\boldsymbol{Y}=\boldsymbol{1}$ to marry (if not, $\boldsymbol{Y} = \mathbf{2}$). They are *marriageable* if $\boldsymbol{Y}=\mathbf{1}$ and $\boldsymbol{F} = \mathbf{f_m} + \mathbf{f_w} =$ **even**, subject to local marriage rules related to kin terms and other norms. Trautmann's desire for classificatory cross-cousin marriage is satisfied, but so is the possibility for marriage for consanguineals of opposite gender, as in the case where $\boldsymbol{F} = 2$ for ♂ZD/♀MB reciprocals.

Sidedness operators $\boldsymbol{f} = \{\mathbf{f_m}, \mathbf{f_w}\}$ and $\boldsymbol{g} = \{\mathbf{g_m}, \mathbf{g_w}\}$ involve more than a substitution for BdA operators. A sex of link notation ($f_{♂}s$) is needed in BdA notation to express "sidedness" links in the new paradigm. There is a fundamental classificatory bilateral cross-cousin gender symmetry in BdA's notation which creates a Kariera-like structure for Dravidian, whereas a less restrictive crossness applies to Dravidian. The "sidedness" calculus is fundamentally asymmetric in the use of $\boldsymbol{F} =$ **even/odd** to define sidedness rather than $\boldsymbol{G} =$ **even/odd**. Classificatory cross-cousin male/female pairs are those with a shallow common ancestor such that relative generation, G^0, corresponds to $\boldsymbol{mf} = \mathbf{0}$, and where combined female links to the common ancestor correspond to $\boldsymbol{F} = \mathbf{f_m} + \mathbf{f_w} =$ **even**. Male/female pairs with $\boldsymbol{mf} = \mathbf{+/-1}$ (reciprocally) and $\boldsymbol{F} =$ **even** are classificatory cross-(♀MB/♂ZD uncle/nieces) but do not include cross-(♂FZ/♀BS aunt/nephews) for whom $\boldsymbol{F} =$ **odd**. This generalization of Dravidian reckoning calculates consanguineal relative cross-sidedness consistent with egocentric crossness for classificatory MBD, Viri- and uxori-sided marriage: Why not FZ/BS marriage? Individual consanguineal marriages may be viri-sided and/or uxori-sided or neither, as defined in the appendix and by Houseman and White (1998a): The marriage rule $\boldsymbol{F} =$ **even** corresponds to a viri-sided marriage; $\boldsymbol{G} = \mathbf{g_m} + \mathbf{g_w} =$ **even** to a uxori-sided marriage (e.g., FZ/BS $\boldsymbol{G} = \mathbf{2}$ – note here that $\boldsymbol{F} =$ **odd** and FZ/BS is not viri-sided); $\boldsymbol{F} = \boldsymbol{G} =$ **odd** to neither (e.g., FFZDD, $\boldsymbol{F} = \boldsymbol{G} = \mathbf{3} =$ **odd**); or both viri-sided and uxori-sided (e.g., MBD and FZD, $\boldsymbol{F} = \boldsymbol{G} = \mathbf{2} =$ **even**),. The fact that FZ/BS is unmarriageable in Dravidian corresponds to $\boldsymbol{F} = \mathbf{1} =$ **odd,** *i.e.,* this marriage is not viri-sided: rather, it has $\boldsymbol{G} = \mathbf{2}$ and is uxori-sided. These sidedness criteria derive from kinship network analysis initiated by White and Jorion (1992) that was unknown at the time of Trautmann's (1981) work on Dravidian. White (2010) contains a proof that for a kinship network of consanguineal marriages and their ancestors, if both rule $\boldsymbol{F} =$ **even** and $\boldsymbol{G} =$ **even** are operative, then there are no $G^{+/-1}$ marriages, only G^0 marriages. Trautmann's (1981) paradigm is equivalent to the occurrence of both $\boldsymbol{F} =$ **even** and $\boldsymbol{G} =$ **even** for a consanguineal marriage network and thus to a Kariera terminology.

White (2010; see Harary 1953) proves that every connected consanguineal marriage network with no $\boldsymbol{F} = \boldsymbol{G} =$ **odd** marriages (either $\boldsymbol{F}$ or $\boldsymbol{G} =$ **even** or both) will be sociocentrically sided. If $\boldsymbol{F} =$ **even** then the Hu's side parallel kin will include his patriancestors (PAs) and there are $\boldsymbol{S}$ PA groups including and from the Wi's PA to new PAs through other maternal links, terminating in Hu and Wi's common ancestor. Because $\boldsymbol{F} =$ **even** requires $\boldsymbol{S} + \boldsymbol{S'} = \boldsymbol{J} =$ **even** then if $\boldsymbol{S} =$ **even**, $\boldsymbol{S'} =$ **even** links through daughters and their PAs back to Hu's PA. If $\boldsymbol{S} =$ **odd** then $\boldsymbol{S'} =$ **odd.** For every j=1,…, $\boldsymbol{J}$ the j = even PA's are on the Hu's side and the j = odd PA's are on the Wi's side, so ***every consanguineal marriage network folds into two sides*** (see White 2010 for a diagrammatic illustration). Then because any consanguineal marriage network folds into two sides, any two such marriages having a common member C will fold into two sides: C's side, and the opposing side. The

same proof follows if ***F*** = **even** or ***F*** = ***G*** = **even**. That is, egocentric sidedness connected consanguineal marriage network will produce consistent sociocentric sidedness. Figure 9-2 in Houseman and White (1998a) for the Makuna is a perfect example for ***F*** = ***G*** = **even** consanguineal marriages (100% viri- and uxori-sided), i.e., ***F*** = ***G*** = **even** for all these marriages, which also implies they are all same-generation (White 2010). For the Makuna ***F*** = **even** with a single (1%) exception among all marriages, including those that are nonconsanguineal. Houseman and White (1998a) found "sided" kinship networks similar to the Dravidianate in Amazonia, and created percentage measures for the extent to which they were sociocentrically viri-sided, uxori-sided, or both.

Where marriages follow a mix of viri-sided and uxori-sided $G^{+/-1}$ marriage rules, no consistent sociocentric sidedness can emerge. Some families with viri-sided MB/ZD marriages and some with uxori-sided FZ/BS marriages, for example, are incapable of forming a sociocentrically sided consanguineal marriage network, given even that the two sidedness rules converge for G^0 marriages. Different sidedness rules that vary from family to family in $G^{+/-1}$ marriages are historically unlikely, so this does not offer a viable subtype of the Dravidianate.

Houseman and White (1998b) went on to evaluate the Sinhalese Dravidianate network structure, focusing on Pul Eliya (Leach 1961), the only South Asian ethnographic case with Dravidian terminology[1] that provides a complete village genealogy.[2] They found that the sociocentric network of consanguineal marriages and their ancestors were 100% viri-sided, equivalent to the fact of 100% viri-sided egocentric sidedness in the consanguineal marriages. This viri-sidedness – which describes a particular type of Dravidianate marriage structure – did not apply outside the core of consanguineals marriages in the community, however. White (1999:Table 8) went further with this case study of the Pul Eliyan kinship network to produce a complete census of the types of all 23 consanguineal marriages in the village which knit together several hundred individuals with consistent viri-sidedness. Of the 23, 9 were of the $G^{+/-1}$ classificatory ♂MB/ZD type and 14 of the G^0 classificatory MBD/FZD type.

This leads to the possibility of two types of Dravidian: (1) viri-sided only (Sinhalese, Tamil, and Karnataka), where ZD marriages occur along with G^0 classificatory MBD and FZD marriage, and (2) G^0 classificatory MBD and FZD marriage only, as argued for the Trautmann paradigm. A third uxori-sided paradigm with FZ/BS marriage is unlikely because while ZD marriages are consistent with early marriage for females, FZ marriages are not. The Houseman and White (1998a) review of data on Dravidianate cases in Lowland Amazon also shows this. All 16 cases where the only oblique marriages are with ZD have sociocentric sidedness, but a minority of oblique marriage cases have both ZD (viri-sided) and FZ (uxori-sided) marriages but do not form sociocentric sides. Two oblique marriage cases have only rarely occurring uxori-sided BD marriage. There is no evidence of uxori-sided consanguineal marriage networks, and this is not a likely model for a subtype of South Asian Dravidian. This supports the view of (1) and (2) above as the subtypes of Dravidian, both of which yield sociocentric viri-sidedness which in case (2) is also uxori-sided. In either case, egocentric sidedness of *consanguineal* marriages is auto-aligned into a sociocentric 2-sided moiety-like configuration of sidedness.

Figure 1 shows the kinship terminology of the Sinhalese and Pul Eliya in particular, consistent with Dravidian subtype (1). Notes 5 and 10 for that figure, on crossness and marriageability for BS and ZD, are pertinent to the present discussion.

Figure 1. Paradigm of Sinhalese kin terms (Trautmann 1981:154; Figure 3.20) and Pul Eliya. Reciprocal kinship behaviors between males (Leach 1961:126) are described in the footnotes.

		♂ Sinhalese ♀					
		X cross	// parallel				X cross
G^2		kiriāttā [1] FF, MF			kiriamma FM, MM		
G^1	e	māmā [2] MB,FZH, WF	loku appā [3] FeB, MeZH	appā [4] F	amma M_0	loku MeZ_0, $FeBW_0$	nändā [5] FZ_1,MBW_1, WM_1
	y		bāppa [3] FyB, MyZH			kuda MyZ_0, $FyBW_0$	
G^0	e	massinā [6] MBS, FZS, WB, ZH	ayiyā [7] eB, e(FBS), e(MZS),e(MBDH), e(FZDH)		akkā eZ_0, $e(FBD_0)$, $e(MZD_0)$,$e(MBSW_0)$, $e(FZSW_0)$		nänā [8] MBD_3, FZD_3, WZ_3, BW_3
	y		malli [6] yB, y(FBS), y(MZS), y(MBDH), y(FZDH)		namgi yZ, y(FBD), y(MZD),y(MBSW), y(FZSW)		
G^{-1*}		bänā [2] ♂?ZS, DH [9]	putā [3] S, ♂?BS [9]		duvā D_0, ♂?BD_0 [9]		leli [2, 10] ♂?ZD_4, SW_4 [9]
G^{-2}		munburā (miniburā) [1] SS, DS			minbiri SD, DD		

[1] Kiriāttā / miniburā: Friendly informality. $G^{+/-2}$. Divisions (♂ and ♀) apply to ego's and spouse's grandparents in Tamil. All underlined kin terms are general Sinhalese but also hold for Pul Eliya.
[2] Māmā / bänā: Respect but much less than between father/son (extreme when son-in-law is *binna*-married). $G^{+/-1}$. Divisions (♂ and ♀) apply to ego's and spouse's parents in Tamil. The reciprocal ♂Māmā / ♀leli *classificatory* category for Pul Eliya contains distant consanguineal marriages that are properly viri-sided.
[3] Loku appā or bāppa / putā: Respect relationship rather lacking in feeling on both sides. $G^{+/-1}$. Divisions (♂ and ♀) apply to ego's and spouse's parents' siblings in Tamil.
[4] Appā / putā: Extreme respect tending to avoidance. $G^{+/-2}$. Divisions (♂ and ♀) apply to ego's and spouse's parents' siblings in Tamil.
[5] The opposite-sex reciprocal of FZ (X=cross) is ♂BS=puta (//=parallel) hence unmarriageable, unlike MB. No term for HM is attested by Trautmann, who uses seven different sources, including Leach (1961), which allows G^{+1} consanguineal correctly-sided marriages to be contracted without a conflict in egocentric kin terms.
[6] Massinā / massinā: Familiarity tending to joking relation. G^0. Divisions (♂ and ♀) apply to ego's and spouse's cross-cousins in Tamil.
[7] Ayiyā / malli: Marked respect, formality. G^0. Divisions (♂ and ♀) apply to ego's and spouse's siblings and parallel-cousins in Tamil.
[8] There is no determination of the position of wife. Nänā≠wife. In Dravidian generally, wife="woman", as in: Baiga (dauki=wife, woman), Vedda (gani= wife, woman), Kondh (ayal= wife, woman). In Nakarattar, a merchant banking class we find descriptive term wife=pentir. There are many colloquial terms and ways of referring to wife, however, for example the Sinhala terms mahattaya ("husband") and nona ("wife"). These are actually status terms such as (doctor sir/lady) conveying the sense of not only husband and wife, but also master and mistress. G^0.
[9] Question marks for G^{-1} are imputed by consistency with other Dravidian systems (Trautmann 1981:40, 103, 121, 134, 135, 138, 141, 144).
[10] It is the ♂eZD that is eligible for marriage with ♀MyB in Tamil and Karnataka but not in Sinhala/Pul Eliya.

To summarize, three sources of data on kin term structure (KTS) are perfectly triangulated for Dravidian South Asia:

1) the kin terms themselves (Read 2001, 2007, 2009, 2010a, 2010b; Read and Behrens 1990), where classificatory MB/ZD relations are "cross" and potentially marriageable while FZ/BS are neither reciprocally "cross" nor marriageable in any of the terminologies (Trautmann 1981: 121, 134, 135, 138, 141, 144, 150:Tamil, 154: Sinhalese, 156, 157, 159, 162, 163, 165, 166:Telugu, 170, 188);
2) the actual marriages that occur in the DSA societies, which include ZD and classificatory ZD and cross-cousin marriages but never BS marriages, and
3) the rule that Dravidians use, where reported (e.g., for Telegu and Tamil), to reckon the cross distinction and marriageability.

The inclusion of these elements in DSA kin term structure as an expansion of the Trautmann KTS paradigm would seem to be mandatory as a revision by BdA of his Dravidian algebra to bring it into accord with historical Dravidian and DSA ethnography. Similar enlargement is required of the original Trautmann (1981) model of the Dravidian KTS, its mathematical modeling by Tjon Sie Fat and Trautmann (1998) and the appropriate corollaries that follow in the discussions in Godelier, Trautmann and Tjon Sie Fat (1998).

The relation between kin terms and marriages is that actual marriages or documented marriage types for each of Trautmann's cases occur only for kin term pairs that are both "cross." "Cross" terms in $G^{+/-1}$ for a given Dravidian society do not necessarily imply that there are marriages in this classificatory category, but they may occur in some cases and not in others. Since such variants do occur in DSA, they should be reflected in a general Dravidian KTS model, with the restriction to same-sex marriage (the Trautmann paradigm) only as a special case.

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[1] Pul Eliya is a village of Sinhala. The Sinhala are of Indo-European language stock but due to close interaction over millennia have assimilated many Dravidian language features. Spoken Sinhala's distinctiveness from the Northern Indo-Aryan languages is largely due to Dravidian influences and this is especially true for kinship terminology. Trautmann (1981) classifies Sinhala as a Dravidian kin term system.

[2] Exceptions include datasets such as those of Pauline Kolenda for the Nattathi Nadars of southernmost Tamilnadu that could be shared if names were anonymized.