Movements of a Ghostly Minuet Neo-Riemannian Themes in Warlpiri Kinship

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Séminaire MaMuPhi - IRCAM

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What we are up to

$$\begin{pmatrix} A & = & B \\ A' & = & B' \\ C & = & D' \end{pmatrix}$$

- Reviewing the mathematical approaches to kinship and marriage systems in the tradition of Claude Lévi-Strauss and André Weil ([21]) including
- The group-theoretical model of Philippe Courrège ([4])
- The topos-theoretical approach by Bill Lawvere and Stephen Schanuel ([19, 18])

 Some topological ideas based on ideas from Peter Lucich ([23]) Anthropologists have invented shorthand to appreviate complex kinterms e.g. "MMBDD" stands for the relation "maternal grand uncle's granddaughter", a female maternal cross cousin of the second degree.

- We will occasionally use the following basic alphabet: M for "mother", F for "father", D,S for "daughter" and "son", B, Z for "brother" and "sister", or sb for "sibling".
- For the affine terms "husband" and "wife" we will use H and F, for "spouse" sp.

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Terminological preliminaries

Australian aboriginal societies are traditionally split up in mutually exclusive groups or parts which are called

- moieties if the society is split in two parts,
- sections if the society is split in four parts,
- > and subsections if the society is split in eight parts.

Terminological preliminaries

- These parts may go by special names for each or they may not and a society that has subsections might as well group them together to sections or moieties.
- We will sometimes speak of subsections if there are 16 parts but in general in Australia there seems to be no society with more than 8 named subsections.

Terminological preliminaries

- If the sections or subsections are named the term "skin" is used in the Australian vernacular.
- In particular, the Warlpiri have eight named subsections and the question "What's your skin?" is of outmost importance in daily life!

The Warlpiri

- The Warlpiri are a group of aboriginal people living in the Western part of central Australia
- Being forced to abandon their semi-nomadic traditional life as hunters and gatherers in the remote **Tamani desert** after WWII they now live in a couple of (self-governed) communities with Lajamanu and Yuendumu as centers
- The recently published monumental "Warlpiri Encyclopedic Dictionary" ([16]) gives 3000 as the current number of speakers of the Warlpiri language

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The Warlpiri

- Warlpiri culture is a variant of the dreamtime animistic society typical for aboriginal Australia
- Its richness and complexity has created and fascinated a distinguished tradition of anthropological research instigated by A. P. Elkin in the early 1950s ([3])
- Starting with Mervyn Meggitt's classical monograph "Desert People" (1962[25]),
- Nancy Munn's work on Warlpiri iconography in "context" ([28, 30]).
- The MIT linguist Ken Hale and his students have established Warlpiri grammar firmly on the chart of generative linguistics ([10, 31, 34])
- The 1980s saw a reassessment of women's role in Warlpiri culture by Diane Bell ([1]) and Barbara Glowczewski ([5, 6])



Figure: The Warlpiri skin names [15].

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The **eternal logic** is the logic of cyclical perpetuity, or unbroken circles, as opposed to what might be termed the linear logic, the logic of linear perpetuity and of beginnings and endings - both valid forms of logic, and both present in all actual philosophies, though generally with one prevailing over the other.

The eternal logic is evidenced in many ways in Warlpiri thought concerning the nature of entities in the world. An important theme which runs through Warlpiri ritual and totemic theory is the theme of the '**persistence of entities through transformation**', the idea that a given entity presented to the senses at a given time is simply the current manifestation of something which has existed always and will always exist.

The **logic of complementarity**, or the 'unity of the opposites' the idea that any whole consists of complementary parts; or, viewed from the other angle, the idea that any opposition forms a unit, that opposed entities constitute a unity; each entity complements some other entity.

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This theme is massively illustrated in sacred myth where, for example, Dream Time personalities representing a natural species and semi-moiety and traveling from one site to another will suddenly be transformed into a complementary species and, typically, a complementary subsection... Indeed, this theme is one of the most important organizing principles in Warlpiri society. (Ken Hale [11], p.235f)

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Jiliwirri, or upside-down Warlpiri

For certain male initiation ceremonies the Warlpiri have a special secret joking language game called **Jiliwirri**, or "upside-down Warlpiri" ([9]) where the words take on precisely the opposite meaning of their usual sense:

 Literally "Another one stays on East" for "I am going West" (after [9], example 7A, p.474)

This is another manifestation of the **logic of complementary**: in the limit the minimal meaning differences vanish to unity of opposites and the signs start to oscillate between pure difference and pure identity.

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Since jiliwirri replaces a term by its minimally opposite antonym, one can probe into the **semantic fine structure** of Warlpiri concepts e.g. the semantic oppositions inherent in the kinship system:

In the subsections, the following form minimally opposing pairs ([9], p.476):

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 Japanangka/Jungarrayi; Japangardi/Japaljarri; Jupurrurla/Jangala; Jampijinpa/Jakamarra.

Warlpiri iconography

The unique drawing style of the Warlpiri has been the subject of a study ([30]) by Nancy Munn who sums up the most characteristic feature by

•••• "the spatial grammar with which we are dealing is strictly in accord with the rules of that two-dimensional country 'Flatland'. ([29], p.206)

In particular, the Warlpiri depict things by the imprint they leave on the ground! E.g. a **kangaroo** in Flatland looks like this

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Metaphysics of the subsection system

The important ibis totem at Renner Springs (Bunarabanda) long ago told the Walbiri that, when men died, they died "completely". The sun, moon and rain dreamings, however, contradicted the ibis. They said that, just as they themselves reappeared regularly, so the Walbiri would always return after death-that is, dead people would be reincarnated in the form of the guruwari spirit-entities. The rain dreaming from Walabanba, near Bullocky Soak, then "gave" the subsection system to the Walbiri, saying that this too "never finished", for it enabled subsections to cycle continuously through the generations. (Meggitt [25], p.167)

Myth of the ibis men

When the ibis men enter the earth, they announce that they are "finished" and will not be seen again. But the rain dreaming there and the sun who has accompanied them deny this. They say that people do not simply finish when they die. They come back again, just as the sun, the moon and the rain reappear regularly; that is, totemic beings are reincarnated in the form of guruwari spirit entities, activated by human totemistic rituals. (Meggitt [26], p.41)

Metaphysics of the subsection system

- Ibis totem belongs to Japaldjarri-Jungarrayi subsection pair (patricyle)
- Single ibis totem opposed to three cylic dreamings (two in the ibis men myth)
- Cyclically reappearing subsections correspond to cyclically reappearing dreamings
- The myth contrasts the "linear logic" of the ibis with the "eternal logic" of the other dreamings
- By further subdivision the Warlpiri subject system articulates the "logic of complementarity" as well (cf. Hale)
- Classificatory kinship of the subsection system relates primarily to totemism and cosmology!



1. NAPALJARRI 2. IAPALIARRI 3. NUNGARRAYI 4. IUNGARRAYI 5. NAPANANGKA 6. JAPANANGKA 7. NAPANGARDI 8. JAPANGARDI 9. NAKAMARRA 10. JAKAMARRA 11. NAPURRULA 12. JUPURRULA 13. NANGALA 14. JANGALA 15. NAMPIJINPA 16. JAMPIJINPA

Figure: Warlpiri kinship terms for male ego ([17], p.187)

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- "Ngati" by denoting at the same time ego's mother as well as her sisters induces an equivalence relation ~ between the genealogical kinterms M and MZ.
- The problem of kinterm analysis is to describe precisely the equivalence relation induced by the kinship terminology of a particular language.

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Then the problem of a general classification of possible kinship terminologies arises.

- The tools developed by anthropologists are algebraic concepts to describe the equivalence classes generated over a basic alphabet like M,F,D,S, etc. either by
- ► rewriting rules starting from basic "focal" types (Lounsburry-Scheffler [33]): e.g. M → MZ in order to describe the extension of meaning for "ngati" from mother to aunt,
- or as congruence classes for (inverse) semigroups or appropriate kinterm monoids over the alphabet (Boyd [2], Gould [7], Liu [22]).

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- Warlpiri distinguishes between older and younger siblings in ego's generation
- Warlpiri distinguishes distaff from sword side
- Warlpiri merges lineals with collaterals
- Warlpiri is therefore of the so called bifurcate merging type

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- In contrast, English is non-bifurcate (M ~ F) and non-merging (M ≁ MZ)
- The genealogical equivalence ~ is reminiscent of octave equivalence in music: though M and F are "really" different sounds ("mother" vs. "father") they have identically sounding genealogical "overtone series", i.e. sets of terms for maternal and paternal kin!
- The identity of individuals is displaced to the identites of their effects on genealogies. The theme of this new genealogical logic shows up again in the intrinsic logic of the genealogical topos of Lawvere and Schanuel!



Figure: Claude Lévi-Strauss (1908-2009)

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Nous entendons par structures élémentaires de la parenté les systèmes où la nomenclature permet de déterminer immédiatement le cercle des parents et celui des alliés; c'est-à-dire les systèmes qui prescrivent le mariage avec un certain type de parents; ou, si l'on préfère, les systèmes qui, tout en définissant tous les membres du groupe comme parents, distinguent ceux-ci en deux catégories: conjoints possibles et conjoints prohibés.

Nous réservons le nom de **structures complexes** aux systèmes qui se limitent à définir le cercle des parents, et qui abandonnent à d'autres mécanismes, économiques ou psychologiques, le soin de procéder à la détermination du conjoint. L'expression «structures élémentaires » correspond donc, dans ce travail, à ce que les sociologues nomment habituellement marriage préférentiel. Lévi-Strauss ([21], p. IX)

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Figure: Philippe Courrège in Oberwolfach 1967. (Photo by Konrad Jacobs)

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Definition.

An (elementary) kinship system is a triple (S, ω, μ) where S is a finite set, and ω, μ are permutations of S. A morphism of kinship systems $(S_1, \omega_1, \mu_1) \rightarrow (S_2, \omega_2, \mu_2)$ is a function $f : S_1 \rightarrow S_2$ that is equivariant with respect to ω and μ i.e. $f \circ \omega_1 = \omega_2 \circ f$ and $f \circ \mu_1 = \mu_2 \circ f$. The resulting category \mathcal{K} is called the *category of kinship* (systems).

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The intended interpretation is that *S* represents the set of (disjoint) marriage classes, that the conjugal function ω links the men in class x to the class $\omega(x)$ that contains their wifes ("men in x marry women in $\omega(x)$ ") and that the matrilineal function μ links the mothers in class x to the class $\mu(x)$ that contains their children ("women in x have children in $\mu(x)$ ").

Define a *patrilineal* function $\pi := \mu \circ \omega$ that links the fathers in x to their children in $\mu(\omega(x))$ ("**men in** x **have children in** $\mu(\omega(x))$ "). ¹) One can equally well use π and μ as undefined terms and define $\omega = \mu^{-1} \circ \pi$.

 $^{^{1}\}mu$ and π are called the maternal resp. *paternal* function in Courrège (1965).

Elementary Kinship Systems as actions

Courrège's elementary kinship systems are equivalently: actions of the free group on two generators.

$$\frac{\{\omega,\mu\} \to |\mathsf{Sym}(S)|}{F\{\omega,\mu\} \to \mathsf{Sym}(S)}$$

Much later, Lawvere [18] also introduced actions of the free *monoid* on two generators as a model of kinship.

His emphasis was on using the structure of the totality of such systems, a presheaf topos, to investigate kinship.

Using various ideas from category theory and topos theory, he demonstrated various ways to enhance Courrège's model.

Lawvere's Genealogical Topos

For the monoid F_2 , we must move from finite sets to arbitrary sets to retain a *presheaf topos* $\mathcal{T} := [F_2, \text{Set}]$ of kinship systems.

Lawvere pursues the interpretation of the generators of F_2 as patrilineal and matrilineal descent.

Thus an F_2 action $X : F_2 \rightarrow \text{Set}$ is now conceived of as a society.

Note that this includes some quite strange societies that do not have empirical counterparts.

For example, one individual who is their own mother and father, the empty society, and indeed societies with an infinite number of individuals.

Some of these will be useful and interesting.

Na/Mosuo society

Small ethnic group in Southwest China.

Hua, Une société sans père ni mari, les Na de Chine [12]



Easily accounted for in the genealogical topos, we take m to act as the identity.

Genealogical topos: Products

It was already pointed out by Courrège that cartesian products of elementary kinship systems are useful.

For example, the four section system of the Kariera (Figure 5) in NW Australia (Radcliffe-Brown [32]) arises as product of a two section patrilineal and matrilineal structures.



Figure: Kariera section system, [4]

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Question: what meaning can we give to exponentials in \mathcal{T} ?

Genealogical topos: Individuals and points

The terminal society 1 is the singleton with the trivial action. For X a society, points $1 \rightarrow X$ are "super-individuals", being their own mother and father.

We can use the resources of ${\mathcal T}$ to refer to individuals, and express relations between them.

Consider the representable society $I := F_2(-, *) : * \mapsto F_2(*, *)$

By Yoneda, elements of a society X are equivalently morphisms $I \to X$ in \mathcal{T} .

"y is an ancestor of x": $\exists w : I \to I$ such that $I \xrightarrow{w} I \xrightarrow{x} X = I \xrightarrow{y} X$

w is not necessarily unique. We pass to the category of elements...

Genealogical topos: Genealogical chart, internalizing chronologies

Let $X : F_2 \to \text{Set}$ be a society, then the category of elements $\int_{F_2} X$ is the genealogical chart.

Lawvere suggests we equip this with an "age" functor $\int_{F_2} X \to D$ to an ordered set (e.g. dates).

"... a construction of Grothendieck (1983) would permit internalizing such a chronology in \mathcal{T} ."

Proposition ([8], §28)

 $\int_{\mathbb{C}} : [\mathbb{C}^{op}, \mathsf{Set}] \to \mathsf{Cat} \text{ has a right adjoint } \nu_{\mathbb{C}} : \mathsf{Cat} \to [\mathbb{C}^{op}, \mathsf{Set}]$

Thus our charts equipped with an order are equivalently morphisms of presheaves $X \to \nu_{F_2}(D)$, which live again in \mathcal{T} .

Genealogical topos: subobject classifier

The formula for Ω in a presheaf topos tells us that as a set, Ω has elements the *ideals* of F_2 (subsets closed under *m*, *f*), with actions:

$$A, g \mapsto \{w \in F_2 \mid w \cdot g \in A\}$$

In specifying a *part* of a society, we say more than just whether each individual belongs to the part or not.

Each individual can be considered to have a "degree" of belonging to the part – an individual may not belong directly, but may be linked via the structural maps to one who does.

 Ω is a rather strange thing, a society whose individuals are sets of possible ancestor relations and where the "mother" and "father" of an individual relate these sets by "division".

Enhancing the topos: gender objects

Consider the following object G of \mathcal{T} :



Such an abstract two-element society may be called a binary gender object.

By slicing over G, we obtain a topos \mathcal{T}/G of binary gendered societies.

Each individual is now labelled by an element of G, and the actions must commute: the father of a male is a male, etc.

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Enhancing the topos: subsections object

A similar idea can be used to incorporate an elementary kinship system, seen as a particular object of \mathcal{T} .

Left: Warlpiri subsections. Right: A version of the Murinbata section system.



Slice over such an object $\ensuremath{\mathbb{W}}$ to obtain societies conforming to the elementary system.

Moreover, we may form the product $G \times W$, and thereby obtain societies obeying a gendered section system.

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Speaker-centric and Sociocentric Set Designations

	speaker-centric (relative) terms	<u>sociocentric</u> (absolute) terms (1 = Japaljarri-warnu)			
	(speaker in set 1)				
		adult		child	
		male	female	male	female
1.	yurnturrujangu	JAPALJARRI	NAPALJARRI	JAPALYI	NGALYIRRI
м.	purtari-rlangu10	JANGALA	NANGALA	JANGKARLI	NGANGKALA
M ² .	ngarrka-panji	JAPANGARDI	NAPANGARDI	JAPAYARDI	NGAMPAYARDI
м3.	kulu-panji	JUPURRURLA	NAPURRURLA	JURLAMA	NGAMPURLA
P.	papang-ku-rlangu	JUNGARRAYI	NUNGARRAYI	JUKURTAYI	NGAMPUKURLU
PM.	warnarrpi-rlangu	JAKAMA RRA	NAKAMARRA	JAKARRA	WAJALA
PM ² .	murrkardi-rlangu	JAPANANGKA	NAPANANGKA	JANAMA	NGAMANA
PM ³ .	papa-nginta	JAMPIJINPA	NAMPIJINPA	JAMPIRLKA	NGAMPIJAKURDU

FIGURE 3

Subgroups of Dg



Figure: The Warlpiri subgroups and classes [15, p. 76].

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Figure: Warlpiri kinship after Meggitt (1962) from ([24], p.248). Wallpaper group *cm*.

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Warlpiri genealogy as repeating pattern

Orbifold corresponding to the wallpaper group *cm*:



The Möbius band has Euler characteristic 0, is non-orientable, and has one boundary; it is $*\times$, a punched crosscap.

Figure: The Möbius tape corresponds to *x

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