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## Abstract

*In recent decades, fieldwork with 20th century hunter-gatherers has led to a "paradigm shift" away from emphasis on child care by the mother alone, toward alloparental care in which parents and their children benefit from help provided by children's older siblings, mother's siblings, mother's mother and more distantly related or unrelated others. This paper emphasizes the importance of alloparental care among the Alyawarra-speaking people of Central Australia in 1971-72. It reports on 1439 numerically coded behavioral observations of infant and child carrying, in combination with extensive kinship, genealogical, demographic and census data that reveal previously undetected patterns in child care, including the extreme rarity of carrying by parents (2.85% of carries by mothers, 0.28% by fathers). I suggest that Alyawarra infants and children were treated as part of the Commons, deeply analogous to all shared resources including kangaroos, waterholes and sacred sites. Everyone ultimately benefited from the birth of a child and its later contributions to the welfare of all, so virtually everyone was responsible for participating in its care. I interpret these data in terms of kin selection, reciprocal altruism, mutual aid and other survival strategies that precluded the Tragedy of the Commons in the harsh and capricious environment of the Central Australian desert.*

## Acknowledgements

I shall always be grateful to the Alyawarra-speaking people of the Northern Territory of Australia for their wonderful cooperation while I did my research with them in 1971-72. I especially appreciate their marvelous sense of humor at all times, but most importantly at the beginning of my observational data collection while I was sitting on top of my Land Rover, learning how to use my recording system without being destroyed by sun and wind. Special thanks to Richard Slobodin for using Kropotkin's *Mutual Aid* as a text in a course on the history of anthropological theory at McMaster University in 1975, and to my wife, Nancy Hubley, for taking Slobodin's course and discussing this paper with me more or less continuously for about two years. I give many thanks to Sarah Hrdy, Robert Banks, Valerie Munt and John Price for their detailed reading of the paper, their assurances that it was worth writing, and their many thoughtful recommendations for improving it. As always I thank Doug White for facilitating my online access to the UCI Libraries at the University of California, Irvine, and the staff of the Abbie Greenleaf Memorial Library in Franconia, New Hampshire, for their highly supportive Interlibrary Loan Service.

## Table of Contents

## 1. Rationale, overview and roots

### Rationale

At the end of his essay on "People without Politics", Les Hiatt eloquently summarized his description of Australian Aboriginal societies. I have selectively compressed his final paragraph here.

> "Few peoples can have placed higher value on altruism and mutual aid than the Aborigines of Australia. The absence of government, Kropotkin would say, was to be regarded not as a low level of political evolution but as a luminous peak. The authoritarian mode in public affairs was discountenanced. Natural resources and the land itself were equitably distributed among

descent groups, and appropriation of clan estates by force was unknown. Such characteristics belong to the anarchist tradition." (Hiatt 1996:99)

I modify and expand upon these sentiments throughout this paper.[1]

In her recent book entitled *Mothers and Others*, Sarah Blaffer Hrdy (2009) made a strong case for the importance of allomothering (or alloparenting) and cooperative breeding among humans in early and recent hunter-gatherer societies. Hrdy (2009:22) defines alloparent as "any group members other than the parents who help [parents] rear their young". Thus *alloparenting* (Wilson 1975a:349-352; Hrdy 2009 Chapter 6) is an altruistic breeding strategy in which parents and their children benefit from generalized care provided by diverse helpers such as children's older siblings, mother's siblings, mother's mother and more distantly related or unrelated others.

*Cooperative breeding* takes alloparenting even further when women who provide generalized care for other women's children also provide specialized care by provisioning or feeding those children (Hrdy 2009:30,177-179), and in extreme cases (e.g., eusocial species and nannies in highly stratified human societies) even refrain from having children of their own while assisting other mothers (Wilson 1975a:125-128). As I show below, alloparenting unambiguously characterized the Alyawarra speaking people of Central Australia in 1971-72, but obtaining evidence for cooperative breeding in its more specialized sense was problematic. In this paper I focus on the carrying of infants and children by parents and alloparents among the Alyawarra, and briefly discuss cooperative breeding *sensu stricto*.

In an influential book on *Attachment*, Bowlby (1969) hypothesized, on the basis of then-available evidence, that mothers were primary or exclusive caretakers of infants in Pleistocene societies. But in recent decades, fieldwork with 20th century hunter-gatherers has led to a "paradigm shift" toward the Cooperative Breeding Hypothesis (Hrdy 2006, 2009, in press) that focuses attention on alloparental care as a prerequisite for child survival in the Pleistocene. Yet Meehan and Hawks (2013:85) note, "[R]esearch on children's attachments to non-maternal caregivers, and attachment in cross-cultural perspective, is limited. There continues to be an emphasis on the mother-child dyad, and research is predominately conducted in Western cultures, where mothers and children are more isolated from assistance than what is typically found throughout most of the world."

In keeping with the shift in focus and the potential value of non-Western data that situates the mother-child dyad in a broader context, I have two major objectives in writing this paper. First, I present and analyze relevant genealogical and behavioral data from Central Australia that pertain

[1] It may be politically incorrect to say words such as *sociobiology*, *mutual aid* and *anarchist*, but circumlocutions are a real bother. After much rewriting, I opted for simplicity and retained the problematic terms.

to arguments by Hrdy, and many others whom she cites, concerning the biological bases of childrearing among Pleistocene and recent hunter-gatherers. Second, I explore some ways in which the long-dismissed concept of mutual aid can contribute to a Darwinian understanding of my data and of arguments by Hiatt and Hrdy. Mutual aid in various guises, as a constituent of Darwinian evolutionary theory, implicitly or explicitly ties together all Parts of the paper, and becomes the major theme in Part 5.

The paper is based on my fieldwork in 1971-72 with the Alyawarra, and is a contribution to the expanding body of naturalistic observational research on infant and child behavior in hunter-gatherer societies. People whose precedents I follow have argued that greater progress would be made in understanding human behavior in general, and childhood behavior in particular, if investigators would focus more on what people do and less on what they say they do – or should do – in their everyday lives.

**Overview**

Part 2 introduces my research methods and the resulting dataset. Although the research reported here uses methods that were developed in studies of nonhuman primates and other animals, it focuses squarely on human behavior that was embedded in an extraordinarily complex human society whose roots may reach back 50,000 years. I introduce some aspects of this societal complexity in my overview of life among the Alyawarra in 1971-72, and add more complexity *passim* during my discussions and interpretations of Alyawarra childrearing.

Part 3 presents a refined summary of my earlier analyses of Alyawarra history, ecology and kinship which together form the context for carrying infants and children. In my discussion of kinship, I focus on six densely interconnected levels of kinship networks including: ancestral Dreamings, biological genealogies spanning 5 to 6 generations, the sociocentric section system ("skin"), the egocentric kinship terminology system ("kin"), and classificatory and universalizing add-ons that encompass non-biological kin and extend the range of all of these systems to span multiple societies. Throughout the paper, I rely heavily on this understanding of Alyawarra kinship to improve my understanding of child rearing practices.

Part 4 presents detailed quantitative answers to questions such as "who, what, when, where and how" concerning diverse aspects of carrying behavior in the lives of infants, children and their caregivers. I summarize nearly 200 hours (41,000 records) of observational data concerning the carrying of 24 infants and children by 103 residents of the camp where I lived for almost a year. I use three approaches to summarizing the data: *statistical* analyses of child care modes, styles of carrying, and sex-age relations between carriers and the children they carried; *genealogical* analyses of relationships among the 24 children and 103 carriers emphasizing the diverse roles of

consanguineal, affinal and non-biological kin in the day-to-day lives of the children; and *terminological* analyses of kin relations among children, their mothers and the women with whom they most closely interacted in single family residences and in single-sex women's residences. By all of these measures, it is clear that carrying infants and children was widely distributed across both sexes, all ages, and most genealogical relationships represented in the camp, and that a child's parents contributed few of the carries that a child received.

Part 5 addresses the "why" question by arguing that cooperation and mutual aid, which constitute dominant motifs in Alyawarra society, contribute significantly to an understanding of behavior patterns that make little or no sense when viewed from a traditional biological perspective that emphasizes competition. In this Part, the presentation is essentially conceptual rather than quantitative. Elements of the argument include kin selection, reciprocal altruism, alloparenting, strategies that avoid the tragedy of the commons, plus altruistic and utopian anarchist traditions in 19th century Russia and 20th century Aboriginal Australia. My emphasis on mutual aid in its many forms throughout the paper should not be interpreted as my denial of the importance of competition and conflict in human societies. Rather it is an attempt to achieve a balance where an unbalanced emphasis on competition has long prevailed. Disagreeing with the interpretation in Part 5 does not justify dismissing the data in Part 4.

In Part 6, I recapitulate and summarize my argument and consider its strengths and weaknesses.[2]

**Roots**

The article has had a long and complex gestation spanning about 45 years. My field research design, prepared in 1969, derived from work published *before* I did my fieldwork in 1971-72, including nonhuman primate field and laboratory studies in the ethological tradition (Yerkes and Elder 1936, Carpenter 1940, Tinbergen 1963, DeVore 1963, Hinde and Spencer-Booth 1967, Kummer 1968, Denham 1971) and many others. My behavioral observation methods followed the

[2] This article is an expansion and major revision of a paper (Denham 1974) that I published on the same topic shortly after I finished my doctoral dissertation (Denham 1973). I wrote the earlier paper as an exercise in numerical pattern detection based on only 30% of the observational data that I recorded during my fieldwork, and I analyzed the data superficially. In that paper I explicitly described the nature and scope of shared infant carrying among the Alyawarra, without using the term "allomothering" which Wilson (1975a) introduced into mainstream sociobiology in the following year. Just when Bowlby's (1969) book was becoming a classic, nobody was interested in which people or how many of them carried infants in Aboriginal Australia, and the paper simply disappeared. In response to recent work on allomothering and cooperative breeding by Hrdy (2009) and many others cited by her, I deal with similar issues in this revision but expand the scope to include additional topics, use 100% of my observational data records, and do a much more thorough job of analyzing these and other data from the theoretical perspectives of 2015. In places where the new article overlaps the old one, the new one takes precedence.

lead provided by Ruth Bobbitt and her colleagues at the University of Washington (Bobbitt, Jensen and Kuehn 1964; Kogan, Wimberger and Bobbitt 1969) who developed coding schemes and computational methods to facilitate studies of primate behavior and human mother-infant interactions. I adopted and modified Rose's (1960) innovative numerical methods for the study of Australian Aboriginal kinship and demography, which bear interesting similarities to methods used in ethological studies of nonhuman primates. Since my focus on research methods was an important part of the fieldwork, I deal with methodological issues throughout the paper, with special emphasis on *particularity* and *realism* (Auerbach 1953, Watt 1957).

From the perspective of 1971-72, my work with the Alyawarra can be described most accurately as exploratory research. In his discussion of experimentation in the behavioral sciences, Kaplan (1964) described heuristic and exploratory experiments as follows.

> "[The heuristic experiment] is designed to generate ideas, to provide leads for further inquiry, or to open up new lines of investigation. . . . [The exploratory experiment] is frankly intended just to see what would happen IF _____. Often it is associated with new techniques. . . In general, it invites serendipity, the chance discovery; it is part of what we do to deserve being lucky" (Kaplan 1964:149).

Kaplan's description undoubtedly applied to observational as well as to experimental research, and in particular it applied to the observational research described here.

My exploratory data analysis follows the lead of Erickson and Nosanchuk (1977) and Tukey (1977), and is deliberately simple. My objective has been to summarize what I saw and to present it in an intuitively obvious fashion. More sophisticated methods in genetics and mathematics could have enhanced the precision and elegance of the paper, but they would have sharply reduced its readability.

My interpretations of the Alyawarra data derive from research on infant care in hunter-gatherer societies (Blurton Jones 1972, Bowlby 1982:6, Kagan et al. 1994: Chapter 2, Hewlett and Lamb 2005:5), the analysis of mutual aid (Kessler 1879/1880, Kropotkin 1902, LeGuin 1974, Todes 1987, 1989, Sapp 1994, Hiatt 1996); and work on Darwinian evolution of altruistic behavior (Darwin 1872, Hamilton WD 1964, Trivers 1971, Wilson 1975a, Hrdy 1977, 2009). These and many others have developed theoretical concerns that generally were absent from hunter-gatherer research 45 years ago. Nevertheless my data address current theoretical problems and I hope that publishing them now will be useful.

In the early 1970s when I did this field research, a battle raged over the "simple observations" upon which I based my work. Ethologists such as Tinbergen (1963:412) argued that "Contempt for simple observation [was] a lethal trait in any science"; philosophers of science such as Hanson (1958:3) and Kuhn (1962:79) argued that simple observation was intrinsically theory-laden hence was far from simple; rationalists such as Chomsky (1959, 1967:142) in his scathing attack on B. F. Skinner (1957) argued that "the general point of view [of empiricist ideas] was largely mythology". Now, over forty years later, many who study human and nonhuman social behavior tentatively accept "simple observation" in some form as a legitimate method that must be used cautiously. My objective here is not to reopen the battle over simple observation, but is much more modestly to demonstrate ways in which observational data collected with a hunter-gatherer society almost half a century ago can contribute to an understanding of our species.

## 2. Field methods and datasets

### Alyawarra population

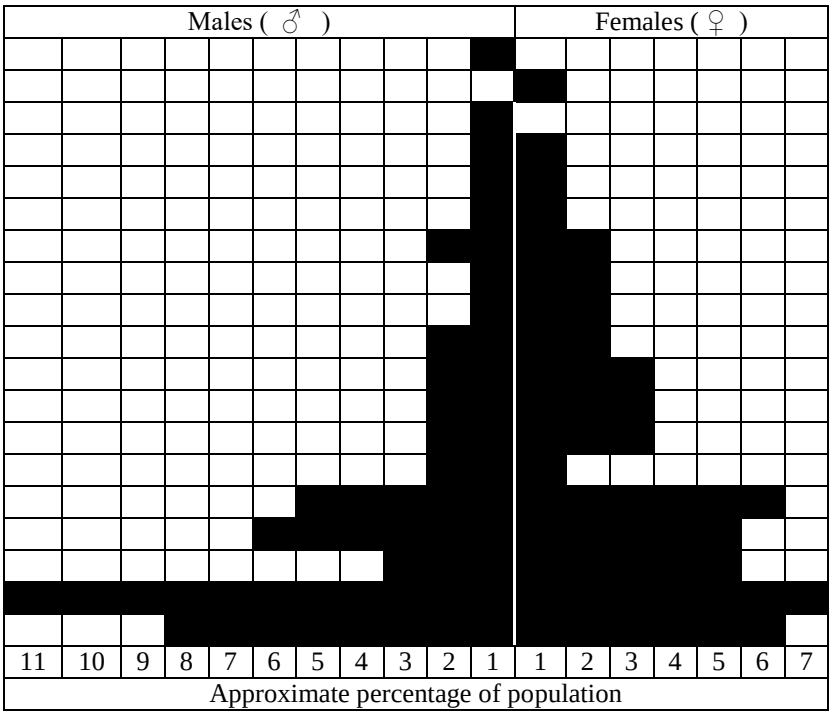
***Population size.*** In 1971-72, I estimated (Denham 1975a) that the total Alyawarra population was somewhere in the vicinity of 500 people. Against this background, my research population consisted of 264 people living in four different camps, *Mura*[3] *Angungera, Mura Liladera, Murelgwa Bendaijerem, Murelgwa Gurlanda*, plus 113 of their deceased ancestors whom I identified while reconstructing genealogies, yielding a total research population of 377 people. I realize now that my sample from the southern area of traditional Alyawarra territory significantly under-represented the northern Alyawarra (Memmott p.c.). I made all behavioral observations at Murelgwa Gurlanda, with a typical population of approximately 100 people, and discuss that camp in considerable detail below.

***Population pyramid.*** Using multiple sources, I obtained and cross-checked ages of all living members of the research population. My principal source was the Chalmers family who homesteaded MacDonald Downs Station in 1923 and systematically accumulated Aboriginal birth, death and other census data for half a century (Denham and White 2005).

Figure 2.1 represents the 264 living members of the research population, 134 males and 130 females; the sex ratio was 1.03 males per female (Denham 1975a). Among people younger than 30 years and older than 59 years, males (n=107) were more numerous than females (n=90); in the 30-59 year age range, females (n=39) were more numerous than males (n=27). Differences in age-specific sex ratios may be attributable to random variations in live birth sex ratios within the small population, to employment and selective migration, to sex-related differences in mortality, or to

[3] I gloss *mura* as "small dispersed camp" and *murelgwa* as "large aggregated camp".

any combination of these factors. Since it was impossible to obtain reliable data concerning births and deaths of deceased people, the live birth sex ratio and details of infant mortality are unknown.




| # ♂ | Age | # ♀ |
|---|---|---|
| 1 | 90-94 | - |
| - | 85-89 | 1 |
| 2 | 80-84 | - |
| 1 | 75-79 | 1 |
| 3 | 70-74 | 3 |
| 2 | 65-69 | 2 |
| 6 | 60-64 | 4 |
| 2 | 55-59 | 4 |
| 3 | 50-54 | 4 |
| 6 | 45-49 | 6 |
| 6 | 40-44 | 8 |
| 6 | 35-39 | 9 |
| 4 | 30-34 | 8 |
| 5 | 25-29 | 2 |
| 13 | 20-24 | 17 |
| 15 | 15-19 | 12 |
| 9 | 10-14 | 15 |
| 28 | 5-9 | 18 |
| 22 | 0-4 | 16 |
| 134 | - | 130 |
| Number of people | | |

**Figure 2.1. Population pyramid of 264 living members of the research population**

I speculate that the small deficiency of men in the 30 to 59 year age range was due to their working on cattle stations elsewhere in the Northern Territory; similarly I speculate that the same explanation applies to both young men and the young wives of older men in the 25-29 year cohort. The population was young: 40.9% of its members were younger than 15 years and the median age of the population as a whole was 19 years. Thus my observational records concerning infant and child carrying pertain to a society in which neither the age structure nor the sex ratio was anomalous for hunter-gatherer societies (Binford 2001).

***Cohorts.*** For analytical purposes in this paper, I defined Alyawarra age categories in years as in Table 2.1. I segmented the population into five major cohorts of 14 years each, but due to the large number of carriers (42) in the <14 year cohort, I divided that group into four subgroups, 0-1, 2-5, 6-9 and 10-13 years. The 14-year intervals used in the table are based on a) the approximate age of 14 years at which young women could marry and young men could be initiated, b) the age at which young men became eligible to marry *and* the mean age difference of 28 years between mothers and their children, c) the mean age difference of 42 years between fathers and their children, and the approximate age of 56+ years at which senior women became elderly women.

| Infants and children | Women | Men |
|---|---|---|
| infant$^{n}$ 0-1 | young woman$^{m}$ 14-27 | young man$^{n}$ *ardwa andidja* 14-27 |
| child$_1$$^{n}$ 2-5 | mature woman$^{m}$ 28-41 | mature man$^{m}$ *ardwa elgwa* 28-41 |
| child$_2$$^{n}$ 6-9 | senior woman$^{m}$ 42-55 | senior man$^{m}$ *ardwa elgwa* 42-55 |
| child$_3$$^{n}$ 10-13 | elderly woman$^{m}$ >55 | elderly man$^{m}$ *ardwa ayua* >55 |

**Table 2.1 Alyawarra cohorts as I define them for use in this paper.**
(see Green 1992 for "woman")
Key: $^{n}$ = nonmarriageable $^{m}$ = marriageable

## Murelgwa Gurlanda

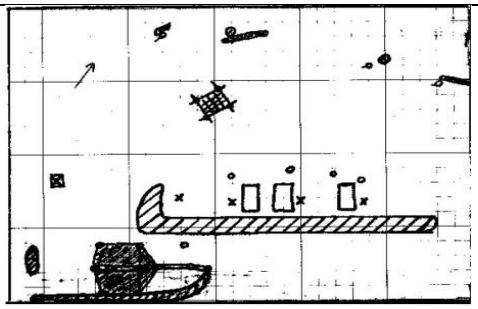
Here I introduce the camp from a methodological perspective and return to it later to examine substantive issues.

***Gurlanda visibility*** (Denham 2014b). My observational records pertain to a society in which visibility generally was not seriously limited by topography, vegetation or opaque structures. The layout of camps and residential structures yielded excellent – but *not* perfect - visibility of many activities of daily living and was a primary consideration underlying my decision to conduct fieldwork with the Alyawarra. The illustrations in Figure 2.2 indicate the nature of the physical setting where I made the records that I analyze below. It shows a photograph of a representative residence and the open terrain in which it was located, a ground plan of a representative residence, and a photograph of me making observational records from my vantage point beside my tent. Observing from atop my Land Rover (for my precedent see Altmann and Altmann 1970:7,17), I may have looked a bit silly for a few days, but I did it with what I believe was the full acceptance of the people who smiled gently and ignored me. The position enabled me to see the entire camp and to record what I saw without intruding on anyone's privacy. What my observations lost in detail they gained in breadth of coverage.

***Gurlanda residences and settlement pattern.*** Murelgwa Gurlanda was a large semi-sedentary aggregated camp of a type that generally formed in ecologically rich times and persisted for weeks or months, often with populations in excess of 100 people. A murelgwa consisted of one or two *ngundyas* or single men's residences, 4 or 5 *alugeras* or single women's residences, and 15 or a great many more *anoardegans* or residences for monogamously or polygynously married men and women with their young children. Figure 2.3 shows representative residences at Gurlanda. (See Memmott 2007 for comparable materials from other Australian Aboriginal societies.)

*a)*

Foreground: alugera R24 with small shade, large shelter, several windbreaks, kangaroo cooking in fire pit, etc. Distant background: ngundya with cars, 3 anoardegans, open desert.



*b)*

Plan of alugera R21 with 1 small shade, 1 large shelter, 2 hatched windbreaks, 3 open rectangular sleeping depressions, fires for warming X and cooking [X].

*c)*

Me recording observations from a vantage point beside my tent. I could see the entire camp.

**Figure 2.2. Sandhill country, residences, observation point and visibility at Murelgwa Gurlanda.**

a) *ngundya* b) *alugera* c) *anoardegan*

**Figure 2.3. An example of each type of residence.**

Within a murelgwa, each alugera formed the nucleus of what I call a "neighborhood". These neighborhoods corresponded to small, more mobile camps (mura) with populations of 15 to 30 people that dispersed when ecological conditions shifted toward droughts, perhaps lasting for months or years. Several mura aggregated again to reconstitute a murelgwa when conditions improved. The composition of the murelgwa remained fairly stable from time to time, but was subject to frequent variations in size and occasional variations in location.

Figure 2.4 shows the layout of Murelgwa Gurlanda in sandhill country where I conducted the behavioral observations, with membership in alugera-centered neighborhood clusters indicated by arrows. The four clusters of arrows connect peripheral anoardegans (yellow) to central alugeras (pink); i.e., each arrow denotes a genealogical and/or behavioral link between the anoardegan at the back end of the arrow and the alugera at its point. The ngundya (blue) was used by all of the men in the camp, therefore was linked behaviorally (but not graphically) with all of the anoardegans and was linked only indirectly through the men's wives to the alugeras.

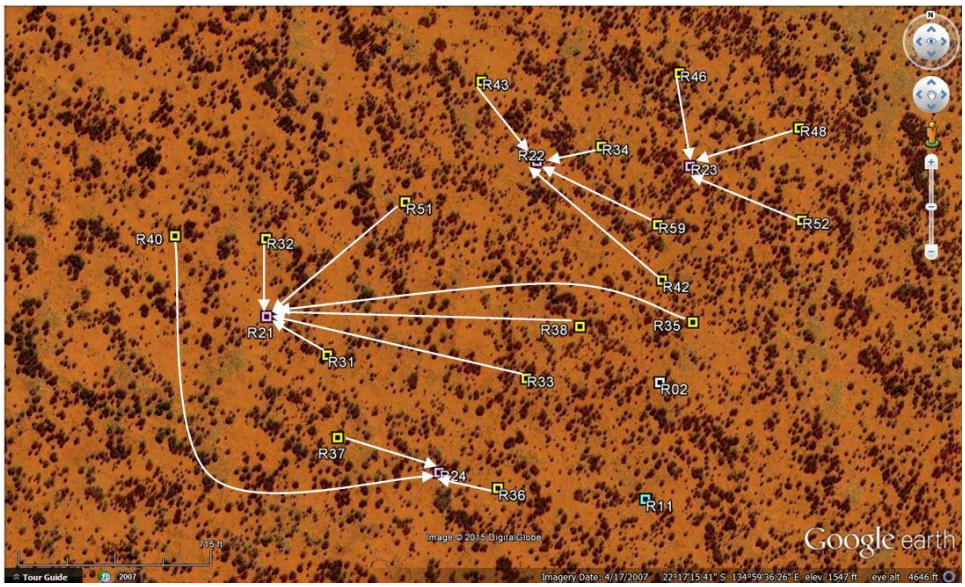



**Figure 2.4. Enhanced plan of Murelgwa Gurlanda, a large aggregated camp, on 27 December 1971.**
1 *ngundya* R11, 4 *alugera* R21-24, 16 *anoardegan* R31-59, my tent R02

Defining the neighborhoods was a complex undertaking. The dimensions that I considered included but were not limited to: genealogical relations of descent and marriage; membership in language groups, Countries, descent lines, descent moieties, generation moieties and sections; classificatory kin relationships; behavior observations; and discussions with many informants.

I made my observational records from a viewing point adjacent to my tent (02 white). From that point, activities at residences affiliated with R22 and R23 were slightly harder to observe than those affiliated with R21 and R24.

## Observational methods

***Field preparation.*** During the 7 months between arriving in the field and beginning to record the observational data, I became well acquainted with the society and with all members of the research population. At no time did I have one or a few key informants; rather, to the best of my ability I worked with all members of the research population. As I describe in more detail below, I made exhaustive or comprehensive sets of camp and residence photos, camp plans and residence plans; took two portrait photographs of almost everyone in the population and gave one copy of each photo to the person photographed; elicited demographics, vital statistics, genealogies and kin term applications data from most or all of those people; repeatedly collected population-wide censuses and residential group composition data for everyone; and systematically recorded meteorological data. I coded all of these data alphanumerically and integrated them with the behavior records, thereby making all of the data amenable to computer-assisted analysis for many purposes.

To further enhance my ability to recognize and identify people, I participated in a series of initiation ceremonies and visited many Dreaming sites with a large number of old and young men; photographed and recorded music and dance performances by men, women and children, and so on. By Day 199, I could recognize and identify by European name and Identification Number all residents of Murelgwa Gurlanda where I made the observational records, and virtually everyone else in the research population so long as I saw them in familiar contexts.

***Photo data cards.*** To record the complete set of data for every person as described above, I used a preprinted deck of 6x8 inch cards illustrated in Figure 2.5. Elsewhere (Denham and White 2005) I have described the cards in detail and explained how to use them. The datasets recorded on each card included:

- **Portraits.** I took two Polaroid photographs of each person, one to mount on that person's data card, the other to give to the person.
- **Vital statistics.** At the top, I recorded numerically coded data concerning each person's sex, age, marital status, membership in a language group, Country and section, and other features.
- **Genealogies.** In the middle, I recorded numerical codes for each person's father, mother and children. Over a period of eleven months I extended those relational chains to a depth of 5 or more generations for most members of the research population.
- **Kinship term applications.** At the bottom, I used the photographs and the genealogies, plus a glossary of Alyawarra kinship terms, to elicit kinship reference terms used by 104 people to identify the photographs of 227 members of the research population, yielding a total of 23,600 kinship term applications.
- **Censuses.** On the back, I recorded census data twice per month for 8 months to identify the camp and the residence where each person lived on those census days, thereby accumulating 16 complete censuses of the research population.

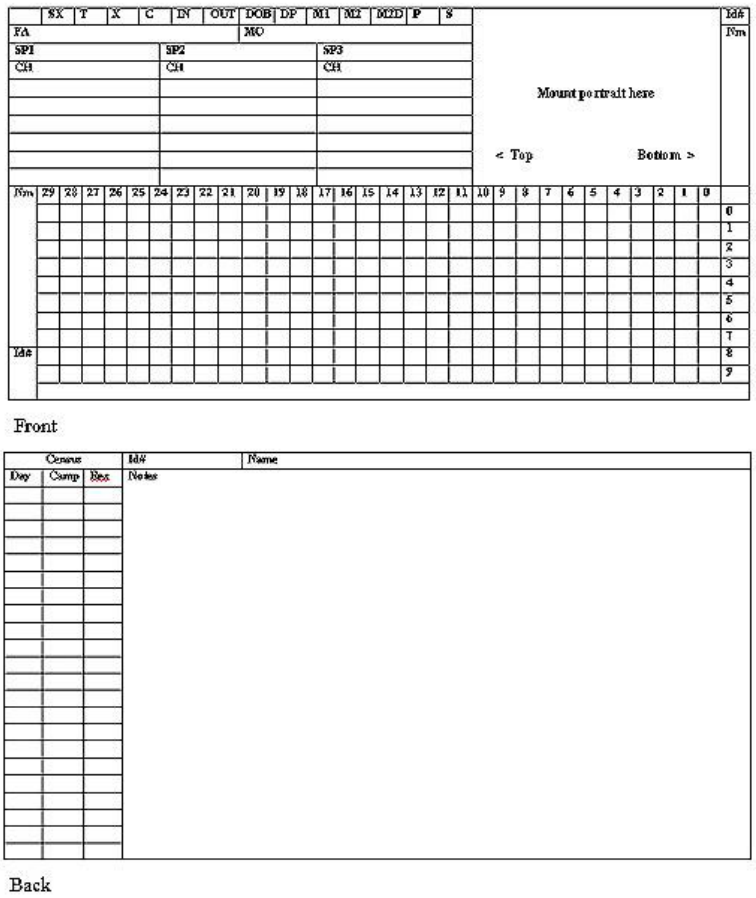



**Figure 2.5.** Front and back of 6x8 inch cards used for recording personal data.

***BEVRECS vocabulary and grammar.*** Before departing for Central Australia, I developed a notational system called BEVRECS based on work by Bobbitt, Jensen and Gordon (1964) and their colleagues. Each behavior record contained eight kinds of information concerning one and only one activity (**BEHAVIOR**), the people (**ACTOR**, **ORIENTATION**) engaged in it, the artifacts (**OBJECTS**) used in its performance, its location in space (**LOC1**-begin, **LOC2**-end), its chronological order (**DATE** / **TIME**) and a code (**CONTINUATION**) that linked 2 or more records that pertained to the same event. The behavior categories or behavior units used in making these records included low-precision verbs such as "walking", "nursing", "throwing" and "carrying". In the case of carrying, codes designated styles: in the hands, in a carrying device called a coolamon, ventrally on the chest, laterally on the hip, and dorsally on the back and shoulders. The codes were general enough that they could be recorded reliably and analyzed easily among virtually all humans, most nonhuman primates and many other mammals. I described the grammar of BEVRECS in Denham (1975b), and listed the complete vocabulary of BEVRECS codes that I used in recording these data in Denham (2001).

When I could identify a specific action but was in doubt about the identity of the actor due to poor lighting, obstructions to visibility, etc., I entered an Actor ID code in the 990-999 series: "990 = unknown Aboriginal child of unknown sex, 991 = unknown Aboriginal female child, … 997 = unknown Aboriginal male adult, … 999 = Unknown Aboriginal person, unknown sex, unknown age". Among the 41,813 records in the observational dataset, I identified 39,855 (95.3%) Actors using specific ActorID codes, but in 1,959 (4.7%) of the records I was unable to identify the actor precisely, so I used ActorID codes in the 990-999 range.

Each behavior record had fields for LOCATION1 and LOCATION2. When I made a record of an event such as carrying, I entered the code for the initial location (residence, bore, vehicle) in the LOC1 field. If the entire event occurred at the initial location (e.g., same residence), I made no entry in the LOC2 field. If the event ended at a different location (e.g., at another residence), I entered the code for the final location in the LOC2 field. Since I recorded the time of onset but not the time of termination of events, these records are of limited value for measuring durations.

When I recorded my data with the Alyawarra in 1971-72, I *did not* do so as part of a plan to write this paper. Rather I used a kind of "vacuum cleaner" approach to recording a very broad spectrum of data with an expectation (hope) that I would discover interesting and useful patterns in the data in future years. Subsequently I decided to use the data to elucidate aspects of Alyawarra socialization in conjunction with my much more extensive analyses of Alyawarra kinship. Perhaps this paper attests to the success of my approach. I introduce additional sampling issues in Part 4.

As is inevitable, my data are theory-laden (Hanson 1958:3) with regard to the topics that I addressed and the kinds of data that I did and did not record, and technique-laden (Sapp 1994:74) with regard to my observational and recording methods, and the data structures that I used.

All of my Alyawarra data are available online and are fully documented in the Alyawarra Ethnographic Archive (Denham 2014a) at http://www.culturalsciences.info/ and Group Compositions in Band Societies Database (Denham 2010) at https://www.kinsources.net/.

## 3. Setting

Part 3 is a comprehensive introduction to additional aspects of the field setting, focusing primarily on the lives of Alyawarra women. In it I compress discussions from earlier papers, insert many refinements to enhance the precision and texture of earlier arguments, and add numerous details about women's lives.

**Topography** (Denham 2014b:10-14). I conducted my research in a cluster of Alyawarra camps located about 250 km northeast of Alice Springs in the southeastern quarter of Australia's Northern Territory. All places and events discussed in this paper occurred within the area covered by Figure 3.1. The region of interest occupies a square roughly 425 km on a side generally bounded as follows:

- North: Barkly Highway (visible on map, eastward from Tennant Creek)
- East: Border between Northern Territory and Queensland (faint vertical line in the east)
- South: Plenty River Highway (invisible; eastward via Hart's Range, Plenty River, Jervois)
- West: Stuart Highway (visible on map, northward from Alice Springs to Tennant Creek)

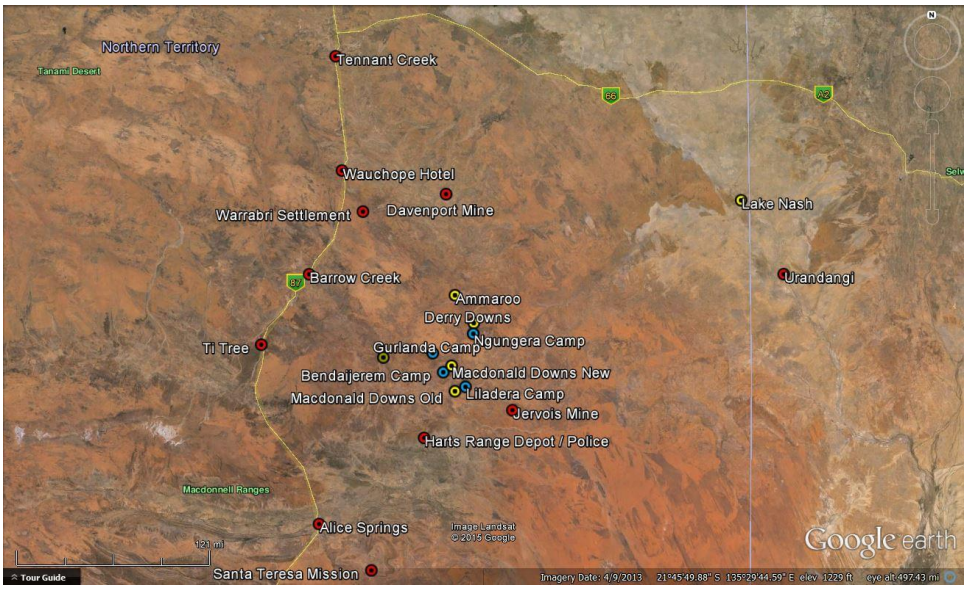



**Figure 3.1. General location of Alyawarra camps in the Sandover-Bundey River basin.**
Red = towns, yellow = pastoral properties, blue = Alyawarra camps, white vertical line = Queensland border.

*a)* Murelgwa Gurlanda *b)* Bundey River *c)* Todd River

**Figure 3.2. La Niña 1971.** Misty morning at Gurlanda; flood beginning at Bundey River; full flood at Todd River.

**Figure 3.3. Alugera R21, 29 October 1971. A single women's residence in cool wet weather.**
Structures include 2 shelters, 2 long windbreaks, 1 shade, 2 covered and 2 uncovered shelters for hunting dogs, and a fire pit used to cook kangaroos and bread (in the pan).

**Climate and natural selection** (Denham 2014b:14-21). Figures 3.2 and 3.3 show aspects of the desert in which Alyawarra territory was located. By traditional measures based on assumptions of a 12-month seasonal cycle, the region received about 25 cm of rainfall annually. However, the climate was highly variable, being strongly affected by large scale irregular climate rhythms and extremes including multi-year droughts typically associated with El Niño conditions, brief but intense floods associated with La Niña conditions, cyclones from the Pacific Ocean and monsoons from the Indian Ocean. I conducted my BEVRECS observations near the end of a moist La Niña period. Figure 3.2 illustrates the impact of significant amounts of rainfall in and near Murelgwa Gurlanda, and the residence covered with tarpaulins in Figure 3.3 shows the standard response to rain.

Darwin (1872) was deeply impressed by the super-fecundity of life in Bahia on the east coast of Brazil where "tangled bank" and "tangled jungle" were the contexts within which he formulated his metaphorical struggle for survival (Todes 1989:3). Based in small part on his field observations and in large part on ancient European concepts of the *scala naturae, natura non facit saltum* and especially the principle of plentitude (Lovejoy 1936), this tropical fecundity found no parallel in the harsh and capricious deserts of Central Australia where Aboriginal population density in 1971 approximated 1 person per 110 $km^2$. Here predators were absent, life-threatening diseases were rare, climatic conditions were extremely harsh and unpredictable, and Hiatt (1996:99) indicates that intraspecific density dependent competition among humans was minimal to nonexistent. I suggest that under such conditions, natural selection should be expected to enhance the likelihood of multigenerational survival of individuals who cooperated with each other and reduce its likelihood among those who failed to cooperate. No doubt competition occurred, but here it was more appropriately defined counter-intuitively in terms of cooperation: perhaps the most cooperative won the Darwinian competition for survival.

Empirical support for an ecological argument concerning alloparenting among Aboriginal Australians appears in Hrdy's (2009:197-199) discussion of three major ecological factors in the evolution of cooperative breeding and alloparenting in avian species. They are: slow life histories (slow to mature and likely to live a long time), occupying the same area year-round (i.e., non-migratory), and living under harsh conditions where they face "special environmental challenges such as unpredictable rainfall or fluctuating food availability". Worldwide, many of the avian taxa that are most prone to evolve cooperative breeding originated in the Australasia and Afrotropic ecozones, and "many of the best-studied examples of cooperative breeding belong to the Australian-derived family *Corvidae*". These conditions parallel those of traditional arid zone Aboriginal Australians who had slow life histories like all humans, were locally nomadic but were not seasonally migratory, and lived in a harsh and capricious habitat.

**Political economy, history and ecology** (Denham 2014b:21-28). The Alyawarra and adjacent arid zone hunter-gatherer societies northeast of Alice Springs were characterized traditionally and well into the 20th century by politics based on *anarchism* in the most positive sense of that polysemous term (Kropotkin 1902, LeGuin 1974, Smith P. 1979, Hiatt 1996:78-99)[4] and economics based on *primitive communism* (Engels 1884:*passim*). I use both of those key terms minimally and simply, without the host of negative connotations that accumulated around them in the 19th and 20th centuries. This benign anarchistic communalism, being free from hierarchical organization and the accumulation of wealth, was likewise free from competition and conflict over land and resources (Hiatt 1996:13-35;99); i.e., people did not own land and resources, but rather they were responsible for maintaining them communally, in the finest possible condition and in perpetuity, for the benefit of all within their own societies and among neighboring societies. Gammage (2011:*passim*) clearly demonstrates how cooperative Aboriginal users of fire contributed to the maintenance of park-like vegetation patterns continent-wide prior to 1788.

Historical phenomena that modified Alyawarra lifestyles in the Sandover-Bundey River region between 1923 and 1971 included Black-White *conflict* concerning access to land and resources, introduction of *bores* or permanent water supplies (wells) that encouraged sedentarization, introduction of *motor vehicles* and *money*; and distribution of government subsidized *rations* that supplemented traditional foods. Here I am less concerned with specific historical events than with historical processes that modified all Aboriginal societies, devastating some, touching others more gently.

[4] The works by Kropotkin and Hiatt are basic to my argument. However, LeGuin's *The Dispossessed* and the many works written in response to her powerful fictional account of a dynamic utopia of the future have helped to shape my attitude toward anarchistic traditions in Central Australia. Presumably it was entirely coincidental that the pastoral property adjacent to my research site was named Utopia Station.

In 1923, the Chalmers family homesteaded MacDonald Downs and quickly became known as "good bosses", in striking contrast with "cheeky bosses", Aboriginal English for *aggressive* or *offensive* (Lyon and Parsons 1989:vi) such as the violent managers of Elkedra and Frew stations (Memmott 1998:207) in far northern Alyawarra territory. Thus early on, MacDonald Downs and affiliated properties became a safe haven for the southern Alyawarra. The introduction of wind-powered pumps or *bores* to provide reliable water supplies at fixed locations contributed to the gradual sedentarization of the Alyawarra. By 1971, camps among my research population generally were established perhaps 0.8 km from a reliable bore, and water quality was consistently good.

The ownership of *vehicles* and the use of *money* were introduced to the Alyawarra in mid-20th century, but the concept of ownership was sharply redefined in the process. The money was insufficient for buying, operating and maintaining a vehicle unless several people pooled their resources. Thus each vehicle was owned in "shares" by multiple owners; other people were responsible for maintaining it; yet others provided fuel; still others provided rifles to use in hunting; yet others provided ammunition and so on. In other words, in the midst of the capitalist Australian economy everything associated with a vehicle and its use by Aboriginal people was communalized. These vehicles were used with considerable difficulty for long distance travel (e.g., to Lake Nash Station), but at Gurlanda they were used only rarely for local hunting and foraging where scarce fuel and frequent breakdowns made them more trouble than they were worth. Thus machines that ostensibly enhanced mobility for highly mobile people did so in a very limited manner in my research population (see Peterson 2000 for comparable descriptions of motor vehicle use by Aboriginal people elsewhere in Central Australia).

Likewise, *rations* and associated changes in diets, hunting and foraging contributed to sedentarization as well, but as was true of conflict, bores and motor vehicles, there was nothing simple about this factor. The Chalmers family maintained a relationship with the Alyawarra based on a common expression among the Alyawarra that said, "We take care of them". Quite simply, "We take care of them" was the Alyawarra way - and the Chalmers' way – of saying "mutual aid" (Kessler 1880, Kropotkin 1902, Hrdy 2009).

Alyawarra men used the expression with reference to their women and children, their young men as they approached initiation and the "singing" that it entailed, their elderly relatives who could not function independently, and especially with regard to their own and their neighbors' Dreamings, Countries and *angerdelungwa* stones and carvings. Furthermore they extended it to the Chalmers family and the Chalmers family reciprocated: they "took care of" the Alyawarra. This relationship functioned reciprocally for half a century between the Alyawarra and the

Chalmers. Thus the Alyawarra at MacDonald Downs and Derry Downs did not "live on rations" but rather they retained access to their own Countries and lived there with a considerable degree of financial and social security, supported in part by rations that enabled them to follow their own traditions as well as anybody could do that under colonial rule. It is reasonable to frame this relationship in terms of Rowse's (1998) barter and McGrath's (1987) accommodation (Hokari 2002).

By the early 1970s, rations had sharply reduced the significance of women's seed collecting among the Alyawarra at MacDonald Downs, but rations had not replaced the meat that men hunted, and their hunting continued to yield a great deal of it. Three species - red kangaroo (*Megaleia rufa*), euro (*Macropus robustus*), and bustard (*Eupodotis australis*) - made up more than 80% of the total number of individual prey taken and more than 95% of their total weight in the twelve-month period beginning in May 1974 (O'Connell and Hawkes 1984:516-517). During that year, hunters at Bendaijerum took an estimated 400 kangaroos (mean 25 kg), 30 euros (mean 18 kg) and 40 bustards (mean 7 kg), plus 545 kg of other animal species. That is a total of 11,363 kg of meat per year for about 100 people including a great many children, or a remarkable total of 114 kg of meat (less skin, bones, offal) per person per year. O'Connell notes:

> " … hunting success rates will seem high to anyone with any experience in that part of Central Australia. The 1974 field session coincided with La Niña conditions … which among other things meant a significant peak in rainfall – a total of more than 40 inches for that rainfall year, four times the long term annual average. … The high rainfall provoked a real peak in red kangaroo numbers … [and probably was] responsible for the high encounter rate for bustards. In short, given my interest in foraging, it was a good – if unusual – year to be in the field." (O'Connell p.c.)

In other words, this large yield may have been a bit above average even for a La Niña year.

Writing of the Alyawarra living at Warrabri Settlement in 1976-82, Bell (1993:76, 88) said that the Alyawarra camp on the east side of the settlement was as far as possible from the settlement core.

> "If one tried hard and always faced the east, it would be almost possible to collect sufficient data to write an ethnography of the "traditional" life of the Alyawarra."

For the Alyawarra, looking toward the east from Warrabri was akin to looking backward in time. It implied looking toward traditional Alyawarra territory, values and history, and to a great extent

was aimed at the camps at MacDonald Downs and Derry Downs where the Chalmers family served for half a century as a buffer between White Australians and the Alyawarra (Ford 1966).

I argue that the Alyawarra at MacDonald Downs experienced far less disruption than most other Aboriginal societies, and that we can learn a great deal about Alyawarra behavior in 1923 and earlier by paying careful attention to their behavior in 1971-72.

**Sexual segregation and division of labor**

Sexual segregation began at puberty and was never total, but was complicated enough to require explicit discussion here. Among the Alyawarra in 1971-72, there were important divisions of labor and space between men and women. At Murelgwa Gurlanda, women and children spent much of their time at an alugera or an anoardgan, but I almost never saw mature women at an ngundya. Likewise, men spent much of their time at an ngundya or their own anoardegans, but I almost never saw mature men at alugeras or at anoardegans other than their own. When visitors arrived from other camps, visiting men confined their activities to the ngundya and visiting women confined theirs to the alugeras; anoardegans seemed to be off limits to visitors.

Children of both sexes lived and played at anoardegans and alugeras, and infrequently appeared at the ngundya; older uninitiated boys spent time at alugeras and sometimes went to the ngundya, and on a few occasions older girls took food to open spaces within several meters of the ngundya and gave it to their recently initiated brothers who came into the open spaces to fetch it.

In general, men used .22 rifles to hunt under dry conditions; older boys sometimes accompanied them but women and young children did not. Women used large dogs to hunt under wet conditions; men and children did not accompany them. Women and children were responsible for vegetable food gathering, but men did it sometimes when they were hunting. Everybody down to the smallest child who could carry a tiny bucket was responsible for carrying water from the bore to their residences. Men and women ordinarily did not fetch water from the bore at the same time, but they did collect rations from the ration shed at the same time.

While returning to the camp from a hunt, men often stopped in the bush to cook the kangaroos they had killed; otherwise, as soon as they arrived in the camp with uncooked kangaroos, they gave them to women who cooked them at their alugeras. Women cooked the foods that they collected. Both meat and vegetables were shared throughout one's own neighborhood, and generally throughout the camp when the quantity was sufficient, as it usually was.

The initiation of young men featured a great diversity of singing, dancing, painting, sculpting, teaching and other activities. Some activities were held in public and all participated; some were held at alugeras or ngundyas where children and members of the opposite sex could see and hear

what was happening but could not participate; some were held at restricted access locations that were entirely off limits to children and members of the opposite sex. In the latter case, the secrecy was explained in terms of safety, again invoking the expression "We take care of them." when exposure to activities was considered to be dangerous to people of the wrong sex or age.

On the other hand, sexual equality before the law was demonstrated when a group of women got tired of waiting for an initiation to begin. Under the leadership of one particularly forceful woman, they took the men to court for delaying it. The trial occurred at dusk with the raised voices of men and women carrying across the sand hills for everyone at Gurlanda to hear. The conflict was resolved peacefully and to everyone's great relief when, with considerable difficulty, the men convinced the women that the delay was necessary because some key participants had not arrived from Lake Nash Station, about 300 km away, and substitutes were not available.

Thus sexual segregation and division of labor were overlapping factors that had major implications for the carrying of infants and children. During daylight hours, infants and children were at anoardegans and alugeras, or foraging with women, but initiated males generally were absent from those locations. After dark, married men generally were at their residences with wives and children, but I could not see them. Initiated young men who were undergoing their 14 years of intensive training in the Dreamings had little contact with women and limited contact with children during their novitiate.

The alugeras, and activities such as foraging and water hauling sorties that originated at the alugeras, provided endless opportunities for contact between children and their older siblings, cousins, mothers, mothers' sisters and co-wives, grandmothers and visitors. Thus alugeras were nearly ideal settings in which allomothering could occur.

**Kinship**

Eliciting data from key informants concerning ways in which kinship systems are expected to work is fundamentally different from watching the same kinship systems in action on a daily basis across a population of 377 living people and deceased ancestors. Here I concentrate on kinship in action.

Kinship research on humans fell out of favor during the last decades of the 20$^{th}$ century, and detailed research on kinship among nonhuman primates and other animals is difficult to perform in natural settings. But attempting to make sense of infant and child carrying and allomothering among the Alyawarra would be virtually impossible without paying attention to data on descent, marriage and kinship – especially on genealogical relations broadly defined - from the perspective of women whose knowledge and practice of kinship has received less anthropological attention than it deserves. I have considered women's perspectives in earlier papers and deal with it in some

detail in the following paragraphs. I return to this topic below when I present data on carrying infants and children.

In Denham (2012a, 2013, 2014b), I dealt in considerable detail with descent, marriage, kinship and demography of the research population as a whole. Here I focus on issues especially pertinent to women and older girls who, as I show below, most often carried infants and children. I focus especially on aspects of kinship that may be unknowable in ethological field studies of feral nonhuman primates, and that sometimes have been disregarded as if they were irrelevant in laboratory studies of infant care among urban human populations. Some of the topics covered here contribute directly to relations between carriers and those whom they carried, while others define the context of that activity without being a part of it. Thus the relational data may bear on both proximate and ultimate causation of behavior by infants, children and their caregivers.

***Basic vocabulary.*** I abbreviate primary kin types (F=Father, M=Mother, B=Brother, Z=Sister, S=Son, D=Daughter, H=Husband, W=Wife) and combine them as needed (MB = Mother's Brother, FZ = Father's Sister). Ego is the speaker and Alter is the person to whom he refers or addresses. Throughout my discussion of the carrying of infants and children, I also use "ego" to identify a child who was carried and "alter" to identify a person who carried that child.

I shall be concerned broadly with terms used generally in kinship research: *consanguineal* kin (biological kin: F, M, B, Z, S, D, etc.); *affinal* kin (marital kin: "in-laws" in American parlance who are not demonstrably consanguineal kin); *lineal* kin (direct ancestors and descendants: FFF, FF, F, Ego, S, SS, SSS); *collateral* kin (branching relations – siblings, parent's siblings, cousins, etc.); *endogamy*/*exogamy* (marrying inside/outside of one's own group including society, Country, moiety, section, generation); *egocentric* (kinship terms used by a speaker in reference to individuals based on his or her own unique position in a society such as Father, Mother, Sister, etc); *sociocentric* (kinship terms used by ego in reference to 2, 4 or 8 categories of people based on their memberships in moieties, sections or subsections such as Kamara, Pityara, etc.). Also I shall introduce additional terms as needed that apply primarily or specifically to Australian Aboriginal descent, marriage and kinship.

The following is a highly simplified, perhaps simplistic, introduction to Alyawarra kinship.

***Dreamings.*** The Alyawarra defined their kin relations primarily in terms of a leaderless family of primordial ancestors who long ago emerged from the Earth, travelled extensively, established the topographic features (mountains, plains, river channels, water holes, trees) of Central Australia, and descended again into the Earth. The ancestors, called Dreamings in Alyawarra-English, remain affiliated with the features they originated by a very rich literary, musical and graphical

heritage. Each feature is situated on a small area of land that is referred to as a Dreaming site and a larger area referred to as a Country, each bearing the name of its titular ancestor. Ancestral Dreamings are somewhat akin to Platonic forms, as well as to the plants, animals and nonliving species such as emus, kangaroos and waterholes that manifest those forms. Each ancestral species is affiliated with its Dreaming site or Country and often bears the same name.

For example, Kangaroo Dreaming created a specific (hypothetical) waterhole near the Sandover River. That waterhole was thus a Kangaroo Dreaming site, the land surrounding it was known as Kangaroo Country, and the great mobs of ordinary kangaroos that lived nearby were physical manifestations of the ancestral Kangaroo Dreaming.

In addition, people from many human families lived in that Kangaroo Country, and some had hereditary affiliations with it. The patrilineal descent group to which they belonged was known as Kangaroo Country and its members Dreamed Kangaroo. These relationships gave them a huge range of responsibilities for maintaining Kangaroo Country and everything within it in exactly the state in which the ancestral Kangaroo Dreaming left it at the beginning of time. In particular they used kangaroos (lower case) as food, and in return they did everything necessary to insure that kangaroos remained healthy and abundant throughout Central Australia.

When the ancestral Dreamings descended back into the Earth, they left behind stone and wooden objects, as well as extensive oral history narratives in the idiom of the Dreamings, plus music, dance and diverse art forms that were to be stored, used, maintained and transmitted through time to insure the continuity of the universe. The objects generically were known as Dreamings - Kangaroo Dreamings if they were associated with my hypothetical waterhole - and they were carefully stored in secure places. The specified procedures for using, maintaining, transmitting and storing these Dreamings were to be followed precisely.

People referred to every node in this network as a Dreaming and to the network itself as the Dreamtime. The network briefly described here for the Alyawarra was interconnected through space and time to other language groups, eventually reaching societies throughout Aboriginal Australia, with regional or dialectal variations associated with the multitude of Dreaming Tracks by which the primordial Dreamings travelled.

The complex, multidimensional, mixed-content structure described above is the framework for an extraordinarily complex network of kinship networks all of which interlinked virtually everything in Aboriginal Australia. It was an all-encompassing, acephalous hierarchy reaching downward from the ancestors to the sites and Countries, to the humans and other beings like emus and kangaroos who lived in those Countries, and to the objects and traditions left behind when the

ancestors descended into the ground. Not only did the Alyawarra refer to all of these nodes as Dreamings, but also they referred to those Dreamings – and addressed them – with terms from several different kinds of kinship systems. (See Elkin 1964, Strehlow 1947, Stanner 1965, Spencer and Gillen 1899 and many others for supporting materials.)

***Genealogies.*** Biological genealogies for each of the Countries associated with the Dreamings constituted a different kind of kinship network. Each Country genealogy had one (sometimes two) male descent lines and one or two female descent lines that reached from the indefinite past to the indefinite future, and one pair of marriage or generation moieties that potentially reached horizontally or laterally to other Countries and Aboriginal societies. Furthermore, societal endogamy yielded dense genealogical relations based on both descent within and marriage between these Countries, and societal exogamy integrated the Countries and neighboring societies. These biological genealogies showed direct genealogical connections between all parent-child pairs and all husband-wife pairs, thereby providing a detailed scaffolding for egocentric and sociocentric kinship systems.

***Egocentric kinship.*** The Alyawarra superimposed a Dravidian-like egocentric kinship terminology on the genealogical structures embedded in the acephalous hierarchy described above. For example, the reference terms that Ego applied to members of the parental generation included the classificatory Alyawarra kinship term *agngiya* for a male sibling set comprised of F and FB, and *amaidya* for a female sibling set comprised of M and MZ. But Ego applied separate and distinct terms to FZ *aweniya* and MB *abmarliya*. Of particular importance for this paper were the lumping of M with MZ as *amaidya* / mother, the lumping of M's own children with MZ's children as unmarriageable parallel cousins, and the lumping of MB's and FZ's children as marriageable cross cousins. Read (2013) briefly and brilliantly summarizes the enormous literature on egocentric Dravidian kinship in Aboriginal Australia and nearby regions (see Figures 3.5 and 3.6 below for graphic representations).

***Universal kinship terminologies.*** In addition to lumping and splitting kin categories in a distinctive manner (Kroeber 1909), Alyawarra egocentric kinship terms also featured a distance scale of four explicit or implicit positions: biological (or "proper") kin within one's own descent line, plus classificatory (or "tribal") kin ranked as close (same language group and same Country but different descent line), distant (same language group but different Country) and remote (different language group). The universal range of applicability (Barnard 1978) implicit in the distance scale of biological and classificatory kin meant that all Aboriginal people were, at least in theory, related to each other, and that marriages both within and between societies were regulated by a common but locally diverse set of kin concepts.

***Moieties and sociocentric kinship.*** The intersection of descent-based patrimoieties and matrimoieties with marriage-based generation moieties yielded a network of 2, 4, 8 or 16 marriage classes or subclasses at the intersections, each class with an accompanying set of sociocentric kinship terms locally called "skin terms". One of the primary functions of the skin terms seems to have been to establish kinship linkages between societies whose egocentric terminologies were mutually unintelligible. Since basically the same or similar structures were used in many neighboring societies, these marriage classes redundantly interlinked societies throughout much of Aboriginal Australia (Dousset 2005).

In this paper, I spell Alyawarra section names in accordance with my own understanding of Alyawarra pronunciations: Kamara (K), Pityara (P), Burla (B), Ngwariya (N). See Koch (1997), Green (1992) and Denham (2012a) for standardized spellings.

The four sections constituted two exogamous patrilineal descent moieties (K-B, P-N), two exogamous matrilineal descent moieties (K-N, P-B) and two endogamous generation or marriage moieties (K-P, B-N). In a descent moiety (e.g. K-B), section membership alternated through the biological generations (G+n, … G+3, G+2, G+1, G.0, G-1, G-2, G-3, … G-n). Here I arbitrarily assigned male ego to G-1 in B section of KB patrimoiety. Thus the descending sequence of male kin for him was as follows: FFF (section K, generation G+3), FF (B, G+2), F (K, G+1), ego (B, G.0), S (K, G-1), SS (B, G-2) and so on. In this configuration, proper marriages joined members of even numbered generations (0, ±2, ±4, etc.) in sections B and N; likewise proper marriages joined members of odd numbered generations (±1, ±3, etc.) in sections K and P. Thus marriages were acceptable between ego and members of any of the alternating generations in his own generation moiety, but were unacceptable between ego and members of the opposite generation moiety. In their simplest forms, wrong marriages within one's own section could be classified as sibling incest, wrong marriages with members of sections in adjacent generations could be classified as parent-child incest, and wrong marriages with members of wife's section were less serious offences.

***Asymmetrical generation intervals.*** Spencer and Gillen (1899:558-560) and Guhr (1963) described the *tualcha mura* custom among the neighboring Aranda, and something analogous to it was present among the Alyawarra (Denham 2012a). According to the custom, young women upon beginning to menstruate were eligible to marry, but young men at puberty were eligible to begin their formal professional training which postponed their marriages by about 14 more years. In other words, below about 14 years of age, boys and girls lived together in single family residences with their parents, but at puberty they were sexually segregated. Young women moved for a brief period to an alugera with other unmarried women until they married shortly thereafter; young men

moved for a longer time to an ngundya with other unmarried men while they underwent about 14 years of training in the Dreamings before becoming eligible to marry.

Thus *tualcha mura*, which enabled young women to marry when they were about 14 years old but postponed the marriage of young men until they were about 28 years old, yielded a systematic and pervasive mean age difference of about 14 years between husbands and wives at the time of first marriage (see also: Rose 1960, A. Hamilton 1964, Binford 2001). The resulting sexually asymmetrical generation intervals ramified throughout Alyawarra society. One implication of the custom was a sharply unequal mean age difference of about 28 years between mothers and their children, and about 42 years between fathers and their children. In other words, a child's mother was, on average, only 2/3 as old as the child's father. Asymmetrical generation intervals are one of the factors that give rise to alternate (but not adjacent) generation marriages as described briefly above.

***Polygyny and gerontocracy.*** In Table3.1, polygyny was seen differently by men and women. My research population consisted of 47 men aged 28 and above, and 81 women aged 14 and above, who were physically and socially mature enough to be married; hence the sex ratio among all adults regardless of marital status was 1.72 women per man. Among the 47 men, 5 were not yet married, 40 were married, and 2 were widowed. Among the 81 women, 17 were not yet married, 53 were married, and 11 were widowed. Some men and women who were not yet married may have been waiting for suitable mates to become available, but I suggest additional plausible explanations below.

| Number of wives per married man | Men | | Women | | Number of co-wives per married woman |
|---|---|---|---|---|---|
| | n | col % | n | col % | |
| 1 | 28 | 70.0 | 28 | 52.8 | 0 |
| 2 | 11 | 27.5 | 22 | 41.5 | 1 |
| 3 | 1 | 2.5 | 3 | 5.7 | 2 |
| **Totals** | **40** | **100.0** | **53** | **100.0** | **Totals** |

**Table 3.1.** Polygyny as seen from the perspectives of men (left) and women (right).

The excess of adult women over adult men was due in part to: a) an irregular distribution of people in the sex-age pyramid, b) the fact that a husband's death in a polygynous society could yield multiple unmarried widows while a wife's death if she had co-wives did not leave an unmarried widower, c) the classification of women as marriageable when they were about 14 years younger than their brothers, and d) the importance attached to allomothering and possibly cooperative breeding by marriageable young women who continued to live in their childhood alugeras and

serve as caregivers to young children born by their own mothers, their elder sisters or other women. I return to this topic below.

The custom of *tualcha mura* contributed significantly to the prevalence of polygyny among the Alyawarra. Forty married men had a total of 53 wives, so the sex ratio of adults within monogamous and polygynous nuclear families was 1.33 married women per married man, which is a measure of polygyny from a man's perspective. The left half of Table 3.2 shows a man's perspective in more detail; it says that in 70% of the households, men had one wife each, in 27.5% they had two wives each, and in 2.5% (1 case) the man had three wives.

| Age | Men | | | | Women | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 wife | | 2-3 wives | | 0 Co-wives | | 1-2 Co-wives | |
| | n | % | n | % | N | % | n | % |
| Under 20 | 0 | 0.0 | 0 | 0.0 | 2 | 7.1 | 4 | 16.0 |
| 20-29 | 2 | 7.1 | 1 | 8.3 | 4 | 14.3 | 9 | 36.0 |
| 30-39 | 5 | 17.9 | 2 | 16.7 | 9 | 32.1 | 5 | 20.0 |
| 40-49 | 6 | 21.4 | 6 | 50.0 | 6 | 21.4 | 6 | 24.0 |
| 50-59 | 3 | 10.7 | 2 | 16.7 | 4 | 14.3 | 0 | 0.0 |
| 60-69 | 5 | 17.9 | 1 | 8.3 | 2 | 7.1 | 0 | 0.0 |
| Over 69 | 7 | 25.0 | 0 | 0.0 | 1 | 3.6 | 1 | 4.0 |
| **Sub-totals** | **28** | **100.0** | **12** | **100.0** | **28** | **99.9** | **25** | **100.0** |
| **Totals** | **40** | | | | **53** | | | |

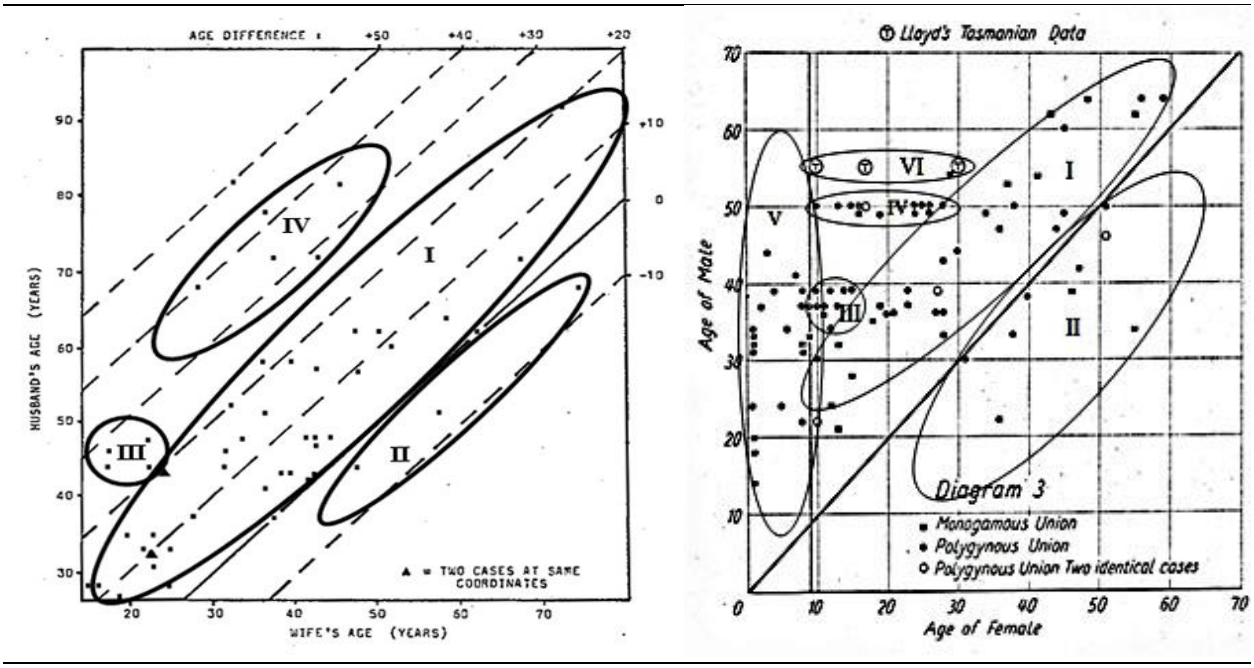
**Table 3.2.** Polygyny as seen – again – from the perspectives of men (left) and women (right).

The right half of Table 3.2 measures polygyny from a female perspective. Although the 28 monogamous men constituted 70% of all married men, the 28 monogamously married women accounted for only 52.8% of all married women; i.e., 47.2% of the married women had at least one co-wife each. Sororal polygyny was a common practice, meaning that co-wives were at least classificatory sisters but often were biological sisters as well. As I show below, the high frequency with which women had co-wives, many of whom were their biological sisters, was important for an analysis of infant and child carrying among the Alyawarra.

The left half of Table 3.2 shows that the 28 men who had only 1 wife each were distributed more or less evenly across the full range of ages, but that the men who had 2 or 3 wives were highly concentrated (50%) in the 40-49 year cohort. Thus the age distribution of men in polygynous marriages was incompatible with the archaic concept of gerontocracy. It was not a matter of competition and exploitation of young men and women by old men. Rather it was a matter of

moving averages in which virtually all younger men postponed marriage until they were at least 28 years old, virtually all of their older brothers married the younger women – thus "taking care of them" in the Dreaming sense as defined above – until their younger brothers were old enough to marry, and the younger men eventually assumed those duties relative to their own younger brothers and their potential wives. The matter did not reflect abuse of power by old men, but was based on scheduling, cooperation and adherence to ancestral Law.

On the right side of Table 3.2, among the 25 women who had co-wives, 24 (96%) were of childbearing age; i.e., 96% of the women of childbearing age had a co-resident proper or tribal sister with whom they shared the raising of their children. These data support an interpretation of




a b

In a) and b), solid diagonal lines with age difference = 0 denote husband (H) and wife (W) of same age (H=W).

**Figure 3.4a**
I. "Main sequence": H 1-20 years older than W
II. H 1 to 6 years younger than W
III. H 40-50 years old with W ≤ 20 years old
IV. H >65 years old with W 25-40 years old.
Diagram by Denham (2012a)

**Figure 3.4b.**
**I.** "Main sequence": H 1-20 years older than W
II. Mature H 1-20 years younger than W
III. Mature H with W 10-15 years old
IV. H ≥ 50 years old with W 10-30 years old
V. H 15-45 years old with W < 10 years old
VI. Not relevant here
Diagram: Rose (1960) enhanced by Denham (2012a)

**Figure 3.4. Husband-wife age differences, Alyawarra and Groote Eylandt.**

sororal polygyny among the Alyawarra as a cooperative social arrangement that primarily benefited childbearing women, many of whom would have remained unmarried during much of their childbearing years had polygyny not been available to them. This form of polygyny is quite different from non-sororal or wealth-increasing polygyny (White 1988) in which old men exercise power or accumulate wealth under the rubric of gerontocracy as may have been the case in some societies in coastal northern Australia that practiced non-sororal polygyny. I fully agree with White that both sororal and non-sororal forms "require more consideration of the way polygyny operates from the female point of view", and follow White's lead in this regard.

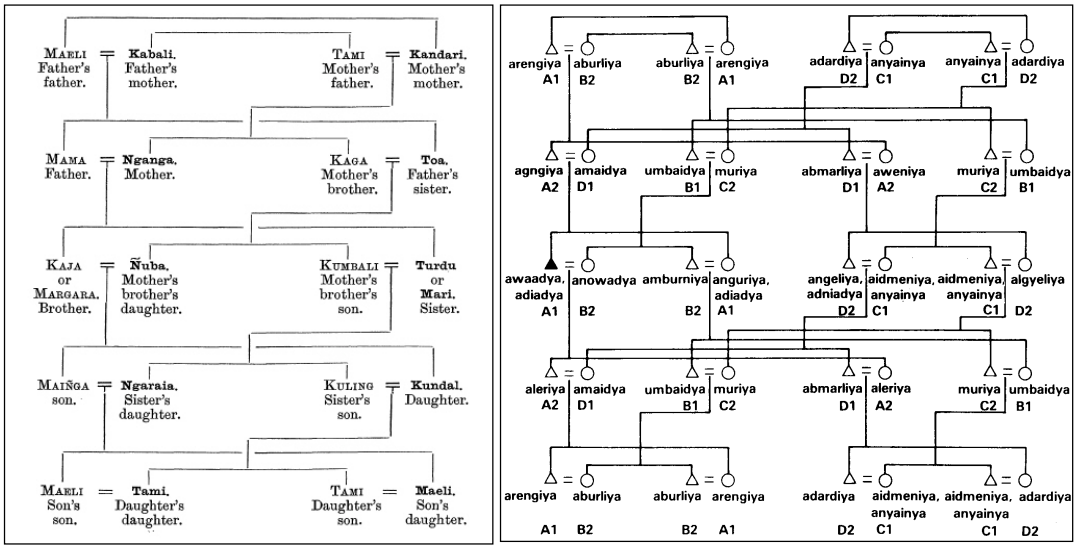
Figure 3.4 shows the age distribution of husbands and their wives among a) the Alyawarra in 1971 and b) the people of Groote Eylandt near the Arnhem Land coast in 1941 (Rose 1960) which I include here only for comparison. *Tualcha mura* or something equivalent to it is clearly demonstrated here. In both cases the predominant "main sequence" group number I was characterized by husbands (H) who were 1-20 years older than their wives (W). Secondary groups II-IV were similar in both cases. Group V at Groote Eylandt reflected polygynous infant bestowal that was present on Australia's north coast but absent among the Alyawarra. Rose's data show that all pre-reproductive wives (< 10 years old) in his research population had older co-wives. These conditions were ideally suited to allomothering (Hrdy 2009) to which I return below.

***Marriage with a twist.*** Figure 3.5a shows egocentric Kariera kinship terms superimposed on a traditionally closed, stratified structure used by Radcliffe-Brown (1931), Lévi-Strauss (1949) and many others. Figure 3.5b shows egocentric Alyawarra terms superimposed on a traditional Aranda-like structure. Figure 3.6a shows Alyawarra terms superimposed on a closed helical structure developed by Atkins (Denham, McDaniel and Atkins 1979), and 3.6b shows the same terms on an open asymmetrical kinship lattice. All of these diagrams are useful, but for different purposes (Denham 2012a). For my purposes in this paper, I prefer the open lattice in Figure 3.6b and return to it below in my discussion of classificatory kinship and infant carrying among the Alyawarra.

Figure 3.5 shows classical models of Kariera and Aranda kinship that are based on societal closure through societally endogamous marriages, horizontal stratification of endogamously closed generations, sibling exchange marriages in which each man (ego) marries a woman who is simultaneously his 1$^{st}$ and/or 2$^{nd}$ cross cousin (MBD, MMBDD, FZD, FFZDD) and in exchange his sisters marry his wife's brothers. These extraordinarily dense patterns of descent, marriage and kinship had the potential, if followed literally for a period of only ten generations, to generate inbreeding coefficients for the Kariera of F=.50781 and for the Aranda of F=.24512, both of which would be lethal. These are idealistic models that may or may not represent kinship terminologies,

but they cannot represent actual marriage practices. Similar models have been proposed for the Alyawarra, but the alternatives that appear in Figure 3.6 seem to be better.

Elsewhere I and others have described at length the closed double helix representation of Alyawarra kinship, marriage and descent that appears in Figure 3.6a (plus the insert in Figure 3.6b) and the open 2-dimensional lattice that appears in Figure 3.6b. Here I summarize earlier works. Please see these sources for details: Denham, McDaniel and Atkins 1979; Tjon Sie Fat 1983, 1990; Héran 1995; Denham and White 2005; Denham 2012a, 2013, 2014b.



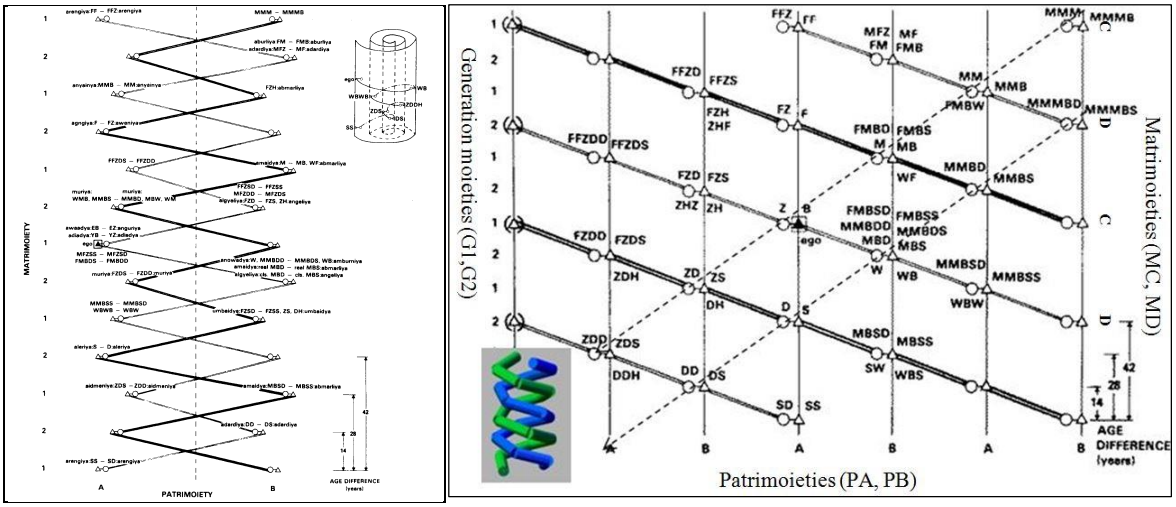

a b

**Figure 3.5. Classical representations of a) Kariera and b) Aranda/Alyawarra kinship.**
Inbreeding coefficients if these models were relevant to marriage practiced, which they are not: Kariera (F=.50781) and Aranda (F=.24512).

Sexually asymmetrical generation intervals among the Alyawarra imparted a "twist" to their marriage and kinship practices, and that twist manifested itself in different ways depending on whether the society was endogamously closed or exogamously open. Had Alyawarra society been fully endogamous, the most effective representation of their descent, marriage and kinship practices would have entailed using the closed 3-dimensional double helix that appears in the inset in Figure 3.6b. But in fact at least 22% of Alyawarra marriages were societally exogamous. Even though the absolute rate was low, it had a large impact due to the context in which it occurred; i.e., it connected the partially endogamous Alyawarra society with about 10 other societies through marriages, sharply reducing its isolation[5]. It eliminated the social and genetic boundedness depicted in the closed double helix representation, and replaced it with horizontal and lateral

[5] For discussions of the small-world problem, see Milgram 1967, Watts and Strogatz 1998, Strogatz 2001, Denham 2013.

openness to other societies. The inbreeding coefficient after 10 generations for the closed double helix model would be F=.230, a little less than that for the Aranda model (F=.245), but its openness to societal exogamy further reduced its inbreeding coefficient in practice.




a b

**Figure 3.6. a) Closed 3-D and b) open 2-D kinship lattice, each node representing a sibling set.**
Generation moieties, G1, G2: diagonal, upper left to lower right
Patrimoieties, PA, PB: vertical, top to bottom;
Matrimoieties: MC, MD: diagonal, upper right to lower left.
Inset: 3-dimensional closed double helix of hypothetical endogamous society.

Alyawarra kinship terms and their associated rules displayed in Figure 3.5b were superficially similar to those reported 70 years earlier for northern and central Aranda (Spencer and Gillen 1899, Guhr 1963). However, those and many other sources said that the Aranda merged their kinship terms with an explicit 8-subsection skin terminology, while the Alyawarra, like the Southern Aranda, merged approximately the same set of kinship terms with an explicit 4-section skin terminology, thereby generating a hybrid structure that included 4 implicit subsections. Lawrence (1937:338), citing the Southern Aranda as an example, used the term "anonym" to designate unnamed or implicit subsections embedded in 4-section systems. Due to this exceptional integration of 4 explicit sections, 4 implicit subsections, and an 8-subsection egocentric kinship terminology, Alyawarra kinship, like Walbri (Meggitt 1962, Bell 1993) and Murngin (Warner 1937, Barnes 1968) kinship, was more complex that the minimal Aranda 8-subsection system. The more complex structure in Figure 3.6b illustrates the descent, marriage and kinship context of Alyawarra infant and child care.

***Exogamy, endogamy and relinked marriages.*** Anthropologists such as Tindale (1953, 1976) and Birdsell (1953, 1976, 1993) argued that Aboriginal marriages rarely or never occurred outside of

one's own society or among consanguineal kin. More recently, Hill et al (2011) noted that, "Anthropologists used to think that humans grew their social networks by associating with people who were genetically related to them. Families moved in with grandparents and cousins, who themselves lived close to other relatives. But a recent study of 32 hunter-gatherer societies found that most individuals living together in large groups were not genetically related" (Hill et al 2011). And in another recent work, Dyble et al (2015) built on Hill et al (2011) by suggesting that the "social glue" that held traditional hunter-gatherer societies together was not kinship, but rather was egalitarian decision making by all adults concerning acceptable genealogical relations among members of residential groups such as small or large camps. My objective here is not to evaluate these arguments or generalizations, but rather it is to demonstrate that the Alyawarra with whom I worked in 1971-72 did not conform to the patterns described by Tindale, Birdsell, Hill and Dyble, and to suggest that the Alyawarra may have been representative of other Arandic speaking people and their neighbors near and far in Central Australia.

Among the Alyawarra, the numbers yielded a radically different picture from that presented by Tindale, Birdsell, Hill and Dyble. Alyawarra numbers included the following: societal exogamy with distant classificatory kin 22%, societal endogamy with closer classificatory kin 29%, and societal endogamy with consanguineal kin 49% (Denham 2012a, 2013, 2014b). In marriages between consanguineal kin, the sexually asymmetric generation intervals totally precluded systematic bilateral sibling exchange marriages among 1st and 2nd cross-cousins, reduced the expected frequency of marriages with patrilateral kin (FZD, FZDDD, etc.) from 50% to 26%, and enhanced the expected frequency of marriages with matrilateral kin (MBD, MMBDD, MBDDD, etc.) from 50% to 74%.

I suggest that *relinked* (White 1997) marriages, in which H and W were biologically related to each other before marriage, generally by short chains and often by multiple routes, were central to child care and many other features of Alyawarra society. Further, I speculate that relinked and other endogamous marriages with a significant number and diversity of consanguineal kin among the Alyawarra served to increase inbreeding coefficients, while societal exogamy served to reduce gene-level inbreeding, thereby offsetting an inbreeding decline in fitness. In other words, I suggest that an entirely unplanned consequence of exogamous marriages with distant classificatory kin and endogamous marriages with close kin was a shifting "balance" that simultaneously reduced the harmful effects and enhanced the beneficial effects of inbreeding, thereby providing a genetic basis for mutual aid and allomothering (Hamilton WD 1964, Wilson 1975a, Hrdy 2009). I return to this topic in detail below.

***Matrilineal descent moieties.*** In Figure 3.6b, the vertical patrimoiety lines give the diagram a "male perspective" on descent, marriage and kinship. It is the traditional perspective that has been

used most commonly by anthropologists for more than a century. Diagrams based on a male perspective are useful for some purposes, but certainly not for all purposes. Specifically, for the purposes of this paper on carrying infants and children, I call attention to the dashed lines that form a pair of matrimoieties (MC, MD) from upper right to lower left. By focusing on the matrimoieties, I emphasize a "female perspective" on Alyawarra kinship.

The matrimoieties represented a complex nesting of actual biological MM-M-Z-D-DD descent lines. For example, at the lowest level of nesting, Matrimoiety C (MC) included several matrilineal biological descent lines that were synchronized with each other and linked together by classificatory relations with regard to their positions in the skin terminology. At the next level of nesting, the descent lines in the alternating segments of MC combined to form one matridescent moiety, while alternating segments of MD combined to form the other matridescent moiety. At the highest level, all strands of these descent lines coalesced to form the pair of exogamous matrimoieties that intermarried with the similarly constructed pair of exogamous patrimoieties. Thus each of the matridescent lines MC and MD was a cognitive group that encompassed several biological descent lines.

The kinship relations and terms that appear in descent line MC were centered arbitrarily on a female Ego and her Z (and her B). That line reached upward to the right through biological M to MM to MMM, and downward to the left through biological D to DD to DDD. To ego's lower right was one segment of descent line MD that contains the classificatory matridescent line of her matrilateral 1st cross cousin MBD. To ego's upper left was the alternate segment of MD that contains the classificatory matridescent line of her patrilateral 1st cross cousin FZD. Farther to the upper left was another remote matriline descending from Ego's FFM.

It goes without saying that in most human societies most of the time we have more confidence in claims of biological parentage through women than through men. Thus, Alyawarra matrilines generally are more robust than patrilines even when parental testing was not available. In Figure 3.6b, matriline M3 probably encompassed ♀ego's real biological mtDNA descent line, while – to an unknowable extent – patriline P3 was less likely to encompass ♂ego's biological y-chromosome descent line. On the other hand, Aboriginal men in Central Australia generally placed more emphasis on patrilineal than on matrilineal descent and could recall members of their patrilines to a greater genealogical depth even though the patrilines rested on less secure biological foundations or simply on classificatory foundations. Women, however, placed more emphasis on their matrilines and capitalized on the fact that ♀ego's biological MMM was on average only 84 years older than ♀ego whereas ♂ego's biological FFF was on average 126 years older than ♂ego.

Egocentric kinship terminologies, being ubiquitous in human societies, have been of central importance for the anthropological study of kinship in individual societies and cross-culturally since the mid-19th century (Morgan 1871/1997). But if one's objective is to understand how matters such as the carrying of infants and children worked within an Australian Aboriginal society, the egocentric terms and their related rules barely cover the tip of the iceberg.

***Population stability*** (Denham 2013:25-27). My observational records pertain to child carrying in a society with a record of population stability as shown by the Net Reproductive Rate (NRR) in Table 3.3. NRR is the average number of daughters born to a woman (or group of women) who passes through her lifetime conforming to the age-specific fertility and mortality rates of a given year. This rate is similar to Gross Reproductive Rate but takes into account that some women die before completing their childbearing years. NRR =1.0 means that a generation of mothers has exactly enough daughters to replace itself in the population, so population size is stable; <1 means the population is contracting, >1 means that it is expanding.

| Cohort | # Mothers | # Daughters | NRR | Mo/Total Proportion |
|---|---|---|---|---|
| 1898-1907 | 22 | 25 | 1.136 | 22/47 = 0.468 |
| 1908-1917 | 35 | 35 | 1.000 | 35/70 = 0.500 |
| 1918-1927 | 29 | 31 | 1.068 | 29/60 = 0.483 |
| Total | 86 | 91 | 1.058 | 86/177 = 0.486 |

**Table 3.3. Net Reproduction Rate for Alyawarra women 1898-1927.**
10-year cohorts of women in the early 20th century with NRR very close to 1.0.
I thank Jean-Pierre Bocquet-Appel (p.c.) for preparing and interpreting this table.

Since I finished collecting my Alyawarra field data in 1972, I used that year as the ending date for computations of population stability. Members of the 10-year cohort of women whose 35-year reproductive careers (ages 15-50 years) ended in 1972 were born between 1918 and 1927. The preceding 10-year cohort spanned the period 1908-1917 and the oldest cohort for whom I collected sufficient data spanned the period 1898-1907. Within each of the three 10-year cohorts defined here, I computed the mean number of living daughters (NRR) those women had produced by the end of their reproductive careers. The mean NRR of 1.058 for this 30-year period is indicative of great stability. For the decades in question, the Alyawarra data depict an essentially stationary population, increasing ever so slightly.

It is not intuitively obvious how population stability might have been maintained among isolated language groups with mean populations of 500 people (Birdsell 1953, 1968) at a time when the total Aboriginal population was in serious decline as a result of colonial policies and practices. I have argued that open boundaries and exogamous marriages enabled the Alyawarra to maintain

their stable population, and have argued that the Alyawarra were not anomalous in this regard. Birdsell (1993), using data from a huge sample of Aboriginal societies from the 1930s to the 1950s, as well as Strehlow (1947) and Stanner (1965) all report comparable resilience for pre-contact (and early-contact) Aboriginal societies in general. Previously published historical data indicates that exogamy rates of 15% may have been average for Australian Aboriginal societies; my own data for the Alyawarra shows a 22% exogamy rate; and data recently published by Dousset (2013), McConvell (2013) and Sutton (2013) plus suggestions by Memmott (p.c.) concerning exogamy among the Northern Alyawarra for whom I have no data, all indicate that exogamy rates probably were significantly higher than indicated by previously published historical data.

Analyses of networks by Milgram (1967), Watts and Strogatz (1998), Denham (2013) and others indicate that the exogamy rates reported above were entirely compatible with the notion that Australian Aboriginal societies long formed a continent-wide web of social and genetic relations with partially endogamous societies or clusters linked by regionally exogamous marriages.

Finally, in anticipation of the main argument of this paper, I suggest that alloparenting as practiced by the Alyawarra greatly enhanced population stability under stressful conditions by enhancing nutritional levels and survival chances of mothers and their children, and by enabling women to shorten their birth intervals rather than extending them as was assumed in the past.

Thus there should be no surprise or puzzlement associated with population stability despite the colonial policies and procedures that many Australian Aboriginal societies faced.

***Summary.*** All things considered, I found *no evidence* among the Alyawarra to support oft repeated hypotheses a) that Aboriginal people engaged in gerontocracy or systematic preferential female infanticide, b) that their societies were socially and genetically closed, c) that marriage with consanguineal kin was prohibited, d) that their kinship and marriage practices entailed prescriptive rules or systematic bilateral sibling exchanges, or e) that residential groups resembled hordes. I do not suggest that none of these phenomena ever existed in Aboriginal Australia, but I do suggest that these residuals of theories from the late-19$^{th}$ and early-20$^{th}$ centuries are ethnocentric bugbears that have little or no place in current research, at least with the Alyawarra.

All of the kinship issues discussed here make a difference when I consider evolutionary implications of carrying infants and children, mother-infant interactions, child care in general and related issues.

## 4. Observational data

Watt (1956, Chapter 1) suggested that the spirit of *particularity* and *realism* characterizes the modern European novel. In this literary form, particular people perform particular actions at particular times and places, thereby manifesting a high degree of realism and immediacy otherwise missing from earlier prose literature. Certainly this paper is not a novel, but its emphasis on particularity and realism are intended to enhance its verisimilitude.

At the same time, however, I recorded the data manually under field conditions and transcribed them manually to punched cards after leaving Central Australia. Not surprisingly, they are imperfect. Specifically, the numbers that appear in this part of the paper sometimes imply greater precision than is warranted by the nature of the fieldwork. I have eliminated clearly unsalvageable records, made editorial corrections where possible, and retained records that contain some missing or incorrect values but are otherwise usable. There are places in the raw data and in the following pages where the numbers may fail to "add up" precisely due to imperfect data, rounding errors, relational anomalies such as half-siblings and multiple or alternate genealogical linkages, optional usages of terms, etc. If you find trivial errors, please disregard them; if you find significant errors, please contact me.

**Data samples**

All of my numbers concerning observational records pertain exclusively to observations that I made while sitting on top of my Land Rover during daylight hours: nothing at night, nothing close-up and nothing requiring special or privileged access.

***Time samples.*** I made my observational records during 191.4 observation hours or 11,485 observation minutes on 51 observation days, an average of about 3.75 hours per observation day. I hand-wrote the 41,813 computer-analyzable records on 80-column code sheets, an average of about 209 records per observation hour or 3.5 records per observation minute. In 1973 I transferred the observational data - plus all of the other numerical data described above - to punched cards, and have routinely transferred them to new media (magnetic tape, floppy diskette, CD, hard drive, my web site), accompanied by texts, images and audio as they have become available over the last forty years.

Table 4.1 shows the time distribution of my observation hours, scattered more-or-less evenly between dawn and dusk and including all 41,813 behavior records. Since I was unable to observe reliably before 06:00 and after 19:30, I abandoned efforts to do so. Optimally I would have recorded for about 800 minutes at each observation hour, but minor deviations from the red line in the Table were inevitable.

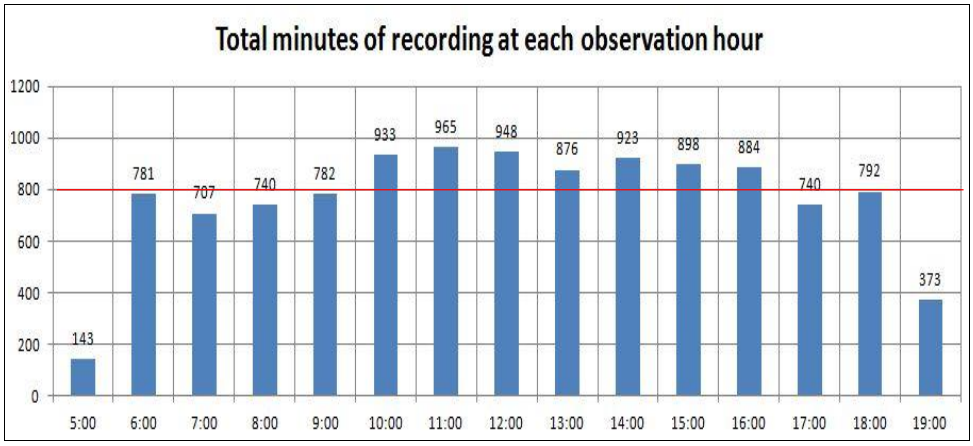



**Table 4.1. Distribution of total observation time by clock hours.**
Red line = optimal 800 minutes of observation per observation hour (n=191 hours).

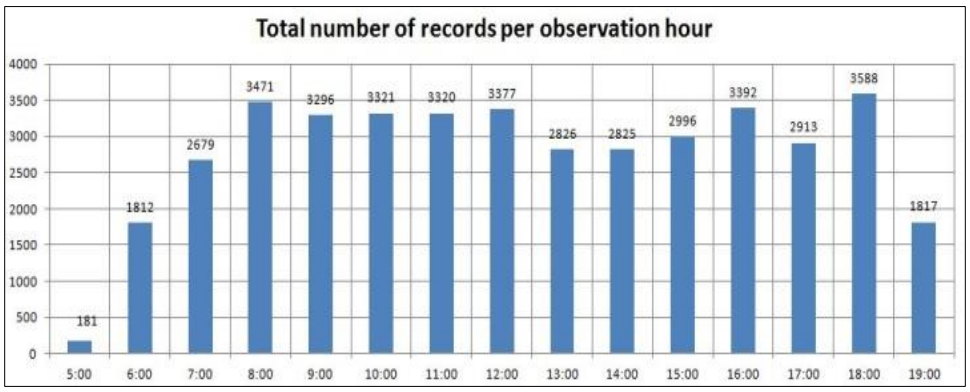



**Table 4.2. Distribution of all behavior records by clock hours (n=41,813 records).**

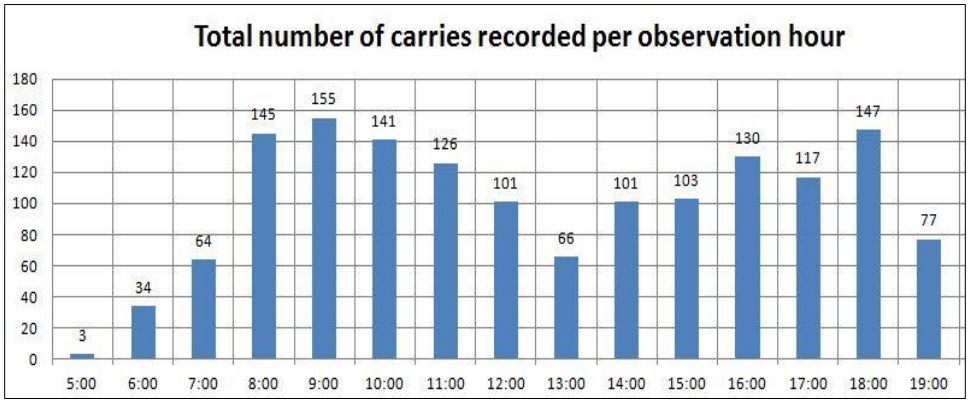



**Table 4.3. Distribution of records of carrying infants and children (n=1473 records)**

Table 4.2 shows the time distribution of all behavior records, while Table 4.3 shows the time distribution of all records of infant and child carrying, both of which show bimodal distributions. Major concentrations of carrying occurred in mid-morning and again late in the afternoon. The low points in Table 4.3, occurring in early morning and early-to-mid-afternoon, corresponded to the overall low activity rates in Table 4.2 as people were beginning the day and later as they rested during the hottest part of the day. The bimodal distribution of these carrying records was not radically different from the temporal distribution of all activities combined, but it stood in sharp contrast with the temporal distribution of many other specific tasks (Denham 1973). Together these time distributions provide a clear but imprecise impression of the "rhythm" of daily life at Gurlanda.

***Population samples.*** The structure of the resident population at Gurlanda when I made my behavior observations was rather different from that of the research population as a whole as depicted in the population pyramid in Table 2.1. Specifically the population pyramid shows a great many girls and boys of ages corresponding to empty or nearly empty cells in the Tables used here. Those children lived at locations other than Murelgwa Gurlanda, so I was unable to observe and record their behavior systematically.

The 1473 records introduced above constituted the maximal number of usable carrying records, but some of those records were problematic due to population mobility as well as observational, typographical and logical errors. Thus I cleaned and compressed the dataset by editing what I could salvage and deleting what I could not.

Alyawarra camp populations were almost always unstable, with adults, their infants and children, and their residences moving intermittently to and from other Aboriginal and White Australian locations throughout the region. These population fluctuations had important implications for the number, distribution and size of residences at Gurlanda. I discuss this matter in some detail here to clarify the numbers used below.

Table 4.4 shows that the population of Murelgwa Gurlanda on each of 16 regularly scheduled census days varied between 32 and 208 people. Due to their high mobility, almost all of the 264 living members of my research population resided at Gurlanda on one or several census days.

I made my behavior records on 51 selected observation days spanning 85 consecutive calendar days from 16 December 1971 through 8 March 1972 (i.e., Days 199-284 of my 294-day project). In Table 4.4, data for Censuses 12 through 16 show that the Gurlanda population on those census days, which corresponded to the period during which I made my observational records, fluctuated

modestly between 73 and 97 people – but not always the same people. Since my behavioral observations covered only 85 calendar days, I cannot comment on seasonal variations in infant and child carrying.

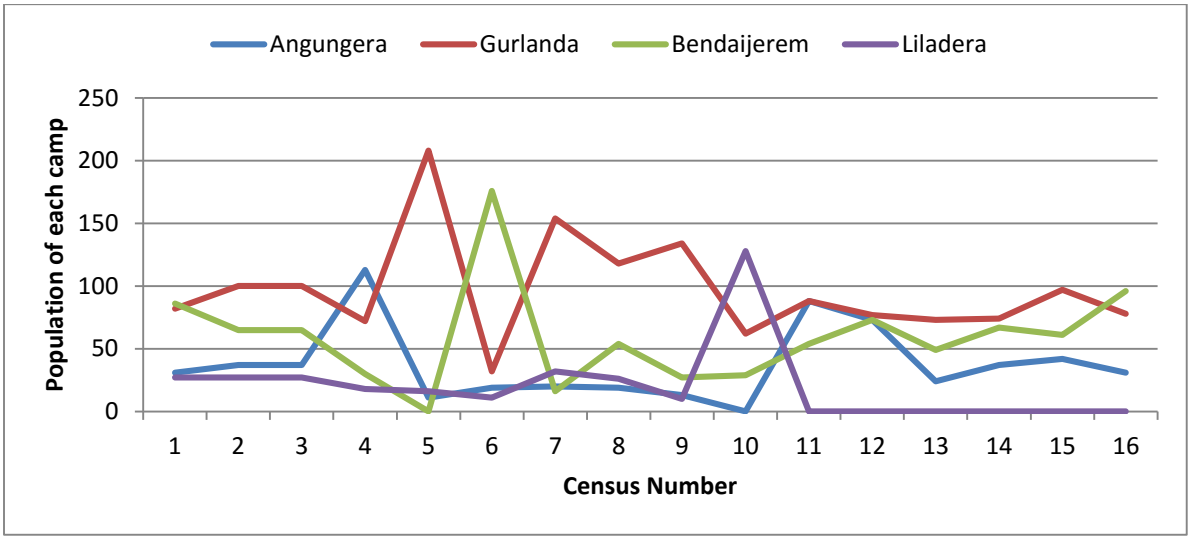



**Table 4.4. Variations in population sizes of 4 camps at 2-week intervals spanning 8.5 months.**

The camp plan in Figure 2.4 (in Part 2 above) represents the distribution of residences at Gurlanda on 27 December 1971, near the beginning of my behavioral observations. It embodies several enhancements that reflect normal changes in residential group compositions. I omitted three residences that were present on 27 December but were abandoned shortly thereafter, and I added 3 residences that moved into Gurlanda shortly after I completed the camp plan on 27 December and remained there while I was making the observational records. Also some residences were temporarily unoccupied and some were relocated during the observation period.

The ngundya (R11 in Figure 2.4) was especially problematic. It had two semi-permanent residents (♂008 and ♂014) both of whom were widowers. However, when initiated but unmarried young men (*ardwa andidja*) stayed at Gurlanda, they resided for shorter or longer periods at R11, thus causing its minimally-stable population to expand and contract – often quite dramatically - from a low of 2 to a high of 13, with perhaps 10 other transient young men sometimes staying there for only one or two nights before moving on.

The 1473 records whose time distribution appears above in Table 4.3 reflect all observed carrying of 29 resident and nonresident infants and children by 138 resident and nonresident carriers of both sexes and all ages. People whom I classified as *residents* lived more-or-less permanently at Gurlanda with allowances for occasional absences of variable duration. Those I classified as

*nonresidents* were visitors who stopped at Gurlanda once or a few times and remained there only a few days each. *Transients* were an unrecorded subgroup of nonresidents who arrived and departed so quickly that I could not census them. The boundary between resident and nonresident was imprecise - especially for *transient ardwa andidya* - but I have been as reasonable as possible in assigning people to categories and in using those assignments.

***Instantaneous scan samples.*** My observational sampling method was a modified version of instantaneous scan sampling, a method whose name I learned from the classic paper on behavior sampling that Jeanne Altmann (1974) published shortly after I completed my fieldwork. Using this systematic, broadly focused method, I recorded the onset of each transient event (e.g., throw stick at dog) and ongoing activity (e.g., carry infant to alugera) that I observed anywhere within Gurlanda. Thus, I captured frequencies of occurrence but did not deliberately capture durations or rates of occurrence per time unit. The method enabled me to record - in strict chronological order and at a modest resolution level - virtually all behaviors that occurred within my field of view at all publicly visible locations within Gurlanda. Given my decision to conduct exploratory observations of behavior throughout the entire camp as viewed from a fixed location, it was not feasible to use sampling methods that were narrowly focused on specific individuals, subgroups, behaviors or sequences, or that were oriented mainly toward hypothesis testing. Almost all sampling methods including this one have both strengths and weaknesses (J. Altmann 1974, Hawkes, et al. 1987), especially when used at widely differing resolution levels. Such are the tradeoffs of fieldwork.

In sum, among the 41,813 records in the instantaneous scan sample dataset, 1473 (3.52%) dealt with 138 people carrying 29 infants and children whose ages ranged from birth to eight years; i.e., I recorded children being carried by roughly 75% of the members of the camp's ever-shifting population. The "blooming, buzzing confusion" (James 1890:462) associated with Alyawarra population movements was real but tractable. In the following paragraphs I analyze the total set and various subsets of the records as needed.

## Child-rearing modes and carrying styles

***Modes.*** Ewer (1968) proposed four categories or modes of child-rearing practices among mammals including carrying, caching, following and nesting. This broad, general scheme may be useful for infant mammals as a whole, but I recommend the following refinements for the Alyawarra.

No single one of Ewer's modes accurately characterizes child rearing practices among the Alyawarra. Both *carrying* and *caching* occurred from birth through early childhood. The transition to *following* occurred as soon as infants began to walk and run. *Nesting* was irrelevant. Thus three

of Ewer's four basic modes applied to the Alyawarra. In this paper I focus exclusively on carrying in two senses of that ambiguous term.

Among the Alyawarra, a generally larger person ("alter", a carrier) could transport a generally smaller person ("ego", an infant or child) in two distinctly different ways both of which are subsumed here under the English term for carrying. In the common sense of the term, c*arrying* occurred when alter picked up or held ego as they moved from one place to another; in the other sense of the term, *clinging* occurred when ego clung to or rode on alter in a manner analogous to clinging among nonhuman primates. In this context, I suggest that carrying was performed by alter when transporting ego, and that clinging was performed by ego in a manner that facilitated being transported by alter. Although both have been subsumed under "carrying" by other writers, I generally distinguish between these two forms.

Thus the Alyawarra used an ever-shifting mixture of caching, carrying, clinging and following that depended upon personal preferences, availability of carriers, absolute and relative ages and sizes of alter and ego, health status, rainfall and temperature, location and terrain, other activities in progress, and so on. Continuous carrying in any form was not common among the Alyawarra as has been reported among the !Kung San (Barr et al 1991) and perhaps others.

***Styles.*** The Alyawarra used five distinctly different infant and child carrying styles. Since I did not anticipate writing this paper when I recorded the data, I did not take photographs of people carrying children.

*Coolamon carrying.* A coolamon, shown in Figure 4.1, is an elongated bowl that was used to carry food and almost everything else that required a large container for transport. Among its many uses, it served as a carrying device for infants. In these bowls, infants rested in a horizontal position and often were covered with one or several layers of cloth that kept them warm in cool weather and protected from insects and heat in warm weather. Ordinarily a coolamon rested on a mother's hip and was held there by her arm. Thus when ego was carried in a coolamon, there was no body contact between ego and alter.

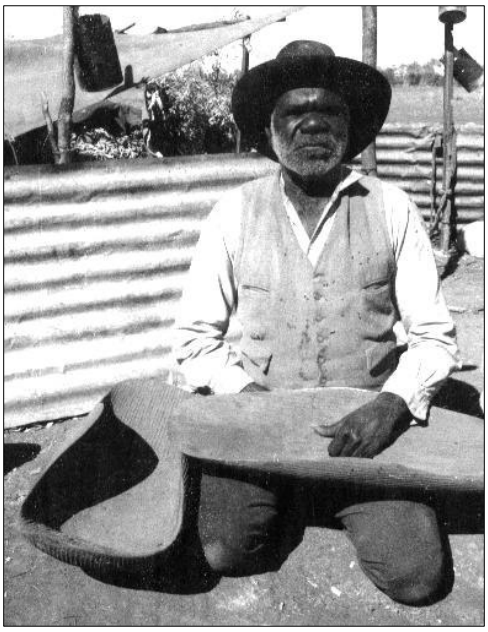


**Figure 4.1. A maker of coolamons.**

*Hand carrying.* Occasionally egos were carried briefly and for short distances by alters holding them upright with both hands, well away from alter's body. It is probable that carries in this style, more often than carries in other styles, ended when alter handed ego to another person, but I have not yet analyzed the data in a way that will allow me to support this point quantitatively. In this carry style, the only contact between ego and alter was through alter's hands.

The other three styles used by the Alyawarra included lateral carrying on alter's hip, and two forms of dorsal clinging, i.e., on the shoulders and on the back. All required that children be in upright positions, and there was a great deal of body contact between ego and alter since in each case ego sat on alter's body and sometimes clung to it as well.

*Hip carrying.* While riding on a carriers' hip, children were held in place by the carrier and optionally used their legs to hold onto the carrier's body. I classified it as carrying rather than clinging since the clinging component was optional. It is my impression that ego's hands ordinarily were free in this position. Given the recent theoretical importance that handedness in lateral carrying has assumed for students of human and nonhuman primate behavior, it is most unfortunate that I failed to record whether ego was carried on the left or right hip. Since handedness was not especially important in 1972, I simply did not think of it then.

*Shoulder clinging.* When riding atop alter's shoulders, ego had primary responsibility for remaining in position by holding on securely with his or her legs and maintaining a balance with or without placing her hands on alter's head.

*Back clinging.* When riding on alter's back, ego had to cling with hands and arms around alter's body or shoulders. Carriers often helped children stay in place by putting one or both hands behind their backs to form a passenger seat.

*Ventral-ventral carrying.* I did not see this style in use by the Alyawarra. In this style alter would hold ego close to alter's chest while the pair were in motion. In my usage, this was different from holding an infant in ventral-ventral contact to facilitate *nursing* by a lactating woman who sat in a more-or-less stationary position. Although nursing with the woman typically in a stationary sitting position was universal among the Alyawarra, *ventral-ventral carrying* from place to place as I define it here was conspicuously missing from the Alyawarra repertoire. I never saw it used by a carrier of either sex or any age. For this reason – as well as because of my failure to code for sidedness - questions associated with alter's handedness or the location of alter's heart cannot be addressed with these data (Lockard, Daley and Gunderson 1979).

After accumulating 373 behavior records concerning carrying, I realized that my codes did not discriminate among the diverse styles introduced above. At that point, I redefined behavior unit 210 (carry) to subsume 6 more-refined behavior units: 221 coolamon carrying, 222 hip carrying, 223 shoulder clinging, 224 back clinging, 225 hand carrying and the unused 226 ventral carrying style. But even then I failed to incorporate a further refinement that would have distinguished between carrying on the left side and on the right.

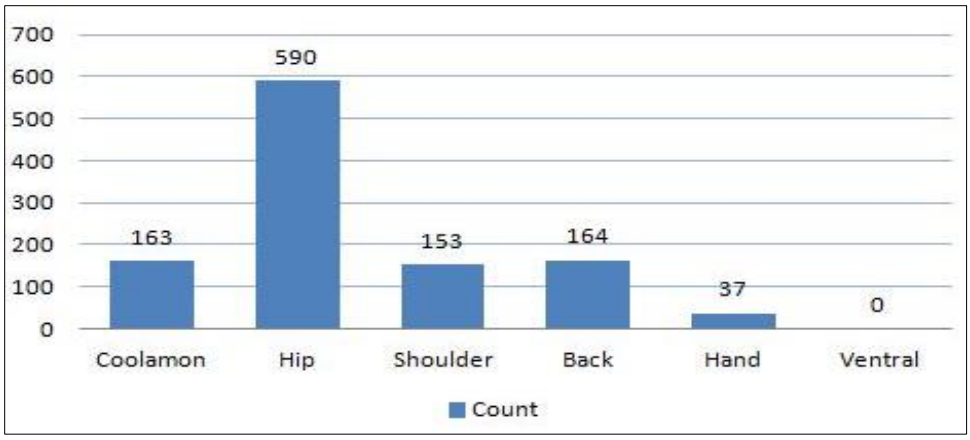



**Table 4.5. Number of carries of each style (n=1107 records).**

Of the 1473 carries that I recorded, 1100 of them had specified styles, 7 had safely inferable styles and 366 had unknown styles. I have used 1107 cases in the following analysis of carrying styles. Table 4.5 shows the number of observed carries of each style. Hip-carrying was by far the most common, accounting for 590/1107 cases (about 53%). Coolamon, shoulder and back carrying were used in nearly equal proportions (about 15% each) and accounted for almost all of the other carries; hand carrying was rare and the ventral style was not used.

Table 4.6 summarizes styles data ordered by increasing age of ego. With regard to carrying, the coolamon style was the only one used for the new infant. It was the dominant style for infants <2 years old, it diminished in importance between 2 and 3 years, and then disappeared. Hip carrying accounted for 30-50% of the carrying of all ages 1-8 years, while hand and ventral styles accounted for little of the carrying. With regard to clinging, the shoulder style was introduced during the second year of life and accounted for about 20% of all carries thereafter. The back style did not become important until the child's third year, but thereafter remained a bit more common than the shoulder style. Thus clinging, which appears at birth in the lives of many nonhuman primates, began later in the lives of these children, but was nonetheless used frequently by their carriers.

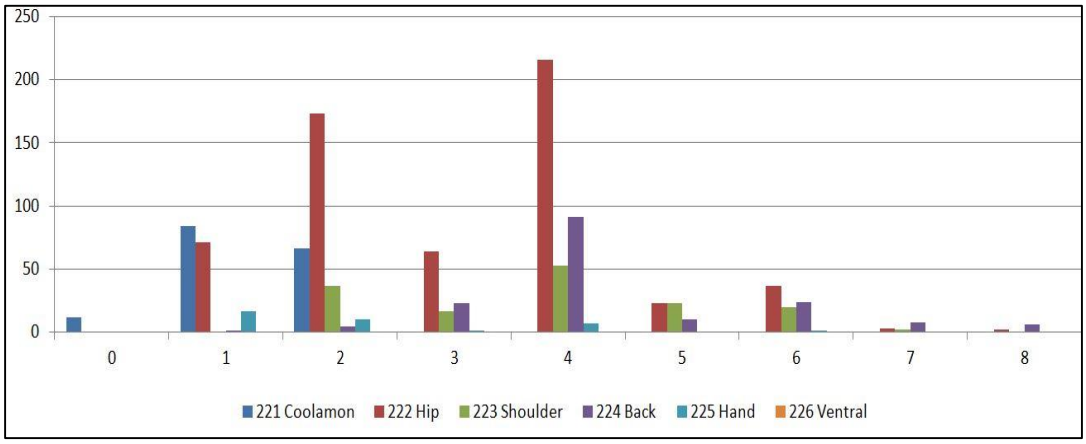



**Table 4.6. Number of carries of each style by age of ego (n=1107 records).**

Table 4.7 focuses on styles ordered by increasing age of carriers. Coolamon carrying was used at a nearly constant rate by carriers of ages 6 through 60 years, and at a reduced rate by the youngest and oldest cohorts of carriers. Hip carrying increased markedly with increasing age through the juvenile and adolescent years, reached a high peak among young adults, then declined regularly thereafter. Shoulder and back clinging were at their highest relative frequencies among juvenile and adolescent carriers, with frequencies of use for both styles decreasing regularly with increasing age of alter and ego.

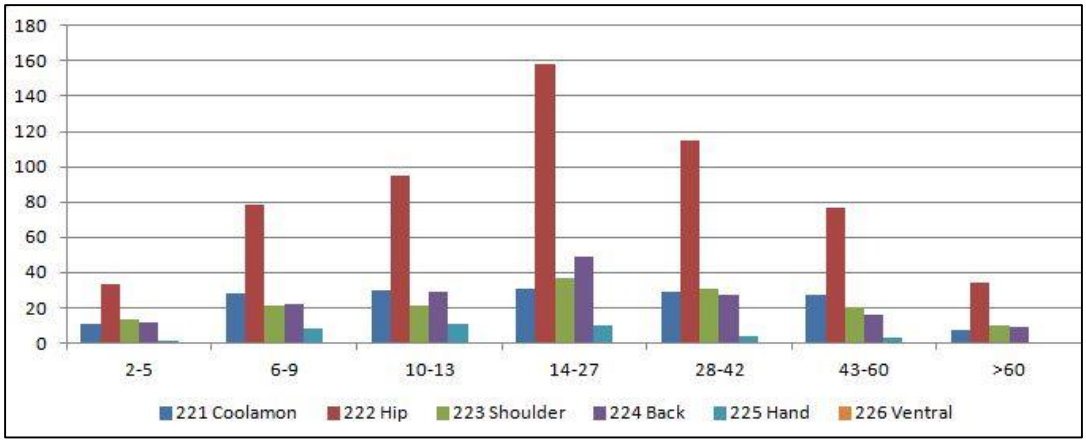



**Table 4.7. Number of carries of each style by age of alter (n=1107 records).**

## Sex-age relations

For detailed analysis of sex, age and genealogical relations, I recomputed the number of egos and alters in their respective sex-age categories. In Table 4.8, I omitted 5 nonresidents from the 29 resident and nonresident egos, yielding an adjusted total of 24 resident egos. In Table 4.9, I omitted records for nonresident and transient carriers and double-counted 15 of the 24 children who were carried by alters and also were carriers of other children, yielding an adjusted total of 103 carriers. This reduced dataset of 1439 records dealt with 103 resident alters carrying 24 resident egos.

| Ego's sex | Egos' ages in years | | | | | | | | | Row Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| ♀ | 1 | 1 | 2 | 1 | 3 | 0 | 4 | 0 | 0 | 12 |
| ♂ | 0 | 0 | 0 | 0 | 6 | 2 | 2 | 1 | 1 | 12 |
| **Column Total** | **1** | **1** | **2** | **1** | **9** | **2** | **6** | **1** | **1** | **24** |

**Table 4.8. Number of resident egos carried in each child's sex-age category**

| Alter's sex | Alters' ages in years | | | | | | | Row Total |
|---|---|---|---|---|---|---|---|---|
| | <6 | 6-9 | 10-13 | 14-27 | 28-41 | 42-55 | >55 | |
| ♀ | 2 | 7 | 9 | 15 | 13 | 8 | 7 | **61** |
| ♂ | 6 | 5 | 2 | 12 | 2 | 7 | 8 | **42** |
| **Column Total** | **8** | **12** | **11** | **27** | **15** | **15** | **15** | **103** |

**Table 4.9. Number of resident alters in each carrier's sex-age category.**

Table 4.10 shows that the 24 resident infants and children were optimally divided into 12 members of each sex but their age distributions were far from optimal for my purposes. The only infant younger than one year old (♀280) was born on Project Day 265, 20 February 1972, just 19 days before I completed my observational data collection, and I saw her being carried only 12 times. Only one girl was 1 or 3 years old and none were 5, 7 or 8 years old; no boys under 4 years old lived at Gurlanda, and ages 7 and 8 years were represented by only one boy each. I partially compensated for the stochastic distribution of boys and girls by collapsing the 1-year cohorts into a) the 0-year cohort for the infant girl ♀280 and b) four 2-year cohorts for all other children. Such missing data is a normal problem with residential group compositions among hunter-gatherer societies.

| **Female Infants and Children** | | | | | **Cohort age in years** | **Male Infants and Children** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Ego's ID#** | **Age** | **Carries per ego** | **Egos per cohort** | **Mean carries per ♀ cohort** | | **Mean carries per ♂ cohort** | **Egos per cohort** | **Carries per ego** | **Age** | **Ego's ID#** |
| 280 | 0 | 12 | 1 | 12 | **0** | - | | | | |
| 266 | 1 | 226 | 3 | 192 | **1-2** | - | | | | |
| 272 | 2 | 200 | | | | | | | | |
| 268 | 2 | 147 | | | | | | | | |
| 262 | 3 | 139 | 4 | 53 | **3-4** | 69 | 6 | 49 | 4 | 135 |
| 269 | 4 | 15 | | | | | | 14 | 4 | 125 |
| 263 | 4 | 45 | | | | | | 179 | 4 | 114 |
| 259 | 4 | 8 | | | | | | 49 | 4 | 106 |
| | | | | | | | | 24 | 4 | 104 |
| | | | | | | | | 93 | 4 | 101 |
| 279 | 6 | 2 | 4 | 9 | **5-6** | 47 | 4 | 5 | 5 | 137 |
| 252 | 6 | 7 | | | | | | 89 | 5 | 105 |
| 251 | 6 | 17 | | | | | | 81 | 6 | 115 |
| 250 | 6 | 6 | | | | | | 12 | 6 | 94 |
| | | | | - | **7-8** | 10 | 2 | 12 | 7 | 89 |
| | | | | | | | | 8 | 8 | 86 |
| **Total carries = 824** | | | **♀ = 12** | **Mean carries 824/12 = 69** | | **Mean carries 615/12 = 51** | **♂ = 12** | **Total carries = 615** | | |

**Table 4.10. Summary of 1439 carries of 24 egos by 103 alters.**

Despite the missing data, the numbers in this table suggest that the mean frequency of carrying and clinging of infants and children declined sharply for egos aged 1 through 8 years (192, 122, 56, 10) which is not remarkable. But the missing data preclude my using this approach to gain deeper insights into the transition from being carried to becoming independently mobile.

***Ubiquity of carrying.*** Table 4.11, below, summarizes sex and age relations between egos and alters. The upper panel pertains to female carriers and the lower to male carriers. The upper tabulates 1153 carries by 61 female alters of 12 girls and 12 boys in 0-4 and 5-8 year age groups; the lower tabulates 286 carries by 42 male alters of the same girls and boys. Cell entries show the number of carries recorded for egos of each sex-age group by alters of each sex-age group. The most obvious conclusion to be drawn from the Table is that a great many people of both sexes and all ages were active carriers of infants and children.

| **Female carriers** | | | | | | |
|---|---|---|---|---|---|---|
| **A** | | **B** | | **C** | | **D** |
| **♀ Carriers (n=61)** | | **♀ egos' age groups (years)** | | **♂ egos' age groups (years)** | | **Row totals** |
| **Age** | **# Carriers** | **0-4 (n=8)** | **5-8 (n=4)** | **0-4 (n=6)** | **5-8 (n=6)** | |
| **>55** | **7** | 32 | 2 | 14 | 6 | 54 |
| **42-55** | **8** | 75 | 2 | 35 | 18 | 130 |
| **28-41** | **13** | 113 | 7 | 61 | 37 | 218 |
| **14-27** | **15** | 166 | 7 | 105 | 44 | 322 |
| **10-13** | **9** | 144 | 5 | 53 | 42 | 244 |
| **6-9** | **7** | 83 | 1 | 46 | 21 | 151 |
| **<6** | **2** | 22 | 1 | 9 | 2 | 34 |
| **Column subsubtotals** | | 635 | 25 | 323 | 170 | |
| **Column subtotals** | | 660 = 57.2% | | 493 = 42.8 | | 1153 |
| **Male carriers** | | | | | | |
| **A** | | **B** | | **C** | | **D** |
| **♂ Carrier's (n=42)** | | **♀ egos' age groups (years)** | | **♂ egos' age groups (years)** | | **Row totals** |
| **Age** | **# Carriers** | **0-4 (n=8)** | **5-8 (n=4)** | **0-4 (n=6)** | **5-8 (n=6)** | |
| **>55** | **8** | 34 | 2 | 18 | 6 | 60 |
| **42-55** | **7** | 16 | 0 | 21 | 5 | 42 |
| **28-41** | **2** | 3 | 0 | 1 | 2 | 6 |
| **14-27** | **12** | 25 | 1 | 12 | 8 | 46 |
| **10-13** | **2** | 13 | 0 | 2 | 2 | 17 |
| **6-9** | **5** | 36 | 3 | 16 | 6 | 61 |
| **<6** | **6** | 28 | 3 | 16 | 7 | 54 |
| **Column subsubtotals** | | 155 | 9 | 86 | 36 | |
| **Column subtotals** | | 164 = 57.3% | | 122 = 42.7% | | 286 |
| | | | | | **Grand total** | 1439 |

**Table 4.11. Number of carries: ego's age group by alter's age group by sex.**

This Table shows that even before Alyawarra children completed the transition to independence in locomotion, they began to carry infants and other children. About 6% of carries were performed by children under 6 years old, 14.5% by children 6-9 years old, and 18% by those 10-13 years old. Of the 103 carriers, 31 were less than 14 years old. Thus people younger than 14 years - and too young to be parents themselves - served as 30% of all carriers and performed about 39% of all carries. I suspect that the high frequency of carrying by children reflects a division of labor whereby children who may be less effective as foragers instead carry younger children, while women who may be more effective as foragers have more freedom to do that essential work.

In Column B, 8 girls in the 0-4 year cohort received 635 carries by female carriers and 155 by male carriers for a total of 790 carries (about 100 carries each), while 4 girls in the 5-8 year cohort received only 34 carries (about 8 carries each). Thus girls aged 0-4 years received something like 12 times as many carries on average as girls aged 5-8 years. For the latter group, only 3 carries were recorded for females in the 5-8 year group by males older than 9 years; i.e., initiated males sometimes (21 times) carried 5-8 year old boys, but almost never (3 times) carried 5-8 year old girls.

Column C shows a radically different pattern for boys. Boys received somewhat fewer carries than girls at all ages, but carrying boys did not end abruptly by age 5 years. Whereas 4 girls of 5-8 years received 32 carries (8 carries each), 6 boys in that age group received 206 carries (34 carries each). By far the majority of those carries were provided by women who had stopped carrying girls in that age range.

In other words, girls aged 0-4 were carried very frequently but after that age they were carried hardly at all, whereas boys age 0-4 were carried less frequently than girls of the same age but continued to be carried at a modest frequency until 8 years old. I suggest that somewhere around 5 years of age, girls ceased to be carried and became increasingly frequent carriers of younger children, whereas boys began to carry younger children at the same age as the girls but the frequency ultimately stabilized at a much lower level, culminating in a nearly complete cessation in carrying 5-8 year old girls by adult men. In this context, patterns in child carrying seem to reveal early traces of sexual segregation in Central Australia.

Thus girls and boys began to carry other children by age 6 years, but the practice accelerated among girls while remaining more constant among boys. Overall 61 girls and women performed about 19 carries each for a total of 1153 carries, while 42 boys and men performed about 7 carries each for a total of 286 carries. While the carrying of infants and children was not restricted to females, they nonetheless performed about 80% of all carries. Furthermore the predominance of carrying by girls less than 14 years old (429 carries) vs. boys of the same age (132 carries) suggest

that, in the context of a lifelong sexual division of labor, the girls may have been "in training" for motherhood.

*Allocation of carries to female and male children.* Despite several important differences between girls and boys as egos and alters in Table 4.11, it is a remarkable coincidence that subtotals in Columns B and C in both upper and lower panels are virtually identical, with girls receiving 57.3% of all carries and boys receiving 42.7% of all carries by both female and male carriers.

*Missing male carriers.* Table 4.11, Column A, shows that the number of female carriers increased systematically to 14 in the 14-27 cohort, then decreased systematically thereafter; but the number of male carriers dropped to 2 in the 28-41 and 10-13 cohorts. The 28-41 cohort corresponded to young married men who worked elsewhere as stockmen and did not reside at Gurlanda, a camp that was much more "traditional" than some of the other camps; thus the absence of these men is not surprising. Boys aged 10-13 years were, generally speaking, too old to be sons of the 28-41 male cohort and their absence appears to be due to stochastic variations in births. Eleven of the 12 carriers among the 14-27 year old males were unmarried ardwa andidja who often visited their younger siblings at Gurlanda. I included them here despite their being in the gray space between residents and nonresidents; perhaps I should have omitted them.

## Genealogies[6]

Here I explore residential group compositions and genealogical relations together as they contributed to biological and sociological aspects of carrying infants and children among the Alyawarra. I prepared one of many possible sets of genealogical diagrams that depict relations among the people who lived at Murelgwa Gurlanda and each of its subcommunities when I made my behavioral observations. Using those diagrams, I tabulated consanguineal, affinal and other links between each ego and each alter, and analyzed the genealogical relations (kin type chains) between carriers (alter) and those they carried (ego). Subsequently I superimposed egocentric and sociocentric kinship terminologies onto the genealogies and kin type chains to examine ways in which Alyawarra cognitive categories related to carrying infants and children.

***Genealogical diagrams of Murelgwa Gurlanda.*** In a previous paper (Denham 2014b), I published a series of genealogical diagrams for subcommunities R21 through R24 as they appeared on 14 September 1971. Here I present significantly modified diagrams of the same subcommunities on 27 December 1971, shortly after I began recording observational data.

[6] See similar descriptions of social relations with references for Yuendumu (Keys 1999 especially Chapter 4, and Musharbash 2003 especially Chapter 5); Alekarenge (Bell 1993); MacDonald Downs (O'Connell 1979).

The September diagrams depicted adult men and women residents only. The new December diagrams in Figures 4.2 through 4.5 depict all residents including all adults, a small group of highly mobile young men, and a great many children, and it reflects all changes from mid-September to late-December in the residences that comprised the subcommunities.

Figure 2.4 (above), the plan of Murelgwa Gurlanda on 27 December, shows 1 single men's ngundya (R11), 4 single women's alugeras (R21 through R24) arranged irregularly in the vicinity of the ngundya, and 16 monogamous or polygynous nuclear family residences (R31 through R59 with some numbers unused) arranged in 4 small clusters or subcommunities adjacent to the alugeras. These 4 subcommunities show free variations on common themes but were by no means simple copies of each other.

Figures 4.2 through 4.5 (below) depict genealogical relations within and between members of all four subcommunities and residences. Red symbols denote the 24 egos for whom I recorded carrying data, showing the residences in which they lived. Single young men who were in the process of transitioning from their natal anoardegans to the ngundya are diagrammed as members of their natal residences but are labeled as residents of R11; likewise to enhance legibility, some single young women are diagrammed as members of their natal residences but are labeled as residents of the alugeras in which they resided.

The diagrams appear in the order: R24, R21, R22, R23. I used that order because it is the clearest order in which to illustrate genealogical relations between adjacent subcommunities.

Generation moieties in these diagrams are depicted horizontally rather than diagonally as shown in Figure 3.6b. Although the diagonal form would have been more accurate, the horizontal is far simpler to construct, perceive and explain. Please imagine that the alternating pink and green generation moieties slope upward from lower-right (youngest members of the youngest generation) to upper-left (oldest members of the oldest generation).

Table 4.12 holds the key to symbols and relations in Figures 4.2 through 4.5.

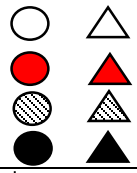
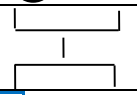
| | |
|---|---|
|  | Living members of the research population who resided at Gurlanda (♂ID#=1-149, ♀ID#=150-299)<br>Living members of the research population who resided at Gurlanda ***and*** were carried during my observations<br>Living members of the research population who *did not* reside at Gurlanda<br>Deceased ancestors (ID# >300) |
|  | Marital relationship<br>Ancestor / descendant relationship<br>Sibling relationship |
| R11<br>R21-R24<br>R31-R59 | Ngundya: single men's residence (all single men lived at the same ngundya)<br>Alugera: single women's residence (one in each subcommunity)<br>Anoardegan: single family residences based on monogamous or polygynous marriages<br>Enclosures delimiting residential groups are color coded : ♂=blue, ♀=red, ♀+♂=black |
| A A | Pair of continuation links between siblings, parents or offspring who live in two different subcommunities; arrows (← →) indicate "directions" to linked subcommunities. Optimally located at left and right margins of diagrams; rarely for legibility located within the body of the diagrams. |
| G+3 … G-3 | Generation numbers: G+3 older to G-3 younger |

**Table 4.12. KEY to symbols and relations in Figures 4.2 through 4.5**

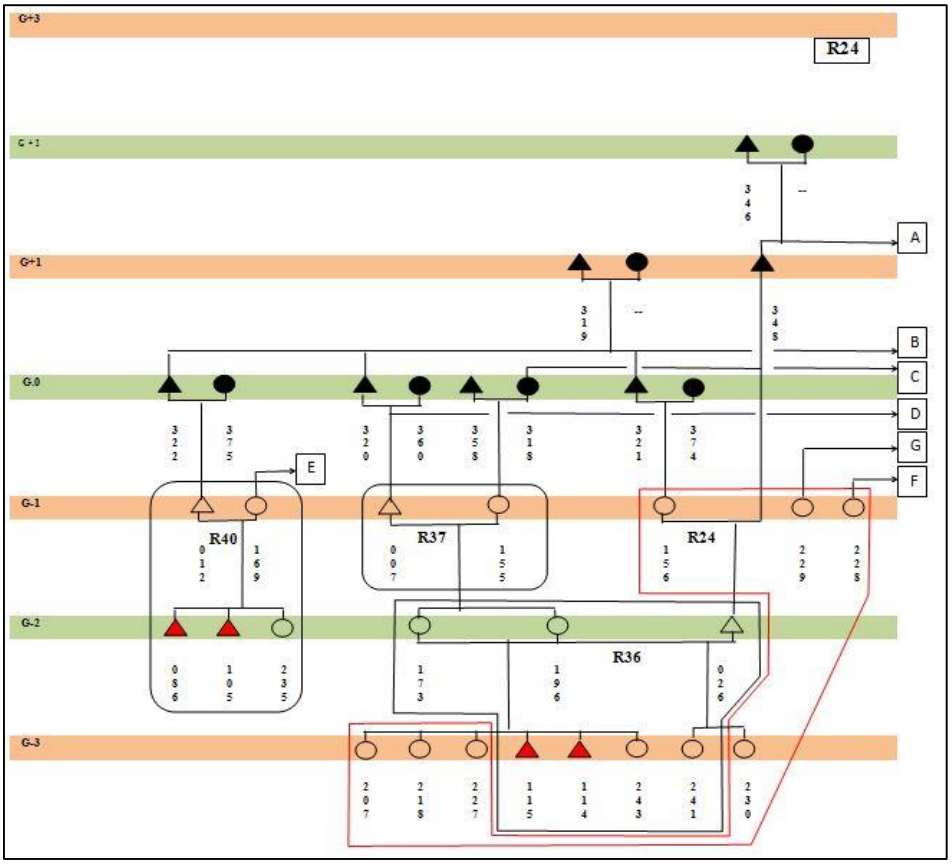



**Figure 4.2.** Genealogical diagram, Gurlanda alugera R24, 27 December 1971.

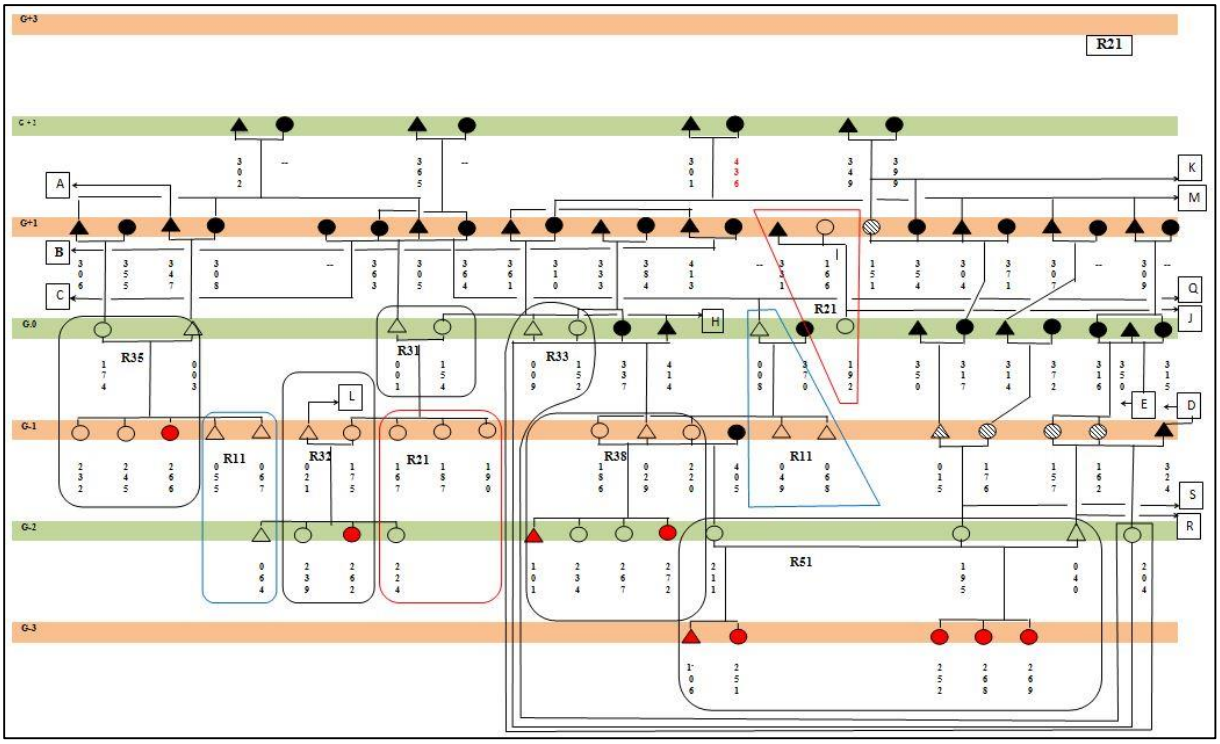



**Figure 4.3.** Genealogical diagram, Gurlanda alugera R21, 27 December 1971.

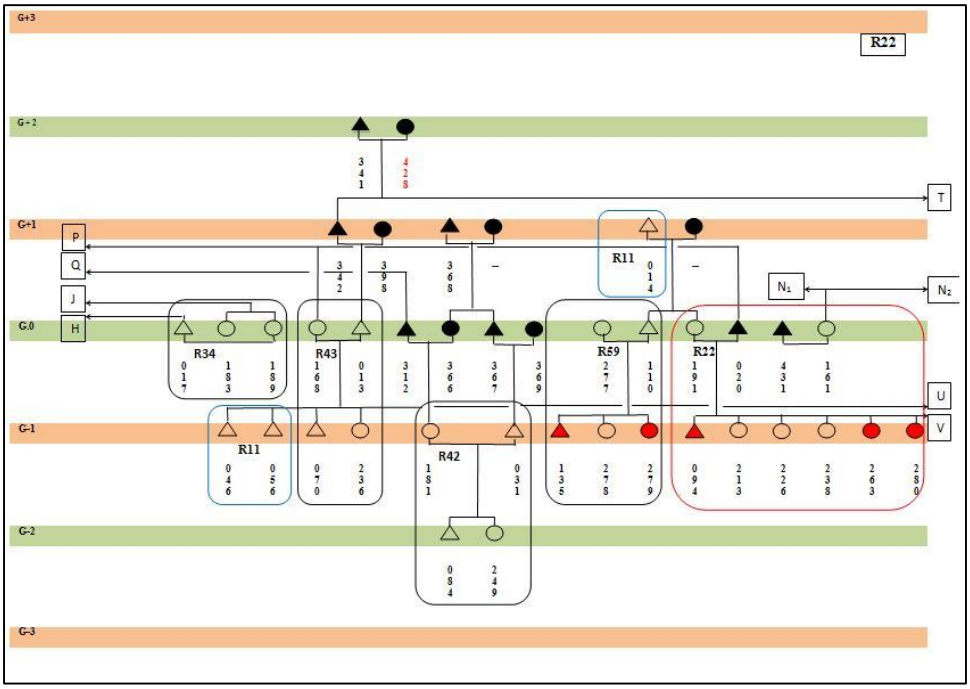



**Figure 4.4.** Genealogical diagram, Gurlanda alugera R22, 27 December 1971.

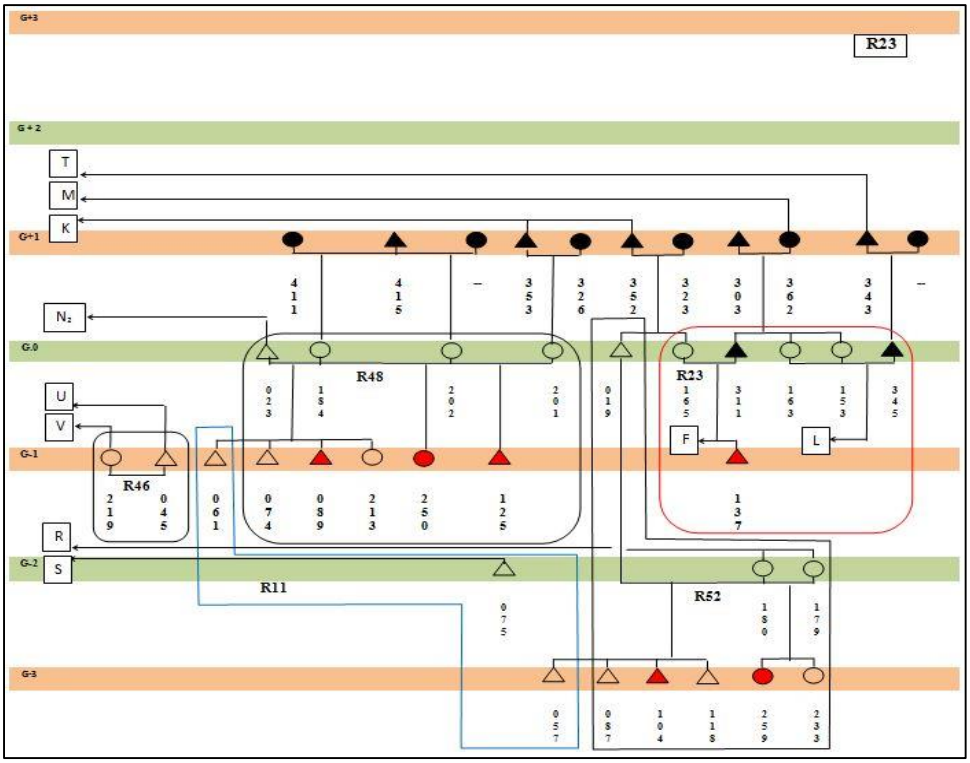



**Figure 4.5.** Genealogical diagram, Gurlanda alugera R23, 27 December 1971.

***Kin types and child carrying.*** After constructing the network of genealogies in Figures 4.2 through 4.5, I literally "connected the dots" (i.e., the series of nodes linking each red ego to each alter) within this set of diagrams and identified the kin type of each node, thereby constructing short chains such as M ("ego's alter is M"), longer chains such as MMBDD ("ego's alter is MMBDD", a 2nd cross cousin and preferred marriage partner of a male ego), or very long ones such as FFFMBDSSD (a remote cousin whose relationship to ego was detectable only by virtue of the rich and extensive genealogies). I connected the dots using two procedures, first by hand, then by using PUCK: Program for the Use and Computation of Kinship data (Hamberger et al 2009, 2014, 2014). The manual and automated procedures yielded matching results.

From the perspective of each ego, all members of the population fell into one of three categories: consanguineal kin, affinal kin or non-biological kin. For my purposes here, ego and alter were linked consanguineally if there were no affinal links between them (e.g., MMBDD), affinally if there was one and only one affinal link between them (*e.g.*, MBD***H***Z), and non-biologically if there were 2 or more affinal links between them (e.g., MBD***H***ZS***W***F). Since everybody was related to virtually everybody else if enough affinal links were admitted into a chain, it follows that any distinction between affinal and non-biological was arbitrary. For convenience, I set the distinction between 1 affinal link and >1 affinal links.

Kin types of carriers formed chains of 1 or 2 links among closest kin, as many as 11 links among remote consanguineal kin, and sometimes more than 15 among affinal kin. When ego and alter were linked by multiple chains – more than 20 alternative chains linked some ego-alter pairs – chains that were consanguineal, matrilineal or short received precedence over those that were affinal, patrilineal or long.

Table 4.14 summarizes kin type relations between the 24 infants and children and the consanguineal kin, affinal kin, and non-biological kin who carried them. The key to kin-type relationships in columns S through N of Table 4.14 appears in Table 4.13.

*Columns*. The three columns on the left side of Table 4.14 show ego's residence, identification number and age, while the eight columns on the right side summarize relationships between ego and alter, and are ordered from left to right by alter's increasing "distance" from ego. The categories of consanguineal kin that I use here are derived from – but are not identical with - the traditional distinction between lineal and collateral kin (e.g., Schwimmer 1995). I focus on ego's siblings, ego's lineal ancestors and their siblings (parents and their siblings, grandkin and their siblings), and ego's ancestors' siblings children (collaterals or "cousins", a large group of 1st, 2nd, 3rd and higher order cousins and cousins' lineal ancestors such as MBD, MMBD, MMBDD, FFFMBDSSD, etc.), and group them in ways that may be of interest with regard to infant and child carrying. The affinal kin column tallies chains that contained at least one affinal link (e.g. MZ*H*B "ego's alter is mother's sister's *husband's* brother"), and the non-biological kin column tallies carries in which kin type chains between ego and alter were absent.

| | |
|---|---|
| S | Ego's siblings in G.0: Z, B |
| P | Ego's parents in G+1: M, F |
| PS | Ego's parents' siblings in G+1: FB, FZ, MB, MZ |
| G | Ego's grandkin and their siblings in G+2 and above (e.g., MM, FF, FMB, MFZ) |
| C | Ego's parents' and grandparent's siblings' children: a complex category of "cousins" in multiple generations<br><br>Parallel cousins (same sex linkage: MZ's or FB's child, unmarriageable)<br>Cross cousins (opposite sex linkage: MB's or FZ's child, marriageable)<br><br>Close cousins (3 to 6 links from ego): 1st cousins, e.g. MBD; 2nd cousins, e.g., MMBDD<br>Distant cousins (7 or more links from ego): 3rd cousins, e.g., MMMBDDD; even more distant, e.g., FFFMBDSSD |
| A | Affinal kin: at least one affinal link breaks the biological "chain" between ego and alter (e.g., MZHB) |
| N | Non-kin: no detectable kin type links between ego and alter |
| | Cell entries are number of carries of each child by each kin type. |

**Table 4.13. KEY to alter's kin type relationships to ego in Table 4.14, columns 4 to 11.**

| | | | Alter's kin-type relationship to ego | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Kin type abbreviations → | | | S | P | PS | G | C | A | N | |
| Anoar-degan # | Child's ID # | Age in years | Siblings | Parents | Parents siblings | Grand kin | Cousins | Affinal kin | Non-bio kin | Total carries |
| **Alugera R21** | | | | | | | | | | |
| **R32** | 262 | 3 | 5 | 8 | 23 | 14 | 70 | 12 | 7 | 139 |
| **R38** | 272 | 2 | 19 | 5 | 73 | 16 | 58 | 29 | 0 | 200 |
| **R38** | 101 | 4 | 7 | 4 | 19 | 6 | 40 | 16 | 1 | 93 |
| **R51** | 268 | 2 | 1 | 6 | 1 | 0 | 14 | 122 | 1 | 145 |
| **R51** | 269 | 4 | 0 | 2 | 0 | 0 | 0 | 13 | 0 | 15 |
| **R51** | 252 | 6 | 1 | 1 | 0 | 0 | 2 | 3 | 0 | 7 |
| **R51** | 106 | 4 | 0 | 1 | 4 | 16 | 2 | 25 | 1 | 49 |
| **R51** | 251 | 6 | 0 | 0 | 0 | 1 | 6 | 9 | 1 | 17 |
| **Column subtotals** | | | 33 | 27 | 120 | 53 | 192 | 229 | 11 | 665 |
| **Alugera R22** | | | | | | | | | | |
| **R22** | 280 | 0 | 2 | 0 | 0 | 0 | 5 | 3 | 2 | 12 |
| **R22** | 263 | 4 | 2 | 0 | 0 | 0 | 19 | 21 | 3 | 45 |
| **R22** | 94 | 6 | 3 | 0 | 1 | 0 | 4 | 4 | 0 | 12 |
| **R59** | 135 | 4 | 2 | 1 | 0 | 1 | 1 | 42 | 2 | 49 |
| **R59** | 279 | 6 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 |
| **Column subtotals** | | | 9 | 1 | 1 | 1 | 29 | 72 | 7 | 120 |
| **Alugera R23** | | | | | | | | | | |
| **R23** | 137 | 5 | 0 | 0 | 0 | 2 | 3 | 0 | 0 | 5 |
| **R48** | 125 | 4 | 0 | 0 | 0 | 0 | 2 | 1 | 11 | 14 |
| **R48** | 250 | 6 | 0 | 0 | 0 | 0 | 2 | 2 | 2 | 6 |
| **R48** | 89 | 7 | 1 | 0 | 0 | 0 | 6 | 4 | 1 | 12 |
| **R52** | 259 | 4 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 8 |
| **R52** | 104 | 4 | 0 | 0 | 0 | 0 | 5 | 4 | 15 | 24 |
| **Column subtotals** | | | 1 | 0 | 0 | 2 | 18 | 13 | 35 | 69 |
| **Alugera R24** | | | | | | | | | | |
| **R35** | 266 | 1 | 13 | 10 | 0 | 0 | 140 | 25 | 38 | 226 |
| **R36** | 114 | 4 | 13 | 3 | 3 | 4 | 87 | 57 | 12 | 179 |
| **R36** | 115 | 6 | 15 | 1 | 2 | 0 | 39 | 22 | 2 | 81 |
| **R40** | 105 | 5 | 2 | 3 | 0 | 0 | 33 | 32 | 19 | 89 |
| **R40** | 86 | 8 | 0 | 0 | 0 | 0 | 3 | 3 | 2 | 8 |
| **Column subtotals** | | | 43 | 17 | 5 | 4 | 302 | 139 | 73 | 583 |
| | | | | | | | | | | |
| **Column totals** | | | **86** | **45** | **126** | **60** | **541** | **453** | **126** | **1439** |
| **Column percentages** | | | **5.97** | **3.13** | **8.76** | **4.17** | **37.6** | **31.48** | **8.76** | **99.87** |

**Table 4.14 Alter's genealogical kin type relationship to ego.**

*Rows*. Each of the 24 infants and children occupies a single row. Rows are grouped and ordered by: a) alugera membership, b) anoardegan membership, c) different mothers when applicable, and d) increasing age within sibling sets.

*Cells*. Cell entries show the number of recorded cases in which each ego was carried by alters of each kin type. As a summary, the Table presents a good overview of the behavior of consanguineal, affinal and non-biological kin relations but obscures details that I describe below.

Of the 1439 observed cases of infant and child carrying, consanguineal kin in columns S through C performed 858 (59.7%) of the carries, affinal kin (A) performed 453 (31.5%), and non-biological kin (N) performed 126 (8.8%).

Thirteen of the infants and children lived in subcommunities R21 and R24, and 11 lived in R22 and R23; thus the number of children in each of those pairs of subcommunities was about the same. However, the number of carries observed in the subcommunities was strikingly different. Infants and children living in R21 and R24 received 1248 carries (87%), but those living in R22 and R23 received only 189 carries (13%). Some of the difference may be due to better visibility of activities in the subcommunities that were nearer to my observation point, but genuine – although unknown - differences between the two pairs may have been more important.

***Consanguineal kin.*** Among consanguineal kin, I saw parents (column P) perform only 45 (3.13%) of the carries. M (41/1439 = 2.85%) and F (4/1439 = 0.28%) very rarely carried their own children even though these children lived in the anoardegan with their parents.

In dealing with 24 resident infants and children, I also dealt with only 15 resident mothers including 8 with 1 child each, 5 with 2 children each and 2 with 3 children each. Only 15/103 = 14.6% of the carriers were mothers of these 24 infants and children, which indicated that 88/103 = 85.4% of the carriers were *not* mothers of the infants and children whom they carried.

Reports to the effect that mothers were the sole or primary carriers of infants and children in hunter-gatherer societies did not apply to my research population in 1971-72. Given the enormous importance so often attributed to care and carrying by a child's own parents – especially by the mother – the very low frequency with which Alyawarra parents carried their own children requires a lot of explaining.

Since men in general who were old enough to be fathers did very little carrying of children (106/1439 = 7.4%), and fathers in particular rarely carried their own children (4/1439 = 0.28%), I have little occasion below to discuss adult males as child carriers. Their direct participation in the

care of children was delayed until boys were metaphorically "reborn" during their initiations at about 14 years of age. At that time virtually all older men, acting as alloparents in an extended sense, assumed nearly complete control of the long term training of initiates in their Dreamings.

Grandkin, like everyone else, were affected by the mean 14-year age difference between H and W. In the top and bottom panels of Table 4.11, the numbers of carries recorded for the two >55 cohorts – one for females, the other for males – were quite similar to each other, but in fact the members of those cohorts were quite different from each other except for the fact that all of them were older than 55 years. Because of the mean difference of 14 years between the ages of husbands and wives and the widespread prevalence of polygyny, men of age 55 could have had few sons' children but many daughters' and daughter's daughter's children. Thus the children available for these older men to carry tended to be the youngest members of their own children's generation, whereas the children available for older women to carry tended to be members of their daughters', granddaughters' and sometimes great-granddaughters' generations.

Thirteen members of the Gurlanda population were grandparents, but collectively these 10 women and 3 men performed only 60 carries (4.2%) in column G. The theoretical importance of MM and MMZ as caregivers (Hrdy 2009 Chapter 8; Kim, Coxworth and Hawkes 2012) was only minimally reflected in my observational data. These women's relationships with their own and their sisters' grandchildren were important, but the relationships simply did not appear in data on carrying infants and children as recorded here. Instead of carrying infants and children, these women generally remained at their alugeras serving as babysitters for the children of one or several of their daughters and granddaughters.[7] By providing this valuable service they would have contributed greatly to the maintenance of a resilient population under very difficult environmental conditions.

Ego's older siblings (column S) performed 86 (6%) of the carries, and ego's parents' siblings (column PS) performed 126 (8.8%), together accounting for 14.8% of observed carries. The early participation of older children in carrying their younger siblings provided a small but reliable source of assistance for a mother with several children. Likewise a young mother could rely on assistance from her own younger unmarried sisters who generally lived in her own alugera, or from a sister of approximately her own age who was her co-wife in a polygynous marriage. These two sets of close kin – especially ego's older sisters and ego's mother's co-wife and younger sisters – generally ranged in age from about 6 years to about 20 years, old enough to be helpful and young enough to be available.

Together ego's close kin including parents, grandkin, own siblings and parents' siblings, often residing in the same subcommunity and frequenting the same alugera, performed 317 (22.13%) of

[7] See Keys 1999 and Musharbash 2003 for discussions of the roles of grandmothers at Yuendumu.

the observed carries. In each category, the actual number of carriers was limited since ego had only 2 parents, a potentially larger but still small number of own siblings and parent's siblings, and a limited number of living grandkin.

The cousins or collaterals in column C encompassed a potentially very large number of kin for each ego and made the greatest contribution of all consanguineal kin with a total of 541 (37.6%) of the carries. Each ego had only 1 M, but ego's M may have had 6 or 7 B and Z, and each of those siblings may have had 8 or more living descendants who were potential carriers of ego. Thus for each linking person in column PS, ego could have a great many alters in column C.

Carrying by 1st and 2nd cousins accounted for 13% of the carries. In the event that mother's married sisters or father's married brothers lived in the same subcommunity with ego, it follows that their children, who were ego's parallel 1st cousins, also were among ego's most frequent playmates, and older cousins living in the subcommunity often carried ego just as ego's older siblings did. While the number of ego's older siblings generally was small, the number of co-resident older parallel 1st and 2nd cousins could be several times larger, thus accounting for some of the carrying by cousins. Children of MB and FZ were ego's cross cousins who generally lived in other subcommunities and were less likely to carry ego.

Carrying by distant and remote cousins accounted for 24% of the carries. In Tables 4.15 and 4.16, I explore this matter in some detail. Because the amount of data used here is large, I have selected only two small examples to illustrate how kin types were distributed. Both examples are derived from the same family who lived in subcommunity R24, anoardegan R36. The family consisted of one man (♂026), his two wives (♀173, ♀196) who were full Z, his two young S (♂114, ♂115) and two young D (♀241, ♀243) all of whom lived in the anoardegan with their parents, and his four older D (♀207, ♀218, ♀227, ♀230) who lived at alugera R24 with their widowed FM (♀156), and with their married MM (♀155) who lived part time at R37 with her H.

First I focus on the daughters, and examine the distribution of carries they performed to demonstrate their kin type relations to the egos they carried. Then I focus on the sons, and examine the distribution of the kin types of their carriers.

Table 4.15 shows the distribution of kin type relations across close, distant, affinal and non-kin egos. The six D of ♂026 carried 23 of the 24 egos at Gurlanda. The Table lists each ego's alugera and anoardegan, the kin type relation between each of the 24 egos and the group of sisters who carried them, and the total number of carries provided by these sisters.

| Ego | Alugera | Anoardegan | Ego's alters (♀207 and her siblings) were: | Number of carries |
|---|---|---|---|---|
| 114, 115 | R24 | R36 | Z | 24 |
| 266 | R24 | R35 | FFBSD | 33 |
| 086, 105 | R24 | R40 | FFFBDSD | 12 |
| 101, 272 | R21 | R38 | FFMBSDSD | 32 |
| 262 | R21 | R32 | MMMBSDD | 15 |
| 252, 268, 269 | R21 | R51 | Affinal | 6 |
| 106, 251 | R21 | R51 | Affinal | 6 |
| 094, 263, 280 | R22 | R22 | Affinal | 5 |
| 135, 279 | R22 | R59 | Affinal | 6 |
| 137 | R23 | R23 | Affinal | 0 |
| 089, 250 | R23 | R48 | Non-kin | 1 |
| 125 | R23 | R48 | Non-kin | 1 |
| 259, 104 | R23 | R52 | Non-kin | 4 |
| | | | **Total** | **145** |

**Table 4.15. Kin-type relations of ♂026's daughters to the 24 egos in column 1.**

Here I focus primarily on consanguineal kin and briefly defer consideration of affinal and non-biological kin. Of the 145 carries provided by these 6 alters, 24 were for their own biological siblings; 45 were for close parallel cousins living in their own subcommunity (R24); 47 were for increasingly distant cousins living in R21; 23 were for affinal kin living in R21 and R22; and 6 were for non-biological kin living in R23. Close relations among the families residing in R24 (anoardegans R35, R36 and R40) appear very clearly in the genealogy in Figure 4.2, even though the genealogical chains connecting those residences had 5 to 8 links as shown in Table 4.15. Furthermore, the systematic increase in social separation across Gurlanda from R24 to R23 is manifested with great clarity in the genealogy, the physical layout of the camp, and Table 4.15.

Table 4.16 shows a similar distribution of kin types among 71 carriers of ♂114 and ♂115, the two S of ♂026. The table has 6 columns, folded on the page for ease of use. The 3 columns at the left margin of the folded table list the kin types of carriers, the number of carriers of each kin type, and the number of carries performed by members of each kin type; the 3 columns at the right margin list codes[8] for classificatory egocentric kinship terms that ego's M applied to these carriers and that these carriers applied reciprocally to ego's M, and the frequency with which those pairs of terms appeared to be proper reciprocals. The table is segmented into 1 group of primary or close

[8] The key to the codes is available at Denham, McDaniel and Atkins 1979, Tables 1 and 2.

kin, 4 groups of cousins and collaterals descended from grandkin, and a small group of non-biological kin. Here I have included affines with ego's ancestors to whom the affines were married.

| Kin types of carriers | Number of carriers | Number of carries | Classificatory kinship terms | | |
|---|---|---|---|---|---|
| | | | Ego's M refers to carrier as: | Carrier refers to ego's M as: | Recip-rocals OK? |
| **CLOSE KIN** | | **41** | | | |
| M = 173 | 1 | 2 | self | - | **Y** |
| F = 026 | 1 | 2 | 18 | 18 | **Y** |
| Z = 207 | 6 | 26 | 17 | 8 | **Y** |
| B = 114 | 1 | 2 | - | - | - |
| MZ = 196 | 1 | 5 | 12 | 11 | **Y** |
| MF = 007 | 1 | 3 | 6 | 16 | **Y** |
| FM = 156 | 1 | 1 | 7 | 16 | **Y** |
| **MMMF** | | **48** | | | |
| MMMFS = 001 | 1 | 2 | 2 | 1 | **Alt link** |
| MMMFSWB = 009 | 1 | 1 | 4 | 4 | **Y** |
| MMMFSWBW = 152 | 1 | 3 | 2 | 3 | **Y** |
| MMMFSD = 175 | 3 | 18 | 7 | 16 | **Y** |
| MMMFSDD = 224 | 2 | 18 | 14 | 8 | **Alt Omaha** |
| MMMFSDS = 084 | 2 | 1 | 4 | - | - |
| MMMFSDH = 031 | 2 | 5 | 17 | 8 | **Y** |
| **MFFB** | | **15** | | | |
| MFFBS = 012 | 1 | 3 | 6 | 16 | **Y** |
| MFFBSW = 169 | 1 | 2 | 8 | 17 | **Y** |
| MFFBSS = 086 | 1 | 6 | 12 | 11 | **Y** |
| MFFBSD = 235 | 1 | 4 | 12 | 11 | **Y** |
| **MFFFB** | | **62** | | | |
| MFFFBSW = 152 | 2 | 8 | 2 | 3 | **Y** |
| MFFFBSS = 029 | 1 | 2 | 9 | 17 | **Y** |
| MFFFBWBD = 168 | 3 | 3 | 11 | 12 | **Y** |
| MFFFBWBDD = 165 | 1 | 2 | 14 | 8 | **Alt Omaha** |
| MFFFBWBDS = 070 | 2 | 2 | 9 | - | - |
| MFFFBWBDSS = 075 | 1 | 1 | 9 | - | - |
| MFFFBWBDDD = 179 | 2 | 4 | 11 | - | - |
| MFFFBWBDDDS = 104 | 1 | 1 | 17 | - | - |
| MFFFBWBSD = 250 | 5 | 5 | 16 | - | - |
| MFFFBWBSS = 061 | 3 | 6 | 11 | 7 | **N** |
| MFFFBWBSW = 184 | 2 | 4 | 14 | 14 | **Y** |
| MFFFBWBSWB = 110 | 1 | 1 | 4 | 4 | **Y** |
| MFFFBWBSWBW = 277 | 1 | 11 | - | - | - |
| MFFFBWBSWBD = 278 | 2 | 12 | - | - | - |
| **FFBS** | | **82** | | | |
| FFBS = 003 | 1 | 3 | 4 | 18 | **Alt link** |
| FFBSW = 174 | 1 | 13 | 11 | 12 | **Y** |
| FFBSD = 186 | 3 | 25 | 23 | 23 | **Y** |
| FFBSDD = 220 | 1 | 11 | 23 | 23 | **Y** |
| FFBSDDD = 234 | 4 | 26 | 14 | 14 | **Y** |
| FFBSS = 055 | 2 | 4 | 17 | - | - |
| **Non-kin** | | **14** | | | |
| 192 | 1 | 2 | 12 | 11 | **Y** |
| 195 | 1 | 5 | 8 | 14 | **Alt Omaha** |
| 252 | 1 | 4 | 16 | - | - |
| 269 | 1 | 3 | - | - | - |
| **Totals** | **71** | **261** | | **Yes = 24<br>Alternate = 5<br>No = 1<br>Don't know (-) = 12** | |

**Table 4.16. Distribution of kin types and classificatory kin term applications for carriers of ♂026's sons.** One mismatch is shown in red.

The members of each cluster of descendants from a grandparent or great-grandparent constituted one or more nuclear, polygynous or multi-generational extended families. The senior member of a group, and the link between ego's family and alter's families, appears in **bold** type accompanied

by the total number of carries by his descendants and their affines. When the identity of that link was established, the identities of the remote cousins were immediately knowable. Thus a key to understanding the genealogy in Figures 4.2 through 4.5 lay in identifying the small number of linking relatives among the grandkin. Had I selected another family for my examples, the grandparental kin types would have been different.

In this table, 3 grandparental links were through ego's M and 1 was through ego's F. The number of grandparental links and the descent lines in which they lay were unpredictable within a camp such as Gurlanda. The number ranged from 0 to 5 or 6 and the distribution of lines through ego's M and F was limited only by the diversity of grandkin. Each kin type listed under a grandparental link may have had multiple living representatives, but for illustrative purposes I have included the identification number of only one of them.

***Relinked marriages.*** Others have suggested somewhat ethnocentrically that kin type chains with many links such as those in Table 4.16 are too unwieldy to be of practical use in navigating through real human genealogies, but that simply was not true among the Alyawarra. From a European perspective, cousins such as MMMBDDD and FFFMBDSSD may seem to be so

| Entry # | Alugera | Anoardegan | Links and kin types from Ego (husband at left) to Alter (wife at right) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | R21 | R35 | 003 | 308 | 306 | 174 | | | | |
| | | | Ego | M | B | D | | | | |
| 2 | R23 | R46 | 045 | 168 | 020 | 219 | | | | |
| | | | Ego | M | B | D | | | | |
| 3 | R23 | R48 | 023 | 354 | 353 | 201 | | | | |
| | | | Ego | M | B | D | | | | |
| 4 | R21 | R33 | 009 | 310 | 309 | 316 | 162 | 204 | | |
| | | | Ego | M | B | D | D | D | | |
| 5a | R21 | R51 | 040 | 157 | 316 | 309 | 310 | 009 | 029 | 211 |
| | | | Ego | M | M | F | Z | S | S | D |
| 5b1 | R21 | R51 | 040 | 157 | 316 | 309 | 307 | 314 | 176 | 195 |
| | | | Ego | M | M | F | B | S | D | D |
| 5b2 | R21 | R51 | 040 | 157 | 316 | 309 | 304 | 317 | 015 | 195 |
| | | | Ego | M | M | F | B | D | S | D |
| 6 | R21 | - | 015 | 317 | 304 | 307 | 314 | 176 | | |
| | | | Ego | M | F | B | S | D | | |
| 7 | R24 | R36 | 026 | 155 | 321 | 320 | 007 | 173/196 | | |
| | | | Ego | M | F | B | S | D | | |
| 8 | R22 | R42 | 031 | 367 | 366 | 181 | | | | |
| | | | Ego | F | Z | D | | | | |

**Table 4.17. Husband-wife chains in relinked marriages.**

remote as to be unknowable, but in Aboriginal Australia - as among some European royalty - the construction and reconstruction of such chains resembled an art form in which almost everyone participated from childhood. In the MMMBDDD chain, the descent lines (MMM and DDD) were easy to recall since younger members of those lines were alive in the community; the challenge lay in identifying the long deceased horizontal (same generation) or lateral (alternate generation) link at or near the center of the chain.

In addition to being long, such chains often had multiple strands and were complexly interconnected. Table 4.17 shows 10 examples of marital relinking between close consanguineal kin at Gurlanda. Each entry includes linking individuals and kin types between ego (husbands) and alter (wives), with affiliated alugera and residence numbers corresponding to those in Figure 4.15 for ease of reference.

In *entries 1-3*, the husbands ♂003, ♂045 and ♂023, married their MBDs who were uncomplicated matrilateral 1st cross cousins. In *entry 4*, ♂009 married ♀204, his MBDDD, a matrilateral 2nd cross cousin who was two generations below his own generation. In *entry 5a-b1-b2*, ♂040 married two women who were linked to him through his MMF. ♀211 (5a) was his MMFZSSD, but ♀195 (5b) was more complexly related to him via two routes, one (5b1) through his MMFB ♂307 and his SD ♀176, the other (5b2) through his MMFB ♂304 and his DS ♂015. *Entry 6* reveals one source of the complexification of the marriage between ♂040 and ♀195, wherein ♂040's parents were themselves partners in a relinked marriage of the pattern MFBSD. In *entry 7*, ♂026 married two women, ♀173 and ♀196 who were full Z of each other, and the relational pattern was the same as in entry 6, viz., MFBSD.

In entries 1 through 7, H was related to W through his own M. I know of no "rule" that stipulates such a strong matrilateral bias, but the preference and the tradition of marrying MBD or other matrilineal consanguines was very strong. The bias was emphasized by *entry 8* and associated discussions. ♂031 married ♀181 who was his FZD. From ego's perspective, both FZD and MBD were 1st cross cousins as in entries 1-3, and in the kinship diagramming tradition of Radcliffe-Brown and Levi-Strauss (Figure 3.5), they were equally suitable as spouses of ♂031. But on the morning following my elicitation of genealogical data for ♂031, he came to my tent almost in tears to apologize profusely for my having discovered that his was an irregular marriage. When it was time for him to marry, no MBD was available to him, so he married a less-preferred FZD – not a wrong marriage, but an embarrassingly irregular one from which I learned a great deal. Figure 3.6b clarifies the problem: since ego's MBD was on average about 14 years younger than ego and his FZD was about 14 years older than ego, the preference was for ego to marry a younger woman.

However, when I collected these genealogical data, ♂031 was 42 years old and ♀181 was 39 years old, so no age-related problem resulted.

The Table lists the 10 relinked marriages whose members lived at Gurlanda when I conducted my behavioral observations, but it does not list all 31 of the relinked marriages among the 264 living members of my research population.

The simplified kin type chains in Table 4.16 are useful for didactic purposes, but they appear in greater complexity (and reality) in Figure 4.6 which displays the entanglement of entry 4, entries 5a-b-c, and entry 6 in the Table. These relinked marriages formed the largest and most complex cluster that I found at Gurlanda on 27 December 1971. In this example, 23 people were members of a single relinked cluster, all of them descended from ♂301 in generation G+2.

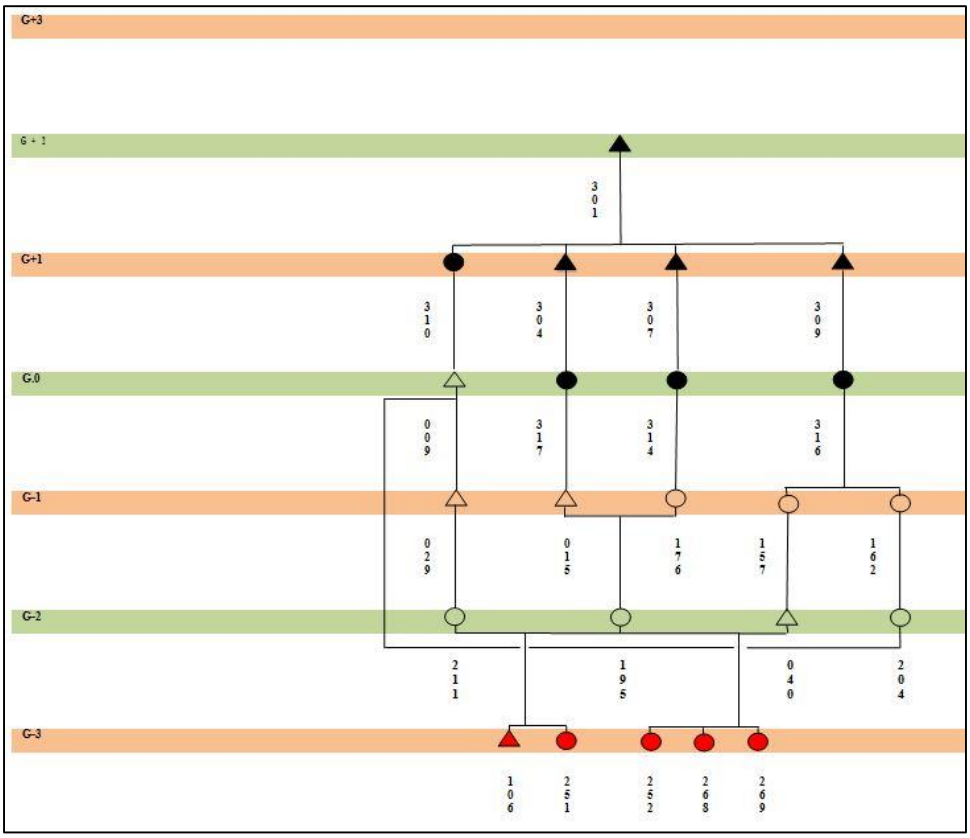



**Figure 4.6. A cluster of 5 relinked marriages populated by 23 people; extracted from Figure 4.3.**

Of the 24 infants and children who were carried during my observations at Gurlanda, 8 were children of relinked marriages, and the Gurlanda population included 10 more of their siblings who were too old to be carried. Thus a total of 18 children who appeared in the Gurlanda genealogy

were children of parents who were closely related to each other before marriage. Together these clusters contributed greatly to the overall density of genealogical relations among the population.

I do not suggest that girls and young women consciously and deliberately computed the sometimes remote and tangled genealogical relationships between themselves and the infants and children they carried. Sometimes their fathers working together did such computations when dealing with relations among the Dreamings, and those who carried infants probably could have done it if needed. But there was no need for them to do it unless an anthropologist asked peculiar questions. Rather, I speculate that carriers based their actions not on explicit instructions or repeated computations from the genealogies, but rather on a host of precedents set in the complementary kinship terminologies by their parents and the other kin among whom they lived every day in the all-encompassing world of the Dreamings. I suggest that the higher order patterns that appear in these Figures and Tables were behavioral evidence that the carriers had metaphorically learned the "direction and distance" from themselves to each of the children in the community and had acted accordingly.

**Kinship terminologies**

To this point I have focused on consanguineal relationships between carriers and the infants and children they carried. Therefore the ego-alter relations I have described above in terms of kin types are directly comparable with analogous relations among members of any other society and, indeed, any other species.

Now I briefly consider distinctly human kinship terminologies, some aspects of which are unique to Aboriginal Australia. I introduced egocentric and sociocentric kinship in Part 3; here I build on some ways in which they articulate with each other and with genealogies. Together they form verbal superstructures "above" the non-verbal biological foundations, thereby adding new dimensions to the eminently practical task of carrying infants and children.

In Part 3, I reviewed the complex mix of highly redundant verbal mnemonic devices that was readily available to assist the Alyawarra in classifying their proper and tribal kin. In addition to the genealogies themselves, plus classificatory sociocentric and egocentric kinship terminologies, they included systematic, formalized and all-inclusive arrays of Dreamings, Countries, moieties, sections and subsections, as well as myriads of oral traditions such as narratives, art, music and dance in which they were embedded. Mercifully, I shall not explore all of the possible combinations here.

Look again at Table 4.16. There I included both affines and non-biological kin along with consanguineal kin wherever they appeared in the Gurlanda genealogy. For example, in the family

headed by the grandkin MFFFB, the key linking relative was MFFFB*W* whose presence defined 12 kin types (MFFFB*W*BD through MFFFB*W*BSWBD) that provided 52 of the carries by members of the group headed by her husband. Absent that affine, her husband's family would have provided only 10 carries rather than 62. Although I collected poor data for the 4 non-biological kin in this table, I include them for they contributed 13 (13/145=8.96%) of the carries.

In Table 4.16, columns 4 and 5, the pairs of kinship term reciprocals came directly from the file of kinship term applications that I introduced briefly in Part 2 above. I showed 227 of my photo cards to 104 members of the Alyawarra population, and asked each informant (ego) to tell me his or her preferred kinship term for each photographed person (alter) in the complete collection of photo cards. The result was a file containing a total of 104 x 227 = 23,608 kinship term applications, including reciprocal pairs used by a carefully selected sample of 104 x 104 people (104 x 104 = 10,816 applications). Since it was physically impossible to obtain a complete set of reciprocals (227 x 227 = 51,529 terms), missing data is a problem in Table 4.16. Since it was impossible to elicit terms from infants and very young children, I used their mothers as proxies in constructing Table 4.16.

Table 4.16 shows 42 kin type chains whose members carried the sons of ♂026 and ♀173. In 24 ego-alter pairs there was perfect agreement (Y = yes) between reciprocal kinship terms, even when kin type chains held as many as 10 links. In 5 cases the pairs appeared to disagree because of exceptions built into the rules of the egocentric terminology. One alternate that occurred 3 times permitted an Omaha-like substitution of the term for M in place of the term for MBD to preclude ego's marriage with his MBD (McConvell 2010, McConvell and Alper 2002, Denham 2013:34-37). Another alternate occurred twice when ego and alter were related to each other by multiple routes and reckoned their relationship by two different routes when I elicited kinship term applications from them. Thus these mismatches were optional or alternate forms rather than disagreements. In 1 case the terms did not match (N = no). Perhaps ego misidentified alter or used an incorrect term; perhaps I misunderstood what ego said or made a typographical error. There is no way to fix it now. In 12 cases, I don't know (DK) reciprocal terms because of missing data. Note that among the non-biological kin, two pairs had missing values, but of the two complete pairs one was correct and the other included an acceptable alternate. Only one error in 30 pairs (60 terms) of complete data suggests that the Alyawarra used their reciprocal kinship terminologies with extraordinary precision even in an informal context such as carrying infants and children.

Also Table 4.18 demonstrates the egocentric classificatory kinship terminology in operation. Except for a few analytically redundant full siblings, it contains all members of Pityara section in G-2 who were affiliated with R21. For example, ego (♀224) referred to alter (♂064) as elder brother (eB), and alter referred to ego as younger sister (yZ); they were a pair of full siblings. The

eZ-yZ terms were used reciprocally between ♀224 and the pair of half-siblings ♀234 and ♀211 who were related to ♀224 as MMBSD. Even more remote was the kin type relationship MMMBDSD between ♀224 and ♀195, also classified reciprocally as eZ-yZ. Outside of R21, therefore omitted from Table 4.18, ♀224's MFBDD ♀249 was a member of R22, and a pair of very remote half-siblings ♀184 and ♀202 for whom I was unable to obtain adequate genealogical data were members of R23. The reciprocal kinship terms 10eB, 11eZ, 12ySibling that were used among these people classified all of them as siblings. Thus all of them were siblings of each other and all of those siblings lived in or were directly affiliated with R21 except for the far outliers at R22 and R23.

| ID# | | Ego | | | | | |
|---|---|---|---|---|---|---|---|
| | | **♂064** | **♀224** | **♀234** | **♀195** | **♀211** | **♀204** |
| **Alter** | **♂064** | 24 Self | 12 yZ | 12 yZ | 7 FZ | 11eZ | 14 x-c |
| | **♀224** | 10 eB | 24 Self | 12 yZ | 11 eZ | 11 eZ | 14 x-c |
| | **♀234** | 10 eB | 11 eZ | 24 Self | 11 eZ | 11 eZ | 14 x-c |
| | **♀195** | 10 eB | 12 yZ | 12 yZ | 24 Self | 12 yZ | 8 M |
| | **♀211** | 10 eB | 12 yZ | 12 yZ | 11 eZ | 24 Self | 22 HZ |
| | **♀204** | 9 MB | 14 x-c | 14 x-c | 14 x-c | 14 x-c | 24 Self |

**Table 4.18. A classificatory sibling set.** Members of Pityara section in generation G-2 who were affiliated with subcommunity R21. Some proper siblings omitted to reduce needless redundancy. Mismatches in red.

The only other Pityara woman in G2 residing in R24 was ♀204, the young wife in a cross-generational marriage with the much older ♂009: she was his MBDDD. By birth she could have been in G-0 with ♂009 as his MBD, but by marriage and because of the cumulative effect of the 14-year W<H age bias, I placed her in G-2. Her 5 parallel cousins at R24, all of about the same age, referred to her as their cross-cousin (x-c: 14 MBD/FZD) and she reciprocated with the same term, while her H and HB referred to her not as MBD but as W (18) in a terminological adjustment that occurred after the marriage rather than being a precondition for the marriage. Among the 36 terms in the Table, 32 reciprocals were in full agreement, 2 alternate terms were used optionally (9 MB, 22 HZ) and 2 mismatches appeared in red (2/36=5.5%).

People who married into the Alyawarra community from among the Aranda or other societies were not treated as marginal if their marriages complied with the stipulations of the section terminology. Indeed the sociocentric system took precedence over the egocentric. If the section relationship was right but the egocentric terms did not match properly, then the egocentric terms could be adjusted to produce conformity at the time of marriage, ordinarily through the reciprocal application of *anowadya* / spouse (18) in place of one or both of the egocentric terms; but if the section relationship was wrong, then the marriage was wrong and multiple defective relationships had to

be ignored or changed. With regard to carrying infants and children, people who married in from other societies were classified and treated the same as Alyawarra who were members of the same skin and kin categories. Thus affinal kin and non-biological kin were fully incorporated cognitively and verbally into all relational networks along with consanguineal kin as described above. They are important here since affines or "in-laws" performed 453 (31.5%) of all carries and non-biological kin performed 126 (8.8%) of them.

Classificatory sibling sets like the ones described here, based on genealogical relations, section relations and the logic of egocentric kinship terms, occurred repeatedly at all generation levels within each section, with minor variations due to special circumstances such as those of ♀204. These fundamental and ubiquitous cognitive patterns reinforced the behavior patterns described above.

I suggest that children learned behavioral and cognitive aspects of their genealogies and kinship systems from earliest childhood on a daily basis in the process of being carried almost everywhere by almost everybody. Since Alyawarra genealogies and kinship made sense only in the context of the Dreamings, it follows that children learned a great deal of public information about the Dreamings in the same way. Learning the secrets was reserved for initiated men and older women.

To Western eyes the genealogy in Figures 4.2 through 4.5, plus its associated kinship systems, plus the multitude of other formal structures and mnemonics associated with them, may be described best as an inscrutable maze. But ♀236, a brilliant 13 year old girl who grew up learning the relations and speaking the language of the Dreamings, required only a few seconds to navigate repeatedly through her own cognitive version of those Figures, relying largely on the section system to coach her elders with genealogical relations and kinship reference terms as needed. Her elders generally responded with a smile and a comment that might be translated roughly as: "Of course. Why didn't I think of that?"[9]

[9] Looking to the future, radically different approaches to understanding relational datasets analogous to Alyawarra genealogies and kinship terminologies are emerging in the field of artificial intelligence and machine learning. Kemp (2004) and many others (Kok and Domingos 2007, Miller et al 2009, Sutskever et al 2009, Jenatton et al 2012, Bordes et al 2014) have used Alyawarra reciprocal kinship term applications [egocentric categories] introduced above to develop computational methods for *discovering latent classes* [sociocentric section categories] in relational data. More recently, Galbrun and Kimmig (2012, 2014) have used Alyawarra genealogies in conjunction with reciprocal kinship term applications to develop a methodology for *relational redescription mining.* Its task is "finding … structurally different patterns [in the genealogies] that describe nearly the same set of object tuples [ordered lists of elements] in a relational dataset [the kinship terms]" … thus providing "a powerful tool to match different relational descriptions of the same concept" (Galbrun and Kimmig 2012:52). See Denham (2012b) for a brief bibliography of AI research using the Alyawarra data.

**Cooperative breeding**

Among the residents of Murelgwa Gurlanda were a number of women between the ages of menarche and menopause who had no children of their own but participated frequently in carrying the children of other women. Hrdy (2009:184) noted that women such as these might comprise groups that were partially analogous to sterile castes (Sherman, et al. 1995) especially if they provided both generalized care and specialized provisioning of children. That would be a clear example of significant biological altruism among our species, as appears to be documented in some other human societies.

However, Hrdy's suggestion is difficult to apply to childless women of childbearing age at Gurlanda. Consider two examples.

First, a man of about 60 years old was married to a pair of sisters in their 40s while his brother was married to two women (not siblings of his brother's wives or of each other) one in her 60s and the other in her 20s. None of those women had any known children, but all of them carried children of other women. The lack of children in these families may have been due to the sterility of the husbands or the less likely infertility of all four of their wives. However, since the wife in her 20s apparently had been married to her much older husband for less than 5 years, it would be inappropriate to conclude that she was infertile (Mascarenhas et al 2012).

Second, a group of older teenage sisters who might have married several years earlier remained unmarried and childless, yet were frequent carriers of a great many children. In response to my inquiries, I learned that they remained unmarried due to a lack of men who were eligible to marry them in terms of age, Country, section, and kinship terms. That explanation was at least superficially plausible but nonetheless was questionable. Given the obvious flexibility of marriage practices in the context of societal exogamy, classificatory kinship, significant W<H age differences, polygyny and reassignments of kinship terms following non-preferred marriages, it was unlikely that no satisfactory men were available.

In both of these examples, it is plausible that the childless status of the women reflected a deliberate decision to function as alloparents rather than as parents, but I obtained no direct evidence to support that interpretation (guess) and remain unwilling to impute unknown decision-making processes to them.

Among nonverbal species, we sometimes may assume that what we see (simple behavioral observations) is what we get, but such is not the case with humans where we can be confident that describing observable behavior is not equivalent to analyzing motives and purposes. On the one

hand, without understanding motives and purposes among the Alyawarra, I cannot impute cooperative breeding to them; on the other hand, interviewing the people with regard to motives and purposes in this regard would have yielded results that were not comparable with behavioral observations among nonverbal species.

Finally, Hrdy (2009:30) says that, "*Mothers and Others* is about the emergence of a particular mode of childrearing known as "cooperative breeding" [which] refers to any species with alloparental assistance in the care and provisioning of young." My observations, conducted by methods described above, yielded a huge body of data on alloparents who carried children, but no data at all on those who fed them. I conclude that the nature of my field research among the Alyawarra made it impossible for me to report on cooperative breeding as Hrdy defined it, and poses problems concerning cross-species comparisons of motives and purposes.

**Summary**

As Ewer (1968) noted, child-rearing practices among mammals fall into four modes, carrying, caching, following and nesting. Humans use several combinations of those modes, yielding a great diversity of orientations toward child-rearing in our societies (Spock 1946, Bowlby 1982, Sears and Sears 1992, etc.). The description in Part 4 provides an encounter with one of those orientations used in Central Australia. I am hopeful that the description says something useful about pre-modern hunter-gatherers; I am confident but not certain that it describes other Arandic-speaking societies and their neighbors in Central Australia before and after 1788; and I am certain that it says a great deal about Alyawarra society at MacDonald Downs, Northern Territory, Australia, in 1971-72. Again I emphasize particularity as I approach the explanatory task from multiple directions.

## 5. Interpretation

The highly detailed patterns detected in my data on kinship and child carrying among the Alyawarra form what I consider to be a coherent representation of a basic segment of life in a marvelously complex society living in a harsh and capricious habitat, with a long history and a simple technology.

Part 4 showed *WHAT* happened in time and space, then went beyond that superficial coverage to display *HOW* it happened *biologically* in terms of sex, age and genealogical relations, as well as *cognitively* in terms of Dreamings, Countries, moieties, sections, and kinship terminologies of two types, sociocentric and egocentric. Here in Part 5, I offer a third level of analysis in which I ask *WHY* the patterns described in Part 4 happened as they did, and approach those patterns from a perspective offered by evolutionary biology and cultural evolution (Mesoudi 2011).

To an extent that I only partially appreciated before I wrote this paper, the Alyawarra in 1971-72 defied the predictions by Spencer and Gillen (1899), Strehlow (1947), Rose (1960), Birdsell (1993) and many others who, for more than a century, bemoaned the impending demise of Australian Aboriginal societies. Often their predictions were justified, and many of the societies simply disappeared by the mid-20th century. But the Alyawarra persisted. The clear and coherent patterns detected in the relational, demographic and behavioral data presented above depict what appears to be a stable society coping with a particularly stressful century. It is implausible to explain away these patterns by invoking "detribalization" or anything like it.

Similarly I rule out the resurrection of 19th century misunderstandings of group marriage and ignorance of parentage among Aboriginal Australians. There was no evidence whatsoever that a great many Alyawarra carried a great many different children because they could not identify their own children. The people knew exactly who their parents, grandparents, children and grandchildren were to a depth of 5 or 6 generations, often through multiple lines of descent and marriage, and were able to reconstruct extraordinarily complex and densely interconnected genealogies with no inconsistencies.

Attempts to understand child carrying behavior from the perspective of Darwinian evolutionary theory rooted exclusively in traditional notions of competition and conflict, following Dawkins' (1976) selfish gene model, run aground almost immediately. There is no more direct evidence of competition here than there is of ignorance, just as there is no evidence of competition between Countries for land and resources in this harsh and unpredictable environment. Furthermore the intricate structures and contents of traditional law that are visible even to reasonably astute outside observers suggest few if any hidden elements of competition. Tristram Shandy's father, a systematic reasoner who "would move both heaven and earth, and twist and torture everything in nature, to support his hypothesis" (Watt 1957:7, quoting Sterne 1761/1996:39), would be hard pressed to make these data respond to a hypothesis based exclusively or primarily on competition in any ordinary sense of that term.

At least on the surface, the data reveal a great deal of intraspecific cooperation, altruism and harmony, not unlike what Russian biologists saw in Siberia in the mid-19th century, what Handlin (1951) reported for 19th century European peasants migrating to North America, what Hrdy has reported for humans and diverse species of nonhuman primates, what scientists have discovered in many phenomena ranging in size from microorganisms to the Gaia hypothesis. Instead of twisting the data to fit my hypothesis, I have attempted to help the data speak for themselves insofar as that is possible, and fit my hypotheses to them.

**Mutual Aid**

At the beginning of this paper, I paraphrased parts of the final paragraph in Hiatt's (1996) essay entitled "People without Politics". Since I omitted several important points in my paraphrase, I quote the entire paragraph now:

> "… few peoples can have placed higher value on altruism and mutual aid than the Aborigines of Australia. The genius of the Australian polity lay in its deployment of the goodwill inherent in kinship as a central principal of organization as a whole. Government in these circumstances was otiose; its absence, Kropotkin would say, was to be regarded not as a low level of political evolution but as a luminous peak. Natural resources and the land itself were equitably distributed among descent groups; appropriation of clan estates by force was unknown, and theft of private property a rarity. The business of everyday life was conducted informally through unspoken understandings, quiet consensus or noisy agreement. In general the authoritarian mode in public affairs was discountenanced. Vanity and self-importance were mocked. Nearly everywhere men insisted on speaking for themselves and, conversely, evinced a reluctance to speak on behalf of others. Such characteristics belong to the anarchist tradition. The tenacity of their roots, embedded deeply in the indigenous polity and temper, has helped to make assimilation of Aboriginal communities into the imported structures of British government a task of notorious difficulty" (Hiatt 1996:98-99).

My approach to understanding altruism and mutual aid rests on works by Hamilton WD (1964), Wilson (1975a) and Hrdy (2009). Following Gould's (1977:252) suggestion, I interpret Wilson's (1975b) assertion that "patterns of human social behavior are under genetic control" to mean that "the range of our potential behaviors is circumscribed by our biology", thereby emphasizing biological *potentiality* rather than biological *determinism*. With regard to humans, I do not deal with altruism in terms of either far outliers who engage in spectacular acts of heroism, or kamikaze pilots who commit suicide. Nor do I argue that shared care and provisioning in the rearing of children excludes competition in other contexts such as sexual jealousy among men or among women (Hrdy, in press 2016). Nor do I deny that people, individually and collectively, oftentimes display the anger and violence that dominate local and world news reports.

Rather, I refer broadly to mundane acts of daily living such as Hrdy (2009 Chapter 1) described with regard to ordinary airline passengers who harmoniously coexist, cooperate and frequently aid each other under conditions that would generate chaos and bloodshed among chimpanzees (*Pan troglodytes*). Specifically I refer to childrearing practices among the Alyawarra wherein a large percentage of those who *could* participate *did* participate, such that cooperation at no cost to

oneself and altruism at some small but non-trivial cost to oneself were maximized and systematic competition was minimized, thus averting Hardin's (1968) tragedy of the Commons.

Despite sporadic outbursts of anger, competition, and disharmony among the Alyawarra, the equally real world of harmony, cooperation and mutual aid that Hiatt and Hrdy described is the world in which I situate my biologically based understanding of childcare among those people. But understanding the foundations of this more benign aspect of the world in which we live has presented major theoretical challenges to evolutionary biologists and others for well over a century. I begin this short but tangled tale in the steppes of Siberia.

Nineteenth century Russian evolutionary theory in the tradition of Beketov, Korzhinskii, Mechnikov, Kessler[10] and Kropotkin (analyzed in Todes 1987, 1989 and Sapp 1994) was similar to but different from 19th century British (or Western) evolutionary theory in the tradition of Adam Smith (1776), Thomas Malthus (1798) and Charles Darwin (6th ed.1872). Both accepted a problematic Lamarckian position on the inheritance of acquired characters, and both agreed that natural selection occurred at the level of individuals rather than groups. But one of their significant differences was in the relative importance they attached to competition and cooperation, selfishness and altruism, among individuals of the same species.

Malthus (1798) asserted that "more individuals are produced than can possibly survive" (Darwin 1872:78), and advocated positive and preventive checks that would reduce population growth. Darwin, following Malthus's lead, introduced another check; viz., a struggle for survival based in part on intense intraspecific competition for resources that could *keep populations down* in the lush tropical environments that he saw in Bahia, and that Wallace saw in the Malay Archipelago. Among Western biologists, the struggle for survival was compatible with the cultural values embodied in the Chain of Being (Lovejoy 1936), the Idea of Progress (Nisbet 1980), the Industrial Revolution (Hobsbawm 1979) and the expansion of the British Empire (Ferguson 2002), and Western biologists generally accepted it with only limited opposition. According to Huxley (1888:165), "Life was a continual free fight, and beyond the limited and temporary relations of the family, the Hobbesian war of each against all was the normal state of existence."

Russian evolutionism, derived in part from Darwin's version, rejected Malthus's assertion that "more individuals are produced than can possibly survive" on grounds that it was "foreign to Russians' [ecological] experience and inimical to their [communal] values" (Todes 1987:538). Based on his own field research across 5 years and 50,000 miles of exploratory travel in Siberia, plus that of many other Russian biologists before him (Todes 1989), Kropotkin (1902:viii) argued

[10] Kessler's (1879/1880) speech established the theoretical importance of "mutual aid" a decade before Kropotkin used it.

that "Paucity of life, under-population – not over-population - [is] the distinctive feature of … Northern Asia".

Kropotkin and his colleagues attributed the deficit to Siberia's notoriously severe and capricious environmental stresses including droughts, floods, temperature extremes and blizzards that, they felt, regularly decimated populations before Malthus's intraspecific competition had a chance to occur. Thus, just as the Western version emphasized what was visible in tropical jungles, the Russian version emphasized what was visible in Northern Asia; viz., intraspecific *cooperation*, harmony and mutual aid that *kept populations up* in the extremes of the Siberian climate. Some of this cooperation occurred between kin as Huxley claimed, but much of it occurred between individuals who were not kin to each other, and in fact might be members of different species.

Speaking simply but I hope not simplistically, a challenge facing each individual in the Western version was to engage in a struggle with one's conspecifics and to emerge victorious, while a greater challenge facing each individual in the Russian version was to engage in a struggle with a harsh and capricious habitat and, more modestly, to remain viable.

At the same time, both versions, Western and Russian, failed to provide adequate evolutionary explanations for the emergence and operation of societies of social insects including bees, wasps and ants that featured sterile castes whose behavior as workers and warriors was interpreted as altruistic and sometimes suicidal. Darwin acknowledged that cooperation, manifested in an extreme form by these altruistic sterile castes among social insects, posed a major challenge for his theory but left it unresolved in favor of concentrating on competition (Darwin 1872:271-273).

Darwin's "selfish gene" model (Dawkins 1976) embodied an intuitively obvious mechanism underlying intraspecific competition between individuals that was expressed in gory but memorable terms such as "nature red in tooth and claw" (Tennyson 1850; repurposed by others). But Russian biologists could not articulate a comparable intuitively obvious mechanism underlying mutual aid. In a long and traumatic political interlude, the Darwinian model was tainted by Social Darwinism, the eugenics movement and the Holocaust, while the Russian model was tainted by a violent form of anarchism caricatured by Conrad (1907), the intrusion of Lysenkoism and the emergence of the Cold War. Although these decades of intense controversy made few direct contributions to solving the theoretical conundrum, they greatly strengthened the foundations of evolutionary biology as a whole, especially with regard to developments in Mendelian genetics, population genetics and the discovery of DNA.

During this period, Soviet and Western attitudes toward Social Darwinism hardened in unison but for different reasons. Liberal rejection of it in the West as summarized by Hofstadter

(1944/1955:204) and Hirshleifer (1971:7) resembled the conservative rejection of it in the Soviet Union during the "great break" of 1929-31 when "Stalin established rigid control of intellectual life, and put an end to meaningful discussion of the implications of biology for social science and social policy. The line that orthodox Marxists had traditionally drawn between biology and sociology was turned into a wall." (Joravsky 1963:39)

When Wilson's (1975a) *Sociobiology* introduced to a broad audience Hamilton's argument that heredity played a major role in shaping behavior, it ignited a firestorm of opposition from many Western scientists who, still reeling from the Social Darwinism fiasco, saw it as a giant step backward (Gould and Lewontin 1979, Sahlins 1977 and others). But in the Soviet Union, the geneticist V.P. Efroimson (1971), in keeping with Kropotkin's search for a mechanism underlying the natural selection of altruism and cooperation, praised Hamilton's work for posing "a challenge to the hegemonic Soviet doctrine about the primacy of social environment and upbringing in shaping the ethical and mental propensities of human beings" (Howell 2010:356). Thus the controversies raged across the fine and fragile line between politics and science.

By mid-20th century, the Western version of evolutionism began a slow rapprochement with the Russian version on many fronts. Sometimes in fields only tangentially related to Darwinian evolutionism, research into the nature of cooperation expanded. Examples include: Ashby (1962) on self-organizing systems, Hamilton WD (1964) and Price (1970) on kin selection, Margulis (1967) and Sapp (1994) on symbiosis, Hardin (1968) on the Commons, Trivers (1971) on reciprocal altruism, LeGuin (1974) and Smith P. (1979) on nonauthoritarian communalism, Wilson (1975a) on sociobiology, Lovelock (1979) on the highly controversial Gaia hypothesis, Axelrod and Hamilton (1981) on game theory, Woese (2004) on lateral gene transfer, Mitchell (2009) on complexity research, Todes (1987, 1989), Sapp (1994), Gould (1997), Dugatkin (2006) and Howell (2010) on the history of Russian biology, Hiatt (1996), Flannery (1994, 2010, 2012) and Gammage (2011) on mutual aid often labeled differently in Aboriginal Australia, and so on almost indefinitely. [11]

Many of these lines of inquiry may contribute to an understanding of childcare among the Alyawarra and become incorporated into its study, perhaps ultimately moving us from what appears to be present-day theoretical anarchism (Feyerabend 2010:1) to future theoretical convergence or consilience (Wilson 1998, Gould 2011). Due to my early emphasis on ethological

[11] It is remarkable that, after a century of highly contentious argumentation about a) castes among social insects and b) nuclei, mitochondria and chloroplasts within eukaryotic cells, both arguments were resolved within a span of four years by Hamilton's (1964) kin selection theory and Margulis' (1967) sequential endosymbiosis theory, both arguably in keeping more with Kropotkin's mutual aid than with Malthus' competition.

methods, I emphasize the line of development featuring Hamilton, Wilson and Hrdy, without denying the potential theoretical importance of alternative approaches.

Hrdy (2009) pulls together some but not all of these recent threads – plus others unmentioned - as they apply primarily to childrearing among humans and nonhuman primates. As a brief nod toward 19th century Russians, she mentions "mutual aid" in Chapter 1, page 16, but neither lists it in the index nor cites Russian or European sources for the expression in her references. However, partial or complete synonyms such as mutual understanding (in the subtitle), cooperation, cooperative breeding and alloparenting, all of which may have somewhat different theoretical connotations, integrate her argument and implicitly tie the book to 19th century Russian evolutionary theory. In hopes of moving beyond 20th century political animosities, I have cited some of the Russian arguments and sources that she omitted.

Despite obvious and significant differences between Siberian steppes and Central Australian deserts, I suggest that from an evolutionary perspective Hiatt's comments on Aboriginal Australia and Kropotkin's comments on Aboriginal Siberia have more in common with each other than they do with Darwin's comments on tangled banks and tropical jungles. I explore this analogy as I expand upon Hiatt's comments concerning altruism and the anarchistic tradition in the harsh and capricious environment of Aboriginal Australia, especially in the arid zone.

**Kin selection**

The general question here is: Why should an individual perform a cooperative act that benefits others but is costly to itself? I ask the question particularly with regard to people who carry infants and children, but it applies much more broadly.

With regard to carrying infants and children, it is intuitively obvious why parents would carry their own children, but it is far less obvious why so many residents of Murelgwa Gurlanda would so often carry so many children who were not their own. Here I address this issue from the perspectives of two theories - *kin selection* and *reciprocal altruism* - in their basic forms, disregarding the many refinements that have accrued to them in recent decades. These two theories can work together, but for didactic purposes I deal with them separately

Papers by Hamilton WD (1964) and Price (1970) on kin selection theory introduced one solution to the puzzle of altruism. The theory has been glossed in overlapping ways by many people. One example says that an individual behaves altruistically when its behavior reduces the number of offspring it is likely to produce itself, but increases the number that the other individual is likely to produce. Another says that a gene for altruism can spread if it helps copies of itself that are present in blood kin. More precisely, the theory reflects a cost-benefit analysis; thus, kin selection

may be defined as natural selection in favor of behavior by individuals that may decrease their own reproductive fitness but increase that of their kin who share some of their genes and benefit from their behavior. Quite simply, Hamilton's rule says: **rB>C**, with r=coefficient of relationship ranging from 0 to 1, B=benefit, C=cost. However glossed, the rule minimally means that genetic relatedness within families is the key to understanding altruism.

Early interpretations of Hamilton's rule placed a great deal of emphasis on unusually high degrees of genetic relatedness between helpers and recipients of help among social insects. But among other species such as humans, if the cost is low enough helping can evolve even when degrees of relatedness are very low (Hrdy, p.c.). Due to the high density of kin relations and the presumably low cost to each of the many people who carried infants, Hamilton's rule may provide a generally accepted evolutionary rationale for the widespread distribution of child carrying among consanguineal kin at Gurlanda.

Understanding how competition works by itself has been easier than understanding how cooperation works in the context of competition between "selfish genes" (Dawkins 1976). Dobzhansky, Ayala, Stebbins and Valentine (1977:98) spoke positively of competition through cooperation: "It is no paradox to say that under many circumstances the most effective 'struggle' for life [entails] mutual help and cooperation." In the same vein, Okasha (2013) said: "One strategy by which 'selfish genes' may increase their future representation is by causing humans to be *non*-selfish, in the psychological sense." This position hypothesizes that otherwise- competitive individuals who engage in mutual aid may leave more surviving offspring than those who do not.

Inbreeding such as occurs among the Alyawarra seems to be an important issue here but it is a double edged sword. Hamilton WD (1964), Wilson (1975a), Hrdy (2009) and others have suggested that kin selection, as a result of certain kinds of inbreeding, may contribute to the emergence of mutual aid, cooperation and altruism in hunter-gatherer societies, while Westermarck (1891:320), Wolf and Durham (2004:*passim*) and others have shown that inbreeding may jeopardize the long-term viability of hunter-gatherer societies. Thus it is reasonable to ask whether and how a society or sub-population such as the Alyawarra can simultaneously keep its inbreeding coefficient high enough to enhance kin selection and low enough to avoid the harmful effects of inbreeding. Is there an evolutionarily stable "balance point" at which a society can have the best of both worlds? If so, were the Alyawarra positioned at that point in 1971-72?

Wilson (1975a:79-80) provided a clear statement of the general problem:

> …small group size and the inbreeding that accompanies it favor social evolution because they ally the group members by kinship and make altruism profitable … But inbreeding

> lowers individual fitness and imperils group survival by the depression of performance and loss of genetic adaptability. Presumably, then, the degree of sociality is to some extent the evolutionary outcome of these two opposed selection tendencies. How are the forces to be translated into components of fitness and then traded off in the same selection models? The logical next step does not seem feasible at the present time [1975], and it stands as one of the more important challenges of theoretical population genetics.

Alyawarra data on carrying infants and children constitutes an excellent example of this problem.

Simple patterns discerned in the biological relations included those in which ego's parents married exogamously between societies and were not related to each other before marriage. Since about 22% of the marriages in the research population were societally exogamous and linked the Alyawarra to about 10 other societies, most of them being their Arandic-speaking neighbors, the Alyawarra constituted a sub-population of a significantly larger population of unknown size. Furthermore, the systematic 14 year W<H age bias and the strong preference for marriage with matrilateral cross cousins (especially MBD and MMBDD) further reduced the genetic closure of the society.

At the same time, more complex patterns consisted of relinked endogamous marriages, some simple, some compound, some highly recursive. In addition to the 10 cases already described above at Gurlanda, 21 more relinked marriages were present in the complete research population of 114 marriages; i.e., 31/114=27.2% of all known marriages in this small population were relinked. Minimal relinking such as marriage with MBD associates 2 descent lines and 2 adjacent generations, but highly recursive marriage chains yielded descent moiety entanglements spanning 5 or more generations – probably much more than 5 but the actual depth was lost due to missing data - with generation moiety entanglements spanning 3 or 4 descent lines, horizontal in cases of same generation marriages, lateral in cases of alternate generation marriages. These marriages, especially the most complex of them, may have boosted inbreeding coefficients enough, at least locally, to enhance the development of kin selection in tight marital clusters.

Recent literature on the interaction of kin selection and inbreeding is both voluminous and apparently inconclusive. For example, using computer simulations, Breden and Wade (1991) argued that "high levels of altruism lead to increased inbreeding, and high degrees of inbreeding accelerate the rate of change of the altruistic allele in the entire population", while Lessard and Rocheleau (2004) said that their research "confirms that more inbreeding does not necessarily promote the evolution of altruism." Perhaps the Alyawarra case can contribute to developing solutions based more on observational data from human populations and less on potentially risky

assumptions about relations between pairs of hypothetical individuals. See Okasha (2013) for a current in-depth review of research on biological altruism.

Despite the amount and diversity of research on kinship among social insects and other species stimulated by Hamilton's rule, its focus on kin relations meant that it was a special theory that did not, by itself, yield a general theory that addressed the much larger problem of cooperation and mutual aid as reported by 19th century Russian biologists in Siberia. In fact, the success of Hamilton's rule contributed to a narrowing of the field of study: phenomena that Hamilton's rule for kin selection, in any of its permutations and extensions, could explain were classified as altruism, and the much broader range of cooperative behaviors that 19th century Russian biologists sought to explain remained in a residual category of controversial unexplained phenomena under the heading of mutual aid.

**Reciprocal altruism**

Two approaches to the residuals, by Trivers (1971) on reciprocal altruism, followed later by Axelrod R. and Hamilton WD (1981) on game theoretical simulations of the Prisoner's Dilemma, initiated the exploration of other mechanisms that might account for some forms of cooperative behavior among individuals who were not biologically related to each other.

Kin selection (Hamilton W.D. 1964) does not help to explain altruism among non-relatives, and it may not offer much help when consanguineal kin are too remote. But Trivers' (1971) theory of *reciprocal altruism* and Axelrod and Hamilton's (1981) work on the *prisoner's dilemma* provide a generally accepted evolutionary rationale for the widespread distribution of child carrying among non-consanguineal or remote consanguineal kin by the Alyawarra. Reciprocal altruism is defined variously as a behavior whereby an individual (ego) acts in a manner that temporarily reduces its own fitness while increasing the fitness of another individual (alter) in a context in which alter can act in a similar manner toward ego at a later time. The individuals must have the ability to recognize each other at least minimally and to interact with each other more than once, but they need not be biologically kin to each other. These conditions are met by non-biological and remote biological kin among the Alyawarra.

Child carrying by almost all members of the Alyawarra population not only provided widely distributed care for children, enhanced their diets and allowed their mothers to have more children, but also it set up demands for reciprocal altruism to be practiced later by children-cum-adults toward the people who took care of them in their childhood. It was simultaneously altruistic in the ordinary sense of that term and selfish in the biological sense. Thus when an alter carried a great many different young egos, as happened among the Alyawarra, that carrier built up an implicit and

widely distributed "savings account" for the rest of her life, and the lives of her descendants, in an extended network of indirect reciprocal obligations.

Specific gift giving between specific individuals may entail precise recognition of each other, forethought, scheduling of immediate and delayed returns, planning, conniving, etc. but nonspecific or generalized carrying of infants and children among the Alyawarra may have been too diffused to fit such a scheme. Surely no carrier said, "X owes me Y because I carried him 17 times when he was a baby." Rather I am concerned here with the broadly encompassing cultural value that says, "We take care of them", a value that seems to have been ubiquitous in the society.

A slight increase in the specificity of the key expression might say, "We take care of them *and they take care of us*." An even more specific but extended form implied by the generic says, "We take care of them *when they are young* and *they take care of us when we are old AND take care of our children when they are young*." Furthermore, "we" and "they" can be defined with various degrees of specificity such as named individuals, residence groups, sex or age groups, moiety or section groups, and so on. I think it is not a coincidence that the Alyawarra language has more than 30 pronouns denoting specific kinds of kin group compositions (Green 1992:314-317).

Many similar contrasts could be substituted for the italicized phrases by outside observers without ever implying forethought or planning by members of the Aboriginal society. The value was "in the air" just as evolution was in the air among mid-19$^{th}$ century British intellectuals, and their own version of Christianity was in the air among early-20$^{th}$ century Mississippians. Again quoting William Faulkner (from Gwynn and Blottner, 1959:86) as I have in the past with regard to his indoctrination into Christianity: "I grew up with that. I assimilated that, took that in without even knowing it. It's just there. It has nothing to do with how much of it I might believe or disbelieve – it's just there."

While the basic concepts of kin selection and reciprocal altruism are understandable, measuring the evolutionary rate at which they came into existence and spread across one, many or all Australian Aboriginal language groups is less so. This is a major problem, for the real world runs on some kind of "schedule" (Simpson 1944; Gingerich 1993). By this I mean the following: if kin selection and reciprocal altruism developed gradualistically (Darwin 1872:203), over hundreds of thousands or millions of years, then they could apply to our species as a whole, but they would not apply exclusively to Aboriginal Australians, or to the Arandic-speaking people of Central Australia, or to the Alyawarra, all of whom operate on a fundamentally different and much shorter time scale. At the opposite extreme, if they developed rapidly at a rate equivalent to that of linguistic change, they could apply exclusively to Aboriginal Australians or to individual societies. Simply for convenience in writing this article, I assume that they have had 50,000 years (1190

male generations of 42 years each, 1786 female generations of 28 years each) to come into existence and spread across the continent, so that Hiatt's comments (and mine) concerning altruistic and anarchistic traditions may apply to most if not all Australian Aboriginal people, at least in the arid interior of the continent.

**Classificatory kinship terminologies**

Hiatt (1996:98) argued that the "genius" of the Aboriginal people lay in their use of kinship as the organizing principal of their societies, and Hrdy (2009:14) noted that classificatory kinship terminologies can facilitate the development of mutual understanding or mutual aid. A single form of classificatory kinship might be sufficient to do the job, and in many societies there is only one form. But among the Alyawarra (and perhaps other Australian Aboriginal societies), "we take care of them" was linked to at least six "levels" of kinship structures that were tightly interconnected with each other. The Dreamings and the hierarchy of relations (Countries, descent moieties, people, waterholes, etc.) among them constituted the foundation. The genealogies constituted the second level. The sociocentric kinship system, expressed in the section and subsection terminology based on the intersection of Dreamings and descent moieties with generation moieties, constituted the third level. The egocentric kinship system, containing specific kinship terms used in specific face-to-face interactions within one's own society, constituted the fourth level. Generalization of sociocentric and egocentric terminologies within their own society incorporated in-marrying migrants from other societies into a classificatory system of relationships that was indifferent to biological relations, and formed the fifth level. At the sixth level, the universality of this remarkable network of kinship networks meant that in an increasingly tenuous sense, reaching outward from one's own alugera and own society, everyone was related to almost everyone else. "We take care of them" shaded into "all of us take care of each other". Carrying children was one of several simple but powerful acts that expressed the altruistic value and the "genius" of the Australian Aboriginal people.

**Avoiding the tragedy of the commons**

The Alyawarra validated "We take care of them" by preventing a "tragedy of the commons" in several ways. Hardin (1968) used his expression to denote a situation in which members of a society, acting independently and rationally according to each person's self-interest but disregarding the best interests of the group as a whole, deplete a common resource necessary to all, thus often leading to the collapse of the society (Tainter 1988, Diamond 2005).

Here I expand briefly on what I said earlier about the traditional political economy among Aboriginal people of Central Australia. It seems to be characterized best as anarchistic, without leadership or hierarchical organization, in Kropotkin's and Hiatt's benign sense of that term

(Spencer and Gillen 1899, Strehlow 1947). It was combined with communal and personal responsibility - but not with ownership - for land and resources, individual ownership of personal items, and innovative shared ownership of introduced Western items such as motorcars. It was free from the accumulation of wealth, and from competition and conflict over land and resources.

In this context, Gammage's (2011) *The Biggest Estate on Earth* is an idyllic re-creation of land management practices employed by Aboriginal people throughout Australia before the European invasion of 1788, then by the diminishing population of uncontacted people until the last Pintubi were removed from their lands near Lake Mackay, Western Australia, in the 1950s (Gammage 2011). The book mentions the Alyawarra in passing a few times, but never focuses on them.

Some reviewers believe Gammage's book is a utopian fairy tale, but most believe it is a remarkably well-researched and documented account of an amazing way of life based on a profound knowledge of climate, soils, plants, animals and fire built up over perhaps 50,000 years but systematically destroyed in about 165 years by British ignorance and malice that yielded an appalling tragedy of the commons.

Insofar as Gammage's account is utopian, it describes a dynamic utopia shaped by major events in Aboriginal history such as in-migration from Africa and India and dispersion across the continent, as well as tracking of continent-wide long term environmental changes including sea level and climatic changes during and after the Pleistocene (Nunn and Reid 2015), extinction of the megafauna, the creation and development of the Dreamtime as a distributed cognitive system of extraordinary scope and complexity, cumulative changes in technology, and more modest events such as 1000-year droughts and floods (Flannery 1994, 2010, 2012).

In conjunction with this history of changes, one of the major messages from the Dreamings was an insistence on continuity, persistence, stability; not stagnation in any sense, but active change to remain in balance, in harmony with the ever changing world in which the people lived. In response to that message, Gammage (2011:21-99) included 59 plates of mostly early British paintings that illustrate his text concerning the continent-wide park-like conditions that characterized the finely sculptured landscape produced by Aboriginal people using simple fire-sticks (Jones 1969; Pyne 1991:71-150; Flannery 1994:217-236) as sophisticated agricultural implements to guide and enhance the productivity of a very harsh habitat. It is not surprising that ethnocentric British colonists were incapable of reconciling the immaculately groomed landscapes with the simple technology and anarchistic traditions of the Aboriginal people. Yet that harmony apparently averted the tragedy for untold millennia.

Now consider the presumably inevitable conflict over land and resources under stressful conditions that is implied by traditional evolutionary theory, and contrast it with Hiatt's assertion that "natural resources and the land itself were equitably distributed among descent groups [and] appropriation of clan estates by force was unknown", and with Gammage's plates showing how the land and its resources appeared to early British observers.

The land and its resources were treated as the Commons. The Dreamings preemptively averted a tragedy by making the resources of geographical Countries widely accessible on the basis of kin relations, with due respect for the responsibilities of members of the sociological Country who insured its continuity by means of sacred and secret actions. Since there were no concepts of ownership or wealth, a person who might consider appropriating an alien geographical Country knew that he would gain no land or resources that were not already available to him before his takeover. Furthermore he knew that the responsibilities required for maintaining that Country would devolve upon him immediately but he would not have the secret knowledge required to perform them, which was literally a fatal flaw. In other words, appropriating land and its resources by force even in the face of starvation would have entailed enormous costs but no benefits.

Had a person actually attempted to appropriate an alien Country - even under the worst of environmental conditions - the self-organizing anarchistic society with no formal government to handle the problem could have enforced the traditional and highly conservative law of the Dreamings as a collective responsibility to execute the offending member. Thus Hiatt said, "Appropriation of clan estates by force was unknown"; i.e., "we take care of them by sharing the resources, but they must behave responsibly". Sometimes natural selection may lead to something new under the sun, but frequently its primary function is to conservatively trim off "far outliers" who reject the status quo. The anarchistic tradition implied here gave people a great deal of freedom so long as they behaved responsibly in accordance with Aboriginal law, even as it changed through time. It would be difficult for a selfish gene to accomplish much in such a setting.

By analogy, I suggest that Alyawarra infants and children were treated as part of the Commons, just as were all shared resources including kangaroos, waterholes and sacred sites. A mother had special responsibilities for her child early in its life, but within a few months the responsibilities were distributed increasingly among residents of the mother's alugera and within a year or two to people living throughout the camp. Most of those people were consanguineal kin with varying degrees of relatedness, but many were affinal kin and non-biological kin. Everyone ultimately benefited from the birth of a child and its later contributions to the welfare of all, and virtually everyone was responsible for participating in its care.

### Cooperative breeding

My research objectives and methods yielded a great deal of data concerning generalized alloparenting, but nothing of value concerning the motives, purposes and actions of people who might have engaged in more specialized activities of cooperative breeding. Behaviors relevant to the Cooperative Breeding Hypothesis that I could not observe systematically from my observation point included the following: Which allomothers provided premasticated or solid foods to Alyawarra babies? Did women other than their mothers ever suckle those babies? Did grandparents provide food for them? Were infants co-sleeping with mothers or with alloparents? Did infants form especially close attachments with any of their allomothers? Since these and similar micro-level behaviors occurred primarily or exclusively within residences that interfered with my observations, I have no data concerning any of them.

## 6. Summary and conclusions

### Objectives and methods

The first objective of my fieldwork was to collect observational data that would facilitate cross-cultural and cross-species analyses. Data recording methods associated with behavior observations, genealogies and kinship term applications, as well as sampling procedures and analytical methods, were innovative in the 1970s but are less so in the 21st century. All were based to some extent on contemporary ethological research when I designed the project in 1969. The methods controlled the structure, content, quantity and quality of the data and determined much of what I can and cannot say about the Alyawarra almost half a century later.

The second objective of my fieldwork, which emerged after I arrived in the field, was to understand the quintessentially human and extraordinarily complex domains of Alyawarra kinship and the Dreamings. Before I began the project, I concluded that Aboriginal kinship and the Dreamings were so well known that I need not focus my efforts on either of them. That was a very bad decision based on a naïve misapprehension of the history of Australian Aboriginal anthropology. In fact, received wisdom about kinship and the Dreamings as it pertained to the Alyawarra was seriously inadequate. Persistent efforts to demystify those domains have contributed to my writing this paper rather belatedly, 45 years after I did the fieldwork.

My recent decision to analyze the carrying of infants and children, rather than pursuing other topics for which I have suitable observational data, was based squarely on a hunch that the richness of these data would repay the effort required to analyze them properly in the context of current research into alloparenting. My decision to interpret the data from a perspective within

evolutionary biology brought me full circle to my ethological research design in 1969 and my primate energetics paper (Denham 1971).

**Data**

I made 41,813 observational records over 191 observation hours spanning 85 calendar days. Of those, 1473 records pertained to the carrying of infants and children. On an average day, carrying showed a bimodal distribution during daylight hours with lowest frequencies occurring at approximately 0600, 1300 and 1900, and highest at about 0900 and 1800 hours. After omitting children and carriers who were transient visitors but not residents of Murelgwa Gurlanda, I focused on 1439 records for 24 resident infants and children (egos) who were carried by 103 resident carriers (alters). In this group of 12 girls and 12 boys, ages ranged from newborn to 8 years. It was an unavoidably small population, but such is the nature of hunter-gatherer societies. I must leave it to others to determine whether my population was anomalous.

Child-rearing modes employed by the Alyawarra included a varying mixture of carrying, caching and following but not nesting. I focused exclusively on carrying which included clinging. Styles included coolamon carrying, hand carrying, hip carrying, back clinging, and shoulder clinging. Hip carrying was used most commonly, while ventral-ventral carrying was not used at all.

Girls received 57.3% of all carries and boys received 42.7%. However, girls aged 0-4 years were carried very frequently but after that age they were carried hardly at all (8 carries each), whereas boys age 0-4 were carried less frequently than girls of the same ages but continued to be carried at a modest frequency until 8 years old (34 carries each).

Before Alyawarra children completed the transition to independence in locomotion, they began to carry infants and other children. Of the 103 carriers, 31 were less than 14 years old. About 6% of carries were performed by alters less than 6 years old, 14.5% by alters 6-9 years old, and 18% by alters 10-13 years old. Thus people younger than 14 years served as 30.1% (31/103) of all alters and performed 38.9% (561/1439) of all carries.

While both girls and boys began to carry other children before the age of 6 years, more girls than boys became carriers, and each girl carried other children more frequently than boys did. The result was that 67 girls and women performed 1153 carries while 46 boys and men performed 286; i.e., females performed about 80% of all carries and almost all females served as carriers.

Genealogical relations between egos and alters added details. Of the 1439 observed cases of infant and child carrying, consanguineal kin ("blood kin") performed 59.7% of the carries, affinal kin ("in-laws") performed 31.5% and non-biological kin performed 8.8%.

Of major importance was the fact that mothers provided 2.85% of the carries for their own children and fathers provided 0.28%. Furthermore, the 24 egos had a total of 15 mothers, 8 with 1 child each, 5 with 2 each and 2 with 3 each. Since 15/103 (14.5%) of the carriers were mothers of these children, the other 85.5% of alters were not mothers of the egos whom they carried.

Gurlanda's population contained 13 grandparents, 10 women and 3 men, who together performed only 60 carries. The women's relationships with their own and their sisters' grandchildren were important, but those relationships simply did not appear in data on carrying infants and children as recorded here. These women often remained in their alugeras, typically concealed by windbreaks, serving as babysitters for the children of one or several of their daughters and granddaughters. The services were quite valuable but were largely invisible to me.

Ego's older siblings and ego's parents' siblings performed 14.8% of observed carries. Early participation of older children in carrying their younger siblings provided a reliable if limited source of assistance for a mother with several children. Likewise a young mother could rely on assistance from her own younger unmarried sisters who generally lived in her own alugera, or from a sister of approximately her own age who was her co-wife in a polygynous marriage, or from other married sisters who were members of her alugera. Together with ego's mother and grandparents (especially MM) these people often constituted the core population of ego's alugera. Together ego's close kin including parents, grandkin, own siblings and parents' siblings, generally residing in the same subcommunity and frequenting the same alugera, performed 317 (22.13%) of the observed carries even though the actual number of these carriers was limited: each ego had only 2 parents, a potentially larger but still small number of own siblings and parent's siblings, and a small number of living grandkin.

Close and distant cousins and other collaterals encompassed a potentially very large number of kin who carried ego, making the greatest contribution of all consanguines with 541 (37.6%) carries.

Carrying by close cousins occurred when mother's married sisters shared the same alugera with ego and had children who were ego's older parallel 1st cousins. They were among ego's most frequent playmates, and often carried ego just as ego's older siblings did. The number of ego's older siblings generally was small, but the number of co-resident cousins could be several times larger. When added to parents, grandkin, own siblings and parents' siblings, they significantly expanded the core population of ego's alugera.

Carrying by distant cousins and other collaterals is much harder to describe for it was not centered on one alugera but was distributed over most or all of the alugeras in the camp. Generally these distant consanguineal kin were connected with ego by ascending parental links such as *MMM*, plus a horizontal or lateral sibling link such as MMM*B*, plus descending child links such as MMMB*DDD*. In this example, the main link was through MMMB, with a broad diversity of cascading distributary or dendritic branches descending from it. Thus theoretically one MMMB who had 10 children might leave perhaps hundreds of descendants in ego's generation, many of whom were ego's potentially marriageable cross-cousins, while MMMZ might leave a comparable number of unmarriageable parallel cousins. In Western societies, these remote kin would have simply disappeared into the background, but among the Alyawarra they were known precisely, if not in terms of their faces and genealogies, then in terms of their Dreamings and Countries, and the sociocentric and egocentric kinship systems. A few people at Murelgwa Gurlanda had no known kin of this type, but some had scores living throughout the camp and region.

In this context almost everyone was related to almost everyone else; i.e., according to long established tradition, it was likely that close or distant marital relinking (marrying a person to whom you were biologically kin) would occur. Distant relinking over periods of millennia established the overall inbreeding coefficient of the population. Close relinking, which characterized 31 of 114 marriages in the research population, occurred when a man married a woman such as a MBD who may have been linked to him by various other routes as well. Such marriages locally raised the inbreeding coefficient of people who were most likely to carry ego.

Terminological relations established by sociocentric and egocentric kinship systems added more scope and redundancy to relations between egos and alters. For example, relinkage resulted in the superimposition of affinal kinship terms in addition to pre-existing consanguineal kin relations when a man married someone such as his MBD; i.e., MBD was redundantly reclassified as W, and her father, mother and siblings were redundantly reclassified as "in-laws" as well. Likewise, when people married others to whom they were not biologically related as occurred in 22% of the marriages, the classificatory kinship systems immediately incorporated them, terminologically if not biologically, into the genealogical network. Thus the observational data show that affines performed 453 (31.5%) of all carries and non-biological kin performed 126 (8.8%) of them.

For methodological reasons, I am unable to report on cooperative breeding among the Alyawarra.

The patterns that I have reported in the observational and kinship data emerged directly from the objectives and methods that I used in 1971-72. To the best of my ability I have not in any way twisted them to make them fit the following interpretations.

**Interpretation**

On the basis of the data presented above, I suggested that the Alyawarra were a hunter-gatherer society whose survival traditionally rested on keeping its population UP through cooperation in the face of serious environmental challenges ultimately including damaging policies and practices by colonial Europeans. I strongly question the applicability to them of traditional ecological arguments that hunter-gatherer societies in general must keep their populations DOWN through competition, and in some cases through systematic infanticide, to prevent or survive the exhaustion of resources.

The Alyawarra in 1971-72 displayed altruistic and anarchistic traditions that Hiatt attributed to all Aboriginal people of Australia and that Kropotkin attributed to the animals and people that he knew so well from his explorations in Siberia. But noting their presence in either place is easier than explaining it. As a preliminary contribution toward that end, I have proposed a set of explanations based on recent developments in evolutionary biology.

It is not intuitively obvious why so many residents of Murelgwa Gurlanda would so often carry so many children who were not their own. The overwhelming presence of multiple genealogical relations among the Alyawarra suggests that Hamilton's rule for *kin selection* may apply. Defined variously as "natural selection in favor of behavior by individuals that may decrease their own reproductive fitness but increase that of their kin who share a proportion of their genes and benefit from the behavior", it provides a generally accepted evolutionary rationale for widespread child carrying among consanguineal kin.

Hamilton's rule is applicable between close kin, somewhat less so between remote kin, and not at all between non-kin. However, Trivers' work with *reciprocal altruism* and Axelrod and Hamilton's *game theoretical* research with the Prisoner's Dilemma may apply to relations between remote kin and non-kin. Reciprocal altruism, defined variously as "behavior whereby an individual (ego) acts in a manner that temporarily reduces its own fitness while increasing the fitness of another individual (alter) in a context in which alter can act in a similar manner toward ego at a later time", does not assume the presence of a kin relationship.

Hrdy noted that *classificatory kinship* could contribute to the development of alloparenting without specifying precisely how it might work. Classificatory systems exist elsewhere as free-standing egocentric kinship terminologies within specific societies, but among the Alyawarra and perhaps others in Aboriginal Australia they are part of a much more complex array of Dreamings and genealogies plus sociocentric and egocentric kinship systems that have classificatory and universalizing add-ons. Certainly classificatory kinship in this very broad sense co-occurs with

alloparenting among the Alyawarra and the "fit" between them seems to be excellent, but I prefer not to speculatively point the causal arrow (if any) in either direction.

I suggest that the Alyawarra avoided Hardin's *tragedy of the Commons* by at least three strategies that built directly on their expression: "We take care of them". First they precluded competition over land and resources by strictly following instructions from the Dreamings that made such competition extremely costly and totally lacking in possible benefits. The result was an anarchistic society with a degree of cooperation concerning land and resources that was rarely found in human societies outside of Aboriginal Australia.

Second they managed the Commons - land and resources - by individually and collectively using diverse and perhaps ever-changing regimes of fire-stick farming to generate sustainable productivity under park-like conditions over a period of centuries or millennia.

Third I suggest that Alyawarra infants and children were treated as parts of the Commons. A mother had special responsibilities for her child early in its life, but within a few months the responsibilities were distributed increasingly among residents of the mother's alugera and within a year or two to consanguineal, affinal and non-biological kin living throughout the camp. Everyone ultimately benefited from the birth of a child and its later contributions to the welfare of all, and virtually everyone was responsible for participating in its care. Those who participated built up a broadly distributed "savings account" to take care of them in their old age.

**Conclusions**

I follow Hrdy in stressing the important contribution that alloparenting can make to enhancing population stability in a context of high infant mortality. A society in which infant and child carrying was the sole responsibility of the mother or both parents would be radically different from one such as the Alyawarra where carrying was a widely shared responsibility. By sharply reducing the work load of the biological mother, a multitude of caregivers simultaneously enhanced the likelihood that a mother would shorten her birth interval thereby increasing her own reproductive rate, and increased the likelihood that her better nourished children would survive through childhood, both of which would contribute to population stability under harsh conditions. Furthermore allomothering removed the justification for systematic infanticide and other birth spacing mechanisms that would have suppressed the population artificially, leaving infant mortality to operate naturally but minimally.

In addition to benefits from alloparenting that accrue to mothers and their children, additional benefits accrue to others in the community (Hrdy, p.c.). Fathers benefit if they are paired with mothers who conceive again sooner or are freed to forage more efficiently. Allomothers

themselves benefit by being rewarded as valuable members of the community. Inexperienced young allomothers gain valuable childrearing experience by caring for children other than their own. And a kind of old age insurance accrues to all of the people who serve as alloparents.

I suggest that kin selection and reciprocal altruism are forms of individual selection that enhance biological *potentiality* rather than enforce biological *determinism* among humans. Human biology, unlike chimpanzee biology, may *permit* people to display the ordinary altruism that Hrdy attributes to airline passengers, but many people may fail or refuse to do it. In other words, our biology does not "cause" such altruism but it does permit it to occur.

How do multiple strategies that preclude the tragedy of the commons articulate with kin selection and reciprocal altruism? They are vital aspects of mutual aid in the broad sense, but seem not to embody the defining features of kin selection and reciprocal altruism in the narrow sense. Perhaps they remain securely in the residual category of unexplained forms of mutual aid.

What about the extraordinarily complex networks of kinship and the Dreamings, several of which embody classificatory relations such as those to which Hrdy referred? My attempts to describe these networks and their interconnections based on "simple observations" (Tinbergen 1963:412) and the systematic collection of a broad range of quantifiable data concerning descent, marriage, kinship and infant carrying have revealed vastly more – and more interesting - patterns in Alyawarra behavior than I ever hoped to see, but the method is not to the liking of many who are interested in kinship solely or mainly as a form of cognitive and verbal behavior.

I suggest that the data used here are well suited by their nature, quantity and quality, and by the diversity of the patterns already detected in them, to serve as a guide for future research on biological altruism in natural human populations and as a corrective for problematic assumptions that may be built into related simulations and experiments.

My interpretation of the data from the perspective of evolutionary biology is only one possibility. It is the best that I have been able to construct, but it is both speculative and lacking in rigor. It is an attempt to find alternative approaches to longstanding problems of method, substance and theory. If you accept my data but reject my interpretation, especially with regard to righting the long standing imbalance between competition and cooperation, I invite you to create a superior interpretation using the Alyawarra data.

Elsewhere (Denham 2013:66) I have quoted the following statements by Stanner and Strehlow. Stanner's directly complements Hiatt's very similar statement quoted at the beginning of this paper:

> "The more one sees of Aboriginal life the stronger the impression that its mode, its ethos, and its principle are variations on a single theme - continuity, constancy, balance, symmetry, regularity, system, or some such quality as these words convey. … The result is a homeostasis, far-reaching and stable. … Equilibrium ennobled is 'abidingness'" (Stanner 1965:166-67).

Stanner and Hiatt profoundly disagree with Strehlow's missionary negativism:

> "… the native follows tradition blindly: he clings to the primitive weapons used by his forefathers, and no thought of improving them ever enters his mind. In all his mode of living and in all his multifarious occupations, there is everywhere evident the same depressing inertia, the same mental stagnation that has stifled so completely all his literary endeavors. … Central Australia sleeps heavily under the all-oppressive night-shadow of tradition" (Strehlow 1947:35).

I suggest that the data presented in this paper support Stanner's concept of "abidingness", a dynamic condition that is unlike Malthus and Darwin's intraspecific struggle for existence and unlike Strehlow's static dystopia. Perhaps the strategy and tactics manifested in child carrying by the Alyawarra would have failed along Darwin's "tangled banks", but I believe that they, like fire-stick farming and the sharing of resources, averted the tragedy of the commons in the harsh and unpredictable environment of Central Australia.

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