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I am delighted with the broad range of Comments submitted to MACT concerning my paper on kinship, infant carrying and alloparenting among the Alyawarra. I thank all of the authors for their contributions. Although some topics were addressed by only one author, several were addressed by most or all of them, so I have directed my responses to selected topics rather than to individual Comments. I have not attempted to respond to all of the issues addressed in the Comments, but have chosen a representative sample for special attention.

Theoretical bias. I thank Banks (2015:5) for asking a fundamental question about all of my work reported in this and other papers. With regard to my multidimensional relational, demographic and observational data from the Alyawarra, he asks, "Are the networks of knowledge and relationship as rich as they appear to be, or is that some sort of sentimental projection, a white fantasy, ..., a wish projection?" Although he then focuses on the presumed validity of the networks, I take this opportunity to address the question of bias.

Scientific observations, records and interpretations are intrinsically biased by theory and method, and the literature on this problem is both rich and enormous. Theories, formal or informal, inevitably bias our observations both positively by telling us what to see and negatively by telling us what to ignore. Presumably my work is as biased as that of anyone else, but the directions and extent to which it is biased are clearly stated and are sometimes unique. Burling's (1964) classic paper on cognition and componential analysis subtitled "God's Truth or Hocus-Pocus" sets the limits clearly; I hope my work falls closer to God's truth than to hocus-pocus, but I can't be sure.

My data and interpretations derive from my early years. My roots are in mid-20th century Mississippi where I was born in Oxford and raised in Indianola. My parents, teachers and peers believed that I should be as racist as they were, but their attempts to teach me their values failed. Furthermore, my undergraduate and graduate training convinced me that the Aboriginal people of Australia, like the African American people of the Mississippi Delta, had been grossly misunderstood and misrepresented by a broad diversity of ethnocentric European observers, some of whom were ignorant, arrogant and vicious.

As is universally true, I began my research with preconceived notions. I was committed to covering a selected cluster of topics as comprehensively and systematically as possible, using numerical methods that yielded data which I believe to be largely immune to traditional misrepresentations from the perspective of either sentimental fantasies or racist nightmares, thereby depicting the lives of one group of Aboriginal people of Central Australia as accurately as possible. The result is a body of work that challenges some longstanding social theories within and outside of academia, within and outside of Australia. My data are imperfect and complex, they are not easy to interpret,

they do not cover all topics of interest to current theorists (see especially Herlosky et al 2015), and I shall always be concerned that the undetected error rate exceeds 5% in some places. But I assure you that I did not fabricate the data or impose any patterns on them; rather I discovered the patterns in them. Certainly my interpretations of those patterns in the broader context of Alyawarra society may be incorrect, but the data and the patterns that emerge from them are as systematic, comprehensive and unbiased as I could make them.

Stack's (1974) *All our Kin* presents an important description and interpretation of alloparenting and cooperative breeding in an African American community, thereby rejecting pervasive White stereotypes of dysfunctional and self-destructive Black families. Likewise, I hope my report on alloparenting and mutual aid among the Alyawarra will help to reject equally pervasive White stereotypes and myths concerning primitivity of the people and societies of Aboriginal Australia.

Ethnographic data. I thank Lehman (2015) for his brief ethnographic description of the Chin peoples of upland Western Burma who engaged in both alloparenting and cooperative breeding over half a century ago. I suspect that there were a great many other societies in which such behaviors were common or ubiquitous in the 20th century when such behavior was not salient to Western observers, and remain unreported or under-reported in the ethnographic literature. I hope my report on the Alyawarra from 45 years ago will bring alloparenting to the attention of other ethnographers who might contribute important information to the study of distributed parenting, mutual aid and related topics before their data are lost. Research in this field is very active now (Hewlett and Lamb 2005, Hrdy 2009, Herlosky et al 2015), and additional contributions would be valuable.

Both Herlosky et al (2015) and Hrdy (p.c.) questioned my decision to omit detailed observational data on alloparenting by Alyawarra men. As I said in my paper (Denham 2015:57-58), Alyawarra men contributed very little to the carrying of children. Rather, "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." In other words, just as *sequential specialization* (Hirshleifer 1977:38) occurs among females when they progress through a common series of different productive roles in the course of their life cycles, so too does a similar but different kind of sequential specialization occur among males. Among females, that specialization deals in part with the complexities of infant and child carrying. Among males, it deals with perhaps even greater complexities associated with learning and teaching the Dreamings, but it occurs at different points and in different contexts in the male life cycle. Thus addressing the male life cycle in this paper would have added a wholly different and confusing set of dimensions to my analysis of infant carrying.

Comparative research. Lehman (2015) and Herlosky et al (2015) note the potential importance of using comparable data from other societies to better understand Alyawarra behavior from a cross-cultural perspective, while Hrdy (2009, 2016) expresses similar interests with regard to both cross-cultural and cross-species perspectives. I was fully aware of the importance of performing comparative studies when I designed the project, and for that reason my research design insures

that collecting comparable data from other societies should pose few or no problems if others choose to replicate my work at different places and times. But doing my research in some other way *just* to facilitate cross-cultural comparisons with preexisting datasets would have been counterproductive. Perhaps some recently collected observational datasets for human or nonhuman societies are sufficiently similar to mine to permit meaningful comparisons, but since I have no knowledge of them, I made no attempt to examine comparative data in my paper. However, I agree with Lehman that differences in child care practices probably are associated with differences in economic practices, and they can be studied most effectively by cross cultural comparisons.

Motivation. Just as mutual aid and cooperation are notoriously difficult to explain, so too is motivation. Among the Chin of Burma, women are said to engage in alloparenting and cooperative breeding "because they *like* babies as such" (Lehman 2015). Herlosky et al (2015) say that I should have interviewed caregivers with regard to their *purposes* or *motives*. Adam Smith (1759) argued that the *passions, appetites,* or *sentiments* driving men were implanted by a wise Providence to promote the survival of the species (Hirshliefer 1977:19). Hirshleifer (1977:26) also discusses "drives or instincts … that economists inadequately call preferences". Kagan (1994:35-37) defines *temperament* in terms of both genetic and environmental contributions to persisting patterns in infant behavior. Tinbergen (1963) points to *species specific* behavior patterns. Hrdy (2016) examines biological bases of *prosocial,* as opposed to antisocial, behaviors. Skinner (1953) associates motivation with *operant conditioning* and *schedules of reinforcement*. Hamilton (1964) explains *kin selection*. From the perspective of animal breeding, Banks (2015:4) discusses *social effects models* and the selection of genetic differences in what he describes simply as "*getting on with others*". All of us are groping for causal explanations that remain elusive.

Network society. Among the multitude of interdigitated networks that I introduced in my paper, I must add two more layers that I did not discuss adequately. The layout of the residences (ngunya, alugera, anoardegan) in each camp and the distribution of the camps across the vast expanse of Alyawarra territory constitute measurable physical arrays that are embedded in the plans and maps in my paper, and they constitute the geographical and architectural structures within which the Alyawarra engage in a great deal of physical mobility. A less obvious layer exists within the Dravidian kinship terminology, where reciprocal kinship terms for siblings are marked for age as indicated in Table 4.18 and discussed briefly on page 67. An older sibling refers to a younger sibling as "younger sibling" (ySib), while a younger sibling refers to an older sibling as "elder brother" (eB) or "elder sister" (eZ). The elder-younger sibling relationship seems to be literally true between proper or full consanguineal siblings but may be used more flexibly between close, distant and remote classificatory siblings or half-siblings.

Having examined a wide range of topics addressed in my paper, Banks (2015:6) concludes that "Aboriginal Australians have been immersed in, and managing, and co-creating and nurturing network society for tens of thousands of years." He cites Manuel Castells (2009) as his source for "network society", but does not explore the concept further. I think his conclusion is fully justified, and take this opportunity to expand upon it briefly.

Castells (2001:4) defines *network society* as "a society where key social structures and activities are organized around electronically processed information networks; … i.e., social networks that process and manage information using micro-electronic based technologies." Here Banks is concerned with interpersonal network connectivity and the flow – perhaps *distribution* would be a better word - of great quantities of highly detailed information across the various non-electronic networks that structure Alyawarra society and that of their neighbors.

Banks expresses amazement at how the Alyawarra learned all of this material. From my perspective, "learn" has two distinctly different meanings here, and both are relevant. In its broader sense, "learn" means to create or imagine the Dreamtime and all of the interlocking networks encompassed by it among the Alyawarra, presumably done incrementally across many generations and in conjunction with other societies in Central Australia. I agree that this was indeed a remarkable feat and I have no idea how it happened. In the narrower sense, "learn" refers to enculturation, the gradual acquisition of knowledge and norms of Alyawarra culture by each maturing child. This latter kind of learning presupposes the existence of the former kind, and in my opinion is less puzzling. Virtually everything in the society is expressed in terms of the Dreamings and the networks that constitute it. Thus relationships associated with cells embedded in any metaphorical layer of the system of networks are defined and supported with great redundancy by the relationships of adjacent cells in all layers. When you grasp the structure of the system of networks and place several people into that structure, almost everyone else falls into place almost automatically. I have no idea how the Alyawarra envision these structures, but I hope that my matrix-like view of them is somewhat analogous to theirs. Presumably children learn these relations more-or-less the same way they learn to speak the Alyawarra language: Aboriginal children master their own language at an early age, but it is notoriously difficult for adult Indo-European speakers (including myself) to master that language at all.

I suspect that Banks may be right when he suggests that "everyone is usually expected to be unique" despite the classificatory terminologies of kin and skin, especially when the elder-younger distinction differentiates between full siblings of the same sex, perhaps including identical twins. The result "would be a very thin but extremely wide network, which presumably could be considered to be optimal in an extremely resource-limited environment, and one which had been so for a very long time" (Banks 2015:6). He further speculates that "such a complex and powerful system [might be] some sort of strange attractor (as defined in his Comment) in socio-genetic evolutionary space." Perhaps this matter articulates with longstanding anthropological arguments concerning the equivalence of same-sex siblings in kinship terminologies (Radcliffe-Brown 1931, Tax 1955, A. Hamilton 1971, McConvell and Alper 2002), but this important issue lies outside the scope of these Comments.

Notice that my paper deals explicitly with individuals and their particularity, thereby avoiding group selectionism that has characterized some publications in social or cultural anthropology. Banks (2015) likewise focuses on individuals, using that term nine times in his Comment. And Ballonoff (2015) notes that Hirshleifer (1977), following Wilson (1975), focuses on individuals in his discussion of economics from a biological perspective. No doubt the longstanding debate about

the relative merits of individual and group selection will continue indefinitely, but invoking group selection with regard to alloparenting among the Alyawarra seems to be unnecessary.

Mating structures, inbreeding and outbreeding. Banks (2015:3) notes that Alyawarra males have to "pass a test" before being allowed to marry (and mate), and that the resulting age difference between males and females at mating, coupled with distinctive patterns of relatedness of mating pairs, yields an overlapping pattern of generations with sex-related differences in the expression of individuals' genes in their male and female descendants. The patterns described here are indeed distinctive, but I suggest that they probably are not unique to the Alyawarra. See Denham (2014) for a bibliography of works dealing with age-biased marriage systems in Aboriginal Australia.

Pointing to regular cyclical patterns of relationships between inbreeding and outbreeding throughout Alyawarra society and through time and space, Banks (2015:3) suggests that my discussion of these aspects of mating structures was superficial despite the rich literature available on the topics. He is right. At the very least, I should have known about, reviewed and cited Shields' (1982) *Philopatry, Inbreeding, and the Evolution of Sex*, Waldman's (1988) "The ecology of kin recognition", and related works. Shields deals with *optimal inbreeding*, alloparenting, cooperative breeding and philopatry (the tendency of organisms to stay in, or return to, their natal areas, especially when breeding). Waldman deals with topics such as *optimal outbreeding*, recognition and discrimination of kin, and coadapted gene complexes. Although measuring optimality may be problematic, considering the linked problems of inbreeding and outbreeding in greater detail from the perspectives of these and other authors would have been valuable.

Mobility. Banks (2015:5) argues that the fluidity or complexity of physical location among the Alyawarra may be "a cultural innovation of extraordinary importance." He does not specify precisely which kinds of movements he addresses here, but in response I point to movements of individuals within several imprecisely bounded categories of mobility, distinguished by location, frequency of occurrence and distances covered, some of which I did not address in my paper. I refer to the following that might happen anywhere in or near Alyawarra territory: a) high frequency, long range mobility of adults with their families who traveled extensively throughout the southeastern quarter of the Northern Territory, visiting Aboriginal camps, pastoral properties, towns, settlements and missions, sometimes failing to return to MacDonald Downs Station for months or years; b) low frequency, short or intermediate range mobility associated with abandoning residences or camps when deaths occurred, or when climatic changes resulted in the aggregation of small camps or the dispersal of large camps; c) high frequency, intermediate range mobility of men as hunters, and women (accompanied by large numbers of children) as foragers in the vicinity of their residences; d) high frequency, short range mobility of infants and children with their carriers between residences, bores, and other locations within and adjacent to the camp in which they resided; and e) protracted visits to Dreaming sites by young men and their escorts as part of their extensive training in the Dreamtime. It is easy to treat these as several distinct kinds of mobility patterns, but it probably is more accurate and considerably more difficult to treat them as a multitude of related mobility events in space and time. From this perspective, speaking of Central Australian Aboriginal people as "nomadic" is not wrong, but it is simplistic, ethnocentric and not especially useful. As Banks notes, this mobility "is another almost infinitely complex

dimension of what is already a highly dimensioned social and cultural existence – and one with structure and connection always inherent and known."

Economics and evolutionary biology. Ballonoff (2015:1) begins his Comment by suggesting that the data and interpretations that appear in my paper could serve as a test of Hirshleifer's (1977) argument concerning the *isomorphism* between sociobiology and microeconomics. Paying attention to the "message sociobiology has for economics", Hirshleifer considers the use of concepts such as cost and benefit in both disciplines, and advocates the merger of concepts such as economic optimization and biological adaptation, where formalizations of both are equations of constrained maximization (Hirshleifer 1977:2-4).

The historical trail that Ballonoff follows proceeds from Adam Smith (1775), through Malthus (1798) and Darwin (1872), to Alchian (1950), Hamilton (1964), Wilson (1975) and Hirshleifer (1977). Although the recent authors do not deal with Kropotkin (1902), they generally focus on viability rather than maximization, which is precisely the perspective that Kropotkin used in pursuit of evolution without Malthus in the harsh Siberian environment. Furthermore, Hirshleifer's emphasis on individual selection and the uniqueness of individuals fits well with Banks' remarks concerning the congeries of networks in which each unique person may occupy a unique cell.

Aboriginal history. Ballonoff (2015) contrasts not only the structures but also the histories of a) societies with discrete horizontal generations as depicted in traditional kinship models, with b) societies such as the Alyawarra in which helical generations may characterize descent, marriage and kinship under conditions of strict societal endogamy. According to him:

> Because the descent relation is a helix for the Alyawarra, unlike cultural systems that can be described using discrete generations, the helical relationship covers all of the Alyawarra, past, present and future, as one descent relation (not a sequence of separate ones by distinct "generations") that covers the entire history. The existing population at time t are the then visible parts at t of one "generation" that covers the entire history of the Alyawarra. (Ballonoff 2015:2).

Although I have been intrigued for many years by the double helix in Alyawarra kinship, I have never before seriously considered its impact on the nature of history – actually on the concept of time – in Aboriginal Australia or in other societies with significant systematic W<H age biases. In this context, maximization is associated with change, growth, development or competition while viability is associated with stability, equilibrium, continuity or cooperation. Clearly the associations with stability and related concepts underlie my interpretation of Alyawarra alloparenting and Gammage's (2011) interpretation of the ubiquitous practice of fire stick farming that dominated Aboriginal land use planning for what appears to have been a very long period.
I support Ballonoff's conclusion: "One much suspects that many of [Banks' questions] can be addressed, in Australia, by extending the analysis started by Hirshleifer, using Banks' directions of enquiry, based on the data found by Gammage and Denham."

Analogies. It is entirely appropriate and highly stimulating that Banks uses the extreme analogies of *network society* and *strange attractor* with regard to the Alyawarra, and that Ballonoff deals

with analogies between economics and kin selection. In doing so, they capitalize on Hofstadter's (2001) persuasive argument that analogy is the core of cognition and is basic to scientific speculation, invention and discovery (Hofstadter 2013:451-455), at least in the Western intellectual tradition but perhaps not in other Great Traditions. Ballonoff (2015) engages in further analogizing when he considers Hirshleifer's (1977) paper against the background provided of Alchian's (1950) paper on economics and evolution, and implicitly follows Pringle's (1951) paper on analogies between learning and evolution. These and many related works speculate on similarities, analogies, possibly isomorphisms without special reference to substantive matters. Hofstadter (2013: 451-455) argues that perceiving and pursuing analogies between substantively remote entities and events are keys to doing creative science.

I conclude my Response with an analogy of my own, building on Banks' Comment and based on material taken directly from the "distributed computing" entry in Wikipedia, 1 January 2016. Think simultaneously of the Australian Aboriginal Dreamtime as a truly extraordinary human creation and as a unique and enormous distributed computing system. While there is no single definition of a distributed computing system, the following defining properties are commonly used:

- There are several autonomous computational entities (people, computers, nodes) each with its local memory.
- The nodes communicate with each other by passing messages (talking, etc.).
- The structure of the system – its network topology, network latency, number of nodes - is not known in advance.
- The system may consist of different kinds of nodes (ancestors, humans, animals, Countries) and network links (languages), and the system may change (through time and space) during the execution of a distributed program.
- The system has to tolerate failures (ultimately deaths) in individual nodes.
- Each node has only a limited, incomplete view of the system, and may know only part of the input.
- No special nodes manage the network; all responsibilities are uniformly divided among all peers.

This is a fair description of the structure and operation of the Dreamtime, and its transmission through the millennia, with no reference to its extraordinary content in any form: texts, music, dance, images, sculptures. With the aid of Banks' analogies, perhaps my paper will help you to imagine the lives of Alyawarra infants as they are born into this "cognitive space" as unique individuals.

References

Alchian, Armen A. 1950, Uncertainty, evolution, and economic theory. *Journal of Political Economy* 58(3):211-221. Reprinted in Armen A. Alchian, *Economic Forces at Work,* 15 (1977).

Ballonoff, Paul, 2015. Comment on Denham, "Alyawarra kinship, infant carrying, and alloparenting". *Mathematical Anthropology and Cultural Theory* 8(5):1-5.

Banks, Robert, 2015. Comment on Denham, "Alyawarra kinship, infant carrying, and alloparenting". *Mathematical Anthropology and Cultural Theory* 8(3):1-6.

Burling, Robbins 1964. Cognition and Componential Analysis: God's Truth or Hocus-Pocus? *American Anthropologist* 66(1):20-28.

Castells, Manuel, 9 May 2001. Identity and change in the network society. Interview with Harry Kreisler, *Conversations with History*, Institute of International Studies, University of California at Berkeley; University of California Television.
Video: http://conversations.berkeley.edu/content/manuel-castells.
Transcript Part 4. http://globetrotter.berkeley.edu/people/Castells/castells-con0.html

Castells, Manuel 2009. *The Rise of the Network Society.* Wiley-Blackwell.

Darwin, Charles 1872/1962. *The Origin of Species by Means of Natural Selection*, 6th ed. Foreword by G.G. Simpson. New York: Collier Books.

Denham, W.W. 2014. Asymmetrical marriages in Aboriginal Australia: an annotated bibliography On-line at:
http://www.culturalsciences.info/AlyaWeb/public/dir/03ePst/WD2013_AsymetricMarBiblio.pdf

Denham, Woodrow W. 2015. Alyawarra kinship, infant carrying and alloparenting. *Mathematical Anthropology and Cultural Theory* 8(1):1-101.

Gammage, Bill 2011. *The Biggest Estate on Earth: How Aborigines Made Australia*. Sydney: Allen and Unwin.

Hamilton, Annette 1971. The equivalence of siblings. *Anthropological Forum* 3:13-20.

Hamilton, W.D. 1964. The genetical evolution of social behavior, I and II. *Journal of Theoretical Biology*, 7:1-16 and 17-52.

Herlosky, K.N., E.M. Brogden, C.Y. Franco, A.N. Crittenden 2015. Commentary on Denham's, "Alyawarra kinship, infant carrying, and alloparenting". *Mathematical Anthropology and Cultural Theory* 8(2):1-9.

Hewlett, B.S and Lamb, M.E. 2005. *Hunter-Gatherer Childhoods.* New Brunswick, NJ: Transaction Publishers.

Hirshleifer, Jack 1977. Economics from a biological viewpoint. *Journal of Law and Economics*, 20(1):1-52.

Hofstadter, Douglas R. 2001. Analogy as the Core of Cognition. In: *The Analogical Mind: Perspectives from Cognitive Science*, Dedre Gentner, Keith J. Holyoak, and Boicho N. Kokinov (eds.). Cambridge MA: The MIT Press/Bradford Book, pp. 499-538. Presented as Stanford Presidential Lecture in the Humanities and Arts, February 6, 2006. http://prelectur.stanford.edu/lecturers/hofstadter/analogy.html

Hofstadter, Douglas R. 2013. *Surfaces and Essences: Analogy as the Fuel and Fire of Thinking*. New York: Basic Books.

Hrdy, Sarah B. 2009. *Mothers and Others.* Cambridge: Harvard University Press.

Hrdy, Sarah B. 2016. Development plus social selection in the evolution of "emotionally modern" humans. In Meehan C.L. and A.N. Crittenden, eds. *Childhood: Origins, Evolution and Implications.* University of New Mexico Press.

Kagan, Jerome, Nancy Snidman, Doreen Arcus, J Steven Reznick 1994. *Galen's Prophecy: Temperament in Human Nature.* New York: Basic Books.

Kropotkin, Petr 1902/1955. *Mutual Aid: A Factor of Evolution.* Boston: Porter Sargent Publishers.

Lehman, F.K. 2015. Comments on W. Denham's, "Alyawarra kinship, infant carrying, and alloparenting". *Mathematical Anthropology and Cultural Theory* 8(4):1.

Malthus, Thomas 1798/1970. *An Essay on the Principle of Population.* Edited by Anthony Flew. Penguin/Pelican Books.

McConvell, P. and B. Alpher, 2002. On the Omaha trail in Australia: Tracking skewing from east to west. *Anthropological Forum* 12(2):159-175.

Pringle, J.W.S. 1951. On the parallel between learning and evolution. *Behaviour* 3(3):174-215.

Radcliffe-Brown, A.R., 1931. The social organisation of Australian tribes. *Oceania* 1:1-124.

Shields, W. M. 1982. *Philopatry, Inbreeding, and the Evolution of Sex*. New York: SUNY Press.

Skinner, B.F. 1953. *Science and Human Behavior.* New York: Macmillan-Free Press.

Smith, Adam 1759/2010. *Theory of Moral Sentiments*. New York: Penguin Classics.

Smith, Adam 1775/2003. *The Wealth of Nations.* New York: Bantam Classics.

Stack, Carol 1974. *All our Kin.* New York: Basic Books.

Tax, SoI (1955) Some problems of social organization. *In Social Anthropology of the North American Tribes.* Fred Eggan, ed. pp. 3-34. Chicago: University of Chicago Press.

Tinbergen, N. 1963. On aims and methods of ethology. *Zeitschrift für Tierpsychologie* 20:410-433.

Waldman, Bruce 1988. The ecology of kin recognition. *Annual Review of Ecology and Systematics* 19: 543-571.

Wilson, E.O. 1975. *Sociobiology*. Cambridge: Harvard University Press.