

# Speculation on the evolution of the Nyoongar hunter-gatherer family system

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**Abstract:** Recently, a small team of Nyoongar and non-Nyoongar researchers applied a dual lens methodology to explore *moort*, the traditional hunter-gatherer family of the local Aboriginal Nyoongar people. An integrated system of seven most valued behaviours emerged. These are: *Danjoo maam yok winni rak kardip* (mutual gender respect), *moiety* (inbreeding prevention), *kooboorn* (totems), *moran* (kinship), *boodiya* (Eldership), *kallip* (knowledge of people and land), and *dalbarbak koolangarra* (honouring of children and childhood). In this paper, we explore the earliest adaptive functions of these behaviours. A comprehensive review of evolution was undertaken, searching for what contributed to the need for, and capacity to meet each behaviour. We found that these behaviours made significant contribution to the egalitarian, cooperative, sustainable and rich cultural nature of Nyoongar hunter-gatherer society.

**Keywords:** Nyoongar, family system, hunter-gatherer, evolution, egalitarian

## Introduction

Nyoongar people are the first inhabitants of the southwest corner of Western Australia. The earliest evidence of their occupation is 48,000 years old (Turney et al 2001). Nyoongar people believe, and the government accepts,

that occupation since is unbroken (Noongar Recognition Act 2016). *Moort* (family) is an encompassing system guiding behaviours and relationships between Nyoongar people, land and its ecological systems. Recently, a group of Nyoongar and non-Nyoongar researchers used a dual lens methodology to explore *moort*. An integrated system of seven most valued behaviours emerged from this work; *danjoo maam yok winni rak kardip* (mutual gender respect), *moiety* (inbreeding prevention), *kooboorn* (totems), *morán* (two-fold kinship system), *boodiya* (Eldership), *kallip* (knowledge accretion), and *dalbarbak koolangarra* (honouring of children and childhood). The seven behaviours of *moort* are specific to Nyoongar people. While many other Australian first nations and hunter-gatherer communities elsewhere share or once shared comparable or related belief systems, we do not imply that this is universal. In this paper we explore the evolutionary origins of these behaviours.

To do so, we build on previous work (Robertson et al 2019b; 2021) which brought together a research team consisting of Nyoongar, other Aboriginal and non-Aboriginal academic researchers from various fields including botany, epidemiology, linguistics, evolutionary biology, family and heritage, all with an abiding interest in the deep history of the human presence in Australia. This research was largely funded and led by the Kurungkurl Katitjin, Centre for Indigenous Education and Research at Edith Cowan University in Western Australia.

The present work is by a subset of the original research group. Curiosity drove us to explore the earliest adaptive functions of *moort* behaviours. A comprehensive review of evolution was undertaken, searching for what contributed to the need for, and capacity to meet each behaviour. Each of the behaviours was identified in *Homo sapiens* before the earliest evidence of occupation in Sahul (the older Australian landmass), which, according to the latest estimates, was between 65 and 80 kya (Clarkson et al 2017). It is important to note that some elders stated in interviews they believed they evolved in Australia. The Nyoongar creation story talks of the spiritual presence of the ‘carers of everything’ before they became human children (Nannup 2006). Likewise, a child’s presence is dreamed into being before conception (Nannup 2013 pers comm). Echoes of such a difference in the understanding of human origins in Australia, home grown or immigrant, can also be seen in the two models put forward by archaeologists, regional continuity or replacement, which are not, argues Pardoe (2010), irreconcilable.

For the purposes of the research, the human family is understood to be a constellation of people joined by blood, contract or love. Its primary function

is the continuance of a recognised lineage. Family is an organic system with dynamic interdependent parts, ever regenerating in a constantly emerging ecology. There are two parts to the family system: the family nucleus (mother/father/offspring) and its context. The nucleus is intimate and generates its own story of how mother/father came together and conduct their relationship, how children are conceived and raised, relationships between siblings, and how children leave the nucleus. Thus, each family has a unique internal temperament, generated by the coalition of personalities as they respond to each other, to the pressures of purpose and the local ecology. Consequently, family is at the core of individual and group identity and belonging and contributes to the quality of life in the future.

Family context concerns its economic and social niche within the ecology and the community: how, as an economic unit, the family collects resources to support itself in the present and for the future, and how, as a cultural entity, it expresses itself in the physical, social and cultural environment. Family context is also about the nucleus as a reflection of the zeitgeist concerning, for example, how the genders perceive each other, regard for children and elders, and social status. Family therefore is a vehicle for both a genetic and cultural transmission (Palmer & Coe 2020).

## Methodology

The *moort* research used a dual lens, also known as a two-ways, approach in which a theme is explored simultaneously through traditional Aboriginal and contemporary social and natural science perspectives. Two-ways learning/teaching was first developed by Pincher Nyurmiyarri in 1976, who sought to incorporate traditional and contemporary knowledge in the classroom. This innovative and constructivist approach, built around principles of negotiation and action research, was integrated into teacher education curriculum in the Northern Territory (Ober & Bat 2007:73). At Kurungkurl Katitjin, *koodjal djining* (looking both ways) is used as a participatory action approach to research and teaching that explores themes looking simultaneously through traditional Nyoongar and modern contemporary western lenses, searching for resonances that can support both communities going forward together (Robertson et al 2017). At Kurungkurl Katitjin researchers needed to overcome challenges concerning differences between traditional Nyoongar and contemporary western understandings about the expression of knowledge, the concept of time and the value of memory. Additionally, principles were developed

concerning the enrolment of Nyoongar people in the process of research (Robertson et al 2017).

To describe *moort* the research team firstly conducted a search of published and grey literature produced by Nyoongar people and early settlers. This included traditional stories relating to family life. From this a faint word portrait of pre-settlement family life began to emerge. This material was shared in quite lengthy and often multiple interviews with over 30 Elders and older Nyoongar people. Most were born in the bush and spoke Nyoongar as a first language. They were invited to participate through a targeted word of mouth (bush telegraph) campaign conducted predominantly by Elders in residence at the university. Once formal consent processes were concluded, they were provided with the preliminary findings and invited to share their reflections. These were recorded, returned and often revised and refined by the Elder. Material that was suitable for the project was subjected to further consent for use in publications. Thus, the Elders were crucial in the articulation of the seven values.

More recent Nyoongar experience of *moort* was collated from a further 20 semi-structured in-depth interviews with thriving Nyoongar families in both urban and rural settings, where it was discovered that the seven values remain profoundly significant (Robertson et al 2021).

The *moort* project used a principled process bringing together contemporary psychological, anthropological, legal and social theory, alongside traditional Nyoongar knowledge: 'In koodjal djining co-operative enquiry and participation action research techniques are used to establish the principle of collaboration and a process of persistent reflexivity between the knowledge sets' (Robertson et al 2017:286).

Through the research process we found that the most valued behaviours originated in the dreamtime and were crucial in sustaining life and culture during the Last Glacial Maximum (LGM), which western Sahul experienced as a 10 ky drought and again when the landmass was significantly reduced during the sea level rises associated with deglaciation between 15 and 7 kya (Robertson et al 2019b).

The search for the evolution of the seven behaviours was undertaken in two stages. Firstly, each most valued behaviour was refined to an underpinning concept, for example, mutual gender respect was refined to gender relations. This was not to detract from or devalue *moort*, but rather to understand its existence prior to the arrival and formation of Nyoongar people and culture on their *boodja* (land). The second stage was a comprehensive review of human evolution using several lenses: 1) an exploration of each non-human higher

primate, then each hominin, looking particularly for what was known about social and familial behaviours; 2) an exploration of the archaeological record and what it suggested about hominin physical, social, and skill development, and geographic spread; and 3) an exploration of the many hypotheses about various aspects of human evolution, particularly culture and language. The review enabled the identification of each of the seven behaviours within their evolutionary context. This paper identifies each of these behaviours, exploring what contributed to the development of capacity and need for each element to evolve.

## Evolution of the family nucleus

The family nucleus is focused on care for offspring and pair bonding. Care for offspring, predominantly by mothers, is embedded in mammalian behaviour. It is an ongoing and primary factor in the survival of humanity. The relational context of this is described as attachment and includes a strong emotional component (Bowlby 1988).

Fisher (2016) saw pair bonding as a factor in the transition to bipedalism which necessitated the carrying of infants which slowed mothers down and made them more vulnerable to predators. If a dedicated male partner could offer a mother more food and protection a trade-off could be monogamy if they were unable to support more than one female and their children. However, Woodburn (1998) and Hawkes et al (2001) suggest that in hunter-gatherer groups meat is not the property of the hunter to distribute preferentially. Rather, it is the property of the group. Therefore, mothers did not directly benefit from being the bonded partner of a hunter. For Chapais (2013), monogamy appeared early in the hominin clade and was founded on high levels of paternal involvement. Hrdy (2011) points out that the role of fathers is variable; the presence of the child's grandmother, female kin or older daughters also affect survival (Sears & Coall 2011; Kramer & Russell 2015). In Hrdy's view, hunter-gatherers may have adopted a variety of mating systems including monogamy, polygyny and polyandry combined with proactive alloparents. It is this range of mating possibilities that makes it impossible to suggest when pair bonding having an emotional component extraneous to child raising developed or became an anticipated aspect of maturity. This paper focuses of the context of the family system.

## Seven behaviours of *moort*

The seven most valued behaviours comprise an integrated family system (Table 1):

- *Danjoo maam yok winni rak kardip* (mutual gender respect) is an extension of gender specialisation inherent in the hunter-gatherer economy. Nyoongar people were hunter-gatherers although they did plant grains and yams and undertook aquaculture (David et al 2006). This is extended to men's business (typically land) and women's business (typically fertility and family);
- *Moiety* (inbreeding prevention) means the community is divided into groups and marriage between members of the same group is forbidden. Elders assign a moiety to each child at birth;
- *Kooboorn* (totems) is the expression of the moiety system, typically by an animal. Other totems may also be given which confer lifelong responsibilities for a plant or animal;
- *Moran* (kinship) specifically refers to two factors; firstly, siblings are ranked with cousins and secondly, inter-*moort* marriage extends access to resources for both families;
- *Boodiya* (Eldership) concerns a seven-djoowak process. The closest English concept of *djoowak* is generation but *djoowak* in this context does not refer to the time in which a child passes from birth to adulthood, which in Nyoongar is approximately 19 years. Rather it refers to seven stages of a life history, each stage being 15 years: The eldership system is also a way of holding and building onto knowledge. Any group of elders represents a massive memory bank not just of their lifetime but also of those who preceded them;
- *Kallip* (knowledge of people and land) is the amassing and preservation of knowledge about people and their environment and its ecological systems. The objective of *kallip* is to live sustainably. Knowledge is remembered and expressed through culture, story (often as metaphor), artefacts, dance, music and art; and
- *Dalbarbak koolangarra* (honouring of children and childhood) is a significant part of the second story of the creation trilogy which places children as the future 'carers of everything' (Nannup 2006). Childhood is understood to be a special place with its own strengths and vulnerabilities. There are four stages of childhood: *koolanga nganiak moonang* (the child

who is carried), *koolanga nganiak djakarra gel* (the child who is walked with), *mirding kannow koolangarra* (the third stage of childhood) between second and third molar eruptions, and adolescence, completing at 19 years (Robertson et al 2021:15–26).

For the purposes of this project the seven behaviours derived from the values and examined in the review of evolution are:

- 1) gender specialisation creating the hunter-gatherer economy of males hunting and woman gathering, predicated on sharing;
- 2) a recognition of the need to prevent inbreeding;
- 3) symbolic representation to communicate a genetic marker;
- 4) a two-fold kinship system informing relationships and resource sharing;
- 5) longevity as a facet of governance;
- 6) knowledge accretion;
- 7) long childhood.

Table 1 Summary of the most valued behaviours in *moort* and underpinning behaviours reviewed in this paper

| Most valued behaviours in <i>moort</i>                             | Underpinning behaviours  |
|--|--|
| <i>Danjoo maam yok winni rak kardip</i> (mutual gender respect)    | Gender specialisation creating the hunter-gatherer economy of males hunting and woman gathering, predicated on sharing |
| <i>Moiety</i> (inbreeding prevention)                              | A recognition of the need to prevent inbreeding  |
| <i>Kooboorn</i> (totems)   | Symbolic representation to communicate a genetic marker  |
| <i>Moran</i> (kinship)   | A two-fold kinship system informing relationships and resource sharing   |
| <i>Boodiya</i> (eldership)   | Longevity as a facet of governance   |
| <i>Kallip</i> (knowledge of people and land)                       | Knowledge accretion  |
| <i>Dalbarbak koolangarra</i> (honouring of children and childhood) | Long childhood   |

## Evolution of seven behaviours of the Nyoongar hunter-gatherer family

The seven behaviours of the Nyoongar hunter-gatherer family system evolved prior to human arrival in Sahul. Therefore, the following description needs to be commensurate with contemporary theories concerning earlier hunter-gatherers



which are typically described across many branches of archaeology and anthropology as egalitarian, cooperative, sustainable and participating in symbolic and culturally activities.

### ***Gender specialisation***

The co-evolution of a cluster of factors including bipedalism, encephalisation and its sequelae, and the impact on the architecture of the pelvis brought problems for which gender specialisation became an adequate solution.

The fossil evidence suggests running, both to escape being preyed upon, and to catch prey, was part of the hominin repertoire by approximately two million years ago (Bramble & Lieberman 2004). Pickering & Bunn (2007) feel it was more likely to be tracking. Persistence running, or tracking, specifically facilitated an increased consumption of meat. Hominins chased or tracked their prey to bring the animal to heat exhaustion and death. Lieberman et al (2009:77–92) examined this practice in detail and found it efficacious, having a relatively high success rate and a relatively low metabolic cost. Running or tracking is typically associated with male behaviour; however, Ocobock & Lacy (2023) argue that females are as good, if not better, over marathon-length distances.

Running or tracking enhanced access to meat which improved nutrition, supporting encephalisation (Schulkin 2016). This is reflected in changes in relative brain size over time; the brain of *Homo habilis* was 1.7% of body weight. *Homo heidelbergensis*' brain was 1.9% of body weight. *Homo sapiens*' brain is 2.2% of body weight (Blaxland & Dorey 2018).

Running also had an impact on the architecture of the pelvis (DeSilva & Rosenberg 2017). Bipedalism may have created birthing problems, and recent research indicates that in the pre-Homo hominins, particularly *Australopithecus sediba*, it was locomotor rather than obstetric needs that 'drove the emergence of the basic Homo pelvic bauplan' (Kibii et al 2011:1411). Further adaptations included a narrower birth canal which evolved in *Homo habilis* 2 mya (Stearns & Medzhitov 2015). Gunstra et al (2023) suggest other factors such as pelvic floor stability and thermo-regulation may have also contributed to birthing problems. These changes affected the process of birth and nature of the neonate.

DeSilva and Rosenberg (2017) suggested birth became risky and painful and that an assistant was beneficial because the mother could not see what was going on. In other primates, mothers give birth alone to forward-facing infants. It was perhaps this meeting of the needs of the new mother that some



think underpins prosociality in hominins (Hill & Hurtado 2009). A trade-off for a larger brain was a neonate that was less mature at birth; Leakey (2008) suggests that if a human neonate arrived at a similar level of development as a chimpanzee neonate it would have been in utero for 21 months. Continued brain growth after birth meant neonates needed considerable care and attention for several years which is not compatible with persistence running. Consequently, in many societies, females, particularly those who were pregnant or with infants at the breast, gathered nuts, berries, eggs, reptiles, and other smaller resources enabling them to move more slowly (Hrdy 2011). It is likely there was variation in sex-specific foraging. Marlowe (2007) suggests when tools were used and expertise developed, relative sex specific advantages crystallised.

If, as Marlowe (2007) suggests, sex-specific foraging led to sex-specific expertise concerning tools, we think this may have increased the range and perhaps volume of food. Another behaviour, cooking, almost doubled the value of any biome. For example, cooked starch gives more than 30% more energy, and cooked meat renders a higher protein value (Carmody et al 2011). There is evidence of structured hearths and cooking from 780 kya (Ya'aqov 2012). It is impossible to tell whether males or females were doing the cooking. We suggest it is possible that any group with sex-specific resource acquisition and cooking significantly increased the range and value of their diet and could support a larger population.

Traditionally, a Nyoongar man has a *ketj-ketj* (spear) and other tools and a Nyoongar woman has a *warnu* (digging stick) and a *yandi* (a vessel). Both men and women may be involved in catching small animals and fish (Robertson et al 2021:21). Elders interviewed indicated cooking was a shared rather than gender-specific activity. Both genders may carry a *karlmatta* firestick, although the collecting, grinding and cooking of seeds was typically done by women. For Nyoongar people, as for most other Aboriginal groups in Australia, an important aspect of sex-specific resource acquisition is *walluk yonga* (to share) around *ngala kala* (our campfire).

### ***Inbreeding prevention***

We consider how the need for new inbreeding prevention strategies emerged in early *Homo sapiens* and what capacities were developed which could be used to meet this need.

Other higher primates have inbreeding prevention strategies. For example, Morrison et al (2023) identified multiple inbreeding avoidance strategies in wild mountain gorillas including 'familiarity-based mechanisms of kin identification

and age-based avoidance that limits mating between fathers and daughters in their natal group' (Morrison et al 2023:1). Stringer (2016) places the origin of *Homo sapiens* in the African late middle Pleistocene and describes their expansion across various ecologies. Aiello and Dunbar (1993) and Dunbar (2003) suggest early *Homo sapiens* can be associated with larger socially bonded groups, with increasingly complex technology, and with the exploitation of multiple ecologies. This suggests to us an increasing capacity to solve problems incurred by new contexts. Obviously, larger groups needed a wider range; perhaps persistence running or tracking prey brought *Homo sapiens* into new territory which enabled the discovery of further resources. Larger groups needed either to split and disperse or develop a mechanism for maintaining group size (Dunbar 2003). We suggest that consequently, even though individuals dwelt at a distance from each other, they may have been significantly interrelated. Inbreeding prevention strategies such as those described by Morrison (2023) above which relied on familiarity would no longer be effective, confronting early humans with the need for a new strategy to prevent inbreeding.

We suggest that to develop such a strategy required a capacity to imagine the potential offspring of a proposed breeding pair, to think ahead and to act together to affect others. The capacity to imagine a possible outcome of action was demonstrated in the making of Acheulean tools, particularly the production of biface technology which can be seen in the archaeological record sparsely from 1.95 mya (Mussi et al 2023) and more frequently after 700 kya (Cole 2015; 2019). The completed tool had to be imagined before it was made. Foley and Gamble (2010) saw a connection between the capacity for this complexity of tool making and other areas requiring intentional gazing, that is, looking at something to visualise what is possible, and called it the 'Acheulean gaze'. Thinking ahead can be seen in the transportation of tools. By 300 kya obsidian as a raw material for knapping was carried over 50 km in Kenya (Brooks et al 2018).

Rappaport (1999) suggests ritual may have developed as a (sometimes) non-instrumental, conventional, performative method of communicating individual intentions towards cooperative actions. Lang and Kundt (2023) suggest pre-symbolic communication ritual can indicate similarity (shared interest), coalition (initiation into the group or initiation into adulthood) and commitment (expression of obligation). Signals concerning the latter can include 'painful body modification' (Lang & Kundt 2023:4). This may be seen in the archaeological record, such as missing finger segments on hand stencils in Europe from 27 kya (McCauley et al 2018). Other body modifications include

scarring and tattooing; Ötzi, who died between 3239 and 3105 BC, was found bearing 61 tattoos (Bonani et al 1994).

Commitment, ritual, and thinking ahead indicates a capacity for shared intention to act and to bring the requisites to perform the act. Lang & Kundt (2023:11) argue that collective ritual:

would further co-evolve with symbolic communication such that conventional norms around resource sharing, mating, exchange, fighting, teaching, and stone-tool production would regularly co-occur with signals of commitment to those norms. Ritual's function would be further enhanced by taboos, permanent markers (e.g. scarification), and similar ritualized practices associated with collective action. (Lang & Kundt 2023:14)

Ritual remained a way in which hunter-gatherers mediated relationships with place, helping them cope in variable environments (Maape 2020).

Watts (2022) notes that the development of campfires implies new levels of trust within groups and by 160 kya a move from sporadic to habitual use of red ochre. Watts et al (2016) suggest red ochre was used for ritual display. Knight (1991) and Power (2019) make the case for ochre use by women to simulate menstruation as part of a collective strategy to resist or confuse would-be dominant males attempting to monopolise imminently fertile females. Males would have been interested in menstruation because it denoted imminent fertility. They may have favoured menstruating women with provisioning because it may have led to pair bonding. If all females appeared to be menstruating, because of the use of ochre, they were able to select and reward the males they wanted, ie those prepared to invest in childcare.

If, as the material in this section suggests, larger groups of hunter-gatherers spread over a wider area, previous inbreeding prevention strategies relying on familiarity may no longer have been reliable. We suggest that another mechanism emerged which co-opted the capacity to predict outcomes of behaviour, to think ahead and to make ritual display. If females were able to act in a group to fool males about menstruation as Knight (1991) and Power (2019) suggest, then they may also have been able to act in a group to convince females and males about a signal such as scarification that made mating with another taboo or acceptable. Another and perhaps much later inbreeding prevention strategy is discussed in the next two sections.

### ***Symbolic representation***

We now consider how the inbreeding strategy *moiety*, symbolically expressed through totems used by Nyoongar people, may have emerged. Moiety means the community is divided into groups and marriage between members of the same group is forbidden.

The Nyoongar community has been relatively small and interrelated thus it was essential for female elders to know the bloodline of the parents, grandparents and great grandparents to assign the right moiety. ‘Traditionally Nyoongar people trace blood descent through the mother or the father. The totems Manitch (white cockatoo) and Wardong (crow) represent the matrilineal kinship groups. There are four subsidiary groups: Tondarriik, Didarrik, Ballaruuk and Naagaruuk. People cannot marry within the same kinship group. To do so puts them outside the lore’. (Nannup in Robertson et al 2021:15)

Humans travelled from Africa 100 kya and arrived in Sahul between 65 and 80 kya (Clarkson et al 2017) possibly using the route known as the Southern Arc (Balme et al 2009).

Evidence of symbolic marking is present early in human occupation in Sahul with diverse regional art traditions in Kakadu, the Kimberley and Arnhem Land earlier than 30 kya (Kuhn et al 2001). It is not known why symbolism flourished at that time although population density has been proposed (Kuhn et al 2001): personal markings were required to inform strangers, people who unlike family had no knowledge of one’s identity:

As a consequence, we might expect ornament technology to arise first where the chances of meeting strangers, and the benefits of advertising one’s identity and status from afar, were relatively high. (Kuhn et al 2001:7645)

We suggest that the need for inbreeding prevention strategies predates *Homo sapiens* and that strategies coevolved with *Homo sapiens*’ emerging capacity for ritual and symbolic expression. This is in the context of recent arrival in Sahul and rapid population expansion and dispersal (Hiscock 2008). We suggest that a scar, made at birth, of a particular shape or in a particular place on the body may have been used because it is lifelong and cannot be erased. This indicated at first contact whether a male and female were compatible for breeding. Obviously, it cannot be found in material evidence, but it has a long history in Indigenous communities across the globe (Garve et al 2017). Although this is a rather wide speculation, it is worth noting that the oldest material evidence probabilistically postdates earliest occurrence of a behaviour – and symbolic representation could be substantially more ancient than is the existing evidence.

*Moiety* is an unchanging aspect of identity, but breeding status may vary over life. Ochre, or other body adornments, provides a temporary opportunity to demonstrate availability. This behaviour appears to be universal in societies where men and women can mingle freely; for example, in contemporary Australia a wedding ring indicates an existing commitment. In the vast body of art in Arnhem Land (Northern Territory, Australia) there is a preponderance of drawings of females, many of them widows (symbolised by tassels on the elbows) of childbearing age (symbolised by menstrual blood between her legs). Depositions of bones on *Owan Barna* (Mount Borradaile) in Arnhem Land indicate the use of ochre to denote status of the deceased (Hunt et al 2016). The pathway to symbolic representation may have been scarring to identify *moiety*, a permanent feature, then ochre on the body to express breeding status, a changing feature.

Nyoongar land is at the other side of the country from Arnhem Land, and where earliest evidence of occupation is 48,000 years old (Turney et al 2001). By such time, we suggest, populations were settled and mechanisms to manage the relationship between population size and available resources are being developed. The transition to animal totems to symbolise *moiety* may have occurred with the addition of responsibilities for that animal such as not eating it and ensuring its ecological niche is preserved. Also, we suggest, the transition to animal totems may have enabled scarring to be reserved for initiation rites, particularly rites symbolic expression of passage.

### ***Kinship***

Very little evidence of violence has been found among hunter-gatherer remains. It may have been that the capacity for sharing developed through gender specialisation and cooperation required for persistence running or tracking supported an egalitarian social structure. Boehm (2014) and Wrangham (2018), theorising about the absence of violence in early hunter-gatherer societies, suggest that proactive aggression (planned, intentional) was used by males to kill males demonstrating high levels of reactive (unplanned) aggression. Conversely, Knight (2008), based on the previously mentioned female coalitions to, for example, encourage males to provision children and their mother, claims early human kinship was matrilineal.

Here, we contend, that the adaptation of a two-fold kinship system, in which siblings are ranked with cousins and inter-*moort* marriage extends access to resources for both families, also helped to maintain egalitarianism. Ranking cousins with siblings helps to prevent inbreeding because offspring are raised

collectively. Children raised together are less likely to be attracted as pair bonds (Westermarck 1922; Shepherd 1971), and this is particularly the case if an incest taboo is also operant (Shor & Simchai 2009). Ranking cousins with siblings prevents the emergence of dynasties, for example, in *moort*;

the third generation, which coincides with third and fourth djoowak, is kabarli (grandmother) and moyran (grandfather) have responsibilities for the children of their sons and daughters and the children of their sisters' and brothers' sons and daughters. Consequently, if they are invited to take an eldership position, they have little need to invest solely in their own offspring and are perhaps more likely to invest in what is best for the community. (Nannup in Robertson et al 2021:17)

Kaplan et al (2009:3292–3293) suggest these 'relatively egalitarian, dominance-free social relationships' are the result of long childhood, sex-based complementarity in skill acquisition in both production and reproduction, risk-reduction and cooperative resource pursuits and monogamous pair bonding, the importance of voluntarily cooperating partners and the difficulties of defending foraging territory. Pair bonds needed the support of the family group. Individuals needed to pair bond with those living outside the group to prevent inbreeding. When pair bonding also extended mutual rights of families to share in resources, then each family extended the bounds of neighbourliness. Kaplan et al (2009:3293) also suggests:

These social ties produce the basic unit of human social organization: small-scale bands or residential clusters of nuclear families, related through consanguinal and affinal ties, and engaging in cooperative production, altruistic provisioning, and reciprocal sharing in the relative absence of dominance. We refer to this as the evolved modal human social organization, since we propose that most human social groups over the last several tens of thousands of years lived this way.

Although we agree with Kaplan we would not use the term nuclear family in this context, which we understand to have evolved later, and which was forced on Nyoongar people from the 1950s as part of the assimilation programme (Robertson et al 2021).

### ***Longevity and governance***

For the purposes of this project, governance concerns systematic social organisation with rules governing behaviour particularly in times of uncertainty or potential conflict. Larger groups in the context of larger populations probably led to the need for some form of governance. We suggest a longer lifespan probably contributed to the emergence of governance producing a



small group within the community who were older and thus had more experience.

An extending lifespan is not in doubt. Wild chimpanzees live about 15 years (Hill et al 2001). Hunter-gatherers such as Hiwi, Ikung, Ache and Hadza have a life expectancy of approximately 72 years (Gurvan & Kaplan 2007). Whilst there is an extension in all phases of life, the greatest change is the development of life after childbearing, initiated by the evolution of menopause. It is hypothesised that menopause provided females with a window of time without dependent infants and with greater experience to contribute to future generations (Hrdy 2012). Extended post-reproductive lifespan and long childhood development appeared at roughly the same time in human history (Bogin 1997), potentially evolving together as a self-reinforcing unit (Carey & Judge 2001).

The emergence of prosociality is ancient. For example, *Homo erectus* acted beyond individual needs and cared for others without obvious reward (Haeusler et al 2013). Kessler et al (2018) suggest that this caring, which requires physical proximity, had additional survival advantages such as the capacity for infectious disease recognition, something, they posit, that did not require language.

There are a number of theories about how the capacity for governance may have emerged. The first concerns a reduction in violence. Boehm (2014) and Wrangham (2018), as previously mentioned, theorise that hominins domesticated themselves and this required language because it involved males of low fighting prowess cooperatively planning the execution of aggressive and domineering alpha males. By placing language rather than communication as a necessary component, Wrangham is perhaps suggesting that the phenomenon of self-domestication is a form of governance. Female coalitions to manage male behaviour suggested by Knight (1991) and Power (2019) do not require murder. Rather, they use sexual selection to avoid domineering males (Power et al 2013).

Other theories concern the evolution of a capacity for shared intentionality and fairness. Tomasello's work (2019; 2020) strongly suggests that governance as a normative force within relationships, based on fairness and reciprocity, could have been achieved without complex language. In contemporary *Homo sapiens*, the necessary skills for this emerge by three years of age. Engelmann and Tomasello (2019) have shown that by the age of three, there is shared intentionality which generates a tacit agreement about the rules of the partnership; each must fulfil their role, if one fails, they can be called out and exhibit guilt. At accomplishment, rewards are shared equally. Shared intentionality requires and develops respect, fairness and normative self-regulation and requires and develops understanding of different perspectives. Tomasello (2019) believes that by the age of two years individuals understand there are different perspectives.



Central observations in Tomasello's work are that the capacity for shared intentionality develops much earlier than in other primates. He interprets these traits to be indicative of the social context (cooperative breeding). By seeking to share psychological states (joint attention, collaboration) young children solicit care from adults (Hrdy 2011). The rewards for the child are huge: 50% of food eaten by young children (after exclusive breast feeding) is provided by people other than the mother (DeSilva & Rosenberg 2017). We make an addition to Tomasello's observations; by spending time with a multitude of adults, children extend their range of learning opportunities.

### ***Knowledge accretion***

Knowledge accretion involves the storage and expression of information recurrently over generations. Each of the behaviours of the hunter-gatherer family system generated information. For example, as this paper suggests, gender specialisation developed knowledge concerning birthing and more sophisticated tool making. The need for an inbreeding prevention strategy may have been associated with early symbolic representation. If proof of knowledge accretion were needed the use of fire is a clear example.

At first, fire was perhaps about warmth because of hair loss. There are, however, many theories concerning the loss of hair in human evolution: Hair loss has been associated with persistence running or tracking, thus exposing hominins to the cold (Dávid-Barrett & Dunbar 2016). Extra adipose tissue may have been some compensation, but it would have been insufficient as a physical adaptation particularly for infants who cannot thermo-regulate (Wells 2012). Roebroeks & Villa (2011) and Roebucks et al (2021) describe hominins in Europe in the Middle Pleistocene using fire for landscape modification. *Homo sapiens* further developed the use of fire for light, for protection, to preserve food, to control insects and to change the composition of various substances. Nyoongar people also use fire to communicate, to corral animals, and to modify the environment and prevent catastrophic fires (Harben 2008).

Knowledge accretion discussed in the previous two paragraphs can be understood in terms of refinements to practices that were maintained because they improved outcomes. It is not known when knowledge was first accumulated for the explicit purpose that it may be useful in the future. For Nyoongar people, *kallip* (knowledge) is stored in stories, with every story having multiple layers of meaning (Nannup in Robertson et al 2021). Elders hold the most stories and are memory banks containing all the elements of survival knowledge and culture. Some stories were sung:

When a Nyoongar was made an Elder they let a tress of hair on their head grow. When they died that tress would be cut and added to a djoorlib (hair belt) woven out of the hair of the elders that had gone before. This was many metres in length. When they made those journeys the elders would carry the djoorlib and work through it. Each tress represented a time and the time had a song and they sang that song as they walked. (Nannup in Robertson et al 2021:33)

Some stories, called songlines, are more spiritual in nature and can only be fully understood by elders:

A songline is a story associated with a journey made by one of the Spiritual ancestors. During this journey landscape and landmarks were formed, relationships were observed and established, mistakes made, lessons learnt, skills developed and the values of the community were reinforced. A songline has many meanings, for example. At one level a songline is a map; the story is embedded in the landscape. At another level a songline teaches values with wrong or right behaviour often resulting in the formation of a landmark. When that landmark is passed it is a trigger for retelling the story. (Nannup in Robertson et al 2021:33)

### ***Long childhood***

Childhood in this context is the period between birth and dispersal or first reproduction. The gradual extension of childhood in our antecedents is clear; for orangutans' dispersal is at 11 years of age and first birth is at 15 years, similarly to gorillas and chimpanzees (Wich et al 2009; Czekala & Robbins 2001; Hill et al 2001). Long childhood, particularly middle childhood, has only recently, through analysis of fossil jaws and teeth, been understood to be an exclusively *Homo sapiens* trait. Smith et al (2010) found that in chimpanzees first, second and third molars erupted at 58 days, 3.1 years, 6–9 years and 11–14 years respectively compared with first, second and third molar eruption in modern humans at 2.8 years, 6 years, 12–14 years, and 18–22 years respectively. Long childhood may not have been a feature of Neanderthal life history; Smith et al (2010) found that most Neanderthal tooth crowns grew more rapidly than modern human teeth, resulting in significantly faster dental maturation. In one example, although the Neanderthal child died aged eight years, there was wear on the second molars.

Blurton Jones and Marlowe (2002) note three theories concerning the evolution of long childhood: that it was co-opted for a long period of learning (Bogin 1997); is merely a facet of a longer lifespan (Charnov 2001); and that embodied capital will coevolve (Kaplan et al 2001). It is also understood

that long childhood may have evolved so that mothers could increase their reproductive rate by moving childcare from themselves after weaning to her mother (Bjorklund & Myers 2019).

Kuzawa et al (2014) suggest the slowing of body growth associated with long human childhoods enables brain volume to approach adult levels leading to a growth spurt in adolescence. Concomitantly, by middle childhood, prosocial norms have been acquired, and children's normative behaviours reliably match that of their cultural communities (House et al 2020:3).

Childhood is thus universally recognised as the period when culture is transmitted, in which the rules of human interaction and the relationship with the environment are established and when moral development occurs. Consequently, 'in these years the child is seen by societies throughout the world as a vessel into which knowledge, skill and tradition can be steadily and reliably poured' (Worthman 2011:281).

## Discussion

This paper traces the emergence of seven behaviours underpinning the Nyoongar hunter-gatherer family system: gender specialisation, inbreeding prevention, symbolic communication, a two-fold kinship system, longevity and governance, knowledge accretion and long childhood. When operating as an integrated system, these behaviours contribute to the egalitarian, cooperative, sustainable nature of Nyoongar hunter-gatherer society and their sophisticated cultural activities.

Egalitarianism is embedded in all behaviours. Everyone has a moiety, no moiety is more important than another, cousins are raised as siblings, and Eldership is based on merit not on inheritance, accumulated wealth or influence. Egalitarianism is perhaps most significant in gender specialisation; men are not more important than women. Gender specialisation only works when the genders bring back the results of their labours to be shared; a Nyoongar hunter-gatherer life is sustained through trust that resources are shared and through mutual respect for the knowledge and skills inherent in the different labours of men and women. If, as is the case within traditional Nyoongar families, women are in control of their fertility, then they typically have fewer children, providing them with a better quality of life. Fertility is controlled through a combination of late marriage and extended breastfeeding, sometimes up to six years, which also reduces competition between siblings (Robertson et al 2019b; 2021). In the pantheon of Nyoongar stories there are none about sibling rivalry.

Cooperation is particularly found in the two-fold kinship system. It is widely accepted that earlier hunter-gatherers maintained kin and social networks across long distances (Boyd & Richerson 2022). This supported the transmission, specialisation and recombining of cultural patterns (Derex et al 2018). Pair bonds of different families extends the cooperation between those families. The level of intergroup cooperation in the traditional Aboriginal context also concerns inter-relativity. Nyoongar *boodja* (land) is a triangle in a corner of land, surrounded to the west and south by ocean and to the east by desert. At certain times a group of young women travelled east to another group and Nyoongar people welcomed a group of young men from the north (Nannup 2013 pers comm). This ‘stirring’ of the gene pool probably extended across the country and meant everyone understood they were related at some level. Aboriginal people who are not known to each still call each other sister and brother.

We note that in Australia, cooperation with the land and its systems was and remains significant for many indigenous people who often see individual sickness as synonymous with sickness in the land. Nyoongar people call this cooperation ‘caring for country’. There are many other examples of the low impact of hunter-gatherers compared with contemporaneous others: Western hunter-gatherers arrived in Ireland approximately 10 kya, 4000 years later their ecological footprint was minimal (Warren et al 2014; Warren 2022). Yet within 600 years of arriving in Ireland 6000 kya, Neolithic people left a large and remaining ecological footprint including forest diminishment from slash and burn farming (Halstead 2017), blanket bogs on higher ground (Feehan & McIlveen 1997) as well as the monuments including New Grange.

Sustainability is inherent at every level of activity but particularly in the use of totems. Among most Aboriginal people a totem is typically an animal. This is not merely a genetic marker. In many places, totem holders are not allowed to eat their totem and have lifelong responsibility for the well-being of that animal and its ecological niche (Robertson et al 2021). Knowledge accretion, particularly about long-term climate patterns, was also a factor in sustainability. For example, Australia experienced the LGM (25–15 kya) as a 10,000-year drought. In Western Australia survival was limited to three known refugia, one of which was Nyoongar territory (Veth et al 2009). Populations fell by approximately 60% (Williams et al 2013), yet there is no evidence of famine or fighting. Aboriginal women interviewed for the *moort* research project talked of late weaning and of breastfeeding the infants of others when necessary. This pattern of late marriage and weaning sustained groups during times of resource scarcity. This may have supported survival during the LGM because late weaning adapts the child’s growth to the level of available protein. Even where

maternal nutrition is compromised, exclusively breastfed infants are less likely to be stunted or underweight (Kramer & Kakuma 2012). Over generations of compromised maternal nutrition, late weaning protects integrity, the child may be smaller, gradually adapting to diminishing resources (Kuzawa, 2005).

We suggest that bigger groups, resulting from increased meat consumption and high-value cooked food prompted the need for a kinship structure and for moiety. The latter led to the earliest symbolic representation, scarring to show moiety. Bigger groups, it is argued consistently in the literature, enabled innovation in living practices that led to culture:

the foraging niche and its components (pair bonding), multilocality, reduced hierarchies, extended kinship, high mobility, multilevel social networks and prosociality (beyond kin) are the explanation of the evolution of human unique cumulative culture. (Migliano & Vinicius 2022:4)

Cooking means a fire which becomes a central cultural feature, people being drawn to its warmth, light and by the smell of food. Satiated, people remain by the fire as night falls, the smoke protecting them from insects and perhaps setting the context for the earliest reflective conversation. It has remained a concept of home: the Nyoongar word for home is *ngala kala* (our fire).

Hunter-gatherers managed to occupy most ecologies of earth. Their journeys around and into Sahul are well evidenced (Kerwin 2012; Clarkson et al 2017; Robertson et al 2019a). What was particularly effective about the combination of the first six elements identified in the Nyoongar hunter-gatherer family system was its impact on dispersion and childhood. In the initial phase of dispersion, a family 'toolkit' was required. This contained a group with sufficient diversity to support a few generations of breeding if no outsiders were encountered and a sufficient age range ensuring that elders were able to bring knowledge and experience and youngsters their energy and strength. They also had to take a material toolkit, something with which to make fire and a set of stones from which biface tools could be made.

We speculate that when hunter-gatherers reached a place with no unpopulated horizon, as Nyoongar people did 48,000 years ago, they needed to find a way of maintaining a happy relationship between population and resources. The *moort* research indicates they did this by having children in sustainable numbers and by valuing and protecting the length of childhood. Children, in turn, were protected from inbreeding by the moiety and totem system (Robertson et al 2019; 2021). Clearly, Western hunter-gatherers in Ireland were also successful at finding the balance between population and resources and preventing inbreeding although it is not known currently how this was achieved. They

arrived in Ireland approximately 10,000 years ago and despite being a relatively small, isolated, population, 4000 years later they showed no signs of inbreeding (Cassidy et al 2016).

Long childhoods evolved because of the time needed to learn how to become socially adept linguistic beings, which is primarily inculcated in the family. Dunbar (2003), in extrapolating the 'social brain' theory, speculated that language developed from grooming. Language enables multiple individuals to be groomed at the same time, timesharing (grooming whilst doing other things) and the exchange of information about people and events occurring outside one's purview. Additionally, it allows for the collection of personal information about others (Dunbar 2003:174). Similarly, Kaplan et al (2001) articulated a theory that human life history co-evolved with four distinct characteristics:

an exceptionally long lifespan, an extended period of juvenile dependence, support of reproduction by older post-reproductive individuals, and male support of reproduction through the provisioning of females and their offspring. (Kaplan et al 2000:18)

It cannot be assumed that all hunter-gatherers followed the seven behaviours of the Nyoongar people. However we posit that, when integrated, the first six elements of the Nyoongar hunter-gatherer family system enabled the extension of childhood, which for Nyoongar people lasted for 19 years.

## Conclusion

The evolution of *moort*, the Nyoongar hunter-gatherer family system, involved the co-evolution of seven valued behaviours which this paper has discerned from speculated but trusted theories. The first, gender-specialised resource acquisition, was established by 800 kya or earlier (Migliano & Vinicius 2021). It is impossible to determine when men and women emerged as intimately bonded co-parents. Gender specialisation, particularly when combined with cooking, led to larger spreading populations and larger brains prompting the need for, and a capacity to, prevent inbreeding and develop a kinship structure.

The second behaviour, prevention of inbreeding, is answered by the third, symbolic communication. This research posits ochre use and scarring as early genetic identity markers or totems as an early form of symbolic representation. Other ornaments and/or ochre use on the body may have communicated current breeding status.



Kinship, the fourth behaviour, concerns the ranking of cousins as siblings, which over generations, prevents the emergence of dynasties. It also concerns pair bonding between people of different groups and the mutual access to resources. This established and maintained a precedence of sharing and cooperation rather than of acquisition and competition. Kinship networks based on these two factors supported egalitarianism, the hallmark of Nyoongar hunter-gatherer society.

Longevity and a higher birth rate are major contributors to the formation of larger groups needing some form of governance. In this fifth behaviour, longevity provides a group of older, more experienced members to provide governance. Tomosello's (2019) work indicates that governance as a normative force within relationships was achieved without complex language, as it is now with three-year old children.

The sixth behaviour, knowledge accretion, was not exclusive to *Homo sapiens* but significantly increased after 300 kya. *Homo erectus* was able to construct shelters (Saneda 2022) and to sail (Bednarik 1998), both of which required an accumulation of knowledge and the ability to extrapolate knowledge to new contexts. *Homo sapiens*, from the very beginning generated, communicated and refined increasingly large bodies of knowledge.

The last behaviour, long childhood, is exclusive to *Homo sapiens* and it particularly involves the extension of middle childhood. This is the time when children are imbued with the prevailing culture as they undertake formal and informal learning.

It is unlikely that *moort* is representative of all hunter-gatherer family systems but many of its valued behaviours may have supported the gradual expansion of *Homo sapiens* across the globe. The cooperation inherent in its kinship and governance, according to Ambrose (2003), enabled it to survive climate change during the LGM and particularly abrupt climate change incurred by major volcanic eruptions (Golovanova et al 2010). The hunter-gatherer family, as far as it is known, was the singular family system globally until after the end of the LGM in Europe. It continued in many areas, gradually succumbing to colonisation until it remains in only a few areas.



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