Soundscapes of infant care and infant-directed communication in two hunter-gatherer societies

Jerome Lewis[1], Ingrid Lewis[2], and Fabia Franco[3]

[1] University College London, Department of Anthropology

[2] Independent Researcher

[3] Middlesex University London, Department of Psychology

Address for correspondence: jerome.lewis@ucl.ac.uk

Keywords: infant-directed register, soundscape, hunter-gatherer childcare, BaYaka, Maniq

Running head: soundscapes of infant care

Soundscapes of infant care and infant-directed communication in two hunter-gatherer societies

Abstract

This study contributes an ethnographic perspective to the study of infant-directed (ID) communicative activities. We compare soundscapes of infant care and infant-directed vocal communication in two egalitarian, forest-dwelling, mobile hunter-gatherer groups: Mbendjele BaYaka/Aka in Northern Congo-Brazzaville with the Maniq of Southern Thailand. Across the unique patterns of speech and song specific to these different cultures, common threads emerged in infants' soundscapes that suggest the centrality of musically enriched ID-speech for communication with infants. A conspicuous under elaboration of music among Maniq people suggests that while musical activity in a culture may vary greatly, ID-speech does not. The ID speech register thus emerges as more central to childhood socialization and development in these hunter-gatherer societies than does the ID song register. Although the use of lullabies (ID song) by mothers has been claimed to be a human universal (Trehub 2001, Mehr et al 2019) the ethnography from these hunter-gatherer societies supports Takada's (2020: 139-142) conclusion that ID speech and song demonstrate important cultural diversity. This paper contributes to ethnographic accounts of the diversity of ways that cultures organize communicative exchanges with children.

1. Introduction

Using a dual-lens approach from anthropology and developmental science, we compare the soundscapes of infant care and infant-directed (ID) communication in two egalitarian hunter-gatherer groups from Central Africa and Southeast Asia.

The study of the ID-register in Western, Educated, Industrialised, Rich, and Democratic (WEIRD) cultures (Henrich, Heine, and Norenzayan 2010) has been extensive in psychology and linguistics. Researchers have investigated the range of caregivers' communicative activities directed to infants, particularly the role of ID-speech and song in language acquisition (see below) and evolution (Falk, 2004b, 2004a). However, in spite of some noteworthy exceptions (Hewlett, 2017; Takada, 2005, 2010, 2020, 2021) limited attention has been paid to these processes among infants living in non-WEIRD societies.

We present ethnographic descriptions of how people from two distinct groups speak and sing to their children, contextualizing our data within the psychological literature on childhood development, and within the groups' respective ethnographic and historical contexts. Across the unique patterns of speech and song in each culture, common threads emerge that reinforce insights from psychology regarding the role of the ID-register. Even in contexts where musical culture is less elaborated, as among Maniq people, musically enriched ID-speech is still fundamental to communication with infants, perhaps as a response to characteristics of infant auditory perception and attention.

1.1 The context of infant auditory perception

Infants are born with preadaptations facilitating the processing of sound, which are at least in part shaped by prenatal auditory experiences. From as early as 20 weeks gestational age, fetuses perceive low-frequencies from the external environment (Hepper and Shahidullah, 1994), notably in the pitch range of the fundamental frequency of the human voice (F_0), associated with the melodic aspects of speech. A few weeks later, higher frequencies may also be perceived, which are associated with consonants, the more percussive aspect of speech. Early plasticity effects can transfer learning across the prenatal/neonatal stages, with newborn infants showing recognition of speech patterns and songs heard in the last trimester before birth (Lecanuet and Schaal 1996). Moreover, early sound production appears to reflect aspects of language learned prenatally. The general pattern of neonatal crying is determined by physiological parameters, yet its overall shape reflects the dominant rhythmic structure of the language of prenatal exposure (Wermke et al. 2016). These perceptual results correspond to specific physiological-regulatory responses (Granier-Deferre et al. 2011) and enhanced neural encoding. For example, Partanen et al (2013) showed that both at birth and at 4 months, infants exposed daily to a certain melody during the last gestational quarter showed significantly stronger brain responses (ERPs) to the familiar melody than infants who had not experienced it. These plasticity effects bias infant auditory perception towards prenatal soundscapes.

Infancy is characterised by neotenous features, such as lack of independent locomotion and speech, limited attention span and cognitive control, poor emotion regulation and motor immaturity, all of which are associated with plasticity and flexibility in learning, physical and emotional dependency, the formation of attachment bonds and enculturation (Chisholm 1983; Soltis 2004). This makes the soundscapes of infant care

particularly important; indeed, infant soundscapes are enriched by a variety of communicative signals that belong specifically to caregiving contexts. The ID-register includes those aspects of caregivers' vocal behaviours (speech, singing) and gestures addressed to infants which differ from analogous forms of communication addressed to adults. Although studies have described ID-gesture adaptations (Brand, Baldwin, and Ashburn 2002; Dimitrova and Moro 2013), most research has focused on vocal communication.

To contextualise the ethnographic data from the two hunter-gatherer groups reported here, the next two sections examine relevant psychological research into the nature of ID-speech and ID-singing.

1.2 Infant-directed speech

ID-speech across different languages is characterised by semantically and syntactically simplified utterances, higher pitch, slower articulation and exaggerated intonation (Broesch and Bryant 2015; Fernald et al. 1989; Trainor et al. 1997). ID-speech is both attractive to infants (Vouloumanos et al. 2010) and efficient in communicating the speaker's affect and pragmatic intentions (Fernald 1992; Fernald and Kuhl 1987) within the constraints of infant perception (Trainor and Desjardins 2002). The latter aspect has also been supported across geographically disparate cultures in experimental field studies (Bryant and Barrett 2007; Bryant, Liénard, and Clark Barrett 2012), suggesting that at least some aspects of these ID-adaptations may be universal, and possibly driven by the neotenous characteristics described above.

Crucially, psychological research has also shown specific effects of the input language characteristics on early language. Infants exposed to more and better-quality input will

display superior language development (Weisleder and Fernald 2013). Romeo et al. (2018) suggested that, more specifically, being part of conversational turns facilitates children's development of brain structures involved in language processing.

1.3 The infant-directed musical register

ID-speech has typically been described as 'more musical' than adult-directed speech (Papoušek, Papoušek, and Symmes 1991). Compared to adult-directed singing, the tempo of ID-speech is slower, inter-phrase pauses are lengthened, pitch is higher, there is relatively more energy at lower frequencies, and the pitch and jitter factor are higher in ID-songs (Bergeson and Trehub 1999; S. Falk 2007, 2011; Trainor et al. 1997). Western listeners can recognize lullabies from all over the world as child-directed singing (Trehub, et al. 1997; Trehub, Unyk, and Trainor 1993; Trehub and Trainor 1998).

ID-singing is particularly attractive to infants, who typically prefer it to ID-speech (Tsang, Falk, and Hessel 2017), possibly due to its characteristic association with positive affect (Corbeil et al 2016; Trainor, Austin, and Desjardins 2000; Trehub and Trainor 1998). Van Puyvelde et al (2010; 2015) showed specific tonal relationships between vocalisations produced in mother-infant exchanges and positive affect in the interaction being associated with consonant inter-speaker tonal intervals in adjacent turns both in Flemish and Mexican environments. Gratier (2003) found both similarities and cultural variability in the hierarchical organisation, expressive timing and interactional synchrony of spontaneous mother-infant vocal interactions when comparing US, French and Indian dyads. Finally, Western mothers singing to their infants were engaged in multimodal interactions, in which they emphasised the temporal structure of the song, thus providing a segmentation based on the beat to which infants responded in synchrony (Longhi 2009). Such vocal exchanges facilitate the imitation and repetition of prosodic contours by young

infants (Gratier and Devouche 2011), which provides human infants with a first scaffold for the acquisition of specific cultural tools, such as native language and musical structures. These effects of the musical ID-register are of particular relevance to this study.

2 The present study: Soundscapes of infant care

It is clear from the psychological literature that infants are highly aware of their auditory surroundings both pre- and post-natally, and that the quality and quantity of spoken and sung ID-communication that they are exposed to influences their acquisition of other cultural skills, including musical ones. Yet we find that each of the two groups considered in this study make use of the ID-register in distinct ways. These differences are reflected in the different frequency of musical practices more generally.

2.1 Methodology

The methodology for this study was applied during long-term ethnographic fieldwork, based on participant observation and proficiency in the local language, combined with detailed observation on the communicative activities used to engage with infants both directly and indirectly. This gives a perspective drawn from real-life interactions. Though the lab-based approach more common in psychology can be more systematic, this anthropological approach provides a contextualised and in-depth view to complement experimental research.

The two egalitarian hunter-gatherer groups considered in this study are immediate-return societies (Woodburn 1982) that live in small groups and are highly mobile. Maniq live in the Malay peninsula, speak a Northern Aslian language and share many cultural traits with other hunter-gatherer groups in the region such as the Batek (Benjamin 1985).

The Mbendjele BaYaka live in Congo-Brazzaville and are classified as speaking a C10 Bantu language (Klieman 1997, 1999: 90–91; Rossel 1999: 109; Thomas 1979). The BaYaka encompasses several distinctive hunter-gatherer groups that occupy the Western Congo Basin (forest west of the Ubangi River), in the Central African Republic (CAR), Congo-Brazzaville (Congo), Cameroon and Gabon. They are made up of Mbendjele (15-20,000), Baka (45-60,000), Aka (15-20,000) and several smaller groups such as the Mikaya, Luma, Kola, Gyeli, Bongo and others (maybe around 10-15,000). Many still largely depend on hunting and gathering in an immediate-return society, though many, particularly the Bongo, Kola, Gyeli, Luma and increasingly Baka too, are engaged in increasingly diversified economies. The term 'BaYaka' is contracted to different extents and used by Aka, Baka, Luma, Mbendjele and Mikaya, typically as 'bayaka', 'biaka', 'baaka', or 'baka'. While the use of 'BaYaka' encompasses all these groups, their individual ethnonyms are used when providing specific examples.

Though the everyday practices by which they maintain egalitarian social relations differ, both groups reject institutionalised or coercive leadership structures, including between genders (Kricheff and Lucas 2015, Lewis 2008). For example, members of both groups place strong emphasis on rigorously sharing food and other resources, on the importance of individual autonomy in decision-making, and live in small, mobile groups of between 12 and 60 individuals.

Children develop a high degree of skill and independence at a very young age. It is perfectly normal for 2-3-year-old children to handle knives, or to build and maintain campfires. Further, young children learn how to clean and cook small animals such as birds and squirrels, and do so with casual skill and efficiency. Normally, they will also share out the meat from small animals they catch with the same precision and fairness as

adults do with larger animals such as monkeys and pigs. This mode of sharing, especially with food, is deeply engrained and naturalised, constituting the correct way to behave when one has meat or other food. Children from the age of two will play games with other children, often in multi-age playgroups, but they do not play competitive games in any situation. Often, their games involve 'playing' at adult activities, such as digging large holes in the ground to find 'tubers', or even constructing miniature shelters.

Since field work was conducted among these groups they have both been subjected to sedentarising pressures from outside that have resulted in some moving less frequently, taking up more permanent dwellings on the forest's edges where they seek paid work and labour in exchange for goods. Though they still hunt and gather and are often mobile, this is complemented by other ways of living, made necessary because of forest degradation, industrial activity and conservation restrictions (Lewis 2016; Colchester 2018).

Though neither group is isolated, each classifies the space outside the forest as 'other' and contrast its values and practices with their own. The Maniq people call other peoples '*Hamiq'*, and the Mbendjele BaYaka '*Bilo*'. Similarities in these oppositional cultural categories are common across forest hunter-gatherer groups – the Malay Batek refer to others as *Gop* (Endicott & Endicott 2008), the Baka in Cameroon as *Kaka* (Lewis and Kohler 2002). These categorisations stereotypically emphasise 'negative' qualities of these outsiders: their propensity to violence, to social hierarchies and concomitant authoritarianism, to private property and the avoidance of sharing, and to their dependence on fixed assets such as farms. Despite this, these groups have found ways to peacefully engage these outsiders to obtain desirable items from outside the forest – with a particular emphasis on foodstuffs, tools, clothing, and consumer goods.

2.2 Mbendjele BaYaka

Although gender egalitarian (Lewis 2014b), Mbendjele men and women often conduct their daily activities separately. This is formally elaborated into a series of oppositions, equivalences and dependencies between men's and women's production symbolised by the different blood each group must shed for life to go well: the blood of human fertility or menstruation by women, and the blood of animals shed in hunting by men. The relations are understood in terms of a set of rules defining proper sharing that are reinforced and learnt through a taboo system referred to as *ekila* (Lewis 2008).

This sexual division of labour has consequences for behaviour. When men go hunting, their success depends on silence and small numbers, and their safety on strategy and experience. By contrast, women are frightened of encountering dangerous animals such as elephant, buffalo, gorilla, or leopard, and so yodel loudly when walking alone or in small groups. They prefer to move through the forest in large groups of women and children playing, singing, and chatting loudly to warn animals of their approach. When walking between forest camps, mothers are responsible for carrying a large basket containing all the household's possessions, while fathers carry their weapons and the children, typically with infants slung in a strip of bark over one shoulder and children perched on shoulders.

Women's speech style is more sing-song than that of men, and they often yodel for pleasure or sing out tuneful expletives when responding to another's speech. When preparing food in the late afternoon, Mbendjele women exaggerate and stretch out their words into melodious conversations as they exchange pleasantries and chat. Women and girls yodel loudly when walking alone or sing in chorus together whilst gathering, or when they are dam-fishing they coordinate bailing water through song. The frequency with which people accompany daily activities or games with song is striking. Many children's games are song based, requiring complex group coordination organised through the song

(Bombjaková 2017, 258–63; Lewis 2002, 124–35; Oloa-Biloa 2017, 93–106). Growing up in this highly musical society ensures that each member is attuned to a wide range of different ways to sonically interact with others – from disguised speech modes and ordinary speech, to multi-modal forms that incorporate re-enactment, sonic mimicry, song and speech, to intense polyphonic singing ceremonies in which forest spirits are called into camp to dance with the human group (Lewis 2009, 2014a). BaYaka are highly regarded throughout the region for their skill in such multi-modal forms.

Grandparents (*koko*), parent's siblings (*ilɛlɛ or kokɛ*), infant's siblings (*kaadi*), and fathers (*tai*) are frequent carers in camp while mother (*ngwei*) is busy. Carers and mothers tend to carry infants around with them slung in a bark strip or cloth hanging diagonally over one shoulder with the infant sitting on the opposite hip. Infants will breast feed from a wide range of others, mostly grandmothers who use certain leaves or the juice of forest vines to activate the flow of their breast milk, but also other women, including adolescents. Infants sometimes seek out male nipples and will not be rejected. Mbendjele men, as among neighbouring Aka reported by Hewlett (Hewlett 1991), spend a greater proportion of their time in close contact with, and caring for infants, than do fathers among any other recorded society. Such male–infant contact follows similar patterns to that observable among women and children: cooing and play-kissing, bouncing infant, dancing infant using the stand reflex, and other singing and rhythmic movement play, as well as more passive contact as fathers or carers talk to friends, sharpen a knife or do other activities with the infant draped on their lap or snugly held under one arm.

For the first 12 months of life infants (*moniama* or *moɛpe*) rarely touch the ground as they are constantly carried. Hewlett observed neighbouring Aka caregivers holding 3-4 month olds over 90% of the day, and 9-10 month olds for over 85% of the day (Hewlett et al.

2000). Infants breastfeed on demand and often simply serve themselves while held on their mother's hip. Aka infants self-feed almost 70% of the time (Hewlett *pers com* 2016). Crying is responded to very quickly and infants are rarely if ever left to cry alone.

Infants accompany their carers in their daily activities and are frequently passed around between different people, including to other young children who often engage in vigorous play with them. Infants are typically held with both hands around the ribcage seemingly standing or bouncing on the carer's lap. There is intense eye-contact, smiling and laughing with the infant. The carer may repeat the infant's name, other words or phrases teasingly in a sing-song fashion provoking the infant to react with smiles and giggles. The carer's demeanour and voice are deliberately exaggerated in order to make the infant laugh, and to keep the infant's attention. Only exceptionally will infants be put down or placed on the ground, and in such cases never unattended. Infants' babbling vocalisations or gestures are almost always responded to immediately with a touch, caress or acknowledging sounds such as '*Éh-èh-éhhh*!', laughter, cooing or singing.

Emulating women's more sing-song and stretched speech, carers of any gender or age tend to adopt this more tuneful, musical style of speaking when engaging with infants. While they are often passive witnesses to the interactions of others, speech is also directed at them – mostly cooing and joking speech, or indicating interesting items or events, but also as song. When an infant is distressed each whimper or cry is immediately responded to in both sound and action. For example, when an infant wails for attention while arching his back backwards on his father's lap, his father smiles, picks him up, and bounces him on his lower arm or palm. Resting the infant's head on his shoulder, he holds the infant's belly close to his own chest with one arm. With his other hand he simultaneously beats out a rhythm on the infant's upper back while singing spirit play

melodies. The louder the infant wails the louder the singing response, always in time to the percussive rhythm associated with that melody. This powerful sonic and physical engagement is remarkably effective at calming infants. When the infant falls asleep, father does not put him down but covers him with a cloth and holds him until he wakes again.

In the evening infants, toddlers (*eŋgumbo*) and children (*bana*) are allowed to fall asleep as they wish. Evenings in camp often feature story-telling, children's comic dances, or spirit play. Mbendjele have a special talent for sung-fables. Often told around the fire, these stories involve significant audience participation – singing songs at key moments, dancing and imitating events depicted, mimicking protagonists' sounds, and joining in the telling with expletives and ideophones (Lewis 2009, 2014a). Some of the songs are sung to infants long after a particularly vivacious or well-told session. Infants will often engage musically in these sessions – by dancing, clapping or singing along with others. As they get more confident, they will join children's multi-age playgroups to perform spirit plays reserved for children such as *Bolu*.

During community rituals called spirit play (*mokondi massana*), women sit closely together, resting legs and arms upon one another. This physical overlapping is combined with a sonic overlapping as each woman sings a single yodelled melody that combines with different ones sung around her to create a richly complex song of overlapping melodies. Such performances often last several hours, sometimes through the night and on certain occasions for up to three days producing extended continuous musical immersion.

Infants are full participants in these sonic interactions as they are held or carried by their singing or dancing carers. Infants either sit on the carer's lap or hang in a bark sling or cloth on the dancing carer's hip listening, often open-mouthed, suckling or just falling

asleep, as the carer dances, claps and sings. The intensity of these moments of loud overlapping melodies combined with the vigorous movements of the dances performed over many hours naturally encourage infants to sleep. When they do, they are held firm in the nape of carer's elbow so that she can still clap with her hands, dance and sing. Once fast asleep the infant may be dropped into the lap of other women sitting singing on the ground. If they awake, infants are danced to the music by their carers, exploiting their stand reflex. In effect, they dance before they walk. As they get older, they are always lavishly praised for any musical activity, no matter how poorly performed. Carers encourage their participation and educate them by directing their attention to appreciate the performance:

> 'On one occasion during a *mòkóndì màssánà Bòlúbé*, I saw a mother with a newborn who sat close to the women and children … singing and dancing to call the spirit from the forest. As soon as the spirit emerged, she re-positioned her baby in the sling, so the baby could see the spirit. She pointed at the *Bòlúbé* and said to the baby: *"My child, Look! Mòkóndì is beautiful!"…* While this newborn baby could not participate … her presence was acknowledged.'
>
> (Bomdjakova 2017: 254)

Towards the end of performances, infants nestle in their carer's lap, dozing until their carers retire. Mbendjele families share the same woven mat cushioned with dried leaves, where they sleep in tight bundles of heads, limbs, and torsos. This density results in infants hearing and feeling others around them 24 hours a day.

2.3 Maniq[1]

Between 300 and 400 Maniq people live in the montane forests of Satun, Trang and Phatthalung Provinces in Southern Thailand (Kricheff 2019; Wnuk and Burenhult 2014). In a similar way to the Batek in Malaysia, the sociological and cultural differences between Maniq people and their Thai and Malay neighbours are a central component of Maniq people's theories of identity. As such, Maniq people generally divide the world into two categories: *Maniq*, which translates roughly as 'forest people'; and *Hamiq*, which means everyone else.

Within the forest, Maniq people live in short-term camps, which they refer to as *haya*. These camps are normally occupied for a period of several weeks and are composed of between 15 to 60 people. Maniq camps are shifting forms, as people move between camps throughout the forest over time. Maniq people orient their lives around the forest, and living in the forest is a core component of their identity. The forest is where Maniq people hunt and gather, it is where they build their homes, grow up, grow old and where they engage with their ancestors and other spirits through ritual action. The forest itself is sufficiently large and intact that, when they wish to, Maniq people can spend long periods of time away from Hamiq people, finding sufficient food, water, and shelter to allow a comfortable and sustainable way of life.

Maniq people generally stay within domestic family units, who share a shelter known as a *hapoi. Hapoi* consist of a leaf-covered lean-to roof, bamboo sleeping platforms raised a few inches off of the ground, a cooking fire, and a handful of possessions, such as machetes, clothing and bamboo blowpipes and darts used for hunting. However, because

[1] The authors are grateful to Daniel Kricheff for permission to use his unpublished ethnography in this article.

hapoi are open on three sides, and face inward toward each other, the effect is to create an open dwelling space in the camp, within which the boundaries between "households" or "nuclear families" are under-elaborated and under-emphasised.

This physical openness and intimacy apply to the auditory landscape of Maniq people's lives. Living in a Maniq camp means sharing space, experiences, and the soundscape. During the day, one hears the sounds of the forest, but also the sounds of the camp: people speaking, cooking, fixing tools, building or tearing down *hapoi*. One also hears infants crying, children laughing, parents speaking to each other and to children. During the evenings, long conversations may echo across the camp, as people take turns weighing in on the day's events, discussing where to hunt the following day, or simply sharing a funny story or laughing. At night one hears the sounds of the forest, the crackling of campfires and the occasional restless cries of an infant or child.

While Maniq people are well-acquainted with music, music-making and musical culture, these things are notably *under-elaborated* within their own culture and their own quotidian social and familial practices. Some older men may carry with them a bamboo mouth harp, which they can be cajoled into playing by a researcher, but it is exceedingly rare to see Maniq people sing, play music or beat a rhythm. Even when prompted, Maniq people are reticent and shy about singing or making music. Maniq people may occasionally have small battery-powered radios on which they listen to Thai pop music, but this, too, is rare. For the most part, music and singing are not a prominent aspect of Maniq social or ritual lives. When shown a video of Baka people from Central Africa engaging in complex polyphonic singing, one group of Maniq people responded that they found it astonishing to see these forest people, who they referred to as 'Maniq *Rong-Pleng*' – using the Thai word for "singing" – making such loud and elaborate music. It is important

to note that the above description *does not* imply that Maniq society "lacks music" or that Maniq people never make music. Rather, Maniq people in the present day have an under-elaborated musical culture, and tend not to make music or sing regularly within their normal daily lives.

Maniq infants and children grow up surrounded by a tightly knit but frequently changing group of people, who are considered both family and friends. Camps tend to have a matrilocal bias, clustered around female siblings, their partners, and their children, but this is not a rule or even explicitly acknowledged. Maniq children will grow up with siblings, half-siblings, uncles, aunts, nephews and nieces. Because women begin having children around the age of eighteen and will continue to have children into their late thirties, it is not uncommon for an older mother to have children the same age or even younger than the children of her oldest daughters.

Infants spend the majority of their time with their mothers. Fathers spend time caring for infants if the mother is sleeping or needs to leave the camp for a short period of time, or even if she is simply tired or not feeling well. Infants and small children also receive abundant attention and affection from the people around them and will be passed around if the mother needs to do something. Children as young as five or six years old will also take care of infants and toddlers, carrying them in a sling, playing with them or tending to them when they fall or hurt themselves. More often than not, if a small child or an infant falls or starts to cry, an older sibling, sometimes as young as five years old, will pick up the child and comfort it. Sometimes, this consists of pinching the infant's cheeks and mimicking its crying until it stops. At other times, mothers, fathers and other adult relatives will play with infants by making funny faces at them, or by cooing at them to make them laugh, but rarely, if ever, do adults sing or hum melodies to their children,

during play or to get them to sleep. When asked why Maniq people do not appear to sing songs to their children one older Maniq woman responded: 'if you want the child to sleep, just be quiet!'

3 Comparing Mbendjele and Maniq infant soundscapes

These ethnographic descriptions indicate some of the different ways that people find to live well both in and proximal to forest environments. For example, ways of avoiding the attention of dangerous animals are different among the two groups. Mbendjele women are loud, talking and yodelling to warn animals of their approach, while Maniq people tend to be quiet in the forest. Music and song are rare among Maniq whereas Mbendjele often sing to accompany daily activities. Infants are thus exposed to quite different levels of musical engagement in each group.

Table 1 compares different scenes from daily life, through the stages of the day and different dimensions of social interaction.

-- Insert Table 1 about here --

The distinctions evident in 'Scene 3: rituals' demonstrate that among the Mbendjele, ritual life is important and complex, and that it is large-scale and extrovert, involving the whole group, including infants. This is not the case for Maniq, where ritual life is subtle and often ad hoc, focused around enacting everyday activities such as cooking and speaking in particular ways (Kricheff 2019). Furthermore as demonstrated in 'Scene 4: music', Mbendjele ritual music consists of complex polyphony, whereas among Maniq people, activities like singing and playing musical instruments are uncommon.

Might these contrasting uses of sound be reflected in the specific ways people interact and communicate with their infants? Table 2 outlines the distinctions and similarities in infant-directed communication among these two societies.

-- Insert Table 2 about here --

Clear from these ethnographic descriptions is the diversity of ways that people find to interact with their infants, often with the explicit aim of teaching them to grow up with particular values and identities. For example, while Mbendjele and Maniq infants spend a lot of time close to their mothers, fathers, siblings and others also play an important role in infant care (cf. Hewlett 1991). Grandparents, aunts, uncles and other kin and non-kin camp members also frequently hold infants, babysit them, and sometimes breast-feed them. This may reflect broader understandings of egalitarian gender relations among each group. Other practices relate more closely to the physiological capacities of human infants. Like parents everywhere, as represented in the psychological literature, when playing with infants, all groups make use of eye-contact, bouncing the infant, and teasing, and both men and women in each group make use of the ID-register. Additionally, Mbendjele caregivers often tease or joke with infants in a sing-song fashion, frequently calling out their name. But there are different ways of using the ID-register: Mbendjele caregivers will sing and pat their infants when putting them to sleep, whereas Maniq caregivers will generally not sing, although they do pat, hold, and respond affectionately to crying children. As the Mbendjele example shows, lullabies do not necessarily start as soft, slow and flat-pitched, but rather focus on matching the infant's wavelength and intensity, combined with high levels of physical stimulation (firm patting, as do Maniq also). The Mbendjele do not use the descending melodies and musical tricks used in prototypical lullabies, such as slower and slower tempo, *ritardando* and *rallentando* –

because they favour an intense double stimulation generally involving bouncing and patting a rhythm onto the infant's back to accompany the ID-song. Perhaps the characterization of lullabies as made in the literature from WEIRD societies (Henrich, Heine, and Norenzayan 2010) is based on an adult-centric perspective – of what adults find soothing and sleep inducing?

4 Conclusion

Among each group both men and women use melodically enriched forms of communication when interacting with infants or communicating with young children. The form in which this is expressed includes well-known or improvised songs (with words or hummed) among the Mbendjele, but is concentrated in speech, vocal imitation, and cooing sounds among the Maniq.

This consistency in the use of the ID-register could be explained by how the nature of human infancy imposes certain constraints on effective communication. Infancy is characterised by great plasticity in learning, combined with neotenous features such as a poor attention span and cognitive abilities, and poor motor control and emotion regulation. These characteristics drive their need for particular soundscapes of care. In ID-speech, we see simple utterances, higher pitches, slower articulation, and exaggerated intonation (Fernald et al. 1989; Trainor et al. 1997). Such infant-directed speech has been shown to have an important role in infant language development (e.g., Trainor and Desjardins, 2002; Romeo et al. 2018; Weisleder and Fernald 2013), as our informants here also emphasised.

Thus, vocal interactions with human infants are grounded in caring intentions responding to general developmental challenges, such as holding the infant's attention (useful in

learning contexts – see also Takada's 2005, 2010 observations with the San in the Central Kalahari) or helping them to regulate arousal (as in soothing contexts; see Cirelli, Jurewicz and Trehub, 2019). Whilst both cultures make use of the more musical speech and vocal games characteristic of the ID-register in speech, Maniq people have not been observed to sing to their infants. It may be that the amount of musical activity observed in a cultural group when using the ID-register correlates positively with how much song or other forms of music-making are practised by the particular group. This does not mean that those groups who do *not* frequently take part in activities such as sung forms of ID-communication do not enjoy or perceive the intentions behind music, only that it is less valued. Indeed, skill at perceiving musical activities can remain only present as a potential, e.g., revealed in perception experiments – see Bryant and Barrett 2007, Broesch and Bryant 2015 for ID-speech, and Franco, Falk, Hanselmann, Lewis & Lewis, in preparation, for ID-song; or by psychophysiological parameters, Egermann, Fernando, Chuen and McAdams 2015). This would be compatible with Fritz's observation that the Mafa people of Cameroon show an ability to recognise emotion/ intention in non-familiar Western music in spite of their own musical forms being relatively undifferentiated from an emotional point of view (Fritz et al. 2009).

The hunter-gatherer ethnography presented here adds to our understanding of the range of ways that humans have found to bring their infants into the world today, in these cases often in the face of profound marginalisation. Focusing on the distinctive creativity of these resilient groups in how they engage with the early life of infants is significant as many assumptions made in the psychological literature are based on the lives and practices of 'WEIRD' societies (Henrich, Heine, and Norenzayan 2010), most notably in relation to the conception of the significance and characteristics of lullabies. The

ethnography presented here challenges the standard view in the literature that so often focuses on ID-*singing.* Our ethnography shows that singing to infants may not be essential for their development, while using the ID-register in speech remains consistent across both groups. This might support claims that the ID-register in speech is at the very root of the development of vocal communication and language (D. Falk 2004a; 2009, Brown 2017) and suggests future directions for research.

Acknowledgments

Fieldwork was supported by a SEMPRE grant, Arnold Bentley Fund, Awarded Sept. 2014; Leverhulme Hunter-Gatherer Resilience Project Grant number grant RP2011-R-045; and the Evans Fund, Cambridge University. The authors are very grateful to Daniel Kricheff for sharing his unpublished ethnography on Maniq infant care. The authors thank two anonymous reviewers for their constructive critical feedback on earlier versions of this paper.

References

Adami, Christophe. 2012. Adaptive walks on the fitness landscape of music. *PNAS*. 109: 11898-11899.

Benjamin, Geoffrey. 1985. In the Long Term: Three Themes in Malayan Cultural Ecology. In Karl L. Hutterer, A. Terry Rambo and George W. Lovelace, *Cultural Values and Human Ecology in Southeast Asia*. Ann Arbor, Michigan: The University of Michigan, Center for South and Southeast Asian Studies, 219–78

———. 2011. "Egalitarianism and Ranking in the Malay World." In Kenneth Sillander and Thomas Gibson (eds) *Anarchic Solidarity: Autonomy, Equality, and Fellowship in Southeast Asia*, New Haven, CT: Yale Southeast Asia Studies, 170–201.

Bergeson, Tonya R. and Sandra E. Trehub. 1999. Mothers' Singing to Infants and Preschool Children. *Infant Behavior and Development* 22 (1): 51–64. https://doi.org/10.1016/S0163-6383(99)80005-8.

Bombjaková, Daša. 2017. The Role of Institutions of Public Speaking, Ridicule, and Play in Cultural Transmission among Mbendjele BaYaka Forest Hunter-Gatherers. PhD Thesis. London: University College London.

Brand, Rebecca J., Dare A. Baldwin and Leslie A. Ashburn. 2002. Evidence for 'Motionese': Modifications in Mothers' Infant-Directed Action: Infant-Directed Action. *Developmental Science* 5 (1): 72–83.

Broesch, Tanya L., and Gregory A. Bryant. 2015. Prosody in Infant-Directed Speech Is Similar across Western and Traditional Cultures. *Journal of Cognition and Development* 16 (1): 31–43.

Brown, Steven 2001. Are music and language homologues?. *Annals of the New York Academy of Sciences*. 930(1): 372-374.

Brown, Steven (2017). A joint prosodic origin of language and music. *Frontiers in psychology*. 8: 1894.

Bryant, Gregory A. and H. Clark Barrett. 2007. Recognizing Intentions in Infant-Directed Speech: Evidence for Universals. *Psychological Science.* 18 (8): 746–51. https://doi.org/10.1111/j.1467-9280.2007.01970.x.

Bryant, Gregory A., Pierre Liénard and H. Clark Barrett. 2012. Recognizing Infant-Directed Speech across Distant Cultures: Evidence from Africa. *Journal of Evolutionary Psychology.* 10(2): 47–59. https://doi.org/10.1556/JEP.10.2012.2.1.

Chisholm, James S. 1983. *Navajo Infancy: An Ethological Stdy of Child Development*. New York: Aldine.

Cirelli, L. K., Z. B. Jurewicz and S.E. Trehub. 2019. Effects of maternal singing style on mother–infant arousal and behavior. *Journal of cognitive neuroscience*. 1-8.

Claidière, Kirby and Dan Sperber. 2012. Effect of psychological bias separates cultural from biological evolution. *PNAS.* 109, 51: E3526.

Colchester, Marcus. 2018. Legal obstacles to territorial rights recognition, sustainable commodity production and forest conservation on forest peoples' lands in

Southeast Asia with a focus on Indonesia and Malaysia. *Hunter-Gatherer Research.* 4 (1): 81-112. https://doi.org/10.3828/hgr.2018.5

Corbeil, Marième, Sandra E. Trehub, and Isabelle Peretz. 2016. Singing Delays the Onset of Infant Distress. *Infancy.* 21(3): 373–91. https://doi.org/10.1111/infa.12114.

Cross, I. and I. Morley. 2009. The evolution of music: theories, definitions and the nature of the evidence, in S. Malloch and C. Trevarthen (eds.), *Communicative Musicality: Exploring the Basis of Human Companionship*. Oxford: OUP, 61–82.

Dimitrova, Nevena, and Christiane Moro. 2013. Common Ground on Object Use Associates with Caregivers' Gesturese. *Infant Behavior and Development.* 36(4): 618–26. https://doi.org/10.1016/j.infbeh.2013.06.006.

Dissanayake, E. 2000. Antecedents of the temporal arts in early mother-infant interaction. In N. L.Wallin, B.Merker, and S. Brown (eds), *The Origins of Music*. Cambridge, MA: MIT Press, 389–410.

Egermann, H. N. Fernando, L. Chuen and S. McAdams. 2015. Music induces universal emotion-related psychophysiological responses: comparing Canadian listeners to Congolese Pygmies. *Frontiers in psychology*. 5: 1341.

Endicott, Kirk and Karen Lampell Endicott. 2008. *The Headman Was a Woman: The Gender Egalitarian Batek of Malaysia*. Long Grove, IL: Waveland Press.

Falk, Dean. 2004a. Prelinguistic Evolution in Early Hominins: Whence Motherese? *Behavioral and Brain Sciences.* 27 (4): 491–503. https://doi.org/10.1017/S0140525X04000111.

———. 2004b. The 'Putting the Baby down' Hypothesis: Bipedalism, Babbling, and Baby Slings. *Behavioral and Brain Sciences.* 27(4): 526–34. https://doi.org/10.1017/S0140525X0448011X.

———.2009. *Finding Our Tongues: Mothers, Infants, and the Origins of Language.* New York, NY: Basic Books.

Falk, Simone. 2007. Speech Clarity in Infant-Directed Singing: An Analysis of German Vowels. *Proceedings of the 16th International Congress of Phonetic Sciences.* XVI: 6–10.

———. 2011. Melodic versus Intonational Coding of Communicative Functions: A Comparison of Tonal Contours in Infant-Directed Song and Speech. *Psychomusicology: Music, Mind and Brain.* 21 (1–2): 54–68. https://doi.org/10.1037/h0094004.

Fernald, Anne. 1992. "Meaningful Melodies in Mothers' Speech to Infants." In *Nonverbal Vocal Communication: Comparative and Developmental Approaches*, 262–82. Studies in Emotion and Social Interaction. Paris, France: Editions de la Maison des Sciences de l'Homme.

Fernald, Anne, and Patricia Kuhl. 1987. "Acoustic Determinants of Infant Preference for Motherese Speech." *Infant Behavior and Development* 10 (3): 279–93. https://doi.org/10.1016/0163-6383(87)90017-8.

Fernald, Anne, Traute Taeschner, Judy Dunn, Mechthild Papousek, Bénédicte de Boysson-Bardies, and Ikuko Fukui. 1989. "A Cross-Language Study of Prosodic

Modifications in Mothers' and Fathers' Speech to Preverbal Infants." *Journal of Child Language* 16 (03): 477. https://doi.org/10.1017/S0305000900010679.

Franco, F., S. Falk, S. Hanselmann, I. Lewis, I., and J. Lewis. (In preparation). Recognition of the singer's intent in Western infant-directed songs in two hunter-gather cultures.

Fritz, Thomas, Sebastian Jentschke, Nathalie Gosselin, Daniela Sammler, Isabelle Peretz, Robert Turner, Angela D. Friederici and Stefan Koelsch. 2009. Universal Recognition of Three Basic Emotions in Music. *Current Biology.* 19 (7): 573–76. https://doi.org/10.1016/j.cub.2009.02.058.

Granier-Deferre, Carolyn, Sophie Bassereau, Aurélie Ribeiro, Anne-Yvonne Jacquet and Anthony J. DeCasper. 2011. A Melodic Contour Repeatedly Experienced by Human Near-Term Fetuses Elicits a Profound Cardiac Reaction One Month after Birth. *PLOS ONE.* 6 (2): e17304. https://doi.org/10.1371/journal.pone.0017304.

Gratier, Maya. 2003. Expressive Timing and Interactional Synchrony between Mothers and Infants: Cultural Similarities, Cultural Differences, and the Immigration Experience. *Cognitive Development* 18 (4): 533–54. https://doi.org/10.1016/j.cogdev.2003.09.009.

Gratier, Maya and Emmanuel Devouche. 2011. "Imitation and Repetition of Prosodic Contour in Vocal Interaction at 3 Months." *Developmental Psychology* 47 (1): 67–76. https://doi.org/10.1037/a0020722.

Henrich, Joseph, Steven J. Heine and Ara Norenzayan. 2010. "The Weirdest People in the World?" *Behavioral and Brain Sciences.* 33 (2–3): 1–75. https://doi.org/10.1017/S0140525X0999152X.

Hepper, Peter G and B. Sara Shahidullah. 1994. Development of Fetal Hearing. *Archives of Disease in Childhood Fetal and Neonatal Edition.* 71 (2): F81–87.

Hewlett, Barry S. 1991. *Intimate Fathers: The Nature and Context of Aka Pygmy Paternal Infant Care*. Michigan: University of Michigan Press.

————————. 2017. *Hunter-gatherer childhoods: Evolutionary, developmental, and cultural perspectives*. London: Routledge.

Hewlett, Barry S., Michael E. Lamb, Birgit Leyendecker and Axel Scholmerich. 2000. Internal Working Models, Trust, and Sharing among Foragers. *Current Anthropology.* 41 (2): 287–98. https://doi.org/DOI:10.1086/300135.

Hewlett, Barry S. and Jennifer W. Roulette. 2014. Cosleeping Beyond Infancy: Culture, Ecology, and Evolutionary Biology of Bed-Sharing Among Aka Foragers and Ngandu Farmers of Central Africa. In Darcia Narváez, A. Valentino, M. McKenna, and P. Gray (eds), *Ancestral Landscapes in Human Evolution: Culture, Childrearing and Social Wellbeing*. Oxford: Oxford University Press, 129–63.

Hrdy, Sara Blaffer. 2011. *Mother and Others: The Evolutionary Origins of Mutual Understanding*. Cambridge, MA: Harvard University Press.

Jakubiak, Brittany K. and Brooke C. Feeney. 2017. Affectionate Touch to Promote Relational, Psychological, and Physical Well-Being in Adulthood: A Theoretical Model and Review of the Research. *Personality and Social Psychology Review.* 21 (3): 228–52. https://doi.org/10.1177/1088868316650307.

Kohler, Axel. and Jerome Lewis 2002 'Putting Hunter-Gatherer and Farmer Relations in Perspective. A Commentary from Central Africa'. In *Ethnicity, Hunter-Gatherers, and the 'Other': Association or Assimilation in Southern Africa?* Edited by Susan Kent. Washington: Smithsonian Institute, pp. 276-305.

Kricheff, Daniel Abraham. 2019. Action and Identity Among Maniq People in Southern Thailand'. PhD Thesis. London: University College London.

Kricheff, Daniel Abraham and Helmut Lukas. 2015. "Being Maniq: Practice and Identity in the Forests of Southern Thailand." *Hunter Gatherer Research* 1 (2): 139–55. https://doi.org/10.3828/hgr.2015.9.

Lecanuet, Jean-Pierre and Benoist Schaal. 1996. Fetal Sensory Competencies. *European Journal of Obstetrics and Gynecology and Reproductive Biology.* 68 (September): 1–23. https://doi.org/10.1016/0301-2115(96)02509-2.

Leroi, A. M. and J. Swire. 2006. The recovery of the past. *The World of Music*, 43-54.

Lewis, Jerome. 2002. Forest Hunter-Gatherers and Their World: A Study of the Mbendjele Yaka Pygmies and Their Secular and Religious Activities and Representations. London: London School of Economics.

———. 2008. Ekila: Blood, Bodies, and Egalitarian Societies. *Journal of the Royal Anthropological Institute.* 14 (2): 297–315. https://doi.org/10.1111/j.1467-9655.2008.00502.x.

———. 2009. As Well as Words: Congo Pygmy Hunting, Mimicry and Play. In Rudolf Botha and Chris Knight (eds), *The Cradle of Language, Volume 2: African Perspectives*. Oxford: Oxford University Press, 232–52.

———. 2013. A Cross-Cultural Perspective on the Significance of Music and Dance on Culture and Society: Insight from BaYaka Pygmies. In Michael Arbib (ed) *Language, Music and the Brain: A mysterious relationship*. Strüngmann Forum Reports, vol. 10. Cambridge, MA: MIT Press. Pp 45-65.

———. 2014a. BaYaka Pygmy Multi-Modal and Mimetic Communication Traditions. In Daniel Dor, Chris Knight, and Jerome Lewis (eds) *The Social Origins and Evolution of Language: Studies in the Evolution of Language*, edited by. Oxford: Oxford University Press.

———. 2014b. Pygmy Hunter-Gatherer Egalitarian Social Organization: The Case of the Mbendjele BaYaka. In Barry S. Hewlett (ed), *Hunter-Gatherers of the Congo Basin: Cultures Histories and Biology of African Pygmies*. London: Routledge, 219–44.

———. 2016. "Our life has been turned upside down! And nobody cares." *Hunter Gatherer Research.* **2**(3): 375-384.

Longhi, Elena. 2009. 'Songese': Maternal Structuring of Musical Interaction with Infants. *Psychology of Music*, April. https://doi.org/10.1177/0305735608097042.

MacCallum, Robert M., Matthias Mauch, Austin Burt, and Armand M. Leroi. 2012. Evolution of music by public choice. *PNAS*. 109: 12081-12086.

Mampe, Birgit Angela D. Friederici, Anne Christophe and Kathleen Wermke. 2009. Newborns' Cry Melody Is Shaped by Their Native Language. *Current Biology.* 19 (23): 1994–97. https://doi.org/10.1016/j.cub.2009.09.064.

Meltzoff, A. N. (2007). 'Like me': a foundation for social cognition. *Developmental science*. *10*(1): 126-134.

Meehan, Courtney L. 2005. The Effects of Residential Locality on Parental and Alloparental Investment among the Aka Foragers of the Central African Republic. *Human Nature.* 16 (1): 58–80. https://doi.org/10.1007/s12110-005-1007-2.

Merker, B. 1999. Synchronous chorusing and the origins of music. *Musicae Scientiae*. Special Issue 1999-2000: 59-73.

Mithen, S. 2005. *The singing Neanderthals: The origins of music, language, mind and body*. London: Weidenfeld & Nicolson.

Oloa-Biloa, Camille. 2017. The Egalitarian Body: A Study of Aesthetic and Emotional Processes in Massana Performances among the Mbendjele of the Likouala Region (Republic of Congo). PhD Thesis. London: University College London.

Papoušek, Mechthild, Hanuš Papoušek and David Symmes. 1991. The Meanings of Melodies in Motherese in Tone and Stress Languages. *Infant Behavior & Development.* 14 (4): 415–40. https://doi.org/10.1016/0163-6383(91)90031-M.

Partanen, E., T. Kujala, R. Naatanen, A. Liitola, A. Sambeth and M. Huotilainen. 2013. Learning-Induced Neural Plasticity of Speech Processing before Birth. *PNAS.* 110 (37): 15145–50. https://doi.org/10.1073/pnas.1302159110.

Romeo, Rachel R., Julia A. Leonard, Sydney T. Robinson, Martin R. West, Allyson P. Mackey, Meredith L. Rowe, and John D. E. Gabrieli. 2018. Beyond the 30-Million-Word Gap: Children's Conversational Exposure Is Associated With Language-Related Brain Function. *Psychological Science.* 29 (5): 700–710. https://doi.org/10.1177/0956797617742725.

Shenfield, T., S. E. Trehub and T. Nakata. 2003. Maternal singing modulates infant arousal. *Psychology of Music*. 31(4), 365-375.

Soltis, Joseph. 2004. The Signal Functions of Early Infant Crying. Behavioral and Brain Sciences. *Behavioral and Brain Sciences.* 27 (4): 443–58. https://doi.org/doi:10.1017/S0140525X0400010X.

Takada, A. 2005. Early vocal communication and social institution: Appellation and infant verse addressing among the Central Kalahari San. *Crossroads of Language, Interaction, and Culture*. 6: 80-108.

————. 2010. Changes in developmental trends of caregiver-child interactions among the San: Evidence from the! Xun of Northern Namibia. *African Study Monographs*. Suppl. 40: 155-177.

————. 2020. The ecology of playful childhood: The diversity and resilience of caregiver-child interactions among the San of southern Africa. Cham, Switzerland: Palgrave Macmillan.

————. 2021. Pragmatic reframing from distress to playfulness: !Xun caregiver responses to infant crying. Journal of Pragmatics, 181, 180-195: https://doi.org/10.1016/j.pragma.2021.05.021(pp.2-3)

Tomasello, M., Melis, A.P., Tennie, C., Wyman, E., Herrmann, E., Gilby, I.C., Hawkes, K., Sterelny, K., Wyman, E., Tomasello, M. and Melis, A. 2012. Two key steps in the evolution of human cooperation: The interdependence hypothesis. *Current anthropology*. 53(6).

Trainor, L. J., C. M. Austin and R. N. Desjardins. 2000. Is Infant-Directed Speech Prosody a Result of the Vocal Expression of Emotion? *Psychological Science.* 11 (3): 188–95. https://doi.org/10.1111/1467-9280.00240.

Trainor, L J., E D. Clark, A. Huntley and B A. Adams. 1997. The Acoustic Basis of Preferences for Infant-Directed Singing. *Infant Behavior and Development* 20 (3): 383–96. https://doi.org/10.1016/S0163-6383(97)90009-6.

Trainor, L. J. and R.N. Desjardins. 2002. Pitch characteristics of infant-directed speech affect infants' ability to discriminate vowels. *Psychonomic Bulletin & Review*. *9*(2): 335-340.

Trehub S.E., J. Becker and I. Morley. 2015 Cross-cultural perspectives on music and musicality. *Phil. Trans. R. Soc. B*. 370: 20140096. http://dx.doi.org/10.1098/rstb.2014.0096

Trehub, S. E., Unyk, A. M., Kamenetsky, S. B., Hill, D. S., Trainor, L. J., Henderson, J. L., & Saraza, M. (1997). Mothers' and fathers' singing to infants. *Developmental Psychology, 33*(3), 500–507. https://doi.org/10.1037/0012-1649.33.3.500

Trehub, Sandra E. and Laurel Trainor. 1998. Singing to Infants: Lullabies and Play Songs. *Advances in Infancy Research* 12: 43–78.

Trehub, Sandra E., Anna M. Unyk and Laurel J. Trainor. 1993. Maternal Singing in Cross-Cultural Perspective. *Infant Behavior and Development.* 16 (3): 285–95. https://doi.org/10.1016/0163-6383(93)80036-8.

Tsang, Christine D., Simone Falk and Alexandria Hessel. 2017. "Infants Prefer Infant-Directed Song Over Speech." *Child Development* 88 (4): 1207–15. https://doi.org/10.1111/cdev.12647.

Van Puyvelde, Martine, Gerrit Loots, Joris Meys, Xavier Neyt, Olivier Mairesse, David Simcock and Nathalie Pattyn. 2015. Whose Clock Makes Yours Tick? How Maternal Cardiorespiratory Physiology Influences Newborns' Heart Rate Variability. *Biological Psychology.* 108 (May): 132–41. https://doi.org/10.1016/j.biopsycho.2015.04.001.

Van Puyvelde, Martine, Pol Vanfleteren, Gerrit Loots, Sara Deschuyffeleer, Bart Vinck, Wolfgang Jacquet and Werner Verhelst. 2010. Tonal Synchrony in Mother-Infant Interaction Based on Harmonic and Pentatonic Series. *Infant Behavior & Development.* 33 (4): 387–400. https://doi.org/10.1016/j.infbeh.2010.04.003.

Vouloumanos, Athena, Marc D. Hauser, Janet F. Werker and Alia Martin. 2010. The Tuning of Human Neonates' Preference for Speech. *Child Development.* 81 (2): 517–27. https://doi.org/10.1111/j.1467-8624.2009.01412.x.

Weisleder, Adriana and Anne Fernald. 2013. Talking to Children Matters: Early Language Experience Strengthens Processing and Builds Vocabulary. *Psychological Science.* 24 (11): 2143–52. https://doi.org/10.1177/0956797613488145.

Wnuk, Ewelina and Niclas Burenhult. 2014. Contact and Isolation in Hunter-Gatherer Language Dynamics: Evidence from Maniq Phonology (Aslian, Malay Peninsula). *Studies in Language. International Journal Sponsored by the Foundation "Foundations of Language.* 38 (4): 956–81. https://doi.org/10.1075/sl.38.4.06wnu.

Woodburn, James. 1982. "Egalitarian Societies." *Man.* 17 (3): 431. https://doi.org/10.2307/2801707.

Table 1: Summary of daily scenes and their soundscapes across the two cultures.

Bold words indicate that this behaviour is shared.

	Mbendjele	Maniq
SCENE 1 - MORNING	Pre-dawn public speeches wake the camp. **Fires stoked and food leftovers eaten and shared** **People go down to the river to wash** Public speeches announce the intentions for the day of different camp members **Men leave early for hunting**	Day starts with infants crying **Fires stoked and food leftovers eaten and shared** **People go down to the river to wash**, taking infants People visit between windscreens Casual and decentralised discussions about plans for the day **Men embark on hunting expeditions**

SCENE 2: FOREST	Women in larger groups with children and infants (loudly talking and singing) **Men go quietly, in small groups or alone** Couples may go out alone, and **mixed groups** may go on a collective hunting or gathering trip **Avoid non-Mbendjele people in forest** Men carry children when they move camp	Mostly quiet moving in the forest **Men in small groups or alone** Women in larger groups with children and infants (talking quietly, not singing). Sometimes **mixed groups** **Change path when encountering non-Maniq people** Men and women carry children
SCENE 3: RITUALS	Numerous **rituals focus on relationship with the forest** and those between gender groups Women with children and infants rest their legs and arms upon one another during ritual whilst singing	**Rituals focus on relationships between Maniq people and the forest** Small, repeated rituals performed on a regular basis in response to external events

	Numerous taboos observed Spirit play lasts mostly for 3-5 hours, sometimes up to 3 days (whole groups) Mostly based on singing and dancing to accompany ritual activities	Larger rituals have an ad hoc character, often in response to events in the forest
SCENE 4: MUSIC	Individuals often yodel song melodies casually while doing other activities Polyphonic singing, many people at once Instruments such as drums (3 main types), thumb pianos, simple flutes, and percussive objects (buttress roots, logs, bottles, jerricans, machetes are opportunistically used. Occasional radio or memory stick/tape machines	Very little observed Very rare use of mouth harp, although possibly more common in the past Some Thai-language radio

SCENE 5: CHILDREN'S GAMES	**Imitation & make-believe games of adult activities** **Horsing around** **Toys occasionally used** Song-based games with complex coordination	**Imitation & make believe games of adult activities** **Horsing around (loud noises)** **Toys used individually or in interactions**
SCENE 6: GENDERED SOUND	Women have more sing-song speech style than men In camp men tend to make public speeches	No pronounced speech differences, some different styles of laughter for women and men
SCENE 7: EVENINGS	**Conversations, discussions across the camp** Common activities involving multi-modal story-telling, fun dances, spirit play with all present participating, thumb piano sessions late at night.	**Conversations, discussions across the camp** Rare occurrence of melodic speech or humming to soothe infants/children, focus on being quiet

Table 2. Infant-directed communication across the two cultures.

	Mbendjele	**Maniq**
RESPONSE TO CRYING	**Very quick response** **Strong vestibular stimulation (bouncing+patting)** Singing close to infant's ear Both men and women Distraction	**Quick response with young infants** **Strong vestibular stimulation (bouncing+patting)** Cooing vocalisations Often siblings pick up infant, pinch their cheeks Mimic crying Make funny faces
FEEDING	**Breast-feeding from mother and others**	**Breast-feeding from mother and others**
CARRYING	**Infants are carried most of the time by women and men**	**Infants are carried most of the time by women and men**
TALKING	**ID-register is used by both women and men in speech**	**ID-register is used by both women and men in speech**

	ID-register is used by both women and men song Repeat infant's name ID-register Teasing/joking in sing-song fashion	
SLEEPING	**Families sleep together, close physical contact**	**Families sleep together, close physical contact**
SOOTHING	Bouncing and patting Spirit-play melodies The louder the infant wails, the louder the singing is Singing is in rhythm with bouncing and patting	Infant will be held and carried around the camp People other than the parents may step in to soothe the infant ID-singing generally absent

PLAYING	Holding infant by the ribs **Eye-contact** Smiling and laughing (positive affect) Repeat infant's name ID-register **Speak to infant ID-register** Teasing in sing-song fashion Exploiting stand reflex to make infant dance	Lifting the infant in the air above one's head **Eye-contact** Smiling, making faces and cooing sounds **Speak to infant ID-register** Bouncing infant on the lap or shins Peek-a-boo Tickle
CAREGIVERS	**Everyone from the family and others**	**Everyone from the family and others**