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JOURNAL OF COGNITION AND CULTURE 21 (2021) 152–177

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The Ontogeny of Kinship Categorization

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Abstract

Human kinship systems play a central role in social organization, as anthropologists have long demonstrated. Much less is known about how cultural schemas of relatedness are transmitted across generations. How do children learn kinship concepts? To what extent is learning affected by known cross-cultural variation in how humans classify kin? This review draws on research in developmental psychology, linguistics, and anthropology to present our current understanding of the social and cognitive foundations of kinship categorization. Amid growing interest in kinship in the cognitive sciences, the paper aims to stimulate new research on the ontogeny of kinship categorization, a rich domain for studying the nexus of language, culture, and cognition. We introduce an interdisciplinary research toolkit to help streamline future research in this area.

Keywords

kinship – kinterm acquisition – learning – cognitive development

1 Introduction: Defining the Problem

How do children learn kinship concepts? How does an English-speaking child learn to categorize their mother's sister and their father's sister as *aunt*, while a Hindi-speaking child learns to categorize them differently – as *mausī* or *buā*,

respectively? Kinship is a central organizing principle of human societies and its conceptual structures must be transmitted across generations. Some of these structures have a deep evolutionary history: nonhuman primates appear to recognize relatedness between unfamiliar conspecifics and mate choice is influenced by kinship (Parr, Heintz, Lonsdorf, & Wroblewski, 2010; Walker et al., 2017). In humans, kinship is a far more complex, culturally determined system of relatedness that governs social arrangements such as residence, care, marriage, and inheritance. But how do children come to share these conceptual systems? How do they learn to classify people along lines and within circles of relatedness?

Lines of kinship are drawn differently across cultures. Groupings of kin that are so important for some societies (e.g., 'clan') are absent in others. Cross-cultural diversity is thus of fundamental relevance for understanding the ontogenetic development of kinship concepts. How do cultural differences in kinship organization affect children's acquisition of concepts relating to family? For instance, when a child learns how to refer to the children of her parents' siblings, she may encounter a single category, as in English *cousin*; or two categories, distinguished by referent gender, as in French *cousine* and *cousin*; or eight categories, distinguished by side of the family, referent gender, and gender of linking relative, as in the Tanzanian language Datooga. In Datooga, a child also has to learn that a father's sister's son – whom we would call a 'cousin' in English – belongs to the category of 'father' (an example of what anthropologists call 'generational skewing'). To what extent does the acquisition of these concepts depend on the linguistic and cultural particularities of the kinship system being learned, the sociocultural environment of learning, or general patterns of cognitive development? Here we review existing work on the ontogeny of kinship categorization – a rich domain for investigating the relation between language, culture, and cognition.

A great deal of research in contemporary developmental psychology has investigated the formation of social categories, concentrating especially on gender and race (e.g. Liberman et al., 2017). In contrast, kinship – a conceptual domain of major social significance for humans – has received minimal attention in the developmental literature. We believe that the time is ripe for a new research focus on the acquisition of kinship concepts, particularly in light of the renewed interest in kinship in the cognitive sciences (Kemp & Regier, 2012; Krupp, Debruine, & Barclay, 2008; Levinson, 2012; Lieberman, Tooby, & Cosmides, 2007; Lieberman, Oum, & Kurzban, 2008; Mollica & Piantadosi, 2019) as well as increasing recognition of the importance of cross-cultural diversity for understanding human cognition (Evans & Levinson, 2009; Henrich, Heine, & Norenzayan, 2010). The evolutionary social sciences have also seen

a revival of interest in the domain of kinship (Shenk & Mattison, 2011) and are increasingly concerned with acquisitional issues in studies of social learning and cultural transmission (e.g., Hewlett, Fouts, Boyette, & Hewlett, 2011; Lew-Levy, Reckin, Lavi, Cristóbal-Azkarate, & Ellis-Davies, 2017).

Recognizing kin versus non-related individuals is not unique to humans. The central explanatory mechanism for the evolution of altruistic behaviour is kin selection (Hamilton, 1964), and in social group-living species, kin must be reliably identified from non-kin both for deploying altruistic behaviour and for optimal outbreeding (Szulkin, Stopher, Pemberton, & Reid, 2013). Silk (2009) reviews evidence for nepotism in primate species and shows that biases towards kin are widespread across the order and in a variety of social systems. Detecting relatives in primate social groups is likely underpinned by mechanisms such as familiarity, age similarity, phenotypic features, and mating history. Early association patterns appear to be the most important (reviewed in Silk, 2009). Reliable mother-infant and infant-sibling association results in matrilineal kin recognition and nepotism, and these traits form part of our ancestral primate "kinship heritage" (Chapais, 2014). The evidence for paternal kin recognition in primates is accumulating: at present this appears dependent on social organisation and dispersal patterns that affect co-association (e.g., Widdig, Langos, & Kulik, 2016). Primates show extensive capabilities for social learning (Whiten & van de Waal, 2018) and capacities for culture exist in many animals (Schuppli & van Schaik, 2019). The mechanisms of kin recognition (and by extension, rudimentary categorization) that are our species' phylogenetic endowment are therefore just as likely to be products of cultural evolutionary processes that rely on well-built associative learning mechanisms as they are of strict genetic evolution (cf "cognitive gadgets" (Heyes, 2018)). What is remarkable about human kinship cognition is its extension beyond kin/non-kin into different categories of relatives that equally span, and go beyond, bilateral first-order kin. This facility implies some further cognitive revolution in which language and complex cognition play a critical role.

For humans, learning to reason about relatedness involves linguistic categories that are culturally determined (e.g., *aunt* vs *mausī*). Crucially, these categories are relational: kinship roles are calculated relative to some individual. What is more, the relational categories of kinship cohere into larger relational structures: to map the term *cousin* onto some new individual, a child needs to understand the relational concepts of 'parent' as well as 'sibling'. The logical structures of kinship have fascinated cognitive anthropologists for decades (Lounsbury, 1964; Scheffler, 1978; Shapiro, 2018), though sociocultural anthropologists tend to treat kinship relations as more fluid, performative, and practice-based. These different approaches to kinship highlight the richness of

this domain for developmental science: thinking about and behaving appropriately towards kin depends on aspects of both logical and social cognition. In addition, the importance of kinship as a conceptual domain may differ according to the cultural environment in which one grows up. In small-scale societies in which almost all members of the community are incorporated into the kinship system, a child must learn to calculate kin relations across large genealogical distances – a task unfamiliar to most European children (cf Blythe, Tunmuck, Mitchell, & Rácz, 2020).

This review draws on the literature in developmental psychology, anthropology, and linguistics to present our current understanding of the social and cognitive foundations of kinship categorization (§2). The most sustained treatment of the acquisition of kinship concepts is found in developmental psychology, beginning with Piaget's work on egocentrism in the 1920s. Linguistics, and the subfield of child language acquisition, has produced a minor strand of research examining how kinterms are learned. In anthropology, sociocultural anthropologists have been preoccupied by the question of what kinship *is* and have had little to say about how kinship concepts are learned, though ethnographic work points to the potential significance of ostensive communication as well as language socialization in learning about kin. Overall, our review highlights how much work remains to be done in this area. In an effort to stimulate and streamline future research, we present a methodological toolkit for investigating children's acquisition of kinship concepts in §3. We then reflect on the broader implications of this research focus in our conclusion (§4).

2 Social and Cognitive Foundations of Kinship Categorization

What do children have to know to be able to classify the kinship relations that hold between themselves and others? How is this knowledge acquired? In developmental psychology, research on the acquisition of kinship concepts has concentrated on the role of perspective-taking (§2.1). This interest originates with Piaget, who used sibling terms as a tool to investigate the development of relational thought. Piaget recognised that adult-like use of the terms 'brother' and 'sister' requires an ability to think about relationships from multiple perspectives. He used children's metalinguistic discussions of these terms as evidence for the egocentric-to-allocentric shift. Later researchers extended his work to other kinterms and languages, mostly supporting his ideas about a developmental cognitive shift. We discuss how these older models of children's kinship concepts could be usefully revisited in light of contemporary developmental science. Some of the Piagetian research on children's kinship concepts

established a new focus on how children learn the linguistic meaning of kinterms; we critically review this literature in 2.2. Though the transmission of kinship systems must depend to a large extent on language, learning to categorize the people who inhabit our social world also involves non-linguistic cognitive processes, as we consider in 2.3. In 2.4, we draw on evidence from anthropological research to suggest possible sociocultural mechanisms involved in learning to classify kin. Our review suggests an important role for both ostensive communication and everyday social and linguistic practice.

2.1 *Perspective-Taking and Relational Thought*

Piaget was not intrinsically interested in kinship but used sibling terms as a way to test 'decentring', i.e., whether children can take other-centred perspectives. This line of inquiry was inspired by the Binet-Simon intelligence test developed in the early twentieth century, which contained a question asking what was absurd about the statement, "I have three brothers: Paul, Ernest, and myself". To understand why children found this difficult, Piaget (1928) asked approximately 240 French-speaking Swiss children (aged 4–12) about sibling relationships. Based on his results, Piaget proposed that young children cannot distinguish between membership ("we are three brothers") and relation ("I have two brothers"), nor do they understand the reciprocal meaning of sibling terms (that a boy is his brother's brother). He accounted for these early difficulties in terms of children's domain-general perspective-taking abilities, which start out as egocentric. Table 1 presents Piaget's three stages in the development of sibling concepts. According to Piaget, children can take a relational perspective (i.e. X is Y's brother) on kin relations by age 7 and a reciprocal perspective (i.e. if X is Y's brother, Y is X's brother) by around age 11, with all children getting all his 'tests' correct by twelve years of age.[1]

Two early replication studies with English-speaking children largely confirmed Piaget's findings about the egocentric to relational shift (K. Danziger, 1957; Elkind, 1962). Danziger extended his study to include three additional kinterms ('daughter', 'cousin', and 'uncle') and, based on the responses, he modified Piaget's three stages, as shown in Table 1. He includes a 'pre-categorical' stage, in which children define kinterms by referring to a specific individual. He distinguishes two types of relational thinking: concrete (e.g., 'A brother is a boy you live with') and abstract (e.g., 'A boy which is a relation to you'). At the abstract relational stage, children begin to conceptualize kin categories "as part of a web of relationships" (1957, p. 222). Danziger points out that the ability to understand kinterms as reciprocals is more complex than Piaget's

1 The approximate age at which children reach each stage is determined by the age at which 75% of the test children answered the relevant questions correctly.

TABLE 1 Four models of the developmental stages in children's understanding of kinterms

Response type	Piaget (1926)	K. Danziger (1957)	Haviland & Clark (1974)	Greenfield & Childs (1977)
Kinterm is associated with a specific person	–	Pre-categorical	1 (Pre-categorical)	–
Kinterm denotes a category of person, e.g., 'A brother is a boy'	I	Categorical	2 (Categorical)	egocentrism
Kinterm entails existence of two people but relationship is asymmetric, e.g., 'The child who comes second is a brother'	II	Relational *Type 1*: Concrete Relational	3 (Relational but not reciprocal)	reciprocity
Kinterm is relational and reciprocal; child knows that being Y means having X	III	*Type 2*: Abstract relational	4 (Relational and reciprocal)	reversibility

stages suggest: children in his study could often use kinterms reciprocally when describing relationships between third parties but struggled to see their own relationships in reciprocal terms. Greenfield & Childs (1977) observed a similar pattern in their study with Zinacanteco (Mexico) children. They relabel Piaget's three cumulative stages as follows: egocentrism (child can take own perspective); reciprocity (child can understand relationships between two siblings or others); and reversibility (child can take egocentric and allocentric perspectives simultaneously).

While Piaget's understanding of perspective-taking has been critiqued in the light of modern developmental science (see discussion below), his idea that children find it easier to calculate kinship relations from their own perspective than from other people's has been supported by studies in various communities and languages around the world, including Zinacantecos (Greenfield & Childs, 1977), Hawaiian (Price-Williams, Hammond, Edgerton, & Walker, 1977), Mopan Mayan (E. Danziger, 1993), Hausa (LeVine & Price-Williams, 1974), Vietnamese-American (Van Luong, 1986), Icelandic and Danish (Ragnarsdóttir, 1999), Warlpiri (Bavin, 1991), and, most recently, Murrinhpatha (Blythe et al., 2020). This body of research suggests that, regardless of culture, children can abstract kin relations away from themselves by around the age of

eight. Greenfield & Childs (1977, p. 357) express surprise that their study did not reveal culture-specific effects on kinterm learning and speculate that this relates to the "universal importance of kinship."

However, in the only directly comparative study we are aware of, Ragnarsdóttir (1999) did find a difference in Icelandic and Danish children's perspective-taking abilities with respect to kinship. Unlike much of the older research which relies on children's definitions of kinterms, Ragnarsdóttir tested children's knowledge of kin relations within their own family, starting from the child's perspective and moving on to more distant relations, for example: 'Do you have a mother? Who is it?', 'Does your brother have a mother? Who is it?', 'Does your mother have a mother? Who is it?'. While the observed developmental stages lined up with those of Piaget, the Icelandic children performed better than the Danish children, especially with respect to questions about the reciprocal relation between parents and parents' siblings. Ragnarsdóttir (1999) claims that Icelandic children are one year ahead in their understanding of the logical properties of kinterms and accounts for this difference with socio-cultural factors, including the strength of kinship ties in Iceland's small and homogenous society, cultural interest in genealogies, and the patronymic naming tradition. This study also made the important finding that linguistic structure did not affect children's understanding of kinterms: Danish kinterms are semantically transparent compared to their Icelandic counterparts, yet the Danish children lagged behind the Icelandic children.[2] Ragnarsdóttir's results highlight the value of directly comparative cross-cultural studies that make use of the same elicitation methods (see §5).

The main contribution of this Piagetian line of research has been to propose a sequence of developmental stages in children's understanding of kinship concepts. The progression-through-stages model of cognitive development no longer carries much weight in developmental psychology (Barrouillet, 2015), though constructivist approaches are still relevant, and perhaps especially so in the domain of kinship where concepts articulate with one another in interesting ways (e.g., 'grandmother' entails a concept of 'mother'). Mounting evidence in spatial and social cognition research has also countered Piaget's theory of early egocentrism (e.g., Newcombe & Huttenlocher, 2003), which poses problems for claims that conceptual development in the domain of kinship is constrained by children's egocentric perspectives on social relations. Evidence suggests that even infants can reason about third party relationships (Jin, Houston, Baillargeon, Groh, & Roisman, 2018) and are also able to triangulate social relations between third parties in contexts of caregiving (Spokes

2 For example, *farmor* ('grandmother') literally means 'father's mother' in Danish.

& Spelke, 2017). Triangulation (i.e. if A relates to B thus, and A relates to C thus, then B relates to C thus) is a type of thinking essential for kinship reckoning but also relevant for other cognitive domains. We recommend that future work on children's kinship concepts interact much more closely with more general developmental work on social cognition. For instance, the difficulties children encounter in kin-term-based tasks might be usefully explored in terms of Tomasello's (2018; 2019) theory of shared intentionality: understanding that a given individual can be both your brother and someone else's cousin – or that you are your brother's sister – involves the coordination of different perspectives on the same entity.[3] While research on the development of kinship concepts has not exhausted the potential for domain-general processes acting in the rich social milieu of human childhood, we should also take seriously the biological inheritance that may make kinship cognition special – a topic we address in 2.3.

2.2 *Learning Linguistic Symbols*

The studies reviewed above all rely on language to investigate children's kinship concepts. This focus reflects the critical importance of linguistic symbols for thinking about kinship, and in this section we discuss the development of kinship categories from the perspective of language acquisition. However, we do not wish to conflate kinterms and kinship (cf Bloch 2010). Kinterm usage is far more complicated than simply mapping words onto genealogically determined relationships, and kinship concepts go beyond kinterms.[4] Further, as discussed in the following section, children's reasoning about kinship likely also relies on non-verbalizable, implicit knowledge – a topic largely unexplored in the literature. Nonetheless, studying kinterm acquisition allows us to explore the development of a conceptual schema of abstract relations that are necessary for thinking about kinship. For instance, when and how does the concept BROTHER become part of a child's concept of UNCLE? Machin & Dunbar (2016) propose that kinship terminologies may have evolved to reduce the cognitive load of maintaining social relationships. If kinship terms are indeed a cognitive tool that helps us navigate our social world, what are the developmental processes by which children acquire this valuable linguistic knowledge?

Work in child language acquisition shows that kinterms are learned early: Caselli et al. (1995) report that the two most common words in the vocabularies

3 'Aspectuality' (Tomasello, 2019) is important here, too: children must learn that kinterms are not labels for types of person, but for roles a person can hold only in relation to someone else.

4 For a broader view on words and concepts, see Malt & Majid, 2013.

of Italian- and American English-speaking infants up to the age of sixteen months were parental terms. Tardif et al. (2008) look at children's first ten words across English-, Mandarin-, and Cantonese-speaking children in the US, Beijing, and Hong Kong, respectively. Kinterms occur in all three samples, though there are a higher number in the Mandarin and Cantonese samples, likely because these languages have more kinterms and children frequently use kinterms as terms of address. Cross-cultural validity concerning the early appearance and frequency of kinterms is uncertain, however. Gentner (1982) emphasizes cross-cultural variation in early vocabularies, noting that Kaluli data (see 2.4) contained more person names than kinterms. In addition, Evans (2003) has suggested that more complex kinship language (such as respect registers and triangular kinterms) is not learned until adolescence and perhaps even into adulthood.

What do early-emerging kinterms mean to children? Van Luong (1986) suggests that kinterms function only as proper nouns for the youngest children, that is, as names that pick out specific referents. Nelson's (1973) study of eighteen English-speaking children's first words found that forms like *mama* and *dada* were restricted to specific individuals, but she did note one exception, in which a child overextended *Mom* to her two sisters. Overextension of parental terms has been reported in other diary studies (Greenfield, 1973; Rūķe-Draviņa, 1976), suggesting that kinterms can serve as category labels from a very early age. However, Thomson & Chapman (1977) investigated children's overextension of *daddy* and found that while several children extended this term in production, they never did so in comprehension. They argue that we should not evaluate children's semantic representations on the basis of production data alone, a point reinforced by Naigles & Gelman (1995). Early use of kinterms remains ripe for exploration, particularly now we have access to longitudinal child language corpora created using "dense sampling" methods (Lieven & Behrens, 2012).

The semantic trajectory of kinterms beyond infancy has been explored in the context of the Piagetian research discussed in 2.1. Most of this research involved coding the complexity of children's definitions of kinterms. K. Danziger (1957) noted that children's definitions progressed through his developmental stages (see Table 1) at different rates, suggesting that some kinterms are acquired earlier than others. Haviland & Clark (1974) investigated further, eliciting definitions of fifteen kinterms from 50 children aged 3;0–8;10, and showed that "simpler kinterms elicited higher-level definitions than more complex ones" (1974, p. 44). Haviland & Clark explain the order of acquisition of kinterms in terms of semantic complexity, as defined by componential analysis of kinterms based on "parent of" and "child of" relations, such that 'uncle'

is more complex than 'mother' because it entails three relational components rather than one. They show that for almost all children semantic complexity of the kinterm was negatively correlated with the stage of definition produced.

Several researchers have presented evidence to counter the semantic complexity argument, e.g., Greenfield & Childs (1977), and Bavin (1991) who notes that in Warlpiri one grandparental term is often learned before the other, despite the same semantic complexity. An alternative explanation offered for order of acquisition is 'experience', usually defined in terms of household composition or familiarity with different relatives. Haviland & Clark (1974) tested the influence of experience on the level of definition by conducting a parental questionnaire about children's interaction with kin, but no significant correlation was found. In a study with Hawaiian children, Price-Williams, Hammond, Edgerton, & Walker (1977) found that household composition had less effect than age in children's performance on kin-term-related tasks, supporting Haviland & Clark's semantic complexity account. However, Benson & Anglin (1987) included linguistic experience with kinterms in their parental questionnaire and found experience to be a better predictor of performance than semantic complexity.

Goldfield & Snow (1992) improved on measuring 'experience' by exploring the actual use of kinterms in children's interactions. They criticize earlier work for its singular focus on semantic aspects of kinship knowledge (age, gender, and generation) and also consider characteristic aspects of kinship knowledge, particularly those relating to the rights and responsibilities of different kin categories. Using data from Brown's (1973) corpus of young children's spontaneous speech, the authors develop a coding scheme to analyse the kinds of information associated with each instance of a kinterm, as follows: (i) identification; (ii) characteristic features (e.g., that Grandma brings gifts); and (iii) defining features, such as gender or generation. They find that across the 'Sarah' corpus, kin are most often talked about in terms of characteristic features, and argue that young children must therefore primarily conceptualize kin in terms of what they do or are like, rather than in terms of defining properties. Since questionnaire data was not collected at the same time as the interactional data, no connections could be made between everyday language use and performance on a Piagetian-style questionnaire. Using a formal developmental model, Mollica and Piantadosi (2019) show that a combination of semantic primitives and a simplicity preference allows the model to learn the correct word for relatives in four different ethnographically-occurring kinship systems; when given concrete characteristic features as well, their model also shows the continuous 'characteristic-to-defining' shift discussed in Goldfield & Snow (1992) and demonstrated in empirical studies with children.

Many of the above studies assess children's understandings of kinship terms in a limited way. Hirschfeld (1989) argues that definition-based tasks do not test children's conceptual knowledge but rather their meta-conceptual understanding.[5] Further, by focusing on semantic aspects of meaning, researchers have underplayed the role of pragmatics in children's understanding of kinterms. Experimental research has generally failed to separate kinterms used in address from those in third-person reference, and has ignored social, non-genealogical aspects of kinterm use. Carter (1984) critiques work in the Piagetian tradition on this basis, arguing that we should consider how children learn to adapt kin term use to context. Based on a Piagetian-style questionnaire using photographs with children in Maharashtra, India, Carter reports that although young children had trouble identifying kinship relations, they had already learned a complex, relational system of address. As such, he proposes that children learn a "theory of address" before they learn a "theory of referential kintype classification" (1984, p. 198). He also notes that this address system has little to do with kinship, but rather with concepts of seniority and respect. This suggests that kinship concepts may build on more basic aspects of social cognition, such as age and status.

Though previous research has singled out the acquisition of relational kinterms like 'mother', the language of kinship extends beyond nominal kinterms. Some of the world's languages encode information about kinship relations grammatically, e.g., 'kintax' in Australian languages (Evans, 2003), or kinship verbs in Iroquoian languages (Koenig & Michelson, 2010). Children's acquisition of kinship-related grammar has barely been investigated, though a new paper by Blythe et al (2020) investigates this topic for the first time, showing that for Murrinhpatha-speaking Australian children, sibling-marking on the verb is not more difficult to learn than other aspects of grammar.

2.3 *Kinship as a (Core?) Social Category*

While language provides tools for classifying kin, linguistic abilities may rest on more basic cognitive functions. The degree of biological preparedness for learning about kinship is an open question for both developmental and cross-species research. Hirschfeld (1989) criticizes the Piagetian body of work discussed in 2.1 for its reliance on general learning mechanisms such as

5 Benson & Anglin (1987) conducted a definition-based task about kinterms with adults as well as children and showed that even adults' definitions often do not demonstrate the third 'reciprocal' stage of development. Chambers & Tavuchis (1976) tried to use less abstract methods, and in a Piagetian-style task that included photos of families, children performed better at a younger age than in Piaget's study.

perspective-taking and argues that kinship terms constitute "a domain-specific conceptual array with … an enriched initial state" (1989, p. 565). Other scholars in the cognitive sciences also argue for a conceptual system specific to kinship, e.g., Jones (2018) and Lieberman et al. (2008). Lieberman et al. (2008) argue that kinship is a fundamental social category of the human mind, like age or gender. Since kinship influences numerous aspects of behaviour in humans and other primates, including sexual aversion and altruism, they expect that "the mind contains procedures designed for categorizing individuals according to kinship" (2008, p. 999). Presenting a series of memory confusion experiments, their study shows that participants recalled individuals on the basis of kinship relations just as much as on the well-established parameters of gender and age. If adults distinguish between kin and non-kin when processing social information, where does this ability come from?

Linguistic practices of labelling and talking about kin are likely highly significant for kinship categorization, as we discussed above, but kin-related cognition may also rely on nonverbal, implicit cognitive processes, such as olfactory cues (Mateo, 2015), as well as inferencing about affiliation based on observing caregiving relationships between third parties (Spokes & Spelke, 2017). In evolutionary anthropology, the study of facial kin recognition in humans (the ability to distinguish kin from non-kin) has found that adults can reliably detect relatedness from facial photos of genetically-related individuals (e.g. siblings, parent-child pairs) (Dal Martello, DeBruine, & Maloney, 2015; Nesse, Silverman, & Bortz, 1990). However, this allocentric kin recognition is at present only established as an adult ability in a small range of study populations; future research may establish a developmental trajectory and mechanism(s).

A small number of studies have investigated whether children behaviourally distinguish kin from non-kin. Two studies with American children suggest that young children do not show a preference for kin in the context of sharing. Olson & Spelke (2008) asked children aged 3–4 to distribute resources among dolls representing a protagonist, her sisters, her friends, and strangers. Children shared equally among the family and friend dolls. Spokes & Spelke (2016) also used sharing experiments to investigate the conceptual distinction between kin and non-kin in children aged 3–5. In one experiment, 3- and 4-year-old children did not sharply distinguish between siblings and friends, whereas five-year-olds were more sensitive to the sibling / non-sibling distinction, perhaps as a result of schooling. A second experiment provided additional evidence that children do not differentiate strongly between friends and siblings until they reach five years of age. In more naturalistic settings, though, children may exhibit different behaviours towards siblings than towards non-siblings: Azmitia & Hesser (1993) showed that, in a building block task,

English-speaking young children imitate an older sibling more often than an older peer. One difficulty in this kind of research, as Olson & Spelke (2008) and Rand & Nowak (2013) point out, is teasing apart relatedness, social proximity, and social reciprocity, since these are likely to be positively correlated in children's experience.

Developmental research on kinship as a core social category is still in its infancy, but interest in this area is growing: in their review on social category formation Liberman et al. (2017) predict that kinship may be an important factor in children's social reasoning. One key consideration for future work is cross-cultural diversity in who counts as kin. Any innate cognitive structures or biases in the development of kinship concepts would have to allow for highly flexible and historically shifting conceptual representations of kinship. All the studies referred to in this section have looked at siblinghood, a reliable type of relatedness across cultures, but one which is conceptualized differently depending on sibling age, gender, birth order, and parentage. Another issue here is the fact that many communities extend kinterms beyond biological kin, raising the question of how, when, and indeed whether children register kinship distinctions, regardless of kinterm usage. Exploring children's developing understanding of the conceptual boundary between kin and non-kin will unearth difficult anthropological questions about the nature of kinship (Schneider, 1984).

2.4 *Ostensive Communication and Language Socialization*

Thus far, we have identified cognitive abilities that are likely to factor into the ontogeny of kinship categorization: perspective-taking and triangulation; the acquisition of a set of linguistic symbols and associated semantic concepts; implicit processing of individuals and relationships based (perhaps) on olfaction, facial recognition, and affiliational behaviour. We now review possible sociocultural processes involved in learning to categorize kin. In reviewing the literature on learning kinterms, we already mentioned the role of 'experience' in accounting for children's ability to define kinterms. Here we refine this concept by pointing to two dimensions of children's lived experience that likely shape developing kinship concepts: ostensive communication, and everyday social and linguistic practice.

Within the anthropology of childhood, a few studies have described how adults actively prompt children to think and talk about kinship. A striking example is from Guemple's (1988) work on Qiqiqtamiut Inuit socialization. He describes "status-term learning sessions" in which a mother or other female relative will direct questions to an infant in the form '"where" + relational term', e.g. "Where's your paternal aunt?". The infant responds by gazing at the correct

individual, aided by the gaze of all other people present. Children old enough to talk will sometimes be engaged in another routine in which an adult points to someone and asks the child, "who is it?" Among Qiqiqtamiut people, then, we find what looks like explicit teaching of kinship relations, or at least training in person reference. The extent to which this practice teaches children the relational meanings of kinterms is an open question; would Qiqiqtamiut children perhaps perform very well on the Piagetian tasks described in 2.1? Elsewhere in the Arctic, Briggs (1999) has discussed a type of interactional routine that she calls "dramas", where an adult poses a challenging question to a child such as "do you want to come live with me?". Briggs argues that through these interactions, as well as other playful threats (such as when someone threatens to hurt the protagonist Chubby Maata's father), the child learns about the importance of kinship through her own emotional reactions to imagined scenarios. Blythe et al (2020) also stress the role of explicit instruction about kinship relations in Murrinhpatha society. These ethnographic examples show us the potential significance of "ostensive communication" (Gergely & Csibra, 2005) as a developmental mechanism, whereby knowledgeable members explicitly manifest and orient to kinship-related knowledge to help children learn abstract kinship concepts.[6]

Contemporary anthropological research on kinship emphasises the importance of the everyday practices of living together for understanding relatedness, e.g., sleeping, sharing of food and other substances, dwelling together in houses (e.g., Carsten, 2004). These habitual aspects of everyday life are doubtless highly significant in shaping emerging kinship concepts, as Beverly & Whittemore (1993) have argued. Their research coupled questionnaires with long-term ethnographic fieldwork to explore how Mandinka children of Senegal come to understand their kinship network. Finding that children tended to respond to questions about relationships using behavioural or locational criteria (e.g., eating together), they argue that much of what Mandinka children learn about kinship is acquired through "social geography". The ethnographic record also points to kinship knowledge being acquired through observational learning in ritual and other special performative contexts. Fortes (1970[1938]) dedicates a couple of paragraphs to children's knowledge of kinship in his paper on childhood among Tallensi, and notes that children may learn the names of their paternal ancestors during ritual sacrifices. Grau (1998) argues that Tiwi children of Northern Australia learn about kinship through dance, whereby different moves and gestures are associated with different

6 See Lancy (2014, pp. 187–8) for several additional references to prompting routines in kinship socialization around the world.

kinds of kin. Ellis, Green, & Kral (2017) describe a guessing game played by female caregivers and female children in a Ngaatjatjarra/Ngaanyatjarra community (Australia) in which the leader draws clues in the sand accompanied by kinterms and the other player guesses who the person is. This article, along with Grau's, suggests a role for bodily as well as verbal experience in the development of kinship concepts.

Though overlooked by Beverly & Whittemore, language use is also a crucial aspect of habitual, everyday lived experience through which children learn about kin. Several studies in the field of language socialization have shown how children engage with concepts of kinship through their language use.[7] For example, Howard (2007) describes how young Thai children learn to link the roles of younger and older siblings with particular ways of being and behaving. Unlike other arenas of Thai culture, which are structured by a strict social hierarchy, young children generally project solidarity with other children through their choice of reciprocal person-referring expressions. However, in contexts of "compliance-seeking" (2007, p. 214), elder siblings often use an "elder sibling" term in self-reference in order to assert the sibling hierarchy and get younger siblings to follow instructions. Similarly, a younger sibling can appeal to the beneficence typically expected of older siblings by using kinterms to emphasize birth order. By observing children's situated language use, we see how children learn to conceptually differentiate particular categories of kin – in this case, older versus younger siblings. The use of 'elder brother' in self reference also shows children's ability to use kinterms reciprocally, i.e., to refer to themselves from another child's perspective. Van Luong (1986, p. 8) discusses a similar usage in Vietnamese and reports on a Piagetian study designed to see if this linguistic practice leads Vietnamese-American children to achieve "decentration" earlier than reported in other studies. They did not: the study children could successfully take an allocentric perspective aged 7–8, as has been found for speakers of other languages. Van Luong explains the difference between language use and performance on the questionnaire in terms of differential task complexity.

Schieffelin's (1990) pioneering study of language socialization among the Kaluli of Papua New Guinea discusses a special kind of kinship relationship that holds between siblings, evoked by the term *adɛ*. This kinterm is used only in the context of appealing for something and only between certain combinations of sibling (e.g., never between brothers). The term *adɛ* is uttered "in a

7 Language socialization combines ethnographic and discourse-based methods to investigate how children are socialized to use language as well as how they are socialized through language (Schieffelin & Ochs, 1986).

soft, plaintive voice" and points to the close emotional bond between siblings, a bond that allows them to plead with one another (1990, p. 117). One way in which children learn about the special relationship indexed by *adɛ* is through their mothers' use of the term in reference to another sibling, e.g., "don't do that to *adɛ*" (1990, p. 120), where they also use the 'soft' voice quality. Schieffelin explains that through utterances like this, mothers socialize their children into sibling relationships, "informing them how they should act as well as how they should feel" (1990, p. 119). In terms of children's acquisition of the term *adɛ*, Schieffelin notes that young children in her study never used the term to address the wrong kind of person, though they initially use it in the wrong contexts, in speech acts other than appeal. This suggests that the referential properties of the term *adɛ* are established before its subtler indexical meanings.

Ochs's work on language development in Samoa also highlights the importance of affect in kinship socialization. Similar to *adɛ*, the term *tei* in Samoan refers to one's younger sibling and is "loaded with positive affect … used to evoke feelings of sympathy between siblings" (Ochs, 1988, p. 76). What children learn when they learn the word *tei* is not just to whom it can refer but also how one should feel about and behave towards its referents. Though the study of the ontogeny of kinship categorization may prioritize semantic categories and concepts, we should not overlook the interactional and affective meanings of kinterms. While language socialization focuses more on behavioural than cognitive aspects of development, this subfield, with its combination of ethnography and corpus-based study of language use, holds major potential for research on the acquisition of kinship concepts.

3 A Toolkit for Future Research

Two observations about our understanding of the ontogeny of kinship categorization emerge from the above review. First, the acquisition of kinship concepts has occupied a marginal position in research on child development. Second, relevant research on this topic is stranded across disciplines and is difficult to synthesise because of its different research questions, different assumptions about ontogenetic development, and different methodological approaches. For example, questionnaire-based research has analysed children's decontextualized metalinguistic knowledge about kinterms, implicitly or explicitly assuming a semantic theory of conceptual meaning. Ethnographers have explored children's contextually situated negotiation of kinship relations, theorising conceptual learning in more practice-based, experiential terms. We see value in bringing together these different approaches to how children learn kinship

systems. In this section, we introduce a multidisciplinary research toolkit, available on the Open Science Framework (OSF), that can help bridge research questions in different fields and contribute to a more holistic understanding of how kinship-related cognition and behaviour develops. We invite readers to access the toolkit at https://osf.io/fge5h/.

Although kinship has been a central concern of anthropology, no systematic collection of developmental case studies exists on which to build theories. We aim to lay the foundations for such a project. The diversity we see in kinship language and kinship organization calls for a cross-cultural approach and the model we outline here is designed with comparative research in mind. We are inspired by other models of standardized cross-cultural research, including the pioneering Six Cultures Study (Whiting, 1963), which produced case studies of child rearing (though little of relevance to kinship classification); the Language of Perception project (Majid & Levinson, 2007), which produced standardized tests for conducting fieldwork on language and perception; and experimental work in cross-cultural developmental psychology, e.g., Barrett et al. (2013). The anthropological literature should guide researchers in choosing productive field sites for this comparative research. In an exemplary interdisciplinary collaboration between anthropologists and developmental psychologists, Astuti, Solomon, Carey, Ingold, & Miller (2004) chose a community whose folk-biological knowledge posed challenges for innatist theories of concepts of inheritance. In our case, especially rich field sites include those where kinship is conceptualized very differently to Western societies, e.g., where kinship links are not understood to be fixed by 'blood' or genealogy but are fluid and changing (e.g., Bird-David, 1994).

We aim to design a research model that is (i) methodologically rich, (ii) theoretically productive, and (iii) cross-culturally viable. A methodologically rich model combines experimental approaches and targeted elicitation tasks with the collection of naturalistic linguistic and behavioural data, recognising the strengths and weaknesses of different methods and the advantages of combining diverse types of data. A theoretically productive research model can be informed by frameworks at evolutionary, biocultural, cognitive, interactional, and culture-historical levels. And a cross-culturally viable research model takes seriously the feasibility of data collection methods in diverse sociocultural settings, allowing for a certain degree of flexibility in research design. Though we envision a fieldwork-based program of research, we are mindful of the largely untapped resource of the vast ethnographic record and recommend more extensive review of the anthropological literature.

On our OSF site, we present a set of tools for the cross-cultural study of children's acquisition of kinship concepts. Methods are drawn from all disciplines

discussed above and address different aspects of the broad research question. Experiments, questionnaires, and stimuli-based tasks can probe children's logical abilities to calculate kinship relations and assess this kind of knowledge across a large sample of children. We designed a novel referential communication task in which dyads including at least one child are asked to match photos of different kin through verbal discussion. Ethnography and other, less controlled observational methods provide more ecologically valid insights into children's thought processes regarding kinship relations, though they are of course less amenable to comparison. Observational methods – ideally relying on audiovisual corpora of children's language use – can address a wide range of empirical questions about behavioural and linguistic practices. To what extent do children reveal knowledge of kinship distinctions in their behaviour? What do they use kinterms for? How is their everyday experience shaped by kinship? And, crucially, how much cross-cultural variation exists with respect to these questions?

Our toolkit is designed to encourage and equip researchers to conduct multi-methods research on the acquisition of kinship concepts, and to provide data suitable for comparative analysis. By employing both quantitatively- and qualitatively-oriented methods in different cultural environments, the goal is to make generalisations about children's abstract understanding of kinship, adapting those generalisations as necessary on the basis of careful qualitative study of children's kinship knowledge as revealed in everyday social interaction. We illustrate this briefly here with an example from the first author's research with Datooga-speaking children of Tanzania. Questionnaire data in diverse communities (§2.1) has suggested that young children have difficulty identifying kinship relations that hold between two third parties. In an informal questionnaire conducted with 65 Datooga-speaking children, almost all children under the age of six did not correctly label the relationship of their father to their sibling. However, in recordings of spontaneous interaction, young children did strategically refer to kin relations holding between an addressee and a third party. This contrast obviously has methodological implications: responses to questionnaires may only partially reflect children's knowledge, may underestimate the age at which children acquire certain cognitive abilities, and do not reliably tap implicit knowledge. But this differential evidence also has theoretical import: children's ability to think about kinship relations as they affect social and material circumstances at a given moment in time may precede the ability to explicitly reason about kinship in low-stakes environments – a skill that may rely on metacognitive abilities. Either way, a multi-method approach forces us to think harder about the nature of our evidence for the development of kinship knowledge.

The toolkit presented on our OSF page is a work-in-progress: the tools can be adapted and extended as research in this field develops. The open nature of the toolkit means that individual researchers can contribute their own resources and, eventually, data sets and analysis. Our vision for this open, collaborative research project is that in a decade's time, we will have sufficient data to make robust generalizations about how children in different cultural environments learn to classify kin.

4 Children's Acquisition of Kinship Concepts: What's at Stake?

Our aims in this article have been twofold: to review the literature on how children learn kinship concepts; and to stimulate research in this domain with the aid of a toolkit to take this research forward. Based on our review, we conclude that our current understanding of the ontogenetic development of kinship concepts across cultures leaves much to be explored. Kinship-related cognition deserves a much more prominent position in developmental research. Though our focus has been on kinship categorization, we would also emphasise the significance of kinship for child-centred research more generally. Young children's social worlds are shaped by kinship in all parts of the world, yet we know little about how children conceptualise and enact kinship relations.

With this review we hope to stimulate interest in what we see as an outstanding topic for the cognitive and social sciences. Unlike any other species, humans have (culturally) evolved multiple systems of kin organisation. All children face the task of learning to classify people according to kinship – knowing who's who to whom – but the task varies depending on the sociolinguistic environment in which they grow up. To what extent does learning proceed differently in different environments? How do major societal changes in the organization of family affect learning? Does kinship knowledge constitute its own cognitive domain, or is it undergirded by domain-general learning mechanisms? Kinship language is special in that its referents are inherently relational; a child learns extension patterns for a system of terms that are a mixture of self- and other-anchored. What then is the role of kinship in developing relational and multi-perspectival thinking, and in social cognition more generally? Alongside an understanding of adaptive function, and the historical constraints of evolution, Tinbergen (1963) added developmental questions as essential for understanding any behaviour and its variation. Constraints on the acquisition of kinship concepts fundamentally affect what kinds of kinship systems can evolve. By probing how kinship concepts develop in children, we ultimately seek to understand why humans exhibit structured variation in the

putatively universal concept of "family". To pursue the ontogeny of kinship, in Box 1 we pose a set of relevant questions with which we hope to further the interdisciplinary study of the human mind.

Outstanding Questions

1. Is kinship a specialized cognitive domain with biological underpinnings? If so, how does it relate to other areas of social cognition?
2. How does kinship compare to other conceptual domains in terms of complexity?
3. Are particular kinship relations or systems more challenging to learn than others?
4. What kinds of experiments can best test children's reasoning about kinship?
5. Thinking about the situated nature of cognition, what do children use kinship terms and kinship-related concepts for? How does this change as they grow older?
6. How do multilingual children negotiate differently organized kinship systems?
7. How do children's ideas about kinship differ from adults'? What role might children play in changes to kinship systems?
8. How and to what extent does kinship shape children's everyday lives? How are major sociocultural changes affecting children's understanding and experience of kinship?

Acknowledgements

This research was supported by the European Research Council (Starting Grant VARIKIN ERC-Stg-639291 awarded to FMJ). We thank the excd.lab; Marisa Casillas, Frank Mollica, Joe Blythe and other participants at the 2018 CAKTAM meeting; and three anonymous reviewers, for useful comments on earlier versions of the manuscript.

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