CAREGIVER-CHILD INTERACTIONS AND LANGUAGE ABILITIES OF WOLOF-SPEAKING TODDLERS IN RURAL SENEGAL

By

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ABSTRACT

In Western societies, both verbal and nonverbal behaviors have been shown to engage infants' attention, which then contributes to children's language development. It is unknown whether findings are replicable in non-Western agrarian cultures where child-directed speech happens less frequently. Using longitudinal observations of 108 Wolof-speaking caregivers interacting with their young children in rural Senegal, the dissertation investigated how caregiver-child verbal and nonverbal interactions relate to children's verbal abilities at the age of 20-30-months as well as one year later. Cross-cultural research shows that mothers in non-Western agrarian communities primarily engage in nonverbal communication involving body contact and stimulation when interacting with their children. In contrast, mothers from Western industrial societies engage more in face-to-face communication behaviors such as mutual gaze and child-directed speech. Observed differences between cultural groups are based on the questionable assumption that mothers within the same cultural group rely uniformly on a single parenting style. My dissertation explored this assumption in two studies. Study One investigated variability in the extent to which Wolof-speaking caregivers used nonverbal and face-to-face communication when interacting with their toddlers during controlled play sessions. It also examined whether variability in interactional patterns relate to concurrent child language outcomes. K-means clustering analysis yielded two groups of mothers who used similar amounts of physical touch with their children, but differed in their use of face-to-face behaviors, and in their use of nonverbal communication behaviors, including 'nonverbal pretend play,' 'nonverbal object stimulation,' and 'nonverbal cues' such as snapping fingers to get children's attention. These results show within-group variabilities in caregivers' communication style. Multivariate analysis of the covariance showed that children of mothers who used more face-to-face

behaviors such as gaze and conversation turns had higher vocabulary and language milestones than children of mothers who used less face-face-to face behaviors.

Study Two examined the qualities in the Wolof-speaking caregivers' speech and how they related to child vocabulary and language milestones concurrently and one year later. Results yielded substantial variabilities in Wolof caregivers' language input features with questions and directives being the two most frequent input types that caregivers addressed to children. Further, caregivers' here-and-now utterances at 24 months negatively associated with child language outcomes at 36 months. However, their decontextualized talk about past and future events predicted child vocabulary and language milestone at 36 months. Unlike findings from western societies, caregivers' directives that drew children from their attentional focus significantly associated with children's vocabulary and language milestones at 24 months, but only when the directives were not prohibitive (i.e., don't). Also, caregivers' open-ended questions, particularly 'what' and 'how' questions at 24 months had longitudinal associations with children's vocabulary and language milestones at 36 months. But their 'why' questions were mostly for reprimanding the children at 24 months, perhaps explaining why these types of questions negatively predicted their language milestones one year later. Finally, caregivers who were more likely to elaborate on the topics or objects of discussion at 24 months had children with better vocabulary and language milestones at 36 months. Taken together, these studies suggest that it is important to explore within-group differences in mother-child interaction among non-western families, who have been mostly studied in comparison to western families focusing on between-group differences. The findings provide a better understanding of how Senegalese caregivers interact with their children, therefore contributing to developing language development theories that are more representative than what we have seen to date.

To my grandmother, Aïssa Sy, who raised me, loves me, and saved my education.
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CHAPTER ONE: DISSERTATION OVERVIEW

Purpose

This dissertation addresses significant gaps in the literature regarding mother-child interactions and child language development in Africa. Based on observations of 108 caregiver-child dyads from 24 rural Wolof-speaking communities in Senegal, Study One investigated whether there were meaningful *within-group* variabilities among Wolof-speaking caregivers in the extent to which they used nonverbal and face-to-face communication when interacting with their 20-30 months toddlers during controlled play sessions. And if so, would such variability relate to concurrent child language outcomes? In Study Two, I first examined the quality features in the language that caregivers addressed to their 20–30-month-old children. In this dissertation, quality features of caregivers' language refer to five input types, which are *directives*, *questions*, *decontextualized* and *here-and-now talk*, and *elaboration*. Second, I also investigated how these different inputs predicted children's vocabulary and language milestones at 24 and 36 months.

Rationale

A broad range of studies shows that the quantity and the quality of adult-child verbal engagement predict child language outcomes (Gilkerson et al., 2015; Weisleder & Fernald, 2013; Huttenlocher et al., 2002; Rowe, 2012; Rowe, Leech & Cabrera, 2017). Similarly, studies have reported that other behaviors for engaging infants' attention, such as mutual gaze, also contribute to child language development (e.g., Mundy et al., 2007; Tomasello & Todd, 1983). However, like most psychological research, these studies have been in great part conducted in Western societies (Henrich et al., 2010; Arnott, 2008), making the lack of diversity in the developmental science research obvious in many ways. For example, a review of papers published in leading child language journals in the last 45 years showed that less than 2% of the over 7,000 world

languages were represented (Kidd & Garcia, 2022). Also, a more recent review revealed that more than 90% of the samples published in mainstream psychological journals are from the US (Nielson et al., 2017). Therefore, it is unknown whether findings espousing the importance of mother-child interactions and child language development are also generalizable to non-Western agrarian cultures where face-to-face behaviors such child-directed speech rarely happens (Cristia et al., 2017).

More importantly, cross-cultural research shows that mothers in non-Western agrarian communities mostly engage with their children in nonverbal communication involving body contact and body stimulation, while mothers from Western industrial societies engage more in face-to-face communication behaviors such as mutual gaze and child-directed speech (e.g., Keller, 2007; Keller et al., 2009). However, these studies have focused on differences *between* cultural groups, leading to a possible assumption that mothers within the same cultural group rely uniformly on a single parenting style. My dissertation explores this assumption in two studies by investigating *within-group* differences in caregivers-child interactional patterns and how such variabilities relate to child language outcomes. The findings of this dissertation deepen our understanding of how non-Western caregivers interact with their children; a literature based currently on cross-cultural studies that mostly ignore differences in parenting style within cultural groups. The findings also contribute to the development of more cohesive language development theories.

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CHAPTER TWO: STUDY ONE: HOW FACE-TO-FACE AND NONVERBAL COMMUNICATION AMONG WOLOF-SPEAKING CAREGIVERS IN SENEGAL RELATE TO THEIR TODDLERS' VOCABULARY AND LANGUAGE MILESTONES

ABSTRACT

Study 1 investigated variability in the extent to which Wolof-speaking caregivers (N = 108) used physical and face-to-face communication when interacting with their 20–30-month-old toddlers during controlled play sessions. It also examined whether variability in interactional patterns relate to concurrent child language outcomes. K-means clustering analysis yielded two groups of mothers who used similar amounts of physical touch with their children, but differed in their use of face-to-face behaviors, and in their use of nonverbal communication behaviors, including 'nonverbal pretend play,' 'nonverbal object stimulation,' and 'nonverbal cues' such as snapping fingers to get children's attention. Multivariate analysis of the covariance showed that children of mothers who used more face-to-face behaviors, such as gaze and conversation turns, had higher vocabulary and language milestones than children of mothers who used less face-face-to face behaviors.

Introduction

Research has convincingly shown that adult verbal engagement with young children during face-to-face communication predicts child language abilities (e.g., Hottenlocher et al., 1991). Children's communicative skills differ at any given age (Fenson et al., 1994). Although genetic factors may contribute to individual differences in early language abilities (for a review see Stromswold, 2001), it is well-established that environmental factors such as adult-child verbal engagement also play a substantial role (Hoff, 2006). In particular, many studies have suggested that the amount of speech addressed by adults to children, known as child-directed speech (CDS), supports early language learning (e.g., Gilkerson et al., 2018).

In an influential study assessing the contribution of caregiver language input to child language proficiency, Hart and Risley (1995) found that children from more advantaged families heard substantially more words than children from less advantaged families by the time they were 4 years old. This "word gap" was associated with children's language outcomes, such that children from high socioeconomic-status families had bigger vocabularies when compared to children from low socioeconomic-status families. Moreover, even within socioeconomic groups, there is substantial variability in the quantity of speech children hear (Weisleder & Fernald, 2013; Shimpi et al., 2012); these differences are predictive of children's vocabulary. For example, in a study investigating caregiver-child interactions from low-income families, Hurtado et al. (2008) found that children whose mothers talked more often to them at 18 months were more advanced in vocabulary at 24 months than children who heard fewer words at 18 months.

Associations between Nonverbal Behaviors and Child Language Outcomes

Non-verbal behaviors such as gaze, touch, and gesture also contribute to children's language development. Custode and Tamis-LeMonda (2020) investigated the frequency in which

children are exposed to the name of objects when engaged in nonverbal behaviors with their mothers; mothers mostly named objects around their infants when they look at each other's faces or engage in other nonverbal behaviors such as gestures and touching the objects. However, the strongest evidence concerning the link between nonverbal behaviors and child language abilities has been found in the area of gaze behaviors within joint attention episodes. Joint attention in young children is defined as their ability to shift to and incorporate a third object in their interactions with their caregivers (Carpenter et al., 1998). One important early joint attention skill is gaze following, which has been widely shown to link to children's language skills (Brooks, & Meltzoff, 2005; Morales et al., 1998). In particular, mutual gaze is a way by which a social partner initiates a joint attention behavior like gaze following (Csibra & Gergely, 2009; Senju & Csibra, 2008; Mundy et al., 2007). For example, initiating joint attention - measured as the frequency of two eye-contact behaviors at 12 and 18 months - predicted children's receptive and expressive language skills at 24 months (Mundy et al., 2007).

Relatedly, some researchers suggest that mutual gaze contributes to language development because adults share attention with a child when they coordinate gaze and language input (Deák et al., 2018), which helps children learn new words (Tomasello & Todd, 1983). That is, adults play a central role in vocabulary development by taking part in and keeping track of children's attentional focus. Furthermore, some researchers acknowledge the importance of adult verbal input for children's language skills but posit that it is more useful when combined with nonverbal behaviors like mutual gaze. Combining gaze and input not only elicits children's attention, but it helps them connect sights and sounds (Custode & Tamis-LeMonda, 2020; Roy & Pentland, 2002), therefore facilitating their word acquisition. For example, in a study using computer simulations of word learning, Roy, and Pentland (2002) found an increase in word

learning when the input is multimodal (speech and gaze), as compared to when the input is unimodal (speech only).

Language Development Research Predominantly Conducted in Western Societies

Although there is convincing evidence that talking to young children and mutual gaze in face-to-face communication are important for early language learning, this assertion is based almost exclusively on studies of parent-child interactions conducted in the U.S. and Europe. An analysis of the content of most APA journals showed that 96% of the samples were from Western, Educated, Industrialized, Rich and Democratic (WEIRD) societies, which only represent 12% of the word population (Henrich et al., 2010; Arnett, 2009). Notably, less than 1% of the subjects were from Africa or the Middle East (Arnett, 2009).

A review of the literature showed that we know little about language acquisition in many parts of the world, and most of the language data published in language development journals are Indo-European languages spoken in the US and Europe. For instance, we only have language acquisition data for about 1-2% of the world's languages (Lieven & Stoll, 2009). Similarly, nearly 60% of monolingual and over 80% of bilingual corpora in the CHILDES database are from Indo-European languages mostly composed of English and other European languages (Kidd et al., pre-Mpal, 2020). This situation shows that more work needs to be done to investigate whether theories of language acquisition supporting the importance of adult verbal and nonverbal engagement for language development are replicable to non-western agrarian societies where we have less data on mother-child interactions. Although there is a paucity of language development data from non-western societies, there is a long history of ethnographic investigations on the verbal and nonverbal interactions of children and mothers living in non-western societies.

Cross-cultural Differences in Patterns of Caregiver-child Interactions

Investigations of mother-child interactions in non-western societies have been both qualitative and quantitative in nature. Qualitative investigations here refer to anthropological and ethnographic studies conducted in the 1970s based specifically on non-experimental observations of caregiving behaviors in non-Western societies (e.g., Harkness & Super, 1977; Ochs, 1982). These studies have many things in common. For example, they were mostly non-hypothesis driven and ecologically valid in the sense that researchers observed children and caregivers in their real-world settings. They were also mostly descriptive and were all conducted in non-western agrarian societies. Quantitative investigations are generally more recent and build on the anthropological studies of the 1970s to assess the extent to which caregiving behaviors such as child-directed speech occurs in non-western agrarian societies (e.g., Shneidman & Goldin-Meadow, 2012). It is important to note that these quantitative studies have defined child-directed speech in different ways. Some studies define child-directed speech in terms of number of utterances addressed to children (Shneidman & Goldin-Meadow, 2012; Vogt et al., 2015), amount of time talking to children (e.g., Casillas, Brown, & Levinson, 2019), and number of words (Shneidman & Goldin-Meadow, 2012). One central communality between the qualitative and the quantitative cross-cultural studies is that, although conducted in different times of history, they all report the infrequency of certain patterns of caregiver-child interactions in non-western agrarian societies.

Qualitative cross-cultural studies have reported that child-directed speech is infrequent in many non-western societies. In the 1970s, Harkness and Super conducted a narration study with the Kipsigis people, a Kenyan ethnic group living in a farming community in Western Kenya. The test consisted of telling a story to three-year old children and asking them to retell it.

Surprisingly, at three years of age and by age ten, the great majority of children did not retell the story. Harkness and Super hypothesized that children's reluctance to speak might be due to their language socialization. So, they decided to observe how these children interact with their caregivers and interviewed parents about talking to children. The observations showed that adults talked infrequently to children and most communications asked children to do something, not to say something (Harkness & Super, 1977). Other observations conducted in African farming communities showed that child-directed speech is also uncommon in other parts of Kenya and Nigeria (Levine et al., 1994), Cameroon (Keller, 2007), and in Senegal where this study was conducted (Rabain-Jamin, 1998, 2001).

Child-directed speech is also rare in other non-western agrarian societies outside Africa. In her studies on talking to children in Western Samoan, Elinor Ochs (1982) found that caregivers respond very rarely to children's verbal overtures, rather they turn to other caregivers to satisfy the child's need, hence minimizing caregiver-child verbal turn-taking (Ochs, 1982, 1988). Similarly, research has found that adult talk to children very rarely in some agrarian parts of Indonesia (Smith-Hefner, 1988), New Guinea (Schiefflin, 1990) and in the Mayan communities in Mexico (Brown, 1988; de Leon, 1999; Pye, 1986). For example, Smith-Hefner (1988) observed that Javanese people living in rural communities in Indonesia rarely talk to their preverbal infants, but rather playfully coo or croon to them. Relatedly, Brown (1988) reported that Tzeltal Mayan babies are not considered by adults as interlocutors, therefore talking to them rarely.

Building on the strong foundation provided by qualitative studies, more recent studies have used quantitative methods to assess the amount of speech addressed to young children in non-Western settings. To the best of my knowledge, the majority of quantitative investigations of

child-directed speech in non-western societies to date have been conducted in Mayan communities (e.g., Cristia et al., 2019), in North America (Bergelson, et al., 2018), and in Africa, more specifically in Mozambique (Vogt et al., 2015). More importantly, these studies confirmed that child-directed speech in preindustrial or non-western agrarian societies is rare. For instance, Casillas et al. (2019) analyzed day-long recording of the language environment of 10 Tzeltal Mayan children under age 3 by randomly selecting 1-hour clips from each recording. They found that children under age 3 in the Tzeltal Mayan community are talked to for a mean duration of 3.63 min/hr. Similar results were found by Cristia et al. (2019) in a Mayan forager-farmer community, where less than 1 min of speech per daylight hour was directed to children under the age of 4 years. Research quantifying speech directed to children living in rural Africa also found that young children from rural Mozambique heard substantially fewer utterances compared to their peers from urban Mozambique and the Netherlands (Vogt et al., 2015). Furthermore, quantitative cross-cultural studies have not only confirmed the rarity of child-directed speech previously reported by ethnographic studies, but have also found that, as in western industrial societies, it was only child-directed speech that predicted child vocabulary in a preindustrial Yucatec Mayan community (Shneidman & Goldin-Meadow, 2012). While these cross-cultural studies have provided valuable data on the quantity of child-directed speech and its relation to child language in non-Western societies, they have not included measures of other caregiving behaviors such as mothers' gaze patterns, which also play a role in supporting children's early language learning (Custode & Tamis-LeMonda, 2020; Mundy et al., 2007). In addition, the sample sizes used in prior work were mostly very small, so it is unclear whether their findings would generalize to larger communities.

Within and Cross-cultural Studies of Nonverbal Mother-child Interactions

In addition to the rarity of child-directed speech, some cross-cultural observational studies have also reported that mutual gaze between a caregiver and a baby happens very rarely in many African agrarian societies. Robert LeVine and Terry Brazelton observed mother-child interactions among the Gusii ethnic group in Kenya and the Hausa mothers in Nigeria. A common characteristic of the Gusii and Hausa mothers was that they barely made eye contact with their babies (LeVine et al., 1994). Some of the mothers deliberately avoided eye contact with their babies (LeVine & LeVine, 2016; Dixon et al., 1981). A similar practice has been found among a Cameroonian ethnic group called the Nso, where anthropologists have observed mothers blowing onto an infant's face when the child was looking at her, with the goal of avoiding face-to-face contact. In doing so, mothers claimed that they could not get their work done if the child could not be easily taken care of by others (Keller, 2007; Keller, 2005). Moreover, observations of home interactions of the Embu people in rural Kenya showed that toddlers in that ethnic group experienced more physical care, such as touch, than face-to-face behaviors with their caregivers (Sigman et al., 1988).

In addition to cultural studies that have explored parenting behaviors within non-western agrarian cultures, some investigations are comparative in nature, examining cultural diversity in parenting styles across non-western farming communities and western industrial societies (e.g., Keller, 2007). These studies have explored how mothers from different populations and societies interact with their children using a broad range of caregiving behaviors, such as body contact, touch, and physical comforting, as well as face-to-face interaction and verbal engagement. For instance, one study rank-ordered maternal responsiveness behaviors to infant vocalizations, cries and looks among the Gusii mothers and their American counterparts. Results showed that the

Gusii mothers mostly responded to their infants' vocalizations and looks with physical contact rather than reciprocal talking. Also, only 1% of their responsive behaviors involved looking. In contrast, the American mothers sought to engage with their infants by talking, and 43% of their responses to infants involved looking (LeVine et al., 1994; Richman et al., 1992). Similarly, Keller and colleagues (2007) have conducted multiple studies comparing how mothers from a broad range of cultural and socio-economic groups interact with their infants. Keller describes two parenting styles used across cultures: 'proximal' and 'distal' parenting styles. By Keller's definition, 'proximal' parenting involves caregiving behaviors such as touching, caressing, or lifting up the child, while 'distal' parenting involves eye contact and object stimulation (Keller, 2007). She found that mothers living in non-western farming communities, including communities in Africa and India, predominantly use a proximal parenting style, whereas mothers from Western industrial societies predominantly use a distal parenting style.

In one such study comparing interaction patterns of middle-class German mothers and Cameroonian mothers from farming communities, Keller and her colleagues found that German mothers engaged more in face-to-face interactions, which included eye contact, while African mothers mostly used physical communication styles such as touching and lifting up their babies (Lamm et al., 2015). These findings have been confirmed in another study that assessed the socialization goals of parents from Western industrial societies (Los Angeles, Berlin, and Athens), and parents from rural non-Western settings (Cameroonian Nso farmers, and the Gujarati Rajput from India). Parents were asked to give their opinion on a questionnaire of 10 statements about parenting behaviors (Keller et al., 2006). Parents from non-western settings agreed more often with statements regarding the importance of physical communication styles, compared to Western mothers. Unlike Western mothers, their Non-western peers agreed less

about the statements regarding the importance of eye contact and parental effort to attract or follow the child's attention to an object (Keller et al., 2006; Keller, 2007).

There are some speculations on why parents living in non-western farming communities predominantly use physical communication styles and less face-to-face communication including eye contact and talking to children. For instance, LeVine (2003) proposes three levels of explanations in this sense. First, Levine suggests that the effects of environmental pressures on parental goals could explain the predominance of the bodily proximity in mother-child interactions and the rarity of mutual gaze among some African communities. For example, the existence of environmental hazards like "falling off cliffs or hills, falling into rivers, etc." could shape mothers' parental goals because children's physical safety and survival are top priorities. These hazards are menacing to the health and well-being of the child and thus may lead caregivers to adopt solutions such as carrying a child on the back or holding the child, practices that eventually become accepted as customs in a community.

Second, cultural variations in parenting goals can influence parenting practices. LeVine hypothesized that in communities with high infant mortality rate – as is the case in most low-income non-western rural communities – parents' primary concern is the physical safety and the health of their children. According to Levine (2003), parents in these communities might not rely heavily on verbal communication or forms of stimulation such as eye contact. Instead, they may prioritize proximal interactions that promote safety and close relationships. Third, parents living in societies with limited resources may prioritize their children's future economic independence as an important goal (Levine, 2003). For example, parents in these communities typically believe that children need to be obedient to achieve their future economic self-maintenance in a world with instability of resources dominated by adults. It is possible that the practice of gaze aversion

and avoidance observed in some African communities during infancy serves the function of training children to avoid having eye contact with adults, which is considered as to be a sign of disobedience and disrespect (Keller, 2007, LeVine, 2003; LeVine et al., 1994).

Western cultural anthropologists and cultural psychologists have also proposed explanations for why talking to children is rare in non-western agrarian societies (e.g., Harkness & Super, 1977; Brown, 1988). For instance, Harkness & Super (1977) suggested that Kipsigis mothers in Kenya do not talk much to their children because children are expected to be silent in front of an adult, because otherwise they would be treated as disrespectful. Brown (1998) proposed that one reason Tzeltal Mayan caregivers do not often talk to their babies is because they do not consider young babies as conversational partners. Rather, they view them as fragile beings who need to be carried and protected, hence the predominance of physical interaction with young babies. Among Samoans and the Kaluli people in New Guinea, caregivers also talk to their children infrequently; and when they do, parents do not generally simplify their child-directed speech. This could be because they believe that adults have higher status and should not adjust their speech to the level of children, who are considered to be a lower-status group (Ochs & Schieffelin, 2008; Ochs, 1982).

Although mother-child verbal engagement is important for children's language abilities, the prevalence of mother-infant physical contact in Africa also contributes to many child outcomes necessary for optimal development. Harlow (1958) ran his famous monkey experiment to understand, in part, if the bond between babies and their mothers happens because of pure nutritional needs or whether it involves other factors. Harlow separated baby monkeys from their biological mothers shortly after birth. He then put them in cages with access to two surrogate mothers, one made of wire, and one made of terry cloth. The surrogate mother made of wire

provided food, whereas the one made of terry cloth did not. Observed over time, baby monkeys spent more time on the soft surrogate and only went to the wire mother when they were hungry. This finding led to the conclusion that early physical comfort seems to be a more decisive factor than nutrition regarding bonding between babies and their mothers.

Following Harlow's study, many studies have documented the importance of mother-child tactile interaction for children's physical, attachment, and cognitive development. For example, there is convincing evidence that skin-to-skin contact between a mother and her newborn is associated with weight gain. It also reduces risks of mortality in babies born with low birthweight (for a review, see Conde-Agudelo & Diaz-Rosello, 2016). Moreover, in the attachment literature, Ainsworth and colleagues astutely observed mothers' capacity to show affection to their young infants through touch (Ainsworth et al.,1978). They found that this bodily contact during mother-infant interactions promotes secure attachment in infants. More recently, Anisfield et al. (1990) conducted an experimental study to test whether an increase in physical contact with 3-month-old infants would contribute to a more secure attachment at the age of 13-months. Parents in the experimental group received soft baby carriers, assuming that they would increase physical contact. The control group received infant seats, assuming that these would be less likely to increase physical contact. When tested in the Strange Situation at 13 months, infants in the experimental group were more securely attached to their mothers than infants in the control group.

In the same vein, research has shown that an aversion to physical contact by attachment figures is positively associated with infants' angry mood and aggression (Main & Stadtman, 1981). In addition, some researchers have found positive longitudinal associations between physical contact and children's executive functions (Feldman et al., 2014).

It is important to emphasize that mother-child physical contact is a culturally appropriate caregiving behavior in rural African communities. In a comparative observational study, LeVine and colleagues (1994) noted that American mothers demonstrated affection to their infants through face-to-face behaviors, namely, talk and eye contact. In contrast, Gusii mothers in rural Kenya were emotionally present with their babies but showed affection through tactile behaviors. LeVine and LeVine (2016) argued that if we look at the Gusii mothers' behaviors through a western lens, we might think that they are emotionally absent, but they are not. They just do not express affection the way American parents do.

Furthermore, Keller and colleagues (2004) found that rural Cameroonian children who predominantly experienced proximal parenting, including body contact, developed self-regulation earlier than children from Greek middle-class families who mostly experienced distal parenting, including eye contact and object play. Self-regulation was measured as compliance to request and prohibition. And on the other hand, children from Greek middle-class families developed self-recognition earlier than the Cameroonian children. Keller and colleagues interpreted these results in light of differences in sociocultural orientations. They posit that the prevalence of object play in Western mother-child dyads fosters an "independent self"; hence the earlier development of self-recognition among the Greek infants compared to African children. Relatedly, Keller et al. (2004) suggested that the association between body contact and early compliance among African children could be explained by parents' goal of raising obedient children. But can we assume that caregivers living in rural African communities only engage only in physical communication with their infants and not face-to-face behaviors known for promoting language development?

Within-group Differences in Parenting and Language Outcomes

Although cross-cultural studies have greatly contributed to our understanding of differences in mother-child interactions that are typical to Western industrial societies as compared to non-western agrarian societies, most of them do not consider differences in parenting *within* a culture (Keller et al.,2009). For example, in some cases, mothers from western samples use both proximal and distal parenting at a similar rate (e.g., Keller et al., 2009). But this reality is mostly overshadowed by the common tendency of attributing a proximal parenting style to non-western parents living in farming communities, and a distal parenting style to mothers from WEIRD settings, as if the two parenting styles were mutually exclusive. More importantly, ignoring within-culture differences in parenting behaviors leads to the assumption that there is homogeneity in the extent to which mothers within a cultural group use particular parenting behaviors.

In research conducted mainly in Western societies, variability in parent-child interactions has been widely documented within a culture and these within-group differences turn out to matter for language development (See Kidd, & Donnelly, 2020 for a review). For instance, research investigating caregiver-child verbal interaction in low-income neighborhoods found that children who heard more words from their caregivers at 18 months were more advanced in vocabulary at 24 months than children who heard fewer words from their caregivers at 18 months (Hurtado et al., 2008). A similar study exploring the verbal interactions of low-income African American mother-child dyads found that variability in maternal speech predicted child vocabulary (Shimpi et al., 2012). Similar results have been found even in cultures where mother-child verbal engagement is rare (Shneidman & Goldin-Meadow, 2012).

The Current Study: Goals and Hypotheses

My overarching goal is to identify and differentiate the interaction patterns that contribute to different communication styles of Wolof-speaking caregiver-child dyads. To do that, I defined two communication styles a) face-to-face communication and b) nonverbal communication, parallel (but not identical) to the "distal" and "proximal" communication styles studied extensively by Keller and colleagues (e.g., Keller, 2007). Specifically, the face-to-face communication style is characterized by caregiving behaviors that researchers have reported as frequent in Western societies and infrequent in non-western agrarian cultures. Those behaviors include speech addressed to children by adults (LeVine et al., 1994); conversational turn-taking (Keller et al., 2018; Ochs, 1982); eye contact (Keller, 2007; Richman et al., 1992), object stimulation and warmth through verbal engagement (Keller, 2007).-My face-to-face communication style is different from Keller's distal parenting style in critical ways. A major difference is that Keller is not interested in maternal language or child language outcomes. Instead, she has looked at how experiencing proximal and distal parenting styles leads to different child social development outcomes such as self-recognition and compliance (Keller et al., 2005; Keller, 2007). As such, Keller's distal parenting category was uniquely composed of eye contact and object stimulation. This categorization leaves out other distal behaviors such as conversational turn-taking, which are shown to be prevalent in Western industrial societies and rare in non-Western agrarian cultures (e.g., Cristia et al., 2019).

Moreover, the nonverbal communication style in this study includes behaviors commonly reported to be prevalent among non-Western mothers with low formal education levels, specifically tactile interactions, and the use of other nonverbal behaviors to engage or stimulate the child. My nonverbal communication style is parallel to Keller's proximal parenting

style but different. Keller's proximal parenting category involves stimulating the child's body through actions like lifting them up and kissing them (i.e., body stimulation) and maintaining close physical contact between the caregiver and the child (i.e., body contact). In my nonverbal communication category, I incorporate similar behaviors, but also include other nonverbal behaviors that reflect common caregiving practices in non-western agrarian societies.

I propose to adopt a clustering approach, which will enable me to find different groups of caregivers among the 108 caregivers in how they interact with their 20-to 30-month-old toddlers using verbal and nonverbal behaviors associated with face-to-face and nonverbal communication styles. Unlike cross-cultural studies that focus on differences between cultural groups while overlooking within-group variability, I anticipated finding naturally occurring differences among caregivers within the same cultural group in their use of face-to-face and nonverbal communication styles. First, I expected to find caregivers who would be more likely to use face-to-face communication behaviors than others and some more likely to use nonverbal communication behaviors than others. Second, I asked whether some mothers' greater use of face-to-face communication was associated with a reduction in their use of nonverbal communication compared to mothers in the community who used less face-to-face behaviors. Finally, I explored whether differences in how Wolof-speaking mothers use face-to-face and nonverbal communication related to their children's language outcomes. Given the well-established association between face-to-face behaviors such as gaze and caregiver-child verbal engagement, and children's language outcomes, I hypothesized that children of mothers who used more face-to-face communication would be more advanced in their vocabulary and communicative skills than children whose mothers used less face-to-face communication.

Method

Participants

Participants in this study were 106 Wolof-speaking caregivers (Mean age = 29.58 years; Range: 13-67 years; all female) and their children aged 20-30 months (Mean age = 24.18 months; *SD* = 2.81; 51 girls and 57 boys), living in agrarian villages in rural Senegal. These caregiver-child dyads were drawn from 24 villages in the Kaolack region of West-central Senegal, where 65% of the working population are farmers (Senegalese National Statistics and Demographic Agency, 2020). It should be noted that the sample I used in this dissertation was exclusively drawn from the control group, which did not receive Tostan's intervention. Therefore, the analysis excluded any potential effect of the program on caregivers and their children. Selection criteria for the larger sample included that children were being raised in monolingual Wolof-speaking families and had no language, hearing, or visual disabilities. Children's age was confirmed by checking their birth certificates. However, in cases where parents had not registered their children at birth, we consulted with local midwives who kept records of children's births.

Primary caregivers were either the child's biological mother (87.6%), grandmother (8.7%), older sister (1%), or aunt (2.8%). Most of the primary caregivers (79.3%) had no formal education in French or Franco-Arabic schools, although 63.1% attended Koranic schools, and 16.1% had no education at all. Caregivers and their children lived in households where the number of people per ranged from 5 to 38 people. Most of these households were led by polygamous fathers. Participants lived predominantly in compounds built of mud or bricks, with roofs made of straw and zinc. Wells and public tap water were the primary sources of drinking water in these areas.

Procedures

Mother-child interactions

Caregiver-child interactions were observed during structured play sessions. In each village, these sessions occurred in local public rooms such as a health center, school, and rural council building. Caregivers and children sat on a plastic mat with simple toys, including a shovel, cups, and a plastic bucket. These toys were ecologically valid as they were selected to make sure that they were familiar and relevant to the local culture. Before beginning the play sessions, a local native-Wolof-speaking research assistant explained the goal of the study to caregivers. The research assistant told caregivers that their participation and images would remain confidential. Caregivers were instructed to interact with children as they would do at home, using the toys provided. After attaching a microphone to the caregiver's clothing, the research assistant ensured the microphone was synchronized to a camera set about 2 m from the floor mat before leaving the dyads uninterrupted for 15 min. The middle 5-min of each interaction were analyzed.

Development of the coding scheme

The coding system used to code face-to-face, and nonverbal caregiving behaviors was developed collaboratively by a team of researchers that included the STEP team and other local Wolof-speaking research assistants. The draft of this coding scheme was initially developed in English and then translated into French. The goal of translating the coding scheme into French was to allow more collaborative participation of all native-Wolof speaking research assistants who were more fluent in French, the official language of Senegal, than in English. The coding scheme went through many refinements to make it culturally relevant. For example, to measure behaviors used by caregivers to get a child's attention, the Senegalese research assistants suggested that we included finger snapping and claps as they are commonly used by caregivers

when interacting with young infants. This collaborative work resulted in the final list of 8 caregiving behaviors.

Coding & Definition of Caregiving Behaviors

Trained coders used the *Bandicut program,* a video cutting and joining software (https://tinyurl.com/y6pcj6pr) to divide the 5-min caregiver-child interactions into 10 segments of 30-sec. Research assistant observed each 30-sec segment to rate caregivers' face-to-face and nonverbal communication behaviors based on 3-point Likert scale ranging from 0 to 2 (*0 = not at all/very little; 1 = sometimes; 2 = a lot/most of the time*). We obtained total scores for each behavior by summing scores across the 10 segments of 30 seconds.

This study coded 8 caregiving behaviors, four face-to-face communication behaviors, and four nonverbal communication behaviors.

Face-to-face communication

Face-to-face communication is when caregivers and children engage in eye contact and verbal behaviors. The behaviors were coded based on 3-point Likert scale ranging from 0 to 2 (*0 = Not at all/Very little*; *1 = Sometimes*, and *2 = A lot/Most of the time*). The behavior "Warmth through positive tone" was coded on a 4-point Likert Scale (*0 = Not at all, 1 = Very little, 2 = Moderate, 3 = High/A lot*). It is important to note that during the process of developing the coding scheme, we realized that, in general, "warmth through positive tone" happened more frequently than the other face-to-face communication behaviors. Therefore, I decided to expand the number of choice-points to four. To code the face-to-face behaviors, Raters applied each behavior over ten 30-second windows of caregiver-child interaction and decided whether the rating was 0, 1, 2, or 3 for "warmth through positive tone" or 0, 1, or 2for the other face-to-face behaviors.

a) Mutual Gaze

We defined mutual gaze as any direct eye contact between the caregiver and the child. Within each 30-second window of caregiver-child interaction, coders rated 0 for mutual gaze if the caregiver and the child had no eye contact or eye contact just once, very little, or for a very short time. Coders coded '1' if the caregiver and the child had eye contact a few times (i.e., 3 times) or a short period. The caregiver-child interactions were coded '2' for mutual gaze if the caregiver and the child had eye contact many times (i.e., 4 and more) or for a long time. Raters coded the interactions by taking into account both frequency and length of the gaze episodes; thus, very brief gazes were not counted. Duration was considered for the other behaviors as well.

b) Warmth through Positive Tone

The behavior "warmth through positive tone" refers to instances where caregivers express positive emotions to the child by smiling, laughing, singing, and talking to the child with a positive tone. This behavior was the only one coded on a 0-3 scale. Coders coded 0 if the caregiver showed no expression of warmth (neither with her voice nor with her face). A rating of 1 means that the caregiver showed warmth through her voice and facial expressions at least once or very little. Coders coded '2' if the caregiver moderately showed warmth during the whole segment or most of the time. Caregivers were rated '3' if they explicitly showed warmth most or all of the time. For example, when she smiled, laughed a lot, clapped hands, sang, sat close to the child, and talked a lot to the child with a positive tone. For analysis purposes, scores in the highest two categories were collapsed, resulting in a 3-point scale comparable to all the other measures.

c) Conversational Turn-taking

We define conversational turn-taking as a back-and-forth vocal exchange between a caregiver and a child. Coders rated 0 if the caregiver talked to the child, but the child did not respond at all or responded once or very little. Also, if the child spoke to the caregiver, and she did not respond, this code was used. Coders gave a rating of 1 if the caregiver and the child took turns a few times by speaking (even if the speech is unintelligible) or by vocalizing (hun). Coders gave '2' if the caregiver and the child always or most of the time talked to each other even if the child's words were unintelligible.

d) Verbal Object Stimulation

We consider *verbal object stimulation* when the caregiver talks about an object in the immediate environment (the object may be held by Mother, Child, or on the floor). Coders coded 0 if the caregiver talked about objects very rarely or for a very short period or not at all. Coders gave a rating of 1 if the caregiver talked about objects a few times or for a short period. Coders coded verbal object stimulation as '2' if the caregiver talked about objects several times or for an extended period during her interaction with the child.

Nonverbal Communication

In this study, nonverbal communication refers to behaviors that caregivers used to engage the child and to show warmth using physical touch. The following nonverbal communication behaviors were coded based on a 0-2 Likert scale (*0 = Not at all/Very little*; *1 = Sometimes*, and *2 = A lot/Most of the time*). We obtained the total scores for each behavior by summing the scores across the ten 30-second windows.

a) Warmth Through Physical Touch

We considered "warmth through physical touch" when a caregiver showed affection to the child through tactile interactions like touching and caressing. If in an entire 30-second interaction, the mother did not touch or caress the child at all to show affection or does it very little, codes rated this interaction as 0 for the behavior "warmth through physical touch." Coders gave '1' if the caregiver touched or caressed the child to show affection a few times. Coders rated 2 to caregivers who stroked, touched, kissed, or tickled their child many times to show affection.

b) Non-verbal Object Stimulation

Non-verbal object stimulation was coded when a caregiver introduced an object in the interaction. But rather than talking about it, she shook it or made noises to either attract the child's attention or maintain the interaction. A rating of '0' meant that a caregiver made noises with a toy or shook it very rarely or for a very short period or not at all to either attract the child's attention or maintain the interaction. Coders rated ‘1’ if the caregiver displayed the behavior a few times or a short period of time. Coders coded '2' if caregivers displayed the behavior several times or for an extended period.

c) Non-verbal Pretend Play

We considered "non-verbal pretend play" when the caregiver and/or the child only non-verbally or by actions pretended to do something like cooking or eating with the objects. Coders provided a score of 0 if the caregiver and the child did not do any nonverbal imaginary play or did it very rarely. A rating of 1 means that the caregiver and the child non-verbally or by actions pretended to do something like cooking or eating with the objects only a few times or a short period. Coders rated 2 when caregivers pretended to do something non-verbally or by actions many times or for an extended period during the 30 seconds window of interactions.

d) Non-verbal Cues to Get the Child's Attention

The behavior "non-verbal cues to get the child's attention" is when the caregiver used nonverbal actions or sounds such as snapping, clapping, or clicking to engage the child's attention. Coders coded 0 if the caregiver did not use any non-verbal sounds at all to get the child's attention or used them only very little (e.g., pssst, chsssst clapping hands, snapping fingers). Coders coded '1' if the caregivers made vocal sounds like 'pssst' or used non-verbal actions (make noise with the fingers, clapping hands…) a few times or a short time to engage the child's attention. If caregivers used these behaviors many times or for an extended period to get the child's attention, coders scored the interaction as 2.

Coding Procedures & Inter-rater Reliability

Trained coders already coded three of the face-to-face behaviors (i.e., mutual gaze, conversational turn-taking, and warmth through positive tone) and two of the nonverbal communication behaviors (i.e., warmth through physical touch and non-verbal cues to get child's attention) in the service of the STEP project.

For a better organization of the coding activities during the STEP project, a coding leader was designated among the Wolof native-speaker research assistants. The coding leader was responsible for assigning videos to code, and to check reliability weekly on 15% of coded videos each week. If the difference between coders was more than 10%, the coding leader and the coder discussed the differences and produced a final version. The same process of checking reliability was followed until all videos were coded.

For the purpose of this study, research assistants redid the reliability check for each variable of the face-to-face and nonverbal communication styles by double coding 15% of the recorded caregiver-child interactions. The face-to-face behaviors showed good reliability overall. For example, mutual gaze was coded the same way 99% of the time (CI = .97-99). Coders also

reached good reliability for *warmth through positive tone* (ICC = .99; CI = .995-.999), *conversational turn-taking* (ICC = .99; CI = 991-999), and *verbal object stimulation* (ICC = 91, CI = .77-.96). Similarly, the interrater reliability for the nonverbal communication behaviors was also good. For example, the ICC coefficient for *warmth through physical touch was .96* (CI = .87-99), meaning that coders agreed 96% of the time. They also had good reliability for non-verbal object stimulation (ICC = .89, CI =.70-96), non-verbal pretend play (ICC = 1), and nonverbal cues to get the child's attention (ICC = 1).

Measures of Child Language Proficiency

Children's language skills were assessed using two well-established standardized instruments: The Language Milestones Checklist, and the MacArthur-Bates Communicative Inventory (MB CDI: Fenson et al., 2007). Both instruments were adapted by experts in a multi-step process, to ensure that they are valid in Wolof. In terms of validity, both caregiver-report measures (Language Milestones Checklist-Wolof version and the CDI Wolof version) were significantly correlated with child language level assessed using direct measure of child language production during structured play sessions with caregivers (for details, see Weber et al., 2018).

Language Milestones

The Language Milestones Checklist-Wolof version (LMC-W) composed of 38 items was used to measure the communication skills of children in Wolof (Weber et al., 2018). To develop the instrument, an initial English version checklist of 52 items was created based on similar measures used in the US to assess children's communicative skills. Those measures include the LENA Developmental Snapshot (Gilkerson & Richards, 2008) and the Ages and Stages Questionnaire (Squires et al., 1995). The initial 52-item checklist was then translated into Wolof with the help of local child development experts and native-Wolof-speaking research assistants. The LMC-W was piloted in three Wolof-speaking communities to not only give research

assistants the real experience of administering the checklist but more importantly to solicit the feedback of the participants. The pilot phase resulted in refining, rewording, and dropping some items that led to a final checklist of 38 items. Since caregivers in this study, for the most part, could not read or write in Wolof, a local Wolof-native research assistant read the items of the language milestones checklist to them. Caregivers were asked to report Yes or No if their child showed evidence of the communicative skills listed in the checklist. Questions in the checklist included, for example, 'Does your child understand a three-clause sentence?'. The interview was stopped if the mother responded "no" for six successive items. Raw total scores represented the sum of "yes" responses over all possible items administered. The remaining items after the stopping rule were given a score of 0.

Expressive Vocabulary

To measure children's vocabulary, the MacArthur-Bates CDI was used (Fenson et al., 2007). The CDI was adapted in Wolof for cultural and linguistic appropriateness (Weber et al., 2018). A list of 130 words was constructed based on the version of CDI used in three West African languages: Ewe, Twi, and Krobo (Prado et al., 2016). The initial list was submitted to the native-Wolof-speaking research assistants to check the linguistic and cultural relevance of the words. The items were then used in a pilot study, which resulted in a list of 105 words typically known by 20-30-month-old Wolof-speaking children living in rural Senegal. Like the procedure used for the language milestone checklist, a local research assistant read the Wolof CDI words to caregivers and asked them to report whether their child understands and says the words listed in the CDI form. To ensure caregivers understood the instructions of the CDI, research assistants asked them to give examples of when and how their child use a CDI word. Since children use types of vocalizations or onomatopoeias to refer to common objects or animals, we allowed parents to report them (e.g., *ŋeew* for *muus* or '*cat*'). We obtained the row score by summing the

total number of words out the 105 CDI words that caregivers said their children understood and spoke.

Data Analysis Plan

I followed three analytical steps to achieve the goal of this study.

Identification of Face-to-face and Nonverbal Communication Styles

The first step toward achieving the goal of this study was to investigate whether the 8 caregiving behaviors discussed above represent two distinct dimensions of caregiver-child communication (i.e., face-to-face, and nonverbal communication). I answered this question by conducting confirmatory factor analyses (See the result section for more details). .

Clustering Analysis

Before running a clustering analysis, I computed composite scores for face-to-face and nonverbal communication styles. To do that, I added up the means of the total scores of each behavior that had a sufficient loading in the factor analysis.. This technique of calculating composite scores has been used in previous studies (e.g., Van Steensel, 2006; Jordan et al., 2000).

Next, I ran a K-means cluster analysis with the face-to-face communication and nonverbal communication composite scores to identify clusters of parents who used similar caregiving behaviors. Clustering analysis is a person-centered approach appropriate for addressing my research question of investigating the extent to which Senegalese caregivers use a group of behaviors associated with face-to-face and nonverbal communication. Recent quantitative cross-cultural studies that have looked adult-infant interactions and child language are generally limited by their variable-oriented approach that focuses on the one-to-one relation between verbal caregiving behaviors, such as maternal talk, and child language outcomes. A focus on the

predictive power of maternal talk alone on child language outcomes may overlook the nonverbal forms of interactions that caregivers engage in, which may also help children learn their mother tongue.

Caregiving Communication Styles and Child Language Outcomes

To test my prediction that children of mothers who use more face-to-face communication behaviors will have better language skills than children of mothers who use less face-to-face communication behaviors, I ran multivariate analysis of the covariance (MANCOVA). This analysis allowed me to see if the vocabulary and the language milestones of children differed based on cluster membership while controlling for child age.

Results

The results section presents the key findings to the four goals of the study. The first goal was to investigate the extent to which Senegalese caregivers use face-to-face and nonverbal communication behaviors when interacting with their children. The second goal was to test whether the different verbal and nonverbal behaviors form a two-factor solution (i.e., face-to-face, and nonverbal communication style). The third goal was to examine whether Wolof-peaking caregivers differed in how they used face-to-face and nonverbal communication styles in their interaction with children. The fourth goal was to examine whether variability in the use of face-to-face and nonverbal communication behaviors related to children's language skills.

The means, standard deviations, and correlations among the study variables are presented in Table 1.

TABLE 1:
Means, Standard Deviations, and Intercorrelations among Study Variables

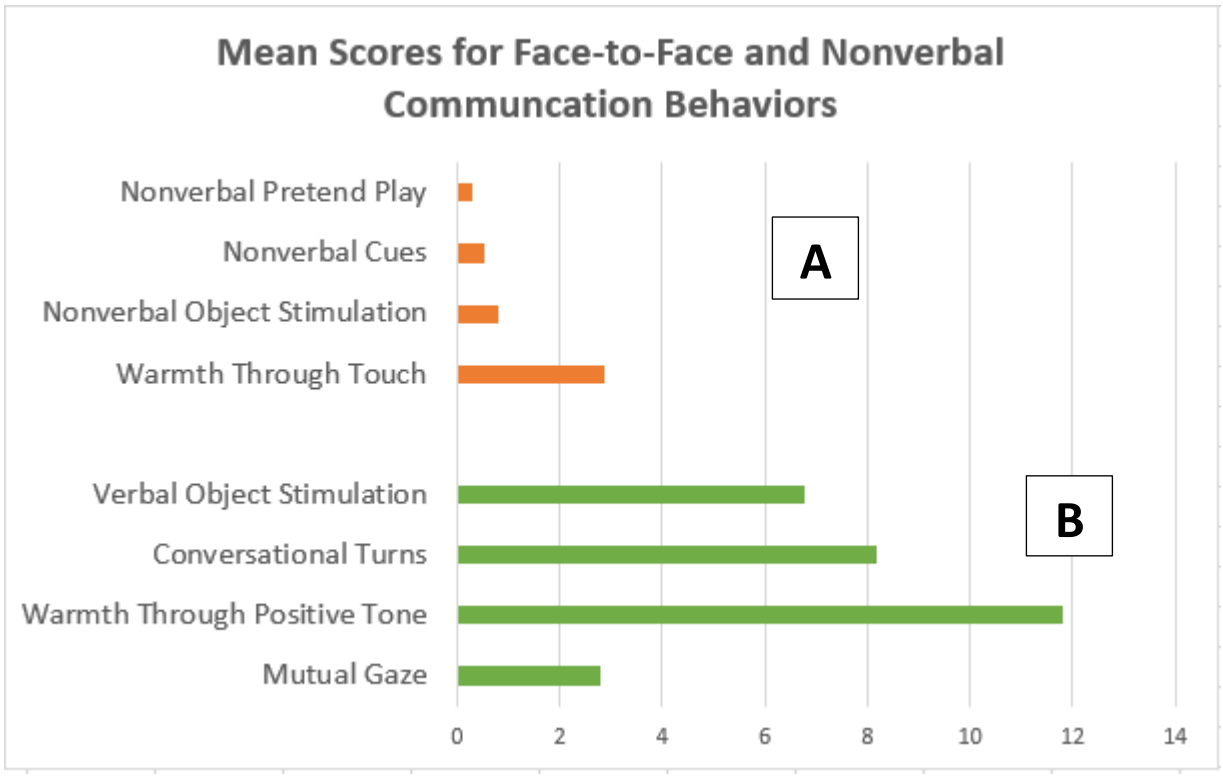
	Study Variables	Min	Max	Mean	SD	1	2	3	4	5	6	7	8	9	10	11
1	Mutual Gaze	0	20	2.98	4.3											
2	Warmth Through Positive Tone	0.67	20	11.8	3.3	.23*										
3	Conversational Turn Taking	0	20	8.18	6.82	.34**	.48**									
4	Verbal Object Stimulation	0	20	6.77	5.17	0.01	.44**	.40**								
5	Warmth Through Physical Touch	0	14	2.81	2.37	0.06	.40**	-0.003	-.19*							
6	Nonverbal Object Stimulation	0	8	0.79	1.79	-0.15	0.06	-.25**	-0.09	0.02						
7	Nonverbal Pretend Play	0	6	0.28	1.02	0.006	-0.07	-.22*	-0.11	0.15	.23*					
8	Nonverbal Cues	0	10	0.54	1.74	-0.006	0.16	-0.14	-0.11	0.19	.81**	.20*				
9	Child Age	20	30	24.18	2.81	.26**	0.02	.36**	0.13	0.01	-0.12	0.09	-0.07			
10	Vocabulary	1	103	44.65	28.74	.28**	0.17	.36**	.20*	-0.02	-0.08	-0.06	-0.008	.47**		
11	Language Milestones	9	38	20.4	5.25	.25*	0.18	.20*	0.15	-0.02	0.01	-0.04	0.11	.33**	.83**	

Note. *p < .05. ** p < .01

Descriptive Statistics of the Observed Caregiving Behaviors

To address the first research aim, I examined descriptive statistics to have a big picture of the ways in which Wolof-speaking caregivers used face-to-face and physical communication behaviors.

FIGURE 1: *Mean Scores for Face-to-face and Nonverbal Communication Behaviors*



Note. The bar graphs represent (A) the mean scores for caregivers' nonverbal communication behaviors and (B) the face-to-face communications behaviors observed in 5-minute play sessions through 10 windows of 30 seconds.

Face-to-face Communication Behaviors

Caregivers differed in how they interacted with their children using face-to-face behaviors. When the face-to-face communication behaviors were examined individually, caregivers most frequently showed warmth through positive tone by talking to the child (*M* =

11.8, *SD* = 3.3). The second most recurrent face-to-face behavior was conversational turn taking (*M* = 8.18, *SD* =6.82), indicating that Wolof-speaking caregivers spent an important amount of time having back-and-forth verbal communication with their children.

Results also showed that in addition to caregivers' tendency to talk with a positive tone in showing warmth to their children and to have conversational turns with them, they commonly engaged in verbal interactions regarding an object (*M* = 6.77, *SD* = 5.17) present in the immediate environment of the play sessions. Although Wolof-speaking caregivers also engaged in mutual gaze with their children (*M* = 2.98, *SD* = 4.3), this was the least common face-to-face behavior in mother-child interactions.

Nonverbal Communication Behaviors

Nonverbal communication behaviors occurred less frequently than face-to-face behaviors, on average. However, when we examined the nonverbal communication behaviors individually, caregivers engaged in some nonverbal communication behaviors more frequently than in others. For example, showing warmth through physical touch (*M* = 2.87, *SD* =2.37) was the most common behavior. The second most frequent behavior was nonverbal stimulation (*M* = .79, *SD* = 1.79) such as shaking objects or making noises with them. The third most common nonverbal behavior was caregivers' use of nonverbal cues (*M* = .54, *SD*= 1.74) such as snapping fingers or clapping to get child's attention. The least frequent behaviors was nonverbal pretend play (*M*= .28, *SD* = 1.02) characterized by imaginary play where caregiver-child dyads pretend to do something like cooking or eating non-verbally or by actions.

Factor Analysis

Several cross-cultural studies examining communicative behaviors by caregivers with toddlers in rural, agrarian societies have identified two distinct communication styles: face-to-

face and nonverbal communication that includes body contact (e.g., Keller, 2007). Of interest was to determine whether the eight caregiving behaviors measured in this study of Wolof-speaking caregivers and their toddlers were also related to these two communication styles or factors. I addressed this question by running a CFA with the lavaan package in R (CRAN, 2020), which yielded a two-factor solution with poor model fit (CFI = .66, TLI = .50, RMSEA= .13). Importantly, the item "warmth through physical touch" negatively loaded onto one of the factors along with other nonverbal behaviors, possibly signaling that the caregiving behavior "touch" might be a factor of its own. I then ran a second CFA without the 'touch' item, which improved model fit, but the fit indices remained unsatisfactory (e.g., CFI = 79, TLI = 65). Therefore, I evaluated model misspecification using model fit in conjunction with modification indices and standardized residuals. Evaluation of the modification indices suggested residual correlations between the following variables: warmth through positive tone and verbal object stimulation, and between mutual gaze and verbal object stimulation. Based on these results, I included the residual correlations into the model to account for the covariance between the variables. I then ran another CFA model, which exhibited increased model fit (CFI = 90; TLI =81; RMSEA = .07). A chi-square difference test was also conducted to compare the two models. The results showed that the second model with the residual correlations accounted for, fit better than the initial model ($\chi^2(2) = 9.65$, $p<0.01$).

In summary, the results showed a clear distinction between two factors: a face-to-face communication factor, composed of *warmth through positive tone*, *conversational turn taking*, *mutual gaze* and *verbal object stimulation*, and a nonverbal factor, composed of *nonverbal object stimulation*, *nonverbal pretend play*, and *nonverbal cues to get the child's attention*. Notably,

warmth through physical touch seems to be a separate dimension of behavior that is indeed nonverbal but physical.

Calculation of Composite Scores and Clustering Analysis

After running the CFA, I then created composite scores for face-to-face communication (*M*= 7.44, *SD* = 3.47) and nonverbal communication (*M* = 1.11, *SD* = 1.17). To create the composite scores, I averaged the total scores of each behavior forming the two factors. I averaged the total scores for the variable "warmth through physical touch" separately as it did not belong to either factor. A similar technique for calculating composite scores based on factor analysis results has been used in previous studies (e.g., Steensel, 2006; Jordan, Snow & Porche, 2000).

The creation of the composite scores allowed me to test my hypothesis that caregivers would differ in their use of face-to-face and nonverbal communication styles. To test this hypothesis, I conducted a K-means clustering analysis with composites scores of the two factors and the scores for *warmth through physical touch*. The results yielded two clusters of caregivers where 47.22% of the sample (n =51) formed cluster 1, and 52.78% of the caregivers (n =57) formed cluster 2. These two groups of caregivers had different patterns of face-to-face and physical communication behaviors. More specifically, caregivers in cluster 1 (*M* = .30), and cluster 2 (*M* = .30) used similar frequency of tactile behaviors to show warmth to their children (*p* = .55).. However, they differed in frequency of nonverbal behaviors (cluster 1: M =.80; Cluster 2: M = .30, p <.05). Importantly, they significantly differed in frequency of face-to-face communication when interacting with their toddlers (cluster 1: *M* = 4.49; cluster 2: *M* = 10.08, *p* <.05). Results of the K-means clustering analysis is summarized in Table 3.

TABLE 2:
Summary of the K-means Clustering Analysis

Caregivers' Communication Styles	Cluster 1 (n= 51)	Cluster 2 (n =57)	Significance
Face-to-face Communication	4.49	10.08	*p <.05*
Nonverbal Communication	.80	.30	*n. s*
Warmth through Physical Touch	.30	.30	*n. s*

As hypothesized, these patterns revealed variability among mothers within the same cultural community in their use of face-to-face, nonverbal caregiving behaviors including touch. In other words, Wolof-speaking caregivers did not use one form of communication style at the expense of the other.

Caregivers' Communication Styles and Child Language Outcomes

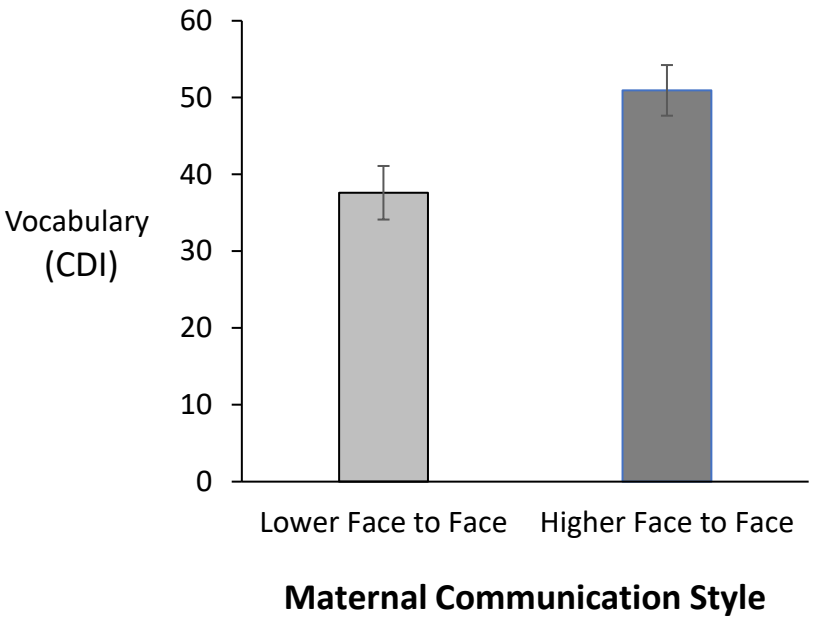
I predicted that children of caregivers who used more face-to-face communication behaviors would be more advanced in their language skills, as measured using Wolof versions of the CDI and the language milestones questionnaire. To test this hypothesis, I conducted a multivariate analysis of the covariance (MANCOVA) with cluster membership as an independent variable, and CDI and language milestones as dependent variables, with child age as covariate.

Before running the MANCOVA, the homogeneity of covariance matrices was tested using the Box's Test of Equality of Covariance Matrices (p =.34) and by Levene's Test of Equality of Error Variances (CDI: p =.64, Language Milestones: p = .52). These non-significant p-values

indicated that the covariance matrices were homogeneous. In other words, the homogeneity of variance-covariance were not violated.

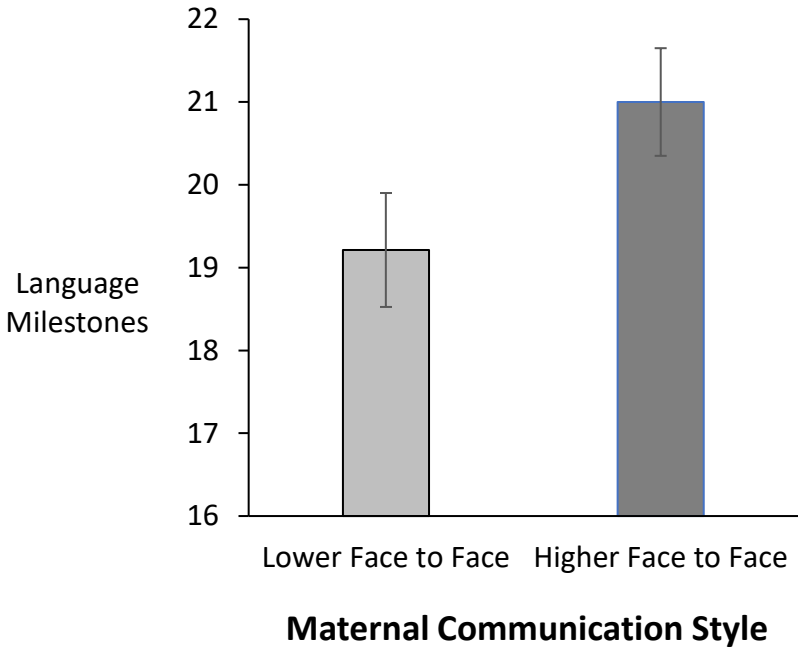
The MANCOVA showed that there was a statistically significant difference between clusters on the combined dependent variables after accounting for child age, F (2,104) = 104, p =.03; Wilk's Lambda = .93, η_p^2 = .07. When compared with children of mothers in the lower face-to-face group, children of mothers in the higher face-to-face communication group were more advanced in vocabulary, as measured with the Wolof CDI, F = (1, 105) = 7.57, p <.05, and they also had stronger communicative skills, as measured with the Wolof language milestones questionnaire, F (1,105) = 5.53, p<.05. These results showed that Wolof mothers' verbal engagement and gaze behaviors with toddlers predicted Wolof children's language proficiency level, consistent with research conducted in Western countries.

FIGURE 2: *Child Vocabulary Mean Scores by High and Low Face-to-face Group*



Note. The lower Face-to-face represents cluster 1, and the higher face-to-face group represents Cluster 2.

FIGURE 3: *Child Language Milestones Mean Scores by High and Low Face-to-face Group*



Note. The lower Face-to-face represents cluster 1, and the higher face-to-face group represents Cluster 2.

Discussion

Summary and Interpretation of the Findings

This study investigated whether there was meaningful variability among Wolof-speaking caregivers in the frequency with which they used nonverbal and face-to-face communication when interacting with their 20-30 months old toddlers. It also examined whether such variability related to concurrent child language outcomes. The current study yielded four main findings. First, caregivers differed in their use of face-to-face and nonverbal communication behaviors, but face-to-face communication behaviors happened more frequently than nonverbal communication behaviors on average. Second, we found that the caregiving behaviors we measured in this study distinctly contributed to face-to-face and nonverbal communication styles. However, confirmatory factor analysis showed that although the caregiver's use of touch to show affection is conceptually a nonverbal behavior, it did not fit in either the nonverbal or the face-to-face factors, signaling it may be a distinct factor of its own. Third, two clusters of caregivers used similar frequencies of physical touch, but significantly differed in the extent to which they used other nonverbal behaviors and how much they used face-to-face communication behaviors. Fourth, children of mothers who used more face-to-face behaviors had stronger vocabulary and communicative skills than children of mothers who used less face-to-face behaviors.

In addition to the first finding showing variability in the frequency with which caregivers used face-to-face and nonverbal communication styles, we also explored individual differences within each communication style. For example, when we examined the frequency of face-to-face behaviors, we found that caregivers displayed warmth through a positive tone more often than through conversational turn-taking, talking about objects, or mutual gaze with their children. Regarding the frequency of nonverbal communication behaviors, we found that caregivers

showed warmth through tactile interaction more often than they used other nonverbal communication behaviors. The fact verbal "warmth" (i.e., in the face-to-face category) and nonverbal warmth (i.e., through physical touch) happened very often, is an indication that Wolof caregivers are generally warm individuals and they showed it both through verbal interaction and bodily contact. This can be illustrated with the significant correlation between *warmth through positive tone* and *warmth through physical touch*.

Maternal warmth has been a variable of interest to researchers studying mother-child interactions in Western industrial societies and non-western agrarian communities (Keller et al., 2018; Mesman et al., 2017). Warmth is generally defined as an expression of affection and positive exchange (MacDonald, 1992), and has been linked to a wide range of child outcomes. For example, parents who display warmth when interacting with their children tend to engage in interactions involving joint attention, which then supports their children's vocabulary (Farrant & Zubrick, 2012). However, given cross-cultural differences in parenting between mothers from western societies and mothers from non-western societies (see LeVine & LeVine, 2016), researchers hypothesized that warmth may not be expressed the same way in different cultures. Therefore, in cross cultural studies, warmth has been defined as the expression of positive emotion through baby talk, and through body contact (Keller, 2007). Based on the observation that western mothers predominantly engage in face-face behaviors involving verbal behaviors, and mothers from non-western farming settings mainly use body contact with their children, we would expect mothers from rural Senegal to express their warmth more through physical than verbal behaviors. However, our findings showed that rural Senegalese mothers displayed more warmth verbally than physically. But it is worth noting that they did not display warmth through

talking with positive tone at the expense of warmth through physical touch, which remained the most frequent behavior among all other nonverbal behaviors.

Furthermore, taken together, the descriptive findings of this study are not consistent with research indicating that caregivers from African farming communities with a low level of formal education display more nonverbal communication behaviors, including physical touch, than face-to-face communication behaviors when interacting with children (LeVine et al., 1994; LeVine, Lloyd, 1966; Keller et al., 2009). The discrepancies between findings in the current study and those in previous research may be due to three reasons. First, the caregivers and children were observed in different context across studies. For example, in previous studies children and their parents were observed in their home environments (e.g., Levine et al., 1994; Keller et al., 2009), but caregiver-child dyads in this study were observed in structured play sessions. Second, Africa is an immense continent with different ethnic groups, therefore the previously studied subcultures may differ in their parenting practices with Senegalese rural caregiving in ways that have not yet been documented. Third, an emphasis on between-group differences can also lead some researchers to pay less attention to observed differences in parent-child interactions within African samples. For example, Keller and colleagues (2009) investigated parent-child interactions across cultures exploring the hypothesis that mothers in the African samples would score higher on nonverbal communication behaviors like body contact and stimulation than mothers in the Western samples. They found that African mothers' scores in some nonverbal, and face-to-face behaviors were very close. Yet, the authors focused more on differences between and not within participants.

The second finding showed that the four face-to-face behaviors measured in this study represent one dimension of caregivers' communication. However, three of the nonverbal

behaviors appeared to form one factor (i.e., nonverbal pretend play, nonverbal object stimulation, and nonverbal cues to get the child's attention), and the 'physical touch behavior' appeared to form a dimension of its own. The factor analysis that led to this finding was an essential step because, as I mentioned earlier in this paper, although the face-to-face and nonverbal communication categories are respectively parallel to Keller's distal and proximal parenting styles (Keller, 2007), they are not identical. More specifically, we developed the face-to-face behaviors based on Keller's distal parenting category (e.g., eye contact) that she has repeatedly shown to be prevalent in Western industrial societies (Keller et al., 2004). At the same time, we also added verbal behaviors such as *verbal object stimulation* and *conversational turn-taking* that Keller did not have in her distal parenting style. However, other researchers have documented these added verbal behaviors as being representative of urban, western educated societies, but not non-Western farming societies like the rural Senegalese communities where the participants of this study come from (Harkness & Super, 1977; Cristia et al., 2019).

The development of our nonverbal communication behaviors went through the same process. For example, the behavior "warmth through physical touch" is parallel to Keller's "body contact" but they are different. Keller's body contact refers mainly to parts of the child body like the legs or the torso being in contact with the mother (Keller al., 2010). Although, our "warmth through physical touch" includes body contact, it also refers to caregivers' display of warmth through tactile interaction such as caressing. Given the different studies on which we based the development of our variables, it was necessary to confirm that, indeed, they could be reduced to two dimensions of caregiving. More importantly, cross-cultural studies theorizing caregiving communication behaviors as face-to-face and nonverbal or physical in nature (e.g., Keller et al., 2009; Keller, 2007; Levine et al., 1994) failed to statistically address the question of whether the

observed data support their theory. In the absence of such knowledge, we cannot fully understand the nature of the communication styles in which caregivers engage with their children. Therefore, our findings contribute to expanding our knowledge in this sense by providing new insights into the dimension of caregiver-child communication that were not previously addressed in cross-cultural studies. Also, the CFA was an important step to take before answering one major question of the current study: *Do Wolof-speaking caregivers within closely-related farming communities in rural Senegal differ in their use of nonverbal and face-to-face communication styles when interacting with their 20–30-month-old toddlers?*

The third finding showed substantial variabilities among Wolof-speaking caregivers in their communication styles. One group of caregivers used significantly more face-to-face communication than the other group. And the group that used less face-to-face communication used more nonverbal communication. More importantly, although one group of caregivers used more face-to-face communications than the other group, both groups used physical communication through touch at a similar rate. In other words, caregivers' engagement in more face-to-face communication was not at the expense of the nonverbal communications behaviors more common in small-scale non-Western societies. In showing naturally occurring variability in the communication styles of caregivers from similar cultural communities, this finding challenges the assumption that mothers within the same cultural group rely uniformly on a single parenting style (e.g., Lamm et al., 2015). Cross-cultural studies of parenting tend to focus on between group differences in mother-child interactions (LeVine et al., 1994; Richman et al., 1992; Dixon et al., 1984**).** These studies have immensely helped us understand the meaningful differences in parenting style between mothers from the Western settings, and mothers from non-Western agrarian communities. However, parenting cannot be fully understood in terms of

dichotomies like distal versus proximal parenting (e.g., Keller et al., 2009). The assumption behind this dichotomy is usually based on research showing that high amount of nonverbal communication behaviors such as body contact are associated with a reduction in face-to-face behaviors like eye contact across cultures (e.g., Keller, Lohaus et al., 2004; Keller, Yovsi et al., 2004; LeVine, 2004). Although this might be true in some samples, it was not observed among the caregivers who participated in the present work.

In summary, these findings demonstrate that although studies of group differences can be enlightening, it is important to also recognize the variability of parenting style within a group. In doing so, our findings invite cross-cultural researchers in child development and parenting to pay more attention to individual differences within a cultural group because an examination of such variability can provide us with a more cohesive understanding of parenting in general.

The fourth finding is that caregivers' face-to-face, but not nonverbal and physical engagement, predicted child language skills in rural Senegal. The association between face-to-face behaviors during caregiver- child interactions in rural Senegal and child language is consistent with findings from Western societies (Carpenter, Nagell, & Tomasello, 1998; Mundy et al., 2007**;** Gilkerson et al., 2018). This finding uniquely contributes to our understanding of language development by showing how verbal behaviors and mutual gaze together support children's language skills. Although previous studies have widely shown an association between face-to-face interaction and language development, most of them looked at individual verbal engagement behaviors such as the number of words children heard (e.g., Shneidman & Goldin-Meadow, 2012). Yet, early language learning is socially embedded, and so requires both verbal and nonverbal behaviors such as gaze, which provides children with a salient cue to word learning (Custode & Tamis-LeMonda, 2020).

But how can we explain the association between face-to-face behaviors and language skills among Wolof-speaking caregiver-child dyads? It is possible that, when interacting with their children, Wolof caregivers coordinate verbal input such as conversational turn-taking and gaze to create shared attention (Deák et al., 2018), which is a well-documented predictor of language learning (e.g., Tomasello & Todd, 1998). This explanation is plausible because our data show significant correlations between mutual gaze, conversational turn-taking, and caregivers' warmth through positive tone, which includes talking to children.

As expected, the analysis linking communication styles and child language skills showed that caregivers' face-to-face behaviors are more important for children's language abilities than nonverbal and physical behaviors. But why is it that the nonverbal communication behaviors did not support Wolof children's language skills? It could be because the behaviors that define nonverbal communication in this study and in previous studies (e.g., Keller, 2007) are usually not language-relevant variables. And a closer look at the intercorrelations matrix among the study variables give a clue for why that is the case. For example, caregivers who showed warmth through talking (positive tone) were less likely to engage in nonverbal pretend play, although the correlation was not significant. Similarly, caregivers who had more conversational turns with their children were significantly less likely to have nonverbal object stimulation, and nonverbal pretend play with them. Also, mothers who used more nonverbal cues such as clicking, snapping had less conversational turns with their children, but this relationship was not significant. Although face-to-face behaviors were significantly associated with children's language skills, we do not suggest that nonverbal communication behaviors such as "touch" are not beneficial for child outcomes other than language. . Indeed, studies have widely shown that physical

interactions including touch support a broad range of children's physical and social emotional outcomes (For a review, see Field, 2010).

Limitations

This study has some limitations to be taken into consideration. The main limitation of this study is that caregivers and their children were observed during controlled play sessions, and not in their home environments, which can potentially affect the ecological validity of the study. In other words, directly observing adult-child interactions in their home environment could give a much more accurate picture of the ways in which Wolof families use face-to-face and nonverbal communication behaviors when interacting with their children. Indeed, studies that have the highest ecological validity are those that were done between the 1970s and the 1980s by ethnographers who completely immersed themselves in a culture and language spent days living with families and children conducting extensive observation of parent-child interactions (e.g., Harkness & Super, 1977; Levine et al., 1994). Recent researchers like Cristia et al. (2016), Shneidman and Goldin-Meadow (2012) also conducted studies with high ecological validity in that they directly observed adult-child interactions in families' real-word home environment, which reflect the real experiences of the children they studied.

Although these studies may have higher ecological validity than the current study, their sample sizes were very small, therefore leading to a potential generalizability issue. In contrast, the participants of our study were chosen from a much broader subset of the population. Given our relatively larger sample size, it would be impractical to use the labor-intensive observations used by ethnographic studies.

While we used valid culturally and linguistically valid measures of Wolof children's language skills (Weber et al., 2018), they were parent reports with a potential social desirability

bias. The term social desirability refers to the tendency of research participants to give socially desirable responses rather than choosing responses that reflect their real feelings (Grimm, 2010). For example, it is possible that Wolof caregivers overestimated their children's language skills because of a reluctance to show the data collectors that their children did not know many words or did not reach a certain communicative milestone (Ozonoff et al., 2011).

Furthermore, future work would benefit from the use of child outcomes other than language to see how nonverbal communication like physical behaviors are useful to Wolof children.

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CHAPTER THREE: STUDY TWO: HOW QUALITY FEATURES IN THE LANGUAGE ADDRESSED TO YOUNG CHILDREN BY THEIR WOLOF-SPEAKING CAREGIVERS RELATE TO CHILD VOCABULARY AND LANGUAGE MILESTONES

ABSTRACT

The qualities in the Wolof-speaking caregivers' (N = 108) speech were examined to investigate whether they related to child vocabulary and language milestones at 24 and 36 months. Results yielded substantial variabilities in Wolof caregivers' language input features with questions and directives being the two most frequent input types that caregivers used with their children. Further, caregivers' here-and-now utterances at 24 months were negatively associated with child language outcomes at 36 months. However, their decontextualized talk about past and future events predicted child vocabulary and language milestone at 36 months. Unlike findings from western societies, caregivers' directives were significantly associated with children's vocabulary and language milestones at 24 months, but only when the directives were not prohibitive (i.e., don't). Also, caregivers' open-ended questions, particularly 'what' and 'how' questions at 24 months had longitudinal associations with children's vocabulary and language milestones at 36 months. Notably, caregivers' 'why' questions were mostly for reprimanding the children at 24 months, therefore negatively predicted their language milestones one year later. Finally, caregivers who were more likely to elaborate on the topics or objects of discussion at 24 months had children with better vocabulary and language milestones at 36 months.

Introduction

There is strong consensus in the field that children who hear more speech from adults have better language abilities (Gilkerson et al., 2018; Foursha-Stevevenson et al., 2017). Research on the quantity of child-directed speech has made significant contributions to our understanding of how caregivers shape early language skills, across different SES and cultural groups (Hoff, 2013, 2003; Hart & Risley, 1995; Vogt et al., 2015). The importance of the quantity of child-directed speech for children's language has been studied not only in western cultures, but also in more global contexts such as in Senegal, Brazil (Gonçalves Barbosa et al., 2016), and in Mayan communities (Shneidman & Goldin-Meadow, 2012).

However, there is abundant evidence that the quality of the language children experience also has substantial effects on their language development (e.g., Hart & Risley, 1995; Huttenlocher et al., 2010; Rowe, 2012; Rowe & Snow, 2020. I investigate how the quality of Wolof-speaking caregivers' speech to 20–30-month-old children relates to children's concurrent and longitudinal language skills. The "quality" of caregivers' speech is defined here as the complexity of the language Wolof caregivers use with their children in terms of vocabulary diversity and syntactic complexity (i.e., whether caregivers use one-clause or multiclause sentences). I am also interested in Wolof caregivers' input quality including their use of directives, questions, repetition, and elaboration. The extent to which their speech is confined to the here-and-now or whether it is removed from the immediate context of interactions, often termed decontextualized speech, was considered as well. A closer inspection of these quality features of child-directed speech among Wolof-speaking caregivers can further our understanding of mother-child interaction and children's early language development in Senegal.

Operationalizations of Quality of Language Input and their Associations with Child Language Outcomes

The qualities in caregivers' language input have been operationalized in numerous ways. For example, studies have analyzed the qualities of maternal language based on its interactional or functional features such as caregivers' use of directives in their language input to children, questions, decontextualized language, and elaboration. These go beyond the linguistic aspects in a caregiver's input to her child by focusing instead on the function of maternal utterances, asking "What is the intended goal or function of a particular utterance?"

Directives. Two types of directives are generally analyzed in studies conducted in Western societies when caregivers interact with young children: directives that encourage children to focus their attention (e.g., when a child directs his/her attention to a ball and the caregiver says "pass *me the ball, I am the goalkeeper*"), and directives that draw children's attention away from the topic or object of discussion, which does not help children in their language development (Hart & Risley, 1995; Paavola-Ruotsalainen et al., 2018). Parents' use of directives when interacting with children can hinder children's language skills, but only if the directives do not follow the child's attentional focus.

In Western societies, a well-established childrearing philosophy is to privilege parenting behaviors that support children's own decisions, mainly during play activities. This autonomy-supportive parenting style has roots in attachment theory and research showing the harmful effects of autonomy restriction on children's social, cognitive, and emotional functioning (e.g., Whipple et al., 2011; Deci & Ryan, 2000). Studies on mother-child interactions and child language have explored whether directives that follow children's lead or attentional focus facilitate language development more effectively than directives that attempt to control or direct

their attention in another direction (e.g., Mccathren et al., 1995). These studies reported that directives that follow children's lead related positively to children's vocabularies, whereas directives that attempted to control children's behaviors or re-direct their attentional focus did not (Tomasello & Ferrar, 1986; Paavola- Ruotsalainen et al., 2018; Masur et al., 2005). Similarly, Akhtar et al. (1991) found two types of directives that related negatively to children's vocabulary size. They found that mothers' production of directives which followed children's attentional focus were positively related to children's vocabulary. However, directives that were intended to redirect children's attentional focus did not.

Besides, anthropological studies exploring caregiver-child interaction in Africa have repetitively reported the tendency of African caregivers to use directives with their children (e.g., Rabain-Jamin & Sabeau-Jouannet, 1997; Harkness & Super, 1977For example, Rabain-Jamin and Sabeau-Jouannet (1997) found that parents in Wolof-speaking communities in Senegal use more *action-request directives* (i.e., asking the child to perform a physical action – "give me the bucket") *than information-request directives* (i.e., prompt the child to give a verbal response – "tell me what you saw outside"). Although anthropological studies are usually not focused on child language outcomes, there are speculations for why African parents rely so heavily on the use of directives. These studies report that, unlike Western parents, African parents do not have a child-rearing philosophy that favors children's own decisions because they live in hierarchical societies where children are usually expected to be obedient, hence the predominance of directives in African parents' speech to their children (e.g., Levine et al., 1994)). In this study, I will explore the use of directives among Wolof speaking caregivers and young toddlers, and what types of directives contribute to Wolof children's language outcomes.

Questions. Research on the quality of child-directed speech suggests that asking questions to children is beneficial for their language acquisition (Hoff-Ginsberg, 1985, Ninio, 1980; Rowland et al., 2003; Vilian & Casey, 2003). More specifically, **w***h-questions* or open-ended questions which use *what*, *where*, *why*, *who*, or *how*, play an essential role in children's word learning (Rowe et al., 2017). Close-ended questions, including yes/no type of questions, may not be challenging enough for children to think and elucidate rich verbal responses. When studied directly, Rowe et al. (2017) investigated parental language input that included the number of words and frequency of wh-questions fathers addressed to their toddlers and found that only wh-questions predicted children's vocabulary. Researchers argue that responding to wh-questions requires a more complex response than yes/no questions because open-ended questions are more likely to prompt children to provide more detailed verbal information. Children's responses to these questions tend to be syntactically more complex as compared to their responses to other questions, which provides opportunities for children to verbally reason and express themselves (Rowe et al., 2017).

Although cross-cultural studies may not have focused explicitly on use of questions in non-Western societies, there are observations from anthropological investigations that in some African cultures, mothers do not ask a lot of questions when interacting with their children. For example, a study compared mothers' verbal behaviors to infants among Kenyan and American mothers around a teaching task. Authors found that American mothers used more questions with children and Kenyan mothers used more instructional verbalizations (Dixon et al., 1984).

Decontextualized Language. Decontextualized language is a type of input removed from the here-and-now context (Snow, 1990). It is more abstract in nature and includes talk about past and future events (Beals & Snow, 1994, Rowe, 2012). For instance, if a caregiver-

child dyad plays with objects in structured play session, an example of decontextualized speech could be "*This car is a little bigger than the one we used the other day.*" A here and now utterance would focus solely on the activity within the moment (e.g., "This car is really big."). Decontextualized utterances relate to children's vocabulary whereas here-and-now utterances are not associated with children's language abilities (e.g., Rowe, 2012).

Researchers suggest two reasons why decontextualized language contributes to children's language outcomes. First, it is believed that decontextualized language pushes children to talk about events or topics that are out of the present moment, therefore challenging them to reconstruct past events and or imagine future scenarios (Rowe & Snow, 2020). Second, input removed from the here and now is usually linguistically more complex than input grounded in the present moment (Demir et al., 2015). In addition, research shows that maternal use of decontextualized language, such as talking about past or future events, was a better predictor of children's vocabulary when they reached kindergarten than the number of words that they heard at 30 months. Also, these researchers found that parents who used more decontextualized language had children who did the same.

Elaboration. Elaborations can be operationalized as *a)* Caregivers' utterances that extend children's utterances in a way that maintains the topic or object of discussion (e.g., child: shovel; mother: a big green shovel) are considered to be elaborations; *b)* as caregivers' utterances that elaborate their own utterances on a topic or object or discussion. Parents' elaboration on objects and topics is a quality feature of child-directed speech that may support children's language skills. Research on elaboration in maternal language input, also called "expansion" (e.g., Taumoepeau, 2016), has shown that expanding on children's words independently contributed to improving children's language development at 24 and 36 months (Livickis et al., 2014). Similar

findings have revealed that the proportion of expanded utterances by mothers when children are between 24 and 33 months of age contributed to growth in children's word type and children's receptive vocabulary at 54 months above and beyond maternal production of word type (Taumoepeau, 2016).

One plausible explanation for this finding is that elaborated utterances are inherently contingent on children's words. Therefore, when a mother elaborates on her child's words, the child's attention is drawn to the lexical information that the mother provides about the object or topic of discussion, thus providing word learning opportunities for the child. By exploring the quality features in the language that Wolof caregivers address to their children, I will also examine the extent to which caregivers elaborate on children's language and whether that contributes to Wolof children's language skills.

Maternal Verbal Communicative Styles and Cultural Context

The literature reviewed so far has primarily come from studies on mother-child interactions in Western societies. Studies that have examined mothers' verbal communicative style with young children in different cultural contexts often rely on comparative psychology methods to examine the communicative function of child-directed speech across cultures (e.g.., Bornstein et al., 1992). For example, studies comparing child-directed communitive function among Japanese and American mothers found that American mothers' speech to their infants was richer in information than the speech Japanese mothers spoke to their children. In contrast, Japanese mothers used utterances marked with onomatopoeias and nonsensical words, and their language was mainly affect-oriented (Morikawa et al., 1988; Toda et al., 1990). These studies generally focus on analyzing the content of child-directed speech and do not study child outcomes.

Other cross-cultural studies have relied on anthropological methods to study the function of child-directed speech in non-western settings. Studies in this category of research view mother-child interaction as mediated by culture (e.g., Ochs & Schieffelin, 1984). In other words, these researchers posit that to understand the type of language parents address to their children, we need to situate language socialization within a community's larger cultural and linguistic context. For example, Clancy (1987) observed that Japanese mothers use directives with their children but often in an indirect way. For example, rather than directly requesting food, they would say, "is there any X?" (Clancy, 1987, p.230). This style of input aims to give orders implicitly, which goes hand in hand with Japanese parenting goal of raising children who develop sympathy with their interlocutors and not be too direct.

Research on Mother-child Verbal Interaction in Africa

Since most of the studies linking the quality features of child-directed speech and children's language abilities are conducted in Western societies, we know little about the complexity of the language children living in Africa - and in Senegal in particular - hear from their caregivers. To the best of our knowledge, there is no study conducted in Africa examining the complexity of maternal speech and its relation to children's language.

My work is situated in the long history of anthropological studies that explore the maternal language features in some African communities. For example, Harkness & Super (1977) investigated the language socialization of Kipsigis children, a Kenyan subculture. They found that mothers do not seem to play an active role in teaching children how to talk. More importantly, the conversations mothers had with their children were mostly about directives, and their questions were mainly for asking children to perform an action. Similarly, LeVine et al. (1994) observed mother-child interactions among the Gusii people in Kenya. They reported that

child-directed speech was very rare, and the utterances mothers spoke to their children were in great part imperatives (e.g., *give me the stick*).

Research on the Language Input Features within Wolof-speaking Communities

Although there is a lack of research on language input features among Wolof-speaking caregivers, Rabain-Jamin has provided an extensive description of the elements in the language Wolof mothers address to their children (e.g., Rabain-Jamin & Sabeau-Jouannet, 1997). Rabain-Jamin (1997, 2001) described four major input features in child-directed speech within Wolof-speaking communities: *commissives*, *assertives*, *expressives*, and *directive*s. Commissives express the speaker's intention to carry out an action (e.g., Mommy is going to put some cream on). Assertives express "the speaker's belief in the truth of the propositional content" (Rabain-Jamin & Sabeau-Jouannet, 1997, p. 434). For example, when the mother asserts something that she knows happens (e.g., Your sister went to school). Expressives carry an emotional feature coming from the mothers. For example, when the mother expresses a joyful exclamation regarding the child's physical characteristics or accomplishment (e.g., What a pretty baby!). Directives relate to the mother's intention to ask the child to carry on an action.

Among the language features examined by Rabain-Jamin, I focused on directives for the current study because they were the most salient input features in child-directed speech among Wolof-speaking caregivers based on previous research. Studies conducted with Wolof caregivers living in Senegal showed that Wolof mothers used a high proportion of directives with their children (e.g., Rabain-Jamin, 2001). Similarly, Rabain-Jamin compared the language socialization of children of Wolof-speaking mothers living in France and that of their French peers. Wolof mothers used more directives when talking to their children than French mothers (Rabain-Jamin & Sabeau-Jouannet, 1997). The body of research by Rabain-Jamin provided an

extensive description of two types of directives that Wolof mothers used in their speech to children. The first one is *directives* that request physical actions such as "dance; get up". The second type of directive that Wolof mothers used with their children was in the form of an information-request that invites the child to provide a verbal response (e.g., Tell your brother what you do with the cup; what do you want to say to me?). Notably, Rabain-Jamin found a greater proportion of action-request directives relative to information-request directive that encourage the child to respond verbally. The higher proportion of action-request directives reflect Wolof mothers' value to rhythmic activities, including dancing (Rabain-Jamin, 1994; Rabain-Jamin & Wornham, 1993).

Another key characteristic of Wolof mothers' conversational exchanges is that they expand the dyadic interaction with their children to include other people as conversational partners (Rabain-Jamin, 1998). To put it simply, when interacting with their children, Wolof mothers talk very little about the immediate physical context. Instead, they prompt the child to say something to another person (e.g., *Say to him that you are not hungry*) or report a speech from another person to the child (e.g., *Your uncle says that your shirt is nice*; Rabain-Jamin & Sabeau-Jouannet, 1997; Rabain-Jamin, 1998). This interaction style is somewhat similar to the notion of decontextualized language reported in Western research (e.g., Rowe, 2012). Although the type of decontextualized language reported in Western studies seems conceptually more sophisticated as it refers to talk about the past and future events, it is somewhat like the type of conversational exchange reported by Rabain-Jamin as they both go beyond the immediate physical context.

The Merit and Limitations of Anthropological Studies

Anthropological and linguistic studies on the language socialization of African children and notably Wolof children have participated a lot in our understanding of mother-child verbal interaction among African communities. Although these studies have provided us with a strong knowledge of language socialization in Africa, none of them, to the best of my knowledge, have looked how the complexity of child-directed speech among African communities contributes to children's language development. Besides, these studies were mostly descriptive or qualitative and had very small sample sizes (e.g., Rabain-Jamin & Jouannet, 1997, n = 8).

Next to these anthropological studies, results from a language intervention in Senegal, where the data of this dissertation are drawn from, showed a significant association between child-directed speech and children's language outcomes (Weber et al., 2017). However, this has been studied in terms of quantity of child-directed speech largely ignoring the body of work saying that the quality of language also matters (e.g., Rowe, 2012). Hence, the current study proposes to go beyond quantifying the language input of Wolof caregivers' and investigate the quality features in caregivers' speech to children and how they relate to child language outcomes.

The Particularity and Goal of the Present Study

This study proposes a pioneering investigation of the effects of various features of maternal language input on child language skills in Senegal. More specifically, it offers a ground-breaking analysis of how the input qualities of Wolof-speaking caregivers during verbal interaction with toddlers affect the concurrent and longitudinal child language abilities of Wolof-learning toddlers in rural Senegal. The current study has two aims:

First, it aimed to describe the most common qualities in the language that Wolof caregivers speak to their children at 20-30 months. For this aim, I expected a high frequency of directives that request children to perform physical activities like dancing, controlling/intrusive directives, and less cooperative and information-request directives.

Second, the study investigated whether, taken individually, the quality features of maternal language input predicted children's language abilities when children were, on average, 24 months old and 36 months old. For example, I hypothesized that children of mothers who used more elaboration, supportive, and information-request directives and frequently asked open-ended questions would be more advanced in vocabulary and language milestones at 24 and 36 months. In contrast, children whose mothers predominantly used intrusive and action-request directives and elaborated less on topics and objects of discussion would be less advanced in vocabulary and language milestones at 24 and 36 months.

Method

Participants

The sample of this study comprised 218 Wolof-speaking caregivers and their children aged between 20-30 months at time 1 (Mean age = 24.18; SD = 2.81) and between 32 and 43 months at time 2 (Mean age = 36.26, SD = 2.82). The dyads were from 24 rural communities in the Kaolack region of Senegal. Many caregivers reported that they attended Quranic schools (63.1% attended Quranic schools), and many of them did not have a formal education in French or Franco-Arabic. Some caregivers (16.1%) had no education, therefore could not read, or write.

Farming was the most common income source for caregivers and children's families, with households being led mainly by polygamous fathers.

Procedures

Caregiver-child interaction during play sessions

Wolof-speaking research assistants observed caregiver-child interactions one year apart at two time-points during structured play sessions, which happened in local rooms such as classrooms and rural community council offices or spaces in health centers. These spaces were provided to our research team by local authorities in the rural communities. The places where the play sessions occurred were structured the same way in the 24 villages. More specifically, each space had a plastic mat and simple toys for children and caregivers to play with. The toys included a shovel, cups, and a plastic bucket. Research assistants set a camera two meters from the mat and synchronized a wireless microphone with the camera that caregivers attached to their cloth when interacting with children. Once in the testing room, a research assistant explained the purpose of the research to the caregiver and instructed her to play with the child as they would

naturally do at home. Next, the research assistant launched the video recording and left the dyad to play for 15 minutes.

Caregiver's and Child's Language Production in a Structured Play Session

To assess the language production of caregivers and children, we analyzed naturalistic samples of caregiver's speech to the child and the child's speech to the caregiver from the middle 5-minute interactions of the 15-minute video-recorded play sessions. Trained native Wolof-speaking research assistants transcribed the middle 5-minutes of each video at times 1 and 2. Research assistants transcribed all interactions at the utterance level, using guidelines that explained what an utterance is and how to format the transcripts. The guidelines instructed research assistants to consider an utterance as having a single intonational contour within a single conversational turn composed of one or more clauses (Huttenlocher et al., 2010; Poulain & Brauer, 2018). An intonational contour usually involves rising pitch associated with questions or falling pitch associated with declaratives and commands. Based on Huttenlocher and colleagues' work in this area, an utterance could be a single word (e.g., water), a single phrase (e.g., on the table), a simple sentence (e.g., Modou is your father) or a multi-clause utterance (e.g., I did not ask you to put the toy there.). If something was unintelligible, transcribers commented on it within the CLAN software, which was used to analyze the transcripts. Unintelligible utterances will not be considered in the analyses.

Consistent with Huttenlocher et al.'s (2010) definition of an utterance, transcribers treated complex utterances linked by subordinating conjunctions like 'because' or coordinating conjunction like 'and' as one single utterance (e.g., 'sit down and dance'; 'I am happy because you are eating'). Utterances were transcribed so that conversation turns were placed on their own lines. This allowed me to mark the sequences of speech that are preceded and followed by a sufficient pause (2 seconds approximately) as different utterances. Independent clauses uttered

within the same conversational turns were considered as different utterances unless they were connected by lexical items such as ‘and’ and ‘because’. Familiar songs and lullaby in Wolof were not transcribed, but they were marked as comments instead.

Coding and Measures of Caregivers' Input

Interactional Features

Decontextualize and Here-and-now Utterances

All utterances will be coded as either decontextualized or here-and-now (Rowe, 2012).

Decontextualized utterances. Three types of utterances were coded as decontextualized. What all these decontextualized utterances have in common is that they are removed from the here and now context of caregiver-child interactions (Rowe, 2012). The first category relates to verbal pretend-play *(e.g., serve the tea and give me some;* in Wolof*: xellil àttaaya bi may ma).* The second category of decontextualized utterance concerns mothers’ utterances about the past or the future *(e.g., Who does the sheep that was displayed on the computer belong to?* – in Wolof*: xar ma nekkoon ca ordinaatëer ba ku ko moom?).* Examples of utterances about the past and future also include *‘What would you do to the chicken if you caught it? (*in Wolof*: Soo jàppoon ganaar ga loo koy def?); ‘If you break it, I will let him know when he arrives that it is Aliw Toure who broke it (*in Wolof*: boo ko yàqee bu ñëwee ma ne ko Aliw Toure moo ko yàq).* The third category is about the mother’s mention of a third person in her interaction with the child. More specifically, this category of decontextualized utterance refers to caregivers’ utterances inviting the child to talk about a person or family member who is not present at the play session or utterances that mention people or family members who are not present in the immediate physical environment. This interactional pattern is deemed frequent among Wolof caregivers (e.g., Rabain-Jamin & Sabeau-Jouannet, 1997). For example, during a caregiver-child structured play session, a caregiver may say*, ‘Have 25 CFA from your dad, and I will buy milk*

*for you when you come back (*in Wolof*: demal sa baay JoxJox la juróom, nga ñëw ma jëndal la meew).*

Here-and-now utterances. They are utterances that do not go beyond the immediate physical context of the play. Coders will consider as here-and-now talk any utterance that caregivers speak within the physical context of the interaction *(e.g., That blue one is the spoon;* in Wolof*: lu bulo loolu mooy kuddu gi).*

Directives

The current study goes with the definition of directives as verbal behaviors from the caregiver that communicate to the child the expectation that they do, attend to or say something (McCathren et al., 1995). For the purpose of this study, I am interested in four types of directives that fall into two categories: the quality of the directives that caregivers address to children, and the purpose of the directives.

Quality of Directive

Supportive Directives. This type of directive refers to utterances in positive imperative forms but follows the child's attentional focus. For example, when the mother and the child are mutually engaged in an episode of pretend play on making tea, and the mother says, "give me my cup of tea." To know the context in which a directive is used, coders will need to watch the video and read the transcripts at the same time.

Controlling/Intrusive Directives. This type of directive refers to utterances that can be positive (e.g., do) or negative forms (do not) that control the child's behavior or draw their attention away from something they are doing. For example, when the child is interested in a toy and the mom says, "put it back where it was" or "Do not take it."

Purpose of Directive

Action-request Directives. Action-request directives are utterances that are imperative forms and have the function of asking the child to perform a physical action such as dance, get up, or go (e.g., take the spoon and bring it to me; in Wolof: demal yét ma kudd ga).

Information-request Directives. In contrast to action-request directives, communication or information-request directives invite the child to provide a verbal response to a question. Structurally, a communication-request directive is an imperative form, but functionally it asks the child to say something rather than performing a physical action. For example, a caregiver can tell a child, “Tell me what you saw on the screen."

Questions

Questions were coded as either open or close-ended.

Close-ended Questions. These types of questions are likely to prompt the child to give yes/no answers (e.g., Does that belong to you? – in Wolof: yaa moom loolu?) or answers with only one correct, short response (e.g., how many toys are there? – in Wolof: Ñaata fowukaay ñoo nekk foofu?).

Open-ended Questions. These types of questions prompt the child to either explain or give an answer beyond yes or no. For example, ‘What did you do when you went to the market? – in Wolof: lan nga defoon bi nga demee màrse?'; 'Why you do not answer when I talk to you? – in Wolof: lu tax su ma la waxee doo ma wuyu?).

Elaboration

Elaboration refers to maternal utterances that build upon the child’s utterances during conversation. For example, if a child says in one statement, “cup" and the mother says, "It is a big blue cup," this utterance would be coded as elaboration because the caregiver stays on the same topic (i.e., a cup), but adds new information to it. Elaborated utterances can also add

grammatical information to the child's language (e.g., child: spoon; mother: the spoon – see Taumoepeau, 2016). It was also considered as 'elaboration' when caregivers elaborated on their own utterances about topic or object of discussion.

Measures of Child Language

Language Milestones

To assess children's communication skills, I will use the Wolof language milestones checklist (Weber et al., 2018). The checklist is composed of 38 items that trained research assistants read to caregivers and asked them if their child has reached a particular language development milestone. Questions in the checklist included "*Does your child know their body parts?"* Caregivers responded *Yes* (0) or *No* (1) to each question. Research assistants stopped the interview if a caregiver said "no" to six successive questions. Raw total scores represented the sum of "yes" responses over all possible items administered. The remaining items after the stopping rule were given a score of 0.

Expressive Vocabulary

To measure Wolof children's expressive vocabulary, we adapted and used the Wolof version of the MacArthur-Bates CDI (Weber et al., 2018). The Wolof CDI is a parent-report of children's vocabulary skills composed of a list of 105 words typically known by 20-43-month-old Wolof-speaking children living in rural Senegal. We obtained the row score by summing the total number of words out the 105 CDI words that caregivers said their children understood and spoke.

Coders' Training and Reliability

Inter-rater reliability will be established at two levels: reliably transcribing caregiver-child utterances in Wolof and reliably coding the utterances for input quality.

Transcription: Training Process and Reliability

Transcriptions were already completed in the service of the STEP project in Senegal. Although Wolof is an interethnic and most used language in Senegal (Ngom, 2004), formal education is in French. Therefore, most Senegalese people cannot read or write Wolof. For this reason, specialists in Wolof were hired by the STEP coordinators to train 8 Senegalese research assistants to transcribe the conversations of the caregiver-child dyads who participated in this study. Following their training in how to write Wolof, research assistants were also trained to recognize an utterance and to transcribe according to the CLAN format (MacWhinney & Wagner, 2010). For example, all the lines of the transcripts' header should start with the symbol "@" so that CLAN will not take the information in the header as being part of the caregiver-child conversation, and so will not count the words in the header. Also, utterances that are part of the dyads' conversations should start with the symbol "*" for CLAN to recognize them as input to analyze.

A team leader was chosen from among eight research assistants to oversee the transcription tasks and to check on a weekly basis 15% of the transcripts done by other research assistants. As a result, a total of 103 sessions were double coded for inter-rater reliability from phase 2. The percent difference was calculated between the 2 coders for both mother and child utterances and words. For example, we used the following equation for child utterances:

$$\%Difference = 100 * \frac{abs(Child\ Utterances\ Coder\ 1 - \ Child\ Utterances\ Coder\ 2)}{mean(Child\ Utterances\ Coder\ 1 + \ Child\ Utterances\ Coder\ 2)}$$

The mean must be greater than 2 words (to minimize the effects of no talkers) and the % difference had to be less than 10% before the coder were considered in agreement. The number of mother transcriptions and the percent agreement is shown in Table 1 (Weber, n.d).

TABLE 3:
Interrater Agreement in Transcripts of Mother Utterances and Words

	n	Agreement
Mother Utterances	103	82%
Mother Words	103	98%

Coding of Input Quality Features: Coders' Training

Besides serving as a coder myself, two Wolof-speaking Senegalese research assistants were hired to code the quality features in caregivers' speech to children. I trained the coders based on existing guidelines for behavioral coding schemes (i.e., Chorney et al., 2015). To reduce bias, the coders were unaware of the hypotheses of the dissertation. The training of the coders involved two steps: 1*) train coders to pilot and refine the coding system*, 2) *implement the coding system* (Chorney et al., 2015). The training was done in three parts. The categories in the coding schemes and their definitions were shared with coders. The next part was to let coders be familiar with the definitions, and regular meetings time were set up. The last part was to watch some videos, read the transcripts and code as a group. This phase of the training were carried out with the following questions in mind: *how can we resolve disagreements in the coding? How well do at least two research assistants agree on the coding? Do the definitions of the code need to be refined, and whether more examples are needed?* (Chorney et al., 2015). The second step was to train the coders again on the revised coding scheme and define the requirements.

Reliability Estimates for Caregivers' Language Input

I conducted Intra-class correlations (ICCs) to establish inter-rater reliability for each language quality feature of interest by double coding 15% (n=16) of the transcripts as in Rowe (2018). The two coders were considered reliable if they agreed on at least 90% of the utterances. Almost all the intraclass correlations were above .90, demonstrating an overall strong level of agreement.

Here-and-now Utterances. The ICC coefficient for here-and-now utterances was .87 [.67 -.96].

Decontextualized Utterances. The two coders had to decide when an utterance was decontextualized. They also decided whether the utterances fell under one of the three subcodes (i.e., past, or future tense; pretend play, and talk about an absent person). The ICC for the interrater reliability regarding decontextualized utterances was .99 [.99-1]. The ICC for the three subcodes were above .95: past and future tenses (ICC = .96, [.91-.98]), pretend play (ICC = .96, [.91-.98]), talk about an absent third person (ICC = .95, [.87-.98]).

Questions. We checked the coders' agreement on deciding whether an utterance was a question and whether the question was either open-ended or close-ended: questions (ICC = .99, [.99-1]), open-ended questions (ICC = .99, [.99-1]), close-ended questions (ICC = .99, [.99-1]), non-directive questions (ICC =.99, [.98-.99].

Directives. The ICC for directives was .99 [.994-.999]. In addition to deciding whether an utterance was a directive, the two raters also coded the quality and the purpose of the directives. The ICCs for the quality of the directive were above .90: cooperative directives (ICC = .95, [.88-98], controlling directives (ICC = .92, [.75-.97]). There was also a strong level of agreement

between the coders regarding the purpose of the directives: action-request directives (ICC = .99, [.995-.999], information-request directives (ICC = .98, [.96-.99]).

Results

In this section, I present findings for the three goals of the study. First, I described how Wolof-speaking caregivers used high-quality language features when interacting with their 20-30 months old children during five-minute controlled play sessions. Since some caregivers talked more and some talk less, I reported the results in terms of proportion to take into account caregivers' talkativeness. Second, I examined whether the quality features in the caregivers' language input of Wolof-speaking caregivers would predict concurrent and longitudinal child language outcomes.

How Caregivers Used Language Quality Features when Interacting with Children

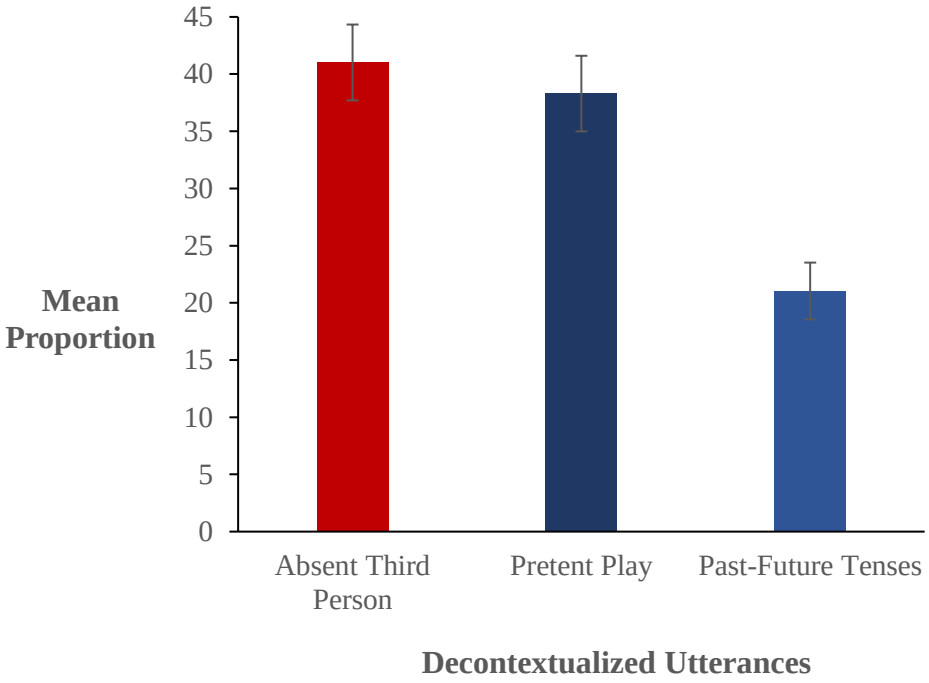
The analyses in this section are based on intelligible utterances only. Therefore, I excluded from the analysis any utterances that the coder judged as inaudible. Similarly, I did not include in the analyses Wolof vocalizations such as *"han," "hun,"* and *"hunhun"* because their meanings are not always straightforward. On average, 82.70% of the total coded utterances were intelligible, therefore included in the analyses (M = 82.70, SD = 10.35, range = 50-100).

Decontextualized and Here-and-now Utterances

I addressed the first research aim by examining the proportion of the quality features in the caregivers' speech. The two first quality features of interest were the decontextualized and the here-and-now utterances in the speech caregivers addressed to their children. The decontextualized utterances fall under three categories: caregivers' utterances about past or future events, utterances about a third person who is not present in the immediate environment where caregiver-child interactions take place, and caregivers' utterances spoken within pretend play activities. When examining the proportions of each type of utterances, the mean proportion for utterances that talked about past and future events was 21.04% (M = 21.04, SD = 24.03, Range = 0-100), the mean proportion for caregivers' utterances talking about someone who was not in the immediate

environment was 41.02% (*M* = 41.02, *SD* = 32.17, Range 0-100). Finally, the mean proportion of caregivers' utterances within pretend play episodes was 38.30% (*M* = 38.30, *SD* = 32.06, range 0-100). These results indicated that caregivers talked less about past or future events in comparison to talk about pretend play, t (93) = 3.60, p <.05, and persons who were not present at the moment of the interactions, t (93) = 4.10, p <.05. However, caregivers used similar proportions of pretend play utterances and utterances mentioning an absent third person, t (93) = .44, p =.66.

FIGURE 4: *Mean Proportion of Decontextualized Utterance Types*

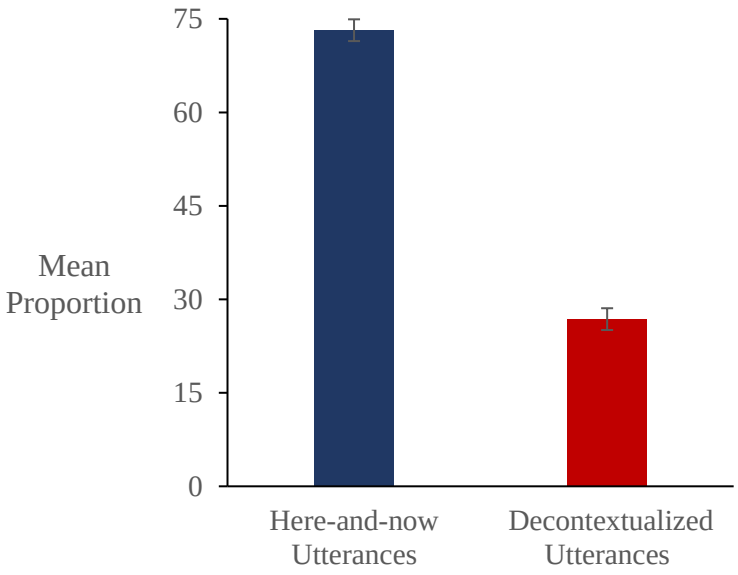


Note. Figure 4 shows the mean proportions of three types of decontextualized utterances referring to caregivers' statements that go beyond the immediate physical environment of the caregiver-child interactions. The 'absent third person' bar represents utterances in which caregivers include in the interactions a family or community member who is not present where the interactions take place. The 'pretend play' bar represents the utterances that caregivers spoke to children within the

context of pretend play activities. Finally, the 'past-future' bar represents the caregivers' utterances about events that happened in the past or will happen in the future.

In addition, I compared the proportions of decontextualized and here-and-now utterances based on all coded utterances. The mean proportion for decontextualized utterances was 26.82% (*M* = 26.82, *SD* = 17.99, range = 0-63.16) and 73.18% for here-and-now utterances (*M* = 73.18, *SD* = 17.99, range = 36.84-100). This finding suggests that when interacting with their children, Wolof caregivers used here-and-now utterances almost three times more than they used decontextualized utterances, t (105) = -13.26, p <.05.

FIGURE 5: *Mean Proportion for Here-and-now and Decontextualized Utterances*



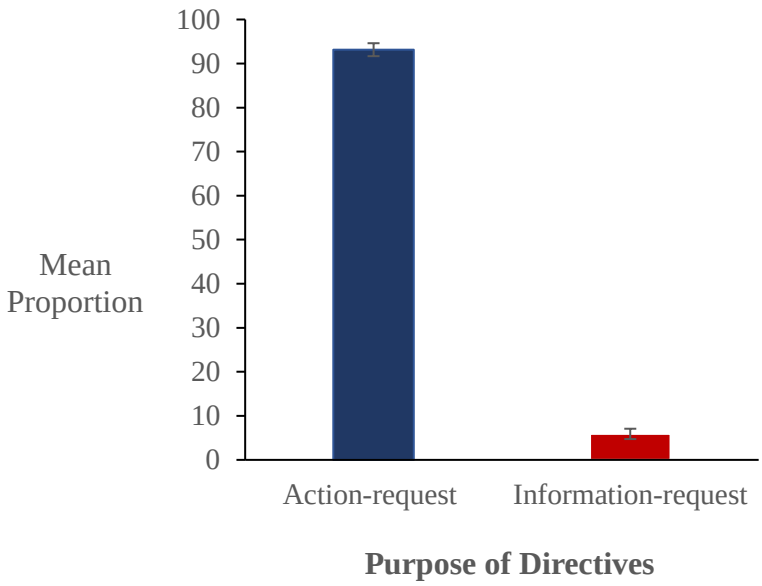
Note. Figure 5 shows the mean proportions for here-and-now and decontextualized utterances that Wolof caregivers used when interacting with their 20-30 months children in 5-min play sessions. Here-and-now utterances refer to caregivers' speech about the immediate environment where the play sessions took place, and decontextualized utterances refer to speech beyond the immediate

environment. Decontextualized utterances refer to caregivers' speech to the child that go beyond the here-and-now context.

Directives

Another question of interest was how often caregivers used directives when interacting with their children. To find that out, I analyzed directives within declarative utterances and directives within interrogative utterances together. Of all the coded utterances, 35.41% were directives on average (M = 35.41, SD = 22.21, Range 0-100). In addition, I was interested in the quality and the purpose of the directive utterances that caregivers addressed to their children. Regarding the purpose of directives, results showed that of the total directives children heard, caregivers spent almost 93% of the time requesting the child to perform a physical action (M = 93.14, SD = 15.09, Range = 0-100), and only 6% of the time asking children to give verbal response (M = 5.90, SD =11.99, Range = 0-53.85). Subsequent sample t-test showed that the mean proportions of action-request directives and information-request directives were significantly different, t (104) = 35.14, p <.05. Similar findings were noted when I analyzed the directives in the context of interrogative utterances only. More specifically, of all the questions that have a force of a directive, 64.71% of them were for asking the children to perform a physical action, and 35.29% of them were addressed to the children asking them to give a verbal response.

FIGURE 6: *Mean Proportion of Action-request and Information-request Directives*

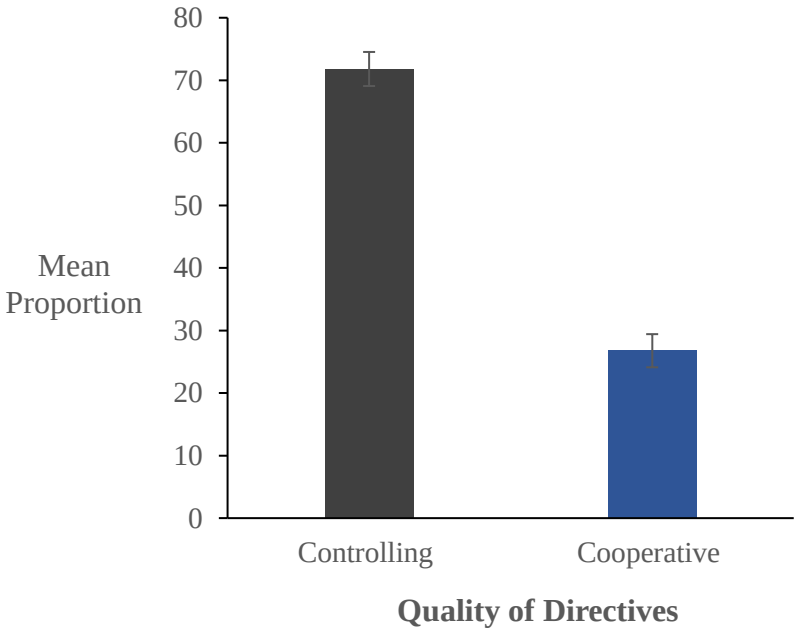


Note. Figure 6 shows the mean proportions of action-request and information-request directives that caregivers spoke to their children during five-minute play sessions. Action-request directives refer to directives that have the purpose of requesting the child to perform a physical action, whereas information-request directives refer to directives that ask the child to give a verbal response.

In addition to the purpose of directives that children heard from the caregivers, I also examined the quality of the directives. In other words, I examined the proportion of directives that encourage children to focus their attention (i.e., cooperative directives) and directives that draw children's attention away from the topic or object of discussion (i.e., controlling directives). The mean proportion of controlling directives was significantly (M = 71.81, SD = 27.91, range = 0-100) higher than the mean proportion of cooperative directives (M = 26.77, SD = 27.16, range = 0-100), t (104) = -8.55, p <.05. This finding indicates that, on average, Wolof caregivers spent about 72% of the time giving children directives that do not follow their attentional focus and spent

about 27% of the time giving them directives that do. Similarly, within questions that have the force of directives, the mean proportion of controlling directives (*M* = 72.30, *SD* = 43.46, range = 0-100) was significantly higher than the mean proportion of cooperative directives (*M* = 24.68, *SD* = 41.71, range = 0-100), *t* (32) = 3.18, *p* <.05.

FIGURE 7: *Mean Proportion of Cooperative and Controlling Directives*



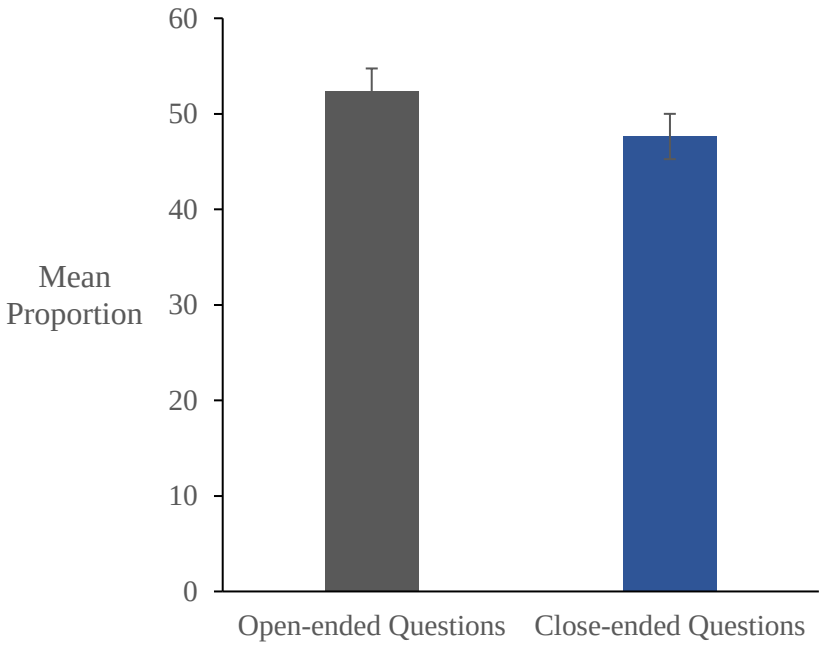
Note. Figure 7 shows the mean proportion of cooperative and controlling directives that caregivers spoke to their children during 5-minute interactions. Cooperative directives are utterances in imperative forms that follow the child's lead. Controlling directives refer to utterances in imperative forms that deviate the child's attention away from an object or topic of discussion.

Questions

Approximately, 40% of the utterances that caregivers spoke to their children were questions (*M* = 39.82, *SD* = 22.22, Range = 0-100). Relatedly, within the total questions that children heard from their caregivers, I was interested in the proportions of open-ended and close-ended questions. I found that the mean proportion of open-ended questions (*M* = 52.37, *SD* =

24.06, Range = 0-100) was higher than the mean proportion of close-ended questions (M = 47.62, SD = 24.06, Range = 0-100), but the difference between the two types of questions was not significant, t (102) = -1, p = .31. This finding indicates that the proportion of open-ended questions (52.37%) was approximately the same as the proportion of close-ended questions (47.62%) that caregivers asked their children.

FIGURE 8: *Mean Proportion of Closed-ended or Open-ended Questions*



Note. Figure 8 shows the mean proportion of closed-ended or open-ended questions that caregivers asked their children during five-minute interactions.

I further explored the open-ended questions caregivers asked children by breaking down the different types (Table 5). I found substantial variation in how caregivers posed open-ended question types to children. Table 5 shows that '*what'* questions (M = 19.84) were the most common form of open-ended questions asked during the 5-minute caregiver-child interactions. Next, I broke down '*what'* questions that only asked children about an object or its name (M = 8) and

'*what'* questions that asked about everything else but objects (M = 11.85). Notably, the Wolof caregivers within our sample asked very few '*how'* and *'why'* questions.

TABLE 4: [a]
Open-ended Question Descriptive Statistics

Open-ended question types **English** (*Wolof*)	Mean	SD	Range
How *(nan, noo)*	.34	1.47	0-11.11
What *(lan, loo ...)* [b]	19.84	18.05	0-75
What (w/o object) [c]	11.85	13.63	0-75
What (w/ objects) [d]	8	13	0-61.76
Where (*fan, foo, fu ...)*	15.96	18.45	0-80
Which *(ban, boo ...)*	.46	2.01	0-13.64
Why *(lan/lu tax ...)*	.63	3.40	0-25
Who (kan, ku, koo …)	12.32	15.87	0-100

[a] Proportion of open-ended question types based on total question utterances

[b] Proportion of all *what* questions

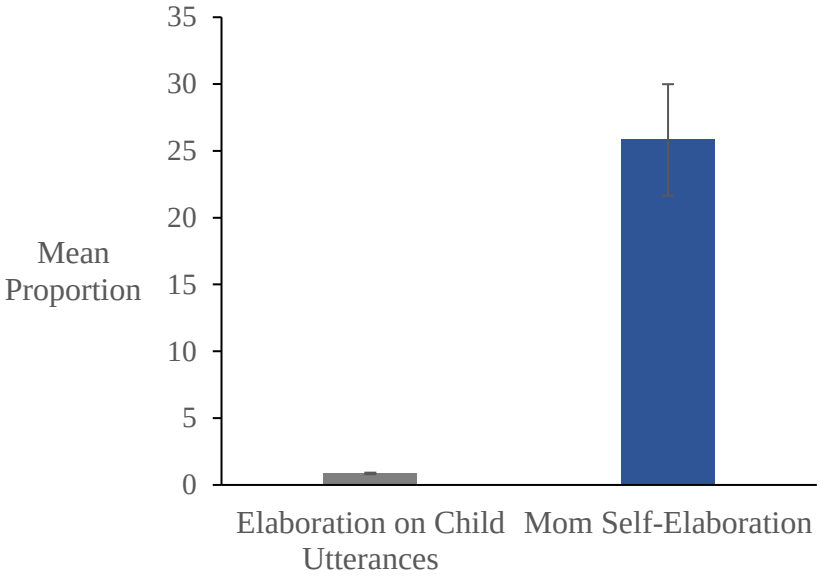
[c] Proportion of *what* questions that did not ask about objects

[d] Proportion of what questions that asked only about objects or their names

Elaboration

When elaborated utterances were analyzed, the results showed that Wolof-speaking caregivers elaborated significantly more on their own utterances (M = 22, SD = 15.72, Range: 0-61) than they elaborated or expanded on their children's utterances (M = .1, SD = .58, Range = 0-5.71), t (90) = 6.20, p <.05.

FIGURE 9: *Mean Proportion of Caregivers' Elaborations*



Note. Figure 9 shows the proportions of caregivers' topic elaborations and elaborations based on child utterances. Topic elaborations refer to the caregivers' utterances that elaborate on the topic or object of discussion with the child (i.e., Mom self-elaboration). Elaboration on child utterances refer to the caregivers' utterances that extend or elaborate on the child utterances.

Associations between Language Quality Features and Child Language

This part of the results section presents findings regarding the second and central question of the current study: *do the quality features in the language input of Wolof-speaking caregivers predict concurrent and longitudinal child language outcomes?* I ran a series of regression analyses to answer this question.

Decontextualized, Here-and-now utterances and Child Language

Preliminary correlation analyses showed that among all three types of decontextualized utterances, only caregivers' use of past and future tenses correlated with child vocabulary and language milestones at 36 months but not at 24 months. The two other types of decontextualized

language, namely pretend play and caregivers' utterances referring to an absent person, did not relate to children's language outcomes concurrently (Mean age = 24 months) or one year later (Mean age = 36 months). Subsequent regression analyses showed that for every one-unit increase in caregivers' utterances about the past and the future, children's vocabulary size and language milestones increased by .23 and .31 units respectively, $p < .05$. Caregivers' talk about the past and future explained 4% of the variance in children's vocabulary and 9.6% of the variance in language milestones. These results indicate that, as shown in previous studies (Rowe, 2012), caregivers who talked more with children about events that happened in the past or will happen in the future had children with higher vocabulary and language milestones one year later.

Furthermore, I first examined the zero-order correlations between the proportion of caregivers' here-and-now utterances and child vocabulary and language milestones at 24 and 36 months. Caregivers' input correlated significantly with child vocabulary one year later ($r = -.23$, $p < .05$). Simple linear regression with here-and-now utterances as predictor and child vocabulary as the outcome variable confirmed the correlation results in that for every utterance increase in caregivers' here-and-now talk, children's vocabulary decreased by .23 one year later. This result indicated that caregivers' immediate talk – as opposed to decontextualized talk – does not have positive longitudinal effects on child word learning.

Directives and Child Language Outcomes

I investigated the association between the *purpose* (i.e., action-request and information-request) and the *quality* (i.e., cooperative, and controlling/intrusive) directives as a measure of input and child language outcomes. Regarding the *purpose* of such input, I found no significant associations between directives that ask children to perform a physical action and child vocabulary and language milestones ($p > .05$). Similarly, the caregivers' directives asking the children to

respond verbally did not significantly correlate with child vocabulary and language milestones ($p > .05$).

Partial correlations for the quality of the directives observed, controlling for child age at age 24 months, are presented in Table 5. Surprisingly, caregivers' directives that follow the child's lead (i.e., cooperative directives) were significantly and negatively correlated with children's vocabulary ($r = -.31$, $p < .05$) and their language milestones ($r = .27$, $p < .05$) at age 24 months. However, caregivers' intrusive/controlling directives that direct the child's attention to something else – mostly an object in this study – were positively and significantly associated with child vocabulary ($r = .24$, $p < .05$) and language milestones ($r = .26$, $p < .05$).

TABLE 5:
Partial Correlation between Quality of Directives and Child Language, Controlling for Child Age

	24-month Child Outcomes	
	Vocabulary	Language Milestones
Controlling Directives	.24*	.26**
Cooperative Directives	-.31**	-27***

Note. *$p < .05$, **$p < .01$, ***$p < .001$

Considering the extant literature, the significant associations between directives that direct a child's attention away from what s/he has been already doing (i.e., controlling/intrusive) and language outcomes are surprising. So, I further explored these relations using the CLAN program's KWAL option that breaks up files by code type (MacWhinney, 2017). More specifically, I broke up the controlling directives into positive (e.g., do) and negative imperative forms (e.g., don't). Next, I conducted a hierarchical multiple regression analysis to determine which among the

negative and positive forms of the controlling directives are responsible for the significant relations found in the partial correlation. To do that, I used proportion measures rather than the raw number of directives to control for the quantity of talk. As shown in Table 6, model 1 with age as a predictor explained 21.2% of the variance in child vocabulary. The second model with positive controlling directives (e.g., look at this cup) as a predictor added 4.3% to the variance in children's vocabulary above and beyond child age, F (2, 101) = 17.29, p <.05; therefore, a significant predictor of child vocabulary. However, the third model was non-significant. In other words, the proportion of caregivers' negative controlling directives (e.g., don't touch the cup) was not a significant predictor of child vocabulary, *F change* (1, 100) = 1.83, p = .18.

TABLE 6:
Hierarchical Regression Models with Age, Positive and Negative Controlling Directives as Predictors of 24-month Vocabulary

Steps	Predictors	*b*	SE	β	*p*	R^2	ΔR^2	*F*	*p*
1	Age	4.45	.87	.44	.000	.21	.21	27.51	.000
2	Positive Controlling Directives	.25	.10	.23	.01	.26	.043	17.29	.000
3	Negative Controlling Directives	.25	.19	.12	.18	.25	.013	12.23	.000

Note. SE = Standard error of *b*. Controlling Directives: *Positive* refers to caregivers' directive utterances that redirect the child's attention to something else. In other words, they give the child a new play opportunity although the new opportunity is different from the child's initial attentional focus. In contrast, the *negative ones* forbid the child to play or do something with an object without offering another play opportunity (e.g., do not use that cup).

In addition, I ran a separate hierarchical regression to determine whether caregivers' use of positive and negative controlling directives predicted children's language milestones. The results

of this analysis are presented in Table 7. When age was entered in the model; it explained 9.4% of the variance in children's communicative skills measured with the Wolof language milestone checklist, F (1, 102) = 11.64, $p < .01$. Caregivers' proportion of positive controlling directives explained an additional 9.2% of the variance in child language milestones, F (1,101) = 12.20, $p < .01$. The proportion of caregivers' negative controlling directives did not predict children's language milestones, *F change* (1,100) = .68, $p = .41$. In addition, I found no significant associations between types of controlling directives, child vocabulary, and language milestones one year later.

TABLE 7:
Hierarchical Regression Models with Age, Positive and Negative Controlling Directives as Predictors of 24-month Language Milestones

Steps	Predictors	*B*	SE	β	*p*	R^2	ΔR^2	*F*	*p*
1	Age	.55	.17	.30	.001	.10	.10	11.64	.001
2	Positive Controlling Directives	.07	.02	.32	.001	.20	.09	12.20	.000
3	Negative Controlling Directives	.03	.04	.08	.41	.20	.005	8.33	.000

Note. SE = Standard error of *b*. Controlling Directives: *Positive* refers to caregivers' directive utterances that redirect the child's attention to something else. In other words, they give the child a new play opportunity although the new opportunity is different from the child's initial attentional focus. In contrast, the *negative ones* forbid the child to play or do something with an object without offering another play opportunity (e.g., do not use that cup).

Caregivers' Questions and Child Language

We found no correlation between the proportion of the total questions caregivers asked children during their five-minute interactions and child language outcomes (p>.05). Also, neither the total proportion of open-ended nor close-ended questions significantly correlated with child vocabulary and language milestones at ages 24 and 36 months (p>.05). The non-significant association between the proportion of open-ended questions and child language outcomes within our sample contrasts with findings from previous studies. Therefore, I further explored this relation by first breaking down the open-ended questions: *how, what, where, which, why, and who*. Table 4 presents the variation in the types of open-ended questions. Regression analysis results presented in Tables 8 and 9 showed that only *how, what,* and *why* questions predicted child language outcomes among all the types of open-ended questions.

More specifically, caregivers' use of *what* questions significantly predicted child vocabulary and language milestones at 36 months, such that for every one-unit increase in caregivers' utterances with a *what* question, children's vocabulary and language milestones respectively increased by .22 and .28. Also, caregivers' *what* questions explained 5% of the variance in child vocabulary and 7.6% of the variance in language milestones at age 36 months. However, the proportion of caregivers' '*what'* questions did not predict children's vocabulary and language milestones at 24 months.

Furthermore, caregivers who asked more *how* questions had children with higher language milestones one year later, such that for every one-unit increase in the number of *how* questions caregivers asked, children's language milestones at age 36 months increased by .21. However, I found no significant association between the proportion of *how* questions and child vocabularies

at 24 and 36 months and their language milestones at 24 months. '*Who'*, '*where'*, and '*which'* questions did not predict the children's language outcomes at ages 24 and 36 months.

Interestingly, caregivers' *why* questions when children were 24-month-old significantly but negatively predicted child language milestones one year later (36 months). In addition, an inspection of the partial correlation (r = -.30) indicated that controlling for child age when the caregiver-child interactions took place had minimal effect on the strength of the relationship between caregivers' *why* questions and child language milestone one year later. In other words, *'why'* questions are negatively associated with child language milestones regardless of the age of the children.

In addition, regression analysis showed that caregivers' *why* questions explained 9% of the variance in children's language milestones one year later, F (1,90) = 10.02, p <.01. That is, for every one-unit increase in the number of *why* questions caregivers asked their children, child language milestones decreased by .32, p <.01. Considering results from previous studies, we would not expect a negative association between *why* questions and child language outcomes. Therefore, I pulled out all the *why* questions for an utterance-by-utterance inspection to better understand what caregivers communicated to children in Wolof when asking them *why* questions. A careful investigation of the questions showed that caregivers asked '*why'* questions primarily for reproaching the child for something they have done (e.g., *why don't you say a word when I talk to you?*) and not for asking them to provide a verbal response—a known communicative style in Wolof.

TABLE 8:
Regression Models with Types of Open-ended Questions Predicting 24 and 36-month Vocabulary

		Vocabulary *b* (SE)							
		24-mos Vocabulary				36-mos Vocabulary			
Models	Predictors	*B*	β	*F*	R^2	*b*	β	*F*	R^2
1	*What* questions	-.04(.44) ns	-.01	.01 ns	.00	.80(.37) *	.22	4.71*	5%
2	*How* questions	-4.93(3.84) ns	-.12	1.65 ns	1.5%	3.51 (2.56) ns	.14	1.89 ns	2%
3	*Why* questions	.51 (2.62) ns	.02	.04 ns	0.00	-2.58 (1.72) ns	-.16	2.25 ns	2.4%

Note. ns = not significant; *p<.05. **p<.01. ***p<.001.

TABLE 9:
Regression Models with Types of Open-ended Questions Predicting 24 and 36-month Language Milestones

		Language Milestones *b* (SE)							
		24-mos Language Milestones				36-mos Language Milestones			
Models	Predictors	*B*	β	*F*	R^2	*b*	β	*F*	R^2
1	*What* questions	.01(.08) ns	.01	.01 ns	.00	.24(.09) **	.28	7.35**	7.6%
2	*How* questions	-.76(.70) ns	-.10	1.17 ns	1.1%	1.27(.61) *	.21	4.25*	4.5%
3	*Why* questions	-.43(.48) ns	-.09	.80 ns	0.7%	-1.27 (.40) **	-.32	10.02**	10%

Note. ns = not significant; *p<.05. **p<.01. ***p<.001.

Elaboration and Child Language Outcomes

One of the goals was to explore whether caregivers' elaborating on topic or object of discussion with their children by adding new information relates to concurrent and longitudinal child language outcomes. I fit regression models to address this question, and the results are presented in Table 10. The results showed no effects of caregivers' topic elaboration on children's vocabulary and language milestones at 24 months. However, caregivers' topic elaboration was a powerful predictor of child vocabulary one year later, such that it explains 12.1% of the variance in children's vocabulary on the Wolof CDI, F (1,89) = 12.20, p <.01. Moreover, for every one-unit increase in caregivers' topic elaboration when children were 24 months old, their vocabulary size increased by .35 one year later (p <.05).

Similarly, caregivers who elaborated more on topics or objects of discussion had children with stronger language milestones one year later. For example, topic elaboration explained 14.1% of the variance in the children's language milestones one year later, F (1,89) = 14.66, p <.001. More specifically, for every utterance that caregivers produced by elaborating or expanding on a topic of discussion when interacting with the children, child language milestones increased by .38, p <.001.

TABLE 10:
Regression Models Predicting 36-month Vocabulary and Language Milestones (n=108)

	36-month Vocabulary Model 1				**36-month Langue Milestones** Model 2			
Predictor	*b*	SE	β	*p*	*b*	SE	β	*p*
Topic Elaboration	.38	.11	.30	.000	.10	.03	.38	.000
R^2	**12.1%**				**14.1%**			
***F* stat**	**12.20*** **				**14.66*** **			

Note. SE = Standard error of *b*.

***p<.001

Discussion

The goal of the study was to investigate variabilities in how Wolof-speaking caregivers in rural Senegal used five quality features in their language input, namely directives, questions, here-and-now and decontextualized language, and elaborated utterances when talking to their 20-30 months old toddlers. The study also examined the concurrent and longitudinal associations of these language inputs and child language outcomes measured with the Wolof MacArthur-Bates CDI and language milestones checklist (Weber et al., 2018).

The Qualities in the Caregivers' Language Input

Here-and -Now & Decontextualized Utterances

Research has repeatedly shown substantial variation in how parents talk to their children using different types of inputs (Rowe, 2012, 2013, 2018; Cartmill et al., 2013; Hirsh-Pasek et al., 2015; Hoff, Core, & Shanks, 2019). The study extends previous research by demonstrating how Senegalese caregivers from underrepresented populations in developmental science use different input features when talking to their children. Notably, I found that caregivers used more here-and-now than decontextualized utterances. Previous research by Rabain-Jamin (1997-2001) showed that mother-child interactions within the Wolof communities frequently involve absent third parties, mostly family members. In other words, Wolof mothers tend to mention an absent family member when talking to their children. This type of input, removed from the immediate environment of the mother-child dyad's interaction, can be considered a form of decontextualized language (Snow, 1990). When compared to caregivers' pretend utterances and talk about past and future events, I found that such input was the most frequent form of decontextualized talk that Wolof caregivers used when talking to their children, confirming Rabain-Jamin's findings. Unfortunately, the literature has not given clear explanations as to why

Wolof mothers use this type of input, except that it is a form of interaction that allows the mother to maintain contact with the child (Rabain-Jamin & Sabeau-Jouannet, 1997). However, we have reason to believe that the collectivistic nature of the Senegalese rural culture may contribute to the commonness of such maternal language input among Wolof-speaking communities.

Directives

Furthermore, the findings revealed that a large proportion of caregivers' utterances (35.41%) when talking to children were directives, in other words, imperatives. Our results are consistent with past parent-child interaction studies conducted in Senegal and other parts of Africa. For example, Rabain-Jamin (2001) analyzed Wolof mothers' child-directed speech and found that directives were the most frequent input type. Similarly, in their analysis of parent-child communication styles among the Kipsigis ethnic group in Kenya, Harkness (1977) noted a high proportion of imperatives in mothers' speech addressed to their 2-year-olds. A more recent study comparing child-directed speech across cultures found that rural Mozambican mothers used much higher proportions of imperatives than mothers in the Netherlands (Vogt, Mastin, & Schots, 2015). The high proportion of directives in the current study might suggest a hierarchical nature of the social relations in the Wolof communities. It also suggests that parenting and childrearing in these communities are based on an authority-submission relationship (Diop, 2012). Notably, the purpose of caregivers' directives was almost entirely to ask children to perform some nonverbal/physical action such as "get up" or "give it to me." Very few directives had the goal of requesting a verbal response from the child. The results of the purpose of the directives are consistent with my predictions and Rabain-Jabin's findings from her analysis of adult-child communication in a Wolof community.

Relatedly, Wolof-speaking caregivers used three times more directives that shifted the child's attentional focus away than they used directives that followed the child's focus of attention during the play activities. This finding reflects a well-established childrearing philosophy in most African and non-Western cultures that favors parenting behaviors such as imperatives, which serve the purpose of socializing children to obey adults and their goals (Keller, 2009; Vigil & Hwa-Froelich, 2004). In contrast, mothers in independent cultures, primarily in Western societies, have an autonomy-supportive parenting style supporting children's decisions. As a result, parents from such cultures mostly follow their children's lead during play activities, a parenting style rooted in attachment theory (Whipple, Bernier & Mageau, 2011; Deci & Ryan, 2000).

Questions

The current study also shows that Wolof-speaking caregivers asked their children many questions during free play activities. Cross-cultural studies that have taught us most of what we know about mother-child interactions in African settings have not explicitly focused on maternal questions. To the best of our knowledge, one study looked at the use of questions by Kenyan mothers compared to American mothers during a teaching task with their children, showing that Kenyan mothers asked fewer questions than their American peers (Dixon et al., 1984). So, the present study contributes to our understanding of parental questions within African contexts by revealing that a significant proportion of the utterances that caregivers spoke to the children were questions. The study extends previous work by examining the types of questions children in African settings hear, demonstrating that Wolof caregivers used similar proportions of open-ended and close-ended questions when interacting with their children. In alignment with previous work, this study also found substantial variability in how Wolof caregivers used open-ended questions, with *what* questions being the most common question type (Leech et al., 2013; Rowe et al., 2017).

Elaborated Utterances

The current study provides the first glimpse into the elaborative nature of child-directed speech among African caregivers. In particular, results showed that 21% of the utterances Wolof caregivers used when talking to children were elaborative talk. It reveals that it is part of Wolof-speaking caregivers' conversational style to elaborate on a topic or object of discussion to maintain the interaction with children. Previous studies have looked at many maternal language inputs in Africa but not elaboration or expansion (Keller, 2007; Levine et al., 1994; Rabain-Jamain, 2001). Therefore, this study extends our knowledge about how African parents, particularly Wolof-speaking caregivers, talk to their children.

Associations between Caregivers' Language Input and Child Language Outcomes

Here-and -Now & Decontextualized Utterances

This study showed that caregivers' immediate or here-and-now talk did not predict children's concurrent language outcomes, nor did it positively affect their vocabulary sizes one year later. That is, caregivers who used more here-and-now utterances at 24 months had children with smaller vocabulary sizes at 36 months. However, one should not take this finding as here-and-now talk is not important for children's language development. On the contrary, talk grounded in the here and now in infancy takes advantage of the child's attentional focus, helping them learn new words (Yu & Smith, 2012). However, as infants get older and increase their language ability, they benefit more from sophisticated child-directed speech, such as decontextualized talk or talk removed from the here and now (Rowe & Snow, 2020). The current study confirms the previous research by demonstrating that Wolof-speaking caregivers' here-and-now utterances when their toddlers were, on average, 24 months negatively predicted their vocabularies at 36 months.

Moreover, research has repeatedly shown that parents' talk about past and future events relates to their children's language development (Rowe, 2012; Rowe, 2013; Demir et al., 2015). This study converges with prior work by showing that the proportion of caregivers' utterances about past and future events at 24 months predicted children's vocabulary sizes and language milestones at 36 months. Thus, the study suggests that parents in non-Western settings like Senegal can also promote child language development by engaging with children in conversations about future and past events.

Interestingly, there were no significant associations between caregivers' past and future utterances and concurrent child language outcomes, which might indicate that the effects of such talk on the language abilities of children are not immediate, but longitudinal. Surprisingly, pretend utterances as a measure of decontextualized talk did not predict child vocabulary and language milestones concurrently and one year later. This finding contrasts with prior research that showed an association between parents' use of 'pretend utterances' and child vocabulary (e.g., Katz, 2001). Also, although the current study converges with ethnographic studies in that Wolof caregivers commonly talk about persons absent from the immediate environment of the interactions, it shows that this type of decontextualized talk might not help children in their language development. These findings suggest a more careful analysis in future research of the pretend utterances of Wolof caregivers and their talk about an absent third person to understand better the non-significant associations between these types of input Wolof toddlers' language abilities.

Directives

Despite the preponderance of the evidence that African mothers use a substantial number of directives when talking to their children (Levine et al., 1994; LeVine & LeVine, 2016; Vogt et al., 2015), we do not know how the directive nature of child-directed speech in African relates to child language skills. This study is the first to investigate the link between caregivers' directives and child language in Senegal. Although Wolof caregivers used greater proportions of directives that requested the child to perform a physical action than directives asking them to provide a verbal response, none of the two forms of directives related to child language outcomes at 24 and 36 months.

Surprisingly, caregivers' directives following the child's attentional focus negatively related to children's vocabulary at 24 months. In contrast, intrusive directives predicted child vocabulary and language milestones at 24 months but not one year later. These findings contradict previous findings from mostly Western societies (Tomasello & Ferrar, 1986; Mccathren et al., 1995; Paavola- Ruotsalainen et al., 2018; Masur, Flynn, & Lloyd, 2013; Masur et al., 2005). A detailed analysis of the intrusive directives revealed that only positive ones (e.g., do), but not negative ones (i.e., prohibitions such as 'do not do that) predicted concurrent child vocabulary and language milestones above and beyond the children's age. This specific non-significant association between maternal prohibition and child language score converges with previous research (e.g., Smith et al., 2019; Taylor et al., 2009). That is, as opposed to findings from Western settings, intrusive maternal directives in rural Senegalese communities can benefit children's language skills if they redirect the child's attention to another learning opportunity, such as an object, even if this is not the child's initial attentional focus. In contrast, the controlling/intrusive directives that forbid

the child to play or do something with an object without offering another play opportunity do not help children in their language learning outcomes.

Taken together, the results about the use of directives among Wolof-speaking communities speak a lot about how cultural practices influence child language socialization (Ochs & Schieffelin, 1984; Super & Harkness, 2002). Due to the hierarchical nature of the Wolof society and parents' goal to have obedient children (Diop, 2012), I expected a high proportion of directives from caregivers, mainly action-request and controlling/intrusive directives. The current study confirms our hypothesis and prior research that maternal directives are an inherent part of the language socialization of Wolof children. Notably, the results contrast with studies in Western settings showing that intrusive directives are not beneficial to children's language outcomes.

The results also raise an important question: How can caregivers' directives that change a child's attentional focus help them in their language abilities? One recurrent explanation for why such directives are detrimental to language learning is that they deplete children's attention and disrupt the flow of mother-child interactions (Akhtar et al., 1991; Masur et al., 2005; Tomasello & Todd, 1983). Nevertheless, what had not been investigated thus far, which the current study did, was examine whether the directives that lead children away from their attentional focus but provide them with a new learning opportunity contribute to their language development. This study shows that these intrusive directives might be more likely to hinder language learning if they are prohibitive (e.g., do not touch that, or 'Bul laal loolu' in Wolof), but not when they redirect the child attention to a potential learning opportunity (e.g., look at this cup, or "Xoolal kopp bii" in Wolof). However, one should interpret these findings cautiously because we do not yet have other studies confirming the results. Also, we need more studies within Senegal and other African

cultures to test the generalizability of the results regarding the association between controlling directives and child language outcomes within African settings.

Questions

In the present work, neither the total proportions of open-ended nor close-ended questions predicted child language outcomes. The non-significant associations between open-ended questions and child language contrasted with prior research (Wasik & Hindman, 2013; Rowe et al., 2017; Leech et al., 2013), although these studies did not look at the effects of the types of open-ended questions on child language individually. However, in the current study, I looked closely at the open-ended questions Wolof caregivers asked their children. I found that '*what,' 'how,'* and '*why'* questions related to child vocabulary and language milestones. In particular, the results showed that caregivers' '*what'* questions had positive and significant longitudinal effects on children's vocabulary size and language milestones at 36 months. Also, '*how'* questions predicted child language milestones at 36 months. Notably, caregivers' '*why*' questions asked mostly for reprimanding children negatively predicted child language milestones at 36 months regardless of children's age when the interactions took place. These results showed that the open-ended questions asked by Wolof caregivers when children were 24 months had long-term effects on their language abilities.

There are many reasons why 'what' and 'how' questions support children's language development. Open-ended or wh-questions, in particular 'what' and 'how' questions, may promote vocabulary and language development in general by encouraging children to provide verbal responses. These responses mainly include labeling objects, as in the case of Caregiver's prompt "*what is this?* or *Lii lan la?* in Wolof), a prompt frequent among the caregivers in this study. Leech et al. (2013) explained that since '*what'* questions are appropriately challenging for 2-year-olds and

elicit object labels, they provide them good opportunities to learn new words and reinforce their vocabularies.

Similarly, *how* questions are conversation-eliciting because they require children to describe or elaborate on objects or topics of discussion, therefore having the potential to support their communication skills. In addition, it was not surprising that caregivers' '*why'* questions, primarily for reprimanding children, did not positively relate to their language milestones one year later. Parental reprimands usually include telling children what they did wrong (Leijten et al., 2018), which may be more likely to change the child's behavior than to elicit conversation. Furthermore, the study has the merit of being the first one to provide an extensive analysis of how African caregivers use questions when interacting with their children. Also, to our knowledge, studies have so far used total proportions of Wh-questions to predict child language (e.g., Rowe et al., 2017). The current study extends previous work about maternal questions by exploring how the proportions of different types of Wh-questions promote child language abilities.

Utterance Elaboration

I found that caregivers who elaborated more on topics or objects of discussion with their children had children with higher vocabulary and language milestones one year later. However, it is worth noting that caregivers used a tiny proportion of utterances that elaborated or expanded on children's language or ideas (M = .09), which did not predict children's language outcomes. However, caregivers' self-elaboration on a topic or object of discussion by adding new information to it (e.g., Caregiver: *look at this ball. It is a blue one and it is bigger than the one at home*) supported Wolof children's language abilities in the long term.

There are many reasons why caregivers' elaboration supports children's language development. First, elaborations are mostly contingent (Taumoepeau. 2016). So, the child's

attention is drawn to the keywords in the adult's utterance through repetition, therefore providing the child opportunities to strengthen their vocabulary (Demetras et al., 1986). In other words, when a caregiver elaborates on an object of discussion, even if the elaboration is not based on a child's prior utterance, she may comment on the size of the object, its function, and color, which provides the child opportunities to consolidate their vocabularies and knowledge about the object. Second, it is also possible that caregivers' self-elaboration provides new syntactic data to words that the child is still learning, allowing the child to refine their knowledge of the word thanks to the syntactic cues to which they are exposed (Hoff-Ginsberg, 1986).

Overall, the findings highlight the importance of understanding of African caregivers interact with their children, and how different types of input support child language development.

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CHAPTER FOUR: CONCLUSIONS

In this chapter, I will provide an overview of the key findings from studies 1 and 2 in relation to the research aims and discuss the contribution of the results to the literature. I will also discuss their limitations, future research, and implications for practice.

Overall Findings

Study One aimed to investigate how Wolof-speaking caregivers used face-to-face and nonverbal communication behaviors when interacting with their 20-30 months old children. In addition, a clustering approach was used to test whether groups of caregivers differed in their use of face-to-face and nonverbal communication and whether such variabilities related to children's vocabulary and language milestones. The results indicated substantial variability within and between communication styles. When Wolof caregivers engaged in nonverbal communication with their children, they did it primarily by showing them warmth through physical touch., making noises with objects to get their attention to the objects, and snapping fingers, for instance, to draw their attention in general. When the face-to-face communication behaviors were examined individually, I found that caregivers most frequently talked in a positive tone to show warmth to their children. They also commonly engaged in conversational turn-taking with children and in verbal interactions about objects. Mutual gaze was the least common face-to-face behavior.

On average, Wolof caregivers used more face-to-face than nonverbal communication behaviors when interacting with their children. Furthermore, results yielded two clusters of caregivers who used similar amounts of physical touch but significantly differed in their face-to-face communication behaviors. They also significantly differed in their use of nonverbal communication behaviors, including 'nonverbal pretend play,' 'nonverbal object stimulation,' and

'nonverbal cues' such as snapping fingers to get children's attention. More importantly, caregivers with more face-to-face behaviors, such as talking and eye contact, had children with higher vocabulary and language milestones.

Study One findings confirmed our prediction that caregivers would use both communication styles by showing substantial variation in how Wolof caregivers used face-to-face and nonverbal communication behaviors. Therefore, they showed that Wolof caregivers did not use one form of communication at the expense of the other, contrasting with studies that assume that the African parenting style is characterized by nonverbal and physical communication (e.g., Keller, 2007; Keller et al., 2009). That is, caregivers frequently used face-to-face communication, which has been widely reported to be a characteristic of Western parents. So, this study calls on the importance of investigating individual differences in mother-child interactions within African mothers rather than assuming homogeneity in how they interact with children.

Moreover, many studies have demonstrated that caregivers' nonverbal behaviors, such as gaze and verbal behaviors like talking to children, contribute to child language development (Mundy et al., 2007; Brooks & Meltzoff, 2005; Shneidman & Goldin-Meadow, 2012). Study One confirmed these studies by showing significant associations between Wolof-speaking caregivers' use of face-to-face behaviors, including mutual gaze, and talking to children, and child vocabulary and language milestones. Such a finding suggests that mutual gaze and talking to children are essential in helping children learn their mother tongue, even in non-Western agrarian communities where face-to-face are believed to occur rarely compared to Western industrial societies (Cristia et al., 2017). Indeed, caregivers' physical communication behaviors, like physical touch, did not relate to children's language. However, this does not mean physical

communication may not be important for Senegalese children. Research has shown significant associations between mother-child tactile interaction and important child outcomes, including a reduction in child mortality, secure attachment, and executive functions (Anisfield et al., 1990; Conde-Agudelo et al., 2026; Feldman et al., 2014).

Furthermore, what we also needed to know was how the qualities in the language that Wolof children hear from their caregivers predicted child language outcomes, which is what Study two investigated. Study Two had two primary goals. First, it investigated how Wolof-speaking caregivers in rural Senegal talked to their 20–30-month-old children using directives, questions, here-and-now, and decontextualized language, and elaborated utterances. It also analyzed the associations between these inputs and child vocabulary and language milestones at 24 and 36 months.

In addition to showing variations in how Senegalese caregivers talk to their children, the Study Two results demonstrated that some inputs are more critical for child language skills than others. Caregivers' here-and-now utterances did not have positive associations with child language outcomes. However, their decontextualized talk about past and future events predicted child vocabulary and language milestones at 36 months. A surprising finding was that only caregivers' intrusive directives predicted child language but not their cooperative directives. Importantly, caregivers' *what* and *how* questions at 24 months had longitudinal associations with their vocabulary and language milestones at 36 months. It is worth mentioning that 'why' questions that caregivers asked to reprimand children were negatively associated with children's language development. Finally, caregivers who were more likely to elaborate on the topics or objects of discussion at 24 months had children with better vocabulary and language milestones at 36 months.

Contributions to the Literature

There is consensus that more than 95% of samples published in most reputed developmental sciences journals are from Western, Educated, Industrialized, Rich, and Democratic (WEIRD) settings, and less than 1% of these samples are from Africa (Henrich et al., 2010; Arnett, 2008). In addition, although mother-child interaction and child language development have been studied through careful experimental studies (e.g., Brooks & Meltzoff, 2005; Tomasello, 2000; Baldwin, 1993), most of these studies were done with American children from middle-class families. This gap has enormous implications for our understanding of human development, parenting, and language development in Africa. That is why there is a critical need to investigate parenting behaviors among Senegalese mothers and their effects on children's language development. The findings of this dissertation have immensely contributed to our understanding of how caregivers in rural and agrarian African communities interact with their children using a variety of nonverbal and verbal behaviors.

Study One identifies substantial variabilities in how Wolof-speaking caregivers interact with children. Its findings reinforce the argument I made earlier in this dissertation that African mothers should not be regarded as parents who uniformly use a nonverbal or physical form of parenting and not face-to-face verbal parenting, which is predictive of language skills and later school success. As such, Study One complements ethnographic studies of parent-child interactions in African settings, limited mainly by their small sample sizes (e.g., Rabain-Jamin & Jouannet, 1997). It also recommends cross-cultural researchers emphasizing between-cultural group differences in parenting to give more attention to within-group differences, mainly in Africa, for a more accurate picture of how African parents interact with their children. Finally,

through Study One, the dissertation confirms findings from western societies on the importance of face-to-face parental behaviors in supporting children's language.

Study Two demonstrated that caregivers' talk about past and future events, open-ended questions, and elaborated utterances support child language skills. These results fit with findings from Western settings espousing the importance of the qualities in maternal language input for child language development (Beals & Snow, 1994; Demir et al., 2015; Hart & Risley, 1995; Livickis et al., 2014; Rowe, 2012; Rowe & Snow, 2020; Rowland et al., 2003; Vilian & Casey, 2003). Besides, Study Two reveals that unlike findings from prior research (e.g., Tomasello & Ferrar, 1986; Paavola- Ruotsalainen et al., 2018; Masur et al., 2005), caregivers' intrusive directives can support child language skills but only if the input is not prohibitive. The study suggests a fine-grained analysis of parental directives that goes beyond deciding whether they follow the child's lead.

Collectively, the dissertation's findings confirmed results from Western societies and extended prior research by yielding results that contradict some precedent findings. The dissertation is critical in the field of child development for many reasons. In addition to bringing diversity to the field, my research comes at a moment when there is an increasing concern in developmental sciences regarding methodological and replicability issues, and significant efforts are being made in this sense (Frank et al., 2017; Visser et al., 2022). One possible explanation for these issues is that most studies are conducted with American populations (Arnett, 2008). This situation raises doubts about the validity of child development theories globally since Americans' culture, and living conditions are vastly different from those of non-western agrarian populations. Therefore, the two studies in this dissertation contribute to developing more cohesive and accurate theories of human development.

Limitations

Studies One and Two have similar limitations that future research should address. One limitation concerns the lab-based setting we used to record the caregiver-child interactions. The controlled play sessions indeed have their strengths in that they were devised to assess the interactions in the same way across dyads and emulate the real-world settings of the caregivers and their children. The play sessions had children and their caregivers engage in one-on-one interactions might look different if observed in their real-home environment. Also, the controlled play session that favors more certain behaviors than others. For example, the play sessions may have encouraged more engagement in face-to-face behaviors such as talking and maintaining eye gaze because caregivers and their children sat on a mat with toys to them. Such a situation may have inadvertently led to less physical or proximal communication behaviors involving body stimulation, like lifting the child, as ethnographic studies found to be a common parenting behavior in non-western agrarian societies. Although these dissertation studies may be less ecologically valid than ethnographic studies conducted decades ago in Africa (e.g., Harkness & Super, 1977; Levine et al., 1994) – because ethnographers immersed themselves in the local cultures and observed parent-child interactions in the home environment – their sample sizes were small, which can potentially cause a generalizability issue. On the contrary, the current dissertation has the merit of having a larger sample than prior studies in African settings and carefully observing all caregiver-child dyads under the same laboratory conditions.

Another limitation is that although I used direct measures of caregivers and children's behaviors, the dissertation entirely depended on indirect standardized parent reports to assess children's language outcomes. Both direct and indirect measures can be subject to biases. For example, direct measures can be biased by the presence of the observer. To reduce this bias,

research assistants who conducted the experiments asked the caregivers to play with their children as they would at home. More importantly, they left dyads uninterrupted for the entire duration of the play sessions. Indirect measures, such as parent-report measures, can be subject to overreporting or acquiescence bias. Interviewers addressed this issue by frequently asking the caregivers to give examples of when their child says one of the words listed in the CDI questionnaire or does one of the activities in the language milestones checklist.

Practical Implications

The dissertation has important implications for early interventions in parent-child interaction and language development in Senegal and potentially for interventions aimed at improving the literacy outcomes of Senegalese children. The results indicated that interventions that target caregiver-child face-to-face interactions, such as caregivers having mutual gaze with their children and talking to them in ways that include talking about objects and conversational turns, may benefit children's language skills. There is also an indication that caregivers who talk with their children using specific inputs such as asking open-ended questions, discussing past and future events, and elaborating on topics of discussion, help their children build their vocabulary and consolidate their communicative skills. Therefore, interventions in these areas before age three can potentially improve the language skills of Senegalese children. One way of conducting such interventions might be to have shared picture book reading with Senegalese parents living in rural areas since most of these parents cannot read or write. In fact, research has overwhelmingly shown that shared picture book reading interventions have positive effects on children's language abilities (for a review, see Dowdall et al., 2020; Cooper et al., 2014). In addition, shared book reading interventions provide ample opportunities for parents to use the

language input types the dissertation has identified as useful for helping children to develop strong language abilities (for a review, see Noble et al., 2019; Lonigan & Whitehurst, 1998).

Considering worrying results that most children in Senegal are functionally illiterate even after three years of formal schooling (Pouezevara, Sock & Ndiaye, 2010) and persistent evidence that early language skills are essential for future academic performance (e.g., Durham et al., 2007), the dissertation offers insights for effective interventions aimed at improving the academic and literacy outcomes of Senegalese children. As in other cultures, the variabilities in caregivers' interactional patterns, child vocabulary, and communicative skills may predict later school achievement in Senegal (e.g., Ramsook et al., 2020). Moreover, the effects of such variabilities on future literacy outcomes of Wolof-speaking children may be positive even if the instruction language, French, is different from Wolof. Therefore, early intervention in mother-child interactions and language development can be avenues to improving the low literacy skills of pupils in Sub-Saharan Africa, including Senegal (Azevedo et al., 2020).

In summary, studies 1 and 2 reveal that caregivers in rural Senegal do not use nonverbal communication, including “touch” to the detriment of face-to-face communication when interacting with their children. This contradicts prior research that portrays African mothers as people who only use a proximal or physical parenting style. The results also show that adults' nonverbal behaviors, such as gaze and verbal engagement, support children's language development in Senegal. As such, the findings suggest avenues for improving children's language skills through early intervention programs on caregiver-child interaction. If increased caregiver-child interactions can improve Senegalese children's vocabulary and communicative skills, which are crucial predictors of literacy development, then we have reasons to believe that these interventions have a real potential to improve the reading outcomes for children.

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APPENDIX A: IRB APPROVAL

MICHIGAN STATE
UNIVERSITY

EXEMPT DETERMINATION

***Flexibility Initiative* - See Special Exclusions Below**

November 20, 2020

To: Lori E Skibbe

Re: **MSU Study ID:** STUDY00005385
Principal Investigator: Lori E Skibbe
Category: Exempt 97
Exempt Determination Date: 11/20/2020

Title: Concurrent and longitudinal association between verbal and nonverbal mother-child interactions and the language outcomes of Wolof-speaking children living in rural Senegal [Title may change].

This study has been determined to be exempt under the Michigan State University (MSU) Flexibility Initiative Exemption Category 97.

Institutional restrictions to in-person human subject research activities conducted by MSU employees, MSU students, or agents of MSU are in place, but MSU is phasing in human research that has the potential for in-person interactions with participants, using a Tier approach. Restrictions to in-person interactions with human research participants by MSU employees, MSU students, or agents of MSU are in place until the activity is permitted under a Tier and a Human Research Plan for a Safe Return is approved. Visit http://hrpp.msu.edu/COVID-19/index.html for the restrictions, Tiers, forms, and the process.

Exemption Category 97: Research involving the study of previously collected identifiable data. The data may include documents or records (but not identifiable biospecimens), unless disclosure of the data outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation. This exemption allows the information to be recorded by the investigator in such a manner that subjects can be identified, directly or through identifiers linked to the subjects.

See HRPP Manual 8-8-A, Exemption Category 97, for the full text of Exemption Category 97.

Exclusions: To continue to qualify for Exemption Category 97, the study must not include:

- Federal funding or federal training grants
- FDA regulated
- Sponsor or other contractual restrictions
- Clinical interventions (including clinical behavioral interventions)

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- Prisoners as subjects
- Receipt of an NIH issued certificate of confidentiality to protect identifiable research data
- Be a study that involves other institutions for which MSU serves as the Institutional Review Board (IRB) of record

If any of the above criteria become applicable to a study determined exempt under this flexibility initiative, the IRB office must be promptly notified prior to implementation of the criteria and the study must be reviewed and approved in accordance with the appropriate review level (e.g. expedited, full board).

Principal Investigator (PI) Responsibilities: The PI assumes the responsibilities for the protection of human subjects in this study as outlined in Human Research Protection Program (HRPP) Manual Section 8-1, Exemptions.

Continuing Review: Exempt studies do not need to be renewed.

Modifications: In general, investigators are not required to submit changes to the IRB once a research study is designated as exempt as long as those changes do not affect the exempt category or criteria for exempt determination (changing from exempt status to expedited or full review, changing exempt category) or that may substantially change the focus of the research study such as a change in hypothesis or study design. See HRPP Manual Section 8-1, Exemptions, for examples. If the study is modified to add additional sites for the research, please note that you may not begin the research at those sites until you receive the appropriate approvals/permissions from the sites.

Change in Funding: If new external funding is obtained for an active study that had been determined exempt, a new initial IRB submission will be required, with limited exceptions. Please see exclusions as funding changes may disqualify this study from this flexibility initiative.

Reportable Events: If issues should arise during the conduct of the research, such as unanticipated problems that may involve risks to subjects or others, or any problem that may increase the risk to the human subjects and change the category of review, notify the IRB office promptly. Any complaints from participants that may change the level of review from exempt to expedited or full review must be reported to the IRB. Please report new information through the study's workspace and contact the IRB office with any urgent events. Please visit the Human Research Protection Program (HRPP) website to obtain more information, including reporting timelines.

Personnel Changes: After determination of the exempt status, the PI is responsible for maintaining records of personnel changes and appropriate training. The PI is not required to notify the IRB of personnel changes on exempt research. However, he or she may wish to submit personnel changes to the IRB for recordkeeping purposes (e.g. communication with the Graduate School) and may submit such requests by submitting a Modification request. If there is a change in PI, the new PI must confirm acceptance of the PI Assurance form and the previous

PI must submit the Supplemental Form to Change the Principal Investigator with the Modification request (available at hrpp.msu.edu).

Closure: Investigators are not required to notify the IRB when the research study can be closed. However, the PI can choose to notify the IRB when the study can be closed and is especially recommended when the PI leaves the university. Closure indicates that research activities with human subjects are no longer ongoing and have stopped. This means there is no further interaction or intervention with human subjects and/or no further analysis of identifiable private information.

For More Information: See HRPP Manual, including Sections 8-1, Exemptions and 8-8-A, Exemption Category 97 (available at hrpp.msu.edu).

Contact Information: If we can be of further assistance or if you have questions, please contact us at 517-355-2180 or via email at IRB@msu.edu. Please visit hrpp.msu.edu to access the HRPP Manual, templates, etc.

APPENDIX B: AVAILABLE DATA SOURCES

Category 1: Surveys

Three types of questionnaires were administered to caregivers.

1. **Caregiver questionnaire (Times 1 & 2, n = 439) : central questions**
    a. **Social norms about having eye contact and talking to babies.**
        i. In your village, different people can be involved in supporting the mothers who take care of babies. Are there people whose opinions matter most to you when you decide on the best ways of interacting with your baby?
        ii. Could you please tell me the three persons whose opinions matter the most when you decide on the best ways of interacting with your baby?
        iii. In your opinion, how many caregivers in your community talk to their babies?
        iv. What do you think about caregivers who talk to their babies?
        v. In your opinion, how many people in your community have eye contact with their babies?
        vi. What do you think about caregivers who have eye contact with their babies?
        vii. We heard that there are people who say that a caregiver should not talk to a baby. In your opinion, who usually thinks that way in your community?
        viii. Would those people approve of you NOT talking to your baby?
        ix. What would they think if you saw you talking to your baby?
        x. What do you think would happen if you talk to your baby?

xi. We heard that there are people who say that caregivers should not have eye contact with their babies. In your opinion, who usually thinks that way in your community?

xii. Would those people approve of you NOT having eye contact with your baby?

xiii. What would they think if they saw you having eye contact with your baby?

xiv. What do you think would happen if you have eye contact with your baby?

b. Knowledge about child development

c. Depressive symptoms (short version of CES-D scale)

d. Pregnancy and birth

i. Ask about number of children

ii. Child loss etc.

e. Discipling children

2. Household questionnaire (Times 1 & 2, n = 439)

This questionnaire asks about the resources the household has, the construction materials used to build the rooms, the size of the household etc.

3. Child's responsible questionnaire (Times 1 & 2, n = 439)

This questionnaire is for the person who makes important decisions in the life of the target child such as finances and health. Questions included the vaccination of the child, breastfeeding, the number, and types of toys/books the child has, and how much time the responsible spends time with the child throughout the day.

Category 2: Interviews (Time 2, n= 63; Time 3, n=27)

Note. After Times 1 & 2, we visited some treatment villages to interview caregivers, hence Time 3.

Interviews were conducted to ask caregivers about parenting practices and social norms in the Wolof rural communities about talking and having eye contact with babies.

Category 3: Video-recordings of structured play sessions (Time 1, n =508; Time 2, n = 473)

Caregivers and children sat on a plastic floor mat with some toys. A Wolof-speaking research assistant instructed the caregiver to play with the child as they would do at home. The research assistant left the dyad interrupted for 15 minutes while a camera set about 2 meters from the mat recorded their interaction. Transcription and coding of 5-min segments of the 15-min play sessions by STEP team yielded these measures:

1. **Transcripts of caregivers' speech to the child (Time 1, n = 506; Time 2, n = 469), coded for:**
    a. Word Tokens
    b. Word types
    c. Mean Length of Utterance
    d. Number of utterances
2. **Transcripts of child's speech to the caregiver (Time 1, n = 506; Time 2, n = 469), coded for:**
    a. Word Tokens
    b. Word types
    c. Mean Length of Utterance
    d. Number of utterances

3. **Quality features of maternal language input (Time 1, n = 506; Time 2, n = 470):**

Utterance level-coding. The following behaviors were coded:

a. Directive (positive/neutral in tone): asking the child to do something in a positive/neutral tone.

Example: “Give me the bucket”; “Come sit here”; “Look at me”.

b. Praise: encouraging/positive words or phrases.

Example: “Well done! You found the spoon”; “You are smart! You found the bucket”; “You are right, this is the cup”; “You can dance very well.”

c. Control/prohibition: asking the child to stop doing something/ asking the child to behave a certain way in a commanding tone using mostly “do not”.

Example: “Don’t break the toy”; “Don’t speak loudly”; “Don’t sit this way”; “Stop doing this”

d. Insult/threat: insulting the child, threatening to hit/or do something bad to the child, threatening someone or something will hurt the child.

Example: “I will hit you if you don’t stop”; “Dad is going to punish you when we go home”; “I will call the dog if you don’t listen”.

e. Question: asking any question.

Example: “Where is the bucket?” “What do you do with a cup?” “What are you eating?” “Do you want to dance?”

f. Label (object name): asking the name of the object.

Example: “How do you call this?” “What is this?”

g. Elaboration: asking what you can do with the object, elaborates the discussion on the object or on another topic.

Example: “We drink milk with the bucket, and we can also put water in it”; “We don’t break the toys so that someone else can come play with it”.

h. Repetition of word or phrase: repeating a word or a phrase in the same sequence. Example: MO says: “This is a cup”, CHI says “cup”, MO says again: “Yes, this is a cup.” Or MO repeats: “Give me the bucket” in the same sequence.

i. Singing: singing.

4. Behavioral coding of mother-child interaction (Time 1, n = 509; Time 2, n = 471) coded for:

a. **MO shows warmth in interaction with CHI**

0: Not at all: MOT does not show any expression of warmth at all (neither with her voice nor with her face).

1: Weak/Very little: MOT shows warmth in the interaction (through facial expressions, the voice, or any other expression of warmth) at least once or very little.

2: Middle/Moderate: MOT shows warmth in a moderate way during the whole segment or most of the time.

3: High/A lot: MOT explicitly shows warmth in the entire bin or most of the time. When she smiles, laughs a lot, claps hand, sings, sits close to the child, and talks a lot to the child with a positive tone.

b. MOT displays affection by touching, caressing CHI

0: Not at all/Very little: Does not touch/caress the child at all to show affection or does it very little.

1: Sometimes: MOT touches or caresses the child to show affection a few times.

2: A lot: MOT caresses/ touches/ kisses/ tickles the child many times to show affection.

c. MO actively sustains interaction with CHI

0: Not at all/Very little: Does not talk at all or almost never talk (once or very little) and does not use any nonverbal communication form to interact with the child.

1: Sometimes: Talks/interacts a little to encourage the child's participation; leaves long silence gaps between conversations.

2: A lot: Always keeps the conversation going /actions/ nonverbal communication (talks a lot, sings, encourages the child, tickles the child…)

d. Vocal turn-taking by MO-CHI

0: Not at all/Very little: MO talks to the child but the child does not respond at all or responds only once or very little. Or CHI talks to MO and she does not respond or does it only once or very little.

1: Sometimes: MO and CHI are involved in a conversation and each of them takes his or her turn a few times by speaking (even if the speech is unintelligible), or by vocalizing (hun, hunhun).

2: A lot: MO and child always or most of the time talk to each other even if the child's words are unintelligible. The child talks; vocalizes a lot and the mother always responds.

e. Mutual gaze between MO-CHI

0: Not at all/Very little: Mother and child never have eye contact or do it only once, very little or for a very short period of time.

1: Sometimes: MO and CHI stare at each other a few times, and/or for a short period of time.

2: A lot: MO and CHI stare at each other many times, and/or for a long period of time.

f. Pretend play by CHI, or between MO-CHI

0: Not at all: MOT and/or CHI do not do any imaginary play at all.

1: Sometimes: MOT/CHI either verbally or by actions pretend to do something like cooking or eating with the objects only for a few times.

2: A lot: Imaginary play either verbally or by actions. Pretend to do something like cooking or eating with the objects, in the entire bin or most of the time**.**

g. MO uses non-verbal vocal sounds or non-verbal actions to engage CHI attention

0: Not at all/very little: MOT does not use any non-verbal sound at all (pssst, chsssst), or uses them only very little; and does not use non-verbal action producing sounds at all (make noise with the toys, clapping hands…).

1: Sometimes: Make vocal sounds like (pssst) or uses non-verbal actions (make noise with the fingers, clapping hands…) a few times or for a short period of time in order to engage the child attention.

2: A lot: Make vocal sounds like (pssst, chssst…) many times; or uses non-verbal actions producing sounds many times (clapping hands or fingers, making noise with the objects…).

h. Mo is disengaged

0: Not at all/Very little: MOT is engaged in the entire bin or most of the time (talks/interacts a lot with the child, no long silence gaps between actions/phrases).

1: Sometimes: MOT is disengaged sometimes (talks/interacts a little, long silence gaps, looks away sometimes, or seems dreaming).

2: A lot: MOT is always or most of the time disengaged (looks away, never talks/interacts with the child or does it only once or very little in the entire bin.

i. If CHI is distressed, MO responds with affection

Not Applicable: If the child is not distressed (does not cry, is not angry etc.)

0: Not at all/ very little: Does not do or say anything with affection if CHI is distressed.

1: Sometimes: Responds with affection a few times to calm the child when he or she is distressed.

2: A lot: Responds always in a sensitive way when the child is distressed.

Category 4: Measures of Child Language Abilities

1. **McArthur-Bates CDI** (Time 1, n =211; Time 2, n = 366)
2. **Language Milestones checklist** (Time 1, n = 439; Time 2 n = 439)
3. **Looking While Listening** (Time 1, n = 195; Time 2, n = 351)
    a. Accuracy
    b. Reaction time

Category 5: LENA Audio Recordings of children's Language Environment (Time 1, n = 225; Time 2, n= 194)

STEP team put a LENA recorder in a chest pocket of a specially designed clothing that children wore all day. The LENA device recorded about 12-hour of talk in the child's environment. The recordings yielded two types of measures, a) automated measures obtained through the LENA analysis software, and b) STEP team members transcribed 60-min recordings sampled from the 12-hour recordings over the course of the day for 40 participants at Time 1.

1. **Automated measures**
    a. Adult word Count: measured a word a man or a woman addressed to the target child.
    b. Conversational Turn Count: measured when the target child speaks and an adult responds within 5 seconds, or vice versa.
    c. Child Vocalizations: speech by the target child that is surrounded by more than 300 milliseconds of silence.
2. **Transcripts**
    a. Speech to the target child by adults
    b. Speech to the target child by other children
    c. Speech by the target child to adults
    d. Speech by the target child to other children

Category 6: Teaching Task (Time 2 only, n = 470)

The teaching task consisted in building a tower using cups of different sizes and colors. A Wolof-speaking research assistant explained the task to caregivers and showed them how to build the tower. The caregivers were instructed to teach children how to build the tower as they

would naturally do at home. The research assistant left the dyads uninterrupted for 5 minutes, and a camera set about 2 meters from the dyads recorded their interactions. Of the 470 TEACH videos, 39 were coded for the following behaviors:

1. **Child overall success: 6-pt Likert scale**
    - **a.** child does not engage with cups
    - **b.** child tries but fails to stack any cups
    - **c.** child succeeds in stacking 2 cups
    - **d.** child succeeds in stacking 3-5 cups
    - **e.** child succeeds in stacking all cups once
    - **f.** child succeeds in stacking all cups more than once

      child wants to play another game (e.g., nest cups)
2. **Caregiver's overall help: 5-pt Likert scale**
    - **a.** mom does not help in child's success
    - **b.** mom helps but only a little or rarely
    - **c.** mom helps about half of the time
    - **d.** mom helps a lot or most of the time
    - **e.** mom helps nearly always or always
    - f. mom tries to help, but child will not stack
3. **Physical scaffolding during selection of cups: 5-point Likert scale**
    - a. Mom places cup herself
    - b. Mom hands cup to child
    - c. Mom moves cup close to child's hand
    - d. Mom taps on cup or makes noise with cup to draw attention to it

e. Mom points to next cup

f. Mom nods head in response to child's query

4. **Verbal scaffolding during selection of cups: 5-point Likert scale**

    a. Mom makes sounds or fillers to direct child ("un-hun" or "tsk")

    b. Mom uses non-elaborative directives, confirmations, or corrections ("this one", "yes", "no, not that one, this one")

    c. Mom uses descriptive directives with color or size ("now the red one", "no, the green one next")

    d. Mom encourages or praises to maintain child's interest ("great job!")

    e. Mom uses questions to maintain interest ("which one goes next?")

5. **Autonomy Support: Response to mistakes – 5-point Likert scale**

    a. Mom physically prevents child from grabbing or placing wrong cup

    b. Mom verbally prevents child from grabbing or placing wrong cup (does not touch child or cup)

    c. Mom completes the child's actions to build tower with correct cup

    d. Mom replaces incorrect cup after child has tried placing, or places, it on tower

6. **Overall strategy: YES/NO answers & # of time**

    a. Mom builds tower at least once as demo

    b. Mom or child arranges cups in order of size

    c. Mom or child unstack tower 1 cup at a time

    d. Mom reduces amount of scaffolding she gives over time

    e. Child stacks at least 3 cups in correct order by himself/herself without any help or confirmation from Mom

f. # of times the tower is built with child actively engaged in placing at least 3 cups

g. Amount of time both are engaged together in building tower

7. Other activities: YES/NO answers

a. Mom counts cups

b. Mom describes colors (separate from scaffolding)

c. Child and mom engage together in nesting cups

d. Child and mom engage together in other stacking game (out of order, upside down)

e. Child and mom engage together in pretend play with cups (drink out of them**)**