Swedish toddlers' use of turn-final gaze in dyadic child-parent interaction

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Abstract

Turn-final gaze at the interlocutor has been suggested to fill different functions in conversation: being monitoring, regulatory or response-seeking. 16 Swedish toddlers use of turn-final gaze in dyadic interaction with their parents was investigated at the ages 1;0, 1;6, 2;0, 2;6 and 3;0. The turn-final gaze behaviour was investigated for correlations to child age and language level. Additionally, child turn-final gaze in turn-final questions, in turns longer than 5 seconds and in different interaction contexts was examined.

Results showed that the use of active turn final gaze increased over ages 1;0-2;0. No correlations between child use of turn-final gaze and child language level could be found. In turn-final questions, 93% of the turn-final gaze was active, i.e. was not present at the start of the turn. Turn-final gaze was used both during conversation and object-oriented interaction at all ages.

A monitoring-response-seeking function of turn-final gaze was proposed to be used by the toddlers as a means to get the parent's encouragement and approval of the child's interactive language use. Additionally, the importance of choosing a suitable measure type of turn-final gaze while investigating small children was stressed.

Keywords

Svenska småbarns användning av turfinal blick i dyadisk förälder-barn interaktion

Stina Andersson

Sammanfattning

Turfinal blick på motparten i ett samtal har föreslagits fylla olika funktioner: övervakande, styrande eller responssökande. 16 svenska småbarns användning av turfinal blick i dyadisk interaktion med sina föräldrar studerades vid åldrarna 1;0, 1;6, 2;0, 2;6 och 3;0. Turfinalt blickbeteende undersöktes angående potentiella korrelationer till barnens ålder och språknivå. Dessutom granskades barnens turfinala blickanvändning i turfinala frågor, i turer längre än 5 sekunder och i olika sorters interaktionskontext.

Resultaten visade att användandet av turfinal blick ökade mellan åldrarna 1;0 och 2;0. Inga korrelationer mellan barnens användning av turfinal blick och deras språkliga nivå kunde hittas. I turfinala frågor var 93% av den turfinala blicken aktiv, dvs inte närvarande vid turens start. Turfinal blick förekom både i konversation och objektsorienterad interaktion vid alla åldrar.

En övervakande/responssökande funktion hos turfinal blick föreslogs användas av småbarn som ett sätt att få förälderns uppmuntran och bekräftelse på barnets interaktiva språkanvändning. Dessutom poängterades vikten av att välja ett relevant sätt att mäta turfinal blick vid studier av små barns blickbeteende.

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1 Introduction

Turn-taking is a fundamental aspect of human communication. We seem to have a predisposition for turn-taking already from birth (Dominguez et al., 2016), and babies as young as eight weeks take turns in vocalizing with their mothers (Gratier et al., 2015).

Eye gaze is considered to be an important instrument for turn-taking in adults (Wiemann & Knapp, 1975; Rossano, 2012). A high degree of turn-final speaker gaze at the listener has been noticed by among others Kendon (1967) and Ho et al. (2015). Different functions of turn-final speaker gaze have been suggested, for example that it is used as a turn-yielding signal or to signal a request for response.

Children's use of gaze at others as well as their turn-taking abilities develops over age. As Levinson (2016) points out, most of the previous research on small children and their turn-taking abilities was done in the 1970s, which calls for further examination of the topic using modern methods.

Rutter and Durkin (1987) investigated gaze in interaction between English speaking children and their mothers at age 0;9-3;0 and found a correlation between child use of turn-final gaze and child age. To my knowledge, no studies have been done on turn-final gaze use in Swedish speaking children, nor on the correlation between child use of turn-final gaze and child language level. Furthermore, I have not found any investigations of child use of turn-final gaze in different kinds of turns (e.g. questions and long turns).

The present study intended to investigate if Swedish toddlers at age 1;0-3;0 use turn-final gaze in interaction with their parents, and if child turn-final gaze use can be correlated to the child's age. Moreover, possible correlations between child use of turn-final gaze and child language level was examined, as well as child use of turn-final gaze in turn-final questions, long turns and different interaction contexts.

2 Background

2.1 Eye gaze in human communication

Compared to other primates' eyes, human eyes are unique in having white scleras (Kobayashi & Kohshima, 1997). In addition, the sclera is noticeably paler than the human face and the rest of the eye. Consequently, the human eye is more suited for detecting and following gaze direction than any other primate's eyes, which in turn facilitates communication with gaze signals.

The use of eye gaze is an important tool in communicating and socializing. Humans have a bias for looking at the eye region of others during physical social interaction (Hessels et al., 2017), and gaze towards the eye region increases in persons with high levels of oxytocin (Guastella et al., 2008), a hormone known for its role in social bonding. Newborns prefer to look at faces with eyes directed towards them in contrast to faces with averted gaze, showing a predisposition for eye contact (Farroni et al, 2002).

Eye gaze is used in dyadic joint attention, where two persons share focus on the same object. The importance of joint attention for first language acquisition was emphasized by Tomasello and Farrar (1986) who investigated dyadic joint attention between mother and child at ages 1;3-1;9. Inside - but not outside - joint attention sessions, maternal references to objects that their children focused on were positively related to the children's language development. At age 1;0 children follow a person's eye gaze direction even without the person moving their head (Tomasello et al., 2007), and use pointing as a means for sharing attention (Liszkowski et al., 2014), two important steps in the development of children's joint attention abilities. At age 0;10-0;11, children in a study by Brooks and Meltzoff (2005) were more inclined to follow an adult's head turn with their own eyes when the adult's eyes were open than when they were closed. Children that followed the adults' gaze more at age 0;10-0;11 had a larger vocabulary size at age 1;6.

Kidwell (2005) showed that children aged 1;0-2;6 can determine whether a caregiver looking at them is just monitoring their behaviour or if the caregiver is about to intervene in their actions. Difficulties with understanding others' communicative use of eye gaze are common in children with autism. Baron-Cohen et al. (1997) observed autistic children at 7-12 years of age with the expressive and comprehensive language level typically found in 2-years-olds. In a word learning experiment, the children where less able to use speaker gaze direction as a key to understand the referents of new words than typically developed children aged 2;0.

Several studies have shown cultural differences in communicative gaze behaviour, for instance comparing Chinese and Canadians (Li, 2004) and Japanese and Americans (Koda, 2017). Senju et al. (2013) compared Japanese and English children's gaze behaviour at 1-7 years of age, finding that Japanese children focused more on the eye region of faces while English children focused more on the mouth region, hence replicating earlier results in adults. Allwood (1999, p. 9-10) suggests that Swedes show a somewhat "Anglo-Saxon" gaze behaviour both tolerating and expecting less eye contact than what is the norm in many other cultures.

2.2 Turn-taking

2.2.1 The organization of turn-taking

In 1974, Sacks, Schegloff and Jefferson (1974) presented their seminal description of the 'speech exchange system' of verbal turn-taking. They pointed out how usually only one party speaks at a time and that both overlaps and gaps between turns are usually avoided. Moreover, they claimed that the interlocutors use turn-allocation techniques i.e. techniques for selecting next speaker: either the current speaker selects next speaker or next speaker self-selects. Duncan (1972, p. 286-287) had already presented several linguistic and non-linguistic cues that together or separately can function as a signal

for turn-yielding. Some of these cues make use of intonation, voice pitch and body language such as gestures and posture. Kendon (1967) presented turn-final gaze as a turn-yielding cue.

Stivers et al. (2009) examined response latencies, i.e. speaker switch pauses, in 10 languages world-wide. They reported that despite cultural differences speakers of all the investigated languages generally avoided overlaps and seemed to strive for as short response latencies as possible. Following a first turn, the mean pause length calculated across all languages was 208 ms. Japanese accounted for the shortest mean pause (7 ms) and Danish for the longest (469 ms). Since a gap or overlap under 120 ms is too short for the human ear to perceive (Heldner, 2011), presumably on many occasions an actual gap between turns is not noticed by the interlocutors. Using EEG to investigate brain waves, Bögels et al. (2015) detected processes of answer production planning in the listener as early as several seconds before a question ended. According to a study by Shipp et al. (1984) the fastest mean vocal reaction time measured in adults was 185 ms. Consequently, short response latencies require that the person taking the turn knows beforehand that the turn probably is to be yielded.

No accepted convention for what constitutes a turn in turn-taking seem to exist. Torres et al. defines a turn as "the talk of the speaker delimited by the talk of the hearer, with the exception of ongoing communicative behaviour by the hearer that lacks propositional content" (Torres et al., 1997, p. 6). Similarly, DeMaio (1982) distinguishes between main channel signals – introducing new topics or expanding on established topics - and feedback/back channel signals (saying 'mhm', 'yeah' etc.), where only the former are counted as turns (DeMaio, 1982, p. 174). Duncan (1972) makes the same distinction and points out how a listener can use a back channel to avoid taking the turn when the speaker uses a turn-yielding signal (Duncan, 1972, p. 288). Likewise, Sandgren et al. (2012) do not consider back channelling as taking the turn in a study on gaze in dialogues between children at age 10-15 years. However, in research on infants or toddlers and turn-taking usually all verbalizations are treated as potential turns (see for instance Schaffer et al., 1977 and Rutter and Durkin, 1987), probably because small children have not yet developed a conventional use of verbal feedback and back channels.

2.2.2 Children and turn-taking

Human babies show turn-taking behaviours already as newborns as they vocalize in overlap with their mothers' vocalizations (Dominguez et al., 2016). At 8 weeks of age babies both anticipate and initiate vocal turns, usually responding to their mothers' vocalizations within 3 seconds (Gratier et al., 2015, p. 239). 3-month olds show a preference for conversational turn-taking by answering in a more speech-like way to contingent adult vocalizations than to noncontingent vocalizations (Bloom et al., 1987, p. 219). This language-like response might in turn inspire parents to talk to their babies more and in a more child-directed way, facilitating the child's language acquisition (Bloom et al., 1987, p. 223-224). Harder et al. (2015) showed that while children at age 0;4-0;10 were coordinating their vocalizations with their parents' vocalizations, they still used more covocalizing than turn-taking patterns. However, the rate of covocalization decreased over age, indicating a development towards a more adult-like communicative behaviour. Hilbrink et al. (2015) found that the response latency in child turns became longer toward the end of their first year, hypothesizing that this is partly due to the child's increasing linguistic and communicative understanding around that age (Hilbrink et al., 2015, p. 255). At age 1;0 children can spontaneously predict turn switches, and the ability increases at least until age 6;0 (Casillas & Frank, 2013). Children has been shown to use longer response latencies than adults. In child-child-dyads at the age of 2;10-3;3 mean length of speaker switch pauses after questions and other requests was between 1100 and 1800 ms, depending on the answer's predictability and complexity (Garvey & Berninger, 1981, p. 38). How fast the parents respond to their children's turns has been shown to be related to the child's language development. At age 1;6, parents whose children had a larger productive vocabulary responded faster than parents of children with a lower productive vocabulary size (Marklund et al., 2015).

2.3 Eye gaze in turn-taking

2.3.1 Some characteristics and functions of gaze in turn-taking

One of the first studies to present alternating gaze behaviour in dyadic turn-taking was done by Nielsen (1964). He noticed that other-gaze decreased while speaking and increased while listening (Nielson, 1964, p. 139-143). In his ground-breaking work on gaze in social interaction, Kendon (1967) investigated both long turns (turns at least five seconds long consisting of continuous speech with no audible phrase boundary pauses), and short utterances (exclamations, accompaniment signals, short questions etc). He suggested that the speaker follows specific patterns for gaze use in turn-taking. At the beginning of or just before a long turn the speaker looks away, and close to the end of the turn the speaker looks up on the listener again, keeping their eyes on the listener at least until the turn ends (Kendon, p. 33). During a long turn, the speaker sometimes gazes at the listener, but only with short glances. In asking non-hesitant short questions, the speaker usually holds their gaze fixed at the listener. Kendon states that speaker gaze at listener has both monitoring and regulatory functions (see 2.3.2 for some examples).

In his doctoral dissertation on gaze use in Italian face-to-face interaction Rossano (2012) claims that gaze is used differently in extended multi-unit turns and turn-by-turn talk (Rossano, 2012, p. 313). The main focus of his thorough investigation on interactant gaze is on the latter. Turn-by-turn talk consists of adjacency-pair-based sequences which in turn contain a first pair part (FPP) and a second pair part (SPP). An FFP is defined as "a turn that makes conditionally relevant the occurrence of a second turn and its absence a noticeable absence" (Rossano, 2012, p. 53), for instance a question, invitation or greeting. Rossano found that when an FPP was directly followed by a SPP, the speaker looked at the listener during the FPP in 77 percent of the cases (Rossano, 2012, p. 138). The strongest predictor for the overall occurrence of a SPP to follow a FPP – regardless of response time – was speaker gaze at the interlocutor during the FPP. Additionally, if the conversation participants shared mutual gaze during the FPP, an SPP was more likely to occur instantly (Rossano, 2012, p. 153).

While investigating communicative gaze use in speakers of three diverse languages - Italian, Yélî-Dnye (Papua New Guinea) and Tenejapan Tzeltal (Mexico), Rossano et al. (2009) found striking similarities concerning gaze use and questions. During a question, speaker gaze at listener was more likely to occur than vice versa. They also found that speaker gaze at listener during the question was usually fixed from the beginning to the end of the question, confirming Kendon's (1967) description of the same pattern during short questions. In a comparative study Stivers et al. (2009, p. 10588) found that speaker gaze at recipient during a question was significantly correlated with shorter response latencies in five out of ten languages (Lao, Italian, English, Korean and Yélî-Dnye). Besides, non-significant indications of the same correlations were found in yet another four languages (ǂAkhoe Haiǁom, Dutch, Tzeltal and Japanese). Only Danish did not show this pattern. Beattie (1978) reported that questions produced with turn-final gaze were more difficult than other questions and stated it to be one example on the monitoring function of gaze. When the speaker asks a more demanding question it is accompanied with a gaze to see how the listener handles it (Beattie, 1978, p 14).

Bolden (2003) shows how gaze plays a part in collaborative turn sequences, i.e. where the listener completes the speaker's utterance. In joint attention sessions when the speaker looks up at the listener close to the end of the turn and thereby shifts focus from the object of attention, this works as an invitation signal to the listener to complete the turn (Bolden, 2003, p. 203-207).

Whether interactants focus on objects or not has been shown to affect the amount of other-gaze. Argyle and Graham (1976) showed how participants in dyadic interaction looked less than half as much at each other in the presence of a task-related simple object than when no object was present. Other-gaze was even more decreased when the interactants focused on a more complex object. Similar effects on other-gaze in object-oriented interaction can be found in children at age 4-12 (Levine & Sutton-Smith, 1973, p. 404). However, Rossano et al. (2009) found that the presence of objects did not hinder the speaker to look up at the listener when asking a question.

In Schaffer et al. (1977) children at two years of age looked up at their mother's more during their own turns than during their mothers'. One-year-olds in the same study did not yet show this pattern but looked up as much during all turns (Schaffer et al., 1977, p. 312-314). The older children's preference for looking up at their mothers more during their own turns was assumed to not only have a monitoring function but also reinforce the other-directed nature of the child's utterance (Schaffer et al., 1977, p. 318). In looking up at the mother, presumably seeking contact, the child signals that the mother should be attentive to what the child is saying/trying to say.

2.3.2 Turn-final gaze and its possible functions

In the present study, a turn-final gaze is defined as the speaker looking at the interlocutor's eye region at the end of the speaker's turn. Some small deviations from this definition might occur in previous research (e.g. gaze at the listeners face instead of eye region, time limitations for how close to the turn end the gaze must occur) but on the whole the phenomenon remains the same.

Since Kendon (1967) turned the attention to turn-final speaker gaze it has become a somewhat accepted concept, albeit not without being questioned. Sometimes the fact seems to be neglected that Kendon only identified a turn-yielding function of gaze in turns that lasted at least five seconds and contained no noticeable pauses. Usually the length of a speaker turn is around 2 seconds (Levinson, 2016, p. 6), which makes Kendon's long turns exceptions.

Different reasons for the observed turn-final gaze have been suggested. While describing turn-final gaze in long turns - usually occurring during the last phrase of the turn, Kendon (1967, p. 53) proposed a monitoring function: to see that the speaker still holds the listeners attention, and to look for signs in the listeners behaviour as to yield the turn or not. But a regulatory function was also suggested: in looking up at the listener when the turn is approaching its end, the speaker is preparing the listener that a turn-yielding is soon made possible and is desired by the speaker (Kendon, 1967, p. 56).

Beattie (1978) aimed to investigate the presumed turn-allocation function of turn-final gaze in measuring response latencies, supposing that shorter response latencies would be a sign of turn-final gaze working as a clear turn-yielding signal. In agreement with Kendon's findings, Beattie only investigated long turns. Using a threshold on 500 ms for short response latencies, he did not find a correlation between those and turn-final gaze, consequently suggesting that turn-final gaze does not have a significant turn-allocating function. However, in a later study (Beattie, 1979) he presented how turn-final gaze did correlate with shorter response latencies in one specific context: in turns of hesitant speech at least 30 seconds long. He proposed that turn-final gaze would function as a turn-yielding cue in contexts were gaze usually is less occurring, as between strangers or during more complex topics of conversation. Kalma (1992) is objecting to Beattie's assumption than the length of response latencies would be a measure on the efficiency of a turn-yielding signal. On the contrary, Kalma proposes that a prolonged turn-final gaze extending after the turn-ending can give the listener time to mentally prepare their upcoming utterance (Kalma, 1992, p. 36).

As a result of both investigating previous research and doing their own study, Wieman and Knapp (1975, p. 83) concluded that other-directed speaker gaze seemed to be the only important non-verbal turn-yielding cue. However, they emphasised how mutual gaze between the interactants probably is a condition for a turn-final gaze to successfully work as a turn-yielding signal (Wieman & Knapp, 1975, p. 85).

Rutter et al. (1978) intended to replicate Kendon's 1967 study, investigating only linguistically complete long utterances. They did find a turn-final gaze in most turns leading to a speaker change but discovered how in more than one third of all turn-changes speaker and listener did not have eye contact. Assuming that the listener needs to be able to notice the speaker's gaze on them to perceive a turn-yielding signal, their conclusion was that despite the high frequency of turn-final gaze it cannot play a decisive role for successful turn-yielding. Also, they refer to Kendon's suggestion of a monitoring function of turn-final gaze and suggest that its essential use might be for the speaker to receive a signal from the listener and not the other way around (Rutter et al., 1978, p 20-21). The monitoring, response seeking function of speaker gaze was emphasised by Bavelas et al. (2002) who presented findings from experiments with spontaneous story-tellings in dyads. They discovered what

they call a 'gaze window', where at first the speaker looks up at the listener, followed by the listener looking back at the speaker which results in mutual gaze. The listener then gives verbal feedback after which the speaker looks away again (Bavelas et al., 2002, 576-577). In this way, the author claims, speaker gaze is mainly used in requesting feedback and not to signal turn-yielding. It is worth noting that the use of short feedback/back channels is not counted as producing a turn in Bavelas et al. (2002) (see 2.2.1 on the definition of turns).

More recent studies on turn-final gaze have not only investigated long turns but more often gaze at turn-endings in general. Ho et al. (2015) used eye-tracking to investigate gaze behaviour in dyadic guessing game sessions. A clear pattern emerged in their data: at turn end the speaker gazed directly on the listener's face, while the listener did not start their turn before the speaker looked at them, usually with a speaker switch pause of around 400 ms (Ho et al., 2015, p. 15). The authors interpret their findings as a clear indication for a turn-yielding function of gaze.

Torres et al. (1997) presented information structure as a new viewpoint when examining turn-final gaze. Investigating gaze in dyadic interaction between strangers, they registered speaker look toward the listener at the end of the turn in only 16 percent of the cases. Though when the beginning of a rheme co-occurred with the end of a turn, speaker look at listener occurred in 100% of the cases (Torres et al., 1997, p. 8). Rhemes are associated with new information, contributing to what is already known. In pointing out that speakers probably often are willing to yield the turn after providing a rhematic addition to the conversation, Torres et al. support the idea of turn-final gaze as a possible turn-yielding signal (Torres et al., 1997, p. 10).

Bi and Swerts (2017) found that in both English and Chinese visual information was enough for determining if one- and two-word fragments were spoken in utterance-final position or not. In all the utterance-final fragments of the spontaneously recorded stimuli speaker gaze was directed on the interlocutor - but not in any of the non-final fragments. This presence vs. absence of turn-final gaze was judged by the authors as a probable reason for the sufficiency of visual-only information to fulfil the task (Bi & Swerts, 2017, p. 75).

Several studies show support for a turn-yielding function of turn-final gaze in multi-party interaction. In conversations between more than two participants, a turn-yielding signal has the possibility not only to show that the speaker is willing to yield the turn, but also to whom. Kawahara et al. (2012) found a prominent turn-yielding and next-speaker-selecting function of presenter gaze in multi-party poster sessions. A pattern emerged where the speaker looked significantly longer at a person in the audience right before that particular person took the turn. Lerner (2003) acknowledges the importance of gaze as a means for turn-yielding next-speaker-selection in multi-party conversations, but stresses that in cases when the speaker gazes at one person but addresses someone else using another kind of next-speaker-selection signal gaze loses that role (Lerner, 2003, p 196).

Having examined gaze in three-party conversations with eye-tracking, Auer (2017) claims that gaze is essential for turn-yielding. The results showed that use of speaker turn-final gaze was an effective way both for yielding the turn and for getting short feedback while keeping the turn (Auer, 2017, p. 29). Moreover, after receiving a turn-final gaze the next speaker more often produced their turn in overlap with the previous turn. This is explained by Auer as a consequence of the listener interpreting the turn-yielding gaze signal as having instant effect and acting accordingly (Auer, 2017, p. 23-24).

Kalma (1992) found that in triadic face-to-face interaction, persons with a conversation leading function used a turn-final 'prolonged gaze' which served as a powerful turn-yielding next-speaker-selection signal. This gaze was initiated close to the turn end and hold steady at a selected listener's face during the speaker-switch pause. In 95 percent of the occurrences of such a prolonged gaze, the gazed at listener became next speaker (Kalma, 1992, p. 28-29).

2.3.3 Child use of turn-final gaze

Previous research on turn-final gaze in children is sparse. Craig and Gallagher (1982) studied dyadic and triadic interaction between four-year-old girls. In three-party conversations, preceding a turn-shift the child speaking usually looked more at another child than earlier during the turn. The child looked

at was most likely to produce the next turn. Even though in 40 percent of the turn-shifts the speaker did not use an other-directed gaze, the authors conclude that turn-final gaze does have a turn-yielding next-speaker-selection function in triadic child-interaction (Craig & Gallagher, 1982, p. 72). Yet, in two-party conversations in the same study the existence of a turn-final gaze could not be proved, in the sense that the mean amount of other-directed turn-final gaze was less than 50 percent. However, two out of six subjects in two-party conversations did use other-directed gaze in almost 70 percent of their turn-endings (Craig & Gallagher, 1982, p. 69), showing a preference for turn-final gaze.

Rutter and Durkin (1987) examined turn-final gaze in dyadic mother-child interaction at the ages 0;9-3;0. They used the term *terminal gaze* denoting a turn-final gaze with an actual turn-yielding function. In assuming that adults do use a terminal gaze, the aim of the study was to investigate when children start to use the same in an adult-like manner. Measuring the proportion of child turns in which the child started gazing at their mother at turn-ending, they aimed to register an active turn-final gaze behaviour from the child (Rutter & Durkin, 1987, p. 55-56). The results revealed a consistent significant increase of turn-final gaze use as the child turned older. Although the age-related increase was present already during the first year, the rate of turn-final gaze use increased faster from age 1;6. The conclusion was that already at the end of the second year the child uses a terminal gaze in an adult-like fashion. Large individual differences were registered, though these stayed constant over time (Rutter & Durkin, 1987, p. 59).

The studies on child turn-final gaze by Craig and Gallagher (1982) and Rutter and Durkin (1987) addressed the topic in different ways. Craig and Gallagher (1982) focused on the proportions of child-turn-endings containing an other-directed gaze. Only when this was the dominating behaviour it would be counted as proof for a prevalent turn-final gaze use, hence their conclusion that child turn-final gaze use only could be proven to be of importance in three-party but not in two-party interaction. Rutter and Durkin (1987), on the other hand, expected to find an increasing amount of turn-final gaze in toddlers showing a natural development towards an adult behaviour. By this reason, in Rutter and Durkin (1987) the low amount of turn-final gaze at the youngest ages was not interpreted as a proof for children not using it, but the sharp increase during ages 1;6-3;0 was understood as the child approaching an adult level.

2.3.4 Motivation for turn-final gaze measures in the present study

In the present study turn-final gaze use in toddlers was investigated using two different definitions. G*eneral turn-final gaze* use was measured if the child's gaze was directed at the parent's eye region at the moment when the child turn ended. This corresponds to a common way of investigating turn-final gaze in previous research as presented in 2.3.2-2.3.3 (e.g. Craig and Gallagher, 1982, in studying children, and Rutter et al., 1978; Bi and Swerts, 2017; Kawahara et al., 2012, in studying adults). This measure does not take into account when the gaze is initiated. With the measure *active turn-final gaze*, on the other hand, an attempt was made to control for the fact that children use eye gaze differently than adults. It is usually not perceived as extraordinary behaviour if a toddler looks continuously on their parent over a stretch of turns, while the same behaviour in an adult probably would be perceived as staring. The active turn-final gaze measure in the present study was only counted if the child fixed their turn-final gaze at the parent during the last utterance of the turn (or during the turn in one-utterance turns) and not if it was already present at turn beginning. This measure is comparable to Rutter and Durkin's (1987) turn-final gaze measure while investigating children, though not identical since they only counted turn-final gaze with onset at the end of the turn and not during the turn. The active turn-final gaze measure does also attempt to capture the common adult turn-final gaze behaviour described by Kendon (1967): the speaker looking up at the listener during the turn and then holding the gaze fixed until the turn ends (Kendon, 1967, p. 33). It is worth pointing out that as a consequence of using these definitions, all instances of active turn-final gaze were also instances of general turn-final gaze, but not vice versa.

2.4 Measurements of child language level

Child language level was measured in two ways in the present study: by SECDI for age 1;0-3;0 and by Unified Predicate for age 3;0.

2.4.1 SECDI

Communicative Development Inventories, CDIs, are extensive standardized vocabulary lists filled out by parents, usually used to study child language development. Monitoring by a researcher is not needed in using a CDI, which makes it a cheap and flexible method. The risk of parents over- or underestimating their children's vocabulary size always exists, but in evaluating the use of CDIs, Law and Roy (2008) concluded that the method is both satisfyingly valid and reliable. The MacArthur-Bates Communicative Development Inventory (Fenson et al., 2007) has been adapted to nearly 100 languages, making comparisons between children's language development in different languages possible. The Swedish adaptation is called SECDI. SECDI-I (Berglund & Eriksson, 2000) investigates both the receptive and productive vocabularies of children at age 0;8-1;4. SECDI-II (Berglund & Eriksson, 2000) measures productive vocabulary at age 1;4-2;4. SCDI-III (Eriksson, 2016) investigates the productive use of a selection of more difficult words and syntax and grammar use in children at age 2;6-4;0. In a validation of SCDI-III Odeskog and Stenberg (2015) found that the subsection investigating syntax use (sentence complexity) had a lower validity than the rest of the test. Therefore, despite the relevance of investigating possible correlations to more complex language use in the present study, when comparing child turn-final gaze to SCDI-III data only the results from the productive word inventory were used.

2.4.2 Unified Predicate

To get a measure of more complex language use than only productive vocabulary, the children's scores in an investigation of unified predicate (UP) clauses (Berman & Slobin, 1994; further developed by Tonér and Gerholm, submitted) were used. During the work with a study using the same 16 subjects as in the present study, Eriksson (2018) made a thorough examination of the complexity and functionality of the speech produced by the children in interaction with their parents at age 3;0. Analysing all utterances containing a predicate, points were given for correct use of words, inflection, word order and semantic functionality. Individual scores were calculated based on the percentage of well-formed sentences each child produced. These scores were used as yet a measure of productive child language level at age 3;0 in the present study. Unlike the SECDI scores, the UP scores do actually represent the children's productive language as they use it. CDI vocabulary lists, even though containing a rather large amount of words at different typical ages of acquisition, can never catch all the words that a child masters. Although the UP-score method too obviously cannot claim to represent the child's full linguistic competence, e.g. because of the limited time and context of the recorded sessions, using more than one method to measure the child's language level increases the validity of the study.

2.5 Study motivation and expected study results

Although child turn-final gaze use has been studied before in English toddlers (Rutter & Durkin, 1987), the findings of cultural differences in other-gaze preference in children already at age 1;0 (Senju et al., 2013) motivate an examination of turn-final gaze in Swedish toddlers. Besides, Rutter and Durkin (1987) did not investigate any relations to the child's language level. In the present study, in trying to correlate child use of turn-final gaze to child language level a possible link between the child's pragmatic and verbal language use was examined.

Based on previous studies in adults where turn-final gaze has been suggested to be used differently in various contexts, in the present study the children's use of turn-final gaze in turn-final questions, long turns and different interaction contexts was examined. The investigation of long turns was inspired by Kendon's (1967) work. Though in the present study due to investigating gaze and turn-taking in

toddlers long turns were simply defined as turns lasting for at least five seconds, and unlike Kendon's (1967) definition not limited to long turns consisting of continuous speech with no audible phrase boundary pauses.

Two different ways of measuring turn-final gaze was used in the present study - the variables general and active turn-final gaze as described and motivated in 2.3.4. The reason for this was to examine if the common measure used in examination of turn-final gaze in adults, i.e. the general turn-final gaze, is narrow enough to capture turn-final gaze behaviour in children or if a narrower definition, i.e. the active turn-final gaze measure, is needed.

Swedish toddlers were expected to use turn-final gaze in interaction with their parents. This was based on Rutter and Durkin's (1987) work which like the present study investigated dyadic parent-child interaction during the child's second and third year. The amount of child use of turn-final gaze at parent was supposed to increase as the children grew older, this too based on the results of Rutter and Durkin (1987).

A positive correlation between child turn-final gaze and child language level as measured by SECDI and/or UP was expected. Since seemingly no examination of child turn-final gaze in relation to child language level has been done before, this expectation was based on Rutter and Durkin's (1987) conclusion that turn-final gaze in toddlers has the same turn-yielding function as in adults and that the use is growing over age. Thereby a more adult-like turn-taking gaze behaviour would be expected to be correlated to a higher linguistic level in the child.

A higher proportional use of child turn-final gaze in turn-final questions than in all child turn-endings was expected based on Rossano (2012). Moreover, active turn-final gaze was expected to constitute a minority of the general turn-final gaze use in turn-final questions, based on Rossano et al. (2009) and Kendon (1967).

Since the definition of long turns in the present study was quite different from the long turns in Kendon (1967), no expectations were stated regarding the use of turn-final gaze in long turns in the present study.

Child turn-final gaze was expected to occur in both conversational and object-oriented interaction, despite research showing that the amount of other-gaze is decreased in object-centred interaction. The hypothesis was based on the findings in Rossano et al. (2009) that the presence of objects does not decrease the speaker's use of other-directed gaze when asking questions and on the assumption that the children in the present study produced turn-final questions.

3 Aims and research questions

3.1 Aims

The aim of the present study was to examine child gaze behaviour in turn-taking between Swedish toddlers and their parents at the ages 1;0-3;0. The intention was to investigate if turn-final gaze was used by the children and if it could be related to the child's age or language level. Furthermore, child use of turn-final gaze in turn-final questions and in turns longer than five seconds was examined, and interaction context in which turn-final gaze appeared was explored.

3.2 Research questions

Question 1:

Do Swedish toddlers use turn-final gaze in interaction with their parents?

> Hypothesis 1:
>
> Swedish toddlers use turn-final gaze in interaction with their parents.

Question 2:

Can child use of turn-final gaze at parent be related to child age?

> Hypothesis 2:
>
> Child use of turn-final gaze at parent is positively correlated to child age.

Question 3:

Can child use of turn-final gaze at parent be related to child language level?

> Hypothesis 3:
>
> Child turn-final gaze use is positively correlated to child language level.

Question 4:

Does the child use turn-final gaze at parent differently in turn-final questions and long turns than in all turn-endings?

> Hypothesis 4a:
>
> The proportional use of child turn-final gaze is higher in turn-final questions than in all child turn-endings.
>
> Hypothesis 4b:
>
> Active turn-final gaze use constitutes a minority of the general turn-final gaze use in turn-final questions.

Question 5:

In what interaction contexts does child turn-final gaze occur?

> Hypothesis 5:
>
> Child turn-final gaze occurs both during object-oriented and conversational interaction.

4 Method and data

4.1 The MINT project

The data in the present study is a part of the five-year long MINT project[1] at the Department of Linguistics at Stockholm University (Gerholm & Gustavsson, submitted). The project aims to investigate the multimodal aspects of child-parent interaction and intends to use the findings for modelling first language acquisition. For this purpose, a comprehensive multimodal corpus is being compiled. The corpus consists of video recordings of 72 child-parent dyads, filmed in a recording studio every third month from the age of 0;3 to the age of 3;0. The recordings are being transcribed and coded with information on verbal, gestural and contextual information. This work is being done by trained research assistants in the annotation tool ELAN (Sloetjes & Wittenburg, 2008)[2], using annotation conventions specifically developed for the project. Additionally, from 0;9 and onwards parental reports concerning their children's language level (SECDI) were collected at all age points.

4.2 Subjects

The participants of the MINT project were recruited by an invitation letter sent out to parents of 2000 randomly chosen new-born babies in the Stockholm region in August and September 2016. Out of the 85 children accepted for joining the study, 72 were still participating at the age of 3;0. For all participating families background data was collected, including information on languages spoken by parents and grandparents, the language/languages spoken to the child at home, family income level and the parents' education level.

For the present study video recordings of 16 monolingual Swedish speaking children (8 girls) and their respective mothers or fathers were used. For every child five recordings were used, recorded at the ages of 1;0, 1;6, 2;0, 2;6 and 3;0, making a total of 80 files. SECDI data was available for all the 16 children in the present study at all ages investigated.

4.3 Ethical aspects

The MINT project was approved by the Swedish Ethical Review Board[3]. The participants were informed that the data collected in the project always would be presented de-identified, and that no sensitive information would be accessible to anyone not working in the project. Additionally, they were informed that they had the possibility to withdraw their participation at any time without any further explanation, though data already collected at that point would not be destroyed. The families were not payed for participation but received copies of the recorded videos after each session.

4.4 Recording sessions

The video recordings were made at Stockholm Baby Lab in a studio adapted for the purpose. The room was equipped with cameras and microphones[4] in order to capture as much of the verbal and non-verbal communication as possible. Three cameras were attached to the walls of the room, and one mobile GoPro-camera was attached to the parent's chest to get a good view of the child's face. Both parent and child were wearing lavalier microphones attached to their clothes, and one microphone was situated in the ceiling in the centre of the room. Some age-appropriate toys were available in the room, and the parent was instructed to play and talk with the child as they usually do at home. For the present study, only the parts of the sessions with no researcher present in the room were used (usually around 10 minutes).

4.5 Annotating the data

4.5.1 Definition and extraction of child turn-endings and turn-final gaze

The annotations on child and parent vocals, child gaze at parent and interaction context for each of the 80 files were extracted in text form and investigated thoroughly. In two cases where the child was crying/sobbing throughout the beginning of the recording, that part of the recording was excluded[5] and the analysis began where the child started talking. In the MINT-project's annotation conventions, gaze annotations begin at the moment a person's eyes start moving from one object/person to another. In the present study, child gaze was measured from the moment where the child fixed their eyes on the parent's eye region. Therefore, all video files were investigated manually, and the extracted text files were corrected as to be in accordance to the definitions of the present study. In this process the view captured by the parent's GoPro-camera was of great use, as well as the possibility to check the recordings frame-by-frame.

As in Schaffer et al. (1977, p. 296), all verbal and non-verbal utterances of parent and child were used, including laughter and shorter instances of fussing and crying. Prolonged breathing sounds and involuntary noises as coughing and sneezing were excluded, as well as singing. Sound effects made by children and parents were included if they were uttered without associated gesturing (for example a child saying '*moo*' as an answer to the mother asking '*what does the cow say?*') but excluded when uttered accompanied by movements (for example a child saying *moo* while making a toy cow "walk" on the floor). The reason for excluding the latter was that those cases could not be assumed to be directed to the parent. For the same reason, the few instances of children talking directly to toy animals etc. were excluded.

In all files every instance of turn change from child to parent was marked as "end of child turn" (EoCT), regardless of whether the child's turn was followed by an overlapping parent turn or a between-speaker pause before the parent turn. Several conditions were set for a turn change from child to parent to be included in the set of EoCTs. If the paus in between turns were longer than five seconds, or longer than two seconds and the parent clearly did not follow up on the child's turn, e.g. introduced a whole new topic of conversation without a verbal transition, the turn change was not counted. The five second time limit was based on Tamis-LeMonda et al. (2015) in which five seconds was set as a maximum response latency length in order for a parent response to be counted as contiguous (Tamis-LeMonda et al., 2015, p. 752). The two second time limit was set based on 'standard' parent response latencies in previous research on toddler-parent turn-taking (Marklund et al., 2015, p. 1164; Schaffer et al., 1977, p. 305). The few instances where child and parent turns were

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[4] *Three Canon HDMI cameras, model XA10; one GoPro Hero3 action camera. Two lavaliers: Sennheiser model eW 100 G2, and one AKG SE 300 B microphone.*

[5] *Two children, one at age 1;6 where 1 min. 53 s. was excluded, the other at age 2;6, where 5 min. 10 s. was excluded.*

fully overlapping were excluded. If the last utterance in a multi-utterance child turn was excluded, the whole turn was excluded from analysis and no EoCT was registered.

All EoCTs were examined concerning child gaze. The definition of general turn-final gaze (FG) was that the child's gaze was set on the parent's eye region at the end of the child's own turn, i.e. at the end of the child's speech signal as perceived by listening and looking at the soundwaves in the annotation program (for a similar definition of other-directed gaze see for instance Kalma, 1992 and Levine and Sutton-Smith, 1973). Additionally, if the moment when the child fixed the turn-final gaze on the parent occurred during the last utterance of the child's turn, an active turn-final gaze (AFG) was counted. (See 2.3.4 for an elaboration on why two different measures of turn-final gaze were used in the present study.) Utterances in the present study were defined as in the annotation key for the MINT-project, where utterances need to be held quite short by methodological reasons (preferably not exceeding five seconds). In the annotation key utterance boundaries are set based on the occurrence of pauses but also using semantic and syntactic cues. Thus, a child utterance in the material consisted of a stretch of child vocalizations separated from other utterances by a hearable pause. In addition, intelligible child utterances were primarily defined by their semantic meaning and could therefore contain hearable intra-sentential pauses. Consequently, child utterances in the present study were mostly quite short, and when intelligible often including only one clause or sentence.

4.6 Data analysis

4.6.1 Examining turn-final gaze in relation to child age and child language level

To answer research question 1 the mean number of general turn-final gaze (FG) per child turn-ending and of active turn-final gaze (AFG) per child turn-ending was calculated in each file.

In answering research question 2 child use of general and active turn-final gaze at ages 1;0-3;0 was investigated for a correlation to child age over all ages using linear regression analysis. Two one-way ANOVAs were conducted to investigate if the use of general turn-final gaze or active turn-final gaze differed between any ages.

The attempt to examine if the variables general and active turn-final gaze captures different gaze behaviours in the children was handled in several ways. To examine if the percentage of general turn-final gaze instances consisting of active turn-final gaze changed over time, mean proportions of active turn-final gaze per general turn-final gaze at each age level were calculated. The outcome at ages 1;0-3;0 was investigated for a possible correlation to child age using linear regression analysis.

The possible difference in use between general turn-final gaze and active turn-final gaze was analysed by conducting a repeated measures ANOVA. Since the chosen variable design caused all instances of active turn-final gaze to be a part of a general turn-final gaze, an investigation was made with the variables converted into two independent variables. A new variable (FG-minus-AFG) was created for this purpose by subtracting the amount of active turn-final gaze from the amount of general turn-final gaze in all sessions. The variables AFG and FG-minus-AFG were investigated for interaction over ages 1;0-3;0 by a repeated measures ANOVA.

Research question 3 intended to examine possible correlations between child language level and use of turn-final gaze at each age separately. Correlations to SECDI- and UP-scores were investigated both at individual level using linear regression analysis and on high/low score group level using independent samples t-tests. At age 1;0, child use of FG and AFG was investigated in relation to the child's active and passive vocabulary size as measured by SECDI-I, part I. At age 1;6-2;6, possible correlations between the use of FG/AFG and productive vocabulary score as measured by SECDI-II, part A and B, was examined. At age 3;0 the child's use of FG and AFG was investigated for relations to the child's productive vocabulary score as measured by SCDI-III, section 12-15. Additionally, at the age of 3;0, the use of FG and AFG was investigated for possible correlations to child UP score.

In dividing the children into high and low SECDI- and UP-score groups, the low score-groups at each age consisted of the eight children with the lowest score at that specific age, and the high score-groups of the eight children with the highest score. At age 3;0 the highest SECDI score in the low-score group and the lowest in the high score-group happened to be the same. The two children were therefore assigned groups based on their UP score at 3;0. The distribution of individual SECDI and UP scores in the high/low score groups are presented in figure 12-17 in appendix B.

4.5.2 Coding of turn-final questions, long turns and interaction context

A turn-final question was counted when the child's turn consisted of only one utterance that was a question, or of several utterances where the last one was a question. The assessment of an utterance being a question or not was based on semantics i.e. the perceived meaning of an utterance and not on the syntactic form. For this purpose, only fully intelligible possible turn-final questions were investigated, although they did not need to be grammatically correct.

Of all child turns containing an EoCT, those lasting at least 5 seconds were counted as long turns. Turn length was measured from the beginning of the first utterance to the end of the last utterance of the turn, including pauses between utterances. Speaker switch pauses were not included in turn length. Time precision of the annotated vocalisations were not high grained i.e. not at millisecond level, and hence the categorization of long turns in the present study could be considered somewhat arbitrary.

In a majority of the files information on interaction context was lacking[6]. Therefor as a part of the work with the present study this was annotated and added to the examined files, but only at EoCTs. In preparation for analysis the context categories occurring in the files were divided into two groups: Conversation ("CONVERSING_child" and "PLAY_peekaboo") and Object-oriented interaction ("PLAY_mo/na/li", "PLAY_book", "PLAY_object" and "PLAY_non-toy"). "PLAY_singing" was excluded. (The interaction context categories are developed further in the transcription and annotation key, appendix C).

4.6.2 Investigating turn-final gaze in turn-final questions and long turns

In answering research question 4, the proportions of general and active turn-final gaze in turn-final questions and long turns were calculated in all files.

While investigating the use of turn-final gaze in turn-final questions, data from ages 2;0-3;0 was used. These were the only ages where turn-final gaze was used in combination with turn-final questions. At each age respectively, only data from children producing turn-final questions at that particular age was included. To examine if child use of turn-final gaze was higher in turn-final questions than in all turn-endings, the use of general and active turn-final gaze in turn-final questions was compared to the use of general and active turn-final gaze at child turn-endings respectively using t-tests at each age. Moreover, a possible correlation between child use of overall turn-final gaze and use of turn-final gaze in turn-final questions was investigated using linear regression analysis.

Child use of turn-final gaze in long turns was investigated in a similar manner as with turn-final questions. Since long turns occurred at all ages, data from age 1;0-3;0 was used in the analysis, though at each age only data from children using long turns at that specific age was included. In examining if the proportional use of turn-final gaze was higher in long turns than in all child turns, the use of general and active turn-final gaze in long turns was compared to the use of general and active turn-final gaze in all child turns respectively using t-tests at each age. Additionally, possible relations between child use of turn-final gaze in all turns and in long turns were examined by linear regression analysis.

4.6.3 Exploring interaction context at turn-final gaze

Research question 5 was explored by calculating the proportions of general and active turn-final gaze occurring during each interaction context category. Because information on interaction context was

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[6] *This was due to the MINT-project's multimodal corpus not yet being fully annotated.*

only available at EoCTs in a majority of the files, proportions of overall interaction context in the recordings and corresponding values for interaction context during turn-final gaze could not be calculated.

5 Results

5.1 Child use of turn-final gaze related to child age and language level

5.1.1 Overall occurrences of turn-final gaze in the data

All children's individual use of turn-final gaze is presented in table 6, appendix A. As described in table 1, a total number of 6371 child turn-endings were analysed in the material. 992 cases of general turn-final gaze were discovered, out of which 601 were active turn-final gaze. While large individual differences were noticed, one child deviated from the others in only using two instances of turn-final gaze across all ages despite producing a high amount of turn-endings (subject CH12 in table 6, appendix A).

Table 1. Amounts of child turn-endings (EoCT), general turn-final gaze (FG) and active turn-final gaze (AFG) calculated across all ages in total.

	EoCT	FG	AFG
Total amounts	6371	992	601
Mean amounts per child	398	62	38

The children's total individual use across all ages of general and active turn-final gaze calculated as proportions of child turn-endings is displayed in figure 1. Note that the active turn-final gaze (striped parts of bars) is presented as a part of the general turn-final gaze. As visible in figure 1 and in table 6, appendix A, no child produced exclusively general or active turn-final gaze.
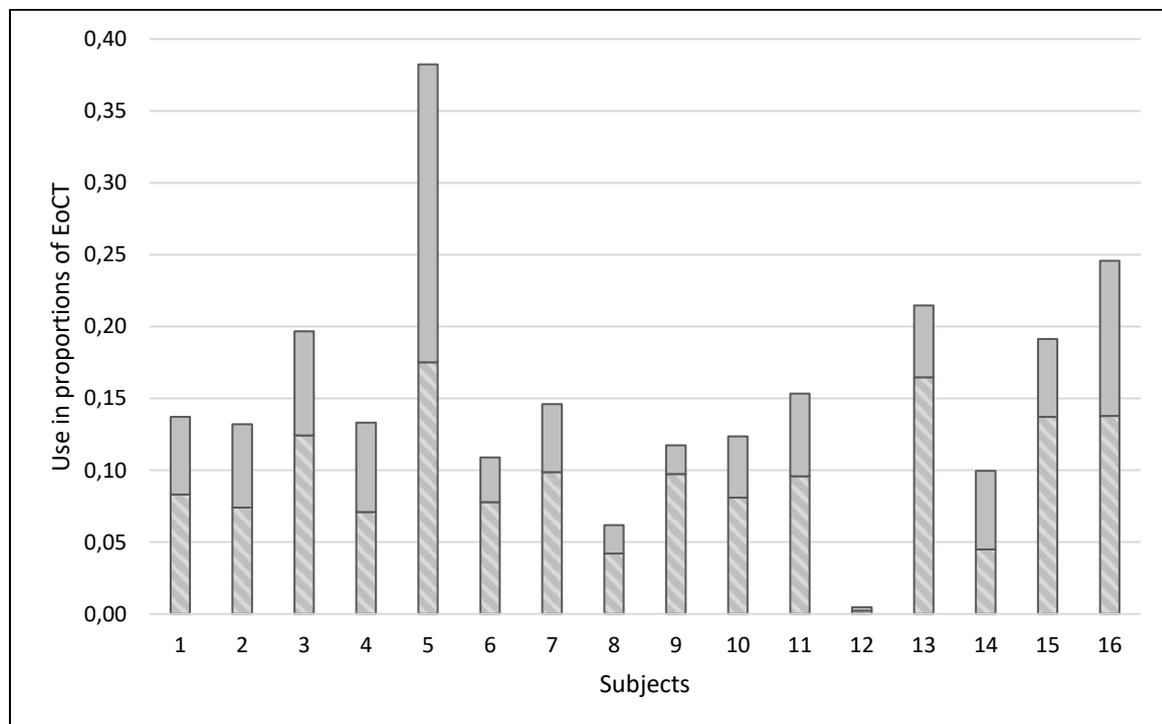
Figure 1. Mean individual proportions across all ages of turn-final gaze calculated as a percentage of all child turn-endings (EoCT). Bars are representing general turn-final gaze (FG), striped parts of bars represent active turn-final gaze (AFG).

5.1.2 Turn-final gaze use at different age points

The mean proportions of general turn-final gaze and active turn-final gaze at all ages are visualised in figure 2.
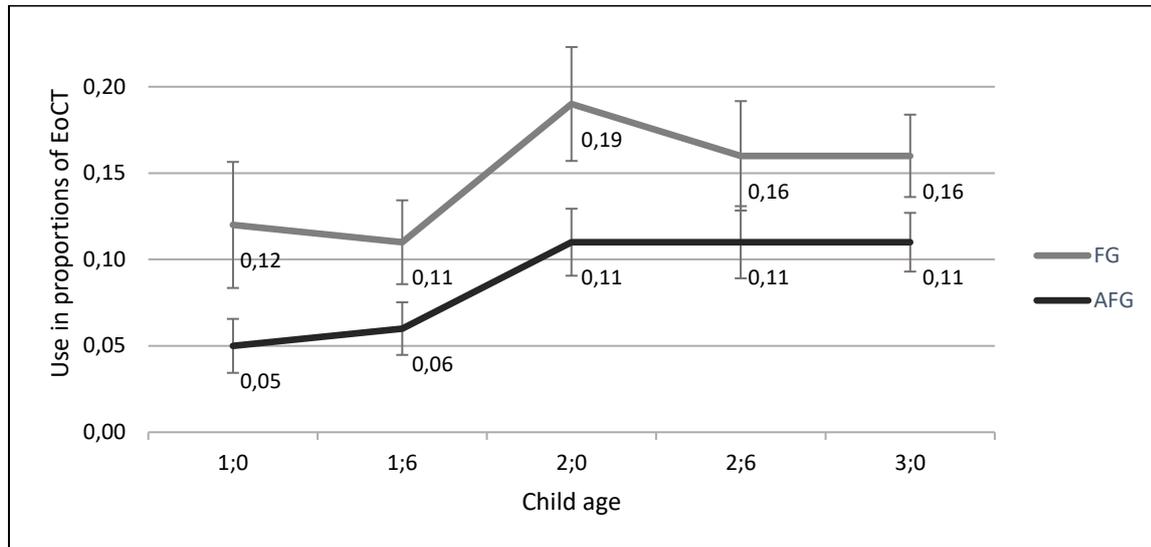
Figure 2. Mean proportions of general turn-final gaze (FG) and active turn-final gaze (AFG) at all ages calculated as a percentage of all child turn-endings (EoCT). Error bars represent +/- 1 standard error of the mean.

No significant correlation between child age and general turn-final gaze was found while investigated by linear regression. A one-way ANOVA investigating if the use of general turn-final gaze differed between any age points showed no significant differences.

A linear regression analysis showed a significant positive relationship between the mean use of active turn-final gaze and child age over all ages ($r = 0.317$, $t(79) = 2.948$, $p < .01$). A one-way ANOVA showed that active turn-final gaze use differed significantly over age ($F(4,75) = 3.104$, $p = .020$). A post hoc LSD test showed that active turn-final gaze use at age 1;0 differed from the use at age 2;0 ($p = .011$), 2;6 ($p = .016$) and 3;0 ($p = .026$), and that the use at age 1;6 differed from the use at age 2;0 ($p = .030$) and age 2;6 ($p = .041$). Significant differences in use of active turn-final gaze between ages are represented by horizontal bars in figure 3.
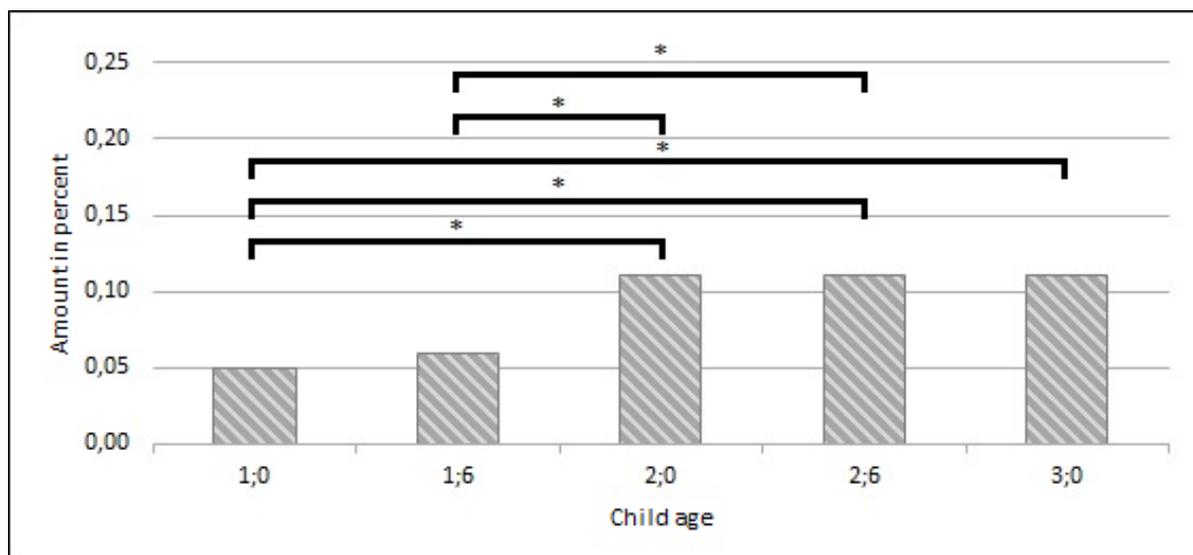
Figure 3. Mean proportions of active turn-final gaze (AFG) at all ages calculated as a percentage of all child turn-endings (EoCT). Horizontal bars represent significant differences (p < .05) between ages.

Using linear regression analysis, the proportions of active turn-final gaze per general turn-final gaze showed a significant positive correlation with child age ($r = 0.401$, $t(79) = 3.865$, $p < .001$). This is depicted in figure 4.
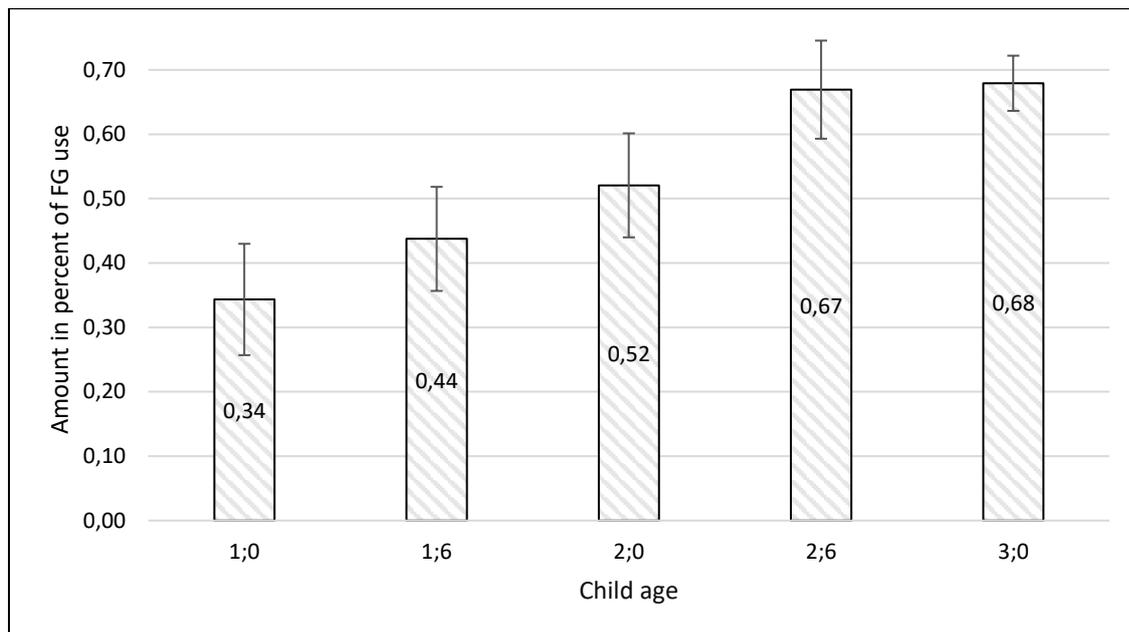
Figure 4. Mean proportions (%) of active turn-final gaze (AFG) per general turn-final gaze (FG) at all ages. Error bars represent +/- 1 standard error of the mean.

A repeated measures ANOVA investigating the use of general and active turn-final gaze at all ages found significant differences in gaze behaviour both between ages ($F(1,15) = 26.770$, p = .000) and between gaze types ($F(1,15) = 16.612$, p = .001).

Another repeated measures ANOVA investigating the variables AFG and FG-minus-AFG at all ages found a significant interaction between age and gaze type variables ($F(4, 60) = 5.047$, $p = .001$). In figure 5 the mean proportions of these two variables over time are presented.
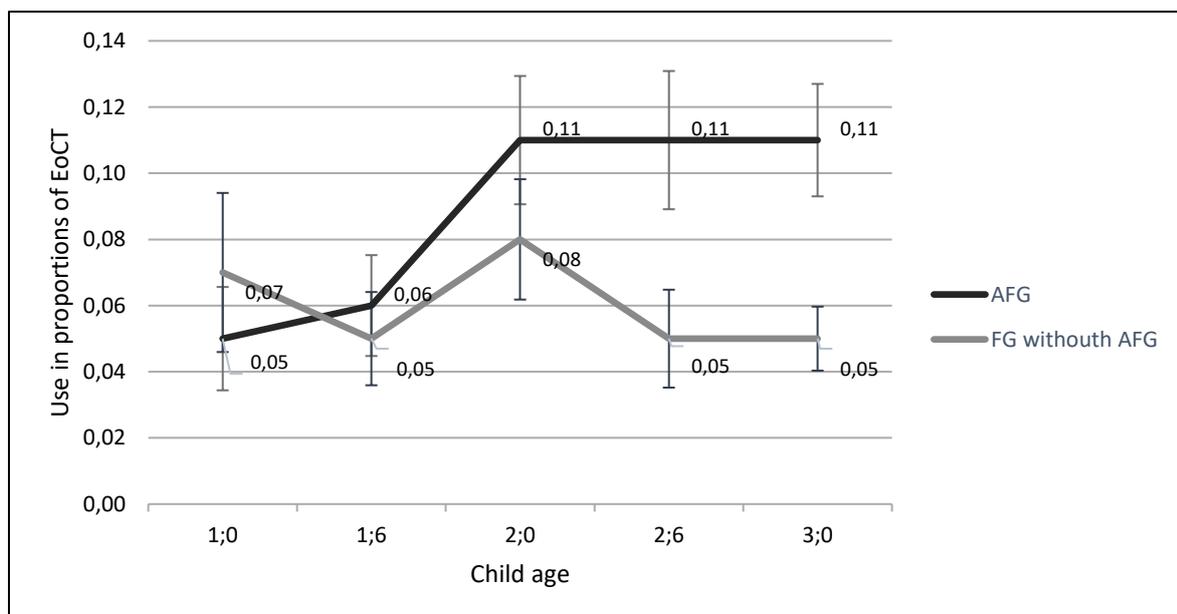
Figure 5. Mean proportions of active turn-final gaze (AFG) and instances of general turn-final gaze that were not *active (FG-minus-AFG) at all ages calculated as a percentage of all child turn-endings (EoCT). Error bars represent +/- 1 standard error of the mean.*

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5.1.3 Turn-final gaze use related to child language level

No significant correlations between SECDI score and child use of neither general nor active turn-final gaze could be found neither at individual score level nor at high/low score group level at any ages. Likewise, no relations between UP score and child use of general turn-final gaze or active turn-final gaze could be found at age 3;0 neither at individual score level nor at high/low score group level.

All children's individual use of general and active turn-final gaze and standardized SECDI scores at all age points are presented in figure 6, aiming to illustrate the clear individual differences found in the material.
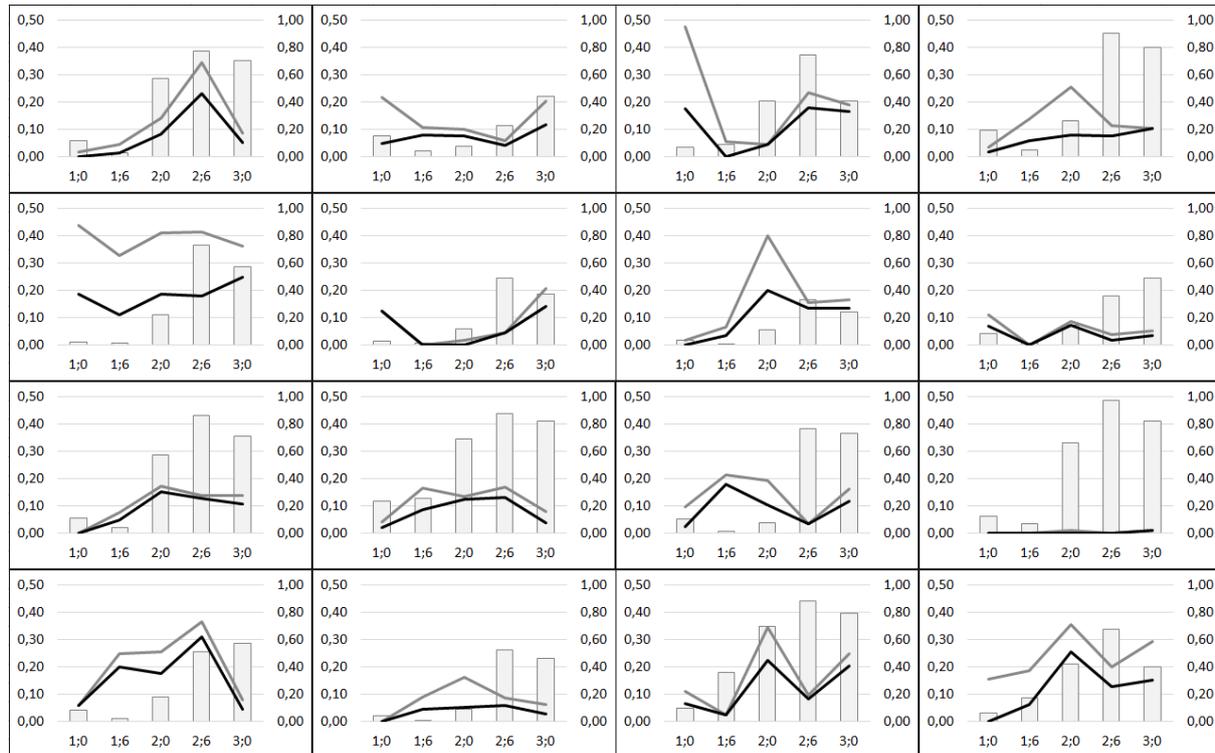
Figure 6. Individual general (grey line) and active (black line) turn-final gaze use, calculated as proportions (%) of child turn-endings at ages 1;0-3;0 (left y-axis). Individual standardized SECDI scores (bars) at ages 1;0-3;0 calculated as proportions (%) of maximum SECDI score at each age (right y-axis).

5.2 Child use of turn-final gaze in turn-final questions and long turns

5.2.1 Turn-final questions

The children used turn-final questions at ages 1;6-3;0. General and active turn-final gaze was used in turn-final questions at the ages 2;0-3;0. Out of 42 instances of turn-final gaze in turn-final questions, 39 instances (93%) were of active turn-final gaze. The remaining three instances were produced by one child at age 2;6 and two other children at age 3;0.

The distribution of turn-final questions and general and active turn-final gaze in turn-final questions at group level is presented in table 2 on next page.

Table 2. Amounts of turn-final questions, general turn-final gaze at turn-final questions (QFG) and active turn-final gaze at turn-final questions (QAFG) at all ages. Proportions on group level of QFG and QAFG calculated as a percentage of all turn-final questions at all ages.

	1;0	*1;6*	*2;0*	*2;6*	*3;0*
Number of turn-final questions	0	2	27	59	78
Number of QFG	0	0	9	17	16
Number of QAFG	0	0	9	16	14
Proportions of QFG	0,00	0,00	0,33	0,29	0,21
Proportions of QAFG	0,00	0,00	0,33	0,27	0,18

Mean proportions of turn-final gaze use in turn-final questions at ages 2;0-3;0 are illustrated in figure 7, as well as error bars showing individual differences at all three age points.
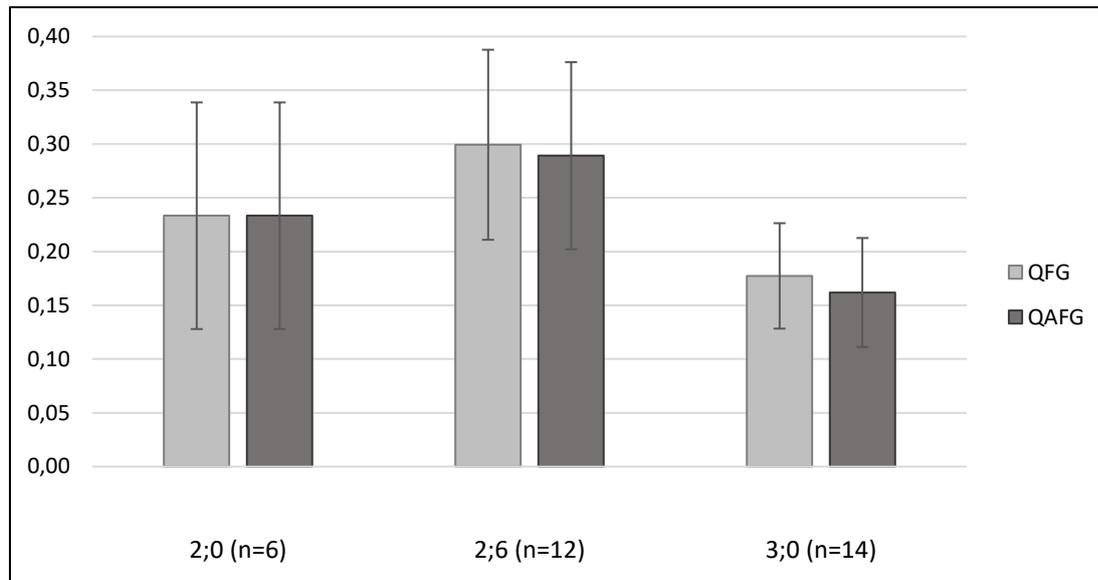
Figure 7. Mean proportions (%) of general turn-final gaze in turn-final questions (QFG) and active turn-final gaze in turn-final questions (AFG) at ages 2;0-3;0. Error bars represent +/- 1 standard error of the mean.

In table 3 the mean proportions of general and active turn-final gaze per turn-final question are compared to the overall mean proportions of general and active turn-final gaze at all child turn-endings. Note that only the children using turn-final questions at each age respectively are included.

Table 3. Mean proportions (%) of general and active turn-final gaze use (FG/AFG) in turn-final questions compared to the same children's overall mean proportional use (%) of general and active turn-final gaze (FG/AFG) per child turn-ending.

	2;0 (n=6)	*2;6 (n=12)*	*3;0 (n=14)*
FG per turn-final question	0,23	0,27	0,18
FG per child turn-ending	0,20	0,19	0,17
AFG per turn-final question	0,23	0,27	0,16
AFG per child turn-ending	0,13	0,13	0,12

The use of turn-final gaze in turn-final questions and the overall use of turn-final gaze at all child turn-endings were compared with t-tests. No significant difference could be found neither concerning general turn-final gaze use nor active turn-final gaze use at any ages.

No significant correlations were found between use of general turn-final gaze in turn-final questions and use of general turn-final gaze at all child turn-endings at any ages. A linear regression analysis showed a marginal positive correlation between the proportional use of active turn-final gaze in turn-final questions and overall use of active turn-final gaze at child turn-endings at age 2;0 ($r = 0.805$, $t(5) = 2.716$, $p = .053$).

Individual proportions of active turn-final gaze use in turn-final questions and overall active turn-final gaze use at child turn-endings at ages 2;0-3;0 are illustrated in figure 8.
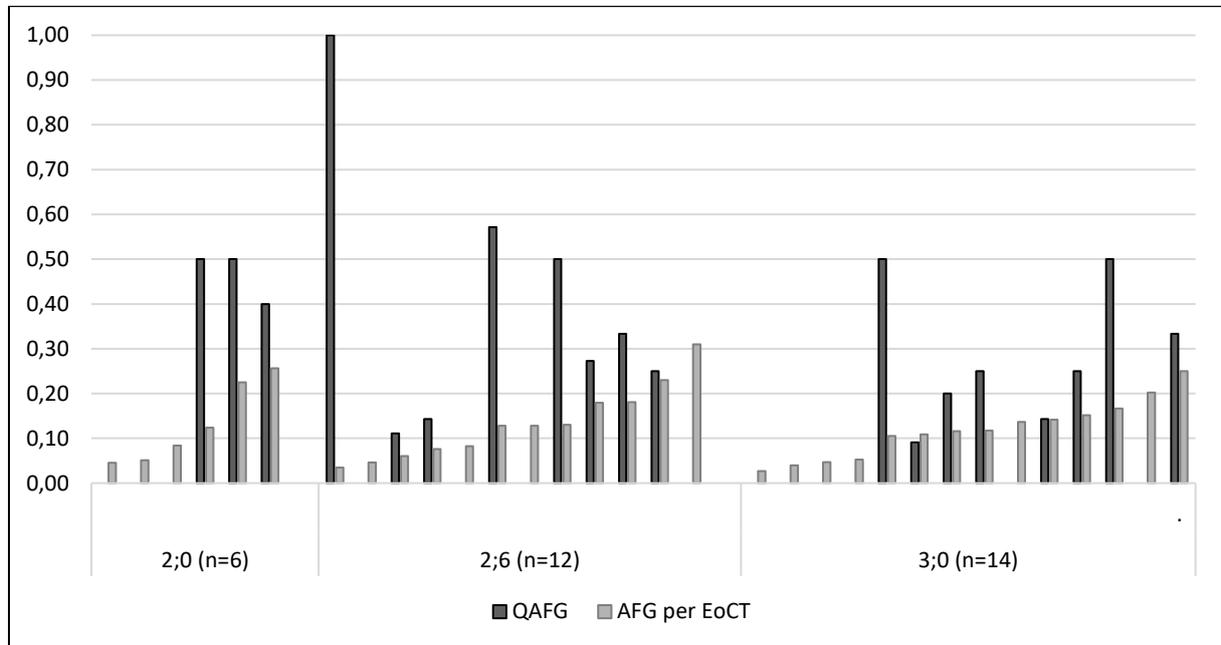
Figure 8. Distribution of individual proportions of active turn-final gaze use in turn-final questions (QAFG) and of overall active turn-final gaze in child turn-endings (AFG per EoCT) at ages 2;0-3;0.

5.2.2 Long turns

The children produced long turns at all ages, and both general and active turn-final gaze use occurred in long turns at all ages. The distribution of long turns and general and active turn-final gaze in long turns at group level are displayed in table 4.

Table 4. Amounts of long turns, general turn-final gaze in long turns (LFG) and active turn-final gaze in long turns (LAFG) at all ages. Proportions of LFG and LAFG at group level calculated as a percentage of all long turns at all ages.

	1;0	*1;6*	*2;0*	*2;6*	*3;0*
Number of long turns	32	24	39	73	107
Number of LFG	4	2	8	8	19
Number of LAFG	1	1	6	7	17
Proportions of LFG	0,13	0,08	0,21	0,11	0,18
Proportions of LAFG	0,03	0,04	0,15	0,10	0,16

Large individual differences were shown at all ages levels. Mean proportions of turn-final gaze in long turns are depicted in figure 9 on the next page, as well as error bars illustrating standard error of the mean.
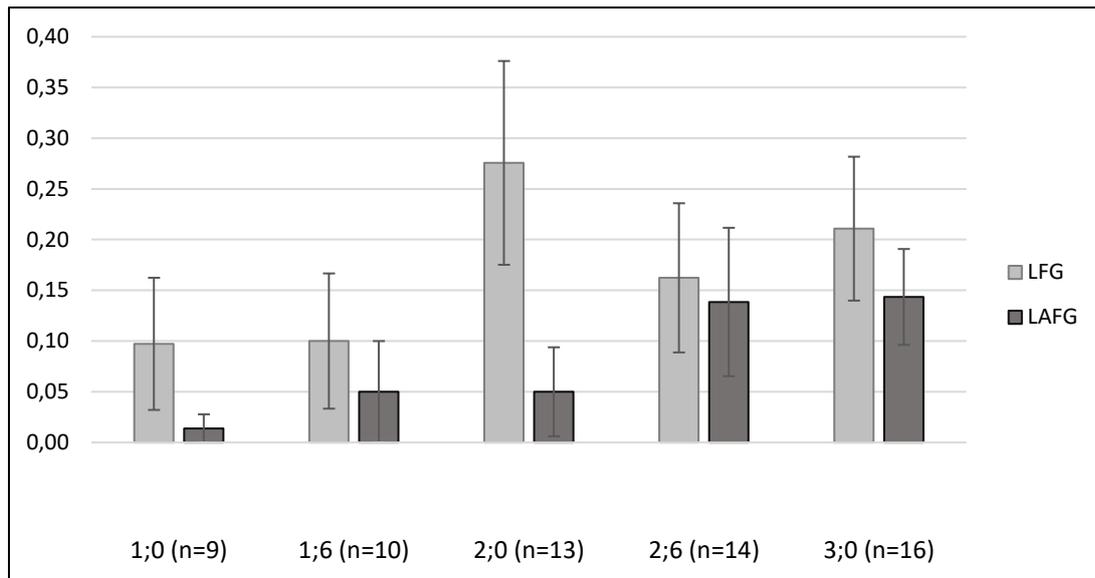
Figure 9. Mean proportions (%) of general turn-final gaze in long turns (LFG) and active turn-final gaze in long turns (LAFG) at all ages. Error bars represent +/- 1 standard error of the mean.

Table 5 depicts the mean proportions of general and active turn-final gaze per long turn compared to the overall mean proportions of general and active turn-final gaze per child turn-ending. Note again that only children producing long turns at each age respectively are included.

Table 5. Mean use of general and active turn-final gaze in long turns (LFG/LAFG) calculated as a percentage of long turns compared to the same children's overall mean use of general and active turn-final gaze (FG/AFG) per child turn-ending.

	1;0 (n=9)	*1;6 (n=10)*	*2;0 (n=13)*	*2;6 (n=14)*	*3;0 (n=16)*
FG per long turn	0,10	0,10	0,28	0,18	0,21
FG per child turn-ending	0,16	0,17	0,21	0,15	0,15
AFG per long turn	0,01	0,05	0,22	0,15	0,14
AFG per child turn-ending	0,06	0,09	0,13	0,10	0,11

Turn-final gaze use in long turns and overall use of turn-final gaze at child turn-endings were compared using t-tests at each age point. No significant differences concerning general turn-final gaze use were found. At age 1;0 the use of active turn-final gaze in long turns was significantly lower than the overall use of active turn-final gaze at child turn-endings ($t(8) = -2.796$, $p < .05$).

Significant positive relations between general turn-final gaze use in long turns and overall general turn-final gaze use in child turn-endings were shown by linear regression analyses at age 1;6 ($r = 0.659$, $t(9) = 2.481$, $p < .05$) and 3;0 ($r = 0.616$, $t(15) = 2.929$, $p < .05$).

5.3 Interaction context during turn-final gaze

In figure 10 on the next page, group level proportions of interaction context during general turn-final gaze use are presented for each age point. Group level proportions of interaction context during active turn-final gaze use are presented for each age point in figure 11 on the next page.
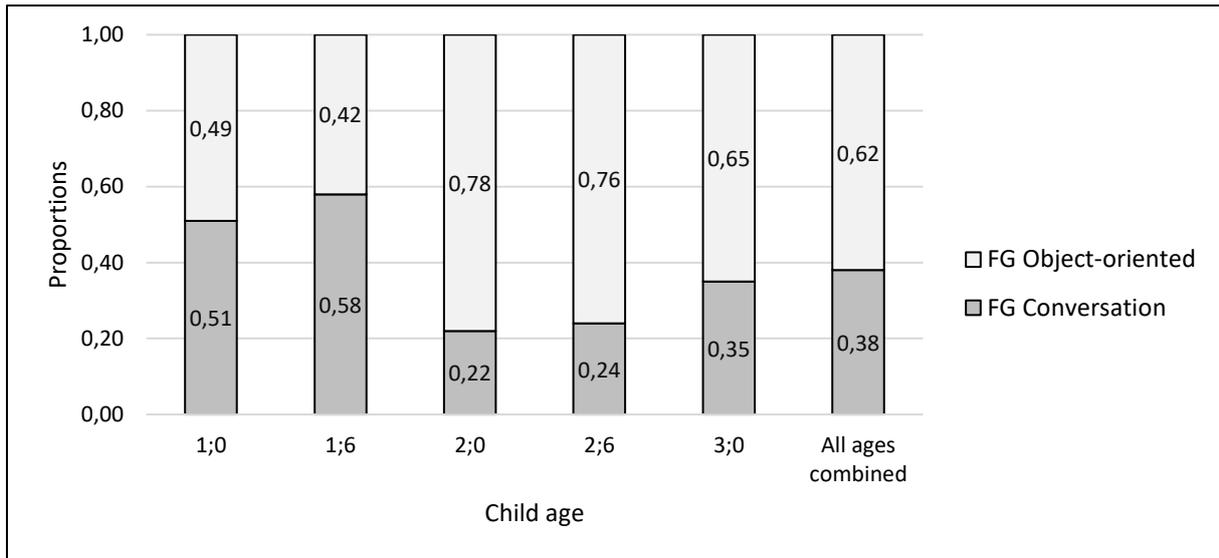
Figure 10. Group level proportions (%) of interaction context during general turn-final gaze at each age point separately and combined.
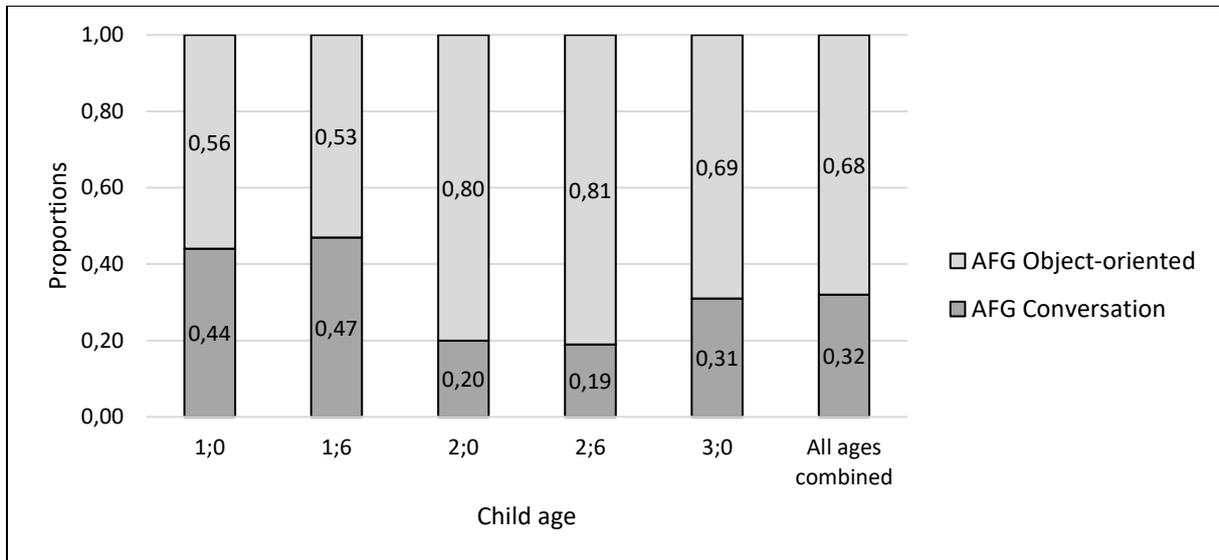
Figure 11. Group level proportions (%) of interaction context during active turn-final gaze at each age point separately and combined.

6 Discussion

6.1 Method discussion

6.1.1 Validity of the study

Despite the existence of a detailed annotation key, there is a risk that the annotators make different assessments of the data. In the data coding phase of the present study all the interaction recordings were carefully checked manually by the same person (the author of the present study). This strengthens the validity of the study as in minimizing probable annotation differences.

The data in the present study was annotated following the annotation key and conventions for the MINT project, which do not include annotating on a fine-grained level. Because of this, gaze and vocal measures in the present study could not be calculated on millisecond level. Despite the possibility to check all recordings frame-by-frame and to inspect the soundwaves in ELAN, the data still can be regarded as somewhat arbitrary compared to a possible data set annotated in a more meticulous fashion.

One aspect affecting validity concerns terminology – previous research on turn-final gaze show substantial differences in the use of definitions of both turns and other-gaze. As mentioned in 2.2.1, whether back channelling and other short feedback are counted as turns varies. Furthermore, some variations on the measurement of turn-final other-gaze include measuring from the onset movement of a speaker gaze ending up at the other's face, when speaker gaze enters the face region of the listener, or when the speaker fixes their gaze at the eye region of the listener. The different ways in which turn-final gaze can be measured (discussed in 2.3.2-2.3.4), e.g. occurrence of speaker gaze at turn end, in a specific timeframe surrounding turn end or requirement of the gaze to start close to turn end etc, complicates comparisons between the present study and previous research.

To examine small children's communicative behaviour always brings the difficulty with assessing intent – did the child really mean to communicate anything with the grunting sound they just produced? As mentioned before, the difficulty in judging what the child is or is not trying to say is one reason for counting all child vocalizings as potential turns and not exclude feedback and back channelling. This is particularly relevant in studying children as young as one year of age, and is the method used in previous studies of small children (e.g. Schaffer et al., 1977; Rutter & Durkin, 1987). If the age range in the present study would have been higher it would have been possible to make other decisions, for instance to only count word-like utterances. Additionally, in the present study crying and sobbing are treated as potential turns as well. In the smallest children once again, it is really hard sometimes to make a distinction between just sobbing and trying to say something with one's sobbing. In two instances segments of recordings containing only sobbing/crying were indeed excluded from the material, but this was not the case when the child was alternating crying and talking. In a study with slightly older children it would probably be easier to determine if a crying sound actually was intended to have a verbal meaning.

In the present study as in many others before (e.g. Rutter & Durkin, 1987; Craig & Gallagher, 1982), turn-final gaze was only investigated in cases of successful turn speaker changes. There might be occasions in which the child intends to yield the turn, but the parent does not take it. Due to the design of the present investigation, possible instances of turn-yielding turn-final gaze at these occasions are not being detected.

The presence of age-appropriate toys in the recording studio might also affect the study's validity. The purpose of the toys is to encourage interactive play between parent and child, but in investigating the topic of other-gaze they can function as a distraction as well. As the aim of the present study was to study the amount of turn-final gaze used by the children, present objects can reduce the amount of other-gaze (Argyle & Graham, 1976; Levine & Sutton-Smith, 1973) giving misleading results. In this

particular study this is extra relevant, since in the Rutter and Durkin (1987) study used as a basis for some of the present study's hypotheses almost no objects were present during interaction recording.

Finally, as mentioned before the use of parental reports of children's language level such as SECDI is a somewhat weak method in the way that parents can be more or less restrictive in their assessment of their child's vocabulary, or might not know their child's linguistic competence very well. Since the parents fill out the questionnaires at home, it is difficult to control for this risk. One way to strengthen the validity is to use more methods for evaluating child language level, which was done at age 3;0 using Unified Predicate scores.

6.1.2 Reliability of the study

As in Rutter and Durkin (1987), individual differences in child use of turn-final gaze were detected in the present study. A larger number of subjects might have helped in stabilising the data.

The use of parental reports as SECDI might also affect the reliability of a study. The vocabulary report can be filled out by the child's different parents at different occasions, or the parent filling it out might be stressed and unfocused and therefore not give as careful answers as on another occasion. From that point of view the Unified Predicate is a more reliable method since the scoring for all subjects can be done by one person.

In the recordings, many children were interacting with their mothers at some ages and their fathers at others. The parents might have different conversational styles, e.g. be more or less talkative or interactive. However, since child turn-final gaze was measured as a percentage of all child turn-endings produced in the file, the presence of different parents at different ages probably has a negligible effect on the results. On the other hand, a child might possibly be more inclined to look one parent in the eyes than the other, for instance depending on the parent's own gaze behaviour.

Different amounts of various interaction contexts in different recordings might affect the child's use of turn-final gaze, since object-oriented interaction has been shown to reduce other-gaze in both children and adults (Argyle & Graham, 1976; Levine & Sutton-Smith, 1973). This is difficult to control for since the parent and child are encouraged to play freely and use toys and other objects as they wish.

6.1.3 Generalisability of the study

The small sample size might affect the study's generalisability especially since the children showed large individual differences concerning both turn-final gaze use and productive language development. Additionally, the results might be affected by the context setting, and cannot be assumed to hold for parent-child interaction in other contexts. Finally, possible cultural differences in child gaze behaviour (Senju et al., 2013) might be a reason for the results of the present study not to be applicable for other languages/cultures.

6.2 Results discussion

6.2.1 Discussion on overall turn-final gaze use

Hypothesis 1, expecting that Swedish toddlers use turn-final gaze in interaction with their parents, was confirmed.

The children were shown to use both general and active turn-final gaze at all ages in the material. This was expected based on Rutter and Durkin (1987). The large individual differences were also expected based on the same source. Though not statistically tested, in contrast to in Rutter and Durkin (1987) the individual differences were not consistent over time.

It is worth noting that Craig and Gallagher (1982) required at least 50 percent of child turn-endings to contain other gaze for the child to be considered using turn-final gaze. In the present study not even the highest mean amount of turn-final gaze use observed – general turn-final gaze in 19 percent of

child turn-endings at age 2;0 (se figure 2) – would be considered as proof for the children using turn-final gaze.

6.2.2 Discussion on turn-final gaze use and age

Hypothesis 2, in which child use of turn-final gaze at parent was expected to be positively correlated to child age was not confirmed while measuring general turn-final gaze. The linear regression analysis showing a significant correlation between active turn-final gaze and age do confirm hypothesis 2. Though while inspected further, the post hoc test showed that this correlation was not comparable to the steady increase in turn-final gaze over age in Rutter and Durkin (1987). The use of active turn-final gaze in the present study did not differ significantly during the child's third year. One probable explanation for this would be that children's use of active turn-final gaze does not have the same function as adults' use of turn-final gaze. If so, no steady development towards an "adult" turn-yielding use of turn-final gaze (as suggested by Rutter and Durkin, 1987) would be expected. This thought is further developed in 6.2.7.

The significant correlation between age and the proportions of general turn-final gaze being active turn-final gaze is of high importance. This shows that these two variables indeed represent different concepts. Besides, it also shows a change in child interactive gaze behaviour, more resembling an adult pattern. At younger ages when the child is looking at the parent at turn end, they have often been looking for a while. At older ages in cases of turn-final gaze they have been looking somewhere else during a part of their turn and looks up at the parent closer to the turn end. Since an increase of active turn-final gaze use could not be found during the third year (see figure 3, p. 17), this cannot be interpreted as the child using a higher amount of turn-yielding gaze as they grow older, but its shows that when they actually do use turn-final gaze, it is more of an active (although probably unconscious) use of the same.

The difference between the variables AFG and FG-minus-AFG as showed by a repeated measures ANOVA and illustrated in figure 5 (p. 18) reinforces the conceptual difference between the cases when the child actively looks up at the parent close their own turn-ending and when they are looking at the parent during their whole turn (or during more than one utterance until turn-ending in multi-utterance turns). Figure 5 also shows the interaction with age, i.e. how the difference between the two variables is increasing at older ages, which corresponds to the pattern shown in figure 4 (p. 18) concerning the proportions of AFG use per FG.

6.2.3 Discussion on turn-final gaze use and language level

Hypothesis 3 expecting child turn-final gaze use to be positively correlated to child language level was not confirmed.

The reason that no significant correlations were found between age and child language level might be the large individual differences in the children's use of turn-final gaze and the small subject sample size. Moreover, if the children had been divided into high/medium/low SECDI/UP score groups instead of just high/low score groups perhaps more distinctive differences in turn-final gaze behaviour between groups would have been found (see table 12-17, appendix B, for a visualisation of the distribution of SECDI and UP scores in the different groups).

Another possibly more probable reason for the lack of correlation between turn-final gaze and child language level would be that toddlers' use of turn-final gaze is not linearly related to the child's linguistic development. In concluding that the turn-final gaze behaviour in small toddlers corresponds to the adult turn-final gaze behaviour, though not yet fully developed - as Rutter and Durkin (1987) did – the assumption is that as the child's linguistic abilities increases the turn-final gaze behaviour would also increase. This was the basis for the aim in the present study of trying to find a possible link between the child's pragmatic gaze behaviour and verbal language use. If instead toddlers' use of turn-final gaze has another function, a linear connection to productive language use development is not obvious (see 6.2.7 for a more developed argument on the topic). The fact that no significant correlations could be found to Unified Predicate scores either despite that this measure gives a broader evaluation of the child's productive language level strengthens the idea that turn-final gaze in toddlers

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should not necessary be considered as an underdeveloped turn-yielding signal ability. Figure 6 (p. 19) does further visualise how in the present study SECDI score level do not automatically correspond with turn-final gaze use.

6.2.4 Discussion on turn-final gaze use in turn-final questions

Hypothesis 4a stating that the proportional use of child turn-final gaze would be higher in turn-final questions than in all child turn-endings could not be confirmed.

Even though the mean use of both general and active turn-final gaze in turn-final questions was higher at all ages investigated than the use in all child turn-endings at the same ages and hence seemingly corresponding to the expected results, these results were not proven to be statistically significant. Perhaps significant results would have been found with a larger subject group than 16 children, especially considering the even smaller number of children actually using turn-final questions in the recordings (6, 12 and 14 children at age 2;0, 2;6 and 3;0 respectively). The hypothesis was based on Rossano (2012) who found a higher amount of speaker turn-final gaze in questions and other first-pair-parts than in extended multi-unit tellings. Most child turns in the recordings could not be considered "extended multi-unit tellings" but rather consisted of one or a few utterances. Maybe thereby the difference in amount of turn-final gaze use in turn-ending questions compared to in all child turn-endings could not be expected to be as clear in the present study as in Rossano (2012) who investigated adult turn-taking gaze behaviour.

Hypothesis 4b expecting that turn-final gaze in turn-final questions would be mainly general i.e. present throughout the whole question, was not confirmed. On the contrary, a majority of active turn-final gaze was used in the turn-final questions. This could suggest that other-gaze in toddlers while asking questions does not essentially have a monitoring function, as suggested by Beattie (1978, p. 14) but rather a response-eliciting function as concluded by Rossano (2012).

Out of the six children producing turn-final questions at age 2;0 those with a higher overall use of active turn-final gaze also had a higher use of active turn-final gaze in turn-final questions. This might simply show how children who used a more active other-gaze in interaction with their parents at that age also were more likely to do this while asking their parents something, in that way emphasizing the other-directed nature of their turn (Schaffer et al., 1977, p. 318).

6.2.5 Discussion on turn-final gaze use in long turns

No hypothesis concerning child turn-final gaze use in long turns was stated due to the large difference between the long turn definition in the present study and former research. The mean amounts of both general and active turn-final gaze in long turns at ages 2;0-3;0 were larger than the overall mean amounts of general and active turn-final gaze in all child turn-endings at those ages, possibly confirming Kendon's (1967) findings. Yet these results were not proved to be significant. However, that the children's use of turn-final gaze in long turns would increase as their use of long turns increase (see table 4, p. 21) is a credible assumption, as using longer turns could be a sign on the child starting to use more complex language.

When investigating the children who produced long turns at each age, the active turn-final gaze use in long turns at age 1;0 was found to be significantly lower than the overall active turn-final gaze use at child turn-endings at the same age. However, this measure is somewhat misleading since the definition of a general turn-final gaze in a long turn does not mean that the child looked at their parent during the whole turn, but only that they started looking before the last utterance of the long turn. This makes the findings that the children who used a high amount of general turn-final gaze in long turns at ages 1;6 and 3;0 also used an overall high amount of general turn-final gaze calculated per all child turn-endings not very surprising – the children who gaze at their parents a long time up to turn-ending also do that during long turns.

6.2.6 Discussion on interaction context and turn-final gaze use

Hypothesis 5 was confirmed: the children used turn-final gaze frequently both during object-oriented and conversational interaction. Based on previous literature (Argyle & Graham, 1976; Levine & Sutton-Smith, 1973), this implies that the amount of child turn-final gaze would be even higher in an experiment setting with no objects at hand.

6.2.7 General discussion on child turn-final gaze and its possible functions

Several functions of turn-final gaze have been suggested in former research, the most usual being a regulatory, turn-yielding function (Kendon, 1967; Kalma, 1992; Torres et al., 1997; Ho et al., 2015) and a monitoring, response seeking function (Kendon, 1967; Beattie, 1978; Rutter et al., 1978; Bavelas et al., 2002). Both Rutter and Durkin (1987) and Craig and Gallagher (1982) concluded that children use turn-final gaze as a turn-yielding signal, though Craig and Gallagher (1982) only found proof for the use in three-party interaction and not in two-party interaction. Schaffer et al. (1977) meant that the child looking up at their mother during their own turn not only has a monitoring function but more importantly a contact-seeking function, reinforcing the other-directed nature of the child's utterance (Schaffer et al., 1977, p. 318).

Rutter and Durkin (1987) assumed that children's use of turn-final gaze has the same turn-yielding function as adult turn-final gaze use. In their study child use of turn-final gaze was increasing steadily over the child's second and third year. In the present study, child use of general turn-final gaze was not significantly correlated to age at all, and active turn-final gaze was not increasing over the child's third year. This implies that either the child's pragmatic turn-taking gaze skills are not developing over the child's third year, or that the child's use of turn-final gaze has another main function than the presumed adult turn-yielding function. The null results in the present study concerning correlations between child turn-final gaze use and child language level also point to another function of child turn-final gaze, presumably a function that the child does not necessary need or want to use more just because their productive language develops further.

The suggestion in the present study is that the child mainly uses turn-final gaze as a means for getting the parent's approval of the child's language use and actions. Child turn-final gaze thus presumably has a prominent monitoring-response-seeking function, but not as much seeking a verbal answer as seeking encouragement and approval of their verbal and nonverbal interactive behaviour. One reason for the suggestion of a monitoring-response-seeking function is the finding that in many cases the children's use of turn-final gaze shows a peak at ages 2;0 or 2;6 and then decreases to age 3;0 (see figure 6, p. 19). This suggests that some children after reaching a certain point in their linguistic development do not longer need the approval of their interactive language use from their parents as much as before. Another finding supporting this theory is the deviant turn-final gaze behaviour in one of the children as mentioned in 5.1.1 (subject CH12 in table 6, appendix A). This child produced a high number of turn-endings in the recorded material, and had rather high SECDI scores at all ages, but produced only two instances of turn-final gaze across all sessions. This child did also deviate from the other children in being very independent in their interaction with the parents, rather leading the conversation from a very young age than following the parent's lead. The suggestion here is that this child did not feel the same need for seeking approval of their language use as the other children, and thus did not use the turn-final gaze.

6.3 Methodological implications

In the present study two variables were used in order to capture turn-final gaze behaviour in toddlers. The general turn-final gaze measure – usually used in investigations of adult turn-taking gaze behaviour – only require the child to look at the parent's eye region in the end of the child's turn. The active turn-final gaze measure adds a condition: the turn-final gaze cannot be present at child turn-start but needs to be fixated at the parent's eye region during the last utterance of the turn. The reason for using these two different measures was to investigate if one is better than the other in capturing child

turn-taking gaze behaviour, taking in account that children use gaze in interaction somewhat differently than adults (see 2.3.4 for a development on the subject).

The results show that the two measures do capture different behaviour. No child used only one of the measures (see figure 1, p. 16). The active turn-final gaze use differed between ages, while the general turn-final gaze did not (see 5.1.2 and figure 3, p. 17). The proportions of general turn-final gaze consisting of active turn-final gaze increased with age (figure 4, p. 18). The interpretation of this is that as the children get older, when they do gaze at their parent at turn end they more often do this in connection to finishing their own turn as opposed to looking at the parent during at long part of their own utterance. Furthermore, the use of general and active turn-final gaze differed significantly, and when comparing the proportions of instances of general turn-final gaze that where active turn-final gaze and those that were not, a difference between the use of the two variables increasing over time was shown (figure 5, p. 18).

As a conclusion, when investigating turn-final gaze in children it is important to be aware of the consequences of choice of measure type. If the purpose is to try to capture turn-taking related gaze in children, based on the results in the present study the active turn-final gaze measure is recommended.

6.4 Ethics discussion

No questions concerning ethical aspects arose during the work on the present study.

6.5 Suggestions for future studies

In the present study the low age of the subjects make comparisons to turn-final gaze in adults difficult, not least because of the difficulty of assessing possible communicative intent in vocalizations uttered by preverbal children. In future studies, turn-final gaze could therefore be investigated in slightly older children, not including toddlers in the preverbal phase. Besides, an investigation of turn-final gaze behaviour in small children using a turn definition not including back channels and feedback could be of interest.

The effect of present objects on toddlers turn-final gaze use could be further explored, for instance by introducing objects after half the recording time during a controlled studio recording.

By only measuring very late onset of active turn-final gaze the results would be more comparable to the Rutter and Durkin (1987) study, thereby making possible a further investigation on the suggested monitoring-response-seeking function in contrast to the turn-yielding function suggested by Rutter and Durkin (1987).

Finally, a more ecological perspective on gaze use in child-parent turn-taking interaction could be obtained by examining child gaze at parent both during and outside of the child's own turns, as well as the parent's gaze on the child during the conversation.

7 Conclusions

The present study aimed to investigate toddlers' use of turn-final gaze in interaction with their parents at the ages 1;0-3;0. Following are the research questions, hypotheses and results of the study presented.

Question 1: Do Swedish toddlers use turn-final gaze in interaction with their parents?

    Hypothesis 1: Swedish toddlers use turn-final gaze in interaction with their parents.

Hypothesis 1 was confirmed, as all children used turn-final gaze in their recordings, though individual differences were large (ranging from 2 to 190 instances of general turn-final gaze per child in all their five recording sessions in total).

Question 2: Can child use of turn-final gaze at parent be related to child age?

    Hypothesis 2: Child use of turn-final gaze at parent is positively correlated to child age.

Hypothesis 2 was only partly confirmed. The use of active turn-final gaze, i.e. where child turn-final gaze at parent was not present at the start of the last utterance of the turn, increased over ages 1;0-2;0. General turn-final gaze did not show any significant correlations to age.

Question 3: Can child use of turn-final gaze at parent be related to child language level?

    Hypothesis 3: Child turn-final gaze use is positively correlated to child language level.

No significant correlations between child use of neither general nor active turn-final gaze was found, and hypothesis 3 could thereby not be confirmed.

Question 4: Does the child use turn-final gaze at parent differently in turn-final questions and long turns than in all turn-endings?

    Hypothesis 4a: The proportional use of child turn-final gaze is higher in turn-final questions than in all child turn-endings.

Hypothesis 4a was not confirmed as no significant differences between turn-final gaze use in turn-final questions and in all child turn-endings could be found.

    Hypothesis 4b: Active turn-final gaze use constitutes a minority of the general turn-final gaze use in turn-final questions.

93 % of the instances of turn-final gaze in turn-final questions consisted of active turn-final gaze. Thereby hypothesis 4b was not confirmed.

Active turn-final gaze in long turns was significantly lower at age 1;0 than the overall use of active turn-final gaze at child turn-endings. Child use of general turn-final gaze in long turns and use of general turn-final gaze in child turn-endings overall were correlated at age 1;6 and 3;0.

Question 5: In what interaction contexts does child turn-final gaze occur?

    Hypothesis 5: Child turn-final gaze occurs both during object-oriented and conversational interaction.

Hypothesis 5 was confirmed, as the children used turn-final gaze during both object-oriented and conversational interaction at all ages.

Based on the results, the importance of measure type choice while investigating turn-final gaze in children was stressed. Of the two measures used in the present study, the active turn-final gaze measure was judged being better for capturing children's turn-taking gaze behaviour at their own turn-endings than the general turn-final gaze measure.

The lack of increase in turn-final gaze use at ages 2;0-3;0 was addressed by proposing that the use of turn-final gaze has a somewhat other function in toddlers than in adults, namely a monitoring-response-seeking function. This suggestion was also based on the finding of a peak in turn-final gaze use at age 2;0 or 2;6 in many children that decreased afterwards. The monitoring-response-seeking function of turn-final gaze was proposed to be used by toddlers as a means for getting encouragement and the parent's approval of the child's interactive language use. This suggestion was presented as an alternative interpretation of the function of child turn-final gaze than the turn-yielding function suggested by previous research (Rutter & Durkin, 1987; Craig & Gallagher, 1982).

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Appendix A: Individual results

In table 6 on this and the following page the individual productions of turn-endings and turn-final gaze are presented at each age separately and combined.

Table 6. All subjects' individual results at all ages. Numbers of turn-endings (EoCT), general turn-final gaze occurrences (FG) and active turn-final gaze occurrences (AFG). Proportions (%) of general turn-final gaze occurrences (Prop. FG) and active turn-final gaze occurrences (Prop. AFG) calculated per EoCT.

Subject	Age	EoCT	FG	AFG	Prop. FG	Prop. AFG
CH1	1;0	60	1	0	2%	0%
	1;6	65	3	1	5%	2%
	2;0	119	17	10	14%	8%
	2;6	87	30	20	34%	23%
	3;0	114	10	6	9%	5%
	All ages	445	61	37	14%	8%
CH2	1;0	83	18	4	22%	5%
	1;6	74	8	6	11%	8%
	2;0	129	13	10	10%	8%
	2;6	139	8	6	6%	4%
	3;0	128	26	15	20%	12%
	All ages	553	73	41	13%	7%
CH3	1;0	40	19	7	48%	18%
	1;6	36	2	0	6%	0%
	2;0	66	3	3	5%	5%
	2;6	106	25	19	24%	18%
	3;0	42	8	7	19%	17%
	All ages	290	57	36	20%	12%
CH4	1;0	58	2	1	3%	2%
	1;6	51	7	3	14%	6%
	2;0	74	19	6	26%	8%
	2;6	79	9	6	11%	8%
	3;0	76	8	8	11%	11%
	All ages	338	45	24	13%	7%
CH5	1;0	32	14	6	44%	19%
	1;6	137	45	15	33%	11%
	2;0	146	60	27	41%	18%
	2;6	94	39	17	41%	18%
	3;0	88	32	22	36%	25%
	All ages	497	190	87	38%	18%
CH6	1;0	16	2	2	13%	13%
	1;6	8	0	0	0%	0%
	2;0	62	1	0	2%	0%
	2;6	65	3	3	5%	5%
	3;0	106	22	15	21%	14%
	All ages	257	28	20	11%	8%
CH7	1;0	55	1	0	2%	0%
	1;6	30	2	1	7%	3%
	2;0	30	12	6	40%	20%
	2;6	52	8	7	15%	13%
	3;0	66	11	9	17%	14%
	All ages	233	34	23	15%	10%

CH8	1;0	72	8	5	11%	7%
	1;6	31	0	0	0%	0%
	2;0	81	7	6	9%	7%
	2;6	103	4	2	4%	2%
	3;0	118	6	4	5%	3%
	All ages	405	25	17	6%	4%
CH9	1;0	56	0	0	0%	0%
	1;6	80	6	4	8%	5%
	2;0	92	16	14	17%	15%
	2;6	86	12	11	14%	13%
	3;0	138	19	15	14%	11%
	All ages	452	53	44	12%	10%
CH10	1;0	97	4	2	4%	2%
	1;6	140	23	12	16%	9%
	2;0	81	11	10	14%	12%
	2;6	100	17	13	17%	13%
	3;0	76	6	3	8%	4%
	All ages	494	61	40	12%	8%
CH11	1;0	41	4	1	10%	2%
	1;6	28	6	5	21%	18%
	2;0	77	15	8	19%	10%
	2;6	29	1	1	3%	3%
	3;0	86	14	10	16%	12%
	All ages	261	40	25	15%	10%
CH12	1;0	29	0	0	0%	0%
	1;6	126	0	0	0%	0%
	2;0	108	1	0	1%	0%
	2;6	84	0	0	0%	0%
	3;0	84	1	1	1%	1%
	All ages	431	2	1	0%	0%
CH13	1;0	33	2	2	6%	6%
	1;6	60	15	12	25%	20%
	2;0	90	23	16	26%	18%
	2;6	71	26	22	37%	31%
	3;0	86	7	4	8%	5%
	All ages	340	73	56	21%	16%
CH14	1;0	8	0	0	0%	0%
	1;6	67	6	3	9%	4%
	2;0	118	19	6	16%	5%
	2;6	116	10	7	9%	6%
	3;0	113	7	3	6%	3%
	All ages	422	42	19	10%	5%
CH15	1;0	45	5	3	11%	7%
	1;6	114	3	3	3%	3%
	2;0	160	55	36	34%	23%
	2;6	73	7	6	10%	8%
	3;0	89	22	18	25%	20%
	All ages	481	92	66	19%	14%
CH16	1;0	26	4	0	15%	0%
	1;6	81	15	5	19%	6%
	2;0	82	29	21	35%	26%
	2;6	164	33	21	20%	13%
	3;0	119	35	18	29%	15%
	All ages	472	116	65	25%	14%

Appendix B: Distribution of individual SECDI and UP scores in the high/low score groups

In figure 12-17 the distribution of individual SECDI and UP scores in the high/low score groups at each age are visualised. Since the possible maximum score differed between ages and measures, in all figures normalized scores are presented, i.e. representing a percentage of the possible maximum score.
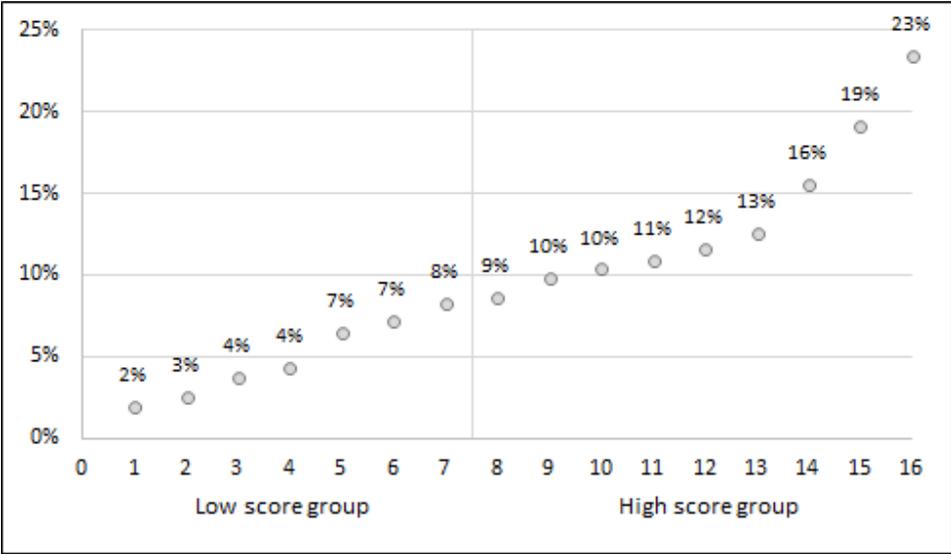

Figure 12. The distribution of individual SECDI-I scores obtained at age 1;0, presented as a percentage of the maximum score.
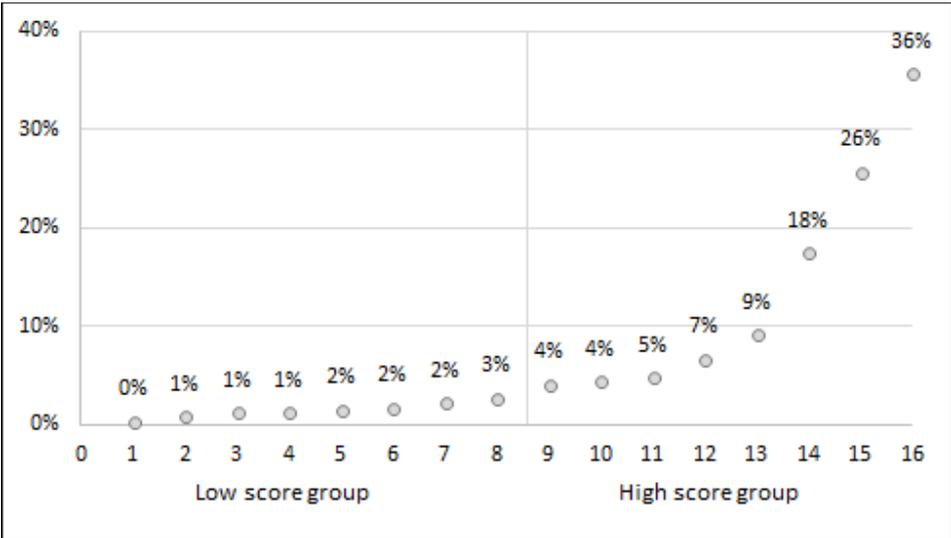

Figure 13. The distribution of individual SECDI-II scores obtained at age 1;6, presented as a percentage of the maximum score.
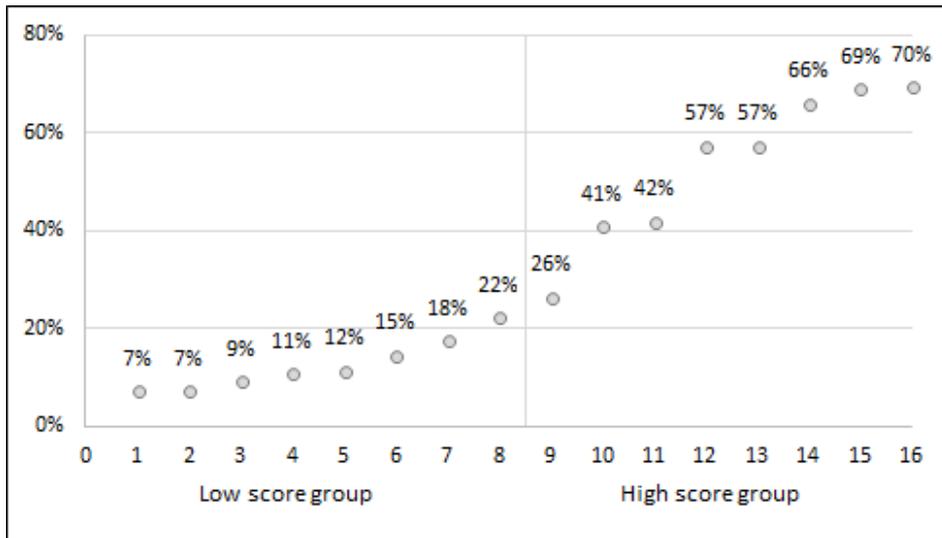
Figure 14. The distribution of individual SECDI-II scores obtained at age 2;0, presented as a percentage of the maximum score.
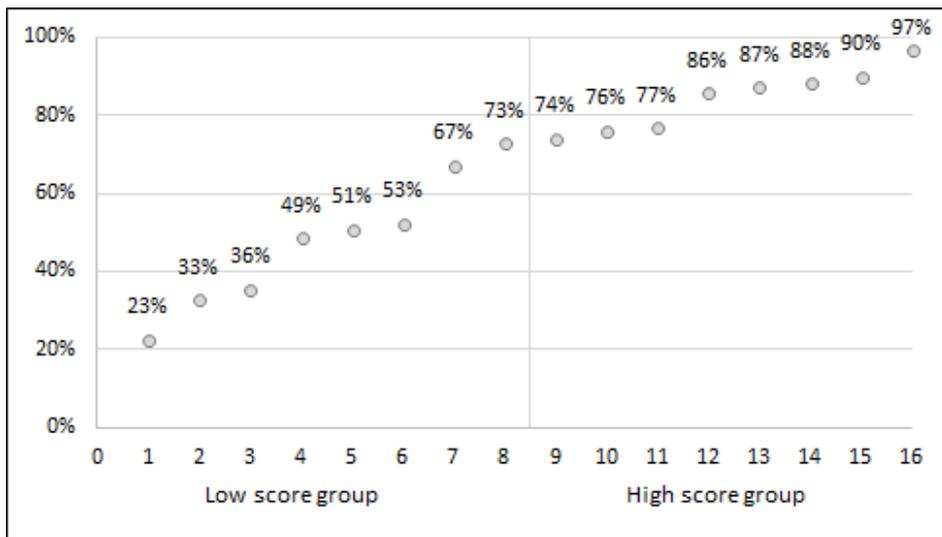

Figure 15. The distribution of individual SECDI-II scores obtained at age 2;6, presented as a percentage of the maximum score.
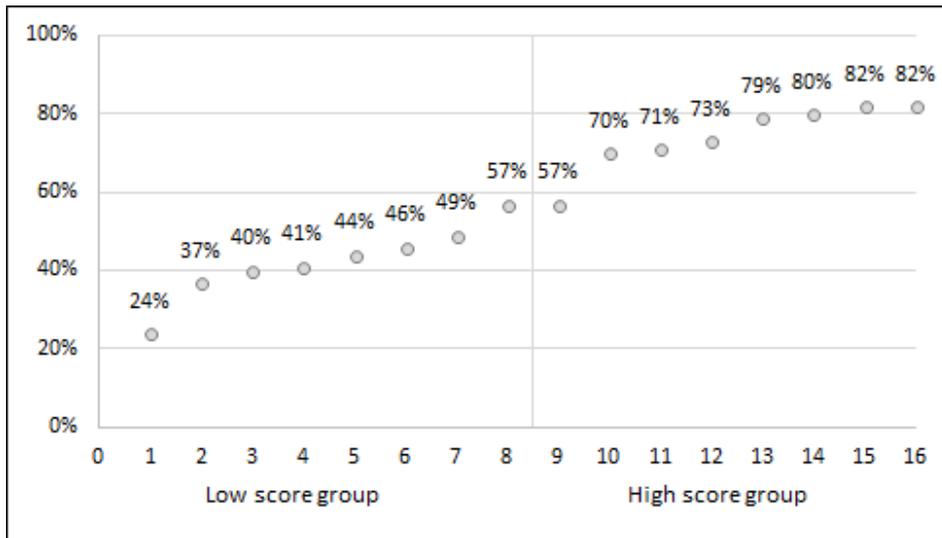
Figure 16. The distribution of individual SCDI-III scores obtained at age 3;0, presented as a percentage of the maximum score.
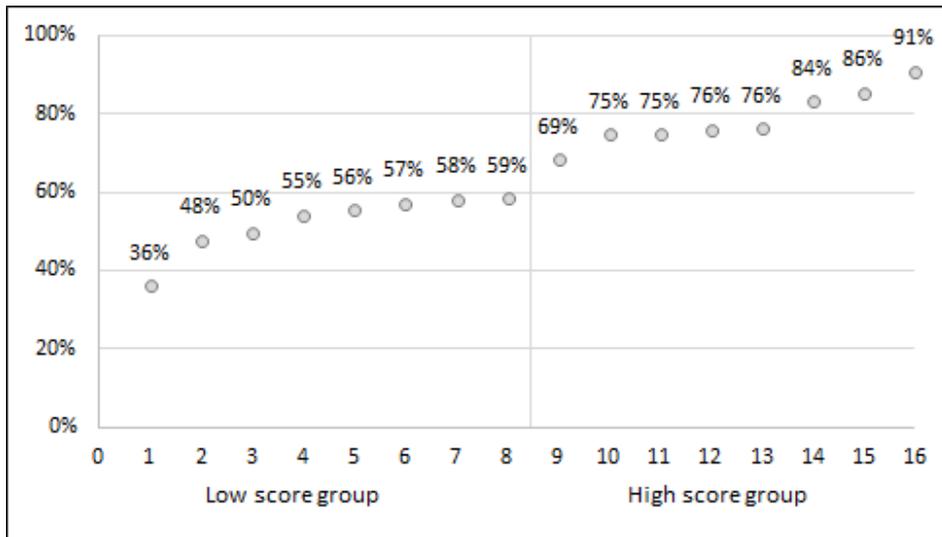

Figure 17. The distribution of individual UP scores obtained at age 3;0, presented as a percentage of the maximum score.

Appendix C: Selected parts of the transcription and annotation key for the MINT project - vocals, gaze and interaction context[7]

Vocal/verbal – parent: Orthographic transcription of parental utterances. In addition, we added labels for specific types of utterances, e.g., #FS for Formulaic Speech, #VR for adult-directed.

Vocal/verbal – child: During the first 3 recordings (0;3, 0;6, and 0;9) we used Controlled Vocabulary[8] (CV) for child vocalizations. This was to avoid the huge inconsistency in spelling which would have been the case if 10 people had tried to make out and create a spelling for crying sounds, whines, grunts etc. Basically, the categories were divided into consonant sounds, vowel sounds and sounds of joy/distress/anger.'

Gaze – parent + child: We can only make qualified guesses as to absolute focus of gaze, since we do not use eye-tracking devices. However, based on the four cameras and the possibility to zoom in, we have a relatively good notion of when parent and/or child alternate gaze. This has been used to classify the most important changes using a CV containing meeting of gaze, looking at researcher, hands, toys and other.

Context – general: A context tier was used to keep track of researchers entering and leaving the room, and whether or not the child and parent were engaged in a common activity.

Tiers

1 tier per person (child and adult) Vocal: orthographic transcription but close to the actual sounds for ja (jag), de (det), va (var/vad), å (att/och) and dom (de/dem). Otherwise, keep to orthography in order to make it searchable. If an adult has deviant speech in any way, such as creaky voice, do not mark this in the tier but add information as a comment to the whole file in "Information from annotator on ready file".

IMPORTANT: caps are only used for loud speech (see below).

Vocal/verbal tier

Label	Explanation
[??]	A message from the annotator to have the tag checked, e.g. word [??]
?	Question intonation, placed after the intended word/phrase.
(?)	Unsure transcription.
( )	Swallowed/omitted sounds, e.g. "den h(är) (het)te Mo"; "vi(lk)en fin" [Eng: "loo(k) a(t) (th)at"; "i do(n't) wan(t) it"]

&	Interrupted (word), e.g.: ”och &ko kolla här då” [Eng: ”and &lo look here”]
&(phrase)	Interruption(phrases), e.g.: ”det har vi sagt &(för att han hela tiden) eftersom han alltid dreglar på fjärrkontrollen” [Eng: "we said that &(because the entire time) because he was always drooling on the remote control"]
xxx	One or more unknown/inaudible words, e.g.: ”ta den då ta xxx bollen” [Eng: ”take that take xxx the ball”]
a-z	Nonwords with communicative function, e.g. “huh?”, imitation or vocal illustration (“nam nam nam” to eat), or sound effects (“hå!”), e.g.: *nam nam nam*
:	Extended sounds are marked with colon, e.g.: “hå:”
Ex ee	Filled pauses are transcribed as the sound, e.g.: ”Ee mm hm aa öh”
-	Continuation intonation, e.g.: ”Ja ska gå å-”
_	Disfluency due to hesitation, e.g.: “jjjja det tror jag”, [Eng: "yyyyes, i think so"], “neeej” are marked as “j_a det tror jag”, “ne_j” [Eng: "nooo" are marked as "y_es", "n_"]
‘	Markes typical (or atypical) reductions, e.g: “har’u”, “är’e”, “var’e” [Eng: "y'ave", "there're", "would’nt’ve"]
CAPITAL	Speech clearly louder than the surrounding speech.
.word.	Speech clearly softer than the surrounding speech. Not whispering.
#VI	Whispering, e.g.: Den e [#VI jättefin] [Eng: it's [#VI really nice]
{word}	A child’s deficit pronunciation for a word or when the child imitates the intonation of a word , e.g. : ’appa’ but it is evident in the context that the target word is ”lampa” → {lampa}
“word/sound”	Irritation/anger
%word/sound%	Distorted speech (changed intonation pattern, sudden use of (other) dialect, cartoon figure speech, etc.)
~	Creaking voice, marked on both sides of the word/phrase, e.g.: hon kom ~så~ långt [Eng: she came ~so~ far]
+	Paus <0,5 sec.
(h:)	Audible in or out breathing.
¤word/sound¤	Crying/whining voice. For children 3 months CV is applied instead. Crying/whining adults (imitation?), use approximate spelling, e.g.: ¤uhhhhhh¤
!word/sound!	Excited speech, screaming etc.
/approximation of sound/	Used for coughs, hummings, panting, whissling, kissing sounds, etc. /grunting x 2/ = repeated sound. Also used for other sources of sounds than vocal, e.g. /clapping sound/. Also used for /sound/ for 12-month olds’ (and older) sounds in between babbling and words proper.
#word/sound#	Laughter. Put # around the utterance produced while laughing, e.g.: #ja det va de värsta# ja varit med om When only laughter: ###
¨word/sound¨	Singing, humming.
#VR	Adult directed speech (usually in interaction with experimental leader); child directed speech is unmarked/standard. Place [ ] around the utterance, e.g.: [#VR ska jag läsa i boken?] ja ska vi läsa? [Eng: [#VR shall I read the book?] yes shall we read?].
#IN	Ingressive speech. Place [ ] around the utterance if it is part of a longer sequence:

	[#IN ja de vore ju] en nåd att stilla bedja om [Eng: #IN yeah that would sure be] a consummation devoutly to be wished]
#LA	Word or phrase in other language than Swedish. [#LA the thing] du vet [Eng/Spa: [#LA la cosa] you know] If you can't identify the language [#LA xxx]
#FS	Formulaic Speech (frozen phrases). A FS could be an idiom like "better late than never", but also (in CDS) expressions that reoccur among many parents and that you recognize, e.g. "titta lampa", "kossan säger… [#FS_å hur låter kossan/vad säger kossan?]. [Eng: "look lamp", "the cow says"… [#FS_oh what sound does the cow make/what does the cow say?].
#UG	Ungrammatical or unsemantic utterances: [#UG_utterance]. Example: [#UG_den va in hons hand][Eng: [#UG_is was in she's hand]; [#UG_ni har två många][Eng: [#UG_you have three many]]; [#UG_nelly hon ramla bakom på stolen][Eng:[#UG_nelly she fall behind on the chair]]; [#UG_fast ja har långt hår för ja e ju blond][Eng: [#UG:_well I have long hair 'cause I'm blond]]; [#UG_ja kunde skriva de själv utan å stava][Eng:[#UG_I could write it myself without spelling]]; etc.

Controlled Vocabularies

CV GAZE-CHILD TIER (children all ages).	qp-gaze (looks at parent); qr-gaze (looks at researcher); o-gaze (looks at our chosen objects); qa-gaze (looks at others stuff or unclear); h-gaze (looks at own or parents hands); out of frame.
CV CONTEXT TIER (one per recording)	ENTER_researcher; EXIT_researcher; Instructions (talk between researcher and parent; instructions); CONVERSING_adult (small talk researcher-parent); CONVERSING_child (talking to child, when none of the following tags apply); PLAY_mo/na/li (play with Mo, Na or Li); PLAY_peekaboo; PLAY_singing (singing, rhymes, rhythmical sounds); PLAY_book (play with books); PLAY_object (play with any of the other toys available); PLAY_non-toy (parents, own clothes, etc.); Other (when nothing above fits the situation). Always judge context based on the adult behavior.