Laughter in Dialogues with Normal-Hearing and Hearing-Impaired Children: Do they all laugh alike?

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Abstract

Despite the technological advancements, children with prostheses or cochlear implants, even when early implanted, show heterogeneous language skills and often struggle with pragmatic communication aspects. In our study, we focus on exploring laughter use and responsiveness to others' laughter in dialogue, comparing Normal-Hearing (N=13) and Hearing-Impaired (N=9) children while engaged in a series of conversational tasks with an adult experimenter. We observe significant differences between groups in the amount of conversational tasks complete in the allocated time and in terms of laughter frequency, speech-laughter and laughter mimicry occurrences. We discuss the observations on children and adult behaviour in relation to previous literature in adult-adult and child-caregiver interaction. Our results support the hypothesis that laughter use and responsiveness in dialogue might be related to pragmatic competences and informative about conversational quality.

1 Introduction

Despite the technological advancements, Hearing-Impaired children (HI) with prostheses or cochlear implants, even when early implanted, show heterogeneous language skills and often struggle with pragmatic communication aspects (Nicholas and Geers, 2006; Crowe and Dammeyer, 2021; Matthews and Kelly, 2022; Most et al., 2010). Difficulties in the pragmatics aspects of conversation negatively impact the quality of conversations, and are correlated with lower quality of life in school (Haukedal et al., 2022) and emotional problems (Holzinger and Fellinger, 2022). In the current work, we aim to explore an aspect of conversation which has received very little attention: the production and response to laughter during conversation in HI children. The interest in laughter arises from studies showing its crucial role in managing interactions, conveying meaning, establishing and maintaining relationships, being highly sophisticated from a pragmatic perspective (e.g. Glenn (2003); Mazzocconi et al. (2020); Dunbar (2022)), and informative about pragmatic abilities (Reddy et al., 2002; Mazzocconi and Ginzburg, 2023; Hoicka et al., 2017; Reddy, 2008). In Section 1.1, we review some literature about the pragmatic difficulties faced by HI children; in Section 1.2, we motivate our interest in laughter, highlighting its link to pragmatic competences and its role in their development and dialogue unfolding; in Section 1.3, we state the aim of our study while in Section 2 we present the corpus analysed and the methodology applied for annotation and analysis. In Section 3, we present our results and conclude by discussing them in relation to previous research in Section 4.

1.1 Pragmatics of dialogue in Hearing-Impaired (HI) children

Pragmatic abilities rely on a combination of linguistic skills, social-cognitive capacities, and executive functions (Matthews et al., 2018), including inhibition, cognitive flexibility, and working memory (Blain-Brière et al., 2014), as well as the capability to derive inferences from linguistic, behavioural and contextual cues (Goodman and Frank, 2016). Previous research has attempted to characterise the communicative difficulties faced by HI children using standardised batteries or by evaluating conversational dynamics (e.g. turn-taking, dialogue acts performed, explicitation of referents, contingency and topic-change etc.). Despite some inconsistencies in the results, likely due to small sample sizes, task differences, and

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varying ages of implantation, most studies report significant differences in the pragmatic domain, even when phonological, syntactic and lexical skills are within the normal range for the child age (Crowe and Dammeyer, 2021; Matthews and Kelly, 2022; Most et al., 2010). Studies focusing on conversation have highlighted atypicalities in turn-taking, initiating topics, maintaining conversation, repairing and clarification requesting (Paatsch and Toe, 2014; Church et al., 2017; Most et al., 2010; Toe and Paatsch, 2013). Similar difficulties have also been found in narrative skills, in terms of coherence, and expliciting referents taking into account the eventual lack of common ground (Boons et al., 2013; Crosson and Geers, 2001; Toe and Paatsch, 2018). More generally Tuohimaa et al. (2023) reported inferential difficulties in a wide range of tasks, including theory of mind, verbal and visual information, and understanding conversational norms and emotions in context.

Most studies until now, especially those focused on evaluating the effects of using cochlear implants, have focused on the structural linguistic speech aspects of communication (Caselli et al., 2012; Church et al., 2017; Nicastri et al., 2014; Paatsch and Toe, 2014; Tye-Murray, 2003). More recently, scholars started to investigate other expressive channels contributing multimodally to the emergence of meaning and the unfolding of the dialogue (Perniss, 2018; Vigliocco et al., 2014; Holler and Levinson, 2019): such as facial expressions, gestures and prosody (Ambrose, 2016; Le Maner-Idrissi et al., 2020; Socher et al., 2019; Panzeri et al., 2021). In particular, Le Maner-Idrissi et al. (2020) observe lower performances in HI children with cochlear implants (age 5;3 – 13 years) in the ability to comprehend emotional speech on the basis of prosody as compared to NH children. Socher et al. (2019) observed specific difficulties in the non-verbal aspects of communication (including prosody, facial expressions recognition and attributing mental states and feelings to other people). A comprehensive assessment of linguistic and pragmatic abilities in Italian children with cochlear implants from a young age has confirmed several of the previously mentioned patterns (Parola et al., 2023): in general, HI children have lower performances than NH children, and difficulties are particularly marked in the paralinguistic scale (evaluating the comprehension and production of several non-verbal cues) and the contextual scale (evaluating the child's ability to use appropriate communicative behaviours with respect to different social contexts). The difficulties mentioned, can lead to misinterpretations and social awkwardness, negatively impacting social integration (Vissers and Hermans, 2018; Haukedal et al., 2022). Consequently, HI children might experience social isolation and have fewer opportunities for peer interactions (Hintermair, 2008, 2011), which are critical for developing social competence (Most, 2007), feeding therefore a vicious cycle (Bat-Chava and Deignan, 2001).

Some authors hypothesise that the difficulties HI children face in the pragmatic aspects of communication may be attributed to the increased cognitive load and fatigue required to process auditory information compared to their normal-hearing peers (Pisoni, 2000; Marsella et al., 2017; Rönnberg et al., 2010). The signal children receive indeed, in particular if fitted with cochlear implants, does not replicate the one received by NH peers, often resulting in less clear auditory input (Henry et al., 2021). To sum up, the literature reviewed highlights how the difficulties faced by HI children, go beyond mere speech, encompassing: atypical turn-taking patterns, conversational coherence, managing misunderstandings, pragmatic inferences, and emotion recognition via prosody or facial expression.

1.2 Laughter and Pragmatic skills

Laughter is a ubiquitous vocalisation in our interactions (Bryant and Bainbridge, 2022; Scott et al., 2014). It is often related to the appreciation of humour, but it is also a tool for managing conversation dynamics (e.g. turn-taking and topic-change) (Jefferson et al., 1977; Ludusan and Wagner, 2022; Bonin et al., 2015; Holt, 2010), providing feedback, showing agreement, expressing emotions, disambiguating interactants' intentions (e.g. smoothing, softening criticism) and speakers' meaning (e.g., marking irony, scare-quoting) (Glenn and Holt, 2013; Mazzocconi et al., 2020; Ginzburg et al., 2020; Glenn, 2003; Attardo et al., 2003; Hoicka and Gattis, 2008), crucial for defining group boundaries, building and maintaining relation-

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ships (Jefferson, 1984; Morisseau et al., 2017; Davila-Ross and Palagi, 2022; Dunbar, 2022).

Several scholars have highlighted how laughter can be a means to track cognitive and pragmatic development in babies and older children (Piaget, 1945; McGhee, 1977; Mireault and Reddy, 2016). Even just laughing at something funny evolves drastically during development, being informative about the patterns learnt: concerning world knowledge, language and social and cultural conventions (Mireault and Reddy, 2016; Hoicka et al., 2017; Telli and Hoicka, 2022). Most scholars identify the presence of incongruity as one of the fundamental components of humour (Raskin, 1985; Attardo and Raskin, 1991; Yus, 2017; Maraev et al., 2021; Tannen, 1993; Mazzocconi et al., 2020). Therefore, appreciating humour in events is informative about the general inferential patterns exploited (Mazzocconi and Priego-Valverde, 2023; Ginzburg et al., 2020). Even just by observing others' laughter (and eventually sharing it) in different settings, children learn about cultural norms and context-specific communication practices, through social referencing (Semrud-Clikeman and Glass, 2010). Given the amount of inferential abilities and playing with shared and implicit information needed in humour (Flamson and Barrett, 2008; Cunningham, 2005), maybe not surprisingly studies show a correlation between humour comprehension and pragmatic skills (Aykan and Nalçacı, 2018; Bischetti et al., 2023).

Moreover, laughter use in relation to non-humourous events (e.g. laughter accompanying criticism, embarrassment, and asking a favour) emerges later in development, being correlated with the amount of shared attention on the object of the mothers' laughter and correlated to the acquisition of socio-cultural knowledge and pragmatic skills (Mazzocconi and Ginzburg, 2023). Even responsiveness to the interlocutor's laughter, increasing through the early years, has been suggested to be a marker of pragmatic development (Reddy et al., 2002; Mazzocconi and Ginzburg, 2022). Laughter seems therefore to be fundamental to socio-pragmatic development, while at the same time, in its use and responsiveness, being informative about it (Mireault and Reddy, 2016).

Laughter, far from being a reflex-like response, is therefore a more complex phenomenon than what is commonly thought. It can be used to disambiguate speech-acts, and can be crucial in interpreting speakers' intentions and meaning (Bryant, 2016). Since laughter can be informative about interactants' appraisals and attentional, cognitive, and emotional states (Mazzocconi et al., 2020), it is a valuable means for managing, commenting, and monitoring the conceptual alignment needed for conversation (Gandolfi et al., 2022). In particular, laughter is often related to the appraisal of some incongruities in the conversational or situational context, and the ability to interpret each other's laughter requires sharing (or at least inferring) general inferential patterns (Breitholtz, 2014), i.e., *topoi*, exploited by the interlocutor (Ginzburg et al., 2020). Laughter mimicry[1] can therefore be a precious signal for interactants, since it can effectively show meta-cognitive alignment on the evaluation of situations, propositions, or stances. Conversely, the lack of laughter mimicry in some situations can be a sign of misalignment in an evaluation or stance, or signal a lack of background in shared knowledge (Jefferson, 1979; Ginzburg and Mazzocconi, 2020). Similarly, unexpected laughter production can signal misalignment, prompting clarification requests, commentaries, or further discussions (Mazzocconi et al., 2018). Moreover, laughter mimicry is influenced by several "pragmatic" factors: context (Bryant, 2020), the interactional partner (Smoski and Bachorowski, 2003), the object of the laughter (Mazzocconi et al., 2020), e.g., it is not appropriate to reciprocate any type of laughter (Jefferson et al., 1977), and the developmental stage of the interactants (Nwokah et al., 1994; Mazzocconi and Ginzburg, 2022). The fact that laughter (mimicry) is tightly linked to pragmatic skills is also supported by studies showing atypical patterns, both in terms of occurrences and acoustic features, in neuro-different populations where pragmatic skills are characteristically divergent, such as for people in the Autistic Spectrum or with schizophrenic traits (Samson, 2013; Reddy et al., 2002; Jones, 2009;

[1] With the term *mimicry* we signify to the re-production of a behaviour shortly after a partner's one that is identical in certain dimensions, as used in Mayo and Gordon (2020) and El Haddad et al. (2019), and reviewed in Chartrand and Lakin (2013).

Polimeni and Reiss, 2006; Helt et al., 2019; Lavelle et al., 2018; Hudenko et al., 2009).

1.3 Current study

On the basis of the literature review presented, the aim of the current study was to investigate whether any difference would emerge in laughter use and laughter responsiveness in HI children as compared to NH children during conversation, being laughter use and responsiveness tightly linked to pragmatic abilities and being so important in the dialogue unfolding and conversation managing. We investigate an aspect of conversation which has never been addressed in the study of pragmatic communication difficulties in HI children. Based on the literature, we anticipated that HI children would face greater challenges in the pragmatically demanding conversational game and exhibit differences in laughter use compared to NH children. A confirmation of our hypotheses would corroborate the existence of a close relationship between laughter dialogic use and responsiveness and pragmatic competences, about which it can be informative.

2 Method

2.1 Corpus

Our corpus is constituted by 22 audio-recorded dyadic interactions of around 30 minutes (M= 31.51 ± 2.16) involving nine HI children and thirteen NH children engaging with an adult (female) during a referential (treasure-hunting) task, periodically alternated with role-reversal sub-tasks (e.g., child-led referential-tasks, child-storytelling).

2.2 Participants

Nine French-speaking children aged 5 to 9 years (3 girls, M = 75.2 months, sd = 14.1 months) with moderate (3), severe (3), profound deafness (3) were recruited via the Centre d'Action Médico-Sociale Précoce (CAMSP) and via the Institut Provençal de Suivi des Implantés Cochléaires (IPSIC) at the Salvator Hospital in Marseille. These children have a variety of devices, including bilateral conventional hearing aids (4), one (1) or two (3) cochlear implants, as well as a cochlear implant accompanied by a conventional prosthesis (1). They received hearing aids at different ages (M = 31.6 ±24.2 months). All of them have no additional disorders, were born from NH parents, communicate orally, and had language abilities in the norm for their age. The control group was constituted of 13 French-speaking normal-hearing children aged 5 to 9 (7 girls, M = 87.1 ± 13.6 months) with heterogeneous socio-demographic profiles equivalent to that of the experimental group. They had no known language, cognitive, neuro-developmental or sensory atypicalities or deficits.

2.3 Tasks and procedure

The child sit opposite the adult experimenter, in a quiet room. Audio from both participants is recorded with a unidirectional headset microphone connected to a ZOOM H4n digital recorder.

Main Map-tasks: A map is placed in the centre of the table so that the child and the adult can see it. On the map multiple items are drawn. These items have been selected according to their frequency of use in French according to the children age (New et al., 2001). The items included in the task were balanced between frequent items (known by the child), infrequent items (likely unknown to the child) and invented items (unknown to the child). The choice of challenging children with unfamiliar terms, was motivated by the aim of investigating the different strategies used to compensate for their lack of knowledge, as well as any conversational failures. The drawings on the map belong to nine semantic categories of items (e.g. bird, ship etc.), multiple exemplar of the same item are present, but differ in terms of physical (e.g. size and colour) or spatial (e.g. at the top, at the corner of the map) features. Participants are engaged in a treasure-hunt map task. The goal for the child is to collect enough hints to discover where the treasure is. These hints are gained by posing questions to the adult experimenter to disambiguate the target item of the category mentioned by the adult. An example instruction from the adult might be "The next hint is hidden behind the bird". As several items may correspond to this description, the child is expected to implement strategies to find the correct target item among the possible candidates within the category.

Sub-tasks The main task is periodically alternated by sub-tasks. These sub-tasks have been

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included in order to help sustain attention, but especially to acquire data from different types of conversation where the roles are more balanced or even reversed as compared to the main task where the adult detains more information than the child and therefore holds a "leading role". The sub-tasks are: (1) "Guess who?": the child and the adult have the same set of cards, not shown to the partner. The child secretly chooses a card and the adult, asking questions, has to guess which of the available cards has been chosen by the child. In this task the roles are reversed as the child detains more information than the adult; (2) "Picture story": the child is given a series of three sequential pictures arranged randomly which s/he has to put back into chronological order to tell the story; (3) " Child Story telling": the adult elicits an unstructured narration asking the child about their holiday or about the plot of their favourite movie; (4) "Find the differences": the child has to find seven differences between two images, by communicating them verbally to the adult. The task is rather difficult for children who are spontaneously led to focus attention and ask the adult for help.

2.4 Laughter Annotation

All our annotations have been carried out using the software ELAN (Brugman et al., 2004). The coding was carried out by one annotator listening to each audio-file until a laugh occurred. The coder then marked the onset and offset of the laugh, distinguishing between laughter not overlapping or overlapping with speech (Laughter/Speech-laughter). Our criteria for laughter identification and annotation are in line with previous work, though adapted since we relied exclusively on the auditory modality (e.g., El Haddad et al. (2019); Mazzocconi and Ginzburg (2022)).[2] Our study focuses on: the occurrence of laughter (frequency), duration, position in relation to speech (laughter/speech-laughter), and to the partner's laughter (Non-/Mimicking). For the purposes of this paper, a *Mimicking* laugh (produced by interlocutor B) refers to any laugh that shortly follows the onset of a *Non-mimicking* laugh (produced by interlocutor A). The following describes our method for identifying Mimicking and Non-Mimicking laughs, where A_i and B_j are the i^{th} and j^{th} laughs produced by interlocutors A and B, respectively, T_{start} and T_{stop} are the start and stop times, respectively, and ΔT is set to 1 second. In order for laugh B_j to mimic laugh A_i, B_j must occur after the *start* time of A_i (1) with an onset before the *stop* time of A_i with a margin ΔT. To avoid duplication, B_i must stop before the start time of laugh A_{i+1} (2).

(1) $T_{start}(A_i) < T_{start}(B_j)$

(2) $T_{start}(B_j) < min\{T_{stop}(A_i) + \Delta T, T_{start}(A_{(i+1)})\}$

Inter-annotator agreement was assessed having a second coder for 20% of the conversations (covering 30% of the laughs annotated by the first annotator). For segmentation (onset-offset) we observed an average degree of organisation of 0.74 (Staccato algorithm, Lücking et al. (2011)).[3] The observed labelling agreement on matched annotations was 98% and Cohen's kappa was 0.9.

3 Results

3.1 Task-completion

In the given time (about 30 minutes), all NH children (N=13) completed all the tasks (mean time 1896.06 sec, sd 95.8 sec), while only 5 out of 9 HI children completed all the tasks (mean time 1892.55 sec, sd 177.60 sec). The other 4 HI children (44%) did not manage to complete the last two tasks in the allocated time.

3.2 Laughter frequency and duration

Over the full corpus, 830 laughs were identified and annotated: 669 in the 13 NH dyads (376 produced by children) and 161 in the 9 HI dyads (89 produced by children). Figure 1 represents the counts of laughter occurrences for each participant. Means and standard deviations for laughter occurrences, laughter duration and laughter frequency over 10 mins by Participant and Group are reported in Table 1. Laughter is overall significantly more frequent in the NH group than in the HI group ($W = 86$, $p < .001$). Nevertheless, the frequency of laughter is not significantly different between HI children and NH children ($W = 34$, $p = 0.11$), while for Adults in the NH group laughter frequency is significantly higher than for adults interacting with HI children ($W = 2$, $p < .001$).

[2] Annotation protocol at https://osf.io/mbv8z.

[3] This is a measure based on Thomann (2001, p.243). It ranges in the interval (-1, 1). A value of 0 corresponds to the agreement expected from random annotations.

Group	N	Participant	Laughter Count	Laughter Mean (sd)	Duration (sec) Mean (sd)	Freq/10min Mean (sd)	Speech-laugh %/Tot.
HI	9	Adult	72	8 (2.96)	0.97 (0.45)	2.58 (1.03)	12.50%
HI	9	Child	89	9.89 (10.7)	1.00 (0.76)	3.13 (3.39)	22.47%
NH	13	Adult	293	22.5 (6.60)	0.91 (0.47)	7.20 (2.34)	14.68%
NH	13	Child	376	31.3 (33.7)	0.89 (0.60)	9.28 (11.3)	40.96%

Table 1: Mean and standard deviation of laughter occurrences, duration and frequency over 10 mins according to Group (HI: Hearing Impaired; NH: Normal Hearing) and Participant (Adult; Child)

Group	Participant	Total L. Mean (sd)	Non-Mimicking L. Mean (sd)	Mimicking L. Mean (sd)	% Mimicking Mean (sd)
HI	Adult	8 (2.96)	7.44 (2.88)	1.25 (0.5)	6.58 (8.25)
HI	Child	9.89 (10.7)	9 (9.99)	2 (1.41)	7.76 (10.86)
NH	Adult	22.5 (6.60)	18.9 (5.01)	5.22 (4.94)	14.9 (16.11)
NH	Child	28.9 (33.4)	25.8 (30.9)	6 (5.08)	18.46 (17.31)

Table 2: Laughter Mimicry distribution and Transitional Probabilities (HI: Hearing Impaired; NH: Normal Hearing) and Participant (Adult; Child)

We run a linear mixed-effect model on laughter duration, having *Group* and *Participant* as fixed effects, and *Dyad* as random factor. Our analysis did not reveal any significant difference in terms of duration neither between Groups (β = -0.07, se = 0.10, df = 33.73, t = -0.74, p = 0.46), nor between Participants (β -0.11, se = 0.08, df = 815.97, t = -1.36, p = 0.17), nor in their interaction (β = 0.08, se = 0.09, df = 817.96, t = 0.90, p = 0.37).

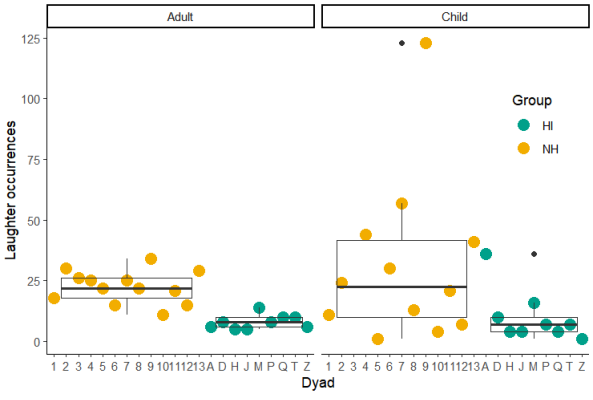

Figure 1: Laughter occurrences by Dyad, Group and Participant

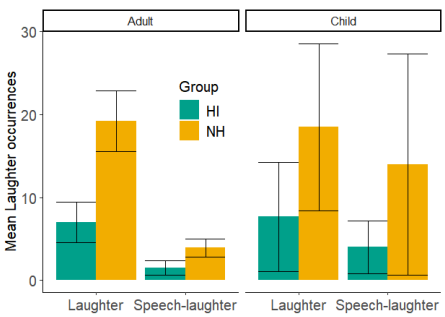

Figure 2: Mean laughter and speech-laughter occurrences by Group and Participant

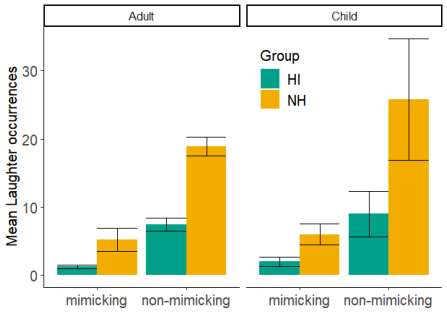

Figure 3: Mean Mimicking and Non-Mimicking laughter occurrences by Group and Participant

3.3 Speech-laughter

We observe a significant difference in the occurrence of speech-laughter between the two groups (χ^2 = 8.0, df = 1, p-value < .005). While no difference is observed in Adults according to Group (χ^2 = 0.08, df = 1, p-value = 0.78), we observe HI children to produce significantly less speech-laughter compared to NH children (χ^2 = 9.72, df = 1, p-value = 0.001).

3.4 Laughter Mimicry

In Table 2 we report means and standard deviations for the occurrences and percentages of Mimicking laughter by *Group* and *Participant*. Despite the high inter-individual variability (Figure 3), statistical testing shows that Mimicking laughter occurrences are overall rarer in the HI group than in the NH group (χ^2 = 7.83, p = .005). Significantly fewer occurrences of Laughter Mimicking are observed in the HI group both for adults (χ^2= 3.91, p <.05) and children (χ^2 = 3.94, p < .05).

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4 Discussion

We investigated for the first time laughter occurrences and responsiveness to the partner's laughter in Hearing-Impaired (HI) children while engaged in different conversational tasks as compared to Normal-Hearing (NH) children. The aim of our study was to test HI and NH children performance in a pragmatically charged conversational game and whether they differ in their laughter behaviour in conversation. We overall observed difficulties for the HI children to complete the conversational tasks in the allocated time and different patterns of laughter behaviour across groups confirming our hypothesis. Interestingly, we observe also some significant differences in the adult behaviour depending on whether she was interacting with NH or HI children.

4.1 Laughter frequency

The first striking result is that laughter is significantly less frequent in the HI group, and especially so for the adult (Tab. 1). Interestingly, the frequency of laughter production observed in the adult interacting with a HI child is more similar to those observed in mother-infant interaction (e.g. Nwokah et al. (1994); Mazzocconi and Ginzburg (2022)) than those observed in adult interaction: friendly conversations 5.8 (± 2.5)/10 min (Vettin and Todt, 2004); speed-dating 21(± 9.28)/5 min (Fuchs and Rathcke, 2018); friendly loosely-controlled conversation French 45/10 min, Chinese 26/10 min; fully ecological and diverse contexts BNC 5/10 min (Mazzocconi et al., 2020). For children, the frequency does not result significantly different between groups, especially due to the high variability in the NH group and the considerable overlap in the distribution observed (Fig. 1). It is nevertheless interesting to remark that while values at the high extreme of the distribution are all NH children, those on the lower extreme of the distribution are predominantly HI children. The fact that frequencies are lower (and balanced) in the HI dyads as a whole, highlights the fact that the dyad works as an organic system where the interactants influence each other (Fusaroli et al., 2014).

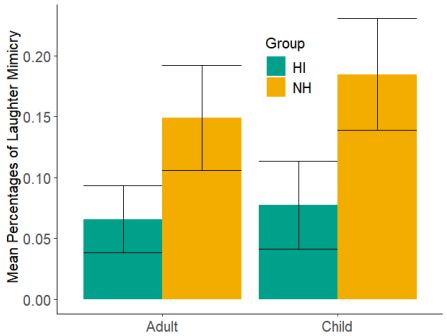

Figure 4: Mean percentages of laughter mimicry

4.2 Speech-laughter

We observe HI children to produce significantly less speech-laughter in comparison to NH children. This is interesting when considering that speech-laughter emerges rather late in development (for most children absent even at 36 months, (Mazzocconi and Ginzburg, 2022)) despite laughter emerging around the third month of life (Sroufe and Wunsch, 1972; Nwokah et al., 1994; Oller et al., 2021) and speech being present since the second year of life. Mazzocconi and Ginzburg (2022) proposed two possible explanations for the late and rare use of speech-laughter in infants: speech-laughter might require quite advanced language abilities, as a matter either of vocal control and coordination, or the development of laughter's pragmatic use to shape (and evaluate) verbal contributions. Interestingly, only the NH children display a percentage of speech-laughter production similar to those observed in adult-adult dyadic naturalistic interaction (e.g. French: 31%, Chinese: 47%, BNC: 30%, Mazzocconi et al. (2020), 50% Trouvain (2001); 60% O'Connell and Kowal (2005); 58% Devillers and Vidrascu (2007)). The adult therefore displays significantly lower percentages of speech-laughter when interacting with children participating in our study (regardless of the group) than in adult-adult conversation. This observation could be attributed to the semi-controlled nature of the interaction, where the adult experimenter engages in the same task with various children following a rather scripted flow. Moreover, she assumes the role of a speech and language therapist, which may lead her, particularly for HI children, to deliberately make her speech as controlled and clean as possible.

4.3 Laughter mimicry

We observe fewer occurrences of laughter mimicry in the HI dyads and significantly lower percentages of mimicking laughter in HI

children as compared to NH children. Different hypotheses can be put forward to explain these patterns. On the one hand, the lower occurrences of laughter mimicry might be a signal of lower conceptual alignment. Laughter is indeed an ambiguous signal highly context-dependent, while at the same time it is highly informative about speakers' mental states and general inferential patterns exploited (and can be a precious means to manage conversations and monitor (and signal) conceptual alignment (Gandolfi et al., 2022). Alternatively, the lack of laughter alignment might be explained considering that HI children face a higher cognitive load in engaging in speech processing in interaction (Marsella et al., 2017), which according to Pickering and Garrod (2013, 2004) would impact the predictions made by interlocutors and the motivation to affiliate or communicate. On the other, following Giles et al. (1991, 2023)'s communication action theory lower alignment might derive from lower motivation to affiliate. This might derive from the fact that the experimental conditions of our data collection might highly resemble those of a speech and language therapy session, an activity to which HI children are extremely highly exposed and which might even elicit a distancing effect. Finally, based on studies showing that initiating laughs (those that are reciprocated by the interactant with laughter mimicry) have peculiar acoustic characteristics as opposed to those that are not reciprocated (Truong and Trouvain (2012); Mazzocconi et al. (2024), it is possible that HI children are not able to pick up on these subtle modulations of the signal, due to the distorted quality of the sound perceived (Pisoni, 2000; Henry et al., 2021), and therefore do not interpret them as an invitation to join the laugh. It is worth noting that, contrarily to what is observed in NH children, for the adult (in both groups) and for HI children percentages of laughter mimicry are significantly lower than those observed in other adult-adult interactions (around 35% across languages and contexts (Mazzocconi et al., 2020; Vettin and Todt, 2004; Smoski, 2004)). A possible interpretation of this is that laughter occurs when mutual comprehension, and laughter interpretation therefore, are granted, and especially laughter mimicry can be used to show similar stances and appraisals. HI interactions are particularly delicate because mutual comprehension (based on alignment) cannot always be given for granted. In general, the lower percentages observed in the adult while interacting with children compared to those observed in adult-adult interaction might be related either to a misalignment in the appraisal of laughables, or to the fact that the adult is avoiding distractions for the child, attempting to help sustain attention in a cognitively demanding task.

5 Conclusion

Overall, we observe difficulties for the HI children group in completing the pragmatically demanding conversational tasks in the allocated time and significant differences between HI and NH children in conversational laughter use and responsiveness: frequency, speech-laughter and mimicking laughter. Considering the literature review highlighting communicative pragmatic difficulties in HI children, these results endorse the view that laughter behaviour might be linked to pragmatic competences and socio-cognitive development (Reddy, 2008; Mireault and Reddy, 2016; Mazzocconi and Ginzburg, 2022, 2023). Laughing while speaking and aligning to the interactional partner's laughter indeed, requires a complex mechanism involving not only understanding but also an evaluative attitude on own discourse or on the partner's discourse. To validate the hypothesis that laughter behaviour can be informative about pragmatic competences and conversational quality, further analyses will test correlations between laughter behaviour, pragmatic competence conversation measures (appropriate responsiveness to dialogue acts, quality of the strategies used to accomplish the tasks), convergence at different levels (pitch, intensity, syllabic rate), turn-taking timing dynamics and speaking time balance. Moreover, additional analyses looking at the laughter's arguments and pragmatic functions might better elucidate whether the differences observed are also related to underpinning differences in laughter pragmatic use to manage the dialogue unfolding, meaning, face-threatening acts and rapport.

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References

Sophie E Ambrose. 2016. Gesture use in 14-month-old toddlers with hearing loss and their mothers' responses. *American journal of speech-language pathology*, 25(4):519–531.

Salvatore Attardo, Jodi Eisterhold, Jennifer Hay, and Isabella Poggi. 2003. Multimodal markers of irony and sarcasm. *Humor*, 16(2):243–260.

Salvatore Attardo and Victor Raskin. 1991. Script theory revis (it) ed: Joke similarity and joke representation model. *Humor-International Journal of Humor Research*, 4(3-4):293–348.

Simge Aykan and Erhan Nalçacı. 2018. Assessing theory of mind by humor: The humor comprehension and appreciation test (tom-hcat). *Frontiers in psychology*, 9:382586.

Yael Bat-Chava and Elizabeth Deignan. 2001. Peer relationships of children with cochlear implants. *Journal of Deaf Studies and Deaf Education*, 6(3):186–199.

Luca Bischetti, Irene Ceccato, Serena Lecce, Elena Cavallini, and Valentina Bambini. 2023. Pragmatics and theory of mind in older adults' humor comprehension. *Current Psychology*, 42(19):16191–16207.

Bénédicte Blain-Brière, Caroline Bouchard, and Nathalie Bigras. 2014. The role of executive functions in the pragmatic skills of children age 4–5. *Frontiers in psychology*, 5:81239.

Francesca Bonin, Nick Campbell, and Carl Vogel. 2015. The discourse value of social signals at topic change moments. In *Sixteenth Annual Conference of the International Speech Communication Association*.

Tinne Boons, Leo De Raeve, Margreet Langereis, Louis Peeraer, Jan Wouters, and Astrid Van Wieringen. 2013. Narrative spoken language skills in severely hearing impaired school-aged children with cochlear implants. *Research in developmental disabilities*, 34(11):3833–3846.

Ellen Breitholtz. 2014. *Enthymemes in Dialogue: A micro-rhetorical approach*. Ph.D. thesis, University of Gothenburg.

Hennie Brugman, Albert Russel, and Xd Nijmegen. 2004. Annotating multi-media/multi-modal resources with elan. In *LREC*, pages 2065–2068. Lisbon.

Gregory A Bryant. 2016. How do laughter and language interact. In *The Evolution of Language: Proceedings of the 11th International Conference (EVOLANG11)*.

Gregory A Bryant. 2020. Evolution, structure, and functions of human laughter. In *The handbook of communication science and biology*, pages 63–77. Routledge.

Gregory A Bryant and Constance M Bainbridge. 2022. Laughter and culture. *Philosophical Transactions of the Royal Society B*, 377(1863):20210179.

Maria Cristina Caselli, Pasquale Rinaldi, Cristiana Varuzza, Anna Giuliani, and Sandro Burdo. 2012. Cochlear implant in the second year of life: Lexical and grammatical outcomes.

Tanya L Chartrand and Jessica L Lakin. 2013. The antecedents and consequences of human behavioral mimicry. *Annual review of psychology*, 64:285–308.

Amelia Church, Louise Paatsch, and Dianne Toe. 2017. Some trouble with repair: Conversations between children with cochlear implants and hearing peers. *Discourse studies*, 19(1):49–68.

Jillian Crosson and Ann Geers. 2001. Analysis of narrative ability in children with cochlear implants. *Ear and Hearing*, 22(5):381–394.

Kathryn Crowe and Jesper Dammeyer. 2021. A review of the conversational pragmatic skills of children with cochlear implants. *The Journal of Deaf Studies and Deaf Education*, 26(2):171–186.

J Cunningham. 2005. Children's humor. *Children's play. SAGE publications*.

Marina Davila-Ross and Elisabetta Palagi. 2022. Laughter, play faces and mimicry in animals: evolution and social functions. *Philosophical Transactions of the Royal Society B*, 377(1863):20210177.

Laurence Devillers and Laurence Vidrascu. 2007. Positive and negative emotional states behind the laughs in spontaneous spoken dialogs. In *Interdisciplinary workshop on the phonetics of laughter*, page 37.

RIM Dunbar. 2022. Laughter and its role in the evolution of human social bonding. *Philosophical Transactions of the Royal Society B*, 377(1863):20210176.

Kevin El Haddad, Sandeep Nallan Chakravarthula, and James Kennedy. 2019. Smile and laugh dynamics in naturalistic dyadic interactions: Intensity levels, sequences and roles. In *2019 International Conference on Multimodal Interaction*, pages 259–263.

Thomas Flamson and H Clark Barrett. 2008. The encryption theory of humor: A knowledge-based mechanism of honest signaling. *Journal of Evolutionary Psychology*, 6(4):261–281.

Susanne Fuchs and Tamara Rathcke. 2018. Laugh is in the air? In *Proceedings of Laughter Workshop 2018, Paris, France*, pages 21–24.

Riccardo Fusaroli, Joanna Raczaszek-Leonardi, and Kristian Tylén. 2014. Dialog as interpersonal synergy. *New Ideas in Psychology*, 32:147–157.

Greta Gandolfi, Martin J Pickering, and Simon Garrod. 2022. Mechanisms of alignment: shared control, social cognition and metacognition. *Philosophical Transactions of the Royal Society B*, 378(1870):20210362.

Howard Giles, Nikolas Coupland, and IUSTINE Coupland. 1991. Accommodation theory: Communication, context, and. *Contexts of accommodation: Developments in applied sociolinguistics*, 1.

Howard Giles, America L Edwards, and Joseph B Walther. 2023. Communication accommodation theory: Past accomplishments, current trends, and future prospects. *Language Sciences*, 99:101571.

Jonathan Ginzburg and Chiara Mazzocconi. 2020. Laughing about laughter: comparing conversational analysis, emotion psychology, and dialogical semantics. In *Laughter and Other Non-Verbal Vocalisations Workshop: Proceedings (2020)*.

Jonathan Ginzburg, Chiara Mazzocconi, and Ye Tian. 2020. Laughter as language. *Glossa: a journal of general linguistics*, 5(1).

Phillip Glenn. 2003. *Laughter in interaction*, volume 18. Cambridge University Press.

Phillip Glenn and Elizabeth Holt. 2013. *Studies of laughter in interaction*. A&C Black.

Noah D Goodman and Michael C Frank. 2016. Pragmatic language interpretation as probabilistic inference. *Trends in cognitive sciences*, 20(11):818–829.

Christiane Lingås Haukedal, Ona Bø Wie, Stefan K Schauber, Björn Lyxell, Elizabeth M Fitzpatrick, and Janne von Koss Torkildsen. 2022. Social communication and quality of life in children using hearing aids. *International journal of pediatric otorhinolaryngology*, 152:111000.

Molly S Helt, Deborah A Fein, and Jacob E Vargas. 2019. Emotional contagion in children with autism spectrum disorder varies with stimulus familiarity and task instructions. *Development and psychopathology*, pages 1–11.

Fergal Henry, Martin Glavin, and Edward Jones. 2021. Noise reduction in cochlear implant signal processing: A review and recent developments. *IEEE reviews in biomedical engineering*, 16:319–331.

Manfred Hintermair. 2008. Self-esteem and satisfaction with life of deaf and hard-of-hearing people—a resource-oriented approach to identity work. *Journal of deaf studies and deaf education*, 13(2):278–300.

Manfred Hintermair. 2011. Health-related quality of life and classroom participation of deaf and hard-of-hearing students in general schools. *Journal of deaf studies and deaf education*, 16(2):254–271.

Elena Hoicka, Jessica Butcher, Felicity Malla, and Paul L Harris. 2017. Humor and preschoolers' trust: Sensitivity to changing intentions. *Journal of experimental child psychology*, 154:113–130.

Elena Hoicka and Merideth Gattis. 2008. Do the wrong thing: How toddlers tell a joke from a mistake. *Cognitive Development*, 23(1):180–190.

Judith Holler and Stephen C Levinson. 2019. Multimodal language processing in human communication. *Trends in Cognitive Sciences*, 23(8):639–652.

Elizabeth Holt. 2010. The last laugh: Shared laughter and topic termination. *Journal of Pragmatics*, 42(6):1513–1525.

Daniel Holzinger and Johannes Fellinger. 2022. Conversation difficulties rather than language deficits are linked to emotional problems in school children with hearing loss. In *Frontiers in Education*, volume 7, page 944814. Frontiers Media SA.

William J Hudenko, Wendy Stone, and Jo-Anne Bachorowski. 2009. Laughter differs in children with autism: An acoustic analysis of laughs produced by children with and without the disorder. *Journal of autism and developmental disorders*, 39(10):1392–1400.

G. Jefferson. 1979. A technique for inviting laughter and its subsequent acceptance/declination. *Everyday language: Studies in ethnomethodology*, 79:96.

Gail Jefferson. 1984. On the organization of laughter in talk about troubles. *Structures of social action: Studies in conversation analysis*, 346:369.

Gail Jefferson, Harvey Sacks, and Emanuel Schegloff. 1977. Preliminary notes on the sequential organization of laughter. *Pragmatics Microfiche*, 1:A2–D9.

Errin Jones. 2009. *Humour and laughter in children with Autism Spectrum Disorders*. Ph.D. thesis, University of Ballarat.

Mary Lavelle, Christine Howes, Patrick GT Healey, and Rosemarie McCabe. 2018. Are we having a laugh? conversational laughter in schizophrenia. *DaP 2018*, page 35.

Gaïd Le Maner-Idrissi, Sandrine Le Sourn Bissaoui, Virginie Dardier, Maxime Codet, Nathalie Botte-Bonneton, Fanny Delahaye, Virginie Laval, Marc Aguert, Géraldine Tan-Bescond, and Benoit Godey. 2020. Emotional speech comprehension in deaf children with cochlear implant. *Psychology of Language and Communication*, 24(1):44–69.

Andy Lücking, Sebastian Ptock, and Kirsten Bergmann. 2011. Assessing agreement on segmentations by means of staccato, the segmentation agreement calculator according to thomann. In *International Gesture Workshop*, pages 129–138. Springer.

Bogdan Ludusan and Petra Wagner. 2022. Laughter entrainment in dyadic interactions: temporal distribution and form. *Speech Communication*, 136:42–52.

Vladislav Maraev, Ellen Breitholtz, Christine Howes, Staffan Larsson, and Robin Cooper. 2021. Something old, something new, something borrowed, something taboo: Interaction and creativity in humour. *Frontiers in Psychology*, 12:654615.

Pasquale Marsella, Alessandro Scorpecci, Giulia Cartocci, Sara Giannantonio, Anton Giulio Maglione, Isotta Venuti, Ambra Brizi, and Fabio Babiloni. 2017. Eeg activity as an objective measure of cognitive load during effortful listening: A study on pediatric subjects with bilateral, asymmetric sensorineural hearing loss. *International journal of pediatric otorhinolaryngology*, 99:1–7.

Danielle Matthews, Hannah Biney, and Kirsten Abbot-Smith. 2018. Individual differences in children's pragmatic ability: A review of associations with formal language, social cognition, and executive functions. *Language Learning and Development*, 14(3):186–223.

Danielle Matthews and Ciara Kelly. 2022. Pragmatic development in deaf and hard of hearing children: A review. *Deafness & Education International*, 24(4):296–313.

Oded Mayo and Ilanit Gordon. 2020. In and out of synchrony—behavioral and physiological dynamics of dyadic interpersonal coordination. *Psychophysiology*, 57(6):e13574.

Chiara Mazzocconi and Jonathan Ginzburg. 2022. A longitudinal characterization of typical laughter development in mother–child interaction from 12 to 36 months: Formal features and reciprocal responsiveness. *Journal of Nonverbal Behavior*, 46(4):327–362.

Chiara Mazzocconi and Jonathan Ginzburg. 2023. Growing up laughing: Laughables and pragmatic functions between 12 and 36 months. *Journal of Pragmatics*, 212:117–145.

Chiara Mazzocconi, Vladislav Maraev, and Jonathan Ginzburg. 2018. Laughter repair. In *Proceedings of SemDial 2018 (AixDial), The 22nd workshop on the Semantics and Pragmatics of Dialogue, Aix-en-Provence (France)*.

Chiara Mazzocconi, Benjamin O'Brien, Kubra Bodur, and Abdellah Fourtassi. 2024. Do children laugh like their parents? conversational laughter mimicry occurrence and acoustic alignment in middle-childhood. Under Review, Preprint.

Chiara Mazzocconi and Béatrice Priego-Valverde. 2023. Humour in early interaction: what it can tell us about the linguistic, pragmatic and cognitive development of the child. In *Proceedings of the 27th Workshop on the Semantics and Pragmatics of Dialogue*.

Chiara Mazzocconi, Ye Tian, and Jonathan Ginzburg. 2020. What's your laughter doing there? A taxonomy of the pragmatic functions of laughter. *IEEE Transactions on Affective Computing*.

Paul E McGhee. 1977. A model of the origins and early development of incongruity-based humour. In *It's a funny thing, humour*, pages 27–36. Elsevier.

Gina C Mireault and Vasudevi Reddy. 2016. *Humor in infants: developmental and psychological perspectives*. Springer.

Tiffany Morisseau, Martial Mermillod, Cécile Eymond, Jean-Baptiste Van Der Henst, and Ira A Noveck. 2017. You can laugh at everything, but not with everyone: What jokes can tell us about group affiliations. *Interaction Studies*, 18(1):116–141.

Tova Most. 2007. Speech intelligibility, loneliness, and sense of coherence among deaf and hard-of-hearing children in individual inclusion and group inclusion. *Journal of Deaf Studies and Deaf Education*, 12(4):495–503.

Tova Most, Ella Shina-August, and Sara Meilijson. 2010. Pragmatic abilities of children with hearing loss using cochlear implants or hearing aids

compared to hearing children. *Journal of Deaf Studies and Deaf Education*, 15(4):422–437.

Boris New, Christophe Pallier, Ludovic Ferrand, and Rafael Matos. 2001. Une base de données lexicales du français contemporain sur internet: Lexique™//a lexical database for contemporary french: Lexique™. *L'année psychologique*, 101(3):447–462.

Maria Nicastri, Roberto Filipo, Giovanni Ruoppolo, Marika Viccaro, Hilal Dincer, Letizia Guerzoni, Domenico Cuda, Ersilia Bosco, Luca Prosperini, and Patrizia Mancini. 2014. Inferences and metaphoric comprehension in unilaterally implanted children with adequate formal oral language performance. *International Journal of Pediatric Otorhinolaryngology*, 78(5):821–827.

Johanna Grant Nicholas and Ann E Geers. 2006. Effects of early auditory experience on the spoken language of deaf children at 3 years of age. *Ear and hearing*, 27(3):286–298.

Evangeline E Nwokah, Hui-Chin Hsu, Olga Dobrowolska, and Alan Fogel. 1994. The development of laughter in mother-infant communication: Timing parameters and temporal sequences. *Infant Behavior and Development*, 17(1):23–35.

D Kimbrough Oller, Gordon Ramsay, Edina Bene, Helen L Long, and Ulrike Griebel. 2021. Protophones, the precursors to speech, dominate the human infant vocal landscape. *Philosophical Transactions of the Royal Society B*, 376(1836):20200255.

Daniel C O'Connell and Sabine Kowal. 2005. Laughter in bill clinton's my life (2004) interviews. *Pragmatics. Quarterly Publication of the International Pragmatics Association (IPrA)*, 15(2):275–299.

Louise E Paatsch and Dianne M Toe. 2014. A comparison of pragmatic abilities of children who are deaf or hard of hearing and their hearing peers. *Journal of deaf studies and deaf education*, 19(1):1–19.

Francesca Panzeri, Sara Cavicchiolo, Beatrice Giustolisi, Federica Di Berardino, Paola Francesca Ajmone, Paola Vizziello, Veronica Donnini, and Diego Zanetti. 2021. Irony comprehension in children with cochlear implants: The role of language competence, theory of mind, and prosody recognition. *Journal of Speech, Language, and Hearing Research*, 64(8):3212–3229.

Alberto Parola, Dize Hilviu, Sara Vivaldo, Andrea Marini, DI Diego, Patrizia Consolino, and Francesca Marina Bosco. 2023. Development of communicative-pragmatic abilities in children with early cochlear implants. *Journal of Child Language*, pages 1–17.

Pamela Perniss. 2018. Why we should study multimodal language. *Frontiers in psychology*, 9:342098.

Jean Piaget. 1945. *Play, dreams, and imitation in childhood*. New York: Norton.

Martin J Pickering and Simon Garrod. 2004. The interactive-alignment model: Developments and refinements. *Behavioral and Brain Sciences*, 27(2):212–225.

Martin J Pickering and Simon Garrod. 2013. An integrated theory of language production and comprehension. *Behavioral and brain sciences*, 36(4):329–347.

David B Pisoni. 2000. Cognitive factors and cochlear implants: Some thoughts on perception, learning, and memory in speech perception. *Ear and hearing*, 21(1):70–78.

Joseph Polimeni and Jeffrey P Reiss. 2006. Humor perception deficits in schizophrenia. *Psychiatry Research*, 141(2):229–232.

V. Raskin. 1985. *Semantic mechanisms of humor*, volume 24. Springer.

Vasudevi Reddy. 2008. *How infants know minds*. Harvard University Press.

Vasudevi Reddy, Emma Williams, and Amy Vaughan. 2002. Sharing humour and laughter in autism and down's syndrome. *British journal of psychology*, 93(2):219–242.

Jerker Rönnberg, Mary Rudner, Thomas Lunner, and Adriana A Zekveld. 2010. When cognition kicks in: Working memory and speech understanding in noise. *Noise and Health*, 12(49):263–269.

Andrea Christiane Samson. 2013. Humor (lessness) elucidated–sense of humor in individuals with autism spectrum disorders: Review and introduction. *Humor*, 26(3):393–409.

Sophie K Scott, Nadine Lavan, Sinead Chen, and Carolyn McGettigan. 2014. The social life of laughter. *Trends in cognitive sciences*, 18(12):618–620.

Margaret Semrud-Clikeman and Kimberly Glass. 2010. The relation of humor and child development: Social, adaptive, and emotional aspects. *Journal of Child Neurology*.

Moria Smoski. 2004. *The development of antiphonal laughter between friends and strangers*. Ph.D. thesis, Vanderbilt University.

Moria Smoski and Jo-Anne Bachorowski. 2003. Antiphonal laughter between friends and strangers. *Cognition & Emotion*, 17(2):327–340.

Michaela Socher, Björn Lyxell, Rachel Ellis, Malin Gärskog, Ingrid Hedström, and Malin Wass. 2019. Pragmatic language skills: A comparison of children with cochlear implants and children without hearing loss. *Frontiers in psychology*, 10:475839.

L Alan Sroufe and Jane Piccard Wunsch. 1972. The development of laughter in the first year of life. *Child Development*, pages 1326–1344.

Deborah Tannen. 1993. What's in a frame? surface evidence for underlying expectations. *Framing in discourse*, 14:56.

Burcu Soy Telli and Elena Hoicka. 2022. Humor and social cognition: Correlational and predictive relations in 3-to 47-month-olds. *Cognitive Development*, 64:101245.

Bruno Thomann. 2001. Observation and judgment in psychology: Assessing agreement among markings of behavioral events. *Behavior Research Methods, Instruments, & Computers*, 33:339–348.

Dianne Toe and Louise Paatsch. 2018. Communicative competence of oral deaf children while explaining game rules. *The Journal of Deaf Studies and Deaf Education*, 23(4):369–381.

Dianne M Toe and Louise E Paatsch. 2013. The conversational skills of school-aged children with cochlear implants. *Cochlear implants international*, 14(2):67–79.

Jürgen Trouvain. 2001. Phonetic aspects of "speech-laughs". In *Proceedings of the 2nd Conference on Orality and Gestuality*, pages 634–639.

Khiet P Truong and Jürgen Trouvain. 2012. On the acoustics of overlapping laughter in conversational speech. In *Thirteenth Annual Conference of the International Speech Communication Association*.

Krista Tuohimaa, Soile Loukusa, Heikki Löppönen, Taina Välimaa, and Sari Kunnari. 2023. Development of social-pragmatic understanding in children with congenital hearing loss and typical hearing between the ages of 4 and 6 years. *Journal of Speech, Language, and Hearing Research*, 66(7):2503–2520.

Nancy Tye-Murray. 2003. Conversational fluency of children who use cochlear implants. *Ear and Hearing*, 24(1):82S–89S.

Julia Vettin and Dietmar Todt. 2004. Laughter in conversation: Features of occurrence and acoustic structure. *Journal of Nonverbal Behavior*, 28(2):93–115.

Gabriella Vigliocco, Pamela Perniss, and David Vinson. 2014. Language as a multimodal phenomenon: implications for language learning, processing and evolution.

CTWM Vissers and Daan Hermans. 2018. Social-emotional problems in deaf and hard-of-hearing children from an executive and theory of mind perspective. *Evid Based Pract Deaf Educ*, 28:455–76.

Francisco Yus. 2017. Incongruity-resolution cases in jokes. *Lingua*, 197:103–122.