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The development of presupposition: Pre-schoolers' understanding of *regret* and *too*

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Abstract: Little is known about presuppositional skills in pre-school years. Developmental research has mostly focused on children's understanding of *too* and evidence is mixed: some studies show that the comprehension of *too* is not adult-like at least until school age, while more recent findings suggest that even pre-schoolers can interpret *too*-sentences in more age-appropriate tasks. Importantly, no study has tested directly, within the same experiment, pre-schoolers' presupposition understanding in satisfaction versus accommodation, nor with respect to other trigger types. Yet, it is well known that adults' processing of a presupposition is costlier when accommodation is required and that the type of trigger influences the processing demands. Therefore, both the trigger type and the contextual availability of a presupposition might influence young children's comprehension. We tested this with a story completion task that assessed 3–5-year-olds' comprehension of presuppositions activated by either *regret* or *too* in contexts that either satisfied the presupposition or required accommodation. Results reveal that pre-schoolers overall exhibit an understanding of presupposition. Crucially, this starkly improves between the age of 3 and 5 and the developmental trajectory depends on both context and trigger type: understanding the presupposition of *regret* seems easier than that of *too* for younger children, and less difficulties emerge when the context satisfies the presupposition. Thus, the development of presupposition comprehension in pre-schoolers depends both on the type of trigger and the contextual availability of the presupposition – satisfied versus requiring failure repair.

Keywords: accommodation; development; experimental pragmatics; experimental semantics; presupposition; presupposition triggers

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1 Introduction

1.1 Presupposition

Presupposition is traditionally considered as background information communicated as taken for granted (Stalnaker 1974). For instance, the utterancescarry the presuppositions in (1a) and (2a):

(1) Lara regrets that the castle was destroyed by a wave.

(2) Claudia has worn the hat too.

(1a) The castle was destroyed by a wave.

(2a) Claudia has worn something else other than the hat.

Presuppositions are carried by *presupposition triggers*, namely lexical items and syntactic constructions that activate a presupposition. Examples of triggers include iterative expressions, definite descriptions, or as (1) and (2) respectively illustrate, factive verbs such as *regret* and focus sensitive particles such as *too* (Karttunen 1974; Levinson 1983).

Two core aspects of presupposing utterances are central in theoretical research on presupposition: (i) the availability in context of the presupposition; and (ii) the triggering problem – i.e., which features the presupposition triggers exhibit and what distinguishes the classes of triggers[1] (Schwarz 2015).

The main idea behind (i) is that the utterance of sentences such as (1) or (2) may lead to two possible outcomes, namely *satisfaction* and *failure*. If the presupposition is entailed by the context, then the presupposition is said to be *satisfied* and the context can be updated with the asserted component of the utterance (i.e., the truth-conditional content). If the presupposition does not already belong to the common ground, this leads to *presupposition failure*. The hearer can then reject the utterance as inappropriate; alternatively, he can repair the failure in order to make sense of the utterance. The mechanism underlying failure repair is *accommodation* (Heim 1982; Lewis 1979); the process whereby the presupposition that is not satisfied is introduced in the context set to make the context update possible.

The basic intuition behind the triggering problem (ii) is that not all triggers exhibit the same properties and these differences in properties may determine differences in

1 Another core issue in theoretical research is the 'projection problem' – i.e., whether the presuppositions of complex sentences are derived compositionally or not – which will not be discussed further here.

how they activate a presupposition. Building on this intuition, several theoretical classifications have been proposed. For instance, Glanzberg (2003, 2005) distinguishes between triggers that activate *strong* and *weak presuppositions*. For the former, accommodating the correspondent presupposition in case of failure is mandatory to preserve the utterance felicity. By contrast, for the latter, repairing the context with the presupposition, in case of failure, is optional because even without the presupposed content the utterance still makes sense. According to Glanzberg's distinction, *regret* is a strong presupposition trigger. The presupposed content carried by *regret* provides a meaningful contribution to the propositional content of the utterance: if failure occurs, then repairing the context becomes necessary to understand the utterance (e.g., Lara regrets *p* iff it is true that the castle was destroyed and that Lara is sad about the castle being destroyed). Conversely, *too* is a weak presupposition trigger: the failure would induce an optional repair because the context can still be meaningfully updated with the assertive component of the utterance (e.g., the asserted content in (2) that Claudia has worn the hat still makes sense).

Beyond Glanzberg's distinction, other theoretical positions also treat factive verbs and focus sensitive particles as different types of triggers. Zeevat (1992) distinguishes between *resolution* and *lexical* triggers: resolution triggers, such as *too*, involve the anaphoric retrieval of an entity or event in the common ground; while lexical triggers, such as *regret*, activate no anaphoric process since their conventional meaning already encodes a precondition for their asserted content. In other words, in this view, that 'the castle was destroyed' would be encoded in the conventional meaning of *regret* (i.e., Lara would not regret the castle being destroyed if in fact the castle was not destroyed).[2]

1.2 Presupposition processing in adults: Cognitive costs

A wealth of experimental research on adults' presupposition processing has focused on the cognitive cost of processing presupposition and on what modulates the cognitive demands.

2 Other interesting ways to classify presuppositions have been suggested in the literature. For instance, Abusch (2010) distinguishes between soft versus hard triggers depending on the cancellability of their presupposition. According to Abusch, the presupposition carried by soft triggers (e.g., achievement verbs and inchoatives such as, respectively, *win* and *break*) can be easily cancelled and this would not impact utterance felicity, in a given context. Conversely, the presupposition activated by hard triggers is hard to cancel. We will not discuss further Abusch's distinction because the cancellability property of several triggers is still a matter of debate. For example, it has been suggested that the classification of *too* as a hard trigger is controversial, since in some cases the presupposition of *too* might be cancelled without impacting the utterance felicity (Jayez and Mongelli 2013).

Three main patterns of results have emerged. First, processing background information comes at a cost: presuppositions are evaluated in online sentence comprehension (e.g., Schwarz 2007) and presupposing utterances elicit longer reading times than non-presupposing utterances (e.g., Tiemann et al. 2011). Second, the extra costs seem modulated by the availability of the presupposition in context. Several behavioral studies show that accommodation elicits greater processing efforts than satisfaction across a variety of triggers, in online processing (Definite Descriptions: Arnold et al. 2000; Haviland and Clark 1974; Yekovich and Walker 1978; Auch/too: Schwarz 2007; Wieder/again: Tiemann et al. 2015). Consistently with this, independently of the type of trigger used, accommodation seems cognitively costlier than satisfaction *per se* in both online and offline processing (Domaneschi and Di Paola 2018, 2019a). Overall, these data have been taken to suggest higher cognitive costs for presupposition accommodation associated with the process of context repair, that involves (i) failure recognition, (ii) the derivation/recovering of presupposed information, and (iii) updating the discourse mental model with this information (see Domaneschi and Di Paola 2018). Third, the specific category of trigger, too, seems to affect the cognitive load of presupposition. In general, lexical triggers appear to behave differently from resolution triggers. For example, Domaneschi and Di Paola (2018) found that recovering the presupposition of a resolution trigger, such as definite description, is costlier than recovering the presupposition of a lexical trigger, such as change of state verbs (e.g., *to stop*), and that people recover the presupposition of definite descriptions less frequently than that of change of state verbs. Drawing on Zeevat (1992), the authors attribute these differences to the underlying nature of processing: while lexical triggers are derived via direct logical implication (e.g., stopping an action logically implies that the action previously took place), resolution triggers are inferred via a discourse-based anaphoric inference for the search of a suitable antecedent given the context – and this might explain the difference in processing costs. Additionally, accommodating triggers such as definite descriptions and change of state verbs seems more mandatory than accommodating focus sensitive particles, and this has been accounted for using Glanzberg's (2003) claim that strong triggers – such as precisely definite descriptions and change of state verbs – meaningfully contribute to the asserted content of the utterance (Amaral and Cummins 2015; Cummins et al. 2012; Domaneschi et al. 2014).

Finally, it is worth noting that presupposition processing does not seem to remain stable across the lifespan, but it seems affected in late adulthood. This pattern is, again, influenced by the type of trigger used (Domaneschi and Di Paola 2019a).

Thus, the findings on the cognitive costs of presupposition processing in adults appear overall homogeneous. Presupposition accommodation is costlier than satisfaction and some categories of triggers involve higher cognitive efforts than others – arguably, either because they are resolution versus lexical triggers or because they activate weak versus strong presuppositions. These trends seem also to change across the lifespan, with patterns of decay in late adulthood. Overall, this suggests that the cognitive resources needed to process presupposition in adulthood are modulated by whether it is satisfied by the context or requires accommodation, as well as by the type of trigger. In turn, the higher cognitive resources index higher complexity associated with understanding presupposition, based on contextual availability and on the class of trigger.

1.3 The development of presupposition

Little is known about presuppositional skills in pre-school years. Developmental research has mostly focused on children's mastery of the focus sensitive particle *too* (see Pouscoulous 2013 for a review). Children have been reported to product this particle from very early on, at around the second half of their first year of life, in several languages that include German, French, Dutch, English (Nederstigt 2003) and Japanese (Matsuoka et al. 2006).

Surprisingly, the comprehension of *too* seems to emerge fairly late, from school-age onward, in various languages (Japanese: Matsuoka et al. 2006; Dutch: Bergsma 2006; German: Hüttner et al. 2004). Matsuoka et al. (2006) used a sentence-picture verification task to test 4–6-year-olds' comprehension of the Japanese 'mo' (also/too). Children were asked to reject or accept a puppet's description of a given scenario. For example, in a scenario in which only a chicken was washing dishes, the puppet uttered a sentence such as 'The chicken also washed a dish'. For all experimental scenarios, the correct answer was a rejection of the puppet's utterance. Children provided (incorrect) yes-answers from 100 to 81% of the times as the age increased (i.e., from 4 to 6 years of age). The studies on children's understanding of *too* in Dutch and German have mainly focused on differences in children's comprehension depending on whether the particle is accented or unaccented. In both Dutch and German, *too*-sentences can take two different readings based on their prosodic realization. When the focus particle is accented, the subject of the sentence is the domain of application of the particle, adding the information to the proposition that the subject S is an entity that is added to a set of contextually given alternatives. This activates the presupposition that someone else other than the subject S performs a given action. In contrast, in the unaccented variant, the domain of application of the focus particle is the object

of the sentence, adding the information to the proposition that the object O is added to a set of contextually given alternatives. This activates the presupposition that S has/has performed the object O and something else. Bergsma (2006) tested 4–7-year-olds' understanding of the Dutch particle 'ook' (too) in a picture selection task. The children heard unaccented *ook*-sentences (*The boy is petting the dog, too*; i.e., he is also petting another animal) or accented *ook*-sentences (*The boy, too, is petting the dog*; i.e., someone else is petting the dog as well), and could choose among three picture alternatives, that showed: (i) a boy petting a dog and a cat; (ii) a boy and a girl petting a dog; (iii) a boy petting a dog. Results indicated that 53% of the 4-year-olds and 40% of the 5-year-olds incorrectly selected the picture depicting the asserted content of the utterance (picture iii), while incorrect choices dropped dramatically to 7% at age 6. A similar paradigm was adopted by Hüttner et al. (2004), who tested 3–5-year-olds' and adults' comprehension of the German particle 'auch' (too). Again, participants heard sentences either with the stressed (e.g., *Max TOO wants to drive a* boat; i.e., someone else wants to drive a boat) or with the unstressed particle (e.g., *Max too wants to drive a* boat; i.e., Max wants to drive a boat and something else), along with assertive controls (e.g., *Max drives a boat*). Children could choose one of three pictures whose content was manipulated as in Bergsma (2006). Results indicated that the youngest children showed more difficulties interpreting the unstressed than the stressed variant of *too* and that children of all age groups exhibited more difficulties as compared to adults. In addition, the incorrect interpretation of *auch*-sentences as sentences with no particle decreased with age. Overall, these studies suggest that understanding a presupposition triggered by *too* is a late achievement and that children tend to ignore the discourse particle before school-age.

More recently, some researchers argued against the late achievement of *too*. They maintain that the use of metalinguistic judgements and paradigms involving presupposition failure (e.g., Matsuoka et al. 2006) might impede children's presuppositional skills and account for their seemingly poor comprehension of *too* (Berger and Höhle 2012; Höhle et al. 2009). In fact, more child-friendly paradigms lowered at 3 the age at which signs of *too* understanding are visible (Berger and Höhle 2012; Höhle et al. 2009; and see also Berger and Pouscoulous 2014; Pouscoulous 2008). Höhle et al. (2009) tested 2–4-year-olds' comprehension of the German *auch* in a highly ecological scenario in which children heard sentences and looked at pictures while their eye gaze was recorded. Results revealed that even 3-year-olds looked more often at the correct target objects for both the stressed and unstressed *auch* variants. Similar findings were found when children were actively engaged in an act-out task. Focusing only on the unaccented variant of *too/also*, Berger and Höhle (2012, experiment 1) asked 3- and 4-year-olds (and adults) to reward a toy character only when he accomplished two activities that he

was supposed to perform. For example, children were introduced to a lion puppet and were informed that he had to eat both a banana and an apple. The scenario ended with the lion uttering either a presupposing (*I've also eaten the apple*) or a no-particle sentence (*I've eaten the apple*). In line with adults' responses, all children correctly rewarded the toy characters significantly more often in the *also* condition. Interestingly, however, a developmental pattern emerged in the errors pattern: when the puppet accomplished only one action (i.e., *I've eaten the apple*), 3-year-olds incorrectly rewarded the puppet 60% of the times, while this proportion significantly dropped to 40% by age 4. On the whole, these data suggest that children's presuppositional skills might emerge much earlier than school age. In fact, it seems that, when the context satisfies the presupposition and when no metalinguistic tasks are required, even 3-year-olds take into account presuppositions triggered by the focus particle.

Developmental evidence is still limited for other presupposition triggers. Syrett et al. (2009) investigated pre-schoolers' (age 3–5) and adults' ability to evaluate definite descriptions based on gradable adjectives (e.g., 'the full one'). Participants saw pairs of objects and were asked to comply with a puppet's request, while the context felicity was manipulated. In the infelicitous condition, presupposition failure was involved. For instance, in one trial there were two disks, one with some spots and one with more spots, and the puppet requested for 'the spotted one'. In the felicitous condition, only one of the disks was spotted. Like adults, children of all age groups provided 100% acceptance rates in the felicitous condition, while they mostly rejected the puppet's request when the context was infelicitous. Therefore, pre-schoolers seem sensitive to presupposition failure with definite description. However, in the second of the two trials, participants were presented with two jars that were full to a different degree in the infelicitous context (one was literally full, the other was 2/3 full). This time, unlike adults, the children mostly accepted the puppet's request.[3] The authors interpreted children's behavior as indicating pragmatic tolerance: the children tolerated the puppet's imprecision and contextually adjusted the request (i.e., 'Give me the fuller one'). Syrett et al. (2009) represents preliminary evidence about pre-schoolers' ability to detect presupposition failure with definite descriptions. However, because of the different behavior in the two trials, this pattern remains unclear.

Dudley et al. (2015) tested 3-year-olds'ability to take into account the presupposition triggered by the verb *to know*. Children were asked to find a hidden toy in one of two boxes, after the experimenter provided a clue. The experimenter's clue consisted of an indication about the attitude of a puppet and could contain either the verb *to know* or the control verb *to think*, in both affirmative and negative

3 The same overall pattern of results was replicated also in Syrett et al.'s (2009) experiments 2 and 3.

forms. For example, the experimenter could utter 'Lambchops [the puppet] knows that it's in the red box' or 'Lambchops thinks that it's in the red box'. Results were mixed: while some of the children seemed to understand the presupposition triggered by *know* (e.g., the object is in the red box), other children treated neither *think* nor *know* as non-factive.

With a series of experiments, Aravind (2018) examined 4–6-year-olds' knowledge of two conditions that govern the speakers' use of presupposition: (i) the common ground requirement (i.e., presupposed information must be previously shared among interlocutors); and (ii) the violation of the common ground requirement (i.e., a speaker can introduce as presupposed information not previously shared with the addressee). (i) was investigated with regard to the presupposition of *too* (exp. 2A) and *the* (exp. 2B). A forced-choice inference task was used that forced the child to reason about what is common knowledge between the speaker and the addressee: the children heard stories about an animal character and two friends, and the stories were manipulated such that only one of the friends shared the presupposed information with the protagonist. The child was asked to identify which of the two friends was the interlocutor, based on the protagonist's final presupposing utterance (e.g., "Guess what? I ate an orange, too, today!"). Results of both experiments revealed that all age groups correctly chose the knowledgeable interlocutor, with 6-year-olds performing at ceiling. Therefore, children seem to master the common ground requirement already from age 4.

As for (ii), this was investigated with another experiment that focused on definite descriptions and used the same forced-choice inference task as before. This time, if the child knew that the common ground requirement can be violated, the expected choice would be the ignorant interlocutor. The 4-year-olds incorrectly chose the knowledgeable listener around 75% of the times and this behavior declined over time, with 5-year-olds choosing the incorrect listener around 50% of the time and 6-year-olds choosing this hardly ever. The author concludes that knowing that presuppositions might introduce new information emerges slowly in development, from age 5, and approaches adult-like levels at age 6.

Overall, Aravind (2018) shows that children grasp the common ground requirement already at age 4, but they come to know when and how accommodating a presupposition only later on. Yet, these studies looked at children's presuppositional abilities separately in contexts in which presupposed information was or was not shared by the interlocutors. More important, Aravind's task involved Theory of Mind (ToM) quite substantially. However, it is worth noting that ToM notably starts to emerge from age 4 (e.g., Happé 2003), and this might have concealed the presuppositional skills of children younger than 5 years of age.

To summarize, most of the developmental research on pre-schoolers' comprehension of presupposition has focused on one type of trigger, namely *too*,

and the current debate essentially splits in two positions. On the one hand, some studies suggest that children do not grasp the presupposition of *too* until school age. On the other hand, a few more recent studies show that even 3-year-olds can grasp the presupposition of *too* in more child-friendly paradigms. As for the other types of triggers, the developmental literature remains limited; results are sometimes inconclusive, and the paradigms used might conceal young children's presuppositional skills because they use tasks that rely on cognitive abilities more developed than those generally exhibited in pre-school years, such as ToM.

1.4 The present study

The theoretical debate has developed key distinctions between presupposition accommodation and satisfaction, as well as amongst the different classes of triggers. Experiments on adults have shown that presupposition accommodation is harder than satisfaction and that different triggers behave differently in terms of processing. These differences might influence presupposition comprehension in pre-school years, when the cognitive system is still developing and mental resources are not adultlike. Yet, little is known in this respect. To the best of our knowledge, no study has directly investigated children's presupposition comprehension when it is satisfied by the context compared to when it is not (and accommodation is required) or examined children's understanding of different classes of triggers within the same experimental design. Yet, exploring presupposition development in light of context availability and the type of trigger would crucially deepen our understanding of presupposition development and, ultimately, contribute to further consolidate research on presupposition itself.

The main goal of this study was to extend the developmental findings on presupposition comprehension in pre-school years and to trace a first developmental trajectory. In particular, we aimed at investigating the role of contextual availability and the type of trigger in pre-schoolers' understanding of presupposition. To these ends, we tested 3–5-year-olds in a story completion task that presented them with illustrated stories and asked them to complete these with one of three pictures that best matched the final sentence of the stories. The illustrated stories were manipulated so that the presupposition activated in the final target sentence could be either satisfied by the context or required accommodation.

Two presupposition triggers were used: the focus particle *too* and the factive verb *regret*. We opted for these triggers for three reasons. First, *too* and *regret* exhibit clearly different properties and are considered as different classes of triggers according to several theoretical approaches. *Too* is a resolution trigger (Zeevat 1992) whose accommodation is optional (Glanzberg 2003, 2005); *regret* is a lexical

trigger (Zeevat 1992) whose accommodation is mandatory (Glanzberg 2003, 2005). They therefore allow us to investigate whether the developmental trajectory for presupposition comprehension is bound to the type of trigger as described in these classifications. Second, keeping *too* in the design is essential to allow comparison with previous developmental research. Third, *regret* does not exhibit the sources of difficulty exhibited by other lexical triggers considered by previous works, such as *to know* or *to stop*,[4] and could burden young children's comprehension less.

Regret carries an attitudinal component – i.e., the speaker is sad about something she regrets. Children are sensitive to positive and negative emotional clues from the first year of life (e.g., Vaish et al. 2008) and exhibit full understanding of sadness and happiness by 3 years of age (e.g., Bisson 2019). Thus, the attitudinal component should not pose particular difficulty for children's understanding of *regret* in our study. Nonetheless, to control for their familiarity with the attitudinal content of *regret*, we constructed a pointing-and-naming picture book that assessed children's ability to recognize sadness (and happiness) with both a comprehension and a production task.

Based on previous findings on adults' and children's presuppositional abilities, we predicted that presupposition comprehension should improve as a function of age in pre-school years. Crucially, the developmental pattern might be influenced by the availability in context of the presupposition and by the type of trigger. Accommodation is costlier than satisfaction in adults' processing and children exhibit less difficulties in tasks that assess presupposition comprehension when this is satisfied by the context (e.g., Aravind 2018; Berger and Höhle 2012; Voltolini 2021) than when presupposition failure is involved (e.g., Bergsma 2006; Hüttner et al. 2004; Matsuoka et al. 2006). Therefore, we predicted that children should exhibit better understanding of a satisfied presupposition than one that requires accommodation. This pattern might improve as a function of age, and 5-year-olds might reveal more proficient with accommodation than the younger children.

The absence of developmental work comparing directly children's mastery of different triggers in tasks that look at presupposition comprehension *per se* – in particular *too* versus *regret* – prevents us from developing specific predictions. Nonetheless, adults' findings show that recovering the presuppositions of resolution/optional triggers requires greater cognitive efforts than recovering the presuppositions of lexical/mandatory triggers, presumably because the former would involve an inference-based search for an antecedent while the latter

4 *Know* can be assigned both a factive and non-factive reading (Dudley et al. 2015 for children; Domaneschi and Di Paola 2019b for adults) and *stop* involves a more complex mental representation that integrates two temporally displaced events, which turned to increase processing demands both in young (Domaneschi et al. 2014) and old adults (Domaneschi and Di Paola 2019a).

logically imply their presupposition. As long as they know the meaning of *regret*, children might therefore show less difficulties taking into account a presupposition activated by *regret* than a presupposition triggered by *too*. If this is the case, a developmental pattern should be bound to both context availability and trigger type: accommodating *regret* might overall turn easier than accommodating *too*; however, this too should improve as a positive function of age.

2 Methods

2.1 Participants

Fifty Italian speaking children aged between 3.1 and 5.11 years participated in the experiment. Children were divided into three age groups: the first group contained 16.3-year-olds (6 F; age range: 3.1–3.11; mean age: 3.3); the second group contained 16.4-year-olds (9 F; age range: 4.1–4.11; mean age: 4.2); the third group contained 18.5-year-olds (8 F; age range: 5.1–5.11; mean age: 5.3). They were recruited from the nursery and pre-school sections of a single school and were tested in a quiet area of the school. Written informed consent was obtained from parents or guardians of all participating children.

Children who failed to respond correctly after being corrected more than twice during the familiarization phase of the presupposition comprehension task were excluded from statistical analyses. Based on this criterion, 2 children were excluded from the analyses, one 3-year-old and one 4-year-old.

2.2 Materials and procedure

Children saw two tasks: first, the presupposition comprehension task; second, a task that assessed their familiarity with the attitudinal component of *regret*. Presupposition comprehension was assessed first to make sure that children's understanding of the regret-trials would not be biased by priming and/or training effects.

Materials and the detailed instructions for both tasks are available on the Open Science Framework online data repository (https://osf.io/h463r/?view_only=f4ea576b17a241a0953928ce1d5a02ec).

2.2.1 The presupposition comprehension task

Presupposition comprehension was assessed with a picture-matching task within a story completion game. A total of 48 illustrated stories in Italian were created.

Each story/trial was composed of three context sentences and one target sentence that concluded the story. Items were presented in three conditions: two experimental conditions, *Satisfaction* (SAT) and *Neutral* (NEU), and an *Explicit* control condition (EXPL). In the two experimental conditions, Context sentences 1 and 2 and the target sentence were fixed. Context sentence 3 was manipulated: the presupposed information triggered in the target sentence was either satisfied by the context (i.e., SAT) or it was not and required accommodation (i.e., NEU). In the Explicit condition, the target sentence explicitly stated both the asserted and the presupposed content. Target sentences could contain one of two presupposition triggers: the Italian focus particle *anche* (too) (N. stories: 24) and the Italian factive verb *dispiacersi* (regret) (N. stories: 24) – Figure 1.

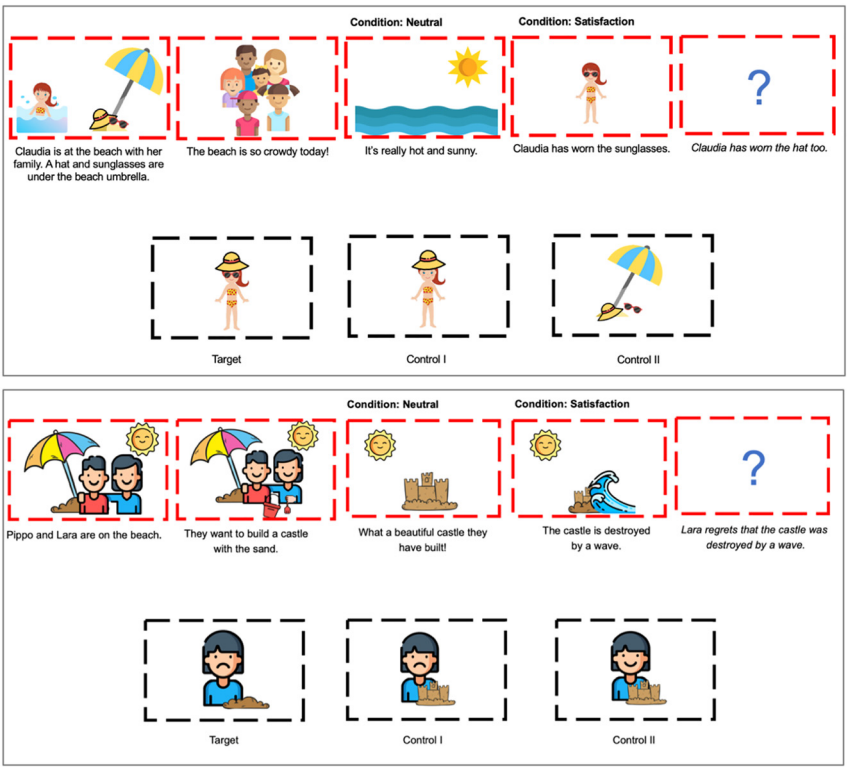

Figure 1: Sample trial with *anche* (too) (top) and *dispiacersi* (regret) (bottom) in condition NEU and SAT. The black dotted images are the three picture choices. In condition EXPL, context sentence 3 was the same as in NEU. The target sentences were "Claudia has worn the hat and the sunglasses" for *too* and "The castle was destroyed by a wave and Lara regrets this" for *regret*.

For each trial, children were read an illustrated story and were asked to complete this by putting in the empty final slot of the illustration a picture out of three that best matched the final (target) sentence of the story. The three picture choices included one target picture and two controls. The *target picture* showed both the asserted and the presupposed content of the target sentence; *Control I* showed only the asserted content of the target sentence; and *Control II* was a picture that showed neither the asserted nor the presupposed content (Figure 1). We reasoned that if the child picks *Control I*, then this would provide evidence for the child considering only the trigger, hence the asserted content, and ignoring the related presupposition; choosing *Control II* would indicate that the child does not consider either the trigger or the presupposition.[5] Finally, the child's selection of the target picture would indicate that she considers the trigger and understands the activated presupposition.

The children of each age group were randomly assigned to one of three lists of materials, such that the same child never saw the same story in all three conditions. For each list, the order of the stories was randomized. In each trial, the order of the presentation of the three picture alternatives was randomized too. For each trial, the child was first introduced the three picture choices one at a time and was asked to name the depicted objects to ensure she recognized them.[6] Afterwards, participants were told that the experimenter was unable to complete some difficult stories, but that she was sure that the child would be able to and that the child's help was essential. The experimenter told the child that they would now read a story together and that the child could help the experimenter to complete it by choosing the picture that best matched the final sentence. After reading each story, if the child did not make a choice, the experimenter repeated the instruction and the target sentence (e.g., "in which picture has Claudia worn the hat too?"). If the child still failed to make a choice, the experimenter completed the story. Each child saw 16 experimental trials and two warm-up stories, that were administered before the experimental trials to familiarize the child with task and procedure.

5 While designing the experiment, we also considered the possibility of adding a third control picture illustrating only the presupposed content and not the asserted content (e.g., destroyed castle, happy girl). However, considering that the attentional resources are very limited in the age ranges at stake in this experiment, especially for the 3-year-olds, we opted for two control pictures only.

6 For each trial, the picture alternatives were introduced before reading the story because, during piloting, we noticed that doing the other way around (i.e., first reading the story and then introducing the picture choices) confused the children too much. They tended to focus on the picture alternatives themselves rather than on the overall story and on completing the task.

2.2.2 Assessing the attitudinal component of regret

A naming-and-pointing picture book was created to assess children's knowledge of the psychological state associated with the factive verb *regret,* namely sadness. This task was inspired from Weisberg and Beck's (2012) pretesting of emotions in which pre-schoolers were asked to rate with a 5-point Likert scale a set of 5 yellow faces that ranged from *very sad* to *very happy*. In our task, children's familiarity with two basic emotions was assessed, namely sadness and happiness. This also allowed us to check for their ability to discriminate between the two emotions under scrutiny. The book consisted of a comprehension and a production part (N. trials/part: 6, 3 for happiness and 3 for sadness). Each of the two parts was composed of a set of pictures that could show human beings, animals and emoticons. We included different categories to ensure children could identify the targeted emotions across entities and assumed that this would have prevented biases related to associate happiness and sadness with a specific category. For each trial, there were four pictures. These showed a happy face, a sad face and two unrelated facial expressions that depicted emotions clearly distinguishable from happiness and sadness (e.g., anger or a neutral expression) – Figure 2. Different pictures were used for comprehension and production. Comprehension was assessed first by asking the child to point to the entity the experimenter named (e.g., for emoticons: which face is happy/sad?). In the production part, the child was asked to name the objects the experimenter pointed to (e.g., How is this face, happy or sad?[7]).

2.3 Coding and statistical analyses

For all tasks, the child's response accuracy was collected live by a second experimenter. In the presupposition task, this was coded as 1 or 0 depending on whether the child picked the correct picture alternative to complete the story. The picture the child picked from the three choices and arranged in the empty slot of the illustrated story was considered the child's choice. In this task, participants could achieve a maximum score of 16 correct responses. Additionally, incorrect responses in the presupposition task were then recoded as a binary variable to analyse the type of error (i.e., 1 for *Control I*; 0 for *Control II*).

7 We offered a response alternative because, during piloting, we noticed that children were not precise enough (for the purpose of the task) in their responses and sometimes provided responses that did not refer to the character's mental state (e.g., Experimenter: 'How is this girl?' – Child: 'She has long hair').

Figure 2: Sample of the materials used in the naming-and-pointing picture book to assess the attitudinal component of *regret*.

In the assessment of the psychological state associated with *regret*, each correct answer was assigned one point. The responses were deemed correct when the child pointed to the target picture (i.e., comprehension: 6 items, 3 for sadness and 3 for happiness) and when she named the correct emotion (i.e., production: 6 items, 3 for sadness and 3 for happiness).

As a general procedure, accuracy was analysed using Generalized Linear Models[8] (GLM; i.e., logistic regression with a logit link) for the main overall statistical analyses and Tukey contrasts for multiple comparisons. When needed, separate analyses by age group were conducted to breakdown significant interactions.

In the presupposition task, the GLM model included Age Group, Condition, Trigger Type and their interactions as the independent variables, while accuracy was the dependent variable. To analyse the type of errors, GLM statistics was used too, as well as separate GLM analysis by age group and chi-square statistics with Yate's continuity correction when needed.

8 Data were first analyzed with generalized linear mixed models (GLMMs), with subjects and items as random factors. These models revealed that the variance for both random factors was very close to zero, and – most probably because of this – did not converge. For this reason, generalized linear model statistics was used. Considering that the GLMMs revealed very small variance in the random factors, Generalized linear models would still provide reliable results.

Children's familiarity (i.e., accuracy in comprehension and production) with the psychological state associated with *regret* was analysed using GLM statistics too. For both comprehension and production, the model included Age Group, Type of Emotion (i.e., sad vs. happy trials) and their interaction.

All statistical analyses were conducted using R software; the glm function in the lme4 package and the Multcomp package in the R environment were used respectively for GLM statistics and multiple comparisons. Data are available on the Open Science Framework web platform, including the R code for the analyses (https://osf.io/h463r/?view_only=f4ea576b17a241a0953928ce1d5a02ec).

3 Results

3.1 Presupposition comprehension

Table 1 reports the proportion of correct responses averaged across interacting variables GroupXCondition, GroupXTrigger and GroupXTriggerXCondition. Both 4- and 5-year-olds performed above chance (i.e., 0.33) in all conditions for both trigger types, as their probability of selecting the correct picture to complete the stories falls outside the 95% Wald CI of the estimated mean proportion of correct answers. Interestingly, the group of 3-year-olds was above chance in all conditions where *dispiacersi/regret* was involved. Yet, when *anche/too* was involved, 3-year-olds performed at chance in all conditions, as their probability to select the correct picture choice in trials with *anche* falls within the estimated mean proportion of correct answers.

A first GLM revealed (i) a main developmental effect, and (ii) age-group differences depending on condition.

(i) *Developmental effect*. Three-year-olds were overall less likely to complete the stories correctly than both 4- (b = 1.808, SE = 0.526, z = 3.433, p<0.001) and 5-year-olds (b = 2.943, SE = 0.678, z = 4.338, p<0.0001). No differences emerged between 4- and 5-year-olds (b = 1.135, SE = 0.727, z = 1.56, p = 0.43).

(ii) *Age Group differences depending on condition*. In the Neutral condition (as compared to condition EXPL), 3-year-olds were significantly less accurate than both 4- (b = –1.463, SE = 0.690, z = –2.119, p = 0.03) and 5-year-olds (b = –2.843, SE = 0.802, z = –3.543, p < 0.001). Tukey contrasts provided a more detailed picture. The biggest differences emerged between age 5 and 3: five-year-olds were significantly more accurate in the explicit than in the neutral condition (b = –2.421, SE = 0.630, z = –3.843, p < 0.01), and importantly, they performed significantly better than 3-year-olds in the explicit (b = 3.336, SE = 0.628, z = 5.308, p<0.01), satisfaction (b = 1.735, SE = 0.393, z = 4.417, p < 0.01) and

Table 1: Mean proportion of correct responses averaged across interacting variables Group by Condition, Group by Trigger and Group by Trigger by Condition (Lower CI – Upper CI).

	Group by condition			Group by trigger	
	Explicit	**Satisfaction**	**Neutral**	**Too**	**Regret**
3-year-olds	0.51 (0.40–0.63)	0.58 (0.47–0.69)	0.50 (0.38–0.61)	0.46 (0.37–0.55)	0.60 (0.51–0.69)
4-year-olds	0.80 (0.71–0.88)	0.68 (0.57–0.78)	0.62 (0.51–0.72)	0.67 (0.59–0.76)	0.72 (0.64–0.80)
5-year-olds	0.96 (0.93–1)	0.88 (0.82–0.95)	0.73 (0.63–0.81)	0.75 (0.68–0.82)	0.96 (0.93–0.99)

Group by trigger by condition

Too

	Explicit	**Satisfaction**	**Neutral**
3-year-olds	0.43 (0.27–0.59)	0.47 (0.31–0.63)	0.47 (0.31–0.63)
4-year-olds	0.82 (0.70–0.94)	0.64 (0.48–0.79)	0.56 (0.40–0.71)
5-year-olds	0.93 (0.86–1)	0.83 (0.72–0.94)	0.50 (0.35–0.64)

Regret

	Explicit	**Satisfaction**	**Neutral**
3-year-olds	0.60 (0.44–0.75)	0.69 (0.54–0.84)	0.52 (0.36–0.68)
4-year-olds	0.77 (0.63–0.91)	0.71 (0.57–0.86)	0.68 (0.53–0.83)
5-year-olds	1 (1–1)	0.93 (0.86–1)	0.95 (0.89–1)

neutral condition (b = 0.990, SE = 0.320, z = 3.090, p = 0.04). Four-year-olds appeared to be in the middle between children at age 3 and 5: in the explicit condition, they were more accurate than 3-year-olds (b = 1.310, SE = 0.358, z = 3.651, p < 0.01), but still less accurate than 5-year-olds (b = 2.025, SE = 0.649, z = 3.117, p = 0.04); in the satisfaction condition, their probability of correctly completing the stories was lower than 5-year-olds' (b = 1.316, SE = 0.401, z = 3.278, p = 0.02); in the neutral condition, they were as accurate as 5-year-olds (b = 0.492, SE = 0.323, z = 1.523, p = 0.83).

Overall, these results suggest that pre-schoolers' presupposition comprehension depends on the context of availability, as well as age group. The biggest differences appeared between the age of 3 and 5 and more difficulties emerged in the neutral than the satisfaction condition. Age-related differences emerged also in the explicit condition, with 5-year-olds performing significantly better than 4- and 3-year-olds. Unsurprisingly, this suggests a developmental pattern in children's general linguistic abilities.

To better explore the developmental pattern in children's presuppositional skills, a second GLM analysis was conducted on accuracy in SAT and NEU conditions only, for both *regret* and *too*. To illustrate the developmental patterns more clearly, Figure 3 graphically displays the frequency of correct responses in each age group, experimental condition and trigger type. This analysis confirmed the previous GLM statistics and revealed a significant two-ways interaction Condition X Age Group (Condition SAT × Group 5-year-olds: b = 1.634, SE = 0.658, z = 2.483, p = 0.01). Tukey contrasts for this interaction revealed that: 5-year-olds were more likely to respond correctly than 3-year-olds both in NEU (b = 0.990, SE = 0.320, z = 3.090, p = 0.02) and in SAT (b = 1.735, SE = 0.393, z = 4.417, p < 0.001); and they were significantly more accurate than 4-year-olds in SAT (b = 1.316, SE = 0.401, z = 3.279, p = 0.01).

Importantly, this analysis also revealed age group differences depending on (i) trigger type (Group 5-year-olds × Trigger Regret: b = 2.935, SE = 0.897, z = 3.271, p < 0.001), and (ii) trigger type and condition (Condition SAT × Group 5-year-olds × Trigger Regret: b = –2.750, SE = 1.237, z = –2.223, p = 0.02). Tukey contrasts for these interactions refined the picture as follows:

(i) *Age group differences depending on Trigger type*. First, 5-year-olds were overall more accurate with *regret* than with *too* (b = 2.203, SE = 0.507, z = 4.343, p < 0.001). With *regret*, their accuracy rates were higher than both 3- (b = 2.475, SE = 0.513, z = 4.818, p < 0.001) and 4-year-olds' (b = 2.065, SE = 0.519, z = 3.971, p<0.001) (Age 3 vs. 4: b = 0.410, SE = 0.335, z = 1.222, p = 0.82). With *too*, the difference between 5- and 3-year-olds approached significance (b = 0.808, SE = 0.311, z = 2.600, p = 0.09). Four-year-olds' performance with *too* did not

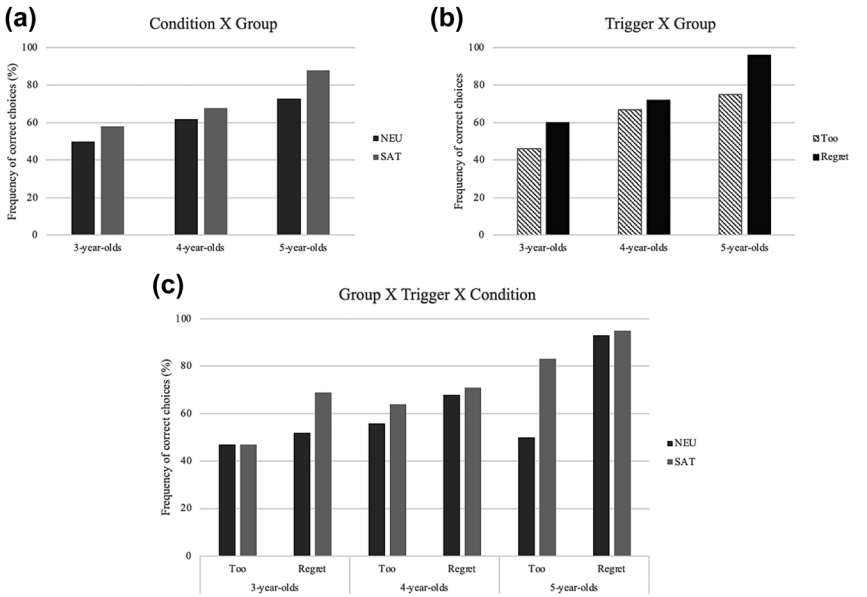

Figure 3: Developmental patterns across age group as depending on context availability and trigger type. Frequency of correct responses averaged across interacting variables.
(a) Condition × Group, (b) Trigger × Group, (c) Group × Condition × Trigger.

differ from either 5- (b = 0.303, SE = 0.314, z = 0.965, p = 0.92) or 3-year-olds' (b = 0.505, SE = 0.319, z = 1.581, p = 0.60).

(ii) *Age group differences depending on Trigger and Condition.* When the context was neutral, 5-year-olds were significantly more accurate with *regret* than with *too* (b = 3.135, SE = 0.777, z = 4.032, p < 0.01). Moreover, they were more accurate in SAT than in NEU with *too* (b = 1.634, SE = 0.482, z = 3.387, p = 0.03), but not with *regret* (b = −0.405, SE = 0.936, z = −0.433, p = 1). Interesting differences also emerged between 5- and 3-year-olds: with *too*, 5-year-olds were significantly more accurate than 3-year-olds when this was satisfied by the context (b = 1.734, SE = 0.499, z = 3.471, p = 0.02); with *regret*, they were significantly more accurate than 3-year-olds when this was presented in a neutral context (b = 3.035, SE = 0.788, z = 3.849, p < 0.01).

Taken together, these results suggest a developmental pattern in children's presuppositional skills between the age of 3 and 5, and this seems to depend on both the availability in context of the presupposition and the type of trigger. Children tended to be overall less accurate in the neutral condition that required

accommodation (vs. satisfaction) and when the presupposition was triggered by *too* as compared to *regret*. Yet, a developmental effect emerged: the 5-year-olds were more accurate when the presupposition of *too* was satisfied by the context as compared to when accommodation was required; interestingly, at age 5, children's accuracy rates did not differ between conditions when *regret* was involved. Importantly, this pattern was not the same at age 3.

3.1.1 Analysis of errors

Table 2 shows the mean proportion of incorrect choices *Control I* (i.e., pictures showing the asserted content only) and *Control II* (i.e., pictures showing neither the asserted nor the presupposed content) in each age group for *regret* and *too* in conditions SAT and NEU. The GLM analysis revealed that, when making mistakes, both 4- and 5-year-olds chose *Control I* significantly more often than 3-year-olds (Age 4 vs. 3: $b = 1.514$, SE = 0.768, $z = 1.970$, $p < 0.05$; Age 5 vs. 3: $b = 2.302$, SE = 0.858, $z = 2.683$, $p < 0.01$; Age 4 vs. 5: $b = 0.788$, SE = 0.972, $z = 0.811$, $p = 0.41$). In addition, even though incorrect responses were higher for *too* than for *regret* (see Table 1), both 4- and 5-year-olds chose *Control I* significantly more often in incorrect trials with *too* than with *regret* ($b = -2.813$, SE = 0.912, $z = -3.082$, $p = 0.002$). Interestingly, this analysis also revealed that the pattern of errors between 4- and 3-year-olds significantly differed by trigger type ($b = -2.823$, SE = 1.111, $z = -2.540$, $p < 0.05$).

To better explore these group-related differences, separate GLM statistics were conducted for each age group. This set of analyses showed that the proportion of choices between *Control I* and *Control II* significantly differed only in the group of 4-year-olds depending on the type of trigger ($b = -2.813$, SE = 0.912, $z = -3.082$, $p = 0.002$). Chi-squared statistics revealed that 4-year-olds chose *Control I* significantly more often than *Control II* in incorrect trials with *too* ($\chi^2(1) = 13.44$, $p = 0.0002$), while this difference was not significant in incorrect trials with *regret* ($\chi^2(1) = 2.083$, $p = 0.14$).

No significant differences between the frequency of *Control I* and *Control II* emerged in the group of 3- and 5-year-olds, presumably because 3-year-olds were at chance when making mistakes; conversely, 5-year-olds made very few mistakes (see Table 1) (Age 3: Condition: $b = -0.19$, SE = 0.617, $z = -0.308$, $p = 0.75$; Trigger: $b = 0.01$, SE = 0.634, $z = 0.016$, $p = 0.98$; Condition × Trigger: $b = -0.251$, SE = 0.967, $z = -0.260$, $p = 0.79$. Age 5: Condition: $b = 17.16$, SE = 3,802.11, $z = 0.005$, $p = 0.99$; Trigger: $b = 17.16$, SE = 7,604.23, $z = 0.002$, $p = 0.99$; Condition × Trigger: $b = -36.041$, SE = 8,501.79, $z = -0.004$, $p = 0.99$).

Overall, then, the distribution of errors was not the same in all age groups. When not understanding the presupposition, 3-year-olds indiscriminately chose either *Control I* or *Control II*. At age 4, this pattern changes substantially: 4-year-

Table 2: Mean proportion of incorrect responses *Control I* and *Control II* averaged across interacting variables Group by Condition, Group by Trigger and Group by Trigger by Condition.

	Group by condition				Group by trigger			
	Satisfaction		Neutral		Too		Regret	
	Control I	Control II	Control I	Control II	Control I	Control II	Control I	Control II
3-year-olds	0.45	0.54	0.52	0.47	0.50	0.50	0.48	0.51
4-year-olds	0.72	0.28	0.58	0.41	0.84	0.15	0.37	0.62
5-year-olds	0.90	0.09	0.92	0.07	0.93	0.06	0.80	0.20

Group by trigger by condition

Too

	Satisfaction		Neutral	
	Control I	Control II	Control I	Control II
3-year-olds	0.47	0.52	0.52	0.47
4-year-olds	0.85	0.14	0.83	0.16
5-year-olds	1	0	0.91	0.08

Regret

	Satisfaction		Neutral	
	Control I	Control II	Control I	Control II
3-year-olds	0.41	0.58	0.52	0.47
4-year-olds	0.54	0.45	0.23	0.76
5-year-olds	0.66	0.33	1	0

olds made more mistakes when the presupposition was triggered by *too* than by *regret*. Yet, in incorrect trials with *too*, they still considered the trigger, while ignoring the presupposed content.

3.1.2 Assessment of the attitudinal component of regret

All age groups performed well in the pointing-and-naming picture book that assessed their familiarity with the attitudinal component of *regret*. In the comprehension part of the book, 3-year-olds provided 75 and 66% correct answers respectively to the sadness trials and the happiness trials. Four-year-olds pointed to the correct items 97% of the time in the sadness trials and 92% of the time in the happiness trials. Five-year-olds were 98% accurate in both the sadness and the happiness trials. In the production part of the book, children were at ceiling: 3-year-olds named correctly the sad items 91% of the time and did so 93% of the time for the happy items; both 4- and 5-year-olds produced the correct label 100% of the time in both the sad and happy trials.

For comprehension, the GLM statistics revealed that the 3-year-olds were overall significantly less accurate than both 4- (b = 1.871, SE = 0.677, z = 2.763, p = 0.005) and 5-year-olds (b = 3.332, SE = 1.057, z = 3.152, p = 0.001). As expected, this indicates a developmental pattern, yet 3-year-olds'accuracy rate remains very high. No differences emerged between 4- and 5-year-olds (b = 1.460, SE = 1.173, z = 1.245, p = 0.41). No differences related to the type of emotion (i.e., happy vs. sad) emerged either (Emotion Type: b = 0.435, SE = 0.469, z = 0.927, p = 0.35; Group 4-year-olds (vs. 3-year-olds) × Emotion Type: b = 0.713, SE = 1.266, z = 0.563, p = 0.57; Group 5-year-olds (vs. 3-year-olds) × Emotion Type: b = –0.435, SE = 1.501, z = –0.290, p = 0.77). As for production, the GLM statistics revealed neither age group differences (Age 4 vs. 3: b = 18.927, SE = 4,510, z = 0.004, p = 0.99; Age 5 vs. 3: b = 18.927, SE = 3,871, z = 0.0055, p = 0.99; Age 4 vs. 5: b = 0.000, SE = 5,945, z = 0.000, p = 1), nor emotion-related differences (Emotion Type: b = –0.311, SE = 0.794, z = –0.392, p = 0.69; Group 4-year-olds (vs. 3-year-olds) × Emotion Type: b = 0.311, SE = 6,379, z = 0.000, p = 0.1; Group 5-year-olds (vs. 3-year-olds) × Emotion Type: b = 0.311, SE = 5,475, z = 0.000, p = 0.1).

Therefore, children of all age groups are familiar with the attitudinal component of *regret* and can discriminate between sadness and happiness.

4 Discussion

This study looked at the role of contextual availability and trigger type in preschoolers' presupposition comprehension. We tested 3–5-year-olds' understanding of

a presupposition triggered by the Italian *dispiacersi* (regret) and *anche* (too) in presupposition satisfaction and accommodation. Overall, both trigger type and contextual availability affect pre-schoolers' ability to presuppose; the developmental trajectory depends then on what type of presupposition (i.e., satisfied vs. one that needs accommodation) is activated by what type of trigger. Two main broad patterns of results emerged. First, independently of contextual availability, children of all age groups were above chance with presuppositions triggered by *dispiacersi* (regret). Interestingly, this was not the case for *anche* (too): 4- and 5-year-olds were above chance, but not 3-year-olds. Second, results revealed a range of developmental effects depending on both the availability in context of a presupposition and the type of trigger. Therefore, pre-schoolers seem more proficient with presupposition comprehension than previously thought, at least from age 4. Yet, children's understanding of presupposition changes depending 1) on whether accommodation is needed or the presupposition is satisfied and 2) on whether the presupposition is triggered by *regret* or *too*. Importantly, a developmental effect occurs throughout pre-school years. First we discuss children's chance level differences between *dispiacersi* and *anche* (§ 4.1). We then focus on the range of developmental effects bound to contextual availability and type of trigger (§ 4.2).

4.1 *Regret* versus *too*: Chance level differences

At age 3, children exhibited some understanding of presupposition. However, in our picture-matching task, their comprehension seems to hinge on the specific type of trigger: 3-year-olds were above chance only with *dispiacersi*. By age 5, children exhibited a better understanding of *dispiacersi*- as well as *anche*-triggered presuppositions, both when they were satisfied and when they needed accommodation. Thus, on the whole, a stark improvement in presupposition understanding occurs between the age of 3 and 5. This broad pattern already indexes a developmental trajectory in presupposition comprehension and stands against the idea that presupposition understanding is a late achievement. In fact, it disconfirms previous findings showing that children comprehend presupposition only from school-age onward and that they systematically ignore the presuppositional content of discourse particles beforehand (e.g., Bergsma 2006; Hüttner et al. 2004; Matsuoka et al. 2006). Rather, our findings indicate that the ability to take into account background information is already present as early as pre-school age; they are, in this respect, in line with Höhle et al. (2009) and Berger and Höhle (2012).

Yet, our participants' performance with *too* did not fully replicate Höhle et al. (2009) and Berger and Höhle (2012). Höhle et al. (2009) tested 2.11–4.11-year-olds' understanding of the German *auch* with eye tracking and reported a high

percentage of children's looks at the target object. Berger and Höhle (2012) tested 3- and 4-year-olds' understanding of *auch* in a behavioral paradigm based on a puppet-rewarding procedure and reported that both age groups correctly rewarded the puppet at ceiling. In our study, 4- and 5-year-olds performed above chance and exhibited a good understanding of *anche*-related presupposition. Nevertheless, they were not at ceiling and 3-year-olds approached chance level. We interpret these discrepancies in terms of differences in task demands across studies. Our design used child-friendly materials and a picture-matching task adapted to young children, which was adopted in several experiments on pragmatic development (e.g., Di Paola et al. 2020; Katsos and Bishop 2011; Miller et al. 2005). However, unlike eye tracking and the act-out task in Höhle et al. (2009) and Berger and Höhle (2012), the picture-matching task still involves some metalinguistic reasoning. Additionally, our participants were asked to complete the stories by choosing amongst three picture alternatives, therefore no hint other than the story context and child-friendly materials was provided that could smooth presupposition comprehension. Overall, this might have made the derivation of presupposed content more stringent for all age groups, especially for the youngest one. Moreover, in this experiment we used the equivalent of the unaccented variant of *too,* that is sentences in which the domain of application of the focus particle was the sentence object (e.g., 'Claudia has worn the hat too' activates the presupposition that Claudia has worn something other than the hat). Studies looking at pre-schoolers' understanding of stressed versus unstressed variants of *too* with a picture-matching paradigm observed that German children as young as 3 years of age show more difficulties with the unstressed variant (e.g., Hüttner et al. 2004). Contrary to Dutch and German, in Italian, the domain of application of the focus particle is disambiguated by the sentence word order. Whether or not young Italian children's understanding of *anche* is affected by its domain of application (i.e., sentence subject or object) is unknown yet. Nevertheless, we cannot exclude that the use of unaccented *too* might contribute explaining our 3-year-olds' difficulties. This issue is interesting and would deserve further investigation in future studies on Italian.[9]

9 Someone might argue that the two contexts provided with *too* and *regret* (Figure 1) are different and cannot be used to measure the same variable. In other words, an objection might be that, in case of *also* (Story 5), the accommodation involves information that is less accessible than in case of *regret*. The reason is that, while in the first case the indication of the hat and sunglasses is in the first picture, in case of *regret* the information of the destruction of the castle is provided in the picture before the blank image. In the accommodation condition, the presupposed content of *regret* in *ALara dispiace che il castello sia stato distrutto da un'onda* (namely the castle – already mentioned – has been destroyed) might seem different than the one presupposed by *also* in *Claudia ha indossato anche il cappello*. A possibility is that, in this latter statement, the interpreter needs to i) accommodate the fact that Claudia wore something else apart from the hat, ii) infer that the thing that she wore was something that was under the umbrella (which is not necessary),

Important, the overall developmental trend revealed by our findings is consistent with the studies above. Indeed, Berger and Höhle (2012) found that *auch* understanding improved as a positive function of age (i.e., the percentage of incorrect trials dropped by 20% from 3 to 4 years of age) – which indicates a developmental pattern in pre-schoolers' understanding of the presupposition of *too*.

Our 3-year-olds performed below chance in the explicit condition for *too*, in which both the asserted and the presupposed content were explicit. This finding is unexpected. It may suggest that 3-year-olds did not understand the task. However, they performed above chance with *regret* – especially in the explicit condition when and when the presupposition was satisfied by the context (i.e., in EXPL and SAT) – which goes against the hypothesis that they did not understand the task. Alternatively, chance performance in the explicit condition for *too* might be due to an unwanted bias in the materials. In the explicit condition, the target sentences were *and*-constructions conjoining two terms. For instance, for the target sentence 'Claudia has worn the hat and the sunglasses', 3 picture alternatives showed a girl wearing both hat and sunglasses (Target), a girl wearing the hat (Control I), hat and sunglasses under a beach umbrella (Control II). It is well established that the semantics and pragmatics of the conjunct *and* are not trivial (e.g., Carston 2002); this might have been responsible for some ambiguity of the target sentences in the explicit condition for *too*. Even though the type of *and*-construction that we used does not seem particularly difficult, it would still be compatible with an enriched interpretation of *and* in the trials for *too*. The youngest children might have been pragmatically tolerant (see Katsos and Bishop 2011 on children's pragmatic tolerance) and might have interpreted a sentence such as 'Claudia has worn the hat and the sunglasses' as meaning 'Claudia has worn the hat *and then* she has worn the sunglasses'. Because none of the alternative pictures depicted this temporal sequence, this might have led them to respond at chance. Note that the same enriched interpretation of *and*-sentences seems less likely in *regret* trials. Here, the explicit condition involved sentences such as 'The castle was destroyed by a wave and Lara regrets this'. Intuitively, an enriched interpretation 'The castle was

iii) remember that there was a hat and sunglasses in the first image and iv) draw the conclusion that she wore sunglasses. In this view, our experiment would measure working memory abilities instead of accommodation. The reason why we are inclined to reject this objection is that we do not believe that ii), iii) and iv) are inferential steps necessary for accommodating the presupposition of *too*. In fact, in this case, the child only needs to infer that Claudia wore another item in addition to the hat. The sunglasses are indeed a good guess, since they are represented in the picture, but this is not a necessary inference to understand the utterance. Rather, it is simply a matter of differentiating between one item (hat, when there's not presupposition) and two items (the hat + *x*, to accommodate the presupposition).

destroyed by a wave *and then* Lara regrets this' does not seem as likely as 'Claudia has worn the hat *and then* she has worn the sunglasses'. In the *regret* scenarios the destruction of the castle and the regret seem to occur simultaneously, the conjunction is therefore less prone to ambiguous interpretation. Also, the two *and*-constructions do not exhibit the same syntactic structure. *And*-sentences such as 'Claudia has worn the hat and the sunglasses' involve a coordination with dependency (i.e., [Claudia$_1$ has worn$_1$ the hat] and [S_1 V_1 the sunglasses]). *And*-sentences such as 'The castle was destroyed by a wave and Lara regrets this' involve no dependency (i.e., [S_1 V_1 by a wave] and [S_2 V_2 this]). Even though young children seem familiar with both and-constructions in acquisitional studies on the syntax of coordination (e.g., Friedmann and Costa 2010), this difference in syntactic structure might have contributed to the dependency coordination sentences becoming more ambiguous and more susceptible to an enriched interpretation of *and*. When constructing the materials, we used *and*-constructions for two main reasons: first, this allowed us to balance the content of the target explicit sentences with both *too* and *regret*; second, this allowed us to use the same alternative choices in all 3 conditions and keep the target picture fixed across conditions. Yet, the use of the *and*-conjunct might have posed extra difficulties to young children of 3. While we aimed at reducing the differences resulting from the use of two different triggers, this might have made comprehension more obscure. This unwanted bias represents a limitation of this study and would deserve further investigation in future studies. Since the 3-year-olds were at chance also in the explicit condition for *too,* caution is needed for the interpretation of their data. Importantly, however, this issue does not hold for the two experimental conditions SAT and NEU, where no coordination was involved.

4.2 Contextual availability and type of trigger: Developmental effects

Most important for the purpose of our study, the second pattern of results revealed a range of developmental effects depending on (i) condition, (ii) type of trigger, and (iii) condition *and* type of trigger. For clarity of exposition, we discuss these separately.

(i) *Developmental effects depending on condition*

In the satisfaction condition, 5-year-olds were significantly more accurate than both 3- and 4-year-olds, while no differences emerged between 3- and 4-year-olds; in the neutral condition, 5-year-olds were marginally more accurate as compared to the satisfaction condition ($p = 0.06$) and they were significantly more accurate

than 3-year-olds. Therefore, the developmental trajectory of presupposition understanding in pre-school years seems modulated by the availability in context of a presupposition. Specifically, satisfaction and accommodation seem to follow slightly different developmental paths. Comprehension of a satisfied presupposition is already present at the age of 3 years and starkly improves from 4 to 5 years of age, when children reach ceiling levels. Things seem different with presupposition failure, for which a stark improvement is visible at the age of 5; by then children can repair the context by accommodating a presupposition. Yet, some difficulties persist compared to understanding non-presupposing utterances (i.e., significant difference in EXPL vs. NEU) and satisfied presuppositions (i.e., contrary to SAT, 5-year-olds were not at ceiling in NEU and the difference might have approached significance due to the small number of observations). Overall, these findings suggest that comprehension is harder for young children when accommodation is required than when the context satisfies the presupposition. Moreover, they shed light on the developmental trajectory and reveal that understanding a satisfied presupposition emerges earlier than the ability to accommodate, thus providing a novel contribution to developmental research on the topic. This pattern contributes to explain some of the discrepancies in previous findings. It confirms Höhle et al.'s (2009) and Berger and Höhle's (2012) intuition that presupposition failure might have lowered children's performance in tasks that required accommodation (i.e., Bergsma 2006; Hüttner et al. 2004; Matsuoka et al. 2006), thus concealing preschoolers' presuppositional abilities.

Interesting, this developmental pattern is also overall consistent with Aravind (2018). Aravind finds that knowing that presupposition must be common knowledge among interlocutors – i.e., a condition involved in presupposition satisfaction – emerges earlier than recognizing that presupposition may not be shared among interlocutors (i.e., a condition involved in accommodation). However, in Aravind's work, children started to be aware of the common ground violation only from age 5 (§1.3). In our study, children already exhibited a good ability to accommodate presupposition at age 4 (i.e., 62% correct responses in NEU). This discrepancy is likely due to differences in task demands between studies. In fact, Aravind used a forced-choice task to investigate children's awareness of the common ground conditions that govern the speakers' use of presupposition. This task relies dramatically on ToM and might have obscured the presuppositional skills of 4-year-olds, whose ToM abilities are indeed not yet as mature as at age 5 or 6. Our task was much simpler and did not specifically rely on ToM to investigate pre-schoolers' presupposition comprehension, thus allowing for young children's ability to accommodate presupposition to emerge more clearly.

Finally, our findings do not only match traditional theories on presupposition that distinguish between satisfaction and accommodation (i.e., Heim 1982; Lewis

1979), but also fit smoothly with adults' studies showing greater costs for presupposition accommodation (vs. satisfaction). These are presumably associated with recognizing the failure, deriving background content and updating the discourse mental model with the lacking presupposition (e.g., Domaneschi and Di Paola 2018; Schwarz 2007; Tiemann et al. 2015) – a series of mental operations that could slow down the developmental time-course.

(ii) *Developmental effects depending on type of trigger*

This study brought to light the following trigger-related effects. First, 5-year-olds were more accurate with *regret* than with *too*. Second, with *regret*, they were more accurate than both 3- and 4-year-olds, while no differences emerged between age 3 and 4. Third, no age group-differences emerged with *too*, except for a marginal significance between 5- and 3-year-olds ($p = 0.09$). Taken together, these findings suggest that the development of presupposition comprehension is bound to the type of trigger. By age 4, children already master the ability to understand a presupposition triggered by *regret*. However, it is only by age 5 that they reach ceiling levels. Therefore, a stark improvement seems to occur between 4 and 5 years of age. Interestingly, a different developmental scenario surfaces with *too*, in this picture-matching paradigm. All age groups were less accurate with *too* (vs. *regret*), and no neat age-group differences emerged. This indicates more difficulties at taking into account the presupposition of *too* compared to that of *regret* in pre-school years. Moreover, the marginal significance between 3- and 5-year-olds deserves a mention. Considering that, contrary to 5-year-olds, 3-year-olds were below chance in the *too*-trials, this hints at a developmental path and the marginal significance might be due to the small number of observations. Importantly, it was only by age 5 that the comprehension patterns for the two triggers neatly branched off: while still exhibiting difficulties with *too*, by age 5 any difficulty with *regret* is fully overcome. Understanding a presupposition triggered by *regret* starkly improves by 5 years of age; conversely, the developmental trajectory for *too* seems slower and, despite improvement, difficulties still persist even at age 5.

Why is it more difficult to understand the presupposition of *too* than that of *regret* for a young child? Since no previous developmental findings on this are available, we draw on the theoretical accounts and interpret the developmental differences in virtue of the different features attributed to the two classes of triggers under scrutiny. *Regret* encodes the activated presupposition (i.e., regretting × encodes that × has happened; see Zeevat 1992). Additionally, it is a strong presupposition trigger (Glanzberg 2003, 2005) – that is, taking into account the correspondent presupposition is necessary to meaningfully update the discourse mental model. Based on this, it may be the case that once a child is familiar with the conventional meaning of *regret*, this already enables her/him to derive its presupposition. Consistently, our participants mastered

the attitudinal component of *regret* and this provides evidence for their familiarity with the conventional meaning of *regret*. Conversely, *too* is conceived of as a resolution (Zeevat 1992) and weak presupposition trigger (Glanzberg 2003, 2005). Understanding a presupposition of *too* requires an inferentially-based search for a suitable antecedent in the discourse and this may tax children's comprehension in pre-school years. Evidence from adults' studies is compatible with an interpretation along these lines. The presuppositions of weak presupposition triggers such as focus-sensitive particles are processed less frequently than those of strong presupposition triggers such as factive verbs (Domaneschi et al. 2014), and processing resolution triggers is costlier than processing lexical triggers (Domaneschi and Di Paola 2018). Moreover, when cognitive functioning is affected by aging, people exhibit some difficulties with resolution triggers, but not with lexical triggers (Domaneschi and Di Paola 2019a). In this wider scenario, then, the differences between the triggers at stake can reasonably influence the developmental path, too. Young children might grasp a *regret*-triggered presupposition more easily than a presupposition of *too* in virtue of the less demanding interpretive mechanism for *regret*, in which no context-dependent retrieval of previous information is strictly necessary for understanding.[10]

Alternatively, one might hypothesize that a potential bias in the pictorial material might have contributed to children's poorer performance with *too*, especially for the 3-year-olds. Our *Control II* showed neither the asserted nor the presupposed content of the target sentence. For instance, given target sentences such as "Claudia has worn the hat too" and "Lara regrets that the castle was destroyed by a wave", *Control II* illustrated, respectively, a hat and sunglasses under a beach umbrella and a smiling Lara with a sand castle. The elaboration of the materials aimed to minimise differences between *too*- and *regret*-trials. Despite

10 It is worth noticing, however, that Judith Tonhauser, David Beaver, Craige Roberts and Mandy Simons recently proposed a series of novel diagnostics in order to distinguish among types of projective contents, hitherto thought of in terms of presuppositions and conventional implicatures. The heterogeneity of projective content has been widely recognized in the semantic literature, but theirs is the first attempt at gaining a more systematic classification of these heterogeneous categories. In their view, it is possible to distinguish four classes of triggers along two properties, called Strong Contextual Felicity Constraint (SCFC) and Obligatory Local Effect (OLE). According to Tonhauser et al. (2013), activators of conventional implicatures belong to 'class B' of their taxonomy, that is, to the class of items that have neither SCFC nor OLE. On the contrary, activators presupposition triggers like *know* or *regret* fall into the 'class C' of operators that project and have OLE, while focus particles like *too*, as well as pronouns belong to the 'class A' of expressions that exhibit projectivity and both SFCF and OLE. This alternative classification suggests another possible line of interpretation for our data, that should be explored better in future works: the differences observed between *too* and *regret* might be explained in terms of different efforts required for checking whether the implication associated with the trigger is established in the context of utterance.

our best effort, *Control II* negated the asserted and presupposed content more explicitly for *regret* (e.g., the girl was not sad and the castle was not destroyed) than for *too* (e.g., the girl is wearing neither the hat nor the glasses since they both are on the ground). This potential bias is unwanted and we acknowledge it as a limitation of the study. However, at least two key considerations argue against this hypothesis. First, if the pictorial material cued the comprehension of *regret*, then one should not see developmental patterns related to contextual availability and rather expect a similar performance across age groups in both satisfaction and accommodation. This was not clearly the case, given the significant difference between 3- and 5-year-olds when *regret* was presented in NEU but not in SAT. Second, in the pattern of errors, no trigger-related differences emerged between the frequency of *Controls I* and *II* in the 3-year-olds.[11] Therefore, the children made an incorrect choice because they genuinely could not grasp the presupposition rather than because of a potential experimental bias. In sum, overall, these results argue in favour of a genuine developmental trend in presupposition understanding that is bound to the type of trigger.

(iii) *Developmental effects depending on condition and type of trigger*

The following developmental effects emerged depending on both context availability *and* trigger type. First, in condition neutral, 5-year-olds were more accurate with *regret* than with *too*. Second, with *too*, but not with *regret*, 5-year-olds were more accurate in condition satisfaction than neutral. Third, while with *regret* 3-year-olds were less accurate than 5-year-olds in NEU, with *too* they were less accurate than 5-year-olds in SAT. These results suggest that, not only accommodation (vs. satisfaction) *per se* was harder for pre-schoolers and *too* posed overall greater difficulties than *regret*, but that this was even more pronounced for the accommodation of a presupposition triggered by too. By age 5, children can update the discourse mental model with the presupposed content activated by both trigger types, provided that this is satisfied by the context. Conversely, 5-year-olds'ability to accommodate a presupposition still depends on the specific type of trigger: they can accommodate a presupposition of *regret*, while extra difficulties remain when accommodating a presupposition of *too*. At age 3, children take into account the presupposition of *regret* when this is satisfied by the context, nevertheless accommodating the presupposition of *regret* still is costlier (as compared to age 5).

11 The same pattern emerged for the 5-year-olds, but the number of incorrect observations was so small that any discussion of their error pattern becomes irrelevant for any interpretation. As for the 4-year-olds, they were well beyond chance with both triggers, and exhibited similar understanding of the *too*- and *regret*-sentences (i.e., 67 and 72% correct responses with *too* and *regret*, respectively). See Tables 1 and 2.

With *too*, 3-year-olds' difficulties are visible – at least in our picture-matching task – even when this is satisfied by the context (vs. 5-year-olds). As a whole, this confirm our main predictions and complete the developmental scenario as revealed by this study: the development of presupposition understanding is influenced by context availability and type of trigger, as well as by what type of trigger activates a presupposition that needs accommodation. By age 5, the ability to accommodate a presupposition is developed, yet this is harder if the presupposition is triggered by *too*. At age 3, accommodating a presupposition of *regret* is still challenging and taking into account the presupposition of *too* is more difficult in general, even when the context satisfies the background information. At that age, children might not yet have sufficiently developed cognitive resources to accommodate even the presupposition of a lexical trigger. Comprehending a resolution trigger such as *too* is more difficult even within a supportive context, most probably because of the costs posed by the search for a suitable antecedent. By age 5, children's presuppositional abilities further develop. Yet, the extra cost associated with the inferentially-driven search for a suitable antecedent still appears to tax the accommodation of a presupposition activated by a resolution trigger such as *too*.

To conclude, what about 4-year-olds? In this study, the most important developmental differences occurred between the age of 3 and 5. Children in the intermediate age group mostly exhibited presuppositional skills comparable to the 3-year-olds: like the 3-year-olds, they were less accurate than 5-year-olds when a presupposition was satisfied by the context and when it was triggered by *regret*. For *too*, contrary to the 3-year-olds, they performed above chance, but this difference was not significant. Overall, then, it seems that presuppositional abilities are similar at age 3 and 4. Yet, the 4-year-olds were pretty accurate in all conditions and with both trigger types, which suggests that presuppositional skills are good by age 4. In addition, the analysis of errors revealed a developmental pattern. Just as the 5-year-olds, when making mistakes, 4-year-olds chose *Control I* (i.e., a picture depicting only the sentence asserted content) significantly more often than 3-year-olds, independently of condition and trigger type. Interestingly, a different pattern of errors emerged between 3- and 4-year-olds depending on the type of trigger: when the presupposition was triggered by *too*, 4-year-olds, but not 3-year-olds, chose *Control I* significantly more often than *Control II*. This highlights that presuppositional skills are not exactly the same at age 3 and 4. At age 4, children might follow a (yet imperfect) 'presuppositionally-oriented' strategy: they do not ignore the trigger, but still cannot derive the associated presupposition, especially when this is activated by *too*. On the whole, the 4-year-olds' behavior gives the impression that a noteworthy developmental step is progressing with presupposition understanding. This opens to the possibility that age 4 might turn a crucial developmental phase for the ability to presuppose. A possibility worth exploring in future studies.

5 Conclusion

This study extended previous findings on presupposition comprehension in preschool years by offering new insights on the developmental trajectory and on the role of contextual availability and trigger type. Results showed that pre-schoolers are more proficient at presupposition understanding than previously thought. Signs of presuppositional abilities are already present at age 3. Yet, understanding a presupposition starkly improves between 3 and 5 years of age. Importantly, the developmental trajectory depends on both type of trigger and contextual availability. At age 3, children show a better understanding when the presupposition is satisfied by the context and it is activated by a lexical trigger (such as *regret*) rather than a resolution trigger (such as *too*). By age 5, children understand a presupposition that is activated by both *regret* and *too* and both when this is satisfied or not. Yet, comprehending the presupposition of *too* is more difficult, even more so when comprehension requires accommodation.

This developmental trajectory mirrors nicely the processing dynamics in adults' presupposition comprehension and support the theoretical intuitions that differentiate classes of triggers as well as presupposition satisfaction and accommodation. Further experimental investigation would now be worth conducting to replicate the findings with a paradigm that is better suited for very young children (i.e., three and below), and to explore children's presuppositional abilities in relation to other types of trigger and within wider age ranges. Finally, future research should also study children's presuppositional abilities with more complex sentential contexts, for example in cases of projection, to see whether there is a stage in development at which presuppositions are understood as genuine presuppositions or as entailments.

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References

Abusch, Dorit. 2010. Presupposition triggering from alternatives. *Journal of Semantics* 27. 37–80.

Amaral, Patricia & Chris Cummins. 2015. A cross-linguistic study on information backgrounding and presupposition projection. In Florian Schwarz (ed.), *Experimental perspectives on presuppositions*, 157–172. Dordrecht: Springer.

Aravind, Athulya. 2018. *Presuppositions in context*. Cambridge, MA: MIT PhD Dissertation.

Arnold, Jennifer E., Janet G. Eisenband, Sarah Brown-Schmidt & John C. Trueswell. 2000. The rapid use of gender information: Evidence of the time course of pronoun resolution from eye tracking. *Cognition* 76. B13–B26.

Berger, Frauke & Barbara Höhle. 2012. Restrictions on addition: children's interpretation of the focus particles *auch* 'also' and *nur* 'only' in German. *Journal of Child Language* 39. 383–410.
Berger, Frauke & Nausicaa Pouscoulous. 2014. *2.5-year-olds consider presuppositions: An eye-tracking study on too and again*. Noto, Italy: European Society for Philosophy & Psychology (ESPP).
Bergsma, Wenda. 2006. (Un)stressed ook. In Dutch. In Veerle van Geenhoven (ed.), *Semantics in acquisition*, 329–348. Dordrecht: Springer.
Bisson, Jennifer B. 2019. It's written all over their faces: Preschoolers' emotion understanding. *Social Development* 28. 74–89.
Carston, Robyn. 2002. *Thoughts and utterances. The pragmatics of explicit communication*. Oxford: Blackwell Publishing.
Cummins, Chris, Patricia Amaral & Napoleon Katsos. 2012. Experimental investigations of the typology of presupposition triggers. *Humana Mente* 23. 1–16.
Di Paola, Simona, Filippo Domaneschi & Nausicaa Pouscoulous. 2020. Metaphorical developing minds: The role of multiple factors in the development of metaphor comprehension. *Journal of Pragmatics* 156. 235–251.
Domaneschi, Filippo, Elena Carrea, Carlo Penco & Alberto Greco. 2014. The cognitive load of presupposition triggers: Mandatory and optional repairs in presupposition failure. *Language, Cognition & Neuroscience* 29. 136–146.
Domaneschi, Filippo & Simona Di Paola. 2018. The processing costs of presupposition accommodation. *Journal of Psycholinguistic Research* 47. 483–503.
Domaneschi, Filippo & Simona Di Paola. 2019a. The aging factor in presupposition processing. *Journal of Pragmatics* 140. 70–87.
Domaneschi, Filippo & Simona Di Paola. 2019b. Relevance and non-factive knowledge attributions. *Acta Analytica* 34. 83–115.
Dudley, Rachel, Naho Orita, Valentine Hacquard & Jeffrey Lidz. 2015. Three-year-olds' understanding of know and think. In Florian Schwarz (ed.), *Experimental perspectives on presuppositions*, 241–262. Dordrecht: Springer.
Friedmann, Naama & João Costa. 2010. The child heard a coordinated sentence and wondered: On children's difficulty in understanding coordination and relative clauses with crossing dependencies. *Lingua* 120. 1502–1515.
Glanzberg, Michael. 2003. *Felicity and presupposition triggers*. Michigan, USA: University of Michigan Workshop in Philosophy and Linguistics.
Glanzberg, Michael. 2005. Presuppositions, truth values and expressing propositions. In Gerhard Preyer & Georg Peter (eds.), *Contextualism in philosophy: Knowledge, meaning, and truth*. Oxford: Oxford University Press.
Happé, Francesca. 2003. Theory of mind and the self. *Annals of the New York Academy of Sciences* 1001. 134–144.
Haviland, Susan & Herbert Clark. 1974. What's new? Acquiring new information as a process in comprehension. *Journal of Verbal Learning & Verbal Behavior* 13. 512–521.
Heim, Irene R. 1982. *The semantics of definite and indefinite noun phrases*. Amherst: University of Massachussetts (Doctral Dissertation).
Höhle, Barbara, Frauke Berger, Anja Muller, Michaela Schmitz & Jürgen Weissenborn. 2009. Focus particles in children's language: Production and comprehension of auch 'also' in German learners from 1 year to 4 years of age. *Language Acquiition* 16. 36–66.
Hüttner, Tanja, Heiner Drenhaus, Ruben van de Vijver & Jürgen Weissenborn. 2004. The acquisition of the German focus particle auch 'too': Comprehension does not always precede

pro-duction. In Alejna Brugos, Linnea Micciulla & Christine E. Smith (eds.), *Proceedings of the 28th annual Boston University conference on language development*, on-line supplement. Somerville, MA: Cascadilla Press. Retrieved from: www.bu.edu/linguistics/BUCLD/supp.html.

Jayez, Jacques & Valeria Mongelli. 2013. How hard are hard triggers? In Emmanuel Chemla, Vincent Homer & Grégoire Winterstein (eds.), *Sinn und Bedeutung 17, Oct 2012*, 307–324. Paris: ENS. Retrieved from: hal.archives-ouvertes.fr/hal-01073508.

Karttunen, Lauri. 1974. Presupposition and linguistic context. *Theoretical Linguistics* 1. 181–194.

Katsos, Napoleon & Dorothy V. M. Bishop. 2011. Pragmatic tolerance: Implications for the acquisition of informativeness and implicature. *Cognition* 120. 67–81.

Levinson, Stephen C. 1983. *Pragmatics*. Cambridge: Cambridge University Press.

Lewis, David. 1979. Scorekeeping in a language game. *Journal of Philosophical Logic* 8. 339–359.

Matsuoka, Kazumi, Nobuhiro Miyoshi, Koji Hoshi, Masanobu Ueda, Izumi Yabu & Miki Hirata. 2006. The acquisition of Japanese focus particles: Dake 'only' and mo 'also'. In David Bamman, Tatiana Magnitskaia & Colleen Zaller (eds.), *Proceedings of the 30th Boston University conference on language development*, On-line supplement. Somerville, MA: Cascadilla Press. Retrieved from: www.bu.edu/linguistics/BUCLD/supp.html.

Miller, Karen, Cristina Schmitt, Hsiang-Hua Chang & Alan Munn. 2005. Young children understand 'some' implicatures. In *The proceedings of the 29th Boston University conference on language development (BUCLD 29)*, 389–400. Somerville, MA: Cascadilla Press.

Nederstigt, Ulrike. 2003. *Auch and noch in child and adult German*. Berlin, New York: Mouton de Gruyter.

Pouscoulous, Nausicaa. 2008. Presupposition in young children. Oral presentation at *The XI Congress of the international association for the study of child language (IASCL 2008)*. Edinburgh, UK.

Pouscoulous, Nausicaa. 2013. Early pragmatics with words. In Frank Liedtke & Cornelia Schulze (eds.), *Beyond the words. Content, context, and inference*, 149–172. Mouton Series in Pragmatics (MSP). Berlin/Boston: De Gruyter Mouton.

Schwarz, Florian. 2007. Processing presupposed content. *Journal of Semantics* 24. 373–416.

Schwarz, Florian (ed.). 2015. *Experimental perspectives on presupposition, studies in theoretical psycholinguistics*. Dordrecht: Springer.

Stalnaker, Robert. 1974. Pragmatic presuppositions. In Milton Karl Munitz & Peter K. Under (eds.), *Semantics and philosophy*, 197–213. New York: New York University Press.

Syrett, Kristen, Chris Kennedy & Jeffrey Lidz. 2009. Meaning and context in children's understanding of gradable adjectives. *Journal of Semantics* 27. 1–35.

Tiemann, Sonja, Mareike Kirsten, Sigrid Beck, Ingo Hertrich & Bettina Rolke. 2015. Presupposition processing and accommodation: An experiment on wieder ('again') and consequences for other triggers. In Florian Schwarz (ed.), *Experimental perspectives on presuppositions*, 39–66. Dordrecht: Springer.

Tiemann, Sonja, Mareike Schmid, Nadine Bade, Bettina Rolke, Ingo Hertrich, Hermann Ackermann, Julia Knapp & Sigrid Beck. 2011. Psycholinguistic evidence for presuppositions: On-line and off-line data. In Ingo Reich, Eva Horch & Dennis Pauly (eds), *Proceedings of Sinn & Bedeutung*, vol. 15, 581–595. Saarbrücken: Saarland University Press.

Tonhauser, Judith, David Beaver, Craige Roberts & Mandy Simons. 2013. Toward a taxonomy of projective content. *Language* 89(1). 66–109.

Vaish, Amrisha, Tobias Grossmann & Amanda Woodward. 2008. Not all emotions are created equal: The negativity bias in social-emotional development. *Psychonomic Bulletin* 134. 383–403.
Voltolini, Alberto. 2021. A contextualist treatment of negative existentials. *Intercultural Pragmatics* 18(3). 415–424.
Weisberg, Daniel P. & Sarah R. Beck. 2012. The development of children's regret and relief. *Cognition and Emotion* 26. 820–835.
Yekovich, Frank R. & Carol H. Walker. 1978. Identifying and using referents in sentence comprehension. *Journal of Verbal Learning and Verbal Behavior* 17. 265–278.
Zeevat, Henk. 1992. Presupposition and accommodation in update semantics. *Journal of Semantics* 9. 379–412.

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