Hybrid approaches to free choice: Evidence from acquisition

Background A sentence such as (1), of the form ◇*(A or B),* gives rise to the 'free choice inference' (FCI) that *Mia can buy the apple and Mia can buy the banana* (schematically, ◇A∧◇B*).* Previous acquisition studies have shown that 5-year-old children successfully compute FCIs from modal disjunctive statements [1]. This is a surprising result when taken against the background of theoretical accounts that treat FCIs as a kind of scalar implicature (SI) [2-9] – given children's reported difficulties with standard cases of SI [10-11]. The findings might be taken to support non-implicature approaches, which treat FCIs instead as entailments [12-16]. In this study, we take up the issue of *negative* FCIs. These inferences arise from negated universal modal statements that embed conjunction, such as (2), which yields the interpretation that *Mia doesn't have to buy the apple and Mia doesn't have to buy the banana* (schematically, ¬□A∧¬□B). [17] report experimental evidence that adults indeed generate negative FCIs, but that these inferences are far less robust compared to positive FCIs. They take their findings to support hybrid approaches that combine an entailment account of positive FCIs and an implicature approach to negative FCIs. In this study, we turn to children, who are reportedly adult-like with positive FCIs and typically non-adult-like with standard SIs. Building on the child results in [1] and the adult results in [17], we posit that if positive FCIs are entailments and negative FCIs are implicatures (as per the hybrid approach), children should display the same kind of asymmetry across polarities as observed in [17]'s adults; the asymmetry might be even more pronounced in children, given their reported difficulties with SIs in general. Moreover, we compare positive and negative FCIs with positive and negative SIs, on the assumption that SI accounts would predict a similar pattern across polarities for the two kinds of inferences.

Experiment We tested 35 English-speaking adults recruited through Prolific and 34 children (5;02–7;03, M=6;03) using a Truth Value Judgment Task. Participants were introduced to two characters, Mia and Sam, who were shopping at the store, and whose parents had set out rules for what they were allowed to buy, what they were not allowed to buy, and what they had to buy. Following the design in [17], participants were shown three symbols for representing the rules: a green circle around an item indicated the character was allowed to buy that item; a red circle with a line through an item indicated the character was not allowed to buy that item; a black square around an item indicated the character was required to buy the item. A puppet appeared in pre-recorded videos to describe the rules for each pictured character, and the child had to indicate whether the puppet was right or wrong. To ensure that participants understood what the symbols meant, participants were first presented with seven practice trials which included guidance/feedback, before proceeding to the experimental trials. Participants were presented with 16 target trials (8 FC targets – 4 positive, 4 negative; 8 SI targets – 4 positive, 4 negative) and 16 clearly true/clearly false controls of various kinds (see Table 1). On target trials, the images falsified the relevant FC/SI inferences. For example, on the positive FCI trials (1), only one of the mentioned disjuncts was visualized as 'allowed', the other was 'disallowed'; on the negative FCI trials (2), one of the mentioned disjuncts was 'allowed' and one was 'required'.

Results Performance on controls was highly accurate in both groups (ranging from 87 to 100% across control types). For both FCI and SI targets (Fig. 1), children showed a larger contrast between polarities than adults, driven by substantially higher rejection rates for negative sentences (FC: adult 66% vs. child 87%; SI: adult 38% vs. child 89%). This was reflected in the statistical modeling, with significant Group × Polarity interactions for both FCIs ($\beta = -1.33$, $SE = 0.42$, $z = -3.13$, $p = .0018$) and SIs ($\beta = -0.89$, $SE = 0.24$, $z = -3.65$, $p < .001$).

Conclusion On the whole, 5- to 7-year-olds and adults exhibit similar response patterns for FCIs and SIs, displaying the same contrast across polarities. The finding that negative FCIs are relatively less robust than positive FCIs, even in children, may provide further support for hybrid approaches, which are better equipped to capture such asymmetries across polarities. We will

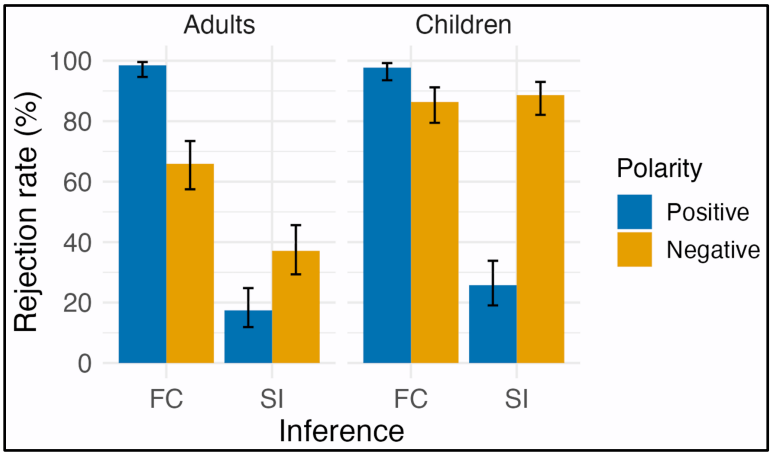
also discuss possible explanations for children's high rate of rejection of the negative SI targets, relative to adults.

(1) Mia is allowed to buy either the apple or the banana.
FCI: ⇝ *Mia is allowed to buy the apple and allowed to buy the banana.*
(2) Mia doesn't have to buy both the apple and the banana.
Negative FCI: ⇝ *Mia isn't required to buy the apple and isn't required to buy the banana.*

Table 1. Trial types

Condition	Example sentence	Target truth value	# of trials	Pictured item (A=allowed, D=disallowed, R=required)
Positive FC	Mia is allowed to buy either the popsicle or the fries.	Target	4	AD
		True	2	AA
		False	2	DD
Negative FC	Mia doesn't have to buy both the popsicle and the fries.	Target	4	AR
		True	2	AA
		False	2	RR
Positive SI	Mia is allowed to buy the popsicle.	Target	4	RD
		True	2	AD
		False	2	DD
Negative SI	Mia doesn't have to buy the popsicle.	Target	4	DR
		True	2	AR
		False	2	RR
Strong modal control	Mia has to buy the popsicle.	True	2	RD
		False	2	AD
Disjunctive control	Mia is allowed to buy the popsicle or the fries.	True	2	AA

Figure 1. Results from target FC and SI conditions. We plot rejection rates, with rejection serving as a proxy measure for FC and SI computation.



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