"Liz can buy a croissant or a donut… Both together, right?"
Distinguishing target Free Choice from non-target Modal AND in Child French

Background: Acquisition studies have shown that (i) while children give non-target interpretations of plain disjunction (1a), where OR is not interpreted exclusively as in the adult grammar (1b) but instead conjunctively as AND (1c) ([5-6]), (ii) they have the target interpretation of modal disjunction (2a), correctly drawing the conjunctive Free Choice (FC) inferences in (2b-c) ([3], [7-8]). A widely accepted account proposed by Singh et al. (2017), relying on Fox' (2007) double exhaustification analysis of adult conjunctive FC inferences (2b-c), is that children have adult-like semantics but cannot retrieve the stronger alternative AND – allowing for the non-adult conjunctive strengthening of OR to the meaning of AND (1c).

(1) **Plain disjunction**

a. Liz bought the donut or the croissant.		$(P \vee Q)$
b. ⇝ Liz bought the donut or the croissant but not both.	[Adult]	$(P \vee Q) \wedge \neg(P \wedge Q)$
c. ⇝ Liz bought both the donut and the croissant.	[Non-adult]	$(P \wedge Q)$

(2) **Modal disjunction**

a. Liz can buy the donut or the croissant.	$\Diamond(P \vee Q)$
b. ⇝ Liz is allowed to buy the donut.	$\Diamond P$
c. ⇝ Liz is allowed to buy the croissant.	$\Diamond Q$
d. ⇝ Liz is not allowed to buy both.	$\neg\Diamond(P \wedge Q)$

Proposal: Putting to test the conclusion that children derive genuinely adult-like FC inferences, we empirically tested an alternative interpretation of children's responses to the FC inferences of modal disjunction: children interpret $\Diamond(P \vee Q)$ as $\Diamond(P \wedge Q)$, just like they interpret $(P \vee Q)$ as $(P \wedge Q)$. Crucially, $\Diamond(P \wedge Q)$ (modal AND) is not equivalent to $(\Diamond P \wedge \Diamond Q)$ (FC inference), since the former entails the latter, but not conversely. Suppose that P and Q can both hold $(\Diamond P \wedge \Diamond Q)$ but *not* simultaneously, then $\Diamond(P \wedge Q)$ comes out as false (3), e.g. John's being in Paris and John's being in London are mutually exclusive situations: they can hold at different times (3b)/(3c), but not simultaneously (3d).

(3)

a. John might be in Paris or in London.	[1] [9]
b. ✓ John is in Paris.	$\Diamond P$
c. ✓ John is in London.	$\Diamond Q$
d. ✗ John is in Paris and he is also in London.	$\neg\Diamond(P \wedge Q)$

Previous designs do not distinguish $(\Diamond P \wedge \Diamond Q)$ from $\Diamond(P \wedge Q)$ which is critical for the interpretation of the results. To this effect, we develop an experimental paradigm with mutually exclusive scenarios to tease apart the two interpretations and thus settle whether children have genuine FC construals of modal disjunction. Our findings extend the empirical observation that children derive a conjunctive interpretation of OR to modal contexts $\Diamond(P \wedge Q)$. This novel observation follows on the proposal that children have the adult semantics for (2), but exhaustify below the modal.

Method: 57 French children (M=5;5 | 3;11-6;9) and 37 adults (M=34 | 22-68) participated in a truth-value judgment task adapted from [4]. In the setup, a shop employee describes what a customer can buy given the number of coins in her purse (4). The task is to judge whether the employee said it right. The conditions in Table 1 vary the price of the objects. Condition 1 replicates prior studies by ensuring the falsity of FC inferences. Condition 2 tests mutually exclusive situations, while condition 3 renders true the $\Diamond(P \wedge Q)$ interpretation.

Hypotheses: If children have the target FC interpretation of modal disjunction (row 1 in Table 1), they should accept test sentence (4) for Condition 2 and reject it for Condition 1. In contrast, if children have a non-target conjunctive interpretation of modal disjunction (row 2 in Table 1) they should reject (4) for both Conditions 1 and 2, while accepting it for Condition 3.

(4) **Test sentence:** "With 1 coin, Liz can buy a croissant or a donut."

Interpretation of ◇(P ∨ Q)	Condition 1	Condition 2	Condition 3
◇P ∧ ◇Q (FC)	No	**Yes**	No
◇(P ∧ Q)	No	**No**	Yes

Table 1: Conditions and expected answer patterns

Results: Fig. 1 shows that **Condition 1** was rejected by adults, but not always by the children. Post-hoc simple pairwise comparisons showed that this difference is statistically significant ($p < 0.0001$). Most children were consistent: 38 always rejected Condition 1, 11 always accepted it, and 8 were at chance. **Condition 2** was always accepted by adults and also mostly by children; the difference with adults was not significant ($p = 0.21$). The individual pattern analysis in Table 2) revealed that children who rejected Condition 1 were split in two groups: 22 accepted Condition 2 (giving a FC interpretation) and 11 rejected it (giving a modal AND interpretation). **Condition 3** was mostly accepted by children in contrast to the adults - in particular by those children who rejected both Conditions 1 and 2. Overall, mixed model analyses with *condition* and *age* as fixed factors showed that **Age** was not a significant predictor for children ($p = 0.55$).

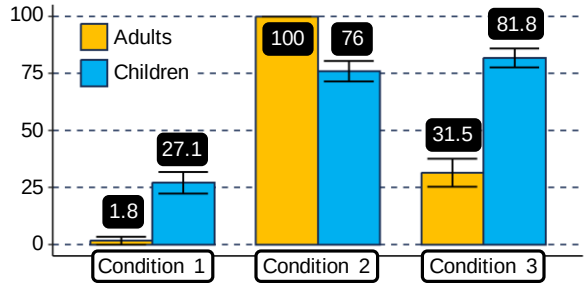

Figure 1: Mean percentage of acceptance for each condition

Table 2: Individual patterns

Condition 1 \ Condition 2	Accept	Reject
Accept	11 (◇P ∨ ◇Q)	
Reject	22 (◇P ∧ ◇Q)	11 (◇(P ∧ Q))

Discussion: Using a novel and more detailed design, our study reveals that FC is not so early acquired contrary to previous claims. Indeed, 22 out of the 57 children (38%) were in fact consistent non-adult interpreters of modal disjunction: 11 had Modal AND (◇(P ∧ Q)), and 11 did not derive FC inferences (◇P ∨ ◇Q). Moreover, 1 in 3 children who seemed adult-like on Condition 1 turned out to be modal AND ◇(P ∧ Q) interpreters once Condition 2 was taken into account. Having shown that the non-adult conjunctive interpretation of OR reported in the literature extends to modal OR, we straightforwardly extend Singh et al's account of conjunctive OR (lack of access to the stronger alternative) to modal contexts on a simple assumption: namely, that double exhaustification takes place below the modal:

(5) a. Exh(Exh(◇(P ∨ Q))) ⇔ ◇P ∧ ◇Q Double Exhaustification above ◇ ⇝ Free Choice
b. ◇(Exh(Exh(P ∨ Q))) ⇔ ◇(P ∧ Q) Double Exhaustification below ◇ ⇝ Modal AND
c. Exh(Exh(P ∨ Q)) ⇔ (P ∧ Q) Double exhaustification of OR ⇝ AND

The exhaustification procedure that leads to the modal AND interpretation is thus exactly on a par with the one that strengthens the meaning of plain disjunction to conjunction (5c).

Selected references: **[1] Ciardelli**, Groenendijk and Roelofsen. (2014). *Approaches to Meaning: Composition, Values, and Interpretation*. **[2] Fox**. (2007). *Presupposition and implicature in compositional semantics*. **[3] Huang** and Crain. (2020). *Language acquisition* 27(1). **[4] Liu**. (2017). *Interpreting Disjunction under Deontic Modals: An Experimental Investigation*. **[5] Singh**, Wexler, Astle-Rahim, Kamawar, and Fox. (2016). *Natural Language Semantics* 24(4). **[6] Tieu**, Yatsushiro, Cremers, Romoli, Sauerland and Chemla. (2017). *Journal of Semantics* 34. **[7] Tieu**, Romoli, Zhou and Crain. (2016). *Journal of Semantics* 33(2). **[8] Zhou**, Romoli and Crain. (2013). *Proceedings of SALT 23*. **[9] Zimmermann**. (2000). *Natural Language Semantics* 8.