Mandarin children interpret declarative *but not* interrogative disjunction as conjunction

Background Although some young children interpret declarative disjunctions (1) as *inclusively* as adults ([7], [8], a.o.), recent studies have identified more "conjunctive children" cross-linguistically ([3], [5], [6]), where $(p \vee q)$ is interpreted conjunctively as $(p \wedge q)$. However, there is no consensus on how such *conjunctive inference* is derived. **[1]** suggests children's adult-like pragmatic reasoning and lack of ability to entertain split information states; while **[6]**, relying on a double exhaustification operation of adult, posits that children's non-adultlike alternative sets are because of their lack of access to the $(p \wedge q)$ alternative, thus triggering a non-adult-like conjunctive strengthening of $(p \vee q)$ to the meaning of $(p \wedge q)$.

Proposal The current study looks at how Mandarin-speaking children interpret disjunctive utterances under interrogative environments. In particular, previous studies focus on languages like English, where declarative and interrogative disjunctors share the same morpheme. Sentences like (2) in English are ambiguous between alternative questions and yes/no questions ([2]); while in Mandarin, such two readings are materialized via different disjunctors: ***huòzhě*** is used in statements (**DD** in (3)), and ***háishì*** derives alternative questions (**ID** in (4), [4]). And the "Yes/No-question" reading of (2) is realized via declarative disjunctor plus yes/no-question marker ***mā*** in Mandarin. Although conjunctive **DD** can be captured by both **[1]** and **[6]**, children's responses to **ID** are more in favour of **[6]**'s account. Further, adopting **[6]**'s account based on scalar implicature and double exhaustification allows us to capture children's additional delay of "Neither/Both"-responses.

Experiment 48 Mandarin-speaking children (3;3-6;7, M_{age}=4;10) completed a within-subject Question-Statement Task (QST, [9]) with a 3 × 4 design, crossing 3 Sentence Types (**DD, ID, DDQ**) and 4 Contexts ("**Coffee**", "**Tea**", **Neither**, and **Both**). Participants were asked to first decide whether the puppet made a statement or posed a question, and then to judge whether the statement was true or answer the question based on the story. The *type* and *accuracy* of children's responses were tallied separately (**Fig. 1 & 2**). The conditions in **Table 1** vary the choices of the character: "**Coffee**"/"**Tea**" validates only one of the two disjuncts, "**Both**" validates both, and "**Neither**" validates neither. If children have *conjunctive inference* for **ID** as for **DD(Q)**, replicating prior studies, they are expected to answer the alternative questions correctly in the condition where both disjuncts are validated, while showing a delay in the condition where only one of the disjuncts is validated.

Results Children only derive conjunctive inferences on **DD** but not **ID**, as evidenced by: (a) In judging the truth value of **DD**s (or answering **DDQ**s) in the four context conditions, children showed significantly higher acceptance over rejection on **DD** utterances *only* in contexts where both disjuncts are validated ($p < .001$) while they give significantly more rejection than acceptance in contexts validating only one of the disjuncts ($p < .001$); (b) When answering **ID**, children's response *types* matched those of adults, however, their *accuracy* showed age differences (54%(3), 63%(4), 73%(5), 94%(6), $p < .001$), which indicates that while children in all four age groups were able to give expected answers under the context where either of the disjunctions was validated, they were not able to accordingly derive the "Neither/Both"-response till they reach 6-year-old.

Discussion The fact that children do not derive *conjunctive inference* on **ID**s poses a challenge to **[1]** but not **[6]** since the ontological distinction between statements and questions comes for free in **[6]**. While **DD** is translated into the logical disjunctive operator, **ID** is translated as part of the ontological structure of the sentence. Naturally, when the former is subject to pragmatic strengthening that leads to conjunctive reading, the latter remains intact. As for **[1]** that bases *conjunctive inference* on the application of certain non-adult-like strategy in the semantics it is then expected that such inference should be present for **ID**s as well, contra to what we have observed. For alternative questions, we further argue that the fact that children struggle with "Neither/Both"-responses arises from the absence of the expected answer in the alternative set. Young children fail to accommodate the absence as such and therefore directly select from the available alternatives. For **[6]**, the unavailability of "Neither/Both"-responses falls out from the question denotation ($\{p, q\}$) and the answerhood presupposition, (6). For **[1]**, however, the denotation of a question is its resolution conditions, and hence *both* is in the question denotation. It should be later removed by other additional operations, as demonstrated in (7). As a consequence, the two accounts predict different developmental trajectories.

(1) John drank coffee ***or*** tea. (coffee $\vee$ tea)
↝ John drank coffee, or tea, or both. {{coffee},{tea}, {coffee $\wedge$ tea}} *Inclusive reading*
↝ John drank both coffee and tea. {{coffee $\wedge$ tea}} *Conjunctive inference*

(2) Did John drink coffee ***or*** tea?
↝ He drank coffee/tea/neither/both. *Alternative answer*
↝ Yes, he did. /No, he didn't. *Yes/No answer*

(3) John hē-le kāfēi ***huòzhě*** chá. **D**eclarative **D**isjunction (**DD**)
John drink-$_{ASP}$ coffee or tea
"John drank coffee or tea."

(4) John hē-le kāfēi ***háishì*** chá? **I**nterrogative **D**isjunction (**ID**)
John drink-$_{ASP}$ coffee or tea
"Did John drink coffee$_{H*}$ or tea$_{H*L-L\%}$?"

(5) John hē-le kāfēi ***huòzhě*** chá **mā**? **D**eclarative **D**isjunction **Q**uestion (**DDQ**)
John drink-$_{ASP}$ coffee or tea Q
"Did John drink coffee or tea$_{L*H-H\%}$?"

Table 1. Context conditions and expected answer patterns for test sentences (3), (4), and (5).

	Coffee	**Tea**	**Both coffee and tea**	**Neither coffee or tea**
				
ID	Coffee	Tea	Both	Neither
DD	Yes	Yes	Yes	No
DDQ	Yes	Yes	Yes	No

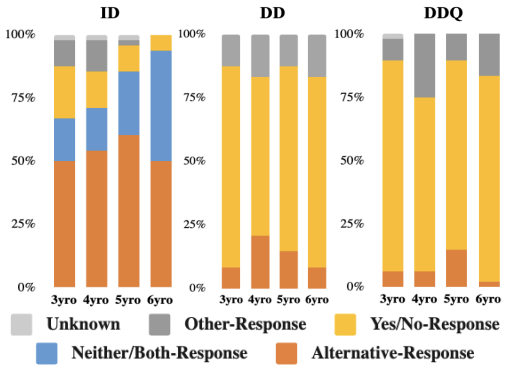

Fig. 1. Type of children's responses to three target Sentence Types

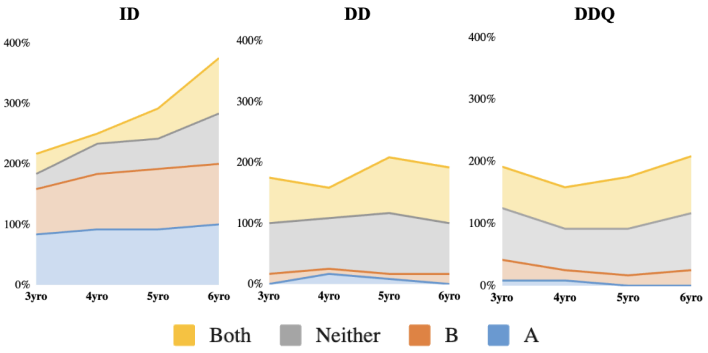

Fig. 2. Accuracy of children's responses to three target Sentence Types under four Context Conditions

(6) **Maximality answerhood presupposition** (Dayal 1996)

(i) $\text{Ans}_{\text{D}}(Q) = \lambda w\text{: } \exists p \in Q[p = \text{Max}_{\text{inf}}(Q, w)].\text{Max}_{\text{inf}}(Q, w)$

(ii) $\text{Max}_{\text{inf}}(Q, w) = p$ iff $w \in p \ \wedge \ \forall q \in Q[w \in q \rightarrow p \subseteq q]$

(7) **Exhaustification operation** (adopted from Roelofsen 2015)

Before exhaustification: $[\![AltQ]\!]_{\text{INQ}} = \{\{w_{p\wedge q}, w_p\}, \{w_{p\wedge q}, w_q\}, \{w_{p\wedge q}\}, \{w_p\}, \{w_q\}\}$

After exhaustification: $[\![\text{Exh}(AltQ)]\!]_{\text{INQ}} = \{\{w_p\}, \{w_q\}\}$

Selected References **[1]Aloni, M. (2022).** Logic and conversation: the case of free choice. **[2]Biezma, M., & Rawlins, K. (2015)** Alternative questions. **[3]Bleotu, A. C., et al. (2024).** Children interpret some disjunctions conjunctively: Evidence from child Romanian. **[4]Erlewine, M. Y. (2024).** Interrogative and standard disjunction in Mandarin Chinese. **[5]Huang, H., & Crain, S. (2020).** When OR is assigned a conjunctive inference in child language. **[6]Singh, et al. (2016).** Children interpret disjunction as conjunction: Consequences for theories of implicature and child development. **[7]Su, Y. (2014).** The acquisition of logical connectives in child Mandarin. **[8]Tieu, et al. (2016).** Children's knowledge of free choice inferences and scalar implicatures. **[9]Zhou, P., & Crain, S. (2011).** Children's knowledge of the quantifier *dou* in Mandarin Chinese.