# Conjunctive Disjunctions: Evidence for the Ambiguity Theory

Adults interpretation of disjunction *or* depends on the sentential environment in which disjunction occurs. Putting aside numerous special cases (see e.g. Klinedinst and Rothschild 2012, Meyer 2015), adult behavior can be summarized as such: In downward entailing contexts, *or* is interpreted logically as the inclusive disjunction OR. But in upward entailing contexts, *or* is interpreted pragmatically as the exclusive disjunction XOR. Summarizing recent work on the acquisition of disjuction, children around age 5 seem to differ slightly: In downward entailing and free choice contexts, children seem to interpret disjunction like adults as inclusive OR (Chierchia et al. 2001, Crain 2008, Su and Crain 2013, Tieu et al. 2015a). But in upward entailing, non free choice contexts, children have been found to interpret disjunction sometimes conjunctively as AND (Singh et al. 2015, Tieu et al. 2015b).

Singh et al. (2015) advocate an account of the AND interpretation of *or* in terms of scalar implicature (or exhaustivization). In this talk, we present evidence for a novel alternative account based on lexical ambiguity. Specifically, we test the following prediction of the implicature account: Whenever implicatures are obligatory, children should obligatorily interpret *or* as AND. We show that the ambiguity theory makes the opposite predictions, and that the prediction of the ambiguity theory is borne out in data from German children.

**The Implicature Theory:** The implicature theory assumes that adults and children associate different alternative sets with *or*: While Alt(*or*) = {A, B, A ∨ B, A ∧ B} for adults (Sauerland 2004), for children Alt(*or*) = {A, B, A ∨ B}. This predicts that adults strengthen the interpretation of *A or B* to exclude A ∧ B when implicatures are computed. But children are predicted to strengthen *A or B* by excluding A ∧ ¬ B and B ∧ ¬ A, which predicts the conjunctive interpretation.

When implicatures are optional, children are predicted to assign either a logical *OR* interpretation to *or* when they don't compute an implicature, or a strengthened *AND* interpretation when they compute an implicature. The implicature theory predicts therefore that the conjunctive interpretation should be obligatory when implicature computation is obligatory.

**The Ambiguity Theory:** We propose that *or* is ambiguous for children between at least two interpretations, a disjunctive and a conjunctive interpretation. Furthermore children apply the strongest meaning principle (SMP) in (1) to resolve the ambiguity.

(1)     *SMP:* If S is ambiguous between interpretations $\alpha$ and $\beta$ with $\alpha \to \beta$ then the weaker interpretation $\beta$ is inaccessible (Dalrymple et al. 1998 and others).

The ambiguity theory predicts all the data that have motivated the implicature theory. Consider first *or* in a DE context. (2) from Chierchia et al. (2001) is predicted to be ambiguous for children between $\alpha$ and $\beta$. But because reading $\beta$ logically entails $\alpha$, $\alpha$ is correctly blocked by the SMP.

(2)     Every dwarf who chose a banana **or** a strawberry received a jewel.

     \*$\alpha$:  Every dwarf who chose a banana *and* a strawberry received a jewel.
     $\beta$:  Every dwarf who chose a banana *or* a strawberry received a jewel.

But in an UE context the entailment relationship is the reverse. Therefore the OR-interpretation is blocked in (3).

(3)     Every boy is holding an apple **or** a banana. (Singh et al. 2015)

     $\alpha$:  Every boy is holding an apple **and** a banana.
     \*$\beta$:  Every boy is holding an apple **or** a banana.

But the ambiguity theory makes different predictions from the implicature theory for cases where implicatures are obligatory. As discussed by Spector (2014) and others, *exh* is ungrammatical when it cannot exclude any alternatives. The same constraint applies to *only*, and causes the ungrammaticality of *\*I ate only ALL.* Since AND is the maximally strong item in an UE context, obligatory exhaustivization blocks the AND-interpretation. Therefore the ambiguity theory predicts that only the OR-interpretation can be available when implicatures are obligatory.

**Design** Following Spector (2014), we assume that strong disjunctions such as French *soit–soit*, German *entweder–oder*, and English *either–or* involve obligatory exhaustivization. We test in German whether *entweder–oder* was interpreted differently from plain *oder* by children. We adopted the design of Tieu et al. (2015b) to German. The two experimental conditions were the 1DT (one disjunct true) and 2DT (two disjuncts true) scenarios. For sentence (4), the two scenarios are described in (4a) and (4b).

(4)     Monkey (either) opened the window or the door. (translated from German)

        1DT: Monkey opened only the door (or Monkey opened only the window)
        2DT: Monkey opened both the window and the door

In addition, we varied across subjects whether the items included complex *either–or* or simple *or*. Participants were randomly assigned to one of the two conditions.

**Results:** We collected data from 21 adults and two groups of children: 19 younger children, 4;2–5;9, $M$=5;2) and 16 older children (7;0–7;11, $M$=7;4). On control items the accuracy rate was above 85% in each participant group. The figure below compares complex disjunctions in red with simple disjunctions in grey in the three age groups. We observe that in the younger children, complex and simple disjunctions differ in the direction predicted by the ambiguity theory. We computed a mixed logit regression (glmer), and it shows that the complexity of disjunction is a significant predictor of correct response (log (odds ratio) 3.981, SE 1.888, $p < .05$) for younger children. There was no significant difference in older children or adults and no significant different between the two groups of children. But the differences between the child groups vs the adults was a significant predictor for correct response (log (odds ratio) $-12.103$, SE 4.586, $p < .01$).



**Probability correct (accept) for 1DT**     **Probability correct (reject) for 2DT**
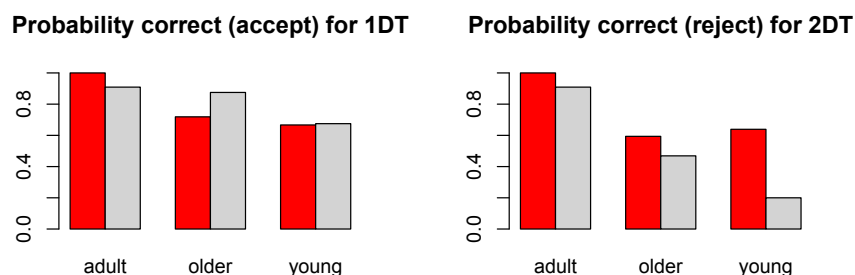
**Discussion:** Our result from 4–5 year olds disconfirms the prediction of the implicature analysis, and confirms that of the ambiguity analysis. The result from the 7 year olds is consistent with either theory, but warrants further investigation. We note that the ambiguity theory we adopt is also compatible with the assumption that *or* also allows an exclusive XOR-interpretation lexically, but would then predict an ambiguity between the AND and the XOR-interpretation in UE contexts. Lexical learning on the ambiguity theory consists of eliminating one possible interpretation, but XOR may never be eliminated.

# References

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