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Interpretation of Disjunction in Turkish-speaking Children

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Introduction

Children interpret disjunction inclusively and conjunctively rather than exclusively (Chierchia et al., 2001; Chierchia et al., 2005; Singh et al., 2016; Tieu et al., 2017).

(1) John or Mary came.

Sentence (1) can be interpreted in three different ways:

- Inclusive: John or Mary came, and possibly both. (Logical Interpretation)
- Conjunctive: Both John and Mary came.
- Exclusive: Only John or only Mary came, but not both. (Pragmatic Enrichment / Scalar Implicature)

Why Don't Children Interpret Disjunction Exclusively?

The question: Why do children interpret disjunction inclusively or conjunctively, rather than exclusively as adults do?

Two competing explanations:

1. The non-adult-like interpretations are a result of scalar implicature and not being able to access alternatives (Singh et al., 2016; Tieu et al., 2017).
2. *Or* is ambiguous between inclusive disjunction and conjunction for children (Sauerland & Yatsushiro, 2018).

We aimed to explore which of these accounts better predicts Turkish-speaking children's interpretations.

Scalar Implicatures

Scalar implicatures are assumed to computed based on scales formed by ordered sets of alternatives:

<and, or>, <all, some>, <must, may>

Alternatives are crucial for implicatures to be derived.

(2) Some books are red.

Not all books are red.

Some but not all books are red.

Two main theoretical approaches:

- **Neo-Gricean:** Why didn't the speaker utter a more informative sentence? (Grice, 1975; Levinson, 2000).
- **Grammatical:** Add an operator, *EXH*, to the sentence, similar to *only* (Chierchia, 2004; Fox, 2007).

Why Do Children Have Difficulties with SIs?

Three accounts have been proposed:

- **Processing Account:**
  Maintaining and comparing alternatives are cognitively costly due to working memory limitations. However, no empirical evidence has been found (Fairchild & Papafragou, 2021; Heyman & Schaeken, 2015).

- **Pragmatic Tolerance Account:**
  Children are more tolerant of under-informative sentences (Katsos & Bishop, 2011; *cf.* Huang & Snedeker, 2009; Singh et al., 2016; Tieu et al., 2017).

- **Alternatives-based Account:**
  Children can compute inferences arising from alternatives that don't require lexical access (Barner et al., 2011).

Explaining Conjunctive Interpretations

While the inclusive interpretation can be explained under all three accounts, only the **Alternatives-based Account**, in combination with the *Grammatical Approach* to scalar implicatures can explain conjunctive interpretations.

Children arrive at the conjunctive interpretation through a non-adult-like implicature (Singh et al., 2016; Tieu et al., 2017).

Key Point: They can compute implicatures; the only problem is they cannot access the stronger alternative.

Ambiguity Account

Disjunction is ambiguous between inclusive *or* and *and* in children. (Sauerland & Yatsushiro, 2018)

Inclusive and conjunctive interpretations do not result from:

- scalar implicature
- lexical access to alternatives.

Disjunction Markers in Turkish

Three disjunction markers in Turkish: **veya**, **ya da**, and **ya. . . ya. . .**

(3) Ali elma **veya** armut al-acak.
Ali apple or pear buy-FUT
'Ali will buy an apple or a pear.'

(4) Ali elma **ya da** armut al-acak.
Ali apple or pear buy-FUT
'Ali will buy an apple or a pear.'

(5) Ali **ya** elma **ya** armut al-acak.
Ali either apple or pear buy-FUT
'Ali will buy an apple or a pear.'

Disjunction Markers in Turkish

1) *Veya* and *ya da* are morphologically complex.

- **veya**: conjunction *ve* 'and' + *ya*
- **ya da**: *ya* + additive *dA*

2) They do not convey the same meaning.

- *Veya* and *ya da* are *simplex disjunctions*, which do not require exclusivity inferences, unlike *ya...ya...* that is a complex disjunction requiring exclusivity inference (Bayırlı, 2018), as seen in (6) and (7).

(6) Ali veya/ya da Ayşe gel-ecek, hatta belki her ikisi de gel-ecek.
Ali or Ayşe come-FUT, even perhaps both too come-FUT
Ali or Ayşe will come, and perhaps both of them will come.

(7) Ya Ali ya da Ayşe gel-ecek, #hatta belki her ikisi de gel-ecek.
Ya Ali ya too Ayşe come-FUT, #even perhaps both too come-FUT
Either Ali or Ayşe will come, #and perhaps both of them will come.

Aim

Our question: What happens if the stronger scalar item *and* is already present in the weak scalar item *or*?

Veya 'or' is bimorphemic: conjunction *ve* 'and' + *ya*.

Alternatives-based Account: Presence of a stronger alternative is important as Scalar Implicatures (SIs) require stronger alternatives to be computed.

Ambiguity Account: Interpretations will either be inclusive or conjunctive, and stronger alternatives do not play a role as interpretations result from ambiguities, not SIs.

Predictions of the Accounts

Alternatives-based Account:

- Children's interpretations are more likely to be exclusive in *veya* sentences compared to sentences formed with *ya...ya...* and *ya da*.
- *Ya...ya...* and *ya da* should yield more conjunctive inferences, as they do not contain the stronger alternative.
- *Ya...ya...* should have the highest number of conjunctive interpretations as the exclusivity implicature is obligatory.

Ambiguity-Based Account:

- Simplex disjunctions *veya* and *ya da* do not require exclusivity inferences and will result in conjunctive or inclusive interpretations.
- Complex disjunction *ya...ya...* will yield inclusive interpretations, but not conjunctive interpretations.

Experiment

Participants: Fifty-eight monolingual Turkish-speaking children (4;02 - 5;11, M=5;01) and fifty-nine adult native speakers of Turkish (18 - 23, M=19.00)

Task: A modified design of Tieu et al. (2017) using a Truth Value Judgment Task.

Procedure: Participants heard a story about a character surrounded by three objects, a puppet shared its predictions. The participants judged whether the puppet's statement was *True* or *False*.

Experiment

Two conditions were manipulated.

- Disjunction type (between participants):
  - *ya. . . ya. . .*
  - *veya*
  - *ya da*
- Scenario (within participants):
  - 0-Disjunct-True
  - 1-Disjunct-True
  - 2-Disjunct-True

16 experimental trials:

- Four 1-Disjunct-True, 2-Disjunct-True, and 0-Disjunct-True conditions, four disjunction-less filler items and two practice trials.

Experiment

Figure: First scene in the experiment

The puppet Bibi uttered the guess sentence: *The chicken pushed the bus or the plane.*

Experiment

Figure: Example scenarios

The experimenter: *Did Bibi guess right?*

Experiment

The 1-DT and 2-DT conditions were crucial to the experiment.

Table: Interpretation of disjunction

Interpretation of Disjunction	**1DT**	**2DT**
Inclusive	Yes	Yes
Exclusive	Yes	No
Conjunctive	No	Yes

Results

- First, we eliminated participants who displayed less than 75% accuracy on the fillers and 0-DT scenarios (correctly answering 6 out of 8 sentences). This led to the exclusion of five children.
- To test the predictions of the alternatives-based account and ambiguity account, we grouped the disjunction markers as either containing alternatives (*veya*) or not (*ya da* and *ya...ya...*).
- We fitted several generalized linear mixed models (GLMMs).

Results

$Model = glmer(response \sim alternativepresence + scenario + group +$ alternativepresence * group + scenario * alternativepresence + scenario * group + (1 —Subject)

	Estimate	Std. Error	z-value	p-value	Sig.
(Intercept)	5.6216	0.8678	6.478	< 0.001	***
AlternativePresenceYes	-0.9829	0.7711	-1.275	0.2024	
Scenario2DT	-7.8256	0.8627	-9.071	< 0.001	***
GroupChild	-3.0179	0.8998	-3.354	< 0.001	***
AlternativePresenceYes:GroupChild	-0.3467	0.8119	-0.427	0.6693	
AlternativePresenceYes:Scenario2DT	3.9571	0.7482	5.288	< 0.001	***
Scenario2DT:GroupChild	7.5374	0.8675	8.689	< 0.001	***

*Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1*

Figure: Results of the maximal model

Alternative Presence and Scenario

To unpack the interactions between alternative presence and scenario, and scenario and group, we fitted four other GLMMs.

First, we investigated the effect of *veya* on 'yes' responses across scenarios (1DT/2DT) and groups (Child/Adult).

Children provided significantly fewer *yes* responses compared to adults ($\beta = 4.1610$, SE $= 1.2195$, $z = 3.412$, $p < .001$), implying that children's interpretations are more conjunctive or exclusive when *veya* is used.

A significant interaction between group and scenario was observed ($\beta = 7.8125$, SE $= 1.2233$, $z = 6.386$, $p < .001$), indicating that children provided significantly more *yes* responses in 2DT scenarios.

Alternative Presence and Scenario

We analyzed the effects of the nonpresence of alternatives (*ya da* and *ya...ya...*) on participants' responses.

The effect of 2DT was significant ($\beta = 3.2679$, SE $= 0.3214$, $z = -10.168$, $p < .001$), suggesting that participants provided fewer *yes* responses in 2DT scenarios.

The effect of group was significant ($\beta = 2.3795$, SE $= 0.4116$, $z = 5.781$, $p < 0.001$), indicating that children were more likely to give *yes* responses compared to adults.

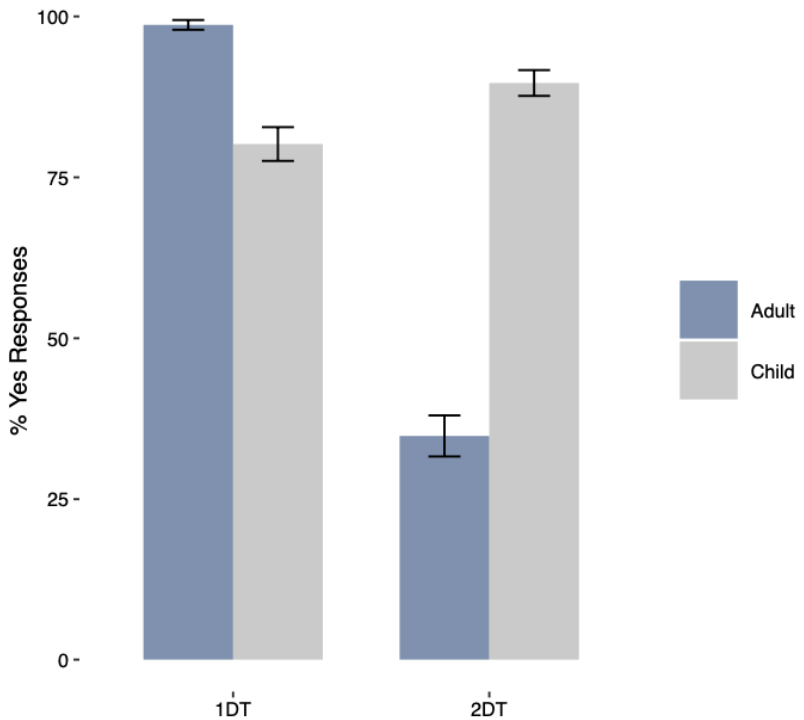
Scenario and Group

Another interaction that the model revealed was between the scenario and group.

First, we examined children's responses in 1DT and 2DT.

The effect of scenario on children's responses was significant ($\beta = 0.9229$, SE $= 0.3011$, $z = 3.065$, $p < .001$), suggesting that children provided significantly more *yes* responses in 2DT scenarios compared to 1DT scenarios.

Scenario and Group



We investigated adults' responses in 1DT and 2DT scenarios.

The results demonstrated that the effect of scenario was also significant in adult participants ($\beta = 5.2425$, SE $= 0.6331$, $z = -8.280$, $p < .001$).

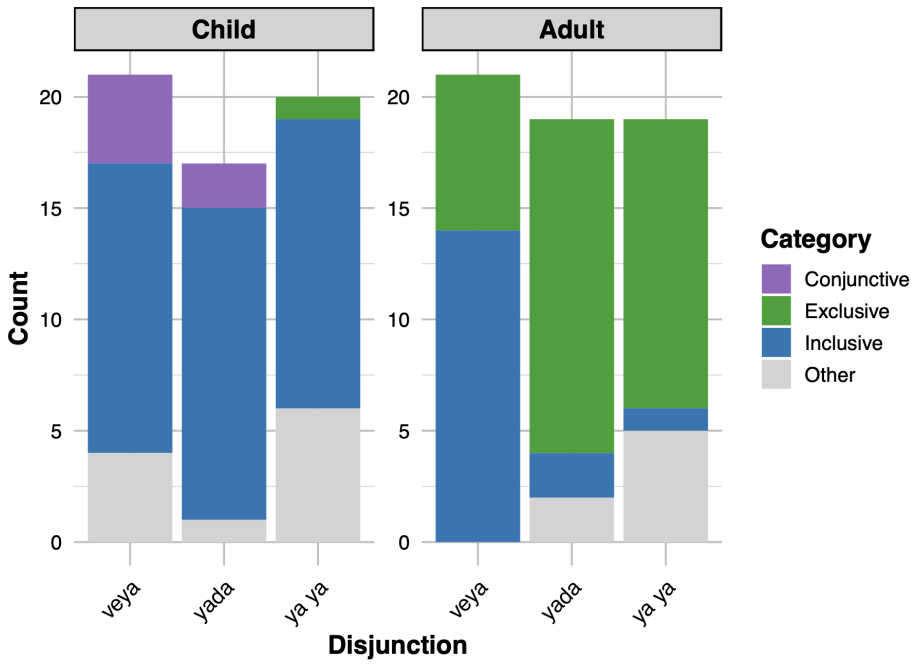
Unlike children, adults provided significantly fewer *yes* responses in 2DT scenarios.

Categorization

Following Tieu et al. (2017) and Skordos et al. (2020), we classified participants' responses as follows:

- **Exclusive:** Participants who accepted at least 3/4 1-Disjunct-True trials and rejected 3/4 2-Disjunct-True trials.
- **Inclusive:** Participants who accepted at least 3/4 1-Disjunct-True and 2-Disjunct-True trials.
- **Conjunctive:** Participants who rejected at least 3/4 1-Disjunct-True trials and accepted at least 3/4 2-Disjunct-True trials.
- **Other:** Participants whose answers did not fit into these categories.

Categorization



Children's interpretations were inclusive, while six children had conjunctive interpretations.

There were no conjunctive interpretations of disjunction in adults, and the majority interpreted disjunctions exclusively.

Discussion

Aim: Whether children's interpretations align more closely with the alternatives-based or the ambiguity account.

The predictions of the *Alternatives-based account* did not hold.

Turkish-speaking children interpreted *veya* conjunctively or inclusively, but not exclusively, even though it facilitated access to the stronger alternative *ve* 'and'.

Also, *ya...ya...* was interpeted inclusively or exclusively, but not conjunctively.

Discussion

Our results align well with the predictions of the *ambiguity account*.

Children interpreted simplex disjunctions *veya* and *ya da* inclusively or conjunctively, whereas the complex disjunction *ya...ya...* was interpreted exclusively or inclusively, but not conjunctively.

Discussion

Only accessing the stronger alternative was not sufficient for children to have adult-like interpretations.

Our results raise the possibility that the conjunctive interpretation may not result from failure to access the alternatives and scalar implicature computation.

Our results also did not support the previous claims that experimental design and random guessing play a role in children's conjunctive interpretation (Skordos et al., 2020).

Discussion

We assumed that alternatives are lexical items, but alternatives might be conceptual and compete at the level of general reasoning preferences (Buccola et al., 2022).

Turkish-speaking children could easily access the stronger alternative, but some of them still interpreted disjunction as a conjunction.

So, if conjunction is cognitively simpler than inclusive *or* and exclusive *or*, some children may prefer the conjunctive interpretation or only access the conjunction.

Discussion

Further support for the conceptual alternatives hypothesis might come from the morphological complexity of Turkish disjunction markers.

Exclusive and inclusive *or* might be more complex than *and* (Zimmermann, 2000; Geurts, 2005; Piantadosi et al., 2016).

or: $\diamond p \wedge \diamond q$ (*Zimmerman*, 2000; *Geurts*, 2005)

exclusive or: $(\mathrm{p} \vee q) \wedge \neg(p \wedge q)$

I argue that there might a possible acquisition trajectory:

Possible Acquisition Trajectory

and $>$ inclusive *or* $>$ exclusive *or*

Future Work and Limitations

- Younger children should be tested to explore whether younger children interpret disjunctions more conjunctively.
- Another study that primes alternatives conceptually rather than lexically should be conducted.
- Another study with a larger sample of Turkish-speaking adults should be conducted.
- Online methods can be used, as it may be difficult for children to judge a sentence's felicity explicitly in TVJTs.
- Serbian- and Croatian-speaking children should be investigated to see whether their interpretations of disjunctions are also similar to those of Turkish-speaking children, as *ili* 'or' can be broken down into two particles: *i*, a conjunction marker, and *li*, a question clitic (Arsenijević, 2011).

Thank You!

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