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Distributional learning of visual object categories in children with and without DLD

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DLD AND DISTRIBUTIONAL LEARNING

o Studies indicate that children with developmental language disorder (DLD) have difficulties with statistical learning (SL) e.g. Siegelman et al. 2017
o Distributional learning, a type of SL, plays a role in the formation of phonetic categories e.g. Maye et al., 2002
o Junge et al. (2018) found that distributional learning contributes to the formation of novel visual object categories in infants

→ It is unkown whether children with DLD have difficulty with this type of visual distributional learning

/p/ /p/ /b/
Voice onset time — Image adapted from De Vos (2012).
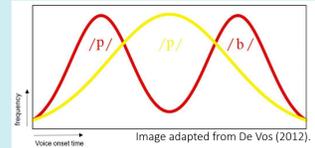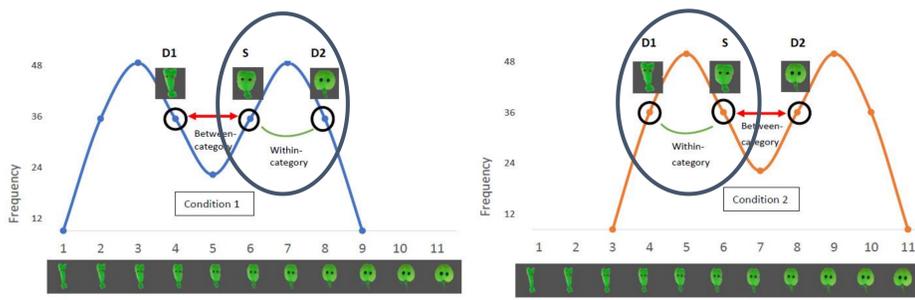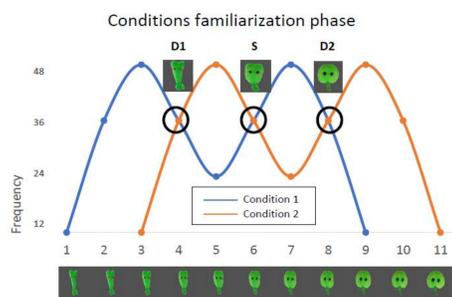
RESEARCH QUESTIONS

1. Are children with DLD less sensitive to distributional cues compared to typically developing (TD) children when learning novel visual object categories?
2. Does the ability of visual distributional learning contribute to lexical knowledge in children with DLD?

METHOD: FAMILIARIZATION PHASE

Based on Junge et al. (2018) and Chládkova et al. (2020).

A familiarization trial.

• An 11-step novel object continuum was constructed

• Participants were familiarized with tokens from the continuum
(288 tokens in total, duration +/- 8 minutes)

• Two learning conditions: distributional peaks at different positions in the continuum
→ Between-participant design: PPs did one of two familiarization conditions

Conditions familiarization phase

D1 S D2

Frequency — Condition 1 / Condition 2

D1 S D2 — Between-category / Within-category — Condition 1
D1 S D2 — Within-category / Between-category — Condition 2

Hypotheses
PPs in Condition 1 learn that tokens S and D2 belong to one category
PPs in Condition 2 learn that tokens S and D1 belong to one category

METHOD: PARTICIPANTS

• 25 children with DLD and 25 TD children (7-9 years old)

• The children with DLD were tested on receptive/productive vocabulary size (PPVT, CELF), semantic knowledge (Word Classes CELF) and lexical-semantic organization (Word Associations CELF)
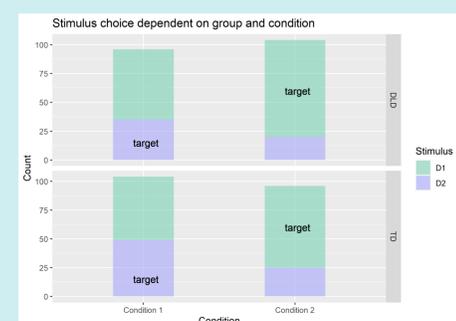
RESULTS

A generalized logistic linear mixed effect model in R was constructed to test:
• Does Condition (1/2) influence stimulus choice
• Is there an interaction between Condition x Group (DLD/TD)?

Children in Condition 1 were significantly more likely to choose stimulus D2 than children in Condition 2: $z = 2.758$, $p = 0.006$. However, there was no significant effect of Group: $z = 0.007$, $p = 0.994$.
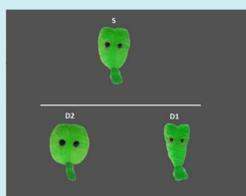
Familiarization condition significantly influences whether viewers prefer the combination S + D1 or S + D2. No evidence for a difference between children with and without DLD.

Stimulus choice dependent on group and condition
target / target — DLD
target / target — TD
Stimulus: D1 / D2
Condition 1 / Condition 2

Linear regression analyses showed no significant relationships between visual distributional learning lexical knowledge in children with DLD.

METHOD: TEST PHASE

• Eight 2A-FC test questions
• Does token D1 or D2 look more like token S?

S
D2 D1

Predictions
• PPs in Conditon 1 will choose token D2 more often than pps in Condition 2
• Children with DLD will show a weaker effect of Condition than TD children

DISCUSSION

• Familiarization condition significantly influenced our participants' preference for the combination of S and token D1 or D2, indicating that distributional properties of the input influence the categorization of visual stimuli

• No evidence for or against a visual distributional learning deficit in children with DLD (see also Lammertink et al., 2020)

• No evidence for or against a relationship between visual distributional learning and lexical knowledge in children with DLD

• There seems to be an inherent preference for the combination S + D1. Perhaps the visual continuum should be changed in future studies

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