

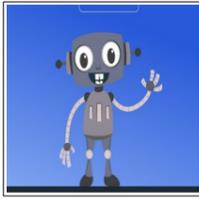
# AiRO – an Interactive Learning Tool for Children at Risk of Dyslexia

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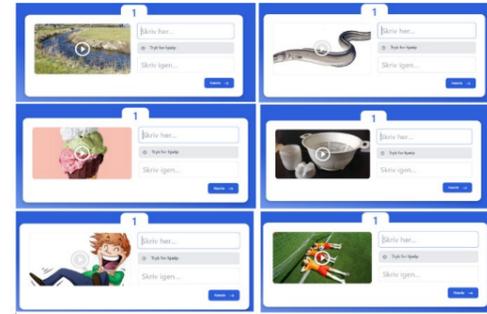
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**Seen from the user's point of view:** AiRO is a friendly agent presenting spelling tasks in a progressive fashion, beginning from trivial one-letter words and continuing (depending on the pupil's profile and performance) with ever more challenging words.



1. Each target word is presented to the user with a pictogram or a photograph, accompanied by its pronunciation (in synthetic speech).
2. The user responds by spelling the target word as best she can, letter by letter.
3. For each new keystroke, AiRO responds with an auditive rendering of the word-so-far (pronounced by a synthetic voice).
4. As soon as the word is completed, an encouraging greeting is given, and a new word presented.
5. The process is spiced up with a little game logic (points and praise); but most users actually find the interaction amusing in itself

## The algorithm **ASPERA** (**A**rticulated **S**pelling **R**esponse **A**lgorithm) is the backbone of AiRO

Aspera is based on these principles:

- **Orthographic constraints:** None. Aspera must convert any string of letters to a phonetic form, phonologically well-formed when possible.
- **Phonetic constraints:** None. The AiRO speech synthesis must be able to articulate any phonetic form (even if phonologically ill-formed).
- **Didactic constraints:** The auditory response must provide relevant cues (promoting and inhibiting), guiding the spelling process closely.

The phonetic productions of Aspera (driving the synthetic voice) must comply with the formal principles of

- **Hyper-articulation**
  - The synthetic voice can accurately pronounce any phone string (even if 'anomalous')
  - The synthetic voice can pronounce any subpart of a phone (allowing sub-phones in *P*-forms)
- **Progressive response**
  - Flawless spelling is confirmed by spoken responses continuously extending towards *P*
- **Polarized feedback**
  - Spelling errors trigger spoken responses maximally distinct from the correct lettering

## AiRO's first days at school

1. In November 2021, AiRO was tested for the first time by pupils in the Danish primary school.
2. 49 pupils were selected from nine kindergarten classes – children 6 years of age with difficulties learning the letter-to-sound correlations
3. The pupils were divided into two groups: One experimental, one control.
4. The experimental group used AiRO on a near-daily basis for four weeks.
5. At the end of the test period, the experimental group outperformed the control group (for reading as well as spelling)
6. Results are summarized in the tables (PRETEST and POSTTEST, resp.)

### PRETEST

Measure (min-max, #items)	N	M	Range
Experimental group			
Spelling (0-28, 10)	23	8.3	4.2-11.6
Reading (0-72, 12)	17	35.7	27.0-43.0
Control group			
Spelling (0-28, 10)	21	11.1	5.2-17.2
Reading (0-72, 12)	14	40.0	32.0-49.0

### POSTTEST

Measure (min-max, #items)	N	M	Range
Experimental group			
Spelling (0-28, 10)	23	8.3	4.2-11.6
Reading (0-72, 12)	17	35.7	27.0-43.0
Control group			
Spelling (0-28, 10)	21	11.1	5.2-17.2
Reading (0-72, 12)	14	40.0	32.0-49.0

## CONCLUSION

In Denmark, every second adult dyslectic has never received individual offers from the education system, such as one-on-one teaching, special courses (in or outside class) or indeed personalized help of any sort (Mejding et al., 2017; Egmont 2018). It's about time that we relieve the burden of dyslexia for everyone – because we can.