

Letter-speech sound mapping within an artificial orthography: A comparison between dyslexic and non-dyslexic readers

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Aims

- 1 To examine if there is a difference between dyslexic readers and normal readers in their ability to learn letter-speech sound mappings
- 2 To explore the ability of letter-speech sound learning measures to predict reading and spelling skills
- 3 To explore how letter-speech sound learning measures are related to phonological awareness, rapid naming, verbal short-term memory, reading, and spelling

What we did

Dyslexic and non-dyslexic readers engaged in a short training (20 minutes) aimed at learning eight basic letter-speech sound correspondences within an artificial orthography. After the training we assessed both the knowledge of these correspondences and word reading ability in this unfamiliar script.

Artificial orthography

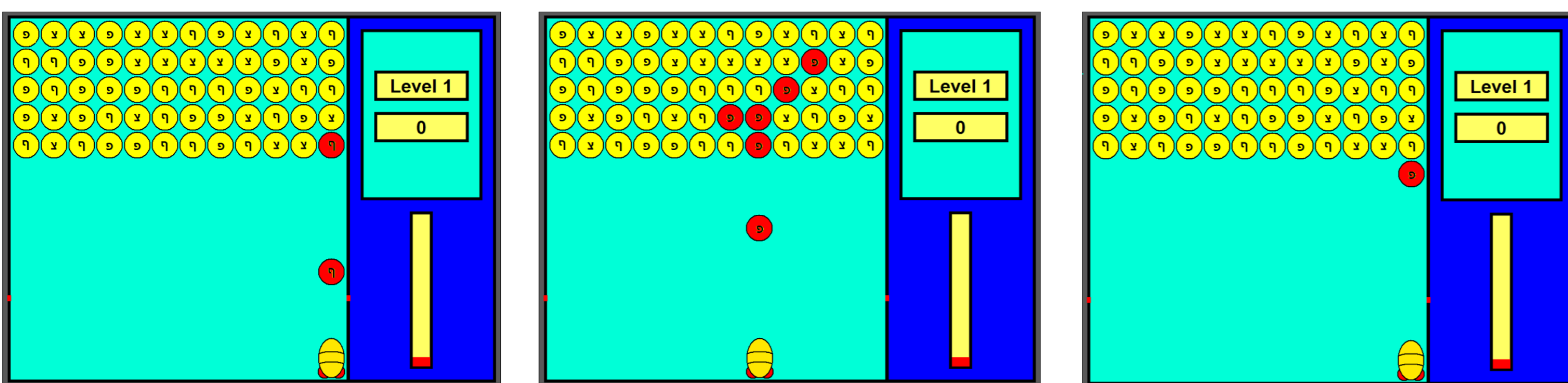
Grapheme	ט	כ	ם	ך	פ	צ	ך	ש
Phoneme (IPA)	/u/	/ε/	/α/	/k/	/t/	/l/	/t/	/n/

We applied correlation and regression analyses to test how disrupted letter-speech sound learning relates to other phonology-related deficiencies, such as poor phonological awareness and poor rapid naming skills, when it comes to predicting reading and spelling skills.

Participant characteristics

Dyslexic Group	Control Group
N=47 (28σ/19♀)	N=27 (15σ/12♀)
Age 9,4	Age 9,7
Intelligence C=5,72	Intelligence C=6,18
Persistent reading disability	Average or higher reading proficiency
Specific phonological deficit	

Training



Results: A letter-speech sound binding deficit as a characteristic of dyslexia

	Dyslexic (n=46)	Control (n=26)
	M (SD)	M (SD)
L-SS identification accuracy** (artificial orthography)	49.00 (7,88)	53.65 (1.94)
L-SS identification speed** (artificial orthography)	1724.92 (650.21)	1393.40 (291.87)
Words read per second* (artificial orthography)	0.048 (0.049)	0.074 (0.063)

** significant at the 0,01 level (one-tailed)
* significant at the 0,05 level (one-tailed)

Findings: Compared to normal readers, dyslexic readers are impaired in their ability to learn letter-speech sound correspondences. After the training the normal readers outperformed the dyslexic readers on both accuracy and speed on a letter-speech sound identification task and on a word reading task containing familiar words written in the artificial orthography.

Results: Predicting reading and spelling skills

Regression analyses indicate that:

After controlling for phonological awareness (accuracy and speed) and rapid naming (letters and digits), the artificial orthography-related measures accounted for an additional 36% of the variance in reading speed and for an additional 27% of the variance in the amount of errors on a word dictation.

Both the amount of words read per second within the artificial orthography and the accuracy and speed measure of the identification task contributed unique variance to predicting reading speed and the amount of errors on a word dictation.

Findings: Together these results show that reading and spelling ability is better predicted by a combination of traditional phonological measures and artificial orthography-related measures than by traditional phonological measures alone. With the combo of tasks we were able to explain 74% of the variance of reading speed and 84% of the variance of the amount of errors on the word dictation.

Results: Correlations between letter-speech sound binding, phonological awareness, rapid naming, and verbal short-term memory

	1	2	3	4	5	6	7	8
1 L-SS Identification accuracy (artificial)	1	-.404**	.453**	.277*	-.012	-.215	-.217	-.044
2 L-SS Identification speed (artificial)		1	-.463**	-.315*	.111	.386**	.535**	.006
3 L-SS Words per second (artificial)			1	.479**	-.126	-.288*	-.369**	.145
4 Phonological awareness accuracy				1	-.150	-.092	-.113	.317*
5 Phonological awareness speed					1	.429**	-.223	.021
6 Rapid naming letters						1	.421**	.057
7 Rapid naming digits							1	0.96
8 Verbal short-term memory								1

** correlation is significant at the 0,01 level (one-tailed)
* correlation is significant at the 0,05 level (one-tailed)

Results: Correlations between letter-speech sound binding, phonological awareness, rapid naming, verbal short-term memory, and reading and spelling ability

	1	2	3	4	5	6	7	8
Reading accuracy	.175	.163	.417*	.303	.039	.096	-.197	.032
Reading rate	.108	-.342*	.423**	-.008	-.377*	-.318*	-.411*	-.169
Spelling: word dictation	-.694**	.296	-.619**	-.348	.094	.160	.493**	-.084
Spelling: recognition accuracy	.496*	-.360	.330	.426*	-.098	-.339	-.395*	-.169
Spelling: recognition speed	-.015	.377	-.272	.086	.455*	.365	.083	.218

** correlation is significant at the 0,01 level (one-tailed)
* correlation is significant at the 0,05 level (one-tailed)

Findings: The amount of words read per second within the artificial orthography was the strongest correlate of reading skill. This measure correlated with both accuracy and speed measures of reading, whereas rapid naming and the speed measure of phonological awareness only significantly correlated with reading rate. The speed measure from the identification task also correlated significantly with reading rate. Moreover, a strong correlation was found between both the accuracy measure of the identification task and the amount of words read per second within the artificial orthography with the achievement on a word dictation.

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