Complementing phonological therapy for dyslexia: visual vs cross-modal treatment

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Introduction

While there is general agreement about the efficacy of classic "phonic" training methods in improving reading disorders in children, our understanding of the reasons why this improvement should occur still remain very poor. In particular, it is widely held that phonological methods that integrate teaching of phoneme-grapheme correspondence are up to twice as active as phonological-only methods (Ehri et al., 2001). However, it is not known whether the additional benefit resulting from intensive training of grapheme-phoneme mapping is due to specific improvement of audio-visual transcoding (Kujala et al., 2001; Magnan et al., 2004) or alternatively to the recovery of a non specific visual or visuo-attentional deficit (Bosse et al., 2007).

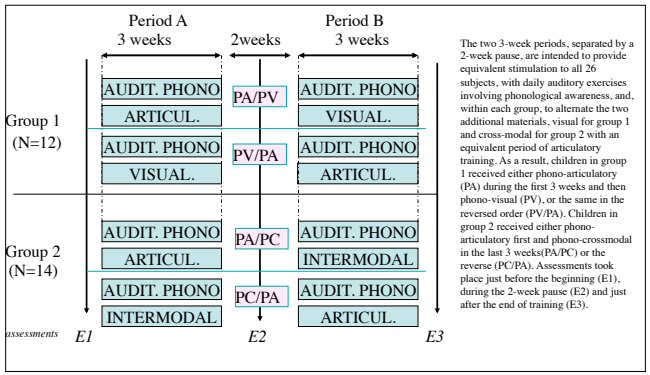
Rationale

In the present study, we sought to evaluate the advantage of adding either audio-visual training or visuo-attentional stimulation to classical phonological treatment. To this end, we compared two groups of dyslexic children with clinically ascertained phonological dyslexia, both receiving the same auditory phonological treatment as a "background treatment" (Habib et al., 1999, 2002), thus insuring that all participants drew some benefit from the study. In addition, one group also received various exercises focusing on visual perception and visuo-attentional processes, while the other received an adapted form of the "Basket-ball game" from Play-On® program (Danon-Boileau & Barbier, 2000).

Material and methods

Participants :

Twenty-six children (21 males), mean age 118 months (±13.5), with severe phonological dyslexia were included in the study on the basis of significant lag between reading and chronological age (mean difference : 34 months ±15) not explainable by lack of intelligence or insufficient schooling.



The two 3-week periods, separated by a 2-week pause, are intended to provide equivalent stimulation to all 26 subjects, with daily auditory exercises involving phonological awareness, and, within each group, to alternate the two additional materials, visual for group 1 and cross-modal for group 2 with an equivalent period of articulatory training. As a result, children in group 1 received either phono-articulatory (PA) during the first 3 weeks and then phono-visual (PV), or the same in the reversed order (PV/PA). Children in group 2 received either phono-articulatory first and phono-crossmodal in the last 3 weeks(PA/PC) or the reverse (PC/PA). Assessments took place just before the beginning (E1), during the 2-week pause (E2) and just after the end of training (E3).

Experimental design

Training procedures

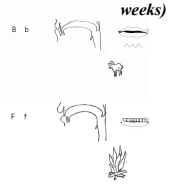
1°) auditory phonological training (6 weeks daily, 30 min/ day)

Triplets of words/non-words recorded on audio-CD

Point to the 2 rhyming words

Response by pointing to labels "1, 2, or 3"

2°) articulatory training (30 min/d, 3 times a week, 3 weeks)



- Example of plates used in intensive articulatory training
- Along with IBM « Speech-viewer™ » software

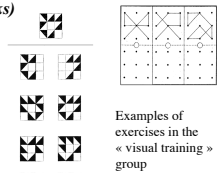
3°) Cross-modal training (20 min/ day, 3 times a weeks, 3 weeks)

From the top of the screen, red or blue balls fall automatically, coinciding temporally with one of two syllables, for instance /ba/ with a red ball and /pa/ with the blue one. Pairs to discriminate successively included the following voiced-unvoiced pairs : /p/ b/, /t/d/ , /k/g/, /f/v/, /ch/j/ and /s/z/.

Children have to direct the ball to the appropriate (same colour) basket. After 5 correct trials, the ball becomes grey and children have to improve their score as quickly as possible

The "Basket-ball game" from Play-on® (Danon-Boileau & Barbier, 2000)

4°) Visual- spatial and visuo-attentional training (25 min, 3 times a week, 3 weeks)



Examples of exercises in the « visual training » group

Results

1°) group comparisons : cross-modal vs visual

Repeated-measure ANOVA (group x sessions).

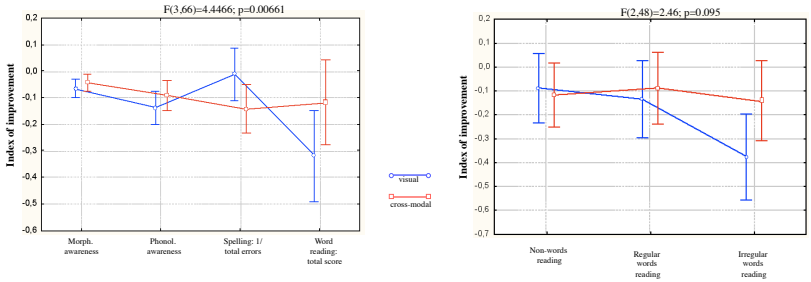
The main result of this comparison was that both groups gradually improved on repetition and phonological / morphological awareness tasks, suggesting the efficacy of "background" phonological training on these variables.

In addition, there was an opposite tendency for number of orthographic errors in text dictation, which improved more in the cross-modal group and measures of "sight" reading which improved more in the visual group.

Sub-group analyses revealed no significant order effect

	group		ANOVA result		
task	*group1 (visual)*	*group2 (cross-modal)*	*group effect*	*session*	*interaction*
Articulation E1 E3	8245(5.97) 8504(3.95)	8507(4.17) 8407(5.26)	n.s.	n.s.	F(1,24)=4,703 p=.00412
Repetition E1 E3	1236(1.73) 1445(1.15)	1303(1785) 1334(1.84)	n.s.	F(1,24)=17.97, p=.00003	F(1,24)=11.21, p=0.0029
Phondogical awareness E1 E3	5954(12.66) 7718(4.89)	6453(16.63) 76(1358)	n.s.	F(1,24)=40.18 p=.00001	ns
Reading E1 E3	2263(8.01) 2890(5.41)	2469(2.94) 26923(2.73)	n.s.	F(1,24)=22.31 P=.00001	F(1,4)=5,429 p=.00294
Orthographic errors (text) E1 E3	2281(11.52) 2415(13.13)	21(1164) 1446(6.72)	n.s.	F(1,24)=3.036 p=.00954	F(1,24)=5.461 p=.00289
Spelling non-word dictation/correct E1 E3	4.58(3.96) 9.58(4.36)	7.92(5.91) 10214(5.23)	n.s.	F(1,24)=25.29 p=.00001	n.s.
Morphological awareness E1 E3	6272(7.74) 7118(4.68)	66(8416) 7161(8.86)	n.s.	F(1,24)=23.78 =.0001	n.s.

2°) Effect of task (indices of improvement)



Indices of improvement (E3-E1)/(E3+E1) calculated from scores before the beginning (E1) and after the end of 6 weeks of training (E3), for the 2 treatment groups ('visual' for visuo-spatial and visuo-attentional exercises,' cross-modal' for Play-on® basket-ball game)

Conclusion

Training phonological awareness with strictly auditory materials remains the basis of dyslexia treatment.

The additional benefit obtained from exerting phoneme-grapheme mapping does not seem to result from improvement of cross-modal mechanisms, but more probably from visual-attentional stimulation. Further advances in dyslexia treatment will have to take into account these preliminary observations

Moreover, these results may be discussed in the light of connectionist models of reading : whereas classical "triangle" model (Seidenberg & Mc Clelland, 1989) hardly accounts for the facts, models taking into account the attentional dimension (Ans et al., 1999) are likely to provide a better explanatory framework.

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