Swiss GraphoGame: Concept and design presentation of a computerised reading intervention for children with high risk for poor reading outcomes

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Abstract

Developmental dyslexia is found in 30 to 65% of the children from high risk families (parent or sibling affected). The computerised GraphoGame training program aims to improve reading acquisition for children with a high risk for developing reading and spelling problems. GraphoGame® is a learning platform developed at the University of Jyväskylä in Finland to support poor reading children during reading acquisition. Here, we present the concept and design of the new Swiss GraphoGame, which at a linguistic level has been developed to especially suit the needs of children speaking an orthographically semi-transparent language (German).

The efficacy of this computerised intervention is currently being evaluated with (Swiss) German speaking children at risk for reading and spelling disabilities in the middle and the end of first grade. Upon successful evaluation of this intervention, the computerised training game may be used by parents, teachers and therapists to help children with special needs with regard to reading acquisition.

Index Terms: developmental dyslexia, computerised grapheme-phoneme correspondence training, GraphoGame technology, first school year, semi-transparent orthography

1. Introduction

Developmental dyslexia is defined as “marked by reading achievement that falls substantially below that expected given the individual's chronological age, measured intelligence, and age-appropriate education” [1]. Dyslexic children perform poorly in phonological discrimination and in verbal short term memory tasks indicating a strong link between phonological awareness and reading skills [2]. Impaired integration of speech sound and print has been considered as one of the core problems impeding reading acquisition in children suffering from dyslexia [3].

Computer-assisted educational games fostering intellectual and cognitive development are increasingly used to support children with learning deficits [4]. For struggling readers, a multitude of such games focussing on different skills exists. Two recent meta-analyses showed that phonic trainings are most effective for dyslexics across languages of different orthographic transparency [5, 6]. GraphoGame, relying on a phonics approach, has been successfully applied in preschoolers in a former study of our own group [7] and in dyslexic children of transparent and opaque orthographies as English. In a British study, for instance, phoneme-based and rhyme-based GraphoGame interventions were compared. Second grade poor reading children (not necessarily dyslexic) aged between 6 and 7 years played the two different versions during 12 weeks. Both versions were found to be effective, but the rhyme-game yielded slightly more progresses during the gaming period [8]. On the other side, in a transparent orthography, systematic repetition of basic phoneme-grapheme combinations is crucial [9].

German is frequently addressed as a transparent language [10], but a closer look uncovers multilateral phoneme-grapheme relations, which have to be incorporated in a training [11]. Moreover, when addressing young children, it has also to be considered that the Swiss variety of Standard German is not identical with Standard German, particularly in terms of pronunciation [12].

The here presented Swiss GraphoGame training for 1st and 2nd graders is currently being evaluated in a longitudinal, randomized, single-blinded, cross-over intervention study. We aim to assess behavioural and neural correlates of grapheme-phoneme learning in children with high risk for poor reading outcome by means of combined EEG/fMRI measurements before and after the training.

Figure 1: Ladder level of Swiss GraphoGame containing bigrams of high transparency. The yellow bar reports the amount of remaining trials. With a click on the loudspeaker, the auditory stimulus (target) is repeated.
2. Methods

2.1. The GraphoGame Method

GraphoGame® technology has been developed by the University of Jyväskylä in Finland [13, 14]. The task of the player is, after having been presented auditorily with the phoneme, to click on the appropriate grapheme from a selection on a computer screen. Tasks may be presented in varied forms, from the simple trial to more playful game variations in order to maintain a player’s motivation. Immediate feedback is provided, the requested target is repeated and the number of distractors is adaptive, i.e., reduced in case of an error. Admitted number of errors is defined according to the difficulty of a specific level. Complex items are presented only after the successful completion of the basic levels. Assessment levels contain the whole phoneme–grapheme inventory permit feedback about the player’s progresses. The game is completed by a reward system. All activities of individual children in GraphoGame are logged [14]. This information can be used to determine individual learning profiles and strategies of children, which may in turn help to further develop the game for different groups of children.

2.2. Swiss GraphoGame

Working with Swiss-German children, the game had to fit the semi-transparent orthography of Standard German. Phonemes of the Swiss High German phoneme inventory [12] are thematically grouped from transparent to opaque phoneme-grapheme relations. Phonemes with a one-to-one phoneme-grapheme relation are presented first, opaque relations once the one-to-one correspondences are consolidated. All correspondences are repeated at least 10 times as targets and are completed by polygrams (see Figure 1), words, short phrases and non-words. All items occur as targets and as distractors. Stimuli were controlled for their frequency in ChildLex [15] and in CELEX [16]. We controlled for Coltheart’s neighbours [17] and summated bigram frequencies [18] in words. In addition, four test levels containing the whole phoneme-grapheme inventory are distributed across the game allowing monitoring performance improvements for core grapheme-phoneme associations.

3. Conclusions and Perspectives

Training grapheme-phoneme correspondences is known to support children with poor reading skills. After evaluation of Swiss GraphoGame in poor reading children, this kind of learning environment may be extended and modified in order to fit the needs of other individuals with reading deficits. School children, adolescent or adult poor readers such as those with developmental or acquired dyslexia and/or alexia may benefit from Swiss GraphoGame. A self-paced training for the application by speech therapists might be promising as well.

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5. References