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Further evidence for persisting difficulties in orthographic learning in highly educated adults with a history of developmental dyslexia

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Adults who present with a history of developmental dyslexia (DD) often continue to be poor spellers, even if they have acquired relatively normal reading abilities and are highly educated (e.g., Miles, 1993). This has been interpreted as reflecting incomplete or imprecise orthographic representations in long-term memory which are inadequate for perfect spelling but which might nevertheless provide partial clues sufficient for reading (Holmes & Carruthers, 1998). However, the processes underlying the long-term acquisition of orthographic representations in adults with a history of DD have not yet been extensively investigated. The aim of the present study was to explore the ability to acquire new orthographic representations in adults with DD. More specifically, learning of orthographic representations for unfamiliar items (pseudo-words) was used in order to ensure a strict control of the degree of exposure to the orthographic material that has to be learned. Both explicit (task 1) and incidental (task 2) learning procedures were administered.

Twelve dysorthographic and 12 non-dysorthographic undergraduate and graduate students participated in this study. The two groups were matched for chronological age (age range: 19-35 years) and gender (5 females and 7 males in each group), as well as for years of education, type of courses taken and academic achievement. The dysorthographic participants presented with a history of reading disabilities and they scored at least two standard deviations below normal performance on standard orthographic tests. All the non-dysorthographic participants presented with scores equal or superior to average performance on these tests.

The abilities to acquire new orthographic representations were assessed by two tasks. In task 1, participants were explicitly instructed to learn to associate the phonological and the orthographic form of 24 pseudowords distributed over three learning sessions. The orthographic form attributed to each pseudoword included inconsistent graphemes. In each learning session, the experimenter firstly presented, one by one, the visual form of 8 pseudowords printed on individual cards and read them aloud simultaneously. Then, only the oral form was presented by the experimenter and the participants were requested to give the corresponding written form. Immediate positive feedback was given for each correctly spelled item. For incorrectly spelled items, the cards containing the correct orthographic form were represented. This procedure was repeated until the entire set of 8 pseudowords was written correctly on two successive trials. There was a maximum number of six trials. The number of correct responses given on the six trials was determined. The non-performed trials for sets of 8 pseudo-words that did not need six presentations for being spelled correctly on two successive trials were automatically considered as correct. Each item was dictated again one week later and spelling performance was calculated. In task 2, participants were incidentally exposed to the orthographic form of 15 pseudowords via a written lexical decision task. The 15 unfamiliar items were divided in three lists of five items which were presented respectively one, three and six times in a random order and mixed with 60 words. The three lists were matched for degree of orthographic inconsistency. After a delay of 30 min at the end of the lexical decision task as well as one week later, the participants had to write-to-dictation the 15 pseudowords.

The results in tasks 1 and 2 were analyzed by a set of mixed ANOVA's, with group (dysorthographic, control), delay (immediate, one week later) as between- and within-subject factors, as well as number of presentations (1, 3, 6) as within-subject factor for task 2. Regarding number of correct spellings in task 1, a main effect of group [$F(1, 22) = 25.40$, $p < .0005$)] and of delay [$F(1, 22) = 179.08$, $p < .00001$)] as well as an interaction effect [$F(2, 44) = 8.28$, $p < .01$)] were observed. The interaction was further explored by planned comparisons, showing that performance dropped significantly in both groups in the delayed versus immediate writing-to-dictation condition, but this drop of performance was much more important in the dysorthographic group. Regarding number of correct spellings in task 2, a main effect of group [$F(1, 22) = 16.56$, $p < .001$)], of delay [$F(1, 22) = 13.48$, $p < .001$)], of number of presentations [$F(1, 22) = 21.19$, $p < .00001$)], as well as an interaction effect between group and number of presentations [$F(2, 44) = 4.08$, $p < .05$)] were observed. Planned comparisons showed that level of performance was much poorer in the dysorthographic group, and this drop of performance increased with number of presentations of the items to-be-learned: the group effect was indeed only

significant for items presented three or six times, but not for items presented once. Furthermore, performance for items presented six times in the dysorthographic group was at the same level as performance for items presented three times in the control group.

Our results show that, in strictly controlled learning conditions, both explicit and incidental acquisition of new orthographic representations is significantly poorer in highly educated adults with a history of DD than in adults with no such history. Thus, adults with DD do not seem to benefit from orthographic exposure in the same way as normal adults. Regarding the processes that could explain this limitation, the data of this study suggest that not only are the initial stages of encoding new orthographic representations disturbed, but most importantly, there seem to exist severe impairments at the level of maintenance in long term memory of new orthographic representations, as suggested by the important drop of spelling performance at delayed recall.

References

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