Bar Ilan University

Examination of Transfer Processes in Implicit Statistical Learning via an Artificial Grammar Learning Transfer Task, While Differentiating Between Verbal and Non-Verbal Stimuli:

Comparison between Adult Readers with Dyslexia and Adults with Typical Development

Hadar Cohen

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Abstract

The primary goal of the current study was to examine the transfer processes in implicit statistical learning among adult readers with dyslexia compared to readers with typical development. The transfer processes were examined by use of an Artificial Grammar Learning Transfer task in two experiments. One examined the transfer processes with regard to verbal stimuli (letters) and the other with non-verbal stimuli (geometric shapes).

The basic assumption in the study is that the learning of literacy skills, including reading and writing, is based on the learner's ability to extract a series of statistical regularities from the stimulation they are exposed to and transfer them flexibly from one stimuli to the other without explicit learning. These skills include the use of simplification and generalization processes. Therefore, difficulties in performing transfer processes in implicit statistical learning may pose as basis for the learning difficulties observed among the dyslectic population.

Research literature indicates that adult readers with dyslexia are capable of statistical learning processes in the Artificial Grammar Learning task, similarly to adult readers with typical development. Meaning, they are able to identify statistical regularities. However, their performances cannot indicate whether the implicit statistical learning processes, which were found to be typical, also reflect typical transfer processes.

The research literature further observes that dyslectic readers experience a specific difficulty in implicit statistical learning of verbal stimuli as opposed to non-verbal stimuli. However, the ability of adult readers with dyslexia to perform an Artificial Grammar Learning Transfer task has not been examined with regard to verbal and non-verbal stimuli. This task requires a higher level of simplification and generalization processes of the learned material. Thus, it is not yet known whether adults with dyslexia experience a difficulty in performing transfer tasks in implicit statistical learning and whether this difficulty is specific to verbal skills or reflects a more primary and general difficulty, non-related to the type of stimulation presented.

The current study examined the transfer processes in implicit statistical learning via an Artificial Grammar Learning Transfer task, in two experiments: verbal stimulation (letters) and non-verbal stimulation (geometric shapes). In the first experiment, participated 28 adult subjects

(10 males, 18 females), 13 subjects in the control group and 15 subjects with dyslexia. The participant's age ranged between 21 and 31. In the second experiment, participated 31 adults (16 males, 15 females), 18 subjects in the control group and 13 subjects with dyslexia. The participant's age ranged between 20 and 32.

Prior to performing the current study, the subjects underwent five reading tests: two accuracy tests (one for vowelized words and the other for unvowelized), two fluency tests (one for vowelized words and the other for unvowelized words) and a non-words reading test. It was found that the reading level of adult readers with dyslexia was low in all five reading tests compared to that of adults with typical development. However, no difference was found in the level of intelligence.

The results of the first test indicates that unlike adults with typical development, adult readers with dyslexia did not reach the chance level for identifying grammatical strings in the Artificial Grammar Learning Transfer task, which includes verbal stimuli (letters). Similar results were found in the second test where, unlike adult readers with typical development, adult readers with dyslexia did not reach the chance level for identifying grammatical strings in the Artificial Grammar Learning Transfer task, which includes non-verbal stimuli (geometric shapes). These findings point to a difficulty in performing implicit statistical learning transfer processes among adults with dyslexia, regardless of the type of stimuli. The difficulty is a general and initial one in this ability and therefore is expressed in the verbal field, where adult readers with dyslexia experience a specific difficulty as well in the non-verbal field.

Difficulties in performing transfer processes in the Artificial Grammar Learning Transfer Task, indicate that although adult readers with dyslexia are able to learn the statistical regularities, their learning is limited and does not reflect simplification and generalization abilities. Thus, their learning processes are less flexible and non-transferable between various stimuli. These difficulties may provide an additional explanation to the reading difficulties observed among the dyslectic population, seeing as transfer processes play a significant role in the ability to learn language skills, which require a transfer of the learned knowledge from one stimuli to the other, even without explicit learning. Therefore, difficulties in performing transfer tasks may pose an obstacle in the ability to develop a solid lexicon as well as the required fluent and exact reading, observed among adult readers with dyslexia.

The uniqueness of the current study lies in it being the first study of its kind to examine the function of adult readers with dyslexia compared to adult readers with typical development, in performing implicit statistical learning transfer processes, via an Artificial Grammar Learning task, while differentiating between verbal and non-verbal stimuli. In light of the above, the current study is as an additional layer in the comprehension of the difficulties adult readers with dyslexia experience and adds to the study of dyslexia in this field.