Theses of doctoral (PhD) dissertation

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VOCABULARY STRUCTURE OF FOREIGN LANGUAGE LEARNERS WITH DYSLEXIA

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1 Background and aims of the research

In recent years teachers have been facing an increasing number of students with dyslexia and dysgraphia as well as students with learning disabilities in the educational system. In fact, 5 to 10 percent of the population is considered to be dyslexic worldwide. The school subjects are already more or less challenging for them, while learning a new language is extremely difficult for the majority of dyslexic students. Difficulties in foreign language (L2) acquisition stem from deficiencies in one or more skills in the students' native language components. The new phonological and orthographic system, and the low average number of foreign language lessons at school increase their difficulties in learning a foreign language. In recent years, it has become a widespread practice to give partial or even complete dispensation of learning a foreign language in school for learners with a learning disability. However, this only further complicates their situation. Although we know a lot about the causes of dyslexia and dysgraphia, and the difficulties in learning a foreign language have been examined for decades, many questions remain unanswered. Research on problems of foreign language learners with dyslexia has so far concentrated on the assessment of dyslexia in a second language, on the differences and similarities of problems in phonological processing across languages, and we can also find references on difficulties in vocabulary acquisition. In native languages (L1) evidence has already been found for divergent semantic processing in dyslexic people.

My teaching experience as a German foreign language teacher has shown that dyslexic students experience difficulties less in reading words, but rather in learning and remembering new vocabulary and in learning and using new grammatical rules and syntactic structures. My question was the following: What is the reason for the difficulty in learning and remembering vocabulary despite the relatively simple spelling and pronunciation rules in German? In addition, this difficulty is not present in the same way in the vocabulary of the conversation topics. Therefore, as a first step within the research of the vocabulary acquisition, my aim was to examine the features and the structure of the semantic representations and the semantic processing in order to better understand why students cannot acquire and remember vocabulary effectively despite their motivation and increasing efforts. In my research I basically addressed the following questions: Do foreign language learners with dyslexia and dysgraphia organise the relationships between words in their vocabulary in a different manner than in their mother tongue and than language learners with typical language development in their native and in a foreign language? That is, do foreign language learners with dyslexia/dysgraphia process and store the information about words and semantic and conceptual content differently, and do they activate these features differently than people with typical language development? Based on theoretical and empirical results, the long-term purpose of my research is to develop a theoretical background and methods that can effectively help dyslexic language learners to acquire foreign language vocabulary.

Research questions

A series of three, interrelated experiments were conducted to estimate differences and similarities in the organisation of lexical knowledge in German learners and native speakers with dyslexia/dysgraphia and persons with typical language development. In the first experiment I measured the spontaneous word generation process involving foreign languages using a free continuous word association task with German stimuli allowing intra- and inter-lingual responses (in any languages they know). The following research questions were addressed:

1) *Are there significant differences between the group with dyslexia/dysgraphia and the control groups in the number of overall associations and the responses generated to the three word classes?*

2) *Are there significant differences in the lexical features of the responses between the group with dyslexia/dysgraphia and the control groups?*

3) *Can the groups be distinguished on the basis of their responses? Is there a word association pattern characteristic of language learners with dyslexia/dysgraphia? Is it possible to discriminate between the three groups based on their patterns of word association?*

In the second experiment I used the same stimuli as in the first, but that time in Hungarian. The participants were Hungarian native speakers with dyslexia/dysgraphia and typical language development. This time the lexical characteristics of the responses of all five groups of the participants–L2 German learners with higher and lower vocabulary knowledge and native speakers (forming the three control groups), L2 German learners and native speakers with dyslexia/dysgraphia–were compared.

Comparing the results of the two word association tests, I addressed the following questions:

1) *Are there similarities in the pattern of word associations in the two groups with dyslexia/dysgraphia irrespectively of the language of the stimuli?*

2) *Are there significant differences in the lexical features of the responses between the control groups and the dyslexic groups?*

3) *Is the lexical-semantic pattern of the associations influenced by the language of the stimuli?*

In the third experiment semantic processing was investigated by means of a semantic decision task in a control group and a group with dyslexia/dysgraphia in German and Hungarian, respectively. With regard to the semantic decision task I formulated the following three research questions:

1) *Do persons with dyslexia/dysgraphia recognise taxonomic relations faster and more precisely than relations with situative features?*

2) *Do persons with dyslexia/dysgraphia recognise semantic relationships similarly irrespective of the language of the stimuli?*

3) *Are there differences in promptness and accuracy of the responses in the different situative and taxonomic relationships between the groups and the languages of the stimuli?*

2   Research method

In my research I examined the features of the vocabulary and the semantic processing of native Hungarian dyslexic language learners by means of two methods: a free continuous word association task in L1 and L2 using a questionnaire, and a semantic decision task. The first experiment was a free continuous word association task allowing inter-lingual responses using German stimuli. My aim was to assess the size and the structure of their lexical knowledge and also their word generating process. In light of the results of the first test, I carried out the word association test with Hungarian stimuli in order to compare the word association patterns in the control groups and people with dyslexia/dysgraphia. In the second experiment the research questions and the design relied on the result of the word association tests and I investigated the processing of certain situative properties

and taxonomic relations in people with dyslexia/dysgraphia and typical language development, in both German and Hungarian. To my knowledge, word association tests and a semantic decision task in a foreign language–to investigate semantic and conceptual processing as well as the differences in the organisation of the L2 mental lexicon–have never been conducted before in this group. The three experiments took place from April 2011 to March 2014 and the participants were all Hungarian native speakers, between the ages of 16 and 36.

Word association tests

Participants

In total, 473 native Hungarian, volunteering, adult L2 learners of German participated in this experiment. The results of 337 volunteer informants are presented in the dissertation. The participants of the word association test with German stimuli (N=195) were classified into three groups: the group of foreign language learners with dyslexia/dysgraphia (n=45) and two control groups. All informants completed a vocabulary test, and the control group (n=155) was divided into two groups based on their vocabulary tests: the group with higher vocabulary knowledge (n=75) and the group with lower vocabulary knowledge (n=75). In total, 142 persons participated in the second experiment containing Hungarian stimuli: 84 persons forming the control group and 58 persons with dyslexia/dysgraphia. All participants in the group with dyslexia/dysgraphia were selected on the basis of diagnostic tests carried out by the Hungarian authority 'Learning ability of the expert and rehabilitation committee services', which fact was confirmed in both word association tests by the participants.

Materials and procedure

The word association test in German was the last part of a questionnaire assessing the vocabulary knowledge of the participants; it contained 18 stimulus words selected from the Hungarian National German curriculum for the 12th grade. Seven nouns (*Familie/család, Garten/kert, Jahr/év, Monitor/monitor, Hund/kutya, Zimmer/szoba, Umwelt/környezet*), six verbs (*kaufen/vásárolni, spielen/játszani, fahren/utazni, kochen/főzni, arbeiten/dolgozni, lesen/olvasni*), three adjectives (*warm/meleg, schön/szép, gesund/egészséges*), one interrogative particle and one conjunction were chosen. In the word association test in Hungarian the same stimuli were used. In the dissertation I only presented the responses generated to the nouns, verbs and adjectives, that is, sixteen words belonging to word classes with rich content (Evans, 2007). The task was to write down at least three and at most five words to each stimulus coming into mind spontaneously. It was allowed to write down the words in any language they know to support the word generating process and to avoid the failure of testing. The participants completed most of the written word association tests during classes at school. The rest of the tests were sent to the volunteers in a Word document and, once they completed the tests, were sent back to me by email.

Method of analysis

For the data analysis of the word associations a partially new categorisation method of responses in L2 was used based on the theory of the multi-modal processing of concepts. I put one part of the responses into categories based on their meaning, and then these categories were compared with the categories used in studies investigating multi-modal conceptual processing (De Deyne–Storms 2008, Wu–Barsalou 2009). According to Barsalou and colleagues, conceptualisation takes place in a situated manner, i.e., concepts are grounded in

situations, and complex simulations become active across modalities to implement situated conceptualisation. The concepts are stored in modality-specific states activating patterns of conjunctive neurons in association areas (Lakoff–Johnson 1999, Pulvermüller 2001, Vigliocco–Vinson 2007, Evans 2007). Concepts are considered to be represented in a distributed fashion, coded by multiple representational units, and the contribution of these units to a concept can vary as a function of the context in which a concept is accessed, therefore providing the basis for conceptual flexibility. The categorisation method in this dissertation is partially based on the LASS (Language and Situated Simulation) theory of conceptual processing claiming that conceptual processing relies on several systems: the language and situated simulations both play a central role in conceptual processing and the representation of concepts (Barsalou et al. 2008).

I consider this partially new categorisation method integrative, since the traditionally used categories in L2 are thus complemented with categories referring to the multi-modal processing of concepts. As a consequence, the content of the categories are partly changed: they are more fine-grained and less artificial. The categories are data-driven, so they adjust to the responses triggered by the stimuli, therefore it is possible to have a more precise insight into the structure of the lexical organisation of L2 learners and also into their word generating process. In this dissertation the following categories were used: *translation equivalents*, *syntagmatic* responses in a narrower sense (collocations, words related to the argument structure), *taxonomic* responses (coordination, synonyms, antonyms etc.), categories coming from studies using the LASS theory such as *lexical* responses (including clang association, compounds, inflexion, derivation), and the category of *situative-introspective properties*. Situative-introspective responses describe the various characteristics of a word's concept, such as information attached to situations (location, time, instruments, individuals, living things, function, environment, manner, quantity and quality or associations in a broader sense), entities (describing external and internal properties of objects), and introspective features (such as mental state, abstract content and reflexion). The category '*other*' included exclusively random or misinterpreted responses (cue: *spielen* > response: *beszélni* (sprechen, 'to speak').

Semantic decision test

The second experiment was carried out to confirm the results of the word association tests using a semantic decision task. The goal was to examine whether difficulties arise for people with dyslexia/dysgraphia only when recalling words or activating associations to words, or there are also measurable differences when the task requires the recognition of semantic associations. In the semantic decision test promptness and accuracy of decision on word pairs with taxonomic relations and situative properties were measured. The participants had to decide whether two consecutive words were semantically related or not.

Participants

The semantic decision test was carried out in several secondary schools, colleges and universities, with a total of 140 persons participating voluntarily in the test. The participants in the group with dyslexia/dysgraphia were selected on the basis of three items using the new diagnostic test 3DM-H (Tóth et al. 2014). The three tasks were the following: a nonword reading test, a phoneme deletion test, and a RAN (rapid naming) test. Data were collected from 140 persons, and the data of 120 persons were used in the data analysis.

Materials and procedure

The nouns from the word association test and the responses frequently given to them served as the starting point of the stimulus-selection for the semantic decision test. Beside the taxonomic relation I chose four situative features, to which people with dyslexia/dysgraphia gave either more or less responses than the control groups in the word association test. After testing numerous word pairs, I chose twenty stimuli and four cues to them referring to situative features such as *location*, *quality*, *object*, and *situation in a broader sense*. Then I selected two *taxonomic* relations to ten words in German and Hungarian. The participants performed 200 trials, half of which were critical trials and half were unrelated word pairs (fillers).

Data analysis

In the word association tests the means of the responses given to the categories were compared. In the semantic decision test reaction time and accuracy were measured and I compared the median reaction times of the groups. The data were analysed using various statistical methods (e.g. ANOVA, t-test, Discriminant Analysis, LVPLS model) in an attempt to reveal the differences and similarities in the word association patterns and semantic processing of participants with dyslexia/dysgraphia and those with typical language development. ANOVA was used if the Levene test for the homogeneity of variance was statistically not significant; otherwise the robust Brown-Forsythe or Welch tests were used to calculate significant differences in quantitative measures over the categories assuming the inequality of variance, since the groups were of unequal size. To compare the results of the informant groups, post hoc pairwise comparisons were used (the Games-Howell test) with a significance level adjusted to the alpha level of 0,05. A paired-sampled t-test was used to compare two groups or two conditions. I used the factorial ANOVA method to investigate the main effect and the interaction of languages, dyslexia and test conditions. Pearson (parametric) and Spearman (non-parametric) correlation tests were used to reveal whether different variables are related to each other and to measure the strength of associations between two variables. Discriminant analysis has been conducted to determine whether it is possible to discriminate between the groups by the number of word associations, the patterns of responses given to certain categories or the promptness and accuracy of responses given to certain conditions. Based on the data gathered in the semantic decision task, the LVPLS model was used to reveal latent variables. This method is used for modelling complex systems and represents a causal network of latent variables. The goal of modelling is to reveal the connection between blocks formed from variables.

3   Results

The most important results of this dissertation are the following:

   1. Dyslexic foreign language learners can elicit fewer responses in all word classes than language learners with typical language development. The differences between the dyslexic group and the group with lower vocabulary knowledge were mostly not statistically significant.

   2. The comparison of the word classes in terms of quantitative measure has shown that groups with lower vocabulary knowledge gave the most associations to verbs, then to nouns. All groups, especially the group with

dyslexia/dysgraphia elicited fewer responses to adjectives. The number of responses in the group with higher vocabulary knowledge was not markedly influenced by the word classes.

3. Although dyslexic foreign language learners gave the most responses in lexical categories (clang associations, morphological forms and, similarly to the group with lower vocabulary knowledge, translation equivalents) the majority of the responses were semantically related (82, 4 percent), predominantly given in their second or third language.

4. They typically generated responses in fewer categories and gave the fewest responses with situative-introspective features. They elicited more responses with concrete (instrument, function) than with abstract content (quality, time, mental state).

5. Taxonomic semantic relations were given in higher proportion than in the control groups, especially coordinate relations, which means that these relations play a pivotal role in the organisation of the mental lexicon in dyslexic L2 learners and native speakers, and points to restricted semantic representations or impaired access to word meanings.

6. Language learners at various proficiency levels, native speakers and persons with dyslexia/dysgraphia organise their lexical knowledge depending on the language (L1 or L2) and their proficiency in a foreign language. In L1, associations with situative-introspective features were activated from the beginning, while these features emerged in high proportion to German stimuli in later responses.

7. No statistically significant differences could be found in the quantity of responses with situative-introspective features between the group with higher vocabulary knowledge and the native speaker groups. Consequently, accessing various contents with situative-introspective features plays an important role in the depth of the vocabulary, producing a more native-like pattern of response.

8. Persons with dyslexia/dysgraphia can be distinctly classified based on the responses given to nouns and on the order of their word association responses. The results of the discriminant function analysis provide evidence for a word association pattern characteristic of language learners and native speakers with dyslexia/ dysgraphia.

9. In the semantic decision task participants with dyslexia/dysgraphia were significantly slower and less accurate in all test conditions than the control groups.

10. Taxonomic relations were recognised significantly faster than the word pairs with situative features, especially by native speakers with dyslexia/dysgraphia. '*Quality*' relations were recognised the most slowly in all groups. The results provide an explanation for the findings of the word association test in terms of the high proportion of taxonomic responses and the low proportion of quality responses of dyslexic persons.

11. Concerning the reaction time of the responses, the semantic relations in German were recognised similarly by the control group and the dyslexic group, whereas in Hungarian statistically significant differences were found in all conditions between the groups. The control group in Hungarian differs in all patterns from the other groups.

12. Hardly any significant differences could be found between the dyslexic group in Hungarian and the control group in German. Consequently, several semantic relations in L1 can be identified by persons with dyslexia similarly to L2 learners with typical language development.

13. The results of the semantic decision test confirmed that the structure of the lexical knowledge depends on the language stimuli. The discriminant function analysis classified the groups based on the condition of 'language of the stimuli' with the best accuracy (overall 85 percent of participants were classified correctly into

the four groups). The results of the LVPLS-model confirm that the semantic decision process is influenced more by the language than by dyslexia.

The results of the semantic decision test confirm the results of the word association test providing further evidence for a different structure of lexical knowledge and divergent semantic and conceptual processing in persons with dyslexia/dysgraphia. The results also confirm previous findings in L2 vocabulary research and provide new evidence for divergent lexical structure in language learners with varying proficiency levels.

4   Conclusions

Pedagogical implications

The results of the word association test show that the vocabulary of language learners with dyslexia/dysgraphia does not differ significantly from students with low language skills. The main differences are manifest in the amount of time spent learning and the greater amount of cognitive resources applied for language processing and learning. The latter can certainly be reduced using carefully selected learning methods. The results also support previous observations that report that dyslexic language learners (and even native speakers) have difficulty remembering words from long-term memory and cues as priming words can less easily be utilised for the recalling process by them.

1. Despite the opportunity given in the word association test to write words in multiple languages, they could only connect 1-3 words to each provided word. However, the majority of the associations when using German stimuli were not in their native language but in a foreign one.

Proposition: During language lessons, linking newly acquired words with 2 or 3 previously learned words would facilitate the recalling process later.

2. Results have confirmed previous findings and observations that dyslexic persons can more easily remember words related to concrete content such as location or function than words related to time or quality. In the lexical network of dyslexic persons words from the same word classes and taxonomic expressions with similar meaning are strongly connected both in L1 and L2, in fact, stronger than in that of typical language learners.

Proposition: Teaching words with concrete content as well as coordinating connections first would provide the students with a basic lexicon, to which further meanings and situative-introspective features could be linked later on.

3. Among the word classes with rich semantic content, it is the easiest for dyslexic students to activate words for verbs.

Proposition: It seems like a reasonable idea to teach verbs connected to verbs from the same semantic field, and to pick verbs with direct internal arguments (to buy something, to travel somewhere).

4. The semantic 'quality' relation of adjectives was the toughest to write associations to and to recognize for all groups. The most responses with situative-introspective features were written in the word association test to adjectives. Thus, the difficulty in acquiring adjectives possibly lies in the fact that various kinds of situative-introspective features are associated with adjectives. However, these features of the words are less obvious at lower proficiency levels.

Proposition: More time would be necessary to teach adjectives, and they should be taught in various contexts and situations.

5. Using the new categorisation method made it visible that language learners of all proficiency levels basically build meaning relations between words. These connections are not limited to taxonomic relations, but in the case of common words manifold semantic and episodic contents are related to words starting from the first associations. Language learners with dyslexia/dysgraphia can activate these contents less effectively, but they do recognise semantic relations similarly to language learners with typical language development. However, the situative contents cannot be recognised with the same accuracy and promptness. Consequently, different meaning relations can be recognised faster or more slowly in the context in reading comprehension tasks in L1 and L2 as well. Therefore, difficulties in reading comprehension can be partially predicted, especially in people with dyslexia.

6. Based on the findings of my research, dyslexia has an influence not only on reading, spelling skills and orthography but also on higher cognitive levels of language processing like semantic processing, such as distinguishing small differences in meaning, concept building, or activation of information to concepts. Thus, I find it important to draw attention to the fact that dyslexic people experience difficulties in learning other subjects as well, not only languages. Therefore, all teachers and prospective teachers should have appropriate knowledge about dyslexia in order to effectively help their dyslexic students to succeed.

Methodological implications

The free continuous word association method proved to be an effective method for gaining a more precise insight into the organisation of L2 lexical knowledge, the differences in semantic content and activating chaining associations in persons with dyslexia/dysgraphia and those with typical language development. Results provide further evidence on the potential of examining meaning relations both in L1 (De Deyne-Storms 2008) and L2 (Fitzpatrick 2006) and highlight, in general, the importance of information referring to situation properties in the case of a free continuous word association task. Results also support the direction in L2 word association research in which more emphasis is put on the examination of semantic content and the structure of lexical knowledge (Fitzpatrick 2006). Thanks to the new categorisation method it could be revealed that words in L1 and common words in L2 trigger associations with situative-introspective features. Certain semantic content (e.g. taxonomic relations) are linked strongly to words from a lower proficiency level while other content will relate to words depending on the depth of vocabulary knowledge (situative-introspective properties). This was also confirmed in the semantic decision experiment. According to the results, the depth of the vocabulary knowledge does not depend on the proportion of the paradigmatic responses, but it is the semantic content related to words that becomes manifold, making the L2 vocabulary similar to that of a native language.

Theoretical conclusions

From a theoretical perspective the results of this research broaden the research field of dyslexia, semantic representation and foreign language vocabulary acquisition. The results of the present research support the view that difficulties of dyslexic persons occur not only in the areas of reading and spelling, but also in higher order cognitive functions. Results of both experiments stress the divergent semantic and conceptual processes in dyslexic persons, and also point out the deficits in the quality of their semantic representations, the integration of semantic features, and the access and manipulation of these processes (Booth et al. 2007), especially in L2. The results underline that semantic integration deficit occurs because the identification and activation of conceptual

knowledge of distantly related pairs with weaker semantic associations usually requires more activation on different brain areas for the access and integration of various conceptual information (Booth et al. 2007, Landi et al. 2010, Richlan et al. 2011) than for translation equivalents or taxonomic relations that have more overlapping features. According to deficit theories, dyslexic persons have difficulty with language related symbols and also the manipulation of these symbols. It seems they also have problems with symbolic representation of concepts (Barsalou 1999), and in general with integration of and access to bottom-up and top-down information. The results also suggest that persons with dyslexia/dysgraphia have characteristic semantic representations with specific links and access routes in their lexical knowledge.

The results of the present research support the theories representing concepts in a distributed fashion, by multiple representational units in native (Barsalou 1999, Vigliocco et al. 2004, Evans et al. 2007) and foreign language (Van Hell–de Groot 1998, Dong et al. 2005) as well. The findings of the semantic decision test revealed that taxonomic and various situative properties cannot be accessed equally fast both in L1 and L2. Furthermore, semantic relations are predominant in the L2 lexical knowledge (Wolter 2001, Zareva–Wolter 2012) and the level of proficiency influences the lexico-semantic organisation (de Groot–Hoeks 1995).

The experiments presented in this dissertation are unprecedented in several aspects, therefore they can be considered only as a starting point for further research concerning both persons with dyslexia/dysgraphia and applied methods. Based on the findings of the current research, further research questions can be asked: Do persons with dyslexia/dysgraphia have a smaller vocabulary than persons with typical language development or can they simply not access words in their lexical network? Are the differences in the structure of the vocabulary knowledge of dyslexic foreign language learners due to problems in language processing or to a larger deficit in the cognitive system related to concepts? Which types of information are more or less available that are related to words and word classes? Why did all groups give the fewest associations to adjectives and why can the semantic feature 'quality' be accessed the most slowly? The findings of the present study may contribute in general to a better understanding of the problems of vocabulary acquisition in L2 and of divergent semantic processing in language learners with dyslexia/dysgraphia, and to developing pedagogical methods which help them acquire vocabulary in any languages.

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