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# PSYCHOLINGUISTIC ASPECTS IN THE ACQUISITION OF SIGN SYSTEMS

## DISSERTATION ABSTRACT

of a dissertation
for acquiring
the educational and scientific degree "doctor"

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Direction: Semiotics

Sofia, January 2023

## CONTENTS OF THE DISSERTATION

# Introduction

Sign systems represent "a collection of signs between which regular relations exist." Natural language is also a type of a sign system, which is particularly complex in its structure (Dobrev, Dobreva, 1994).

We all acquire our native language in the form of a slow but unconscious process, without purposeful effort (intended effort). However, foreign language learning can be seen as the acquisition of new sign systems, which proceeds in a different way than the acquisition of the first language. Virtually, in all cases learning a foreign language is a long process, filled with a series of conscious efforts and considerable difficulties.

The mastery of foreign languages is important for the successful functioning of the individual in society and for the realization of global connections in various spheres of life. A problem for a large part of people, however, is the motivation to learn foreign languages (Wimolwas, 2013).

Nowadays, there is a need to build a system for foreign language learning, which will form and maintain motivation for learning in potential learners, thereby facilitating and speeding up the process of mastering this type of sign system.

A learning platform that can provide high motivation to participate in the learning process are video games. Jan Plass and Paul O'Keefe (Plass at al. 2013) came to this conclusion.

Can video games be considered as semiotics objects? Peirce (1985) defined semiotics as a "quasi-necessary or formal doctrine of signs" and equated it with logic. Meanwhile, the Encyclopedic Dictionary of Semiotics (Sebeok, 1986) considers the definition of semiotics in five different ways, one of which is so-called "applied semiotics". The applied semiotics in question relates to various elements of real life, among which various types of art. Roland Barthes speaks of the "semiology of images" and considers pictures as a kind of signs (Barthes,

1964).

Different types of art can be seen as objects of semiotics. At the same time, video games are complex multimedia systems containing various types of art – graphic images, music, animation. From a semiotic point of view, video games could be viewed from an interesting perspective of complex sign systems composed of several heterogeneous sign systems. These multi-component sign systems could be used as a tool for studying other sign systems - foreign languages.

The purpose of the dissertation is to describe a project developed under my supervision for creation of a mobile video game for learning foreign languages, launched in September 2015. The research tasks are as follows:

1. Examination of the main semiotic theories and concepts and their relation to the study of foreign languages.
2. Literature review on various methodologies for effective long-term memorization, alternative teaching methods, as well as corpus linguistics. Strategizing which aspects of the discussed methodologies can be integrated into the final product.
3. Overview of the practical process of working on the development of a mobile game for teaching foreign languages. Detailed follow-up of the problems of writing and translating educational texts.
4. Description of an experiment with the prototype conducted in May 2017 in "G. S. Rakovski" Comprehensive School and an analysis of its results.
5. Conclusions of the experiment conducted with the prototype. Description of the next steps for development of the full version of the game. Practical studies for selection of the included vocabulary, creation of teaching texts and schemes for repetition of teaching material.
6. Conclusions of the study and setting future tasks for game development.

# Semiotics and sign systems. The semiotic approach to foreign language teaching

There are many definitions of semiotics. According to Umberto Eco, semiotics deals with "everything that can be perceived as a sign" (Eco, 1976). For Charles Morris (Morris, 1938) it is the "science of signs". As Daniel Chandler points out, semiotics is an interdisciplinary field in which scholars from different fields perform. (Chandler, 2007).

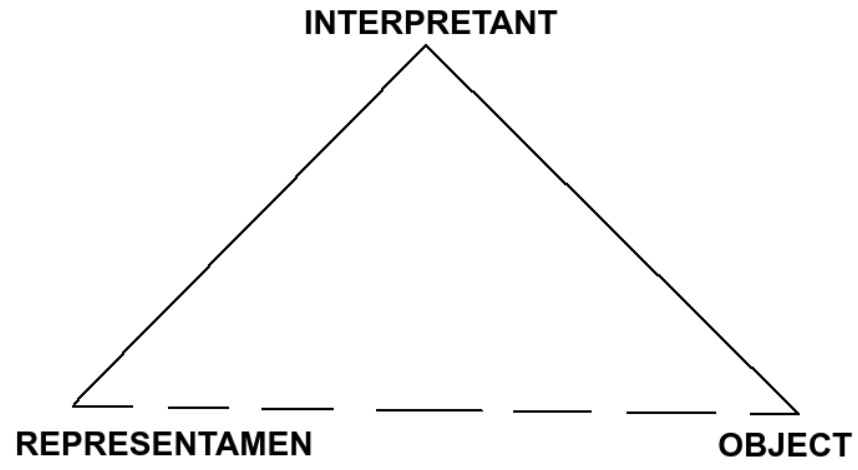
A sign is "a sense-perceptible object that represents another object and carries information to the perceiver about that other object." (Dobrev, Dobreva, 1994).

Central to semiotics are Peirce's and Saussure's theories of the sign, discussed by Chandler in his monograph “Semiotics – the Basics” (Chandler, 2007). For Saussure, the sign has two sides – a signifier and a signified. These two sides of the sign are psychological phenomena. The signified is a concept and the signifier is a sound pattern (Saussure, 1983). The sign as a semiotic phenomenon, according to Saussure's theory, represents a whole - arising from the association of the signifier with the signified, as Chandler points out. Saussure saw the linguistic sign as an acoustic phenomenon. As for the written linguistic system, for Saussure the letter stands for a particular sound. According to Sussure, a given signifier is defined not positively, based on its content, but negatively, in relation to what it is not itself and how it contrasts with others.

For Saussure, the sign is arbitrary, and the relationship between the signifier and the signified is voluntary. Any concept could be associated with any sequence of sounds, and this process of association is completely arbitrary (Saussure, 1983). As Chandler (2007) points out, each language has its own word for different objects, the same object usually means differently in different languages. But it cannot be said of any language that the word in that particular language is best

suited to denote the object in question.

Another model of the sign widely known in semiotics is Peirce's model, discussed by Chandler (2007). While for Saussure the sign has only two sides, for Peirce it is composed of three elements. These are the representamen (sign) - the thing that serves to signify, the object - the thing to which the sign refers, and the interpretant - the meaning that the sign creates, or another sign that arises in the mind of the perceiver of the first sign. The last definition of the interpretant – of a mental sign arising in consciousness on the basis of the first sign – is particularly important. It means that this second sign itself also has a representamen, an interpretant and an object. The object of this second (internal, arising in consciousness) sign is the first (external) sign that has directed to it. The second sign itself, in turn, could lead through its interpretant to a third sign, the third to a fourth, and so on. All three elements in Peirce's sign model are required for a sign to be a sign. These three elements determine what the sign represents - the object, how it represents it - through the representamen, and what it evokes in the person interpreting this representation - the interpreter. Peirce's model is shown graphically in the figure below:




*Peirce's triadic sign model*

Peirce also introduces a notion of the process of signifying itself, or of the relationship between the three elements of the sign. He calls this phenomenon

"semiosis".

Peirce proposes a detailed trichotomous classification system of signs. It defines the type of signs according to three different signs and in three different categories. For Peirce, the three categories in which semiotics operates are Firstness, Secondness, and Thirdness (Peirce 1992; Peirce 1998).

Perhaps the most widely known classification of Peirce's signs is the classification according to how the representamen relates to its object. It divides signs into icons, indices and symbols and is discussed in detail by Chandler (2007). Having in mind this classification, Chandler considers the signification process as proceeding in three main modes:

1. Symbolic. Under this mode, the sign's meaning is based solely on an established convention.
2. Iconic. In this mode of signification, there is some similarity between the meaning of the sign and its form.
3. Indexical. It is a mode of signification in which the object and its representamen are connected in some way, whether this connection is made intentionally or not.

It is possible for signs to be grouped together on the basis of some common feature and as a whole to perform the function of a "sign system". Dobrev and Dobreva give the following definition for this term: "A set of signs between which regular relations exist" (Dobrev, Dobreva, 1994). There are different sign systems, and natural languages represented perhaps the most complex sign systems. They are characterized by a huge number of signs (words) and rules for their use, which are often accompanied by a number of exceptions. This is one of the reasons why learning this type of sign system is a particularly difficult process.

Regarding the acquisition of foreign languages as sign systems, what kind of thought processes are involved in the acquisition of lexical signs? Learning is a

metacognitive process (Nöth, 2014). This process involves several steps. A person comes across a particular word and thinks about whether they have come across it before and whether they can reproduce it. If he remembers that he has come across this word and should know its meaning, he tries to reproduce it. This process of reproducing the meaning of the word could be seen as semiosis. For Peirce, semiosis is "the process of functioning of an object as a sign" (Dobrev, Dobreva, 1994). The representamen (sign), whose function is to denote a given object, evokes in the mind of the person reading the sign in question, an interpretant (concept of the meaning of this sign). Analogously, in the process of learning foreign languages, the learner encounters a given word in the foreign language - which plays the role of a sign or representamen. The sign denoting an object evokes in the learner's mind the concept or meaning of the word that he has mastered (in this case, that concept is the interpretant). Van Lier also notes that “learning processes are processes of semiosis” (Van Lier, 2004).

As Van Lier points out, acquiring a first language is different from acquiring a second language. There are some similarities between the two processes, but there are certainly differences as well. Van Lier describes cognitive development in children as occurring in three successive phases that can be associated with Peirce's three semiotic categories. In learning a second language, these three stages are not separated chronologically. They simultaneously hit the language learner with full force (Van Lier, Matsuo, 2000; Van Lier, 2004). This can be a serious challenge in the learning process. MacArthur and Barron point out that information is usually perceived when something from the surrounding linguistic environment is perceived as significant (McArthur, Baron, 1983). In this regard, Van Lier raises the question to what extent the traditional classroom setting represents an optimal option for foreign language teaching. For Van Lier, the traditional controlled process of foreign language learning, which fixes learners' attention only on isolated elements of the language, does not necessarily represent the ideal teaching methodology. Perhaps language should be acquired not by learning certain rules,

like mathematics, but like music, through a process of "creative exploration" (Van Lier, 2004).

An alternative to the traditional method of foreign language teaching is described in the article by Şenel (2007) "The Semiotic Approach and Language Teaching and Learning". Şenel examines the application of the semiotic approach to language teaching. Different means of expression are included in the learning process. The teacher uses both verbal and non-verbal language means - for example, body language, gestures, eye contact, practical demonstration of the meaning of some words, etc., and students enter into artistic roles.

Various authors point out the connection between semiotics and video games (Rush, 2011; Blomberg, 2018). They could be thought of as semiotic systems.

The structure of video games could be seen as a complex sign system of a multimedia nature, made up of various components. In the context of semiotics, graphic elements including images and animation can be seen as "visual signs" organized into a "visual code", and music and sound effects as "acoustic signs" organized into an "acoustic code", according to the definitions of Dobrev and Dobreva (1994).

In the creation of an educational game for teaching foreign languages, its acoustic and visual sign systems could work in symbiosis, generating a common effect that is expected to contribute to the quick and easy acquisition of another sign system, namely - the foreign language, which is learned through a play-based approach. Some concepts contribute to the effective learning of sign systems, which could be used for developing the game for foreign language learning. They are discussed in the next chapter of the dissertation.

## Theoretical and methodological problems underlying the creation of an educational game for teaching foreign languages

The natural language is a particularly complex sign system, and for this reason its acquisition requires considerable time and effort. Mastering of diversity of the language is another difficult task that requires not only a lot of time, but also communication with different native speakers.

To create a product that effectively ensures memorization of foreign words, this product needs to be based on proven techniques that support memorization. This chapter examines the main principles applied in preparation of the product, ensuring an effective process of memorizing foreign words when mastering a foreign language as a sign system.

Below are some key terms used in the dissertation (Stoyanova, 2014):

Target language is "the language or the sign system which is the object of study".
Language learning is presented when the acquisition of a second (foreign) language takes place in targeted learning.
Mastering of target language is "a spontaneous learning and uncontrolled process that takes place in "natural" conditions - through interaction between a second language learner and a native speaer without any mediation of a teacher, textbooks and teaching aids".

Georgi Lozanov, creator of Suggestopedia - a non-conventional method for teaching foreign languages with extremely high efficiency, claims that during his work as a psychiatrist he came to "conclusions about the actual existence of significant brain reserves in terms of volume and quality" which are "unutilized" (Lozanov, 2005:10). The effectiveness of his methodology was confirmed by an experiment in which a group of participants managed to memorize up to 1000 French words in one study session. Lozanov's suggestopedia deserves special attention and some elements from it should be integrated into the game product.

Suggestopedia has some similar principles with the application of the semiotic approach in foreign language teaching, described by Şenel (2007). The

semiotic approach in question applies "verbal, non-verbal and visual communications leading to effective learning". Visual elements such as pictures, photographs, videos are included in the teaching process, and special attention is paid to body language, individual gestures, postures, facial expressions, etc. Moreover, the theatrical approach where learners step into certain roles is practiced both in suggestopedia and in the semiotic approach.

After a literature review (Lozanov, 2005; Plass et al., 2013), a conclusion is reached: that the developed training product should induce not learning, but mastering of the foreign language, it should be a game where the acquisition process of the material should flow spontaneously and unconsciously for the learners.

In addition to Lozanov's Suggestopedia, other methods for effective memorization have been reviewed with the aim of possibly integrating their aspects into the game.

Various authors (Morgan-Short et al., 2012; Shakouri et al., 2014) highlight the benefits of implicit (unconscious) learning. At the same time, Lozanov (2005) and Caro (2017) appear as supporters of foreign language learning accompanied by translation. The benefits of implicit learning are also evidenced by Lozanov's experiments (Lozanov, 2005). He experimented with control groups, some of which tried to memorize foreign language units for several days using traditional methods, and the rest - using a suggestopedic approach. In the suggestopedic approach, at the beginning of the lesson, the teacher hands out a sheet of text to the students and explains the unknown words, while they listen. Then they relax and, without trying to concentrate, listen to him read the words three times with different intonation. The results of the experiment showed already in the first days that the groups trained by the suggestopedic approach absorbed 21.5% more words and felt optimistic and full of energy.

From here, it can be concluded that even if only the condition for implicit learning is met - namely, that the learner does not consciously participate in an

organized learning process and learns the information presented to him unconsciously and effortlessly, then this is enough to expect higher results in long-term memorization. In addition, the lack of effort needed to be put by learners is an additional factor that positively affects their motivation in mastering the language.

These methodological aspects should be implemented in the product in such a way that the user does not have a clear awareness that he or she is learning and does not try to memorize anything consciously. This can be accomplished by building a fully interactive game in which the participant's actions are primarily related to game-planning responsibilities rather than conscious language lessons. The application should not simply be presented in the form of attractive interface for explicit acquisition of vocabulary and grammar, but should be a game in itself, during which the learner implicitly acquires vocabulary and grammar knowledge while playing, without making an effort to memorize anything.

As an example of a video game structure that meets these requirements, the following model can be used: the user navigates a spaceship on the screen of the mobile device, directing the ship to flying words that represent a possible translation of another word displayed at the top of the screen. The spacecraft must hit the correct translation. In this way, the user is not trying to remember anything consciously, but is playing a game, part of which is the process of unconsciously learning new vocabulary word by word.

The product, the development of which is discussed in the dissertation, prioritizes two tasks: first, ensuring the rapid acquisition of a significant amount of vocabulary, and second, an initial implicit approach to language learning by learners, which, according to research conducted by Morgan-Short et al. (2012), should ensure in the future invariable processing of the foreign language as a native. The product does not claim to teach grammar purposefully, and its acquisition requires development of similar products in the future. However, a part of the grammar can also be learned effectively through the syntagms presented in the game. The high efficiency in the practical acquisition of grammatical rules by

the implicit method is also confirmed by Winitz (1996).

Caro claims that when attention is diverted from the conscious learning process, memorization is better (Caro, 2017:66). Distracting the user's attention from the learning process can be further implemented in the game by adding one more aspect. In addition to flying and hitting an accurate translation, the participant must avoid obstacles that pop up in his path - coming towards other flying objects (planes or asteroids). In this way, his attention is further concentrated on the interactive game actions while the focus on the learning element - the translation of words - is minimized.

Tony Buzan points out that the more sensitive a person is to the information he receives through his senses, the better he will remember that information (Buzan, 2006: 33). Therefore, any information perceived with several senses instead of one is remembered more efficiently. Buzan also points out that the more absurd and unreal the association associated with the object to be remembered, the more strongly it will be remembered (Buzan, 2006:53). At the same time, a study by Bradley (1992) found that images that cause strong stimulation of the senses are remembered more effectively (Bradley, 1992: 379-390).

Based on these studies and their conclusions, new detailed features can be added to the learning game to increase the effectiveness of memorizing words through it. These are: pronunciation of the word, reading the word at the moment of hearing it, turning on vibration at certain moments, depicting the words by means of impactful pictures with a non-standard style. Also, in order to generate absurd associations in the brain, illogical word combinations like "red dog", "flying cat" can be included.

Various scientific studies confirm the effect of emotion on memory abilities. Caro came to the conclusion that any emotion - positive or negative - has a positive effect on memory (Caro, 2017: 67-69). With a strong emotion, a person remembers well what he perceives at the moment, and cannot easily reproduce already created memories (personal conversation). Kensinger (2016) believes that emotions, and

negative ones, aid the process of memorization. Various studies have concluded that low-intensity anxiety has a positive effect on learning, and excessive anxiety interferes with the learning process (Larsen-Freeman & Long, 1991; Gass, 2013). Lozanov believes that not only negative emotions help in the learning process (Lozanov, 2005: 57).

In order to create emotions and tension in the game, some elements could be integrated. For example: maintaining a high flying speed of the virtual spaceship, the need to avoid obstacles on its path and vibrating the device when a wrong word is hit.

In a study conducted in New Zealand with 7-year-old children, it was found that reading stories out loud contributed to the acquisition of new vocabulary (Warwick, 1989:174-187). Therefore, it would be great if the learning game added an element of whole texts that the learners could not only read, but also listen to. For this purpose, in each level the vocabulary being studied should be initially presented as an associative series of words, and at the end of the level the learner will see the words arranged in a meaningful text.

The text at the end of the level helps the learner to unconsciously absorb the grammatical paradigms of the relevant lexical items and to learn in what forms to use them in different situations. It also contributes to the unconscious acquisition of word order and some syntactic features of the foreign language.

According to Anton Caro (personal conversation), the unlocking of the memory reserves and over-memorization capacity that Lozanov talks about can only be achieved when no more than one new word per line is presented to the learner. Entering phrases and sentences is possible only if the express condition of not entering more than one new word on a new line is met. This methodological aspect must be adequately integrated into the product. In the already described pattern of the appearance on the screen of a word to be translated, this means that syntagms and sentences for translation should only be allowed after each of the lexemes in them has been initially presented independently on the screen. An

exception could be allowed only for some interjections, particles and prepositions.

Lozanov uses classical music in his desuggestive learning method. According to it, he selects certain pieces of music that should be played as a background when the teacher reads a text and the students listen. (Lozanov, 2005:47). Selected and tested works from Lozanov's list should be included in the product, to be performed as a background during the game.

In "Suggestopedia - desuggestive training" Lozanov emphasizes, over and over again, the importance of intonation when presening a text. He warns that in the suggestopedic method of teaching a monotonous intonation is even dangerous, as it can induce hypnosis in learners and harm them (Lozanov, 2005: 8, 22-28, 74). Lozanov mentions that unknown words are read three times with a "special intonation" (Lozanov, 1992: 25). In this regard, the pronunciation of the words that are heard simultaneously with their appearance on the screen must be obligatory recorded by real people, and with expressive intonation.

It is a well-known fact that a major problem in memorizing new information is the process of forgetting. Strengthening of the learning material through new repetitions is mandatory for its permanent memorization. The question is how many times, when and how to strengthen it, so that the process of its long-term assimilation is as easy and effective as possible. In science, various schemes for repetition at certain intervals are described, which ensure maximum long-term memorization with a minimum number of repetitions. One such scheme proposed by Pimsleur (1967) involves exponentially increasing intervals starting from five seconds. It could be integrated into the game by implementing a mechanism enabling that the words-to-be-learned can be suggested to the learner on predetermined days.

Various studies testify the role of sleep for effective memorization (Spitzer, 1939; Dumay, Gaskell, 2007). Dividing the study material into sleep-separated cycles is critical to the effectiveness of the final product. Due to the lack of control over the player’s game mode, this methodological aspect should be integrated in a

way that indirectly incentivizes the player to use the game during certain intervals separated by sleep.

A particularly important task in the product development process is the selection of the right vocabulary to be included in it. Here the questions arise as to how many and which words to include.

A number of studies in the field of corpus linguistics find that a very small number of words in each language occur very frequently in speech, and the largest part of the language's vocabulary is the least frequent. That is, by learning a relatively small amount of common words, one could understand almost anything.

Webb and Nation (2017) note that 1000 words could provide approximately 85% coverage of the English language. Schmidt and Schmidt (2014) assume that 3000 language families represent good coverage as a high-frequency dictionary. A number of authors advocates that words in a language should be studied according to their frequency (West, 1953; Nation 1990, 2001).

Specifically for the English language, various lists of words have been compiled, which are believed to provide a very broad coverage of the language with a relatively small number of lexical items. Of particular interest are two relatively new word lists that seem more practical, claiming to provide broad coverage of the language with a very small number of words. Brown and Culligan (2017), who compiled the "NGSL-Spoken 1.2" corpus, claim that it provides 90% coverage of spontaneously spoken English with only 721 words. Dang and Webb (2016) compiled the "Essential Word List" corpus designed specifically for beginners. According to Webb and Nation (2017), its 800 units represent 75% of the English language, provided that their word forms are also known by learners.

When teaching vocabulary, however, another factor should be taken into account besides the frequency of words, namely the level of proficiency in the language with which they are associated, according to the CEFR classification of the Council of Europe (2001). A study conducted by Ćatibušić and Little (2014) concluded that the learners' ability to communicate develops in accordance with

the trajectory defined functionally by the CEFR levels. Since certain lexemes can be characterized by both high frequency of occurrence and high CEFR level, their acquisition by beginners could be problematic.

When looking at lists of words by frequency, it is good to take into account the fact that some extremely important words, without which it is impossible to use the language even at its low levels, purely statistically appear less often and therefore do not appear in these lists with words.

Basic language learning textbooks at A1-A2 levels lack key phrases with which the learner can start having conversations and build up his language level on his own after learning the basic vocabulary. Brendan Lewis, a self-taught polyglot, has written a series of books such as “Language hacking Spanish” (Lewis, 2016) in which he includes these phrases and prepares sample texts and dialogues for absolute beginners who are interested in trying his foreign language learning strategy. These are phrases like: "I don't understand you.", "Can you speak more slowly?", etc. It would be useful to include these and other similar expressions in a vocabulary that teaches the game.

Based on the literature reviewed above and the conclusions drawn, the following suggestions could be made regarding the composition of the educational vocabulary used in the game:

1. Vocabulary should include between 1000 and 3000 of the words used most frequently.

2. As a basis, it would be good to take the new practical word lists NGSL-Spoken (Brown, Culligan, 2017) and the Essential Word List (Dang, Webb, 2016).

3. It is necessary not only to choose the most frequently used words, but also to take into account their levels of assimilation according to the CEFR scale. When it comes to beginners, it is necessary to avoid high-level words that might require complex morphological or syntactic constructions, even if statistically these words are common.

4. It is preferable to add to the most common words some other words that are

of particular importance in using the language, even if they are statistically less common.

5. It would be useful to add "rescue" expressions such as "What does this mean?", "I don't understand." and "Would you repeat?".

## Process of the prototype development and preparation for an experiment researching its effectiveness

This chapter describes the work on development of a prototype of an educational game and on preparation of an experiment to test its effectiveness. Methodological and practical problems in the work process are discussed here. On the other hand, the development of the product up to its first official version represents preparation for the final stage of the research, namely – conducting an experiment in a metropolitan school in order to test the effectiveness of the game. As of today (January 2023), an online version of the prototype that was tested at the school is ready and published. It is available for free installation on the Play Store under the name “LangJet”. This version consists of only one game level that teaches 50 foreign words. The aim is first to confirm the effectiveness of the methodology as a whole. The remaining levels should be developed after practical work on vocabulary selection and development of educational texts, as well as introduction of a scheme for repeating the educational material with the aim of its optimal strengthening.

Based on the scientific theories and research presented in the previous chapter, a plan was built for development of a product with the following characteristics:

1. The product will be a game in the form of a fully interactive game, in which the tasks of the user are mainly focused on actions related to good game performance, and not on the learning process. The inclusion of interactive obstacles to distract

the learner's attention is a must, and the acquisition of new vocabulary should become completely unconscious and purposefully manifest as a side effect of the game.

2. The mobile game should provoke irritation of as many of the user's perceptual senses as possible: through impactful images and vibrating the smartphone when a word or phrase is wrongly hit. Also, the texts should include absurd elements, such as illogical or comically related syntagms ("red dog").

3. The game must purposefully produce and maintain emotion and optimally dosed anxiety in the user.

4. The vocabulary being taught should be presented in the form of stories. During the game, you see on the screen only individual words and phrases connected in associative sequences. Finally, at each game level, the whole text containing the vocabulary learned in the level should be displayed.

5. The teaching of new vocabulary during the game must be done under the strict restriction of introducing no more than one new word per line. As exceptions to this rule, only interjections, short prepositions and conjunctions could be experimented with.

6. In the game, the music chosen by Lozanov, tested and proven to be effective for learning, should be placed as a background of pronunciations.

7. Word pronunciations should be recorded expressively, preferably by professional actors.

8. An aspect should be integrated into the game that motivates the participants to divide the playing time into intervals separated by sleep. It is desirable that after each level played, the game motivates them to continue with the higher level only the next day. This aspect can be integrated by telling the user upon completion of a level that if he continues the game the next day, he will accumulate double game points. Each player's game points are presented in the overall ranking of all participants. Thus, the participant will have the motivation to earn the promised points to get a better ranking than the other participants, and it is logical to

continue playing the next day.

The work on practical implementation of the described methods for effective memorization began with planning the architecture of the mobile game in September 2015, when an initial team developing the product was formed with the following composition and responsibilities: A.N. – game design architect and product manager, F.G. - lead developer, V.L., S.L., D.I. – graphic design, N. Sh. (author of the dissertation) - project manager, chief consultant on linguistic issues and assistant programmer. Subsequently, relatives, friends and volunteers assisted in the activities related to translations and product testing.

At the center of the game plot was a space journey where the player flies on a spaceship over different planets. The first planet available is Earth, and the player cannot continue to fly towards the next one until they successfully pass its level. Each planet represents a level that teaches a certain number of words, and after successfully passing it, the participant receives a text in the foreign language, which is expected to be read and understood. The first planet – Earth – teaches 50 words. According to the plan in the final version, upon reaching the last level - the planet Pluto, the participant must have learned no less than 1000 words.

Each planet is played in two different modes: *Learn* followed by *Challenge.* The spaceship must be controlled with the help of a finger, avoiding the planes or asteroids flying towards it. In the *Learn mode,* while navigating the spaceship and virtually "flying" in the game, the participant sees a word in the foreign language at the top of the screen, under which the word translated in his native language flies freely falling down. He must hit the translation of the word by navigating between the other flying objects that purposely distract him from the translation process. As the word appears at the top of the screen, its pronunciation is heard. The words in the *Learn* mode are connected in an associative series.

If the spacecraft navigated by the user collides with another flying object, the system identifies this as a virtual crash and takes away one life point from the player. With six life points taken away, the level is prematurely terminated as a

failed completion and the player must start over.

The *Challenge* mode is similar but differs from the Learning mode in that the word at the top of the screen has two possible translations in the form of flying words, and the participant must guess the correct one. A mistranslation (a misspelled word or a missed translation of a word) is counted as a mistake and is penalized with one life point - identical to virtual crashes. With each life point taken, the phone vibrates and a visual indication of the error appears. The *Challenge* mode must be played twice successfully with translation in both directions (from foreign to native and from native to foreign language) to be considered correctly passed. In both directions of translation, the pronunciation of the word is heard only in the foreign language. A successful passing of the mode is considered to be achieved with less than six mistakes, otherwise the game is terminated as a failure and must be started from the beginning. In the *Challenge* mode, the words are not connected in an associative sequence, but appear in a random shuffled order. When hit, some of the flying words are transformed into graphic images corresponding to their meaning.



*Certain words and expressions are transformed into pictures corresponding to their meaning after being hit.*

After successfully playing the *Challenge* mode in both directions of translation, the participant sees on the screen a compiled text in the foreign language containing the lexemes already learned during the game. He reads it and it is expected to understand its meaning.

Also included in the *Challenge* mode are additional flying elements that have two functions. They make the game process more interesting and even more distract the learner from the translation process, enhancing the effect of unconscious memorization. There are five types of objects and each of them is responsible for a certain effect in the game. A collision with a flying object or a

mistranslated word is counted as an error. The background classical music from Lozanov's list sounds during the game. Whenever a word appears in the foreign language, its recorded pronunciation is played.

It is important to note that at the time of writing the dissertation, the available and tested version of the game represents its prototype, which teaches 50 words. The purpose of the prototype experiment is to confirm the effectiveness of methodology. The development of full teaching texts for all levels, which should be between 1000 and 3000 words, will be considered subsequently. An overview of the practical work with texts carried out in the period from 2015 to 2018 is presented. The experiments with different types of text structure, the conclusions from each type of texts and the formation of the final structure with which the prototype experiment was conducted are described.

The rest of this chapter of the dissertation traces the process of compiling the texts to be used as a basis for learning vocabulary needed. The work proceeds in several stages, with the texts going through three versions of their structure. What the different versions have in common is that related texts or associative sequences of words are intended to be fragmented into separate units that fly on the screen of the mobile device and can be universally translated into different languages that will be studied or that represent first language for learners.

The table below presents an excerpt from the first version of the texts in Bulgarian, English and Serbian language:

| **Bulgarian** | **English** | **Serbian** |
|---|---|---|
| В магазина | In the shop | U prodavnici |
| на ъгъла | on the corner | na ćošku |
| на улицата, | of the street, | ulice, |
| близо до реката, | close to the river, | blizu reke, |

| | | |
|---|---|---|
| има нещо странно. | there is something strange. | ima nešto čudno. |

In the first version in question, the texts were translated from Bulgarian to Chinese (Mandarin), English, Spanish, French, Serbian, Russian, Slovenian and German. As can be seen from the table above, they are not just a sequences of words but represent parts of meaningful texts or even whole sentences. After analyzing their structure, it was concluded that it could not be applicable. The reason for this was that the syntactic and morphological differences between the individual languages made it virtually impossible to accurately translate the individual translation units into separate lines, or predisposed the learner to acquire an incorrect meaning.

Taking these findings into account, in the period March-April 2016 the texts were completely rewritten with a different structure representing a list where each line contained a single word, phrase or sentence arranged in an associative sequence. However, some words were not presented alone in a line, but appeared for the first time in combination with another word. The structure of the texts was greatly simplified. In this second version, the texts were fully translated into English, Turkish, Swedish, Spanish, Catalan, Italian and Russian. Partial translations were made into Chinese (Mandarin), French, Greek, Portuguese, Norwegian and Hungarian. In this stage of product development, nearly 100 people from all over the world volunteered to translate and edit the texts.

This is an excerpt from the second version of the first level of the game from May 2016 in Bulgarian, English and Turkish:

| No. | Bulgarian | English | Turkish |
|---|---|---|---|
| 1 | той | he | o |
| 2 | писател | writer | yazar |
| 3 | интересен писател | interesting writer | ilginç yazar |
| 4 | един интересен писател | an interesting writer | ilginç bir yazar |

| | | | |
|---|---|---|---|
| 5 | книга | book | kitap |
| 6 | нова книга | new book | yeni kitap |
| 7 | Той пише книга. | He writes a book. | O kitap yazar. |

In this version, the text is not a homogeneous structure of connected sentences, but an associative series of words, phrases and sentences. Complex sentences are completely excluded - a factor that further facilitates the translation process even between languages with different word order. If a complete restructuring is required within a sentence, and hence the presentation of the entire sentence on one line, this is not a problem, as the sentences are short and can be displayed on a mobile device screen, and are also easy to digest by novice users. Although they do not strictly conform to Caro's rule of introducing no more than one new word per line, it stands to reason that these texts provide far more efficient acquisition of new lexicon than the first version.

The texts from the second version were integrated for the first time into the software version of the game and it was tested by the development team as well as by an additional group of volunteers to check its effectiveness. In May 2016, the first published version of the application was officially presented at the "Polyglot gathering, Berlin 2016". Despite the advantages of these texts over the texts of the first version, they also found an insurmountable problem. Because they did not strictly follow the rule of only one new word appearing per line, in cases where two new words appeared per line and the first language and target language word orders differed, it was not clear to the learner which word what does it mean. After the discovery of this error in the use of the second text versions, it was concluded that the texts should be edited a third time, this time always presenting each new word alone on a line, with exceptions only regarding short prepositions, particles, conjunctions and interjections.

The first level of the game was reworked for the third time and translated into 16 languages. The languages he could learn as a native were English,

Bulgarian, Danish, Esperanto, Spanish, Italian, German, Portuguese, Russian, Slovenian, Serbian, Finnish, French, Croatian, Swedish, and Japanese. The foreign languages that can be learned through these languages were: English, Bulgarian, Esperanto, Spanish, German, Russian, Slovenian and French. In the third version of the texts, the average number of lines through which a word is taught is statistically greater. This is expected to further enhance the user's ability to learn new lexicon. The inclusion of new words that are not previously presented alone in a line in phrases and sentences is avoided. There are only three exceptions to this rule: the prepositions "in" and "on" and the possessive pronoun "their". Dividing the text into smaller units makes the translation process even easier. In this version, other languages with different typology and word order can be added practically without any problems. In this latest version, translations were limited to only one trial level of the game containing 50 words. The translations and work on recording the pronunciations of these languages were carried out in the period June 2016 - May 2017. During this period, an advertising campaign of the intermediate version of the product was also carried out abroad. The game received a response both on websites for foreign language learning and in media such as "Language magazine" in the USA ("Space Polyglot", 2016:51). In December 2016, the product received the unofficial support of a group of educators in the US.

## An experiment establishing the effectiveness of the prototype

In May 2017, in the Primary School "G. S. Rakovski" in Sofia, a documented experiment was conducted with four fifth-grade classes in order to establish the effectiveness of the game prototype. In the tested product, the last third version of the texts discussed in the previous chapter was used as a structure. 37 students between the ages of 10 and 12 were divided into two control groups - one learning Slovenian and the other learning French. All students who took part in the experiment declared that they had never studied the relevant foreign language

before their participation. They played the entire first level of the game at home. The first level teaches 50 unique words and ends with a text. The next day the students took a test with the 50 words in question to see how many of them they had learned. The test required the participants to translate the words from the foreign language into Bulgarian without given possible answers and to note to what extent they understood the text they had read at the end of the game. No effort was made to memorize the words during the game, the only requirement was that it be played to completion and then not used until the test the next day. Each student recorded the net playing time reported from the application menu to the nearest second and declared it on the next day's test.

## Results

The average test scores were as follows:

**Slovenian language**: 18 students learned 38 words correctly in a playing time of 18 minutes and 21 seconds. Six students declared that they fully understood (over 90%) the text in Slovenian. 12 students declared that they understood at least half of it.

**French**: 14 students learned 32 words correctly in a playing time of 21 minutes and 47 seconds. Two students declared that they fully understood (over 90%) the text in French. 11 students declared that they understood no less than half of it and one student declared that they did not understand the text or understood less than half of it.

**Overall average score for both languages.**

32 students learned 35 words correctly in a playing time of 19 minutes and 51 seconds.

8 students declared that they fully understood (over 90%) the foreign language text. 23 students declared that they understood no less than half of it and one student declared that he did not understand the text or understood less than half of

it.

The results obtained give the following average rate of memorizing new words: 123 words per hour for Slovenian, 87 words per hour for French and 106 words per hour on average for both languages.

**Results analysis**

The experiment showed a big variation in results. Although most students scored between 52% and 86%, the wide gap between the maximum and minimum scores of 98% and 34%, respectively remains evident. For comparison, with Lozanov's methodology, the maximum and minimum results are 100% and 90%, respectively. Caro claims that in order to derive the maximum benefits from suggestopedia, an assimilation result above 70% is needed (Caro, 2017:60-64). Such a result was achieved by 20 of all participants (63%), five of them with French and 15 with Slovenian. This is a prerequisite to consider that, although the mobile game remains a highly effective product, its methodology is either not equally effective for different types of users, unlike suggestopedia, or a change in the way of its implementation in the product is required. Such a change could be made, for example, in regard to decreasing the difficulty of the game in order to make fewer mistakes.

On the other hand, the average results of the experiment are exceptionally high. Memorizing an average of 106 words per hour without any conscious effort is undoubtedly a very good achievement. This result is about two times lower than the results achieved by Lozanov with the original suggestopedic methodology. At the same time, however, the mobile game proved to be almost 8 times more effective than reading a book in a foreign language without a dictionary, described in a scientific study by Waring and Takaki (2003).

## Conclusions from the prototype experiment. Practical research on the concept of a full version of the game

Based on the discussed theories and the conducted experiment with the game prototype, the following conclusions could be drawn:

1. The developed methodology in the form of a mobile game could represent a highly effective method for memorizing new foreign language units. It has the potential to be more effective than conventional teaching methods, but remains less effective than Lozanov's suggestopedia.
2. Using a product that is a game in the full sense of the word and teaches a foreign language without conscious effort can significantly increase the motivation of learners.
3. The research done shows the number of words memorized just one day after they were taught. An extended experiment that includes testing the words taught without repetition with several tests separated by time intervals could have yielded more objective results regarding long-term memorization.
4. It is desirable to conduct an experiment with a larger group of adult participants under conditions identical to those of the present one. The results could indicate whether the methodology is equally effective for different types of users, as well as whether the degree of motivation and responsible attitude of adults to the experiment will give better results. When a new large variation in results is registered, it should be concluded that this version of the game is not equally effective for all groups of users. It may be necessary to change the difficulty settings of the game to provide more mass efficiency without significantly lowering the average rate of acquisition of new vocabulary.
5. The extended experiment with the full version of the game should include detailed learning texts with a carefully selected vocabulary between 1000 and 3000 words in size, as well as an integrated in-product scheme for cyclic repetition of words at optimal intervals to facilitate their easy long-term retention memorization.

This chapter reviews the practical work involved in setting up a potential

extended experiment with the parameters described above. Potential changes to the structure and design of the game itself are discussed. The practical work of selecting the vocabulary to be included in the full version is traced, and the teaching texts are presented, as well as a detailed scheme for their repetition.

Based on the theoretical research in the field of corpus linguistics and their conclusions, described in the previous chapters, a lexical database was compiled in 2018 to be used as the main source of words in the compilation of educational texts. The database was compiled in English, due to the wide selection of word lists in this language, as well as the fact that it is the most widely studied language worldwide. The process of the practical work of this part of the project was carried out together with Dr. Sofia Angelova, philologist and teacher of English at the Technical University in Sofia.

As already mentioned in the previous chapters, the frequency of the words taught is key to the degree of usefulness of their use. Various studies testify that many of the textbooks for teaching foreign languages suffer from this very problem - incorrect selection of vocabulary (Norberg, Nordlund, 2018; De Jong, 1989).

For the selection of an useful dictionary providing maximum coverage of the language with a minimum number of lexical units it is necessary to use lists of words with a high coefficient of lexical coverage as a basis. Two relatively new word lists seem suitable for this purpose because they provide a broad coverage of the English language with a relatively small number of words. These are "NGSL-Spoken 1.2", (Brown, Culligan, 2017) and "Essential Word List" (Dang and Webb, 2016). The "NGSL-Spoken 1.2" includes 721 words and is expected to provide 90% coverage of spontaneously spoken English. As for the "Essential Word List", Webb and Nation (2017) assume that its 800 items represent 75% of the English language, provided that their word forms are also familiar to learners.

In terms of the number of words included in the database, 1000 seems like the minimum number that provides a high coverage. According to Webb and

Nation (2017), the 1000 most common words would provide 85.35% coverage of a corpus of television program vocabulary in American and British English. Different researchers assume that between 1000 and 3000 of the most common words provide a high coverage of the language, or that a word count in this range is recommended for beginners. (Brezina, Gablasova, 2015; Coxhead, Hirsh, 2007; Nation, 2004; Nation, Hwang 1995; Hyland, Tse, 2007, Schmitt, Schmitt, 2014). After the thousandth most common word, however, the word's usefulness drops sharply. The second 1000 most frequent words provide 4.12% percent coverage, and the fifth - only 0.59%.

However, word frequency is not the only factor to consider in their selection. There may be relatively common words which, according to the CEFR scale of the Council of Europe from A1 to C2 (Council of Europe, 2001), should be taught at the higher levels of the language. They could be difficult for learners or even impossible for beginners to master because of the complex syntactic or morphological constructions they require. At the same time, important words such as days of the week, months, most of the countries of the world and some numbers might statistically not be among the most encountered words, but they might be suitable and even imperative for beginners to learn.

Based on the lexicon from the word lists "NGSL-Spoken 1.2", (Brown, Culligan, 2017) and "Essential Word List" (Dang, Webb, 2016), a database containing 1898 words with different meanings in Bulgarian was compiled. The Cambridge Vocabulary English Profile (2015), available on the Cambridge Dictionary website (2020), classifies words in English on a scale from levels A1 to C2. With its help, the selected word lists were grouped according to the level at which it is expected to be taught. In addition to the vocabulary from the word lists mentioned above, the database also included vocabulary that is an important part of basic life topics and is of particular importance in the learning process of beginners. Also, there were included words that could represent part of the learning texts in the game.

In addition to their level, words were also classified by thematic categories. The idea was to form the basic lexical topics for beginners. So each topic category should not simply include a specific vocabulary, but it could be used as a topic framework for creating an interesting learning text that could recreate dialogues, situations and actions. It was important to define the topics before starting to write the teaching texts, so that the texts themselves could also be divided into topics.

The thesis paper presents tables containing detailed vocabulary from the compiled database distributed by teaching levels. It is important to note that the word database should not be taken as a fixed and definitive list of words to be included in the learning game. In the process of writing the educational texts, words missing from the database may be added, and some words included in it may not be used.

This lexical base is a good list of basic concepts that are presented in most languages. It should be kept in mind, however, that each language has a specific vocabulary. It is possible that in some languages there are several words for some of these concepts, some of these concepts are completely absent, and there are specific words that do not have a specific translation in other languages. Therefore, the teaching texts and sequences of words that fly on the screen can be taken as a common basis for all languages taught, but they must be adjusted accordingly, taking into account the peculiarities of the respective language being taught, as well as the mother tongue of learners.

The content of the learning material is of particular importance for the motivation of learners (Ahmadi, 2017; Grabe, Stoller, 2002; Dörnyei, 2006; Grabe, 2009). Intrinsic motivation is a type of motivation in which learning itself is a reward for learners. They voluntarily try to learn what is very important to them (Arnold, 2000). At the same time, Khazratqulova and her colleagues (Khazratqulova et al., 2020) point to the fact that many texts contain material that is not interesting for students due to its strong focus on vocabulary and grammar as a problem.

Learning texts should contain useful information that learners find important. This could motivate them in the learning process. A good example of this is real practical situations such as ordering in a shop or a restaurant, ordering a taxi or a dialogue when getting to know each other. The presence of dialogues is of particular importance, because it is through them that the integration of the learner into the community speaking the language he studies is possible. The texts should be meaningful and interesting, but at the same time as short as possible. They must technically be able to fit on the screen of the mobile device. In addition, it is not desirable that they take too much time of the user in order to maintain the feeling that the process of using the application is just a game that requires practically no effort.

Having in mind the benefits of teaching a foreign language through stories (Inal, Cakir, 2014; Bafile, 2003), 40 teaching texts have been written after compiling the lexical database. These are the texts that should appear at the end of each learning level. Within the structure of the game, they are analogous to the short text that was examined in the prototype experiment. They were compiled using the database in question as the main lexical source, but at the same time they introduced additional terms and concepts related to their plot. The texts are as short as possible, but meaningful. They tell a story about a family filled with unusual events and circumstances. At the same time, they successively go through ten lexical topics. They present thematic vocabulary useful in certain life situations. However, the thematic vocabulary remains in the background and is woven into a plot narrative. Dialogues are presented in a significant part of them. In writing them, an attempt was made to have each of them end in an unexpected way, so that the interest of the learner can be maintained, and he remains motivated to continue using the learning game the next day, driven by curiosity about how the development of the story will continue.

The texts are presented in the dissertation paper in English - the original language in which they were written, and a Bulgarian translation follows each

English text. An analysis of the content of the texts was made and ideas for their optimal practical application in the game were presented.

The vocabulary taught should be distributed in a time scheme that determines its teaching and memorization strengthening in portions. For this purpose, the Pimsleur's algorithm (1967), discussed in the chapter "Theoretical and methodological problems underlying the creation of an educational game for teaching foreign languages" could be applied. The strict usage of repetitions within the first day could be ignored. Each batch of unique words is presented to the learner on the first, second, sixth, and 24th day of its initial teaching. In this case, if all the taught words were to be consolidated according to this scheme, then it would be expected that they should be remembered by at least the fourth month after their initial teaching. The dissertation presents a table detailing the scheme for initial teaching and the three repetitions of the vocabulary.

According to the training scheme in question, the total playing time spread over 63 days should be about 17 hours. In that time, the learner could be expected to absorb 1,600 words and retain them for at least two months after the last use of the game.

## Conclusions

The dissertation reviews the main semiotic theories and their relationship with the acquisition of foreign languages, which represent sign systems. The following is a review of the scientific literature devoted to alternative methods for fast and effective foreign language learning and to corpus linguistics. Based on the theoretical research, the characteristics of a new methodology for fast and practically unconscious acquisition of foreign languages in the form of a game are proposed. In the empirical part, the complete development process of a mobile game that applies the newly developed methodology is traced, as well as an

experiment establishing its effectiveness.

Based on the discussed theories and the conducted experiment, the following conclusions can be drawn:

1. Video games are complex semiotic systems built from acoustic and visual codes that can be used as a tool for successful teaching of sign systems.
2. Implicit acquisition of signs and their correct use in sign systems could have significant advantages over explicit teaching methods.
3. The developed methodology in the form of a mobile game could be an effective method for learning sign systems and, more specifically, for memorizing new foreign language units.
4. Using a product that is a game in the full sense of the word and teaches a foreign language without conscious effort could significantly increase the motivation of learners.
5. Research conducted with the game prototype shows the number of words memorized just one day after being taught. For more objective results, another experiment should be conducted with a full version of the game in order to establish the effective learning of no less than 1600 lexical items within 63 days.
6. It is desirable to conduct an experiment with a larger group of adult participants under conditions identical to those of the current ones, in order to compare the results and draw conclusions whether the methodology is equally effective for different types of users, as well as whether the degree of motivation and a responsible attitude of adults to the experiment will give better results.
7. Once successfully developed, the mobile application would be great to be upgraded with a new product that, using an identical methodology, teaches grammar in a playful way without conscious effort. The combined use of both products could provide a greater completeness of the learning process.

## Contributions

The conducted scientific research has the following contributions:

1. The structural characteristics of video games as complex semiotic systems have been derived.
2. A prototype model of a video game had been developed and tested, which, through an innovative pedagogical approach, could be used for rapid and practically unconscious acquisition of sign systems, and in particular foreign languages, potentially solving problems with learner motivation.
3. Optimal characteristics of the structure of educational texts for foreign language learning have been derived.
4. A database of 1,898 lexical items, distributed according to their teaching levels according to Cambridge, was compiled, which could be used as a basis for building teaching texts.

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