

Thematic Article

English Language Learning Using Literary Texts in the Virtual 3D Space of the MaxWhere Seminar System

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Abstract

Through this paper, we will provide a brief overview of the 3D virtual library project and a more detailed review of its current application for English language learning. The implementation of the library project makes use of the innovative 3D presentation features of the MaxWhere Seminar System. As an innovative application of the project, we compiled a bilingual learning material for Hungarian students to improve their language skills and competence in English at an advanced level. The complex structure and organization of the learning material is based partially on the hypertextual relationships between entries of selected keywords containing various contexts from different works of world literature. We developed the learning material taking into careful consideration the appropriate characteristics of the hyperlink structure. Our basic hypothesis was that if the bilingual learning material is organized as a more or less scale-free network of interconnected nodes, this might or would result in an optimized and efficient knowledge transfer in the learning process. After the first version of the material had been completed, we wanted to evaluate the overall difficulty of the material. As such, we were using the Google Translate (GT) service to check the proper understanding of a set of selected English language phrases and sentences through their Hungarian translations provided by GT. As a result, we created a more or less scale-free learning material whose linguistic content has been properly checked.

Keywords: three-dimensional virtual library model (3DVLM); MaxWhere Seminar System; virtual learning environment; second language learning

Introduction

The *3D virtual library* project started several years ago as part of the Cognitive Infocommunications (CogInfoCom) research. The primary goal was to collect and present valuable English texts from and about classical Greek poetry and related contents in the 3D virtual space. Later we broadened the scope of the virtual library and added various texts, both ancient and modern, from English and world literature. In parallel with this, the focus of the virtual library has shifted towards English language learning. The current application of the virtual library is aimed, first of all, at Hungarian students with bilingual content based on selected texts from world literature in English translation in order to support their English language learning efforts at an advanced level.

The original *data model* of the virtual library (3D virtual library model, 3DVLM) was based on the hierarchical classification system of the ancient Library of Alexandria, the famous Pinakes, which was elaborated by the prominent librarian and scholar-poet Callimachus in the 3rd century BC. Since we started the 3D virtual library project, we have been continuously developing the data model that our project is based on. Although the hierarchical organization is still essential, the current implementation of the model has a more complex

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organizational structure which makes use of the innovative 3D presentation features of the MaxWhere Seminar System.

To begin building a comprehensive *knowledge base* for the 3D virtual library project, we first selected and processed various Wikipedia entries about Callimachus and his works in English in order to present valuable texts. Then we selected, prepared, and added other texts which were closely related to at least one of items of the knowledge base (e.g. slides about the Ptolemaic dynasty, two fine epigrams by Callimachus, etc.). To meet the possible needs of the language learners, we compiled some supporting materials as well, e.g. thesaurus pages each of which was organized around a selected microcontext (i.e. a fixed collocation of a group of semantically related keywords) and provided plenty of sample sentences. Later, we extended the scope of the knowledge base with classical as well as modern literary texts in English language with parallel Hungarian translations. We also developed efficient navigation and access tools for the learners such as timeline, navigation map of content units, a compiled list of keywords, and randomly generated language tests. We have been continuously updating the content and structure of our knowledge base with additional items (vocabulary and thesaurus entries, literary quotations, commentaries, explanatory notes, etc.).

As a next step in developing valuable and useful content for the library, we compiled a **bilingual learning material** for Hungarian students to improve their language skills and competence in English at an advanced level. By providing broader contexts of designated keywords selected from various works of world literature, our students can hopefully acquire the knowledge about the proper meaning of the keywords as well as their pronunciation (if necessary), spelling, the corresponding collocation pattern, and the context in which they have been used. The structure and organization of the learning material is primarily based on the hypertextual relationships established between the entries of different keywords that we considered as separate nodes of a more or less scale-free network. We intend to provide as many relationships as possible between the nodes preserving the scale-free characteristics of the structure in order to develop the learners' cognitive abilities, especially the recall of lexical knowledge from their long-term memory. Our basic hypothesis is that if the bilingual learning material is organized as a scale-free network of interconnected nodes, this will result in an optimized and efficient knowledge transfer in the learning process. We used the Google Translate service (GT) as an excellent testing tool, based on a trained neural network, to check the understanding of selected words, phrases, and sentences occurring in the developed bilingual learning material through the Hungarian translations. We mention that not only does the field of machine translation exploit the potential of various AI tools, but so does the interpreting industry. At present, there is an ongoing debate about the extent to which human interpreting activity can be replaced by interpreting software supported by AI. It is predicted for the near future that, in addition to AI applications, cloud-based systems will spread in this field (Horváth, 2021).

The basic framework and main development stages of the project

As we mentioned before, the research framework of our virtual library project is the rising *cognitive infocommunications* (CogInfoCom) movement (Baranyi & Csapó, 2012, Baranyi et al., 2015). Greatly inspired by the VirCA system (Galambos & Baranyi, 2011; VirCA, 2013) and its applications (e.g. Gilányi & Virágos, 2013), we decided to focus on the presentation and visualization possibilities of the textual and multimedia content in the virtual 3D space. The first version of the data model developed for our virtual library project (3DVLM) closely reflected the peculiarities of the VirCA system (Boda et al., 2013; Boda et al., 2014). Some years later we discovered the MaxWhere Seminar System (MaxWhere 2022) and its innovative applications (see e.g. Gilányi et al., 2020; Rác et al., 2020).

The MaxWhere Seminar System offers several web browsers (called “smartboards”) neatly arranged in the virtual 3D space. The smartboards are based on web technology and therefore they are especially appropriate to present hypertext-based content. Partly for this reason, MaxWhere is perfectly suitable for learning purposes because it can be considered as a desktop virtual environment for education and learning (Berki, 2020), providing a personalized and customizable learning environment, and various paths for the learners (Horváth, 2020).

Because of the enhanced features and flexibility of the MaxWhere system, we decided to use this new 3D presentation environment for the virtual library project and gradually modified the 3DVLM in compliance with the new challenges, laying great stress on hypertext-based content (Boda & Tóth, 2019, 2020). From the beginning of the project, we have been focusing on the application of the virtual library for English language learning. First, we elaborated a six-level model, the so-called model for increasing efficiency (MIE) in multimedia language learning supporting systems which formulated the basic principles for the development of

efficient language learning materials (Boda et al., 2017). Then we started to develop various implementations of the model, and simultaneously strove to enlarge the knowledge base of the virtual library (e.g. Boda & Tóth, 2020, 2021).

Content development principles

The basic idea that lays behind our bilingual language learning material is to use the treasures of literature to ensure effective language learning. Among other things, motivation of the language learner is crucial because, without the necessary effort and perseverance, one can never be able to acquire, practice, and memorize the basic lexical knowledge required to read, listen and comprehend, speak, and write in a foreign language (in our case, English). Literature can serve as a key tool to help learners through the initial learning difficulties – provided that the learning material is easy to use (*user friendliness*), well organized (*organization and structure*), and contains, as much as possible, all the necessary information (*completeness*).

Regarding user friendliness, **web technology** has been undoubtedly proving its excellence since being invented. Millions of people use decent web pages and web applications daily without much difficulty. So we decided to use web technology and developed our language learning material in HTML using CSS and JavaScript codes to add vivid colors, inspiring typography, and interactivity. The 2D version of the material is currently available on the internet as a part of our 3D virtual library project.⁴

The question of the completeness of the material depends on a variety of sensitive factors. First, we had to select a limited set of **famous works** from the world literature to be dealt with. We started from a well-known play of Shakespeare, then added some classical novels (e.g. from Jane Austen, Victor Hugo, Charlotte Brontë, George Eliot, Leo Tolstoy, etc.), and some best sellers, both old and new (e.g., from Arthur Conan Doyle, Edgar Rice Burroughs, Rafael Sabatini, J. K. Rowling, Stephenie Meyer, Alan Dean Foster, etc.) until the overall size of the learning material has apparently exceeded all possible limits. Second, we should provide in the 2D space, and/or refer to in the 3D space, a short description of the plot and the main characters of the literary works which might be unfamiliar to the average users of the material. In this, Wikipedia was a great help. Again, we had to limit the number of plots because of the limited size of the material. Third, we focused on the **vocabulary development** of the language learners, so we tried to select those *keywords* which seemed to be either well-chosen in a given literary context or might be ambiguous or unknown for the learners (e.g., words that are rare, literary, archaic, old-fashioned, etc.). Because of the enormous number of possibilities, we selected two keywords from Shakespeare (*swashing* and *martial*), and then let the material build itself during the development process following a consistent strategy (see below). Currently, there are **100 English keywords** in the material (but in the regular process of re-reading and checking the material new words emerge consistently, so the compilation of a more or less complete group of keywords seems to be ongoing).

We established a complex strategy for selecting and processing new English words as keywords which formed the core of the material. The main components of the strategy are based on the following elements:

- We searched for and presented several *contexts* for each keyword from the selected group of literary works. Once a context was selected, we emphasized the keyword in bold typography and underlined the sentence or clause where it occurred. Then we provided a Hungarian translation of the English context (either taking it from the corresponding Hungarian translation of the literary work or making it ourselves). In many cases, the selected English contexts contained more than one keyword, which provided a real benefit concerning the consistency of the learning material.

- We provided English and/or Hungarian *commentaries* where it seemed necessary (including definitions of rare or archaic words, missing or alternative Hungarian translations of difficult phrases or clauses, explanations and/or interpretations of certain parts of the presented context, further references and remarks, etc.). We typically omitted the definitions of the words as well as the sample sentences which the well-known monolingual dictionaries prefer in their main entries. Our idea was that in the bilingual language learning material either the group of synonymous words (see below), or the presented English contexts of the keywords (not to mention the parallel Hungarian translations) should provide enough information to understand the appropriate meaning of the keywords.

⁴ https://bodaistvan.hu/callimachus/texts/_hun-eng-01.html (2022-08-29)

– We attached *synonyms*, in a very broad sense, to each English and Hungarian keyword and organized a group of semantically related words around each keyword. Because we chose the meaning of the words as the general basis (or criterion) of the organization, therefore we did not hesitate to add even words of different parts of speech to a given group of words provided that they belonged to the same semantic field.

– Finally, we used GT, considered as *an AI model of a user who has an excellent command of English* (i.e. at an upper, intermediate, or advanced level), to check the translation of selected English sentences from the presented contexts (ensuring that the selected sentences should include at least one keyword). If the machine translation of the original English sentence resulted in an adequate but not quite satisfactory Hungarian translation, we tried to “refine” the English sentence by adding and/or replacing some words until its Hungarian translation could be fully accepted even for a native speaker. This might offer valuable help in identifying particularly difficult sentences calling for extra commentaries (e.g. explanations) and in finding more appropriate (disambiguated, more frequent or common, simplified, specified, embellished, etc.) words and expressions which might replace the keywords in their context for the sake of better understanding. (Note that the simplified editions of classical and popular books, providing a limited number of words and controlled vocabulary at different levels, show a remote resemblance to this approach. For example, let us have a try and follow these simple steps: (a) translate a sentence from English to Hungarian; (b) improve the English sentence so that it can be accepted for a native speaker; (c) translate the improved sentence now from Hungarian to English; (d) compare the original and the transformed English sentences.)

Table 1 summarizes the main elements of the strategy, contrasting elements of an “ideal” strategy (used in language learning supporting materials such as monolingual, bilingual, collocations, synonyms, production, quotations, proverbs, idioms, picture dictionaries, guides and lexicons, thesauri, language learning materials, textbooks, etc.) with the implemented strategy in the developed bilingual language learning material.

Table 1. Elements of the implemented strategy in the developed bilingual material

elements of an “ideal” strategy	relationship	elements of the implemented strategy
(short, monolingual) definitions of words, etc.	⊃	[providing synonyms, explanations, translations, etc. in commentaries]
Hungarian translation of words etc.		
sample sentences	⊆	selected contexts (i.e. extracts from literary works)
selected concordances		
selected quotations		
short texts (e.g. from textbooks)		
collocations	⊃	selected phrases
idioms; phrasal verbs		
grammatical structures (e.g. verb patterns)		
synonyms and related words (paradigmatic relations)		groups of synonyms (in a very broad sense)
antonyms and contrasted words		–
various topics		–
related words (syntagmatic relations)		
conceptual maps (of related words etc.)		
illustrating pictures and other items of multimedia		–
simplified texts	⊃?	[using Google Translate]
bilingual texts	=	bilingual contexts
exercises, tests, etc.	⊃	interactive tests for practicing and memorizing



We can see that the greatest strength of the bilingual learning material is the presented *literary contexts* which, in themselves, implement several features of the widely known language learning supporting materials (including sample sentences, selected quotations, etc.). It is worth mentioning that the sequence of the contexts that come from the same literary work, especially when the plot of the work is also provided, constitutes one of the possible *learning paths* which the users of the learning material could follow (i.e. read the contexts one by one in the right order and memorize their content).

A short overview of the bilingual language learning material

We would like to take a short tour, as a brief guide, going through the main learning paths of the developed bilingual material. The starting point is the **Sources / Források** part which lists all literary works with attached hypertext links to the presented contexts of the corresponding works. Note that there are dedicated links to the three main parts of the learning material which, as we will see, contain the vocabulary content to be learned in the first place. In the current version of the material, we presented the plot of two classical novels (Jane Austen's *Pride and Prejudice* and George Eliot's *Middlemarch*).

The first part (**Part 1**) of the learning material contains words describing an individual with a loudmouthed and arrogant attitude (with words such as raucous, boisterous, clamorous, rowdy, pretentious, swaggering, conceited, disdainful, etc., in some cases adding contrasted or related words as well). Here, as well as in the other two parts of the material, every English and Hungarian word has a link to the corresponding entry of the English word. Moreover, because there are Hungarian words which can be considered as a possible translation of more than one English word, some Hungarian words have additional links to the entries of the appropriate English words (Fig. 1).

Figure 1. A typical part from the Part 1 section of the learning material

<u>hetvenkedő</u> 	<u>boastful</u>
<u>kérkedő</u> 	<u>braggart</u>
<u>nagyzoló</u>	
<hr/>	<hr/>
<u>peckes</u>	<u>swaggering</u>
<u>hősködő</u>	<u>hectoring</u> (archaic)
<u>handabandázó</u>	<u>swashing</u> (archaic)
<u>hepciás(kodó)</u>	<u>swashbuckling</u>
<u>legénykedő</u>	<u>square-jawed</u>
<u>emberkedő</u>	
<hr/>	<hr/>
<u>arrogáns</u>	<u>arrogant</u>
<u>szentelen</u>	<u>cocky</u>
	<u>impudent</u>

The second part (Part 2) of the learning material contains words describing an aggressive and violent attitude (with words such as dashing, impetuous, vehement, martial, furious, vicious, destructive, implacable, etc., in some cases also adding contrasted or related words) (Fig. 2).

Figure 2. A typical part from the Part 2 section of the learning material

<u>szenvedélyes</u>	<u>passionate</u>
<u>robbanékony</u>	<u>vehement</u> [vi:əmənt]
<hr/>	<u>volcanic</u> [vɒl'kænik]
<u>harcias</u>	
<u>harcos</u>	<u>martial</u>
<u>katonás</u>	<u>militant</u>
<u>marcona</u>	<u>soldierly</u>
<u>zord</u>	<u>soldierlike</u>
<hr/>	<u>warriorlike</u>
<u>agresszív</u>	<u>bellicose</u> [belɪkəʊs]
<u>rámenős</u>	<u>belligerent</u> [brɪlɪdʒərənt]
<u>izgága</u>	
<u>kötekedő</u>	<u>unfriendly</u>

The third part (**Part 3**) of the learning material contains miscellaneous and helpful words which occurred in the presented contexts of the keywords (e.g. desist, fearless, gallant, dart, dash, sparkling, heave, flutter, etc.). Here, just as in Part 1 and Part 2, various synonyms and related words were provided in both English and Hungarian (Fig. 3).

Figure 3. A typical part from the Part 3 section of the learning material

<u>bátor</u> ⇒ ⇒ ⇒	<u>brave</u>
<u>merész</u>	<u>bold</u>
<u>vakmerő</u>	<u>courageous</u>
<u>elszánt</u>	<u>daring</u>
<u>rettenthetetlen</u> ⇒	<u>intrepid</u>
<hr/>	
<u>remek</u> (≈ <u>derék</u>) ⇒	<u>fearless</u>
<u>derék</u> ⇒	<u>valiant</u>
<u>vitész</u> ⇒	<u>gallant</u> (≈ <u>brave</u>)
<u>hősies</u>	<u>heroic</u>

The next step can be to click on a selected link attached to either an English or a Hungarian keyword in any of the three parts described above. Let us select ‘raucous’ (translated by ‘durva’, ‘közönséges’, ‘harsány’, ‘ordenáré’ in Hungarian) in Part 1. Then we can find a useful collocation (‘raucous laughter’ = ‘durva röhögés’) and its proposed Hungarian translation by GT (‘harsány nevetés’), bordered by solid red lines (Fig. 4). In addition, there are two contexts from Stephenie Meyer’s *Twilight*, in English and in Hungarian, with useful comments (Fig. 5). (Note that every literary context has a precise reference to the original source.) In both contexts we underlined the sentence that contained the keywords ‘raucous’ and ‘raucously’, and gave the translations of these sentences offered by GT (in this case both translations, although being more or less adequate, were far from being quite satisfactory).

Figure 4. The entry ‘raucous’ in Part 1 of the learning material

RAUCOUS [rɔ:kəs]
... durva röhögés ...
=
... raucous laughter ...
... harsány nevetés ... ⇒

Figure 5. The second context for the keyword ‘raucous’ with attached comments

"Stay away from me," I warned in a voice that was supposed to sound strong and fearless. But I was right about the dry throat – no volume. "Don't be like that, sugar," he called, and <u>the raucous laughter started again behind me.</u> ⇒
COMMENTS
I have a good <i>loud</i> * scream = [jó hangosat bírok sikoltani]
in a <i>strong and fearless</i> * voice = [erős és bátor (határozott, magabiztos stb.) hangon]
<i>raucous</i> * laughter = [durva (közönséges, trágár, ordenáré) röhögés]

There are a great many links in the material, so we can go back and select another keyword, and so on, until we decide to stop. There is also an interactive test at the end of the material which might help the learners to test their knowledge concerning the keywords and contexts provided by the material.

In **Part 4** there are some tables which summarize the content and characteristics of the bilingual language learning material. The ‘List of keywords and expressions’ table lists all English keywords and their Hungarian translations which occurred in the material with corresponding links to their exact place of occurrence. The ‘Link structure’ table lists each English keyword and its *link strength* (i.e. the number of references that point to the given link). This information can be used to determine how many keywords have a given link strength. The result shows that we have got a more or less scale-free distribution (with $\gamma \approx 3.1$ value) (Fig. 6).

Figure 6. The most significant part of the distribution of the link strength of the keyword entries. The network distribution proved to be more or less scale free.

<i>Link strength</i> (<i>x</i> ' axis)	<i>Strength frequency</i> (<i>y</i> ' axis)	<i>Estimated value</i> ($c=429.593, \gamma=3.096, \Delta/n \approx 1.459, iter_n=1008$)
1	430	429.59
2	42	50.24
3	27	14.32
4	12	5.88
5	7	2.94
6	6	1.67
7	3	1.04
8	1	0.69

We placed the bilingual language learning material in the *Atrium* 3D Space of the MaxWhere Seminar System (the space was created by Design Group, Széchenyi István University of Győr). There are 26 smartboards in this virtual 3D space. In addition to two dedicated smartboards which present the content of the learning material itself (for the content to appear on both floors of the two-storey virtual building), we displayed on the other smartboards the corresponding Wikipedia pages about each literary work that the material refers to (Fig. 7, Fig. 8).

Figure 7. The dedicated smartboard which presents the content of the bilingual language learning material on the basement of the Atrium 3D space. On the left and right side of this smartboard there are Wikipedia pages about Shakespeare's play 'As You Like It'.



Figure 8. A view from the first floor of the Atrium 3D space. There are three Wikipedia pages displayed on the smartboards (providing information about the tale ‘One Thousand and One Nights’ and Sindbad the Sailor, and on the first novel of the Harry Potter’s series).



Conclusions

When developing a well-designed learning material, first we would declare its goals and then the basic development principles and the used technology that the content, structure, and organization of the learning material are based on. The initial preparation of the learning material is crucial; on the one hand, if it is inadequate, the process eventually fails. On the other hand, if it is successful, there is always a tipping point in the development process from which the material will “write itself” – that is, every step involves the next until the process finally (and successfully) ends. In the bilingual learning material, the main steps of the development process were as follows:

- (1) We started from a simple sentence from Shakespeare’s play *As You Like It* (“We’ll have a *swashing* and a *martial* outside”), and selected two keywords: ‘swashing’ and ‘martial’.
- (2) We added synonyms and other related words (both in English and in Hungarian) to these initial keywords.
- (3) We looked for literary works that could be sources for the contexts of the keywords. In order to understand the contexts, we added plots to some of the selected literary works.
- (4) We created entries for each keyword. We added short phrases to the beginning of the entries, selected Hungarian and English extracts from the literary works with comments, and, in some cases, translations made by the Google Translate service to check the difficulty of the selections.
- (5) We established source and keyword indexes as learning paths for the users so that they can find the most promising ways to read the material and learn its content.
- (6) We provided an interactive test at the end of the material to help the learners of the material to review and memorize the content.
- (7) We placed the main entry points of the learning material in a carefully selected virtual 3D space.

Meanwhile, we built a complex link structure based on the indexes and the bilingual entries of the keywords in order to make the material user friendly and helpful. We think it is one of the main results of our work that we have successfully developed a more or less scale-free link structure of the bilingual language learning material.

Future directions

In general, the main goals of the 3D virtual library project, as well as that of the developed bilingual learning material, are to improve the English language skills of its users, to help them develop reading comprehension in a foreign language, to motivate them to read classical and/or popular literature and poetry, and, most generally, **to carry the message of ancient times to young generations** (especially to members of the generations CE, Baranyi et al., 2015). Our basic idea is that language learning at an advanced level can serve as a bridge between cultures if we carefully select, preprocess, and provide interesting and valuable literary texts for the possible learners of the internet era in a flexibly organized and innovative way. Therefore, we hope that we can continue our work with increasing efforts and efficiency in the future.

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