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DEVELOPING A SOFTWARE APPLICATION FOR THE STUDY AND LEARNING OF LINEAR A SCRIPT

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ABSTRACT

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The link between the scripts of many ancient languages and technology is minimum and occasionally superficial. As a result, their study and analysis remain a challenge for the researchers. Such an example of ancient script is Linear A, which is still considered the very first European script. Nowadays, there has been three main languages or language families of origin suggested, spoken in the Bronze Age, in order to attempt the decipherment of Linear A texts: (a) a language of the Aegean Sea, (b) certain languages of the Western Anatolia family and c) an Akkadian dialect. Therefore, there is a strong possibility that Linear A may render occasionally more than one language. The present survey initiates the adaptation of an existing computational framework for the interpretation and learning of syllabic scripts, already tested in Linear B script, to facilitate the research regarding the underlying language(s) of Linear A. Linear B have many signs in common with Linear A and of a known phonetic value per sign. Therefore, it is most appropriate for facilitating the study and potential decipherment of Linear A. This paper presents an outline of the designed software application, along with the sources that are studied and used for the adaptation of the existing computational framework for Linear B.

Contribution/Originality: This study is one of very few studies which have investigated the possibility of deciphering and simultaneously learning an ancient script of the Bronze Age, namely Linear A, by developing an interactive software application for this purpose that includes a multilingual database.

1. INTRODUCTION

Linear A is the most ancient indisputable script in the European continent, so far. However, there is a lack of useful software tools that can make use of appropriate glossaries, in order to proceed to its understanding. The syllabic repertoire of Linear A consists of 75 syllabic signs [1] called syllabograms, because they mostly render a syllabic phonetic value of a consonant (e.g., B, C, D etc.) followed by a vowel (e.g., A, E, O etc.) Every syllabogram depicts a culturally common object in an abstract manner, for facilitating faster writing and easy recognition [2]. The syllabograms of each Aegean script are formally designated by a number, initiated with the initials of the script, e.g., LA 52 for Linear A or LB 8 for Linear B, both depicting the double axe and conveying the phonetic value "A" [3].

The research herein aims at clarifying the scope and focuses on interpreting Linear A texts in relation to potentially more than one subject languages. In addition, it contributes to the study of best practices and to the

development of software tools that will lead to better understanding of this script and deciphering its underlying language(s). Another new element of this study includes the development of a digital environment that will facilitate its user in learning and understanding Linear A and its underlying language(s).

2. A SOFTWARE SYSTEM FOR ARCHIVING AND DATA PROCESSING

The tool that is developed has a dual purpose. In the first place, it constitutes a database and a digital glossary of Linear A, that could be enriched with additional elements and be prone to a follow-up of new findings. On the other hand, the user-friendly orientation of the interface will make it a powerful means of learning and understanding the language(s), by identifying the syllabograms and by combining them to end up in today words, in Greek and English.

2.1. Data Entry and Management System

The development of the relevant software application consists of a virtual keyboard for inserting new syllabograms of Linear A in a search engine, which is developed for this purpose and it will provide their translation into one of the underlying languages, chosen [Figure 1](#). A first taxonomy of the known syllabograms will be available and thereon, the user will be able to choose the proper syllabogram(s), contained in every observed word of Linear A, in order to see in which language is based on and how it can be translated. Up to now, the usual procedure was to try and find the word of interest from a list of the already known words.

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Figure-1. The design of the interface.

To this end, a digital dictionary consisting of the already existing words from all sources is being created and become available to the researchers, in order to use the software tools either for learning or for the deciphering of Linear A. As a result, by creating a consolidated vocabulary, it will safely lead us to the answer of whether Linear A renders the combinatory result of a variety of already existing languages. Therefore, the developmental process includes a database, along with a transcription in Latin alphabet and the translation of the basic words in English and Greek. Wherever it is necessary, there will be a comment [Figure 2](#).

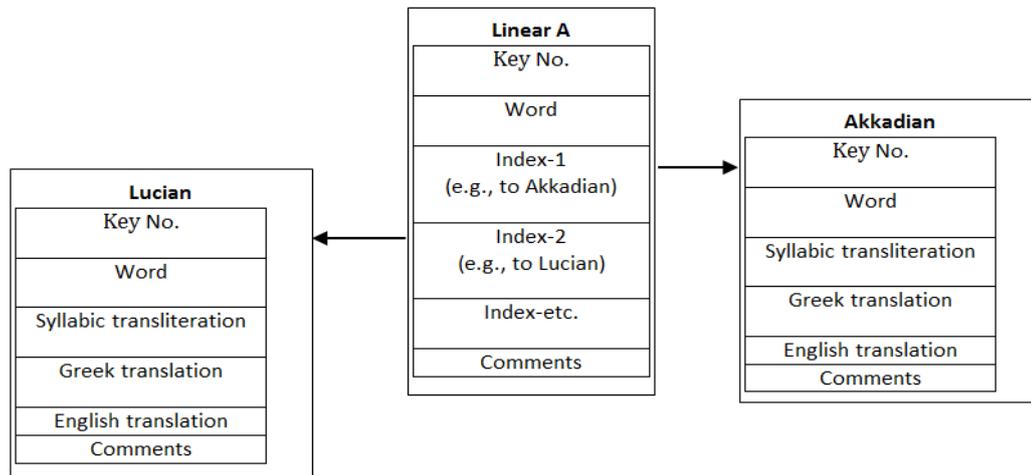


Figure-2. The design of the database.

3. PREVIOUS WORKS

The related works that either facilitate or are used for the development of the herein software tool are classified in the following five categories presented. Their diversity indicates the complexity that arises for the development of software applications that deal with the potential decipherment of ancient scripts.

3.1. Cultural Relations of the Era of the Minoan Cretan Civilization

This category includes works that describe the contemporary cultural context of Bronze Age Crete, before the arrival of the Achaeans to the island (c. 1450 BCE). They facilitate the identification of the ethnicities existed and therefore the potential identification of their languages, spoken at those times. Some notable works/sources are the next ones:

- Aegeus - Society for Aegean Prehistory, 2017. https://www.aegeussociety.org/en/study_category/aegean-studies/, last accessed 2020/9/11.
- Decorte [4]; Ferrara and Valério [5]; Tosa [6]; Woudhuizen [7]; Woudhuizen [8].

3.2. Possible Origins of Linear A

Linear A depicts the commercial relations and administrative practices of the first half of the second millennium in Minoan Crete [9, 10] and this may be the reason that this language commuted to other places and was modified (e.g., to become Linear B for Greek). The origin of Linear A seems to have come from the Cretan Protoliner script [10]. The three main underlying languages or language families to be studied are:

- One or more Anatolian languages that were spoken in Asia Minor and the opposite to Crete territories, such as Luwian, Lycian, Carian, and Lydian that appears to be close to the Etruscan language, sharing many cultural elements with Minoan Crete [11]. However, there is a possible connection in theory with other undisclosed languages of Asia Minor but there are few findings to analyze this.
- A dialect of the Akkadian language, famous to be in use because of trading, stations and communities [12].
- Proto-Greek dialects of Ionian and Aeolic nature and/or a local dialect of Pelasgian origin [9, 13].

The related sources include works like the following ones: Bomhard [14]; Hajnal [15]; Kazansky [16]; Papakitsos [10]; Papakitsos and Kenanidis [17]; Woudhuizen [12].

3.3. Analysis of Existing Scripts and Languages during the Minoan Period

Several languages had been spoken around Crete during the Minoan period (2000 BCE - 1400 BCE) [1, 13]. These languages are potential candidates for being the ones rendered by Linear A. Their study is essential for matching their features to the peculiarities of the syllabary in Linear A. Some notable relevant works include:

Finkelberg [18]; Giusfredi [19]; Gnanadesikan [20]; Ignasi [21]; Kenanidis and Papakitsos [22]; Merlini [23]; Owens [13]; Owens [9]; Thomopoulos [11]; Woudhuizen [24].

3.4. Linear A Description

Whatever is known about Linear A constitutes the core of the software tool, especially of its database and interface. The most notable related work is that of Prof. J. Younger in his website, "Linear A Texts & Inscriptions in phonetic transcription & Commentary" (<http://people.ku.edu/~jyounger/LinearA/>, inaugural date: 30 November 2000), which includes:

- The Linear A texts from Haghia Triada (Ayia Triada).
- Other Linear A texts.
- Common Linear A Ideograms; GORILA's sign charts and palaeographic sign charts.
- Linear A religious texts grouped separately.
- Linear A Lexicon.
- Phonetic Grids for Linear A & B.
- Hypothetical Phonetic Grids for Cretan Hieroglyphic.
- Bibliography from 1980 on (with select works prior).

Nevertheless, the above material is not in a machine-readable format, unless specifically processed.

3.5. Relevant Software Approaches

A few software approaches exist, so far, for learning or deciphering ancient languages and scripts. Most of them regard databases and just a few of them refer to algorithmic processing. Some notable works are:

- "Linear A explained" (2014), http://everything.explained.today/Linear_A/, last accessed 2020/9/11.
- Wikimedia Commons, "Hieroglyphic Luwian" (2018), https://commons.wikimedia.org/wiki/Category:Luwian_hieroglyphs, last accessed 2020/9/11.
- Chorozioglou, et al. [25]; Feder, et al. [26]; Homburg, et al. [27]; Jauhainen, et al. [28]; Kontogianni, et al. [29]; Kontogianni, et al. [30]; Koukis, et al. [31]; Luo, et al. [32]; Papakitsos, et al. [33].

4. CONCLUSION

In this paper, we have presented the possible links of the Linear A script to different languages of the Bronze Age and some basic elements of the tool that is being developed for the interpretation and learning of syllabic scripts in Linear A. Furthermore, we have presented some previous works, which constitute our first object of study and we analyzed as well the cultural context in which Linear A is placed in the timeline. To sum up, a user-friendly platform is being created that is being designed to be simple and with a large amount of information. As a result, it will constitute a valuable digital assistant for the researchers of Digital Humanities world-wide and a useful tool for understanding and learning Linear A.

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