

## **ANALYSIS OF MOVEMENTS OF THE HUMAN BODY-SIGN LANGUAGE USING CAMERA AND COMPUTER**

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### **Abstract**

This paper studies the movement of the human body both during gait and during the production of the Greek sign language, through ready-made video clips derived from a variety of sources.<sup>[2][3]</sup> Moreover, the processing of the video clips through the use of the video analysis software, 'video tracker analysis', by performing measurements of the size of the movement, is presented (position, velocity, acceleration). The above measurements signify the existence of an approximation of the 'normal movements' of the theory (straight smooth motion, straight smoothly accelerating motion, circular motion, and oscillation) to the actual movements of the body and especially to the movement of the hands during the production of sign language. Thus, it is attempted to smooth out the difficulties that students face in their effort to link the theoretical knowledge obtained at school to the real world they experience in their daily lives. Finally, the choice of sign language as a subject under investigation, apart from the interest it presents for the language itself and for the detection of its components, attaches a social character to the subject of Physics. This furthermore presents a different approach to differentiation and the goal of inclusion in School curriculum through the proposed scenario.

### **INTRODUCTION**

The goal of the present study is not only to enrich the teaching tools of Physics in Secondary Education, but also to improve its effectiveness.

The main observations that led to this study involve, first of all, the effectiveness of new technology in teaching sciences. PCs, tablets, smart boards give the opportunity to teachers to present impressive scenarios, activating students' interest in an easy and safe way. Moreover, the use of new technologies can be considerably helpful, as it can eliminate complex laboratory devices, transforming a common classroom to a science laboratory. It can furthermore enrich science teaching by incorporating teaching objectives that had been stepped aside, such as inclusion of students with a range of diversities in a common educational process.<sup>[1],[2]</sup>

On the other hand, applets present a digital world. Thus, characteristics of the world are programmed and students are asked to confirm their existence. The above exploratory approach in science can generate a lot of misunderstanding in our students' minds mainly by promoting confusion between the scientific model and the real phenomenon.

The question in this research is "Can we use real sign movements to teach Kinematics in high school?"

## MATERIALS AND METHODS

To answer this question, we use a common PC to define the 2-dimensional movements that are produced on screen during the use of the Greek Sign Language.

The methodology developed is based on several fundamental aspects, namely, the theoretical analysis of the phenomena, the recording of real movement via camera or the employment of video clips by choice. Afterwards we have to carry out digital measurements, the electronic analysis and evaluation of the results, as well as the proposal of suggested scenarios for class implementation.

In particular we analyze ready-made videos from the Greek Dictionary of Sign Language “Noema”. The specific choice was made to provide a more representative sign of the Greek Sign Language, avoiding dialects. The chosen videos demonstrate the production of signs “I’m hungry”, “Face”, “Toothbrush”, “Hair”, and “Skeleton”.<sup>[2]</sup>

The analysis of the chosen signs was made by a free to use open source software called “video tracker analysis”. In this software, specific points of a picture can be traced during the video projection. These points were later exported automatically or we performed manually measurements of kinematic magnitudes such as change of the position, velocity, acceleration, etc.

The results of this process can be analyzed and presented on graphs in order to facilitate the recognition of the various aspects that comply with models of motion taught at school.



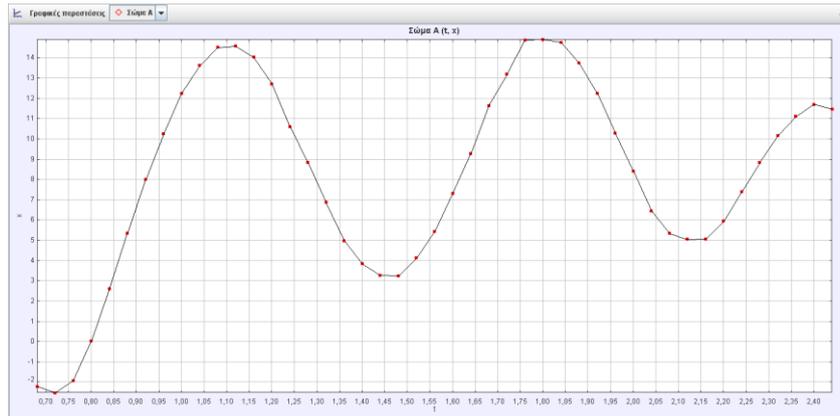
Pic.1 Recorded Traces

## RESULTS

According to the measured magnitudes we found a variety of signs that include enough instances of easy to recognize motion patterns.

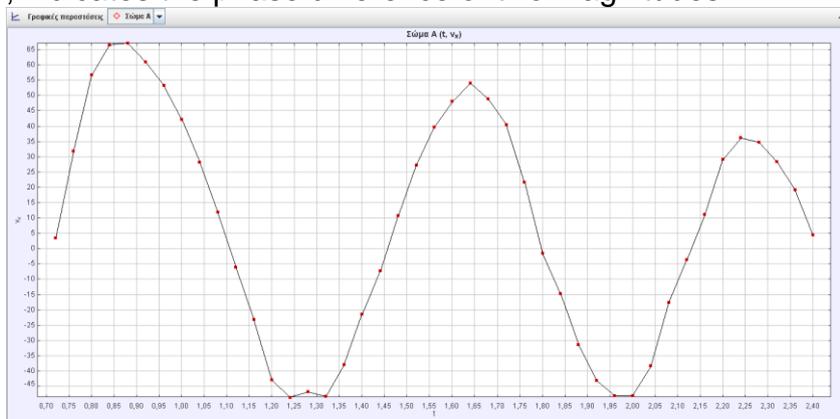
In particular we found

a. A well demonstrated oscillation during the production of the sign “I’m hungry” as it is shown in pictures 2, 3, 4. In this graphs of horizontal position, velocity and acceleration we can recognize the functions that described in theory.



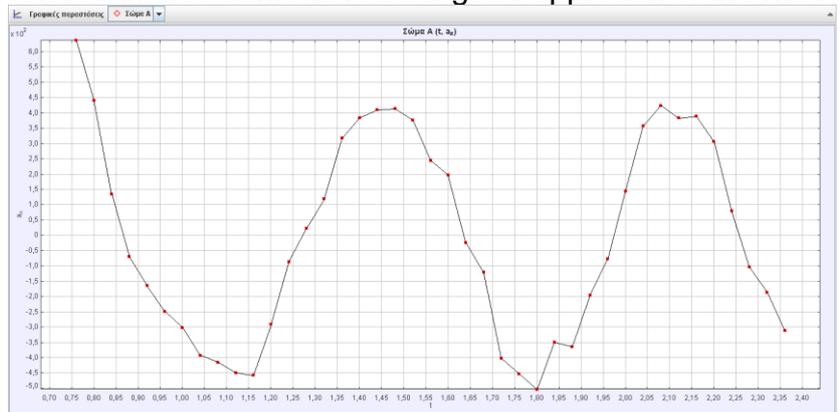
**Pic. 2 Graph of horizontal position**

The analogous graph of velocity confirms the prior result and, moreover, indicates the phase difference of two magnitudes.



**Pic. 3 Graph of horizontal velocity**

Acceleration also demonstrates a good approach of the model.



**Pic. 4 Graph of horizontal acceleration**

Using the same method we found similar approaches of other kinematic models, such as

- b. a uniform circular motion during the production of the sign "Face"
- c. Uniformly accelerated linear motions during the production of the sign "Hair"
- d. A descending oscillation during the production of the sign "toothbrush" [5]

## DISCUSSION

The movement analysis indicates that specific Sign Movements have the kinematic characteristics that are needed to teach the different types of motion in the classroom.<sup>[4],[5],[6]</sup> Furthermore, the teaching process is so simple that can take place in every classroom equipped with a simple PC. Thus, a teaching scenario has been planned and proposed.

On the other hand, even though this method analyses hand movements, these results are not representative of the real movement. The measurements take place in a 2 dimensional screen which indicates the orientation of their reliability. Of course the analysis of the real movement which refers to a three dimensional movement doesn't concern teaching in high school and is not the objective of this study.

Summarising, Sign Language can be used to teach Kinematics in high school, and should be treated as a Trojan Horse which can carry the deaf culture and reinforce the aims of inclusion in modern school.

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