

# E-LINE, A COMPUTER PROGRAM USED IN E-LEARNING

## E-LINE, UN PROGRAM CALCULATOR UTILIZAT IN E-LEARNING

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**Abstract.** *In this paper the authors present a computer program, named E-line, which can be successfully used in the study of straight line, when the e-learning or only a component of the e-learning is involved. The authors of this article have produced the E-line computer program in order to help the people for whom the visual /spatial intelligence is situated to a poor level.*

**Key words:** *technical drawing, e-learning, CAD*

**Rezumat.** *În această lucrare autorii prezintă un program de calculator, numit E-line, care poate fi folosit cu succes în studiul dreptei, atunci când este vorba de e-learning sau doar de o componentă a e-learning-ului. Autorii acestui articol au construit programul de calculator E-line, cu scopul de a ajuta pe aceia a căror inteligență vizuală / spațială este situată la un nivel slab.*

**Cuvinte cheie:** *desen tehnic, e-learning, CAD*

### INTRODUCTION

The e-learning use in study of graphical disciplines is not an easy task. The difficulty consist in the fact that the teaching of graphical disciplines requires the explanation of how evolve a graphical representation, from a blank sheet of paper, to the technical drawing level. The explanation understanding depends, to a large extent, on the visual / spatial intelligence level. (Howard, 2011). When the teaching is conducted conventionally it is possible to return, where appropriate, with different forms of explanations thereby helping understanding the way in that the graphical representation evolved. In e-learning this is not possible and specific tools are needed to enable understanding how an engineering drawing evolves.

Starting from this, the authors have decided to build a computer program to simplify the understanding of how to represent a straight line in a draught. From the working experience with students, the authors understood that always many of them have, small or large, difficulties in understanding the process by which the projections of a straight line are disposed on the projection planes and in the determining process of hers traces.

Because the study of graphic disciplines involves, among others, the study of a CAD system, the computer program was designed to run in AutoCAD and was written in AutoLISP. In the choice of language used, the authors took into account the possibility of using the facilities of AutoCAD in terms of generating the solid objects in surface model and his viewing options. The computer program

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was named E-line, the authors thus trying to put together two terms "e-learning" and "line (Byrnes, 2011).

## MATERIAL AND METHOD

In the activity of analysis of the straight line representation, in double orthogonal projection, the first obstacle encountered by students undertaking this study is related to the ability to view her image in relation with the projection planes. But is not enough that this to imagine only the case where a line is placed in a certain relation with the projection planes, randomly chosen by his mind. It is essential that he may be able to build the correct mental image in which a straight line is reported to the projection planes taking into account, in the same time, the four subspaces known as dihedral. Only in this way the student gets to have a properly structured and consistent image that will play then a decisive role in understanding the graphical representations (Prună et al., 2006).

So, the first requirement for the E-line software was to being able to represent in 3D, in the surface model, the projection planes and the straight line. The surface model was chosen to give the user the ability to see the projection planes and the straight line from any angle desired and to continuously rotate the image, supplying, in this way, the deficiencies of the intelligence visual / spatial that it may have.

Also, in this stage it is good that the student to be able to create mental images of a straight line which lies in the particular position in relation to the projection planes.

Well, launching the computer program, by the *eline* command help, it will display a dialog box where the user is required to select the straight line which he want to investigate, Figure 1. He can opt for a line of common position or for a line perpendicular or parallel with the projection planes.

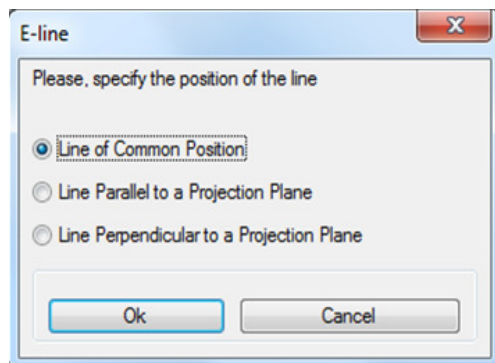


Fig. 1 -Determining the type of the line

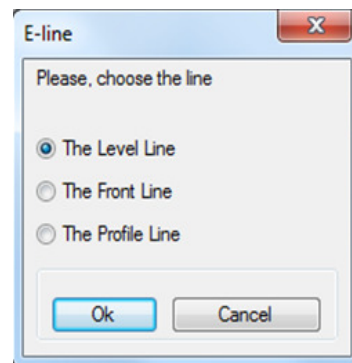
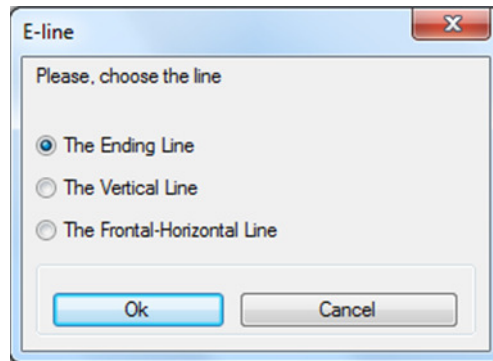


Fig. 2 - Choosing the line which is parallel to a projection plane

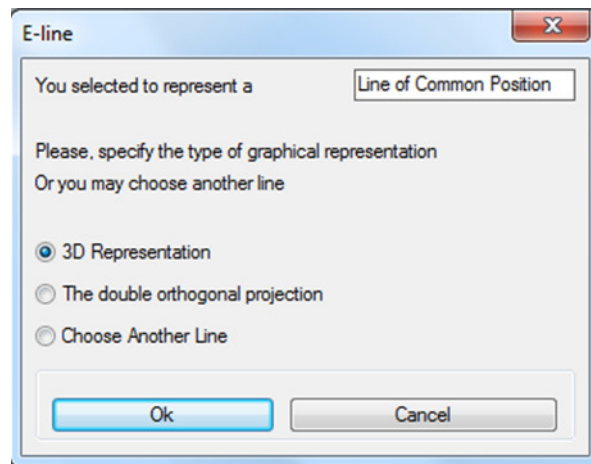
If the student chooses a line that is parallel to one of the projection planes, the program displays a dialog box where they can choose between a level line, a front line or a profile line, Figure 2. If he opted for a line perpendicular to one of the projection planes, the computer program displays another dialog box where he can choose between an ending line, vertical line or a frontal - horizontal line, Figure 3.

This introductory part, where the line is chosen, could be constructed in several ways. We chose this embodiment to determine student to retain how the lines are classified.



**Fig. 3 -** Choosing the line which is perpendicular on to one of projection planes

Calculation program retains the line chosen by the user and request him to establish the type of representation, Figure 4. In this figure it shows that the user has chosen to represent a line of common position and as a means of representation chosen to use the 3D model.

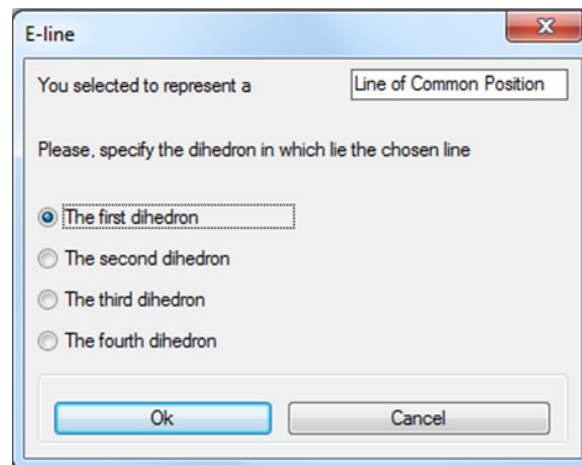


**Fig. 4 -** Setting the representation type of the line

Dialog box shown in Figure 4 allows the student to switch between the two modes of representation, double orthogonal projection or surface model, the software retaining the line selected in the previous step. This was a second requirement for the computer program. Thus, the student can easily make comparison between the two modes of representation. Switching easily between the two representations make that the mental effort, necessary to create images, to be significantly reduced. At the same time, this feature is a tool for check the correctness of the images for those who can easily create mental images.

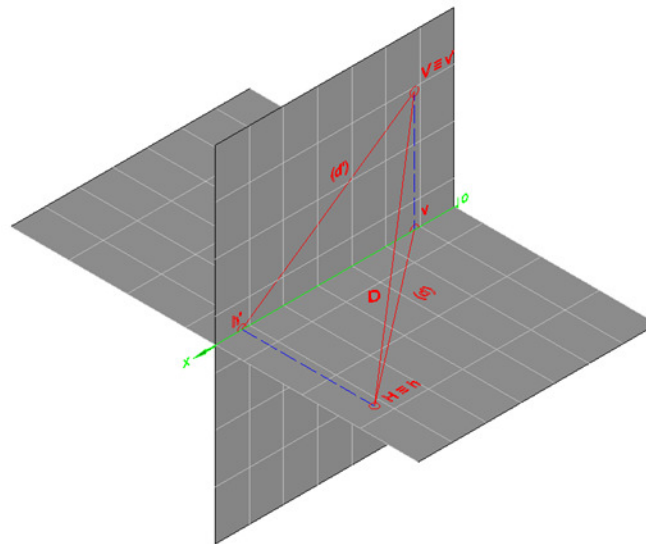
Before as the computer program displays the graphical representation the user must choose the dihedron in which the line is located. This is done using the dialog

box in Figure 5. As shown in this figure, within our presentation, was elected the dihedral one.



**Fig. 5** - The dihedron specification in which the line is

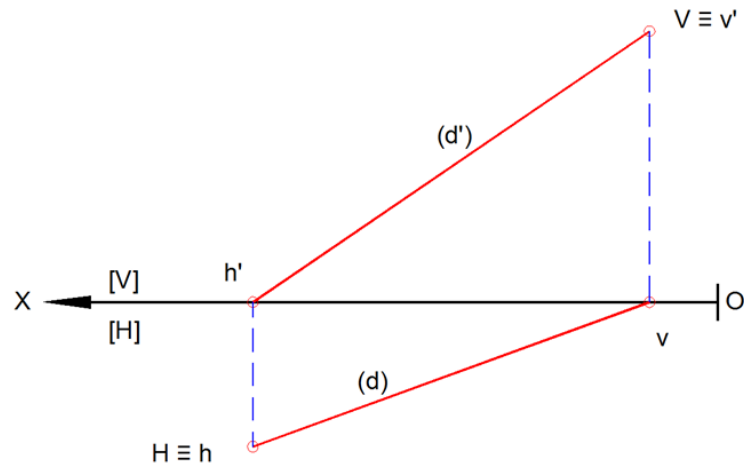
Once the dihedron was specified, the software displays the projection planes, the line in space, her projections and traces, Figure 6.



**Fig. 6** -Line of common position, 3D representation

Being a 3D representation, in surface model, the image obtained can be rotated to any angle or can be rotated continuously with 3dorbit command from AutoCAD.

A third requirement of the E-line program was to represent draught of the chosen line. So, when the student chooses to represent the line in draught, Figure 4, the computer program generates an image that contains projections of the line and its traces, Figure 7.



**Fig. 7** - Line of common position located in the first dihedral, represented in draught

The computer program enables to continue the analysis and by choosing another line as can be inferred from Figure 4. Switching to another line study can be done by using the *goon* command, specially created for this purpose, which has the effect the display of the dialog box in Figure 4.

## RESULTS AND DISCUSSIONS

To assist students who have difficulties in constructing mental images, the authors created a computer program named E-line which allows the study of straight line representation in double orthogonal projection. This was written in AutoLISP language and can run under AutoCAD. This solution was chosen to write the program because, on one side, the students learn how to use AutoCAD to the graphical disciplines and, on the other hand, may be used its graphical representation facilities and visualisation.

The computer program E-line answer to three important requirements:

- ✓ Represents in 3D, using the surface model, the projections planes, the straight line in space, her projections and her traces;
- ✓ Represents in 2D, in draught the straight line projections and her traces;
- ✓ Easily switch from 3D representation to 2D representation, because he retained the student requirements.

This computer program is primarily designed for individual study and may be successfully used in e-learning. He serve to the next purposes:

- ✓ Helps to form mental images for students whose intelligence visual / spatial is not at a high level;
- ✓ Serves as a control tool for those who can easily imagine a straight line in space, its projections and traces;
- ✓ Contribute to the formation of structured and coherent images regarding the straight line representation in the double orthogonal projection;
- ✓ Allows practicing how to classify the straight lines in relation to the projection planes;
- ✓ Enables the student to understand and discover the properties of straight lines that occupies a particular position in relation to the projection planes.

The computer program E-line may be used along with teaching materials in electronic format related to the straight line study in double orthogonal projection. These materials may include direct references to use this program with beneficial effects in terms of the study of the straight line.

### CONCLUSIONS

1. The E-line computer program, built by authors, is a tool that can be used in e-learning when studying double orthogonal projection of the straight line;
2. This computer program is helpful for the students whose intelligence visual / spatial is not high;
3. The e-line computer program is a verification tool for those who can easily build mental images of objects.

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