



THE USE OF COGNITIVE GRAPHICS IN MONITORING OF STUDENT'S PROGRESS

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Abstract

The cognitive graphics was successfully used for presentation of status of technological and industrial process. However it was not used in some other fields, although it has obvious advantage comparing to other forms of presentation of process status. Main idea behind of presentation different data using cognitive graphics is, that using easy understandable cognitive images it is possible to present the status of system in simple way, so that user can easily and fast find out what is the momentarily status of the system and how it will develop. Starting from industrial application we have developed a efficient system for monitoring the progress of students in the educational process. We used the Scalable Vector Graphics to generate cognitive images presenting the student's success in acquiring knowledge and skills. The application can run on personal computers or on mobile devices. It can significantly improve the learning process especially in distance education.

INTRODUCTION

Usually the progress of students in the process of education is presented with the marks in the form of numbers, which can be in different scales. For example in Slovenia we use the scale from 1 to 5 in undergraduate studies and the scale from 1 to 10 in the university and postgraduate studies. This number based system is not very informative, useful and attractive. However in the field of monitoring technological and industrial processes there are several new approaches, which are based on computer technology and graphical presentation of data. One of prospective way of presentation of state of the system is cognitive graphics. In this work we present our efforts to use the same approach in the monitoring of student progress in the educational process.

THE COGNITIVE GRAPHICS

Cognitive graphic image is a model interpretation of the state of some object, situation, and phenomena. Graphic image is constructed using special graphic tools. Object can be any entity for which the model can be synthesized. Cognitive model of the image is based on three elements, what can be presented in the form: $M = \langle P, R, I \rangle$, where: P is a set of concepts in the domain M. R is a given set of relations in M, which are using for

construction of the figures (images), and I is the set of the interpretation of figures (images). The set M is in the image presented by the linked set of graphics elements. R and I present rules.

A linguistic means of describing graphic images have to be:

- Graphemes (graphics primitives)
- Rules of construction, joints, overlays, position and other operations, the synthesis of graphic (geometric) shapes of the image;
- Rules of cognitive (cognitive) interpretation of graphic (geometric) shapes, images.
In this approach the graphic (geometric) figure - is any nonempty set of points. Such a definition has several advantages:
- It does not restrict the class of shapes (points, lines, graphs, charts, surfaces, bodies, etc.).
- Under this definition it is possible to operate with objects (shapes) of any dimension and in the spaces with any number of dimensions;
- To describe the relationship between the points forming the shape can be used in a variety of formal (mathematical and "not quite") and informal apparatus.

For example: algebra, calculus, graph theory, logic, semiotics, etc. These apparatus provide the appropriate methods, tools and technologies.

Such an understanding of graphical tools brings them closer to the semiotic system and the formal language with its own alphabet (dictionary of graphemes) and syntax.

Well-known specialist in artificial intelligence, D.A. Pospelov (1992, 1996), formulated three main tasks of cognitive computer graphics (CGC) in decision support systems based on the figurative representation.

The first task is to create models of knowledge representation, which represent the objects specific to logical thinking, and images-paintings, handling creative thinking.

The second task is to visualize the human knowledge, which cannot be described by the text.

Third - finding ways to transition from the observed images-paintings to the formulation of some hypotheses about the mechanisms and processes that are hidden behind the dynamics of the observed patterns.

In terms of information technology supporting decision-making to these three tasks CGC should be added the fourth. It should ensure the creation of conditions for the development of the operator's intuition and creativity by constructing a graphical user interface based on the methods of cognitive graphics. The development of computer information systems supporting decision-making is usually based on the first two tasks of cognitive graphics. Usually user interface present the data in a familiar character-digital form. The large set of such data presented to the operator, could not be used for decision making. A clear understanding of the third and fourth tasks of cognitive graphics allows formulating additional requirements as to the actual graphics, as well as to the appropriate software and methodological support.

Among them are:

- The adequacy of the studied objects or processes used engineering methods and techniques of teaching;
- Natural and accessibility for the perception of users;
- Convenience for the analysis of qualitative regularities of distribution parameters;
- Aesthetic appeal, the speed of image formation.

Using the above described principles we have developed the software package, which presents the results of students achievements in the form of cognitive images.

RESULTS

The software package for monitoring the student's progress in educational process was developed as follows:

- It is web application, which can be used on mobile devices (smart phones, tablets) too.
- It was developed using server scripting language PHP and mySql database.
- For generation of cognitive images the Scaling Vector Graphics markup language was used, which can be implemented in the HTML5 markup language, so the cognitive images can be presented on mobile devices too.

The software package can import data from databases, or input data can be keyed in the forms on website. User can choice between different shape of cognitive images and colors, which will be used for description of data. For example red color means that something is going wrong, orange that student have to do more and that is close to dangerous area, and finally green color means that student is doing well.

Below are some examples of cognitive images presented at different devices. For example let students have done 80% of homework, solved the 30% of tests, and his activity in course is estimated as 60 % then the cognitive image using ellipse for presentation will be as on Fig. 1.

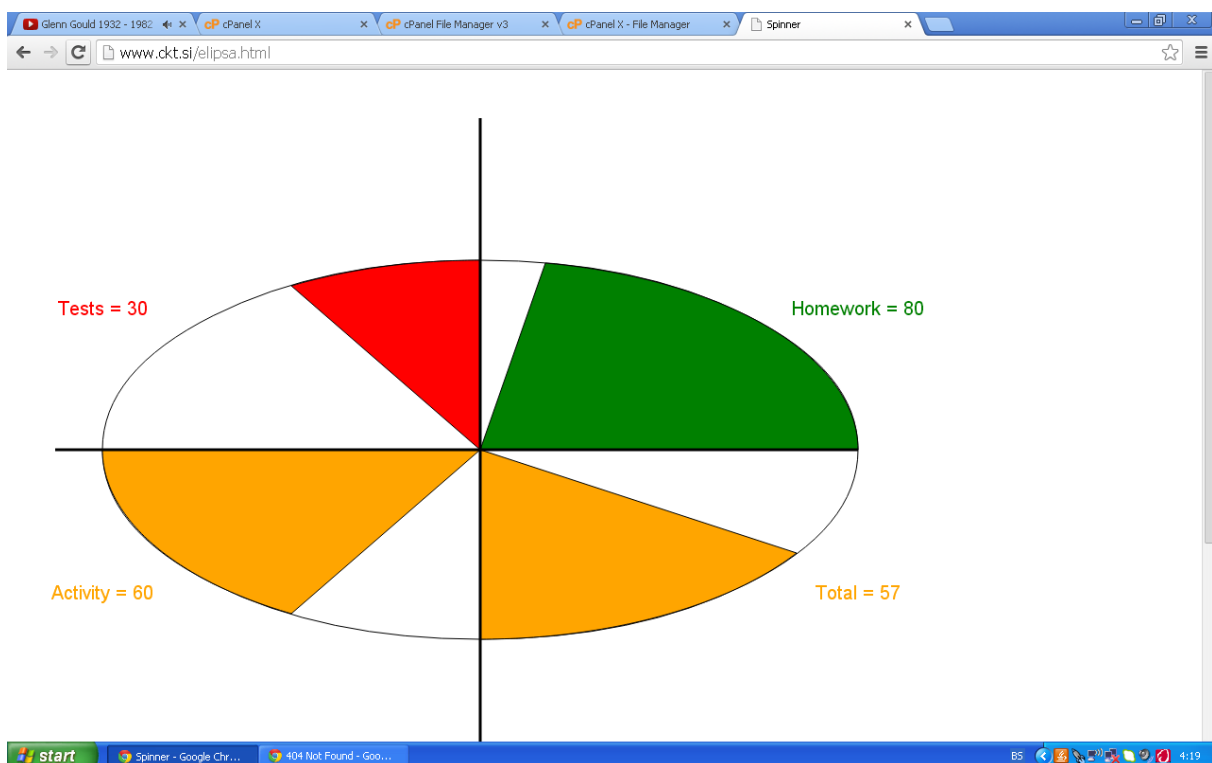


Fig 1: Presentation of state of student with cognitive image on display of PC

The same results could be presented on smart phones too. On figure the data are displayed on iPhone and Samsung Galaxy smart phones. It is still of high quality and easy to read. It is important to have possibility to present the data on mobile device because there are more and more (especially young) people using this devices.

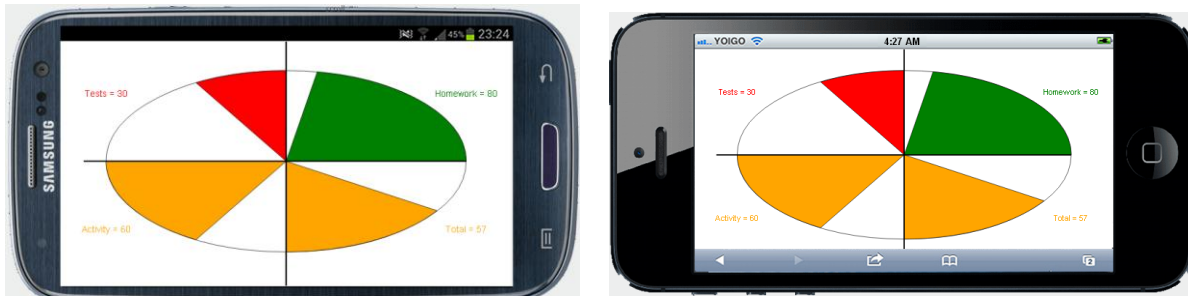


Fig. 2: The cognitive image displayed on different smart phones

We have tested the cognitive presentation of monitoring data on several mobile devices (smart phones, tablets). Because it was generated using SVG the quality of image did not change.

CONCLUSION

The cognitive graphics is strong tool for presentation of data representing the progress of students in educational process. The cognitive images can easily be interpreted and give full information about student's status. It is useful or students and teachers.

Using of SVG for image generation has several advantages. It generated the vector graphics and can be easily used on mobile devices.

The further research has to be done in development of model of learning process. Combination of model and cognitive graphics could significantly improve the educational process.

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