Specialized Language for Creating Training Video Files

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Abstract. This paper deals with the development of graphic linguistics. Computer Graphics is a versatile logical analysis tool with a graphical representation of the subject area. It is suggested to develop graphic thinking that helps to present, formulate and understand logical statements. To implement the language, a software interpreter was created that allows to quickly generate video files using a basic set of parallel statements: COLOR (), LINE (), ELLIPSE (), RECTANGLE (), TEXT (), PICTURE (), BITBLT (), ROTATE (), SHIFT (), WAIT (), IF () GOTO (), SOUND(). Each operator has variable parameters that detail the animation, such as the start and end coordinates, the start and end transparency, the color distribution, the resizing, and the number of frames in each animation. Parallel animations are bracketed {...}. With SOUND () soundtrack can be corrected . The GUI helps to model and adjust the animation program. It is suggested to develop training animations using standard routines that demonstrate the concepts of systems theory: "feedback", "action", "sensor", "situation", "tool", "resource", "property", "environment", "goal", "process", "obstacle", and "stimulant".

Keywords: Graphic Linguistics, Graphic Thinking, Animation Language.

1 Introduction

The phenomenon of linguistics is that any process or system can be described by ordinary sentences. The formulation of thought through language has raised thinking not only to the abstract but also to the collective level. But language can be not only oral or written - it can also be graphic. For modern science, it is important not only to formulate a thought correctly, but also to effectively and quickly explain it and convey it to "consumers" in a versatile, reproducible form in which it would not lose its authorship and not be distorted. The systematization and ordering of linguistic constructions makes it possible to convey logical content more precisely through sentences and to better understand the interlocutor. An unambiguous understanding of the content is important for artificial computer languages. People need new linguistic tools to help them explain to a computer more accurately what its tasks are, with the precision of nuances that require an understanding of the work being done.

The development of linguistic science is also important for many scientific fields, ranging from genetic engineering (DNA can be regarded as a coded system with

which certain meaningful operations at the level of character substitution rules can be performed) to the design of abstract systems using logical statements. Formation of the world picture in the form of signs is not yet complete, because in nature there are many phenomena that are only understood on an intuitive level and are waiting for clarification [1].

If you begin to describe any incomprehensible entity with words that denote elements of that entity, the relationships between them, their properties, their composition, etc., then the essence becomes simple and clear. Moreover, if you compare this description with the description of another well-known system, then you can interpret all the features of the known system for the unknown, and thus to understand the unknown nature [2].

For computer science, linguistic studies are also important in that they try to represent in a symbolic form such spheres of life that are still unclear to the computer. The term "computer" should be understood as a complex technical system that allows you to draw formal conclusions based on the rules of interpretation in a given information environment. An important area of linguistics that can already be programmed on a computer but not yet systematized or formalized is graphical linguistics [3].

2 Specialized Video Language and Logic

For quality education, it is necessary to use tools for clear formulation of thoughts and their presentation in schematic and graphical form. Video files are the most convenient and easy to learn. They provide maximum visibility for the presentation of the material, are easily distributed, and can be played on any device that has a screen. Video files contain more information than regular text, and, at the same time, allow focusing on the main topic and avoiding unnecessary information. You can make the assumption that educational information is better presented in hypertext (HTML), that is, to use in the text drawings, sound, video, algorithmic models, 3D models, links to other pages, comments - all that modern hypertext technology allows. The language HTML [4] can combine for this purpose, different types of files into one document. But such amalgamation is not enough for the systematic and logical analysis that is required in training.

Society is trying to approximate as much as possible the external ways of presenting knowledge and rules to the internal perceptions with which the brain directly operates and applies its internal logic of analysis. Learning becomes easier and more effective when you use the internal notion that the brain uses in analysis. For this it is necessary to find the notion system, which is inherent to the human nature from childhood.

The internal notion system creates a specialized language. There have been attempts to create universal languages for solving problems. For example, the system analysis language UML [5] represents the system quite well, but it is not convenient and versatile for understanding and explaining the operation of a complex system. The inconvenience of UML is that this language does not rely on an intrinsic sign

system that is intuitive. This language is not flexible enough to describe abstract concepts at all.

Human thinking is based on associations, that is, on the principle of transferring the characteristics of one phenomenon to another, and therefore a universal sign system should be built on associations. Searching for information by a person is also associative, that is, the search process is not looking for data, but it searches the assumptions that should be applied to found data to solve the problem. That is why the specialized language for making educational videos should be based on the associative principles.

In other words, it is easier to explain how the system works by means associations. Why is it necessary to choose a movie technology for specialized language development? Because the invention of video technology to transmit diverse and multichannel information has been proved to be very successful. These technologies continue to evolve further to enhance the presence effect. Video technology is different from other ways of transmitting information that it completely captures the mind of the user. When the movie is over, the viewer remembers it as a lived-in reality.

Therefore, film-based learning is remembered better and brighter. In this regard, there is need for software products that allow quickly, simply and as more realistically present any logical conception or educational material in the form of a video.

The question remains: how in the best way to create a video - using a dialog interface or using a specialized video language? The logic of solving the current task by means of software defines any dialog interface that can be proposed for that software. That is, the interface is only a graphical representation of the logic of communication with the software. Thus, always the main point is logic for solving task and language representing it, in particular - the logic of analogies through animations.

This specialized language is intended to graphically interpret the complex logical concepts and their relationships that the instructional video tells. This allows us to raise our understanding to a higher level, since clearly understood graphical representations are involved in this learning process.

We can say that logic uses graphical analogies that the brain uses in presenting situations and analyzing them, for example: part of an object, an important feature of an object, a connection of objects, a sequence of elements or actions, synchronous operation, conditional distance, dynamic structure, effects on the system, accumulation of something, lack of something. The language offered consists of functions and variables for generating clearly understood animated images that can be used as an analogy in explaining complex concepts. Of course, all images have text and audio cues. The result of a program in this language is a regular video file. Similar video creation programs do not have such sets of animations that can be clearly understood and logically interpreted. Rather, they aim to surprise the viewer. In addition, no software product offered the animation language to the user but relied on a dialog interface, sometimes very complex and confusing [6], although the presence of the language does not deny such an interface.

Now, a few words about the technology of developing instructional videos. The suggested language is used to write the educational film script. Before creating the script, you need to apply a systematic analysis of the problems that the film will dis-

cuss. The methodology of system analysis has been refined and modified [7]. In fact, the film will present the results of the system analysis performed on the problem.

This technology allows to:

- avoid disputes in the presentation of educational material;
- select the optimal sequence of information;
- choose the most appropriate graphic analogies for the presentation of material.

Thus, the logic of representing any entity in a dynamic form helps to draw conclusions about that entity. That is, an entity analysis can also be represented by graphical notion.

We believe that in the near future, research into improving video formats will be intensively developed. The standard video file may include additional data, which will include text, tables, algorithms, 3D models, mathematical formulas, logical statements, compressed contents of previous frames, links to Internet resources, links to other video fragments, tags, comments, support for the blind, and other important information. The new video data format will entail new ideas for intelligent processing and editing.

3 Problem Analysis

The idea of using graphic symbols in linguistics has emerged a long time ago [8]. With the development of computer technology, the idea of graphic linguistics has evolved in the form of infographics and presentation theory [2]. Such graphic linguistics enhances or clarifies the content of natural language sentences by graphic means. Linguistics is a tool for solving complex problems [9]. It helps to systematize the problem, to highlight the main thing in it, to list and analyze possible ways to solve it. In order to make this possible, it is necessary to distinguish in the formulation of a problem the features that can be interpreted by commonly known names. The notion of "generally known" implies that there are other examples in which these features are already indicated by such words.

For mutual understanding between computer and human, linguistic constructions can be built on the principles of systems theory, which can represent just everything. Systems theory is based on such basic concepts as "control", "action", "actuator", "sensor", "feedback", "situation", "resource", "function", "tool", "property", "environment", "purpose", "process", "obstacle", "stimulant", and minor, which can generally be called "parameters" or "refinements" of the specified concepts in the form of numbers. In order to understand your computer's linguistic constructions, you need to break them down into interacting parts and find out what they are. This way of using the conceptual basis of systems theory for linguistic constructions makes it possible to describe and understand anything more precisely.

When describing medical systems, for example, to describe the disease, you have also to use such concepts as etiology, pathogenesis, symptom, active substance, side effect, etc. Other abstractions, such as profit, efficiency, ownership, defendant, heir, etc., must be introduced to describe economic and legal systems. The interpretation of graphical notation in these systems will be somewhat different.

For the development of graphic linguistics, which should theoretically take precedence over language in terms of clarity, it is necessary to develop the unambiguous and understandable presentation of such interactions as cause-effect, part-whole, feature-property and others [10]. Recently, separate directions have been formed in the main stream of graphic linguistics [11]: Infographics and its subdivisions Mind Maps, Concept Maps, and theory of presentations. Therefore, to develop the ideas of graphic linguistics, experiments with specific software are needed to design graphic animations and notations.

4 The Principle of Creating a Graphical Scenario

Each animation can be created by changing the coordinates, sizes, transparency, color, as well as the sequence of coloring of standard figures and lines. Appropriate animated text should be added in parallel. Thus, for each type of animation, a specific understanding arises depending on the context in which the animation takes place. In this way it is possible to explain rather complicated things, which words could not describe so vividly.

The animation script of explanation-type is a logically linked sequence of assumptions, statements and conclusions presented in symbolic form [12]. Any chain of inference has a purpose. At each step, among many alternative assumptions those should be chosen that lead to the goal. The same is true in the graphical scenario. In order to choose the right associations each animation should be accompanied by a sound explanation.

Let's illustrate this with an example. Medical students study groups of drugs that produce both therapeutic and side effects. It is necessary to build logical links between therapeutic and side effects, and on this basis to determine the treatment strategy for each individual patient in which the benefits of treatment will outweigh the potential risks. Here is an example of a chain of logical inference that aims to choose the most adequate drug. To understand what is happening to the patient, it is necessary to make a prediction of his condition to the assumption that he will not be treated at all. In order to determine the prognosis of this condition, it is necessary to know how the disease develops, if left untreated, and what complications may result from it. In order to do this, one has to know the peculiarities of the etiology and pathogenesis of the disease in an average organism. In order to determine the characteristics of the body of a particular patient, it is necessary to compare the theoretically possible state of the average patient with that of the particular patient and to identify the most probable directions of the disease progression. After this, it is necessary to make assumptions about the causes of accelerated development of the disease in certain directions. Once assumptions are made about the characteristics of a particular patient's body, they must be tested or refuted by a number of specific laboratory tests. Having concluded the critical condition of a particular organ or tissue, or group of cells, or the relationship between cells, or a chemical that is involved in the etiology and pathogenesis of the disease, the physician chooses the drug that will provide specific mechanisms to combat the disease, affects certain links of etiology, pathogenesis of the

disease, relieves its symptoms. Each drug has side effects that should not harm the body more than the disease. After adequate selection of the drug for the treatment of the patient, it is necessary to determine the dose, dosage form and route of administration, which ensure delivery of the active substance to the site of pathological process and achievement of therapeutic concentration there. In order to teach students how to prescribe drugs correctly, it is necessary to transfer knowledge to them in the form of rules for analyzing patient data, rules for predicting the development of the disease, as well as knowledge about the mechanisms of action of basic drug substances that are included into the medication.

Based on knowledge of drugs mechanisms of action, it is necessary to explain how to determine the therapeutic and adverse effects for each group of chemicals. Among the side effects, students should learn how to identify those that are a direct consequence of a specific mechanism of action, and therefore an inherent part of their pharmacological activity. Understanding this will help to identify measures to prevent the development of serious complications of pharmacotherapy. If there are some uncertainties in the treatment strategy or in the dosage of the drug, it is necessary to learn what laboratory tests are needed to eliminate these uncertainties. Knowledge can be transmitted both in terms of linguistic and graphic statements. The graphical representation of affirmations is more informative than the information that is presented in words. In order to formulate all the nuances of a side-effect, it will take a large amount of texts that cannot be memorized by the average student. If the same text is presented as a diagram with animated elements, then the same student will remember it as a system of concepts that interact and influence each other. According to Freud's theory of perception, such information will be remembered even better if it is associated with certain emotions.

Animations of question-type use a question mark and possible alternatives to answer the question. They raise the interest of the observer, and each item is accompanied by animation: How does a living cell choose the one that is needed at the moment from the set of chemical reactions? How does life organization work? By means of symbolic encoding, living organisms conserve and repeatedly reproduce the synthesis sequences of more complex chemicals that have resulted in a positive effect. The essence for which the positive effect was intended is responsible for preservation and restoration this information. If it does not save this information, the purposeful and organized process of life will turn into chaos. Chaos will also arise if the system ceases to distinguish the positive effect from the negative, and thus loses the purpose of preserving positive information.

In the linguistic description of any field, sooner or later, numbers will have to be used. Understanding the number is very important, especially for prescribing dosages. To explain the dosage, it is necessary to make an animation that compares something, and symbolically shows what happens if too low or too high doses are used. It is possible to convert a static image to a dynamic image by means of cyclic redrawing, in which the coordinates of the lines are changed, as well as the colors and transparency of the drawn elements.

Any language is a means of formulating statements. The statements of this language describe the animations of lines, drawings and inscriptions. Using it creation of train-

ing videos and presentations is possible. To create an effective training video, it is necessary first to define the problem, structure it, then identify the influential factors to solve it, identify the actions, the sequence of their application, describe possible and probable errors, and describe how to correct them.

5 Substantiation of Logic of Graphic Animations

The first step of the educational video is to clarify the problem. In order to explain the problem, it is necessary to describe some essence and its relations, and then it is necessary to formulate with the help of the video the purpose of training. Entities can be marked with rectangles, ellipses, or drawings. Animation requires special operators: "RECTANGLE", "ELLIPSE", and "PICTURE". There is a "TEXT" statement to output the captions. Entity links can be marked with arrows. We will use the "LINE" operator to output the arrows and lines. The animation method of each component also provides some information about the entity that the selected component expresses. One of the frames of the training video is represented on the Fig.1. The lines of different types demonstrate different logical links between elements.

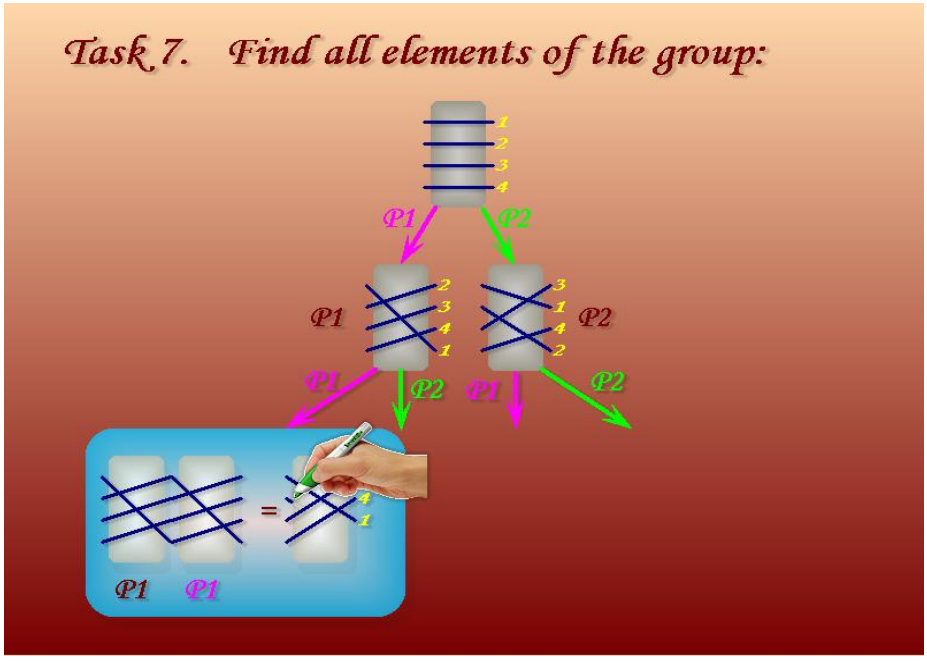

Fig. 1. Video frame from training video on discrete mathematics.

For example, an unpainted ellipse can be used to indicate important elements that need to be addressed, and colored elements are internal components of the system that are not subject to detail. Non-colored rectangle - fragments of the picture that will be further detailed, colored rectangles - parts of the system that is currently detailed. The

smooth enlargement of the rectangle is used to detail a system. The rectangle reduction animation is used to represent a complex subsystem by one element. This allows the viewer to focus on the external subsystem connections that he expects to see after such animation. Animation that reduces the transparency of the rectangle means that this rectangle will provide some clarification to the just drawn fragment. Upon clarification, the explanatory rectangle disappears smoothly and the main scenario continues. In this case, animation is used which increases the transparency of the rectangle. The shadow effect of the rectangle gives the impression that the rectangles are in different planes. The animations of the ellipse are completely similar to the animations of rectangles [12]. You can resize ellipses, move around the screen, paint or paint only the outline, change colors and transparency seamlessly. The ellipses are logically different from the rectangle in that they are taken to denote the vertices of the graphs and in the graphs the connections are important and the elements are not detailed. The links may be ordered and not ordered, that is, they may have an arrow at the end and be visually different in thickness, color and transparency [12]. This may correspond to the type of connections, their importance, and stability. You can use animation to show how one bond influences another one, as well as the interaction between the components. Line without arrow means communication, line with arrow - means action, lines appearing smoothly - mean structuring, line changing color - loss of communication, line - losing transparency - strengthening of communication, line along which colors move - transmission over a channel, a line that changes length - an obstacle to action, a line along which colors do not move but tremble - indicates a delay in transmission. The speed of the animation has to match the speed of the reader's perception of the text. Text can be displayed along the lines as well as inside the components. The text can be written in different angles as well as in different fonts, different sizes, colors and transparency. During the animation of the transformations you should keep the text captions. This gives the idea that one entity is transformed into another. Text animation allows represent the caption in an entertaining way for better memorization. Any parameter is more convenient to represent by a variable. You can change the parameter using arithmetic operations. It is more convenient to repeat animation fragments using loops.

5.1 The Example of Program for Drawing Element on Video Frame

RECT_X=RC_X1+20, RECT_Y=RC_Y1+25, STEP_Y=20
XEL1=RECT_X+50, XEL2= XEL1+8, YEL1= RECT_Y+120, YEL2= YEL1+8
COLOR=DARK_BLUE, Y=RECT_Y+STEP_Y, X1=RECT_X-5, X2=X1+60
RECT_X2= X2-5, RECT_Y2= RECT_Y+100

RECTANGLE (left=RECT_X, top=RECT_Y, right=RECT_X2, bottom=RECT_Y2
transparent=50, begin_transparent=150, begin_left=RECT_X, begin_top=RECT_Y
begin_right=RECT_X2, begin_bottom=RECT_Y2, R=15, begin_R=5
color_center=16777215, color_edge=GRAY, begin_color_center=LIGHTGREEN
begin_color_edge=WHITEBLUE, cursor=1, frames=15, shape_only=0
pen_color=COLOR, pen_width=1, shadow=1, animation=1)

t1=2, t2=3, t3=4, t4=1 ; The element: (2,3,4,1)

X_EQ=RECT_X+130, Y_EQ=RECT_Y+30, XP=RECT_X+5, YP= RECT_Y+105
*K1= STEP_Y*t1, K2= STEP_Y*t2, K3= STEP_Y*t3, K4= STEP_Y*t4*
Y1= K1+Y, Y2= K2+Y, Y3= K3+Y, Y4= K4+Y, TEXT_COLOR=YELLOW
Y1= Y1-STEP_Y, Y2= Y2-STEP_Y, Y3= Y3-STEP_Y, Y4= Y4-STEP_Y

LINE(from_X=X1, from_Y=Y1, to_X=X2, to_Y=Y, color_begin=COLOR
color_end=COLOR, cursor=1, transparent=1
frames=10, arrow=0, shadow=3,width=3)

Y_TEXT=Y-10, Y=Y+20

LINE(from_Y=Y2, to_Y=Y) Y_TEXT=Y-10, Y=Y+20
LINE(from_Y=Y3, to_Y=Y) Y_TEXT=Y-10, Y=Y+20
LINE(from_Y=Y4, to_Y=Y) Y_TEXT=Y-10

TEXT("P1", X=XP, Y=YP, width=11, height=36, angle=0, transparent=0
color=120, begin_color=6461421, begin_X=123, begin_Y=100, begin_width=16
begin_height=10, begin_angle=0, begin_transparent=240, colorize=0, cursor=1
font=13, italic=1, bold=10, underline=0, animation=4, frames=5, shadow=2)
WAIT(5)

6 Conclusion

So far, there are many abstract concepts that are difficult to give to animation and graphic representation, for example: "medicines are applied taking into account the peculiarities of the organism", "goal realization". Such phrases remain in text form above the animated arrows. Nevertheless, graphical linguistics gives a better presentation of information, increases the understanding of complex information, helps to differentiate important and secondary information, improves remembering of important information and increases the emotional background of perception. Marking animations by words in a specialized programming language is justified because it simplifies and standardizes animations in the form of plain text. This approach also makes it possible to use special graphical shells to design animations and save them in the form of specialized algorithmic language.

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