Case Studies of the Use of MS Office as Non-Traditional Software for Modeling, Computer Animation and Simulation

P. Hanzalova and S. Hubalovsky

Abstract**—**The paper highlights the non-traditional use of MS Office – concretely MS PowerPoint. The paper describes two specific examples of how to create animations and simulations using the graphical interface of MS office software. The Visual Basic for Application implemented to MS Office applications has great importance for creation of interactive learning materials. Based on macro programming in Visual Basic for application can be obtained functional simulation. The main aim is to point out that, even in such a simple and commercially available applications useful learning materials (e.g. for presentation or instruction).

Keywords**—** Animation, modeling, simulation, MS Office.

I. Introduction

Computer modeling is nowadays very important. We meet with computer modeling not only in science and technology, but also in the humanities. Animations and simulations have great advantages in comparison with written text. Animations and simulations are much more instructive, exemplary and often clearer. Information reached from animations and simulations can be sometimes easier for reading. Unlike experiments or other living performing, can be repeated several times or slowdown, which in some cases may be essential element of the presentation. Specifically, the simulation allows changing of input data, which is great advantage.

There are many programs for creating animations, but these are often commercial and user need to learn to deal with them. Our goal is determination, if for the same purpose - creating simple animations and simulations - can be also use the commonly used software. For our purposes, we chose a set of MS Office applications, specifically application designed for creating of presentations - MS Power Point. This application can be found in most organizations (institutions) and households, and most people can control it.

II. Computer modeling

„A model is a representation of an event and/or things that is real (a case study) or contrived (a use-case). It can be a representation of an actual system. It can be something used in lieu of the real thing to better understand a certain aspect about that thing.“ [1].

The goal of modeling is to describe some (mostly real) situation using the input information and data that the modeled situation simplified. The principle of the modeling is simplification, which helps for understanding of the real situation. However, it is important to realize that results of the modeling has to be validate. In everyday life, the different models are commonly encountered - at school we can see model of the solar system, model of atom or molecule. Another type of model is mathematical formula (simplified description of reality) or a graph. Commercially available model is also an example of map (plain view in the plane) or a timetable [2].

Models can be represented by physical object (Globe), by narrative structures (verbal description), by mathematical equation, by graphical representation or by computer program [3].

A. Animation

We are interested in two types of models. The first of these are animations graphically illustrating given phenomenon. The history of animation begins in the early of 19th century when it was used in form of piece of paper and string. This type animation is the first method of animation (the principle is based on rapid succession of many static images which, due to human perception of the inertia of the human eye evokes ideally smooth movement).

Computer animation, which appears in the 20th century, already represents a real movement of individual objects [4]. The principle is based on moving of objects. For more complex animations the appropriate software and very expansive software is used. For simple examples, however, we can use other software, which are primarily intended for other purposes.

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B. Simulation

The second way of modeling which we are interested in this paper is simulation. Simulation can be defined as “*a method in which the investigated system is replaced by a dynamic model that presents the modeled system in its activities, or experiments can be performed with the simulation.*” [5].

Simulation is used mainly when it is not possible to achieve the set goal in the real system. This can happen when the real system is too complicated (simulation often real system simplifies and thus can contribute to a better understanding), or if conditions are unfeasible or unavailable (expensive, dangerous), or the dynamics of process is unsuitable for use (too slow to too fast) [5].

There are four types of simulations [6]:

- physical – opportunity to change a system characteristic;
- iterative – possibility to change parameters;
- procedural – monitoring and testing processes (flight simulator);
- situational – role-playing exercises.

It is important to realize the difference between simulation and animation. Simulations enable given model track in real-time, modify some parameters and observe the changes that causes it. Animation has already predetermined parameters that cannot be changed - animations are not intended for discovery, experimentation, but rather to illustrate the phenomenon [3].

Advantages and disadvantages of computer modeling and simulations can be found e.g. in [1]. The list of disadvantages is much shorter than the list of advantages. One of the disadvantages is for example, “… *special training needed for building models.*” This disadvantage we try to partially remove just by using simple programs for creating of simple animations and simulations. It is clear, however, that the complex simulation has to be created in specialized programs.

C. Procedure for Creating the Model

The principle of modeling (specifically physical modeling) as way of reading given task, throw describing the situation, up to test hypothesis (namely the confirmation or rejection of the model) can be found e.g. in [2]. However, when assigning and enter values, we are shifting to the mathematical model. The result is a general solution, which must be discussed and need to be tested in practice (validated).

The process of working with the model may be described by the following scheme [2]:

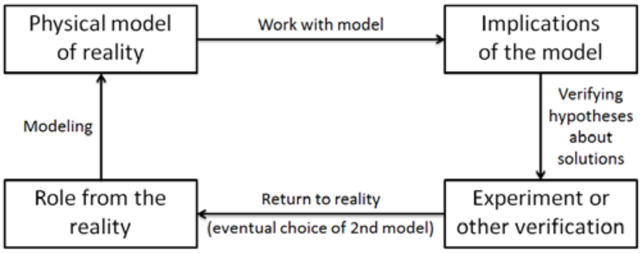

Physical model of reality
Work with model
Implications of the model
Verifying hypotheses about solutions
Experiment or other verification
Return to reality
(eventual choice of 2nd model)
Role from the reality
Modeling

Fig. 1 Process of working with model.

Process of creating oft the model can be described in the following phases [5]:

- Start;
- Inputs to the process of modeling;
- Descriptive phase of the process (implementation of multidisciplinary approach is needed);
- Preliminary phase;
- System identification;
- Mathematization of the model;
- Creation of conceptual model;
- Validation of the conceptual model (it is possible if necessary go back to the start);
- Output: conceptual model.

The process of modeling can be smoothly followed by the simulation process. Validation can be performed just using simulations.

III. The Case Study “Caesar Cipher” – the Use of MS PowerPoint

In this chapter it will be described how to proceed when creating animations and simulations on the topic of encryption - specifically simple substitution cipher. In this type of cipher the initial letter of the alphabet is substitute by other that lies on a certain number of positions on the right. Julius Caesar used this type of cipher during military campaigns and describes it in his book Notes on the Gallic War [7].

This type of ciphers can be easily animated and simulated for the simplicity. Animation helps to understand the principle of encryption and decryption (and how should we do with if we had only paper and pencil). This is an illustrative explanation without so much accompanying text (and so it is understandable to children). But we also emphasize the importance of simulation, which we greatly facilitate the job of both the encryption, decryption and deciphering.

A. Creation of Animation

Example of computer animation is created in presentation program MS PowerPoint (hereafter MS PP), which is sufficient for these purposes. Textually and graphically are described examples for encryption of the Caesar cipher in MS PP. Presentation runs each slides and animation automatically. After starting of the presentation there is no longer need any user interaction.

The following available functions of MS PP are used in creation of the presentation:

- Home –Font (size, color, font, style…);
- Insert – Text Box (+ Format);
- Insert – Shapes (+Format – Shape fill, Shape outline, Bring Forward, Send Backward);
- Insert – Pictures (+Format);
- Animations (Entrance, Emphasis, Exit + its combination entered through Add animation);
- Animations (setting of timing of animations);

- Slide show – Rehearse Timing – automatization of loading images without any intervention by users).

Animation of the presentation should start immediately after launch, so it is advisable to save the presentation as follows:

- File ⇒ Save as ⇒ Save as type: PowerPoint Show.

The examples of animation of Caesar cipher are shown in the Figure 2 and Figure 3.

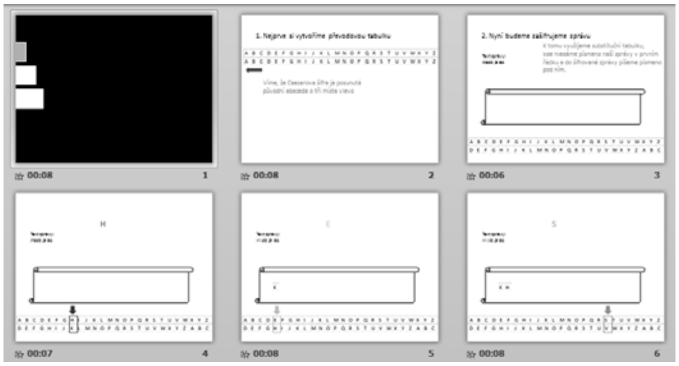

1. Nejprve si vytvoříme převodovou tabulku
2. Nyní budeme zašifrujeme zprávu
00:08
1
00:08
2
00:06
3
00:07
4
00:08
5
00:08
6

Fig. 2 Example of animation of Caesar cipher in MS PP.

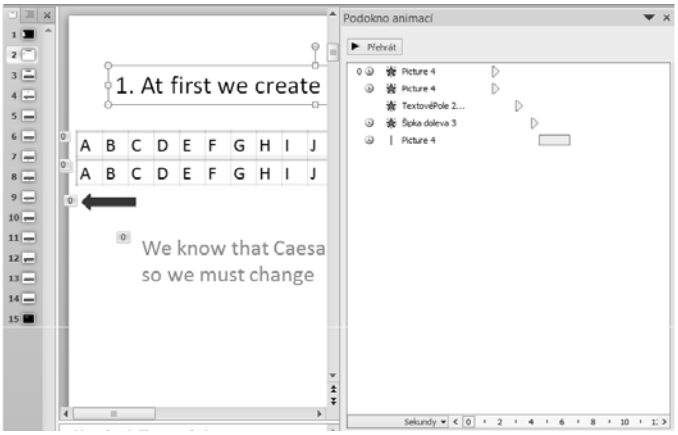
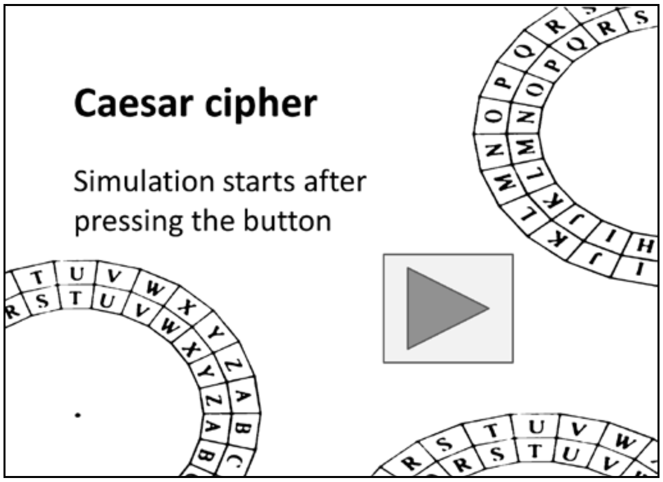


Fig. 3 Example of animation of Caesar cipher in MS PP.

B. Creation of Simulation

Computer simulations can be created in programming language Visual Basic for Application (VBA hereinafter) which is implemented in MS PP. Computer simulation is running computer program that has inputs and outputs.

For our example of the Caesar cipher we need only some basic knowledge of programming and some VBA functions. Of course, the program can be create in much better graphic design (simple start screen of simulation is shown in Figure 4) and other features, but for our purposes it is sufficient the simplest functional variant, which is described below. The goal is not creation of perfect simulation, but pointing out that, even in programs which are intended for other purposes can be create fully functional simulation.



Caesar cipher

Simulation starts after pressing the button

Fig. 4 The Startup Screen of Simulation.

Necessary knowledge of programming in VBA can be found in the following Table 1 and Table 2.

Tab. 1 Instructions in VBA.

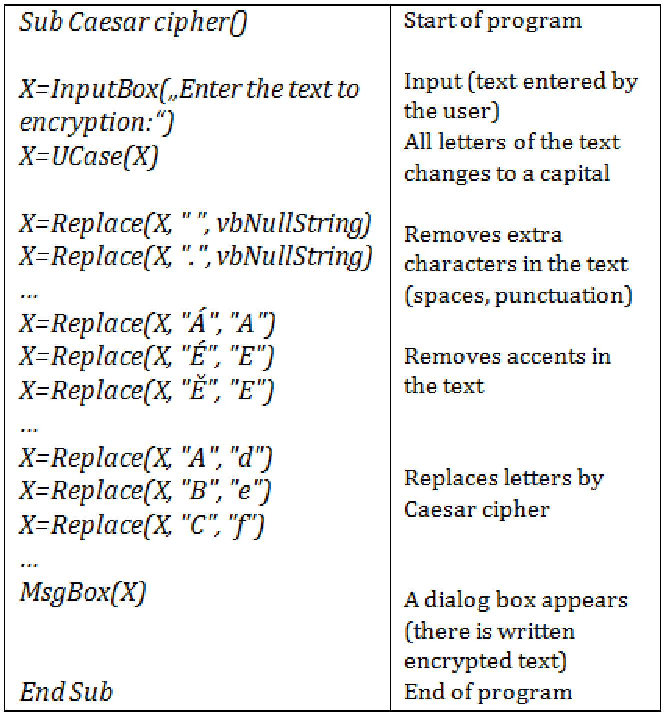
Input:	*C=InputBox(„text“)*	*C* is entered by the user through the dialog box that contains the guiding *text* and the space to enter the value *C*.
Output:	*MsgBox(„text“ & F)*	The output is displayed in the dialog window, where it prints out the *text* and the value of the variable *F*.
Sequence of commands:	*Sub Name()* *Instruction 1* *Instruction 2* *Instruction 3* *End Sub*	There is a macro written in VBA. There is instruction to start (*Sub*), its *Name, Instructions* (in right sequence) and the end of macro (*End Sub*).

Tab. 2 Functions in VBA.

Replace(x, a, b)	Returns a string (some substring *a* in the original string x was replaced by another substring *b*). If we want to remove a substring *a* we have to write *vbNullString* instead of *b*.
UCase(x)	Returns a character string *x*, where all letters are capital.

Source code written in VBA is shown in Table 3.

Tab. 3 Source code in VBA.



Sub Caesar cipher()	Start of program
X=InputBox(„Enter the text to encryption:“)	Input (text entered by the user)
X=UCase(X)	All letters of the text changes to a capital
X=Replace(X, " ", vbNullString) *X=Replace(X, ".", vbNullString)* ...	Removes extra characters in the text (spaces, punctuation)
X=Replace(X, "Á", "A") *X=Replace(X, "É", "E")* *X=Replace(X, "Ě", "E")* ...	Removes accents in the text
X=Replace(X, "A", "d") *X=Replace(X, "B", "e")* *X=Replace(X, "C", "f")* ...	Replaces letters by Caesar cipher
MsgBox(X)	A dialog box appears (there is written encrypted text)
End Sub	End of program

The letters of the plaintext (original message written in that language) will be uppercase letter, while the letters of ciphertext (encrypted text, which in its original language no longer makes any sense) will be lowercase letter. It's important for the functionality of the program. The function

```
X = Replace (X, "A", "D")
```

replaces “A” by “D”.

The function three lines under

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X = Replace (X, "D", "G")
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would replace all letters “D”, including already exchanged by “G”.

After program starts (can be realized either by inserted button, or directly from the VBA), the dialog box with input box for text input is opened. After confirmation, the program encrypts text using Caesar cipher. Finally dialog box with encrypted message is opened.

Example of complex computer simulations for deciphering of the encryption based on bigrams analysis of the cipher text can be found in [8]. Example of complex computer simulations for deciphering of the encryption based on trigrams analysis of the cipher text can be found in [9].

IV. Conclusion

Similarly, the MS Excel application can be used for creation of animation charts as well as simulations. MS Excel offer VBA, calculation directly in cells and visualization of the results via charts. Detailed information can be found e.g. in [3, 8, 9].

Other software suitable for creation for simulations and animations is mathematical software GoeGebra (www.geogebra.org). GeoGebra enables create animation and simulation applets not only in mathematics, but also in physics and technical science.

Many animations and simulations can be found directly on the Internet. But those animations and simulations not always correspond to our requirements. Some are very simple graphically or in low resolution, some emphasize the things that we wanted to demonstrate, some have bad timing or the wrong font size.

Animations and simulations can be used in teaching in any type of school. Pupils have the opportunity to observe some phenomena using multiple senses, which is better for remembering. This is demonstrated by Dalov pyramid of learning [10], from which it can be seen that from what students only hear, remember about 30%, but from what they see, remember 50%. But the students remember the most from their own creation. These programs, in which most students can work, are also suitable for learning. The pupils / students can create their own simulation or animation. Creation of animations and simulations can be included to project methods of education, where the emphasis is on the inter-relationships and on the use of modern technology and development of creativity of pupils / students.

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