Reproduction of antique elements with the use of geometry elements and dynamic software

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Abstract

Proportions are found not only in Mathematics, but also in artistic creations. We will show in an example, how we can design various artistic objects with the use of geometry and geometrical dynamic software. Designing of artistic objects requires using of various techniques, also techniques that are lesser used. These techniques help the development of ideation, geometric reasoning and also stable mathematical knowledge. These tasks are designed for demanding students, used when finishing an artistic unit, what is needed for students who should use as many functions as possible and solution should be difficult for imagination and realization. It is possible to solve the task on the interactive whiteboard, with the help of teacher or independently. It is also possible to show the presentation with the solution at the beginning of the lesson as an inspiration, or at the end of the lesson as a control of the solution.

Introduction

The essence of understanding of mathematics is an awareness of its usage in every-day life. Proportions in particular units are routinely used concepts in mathematics. In the contrary to other disciplines where these connections are very obvious, we are not aware of them (it means we barely realize that art and artistic creations contain mathematical elements and geometrical shapes). Composition and perspective belong among the central points of mathematics. These two segments conform to the rules which were defined by mathematicians and which are valid.

Interconnection between geometry and art

As Gero (2004) said, the proportionality was for a long time considered as the measure of beauty. Under the notion of proportionality, we understand the ratio relationship between the whole and its parts, so that this relationship was convincing and from the point of view of the receiver optically and mentally satisfying. The proportionality is related to the relationship of the whole to the environment.

We can find very striking mathematical elements when observing any artistic creation. Mathematics effect is sometimes highly evident, sometimes it is only cause of accident. Geometric proportion in mathematics means metric relation, metric event.

We use the idea from the work Treatise on Geometry (Vopinka, 1989) "Antiquity is bedazzled with divine gift which is the geometrical shine. It is a gift to which it is attached and by which it is influenced the main stream of its thinking and pursuance. We have used this idea as a supporting idea in creating more difficult tasks in geometry with the use of geometry elements. We use antique vases. Students will have to use all their knowledge of this field and system, and they will also have to use them for designing required shape.

Task 1

Design the antique vase (Fig. 1) with the use of geometric elements in some geometric software.

Problem solution

The basic step is to create two golden rectangles, into which we subsequently inscribe parts of vase. For the creation of a golden rectangle, we will use the basic ratio ***1,618***. We will create two rectangles, one up on the other. We select side **a** randomly, in our case we chose ***a = 4cm***, consequently ***b = 6,472*** (Fig. 2).

Fig. 1 An antique vase.

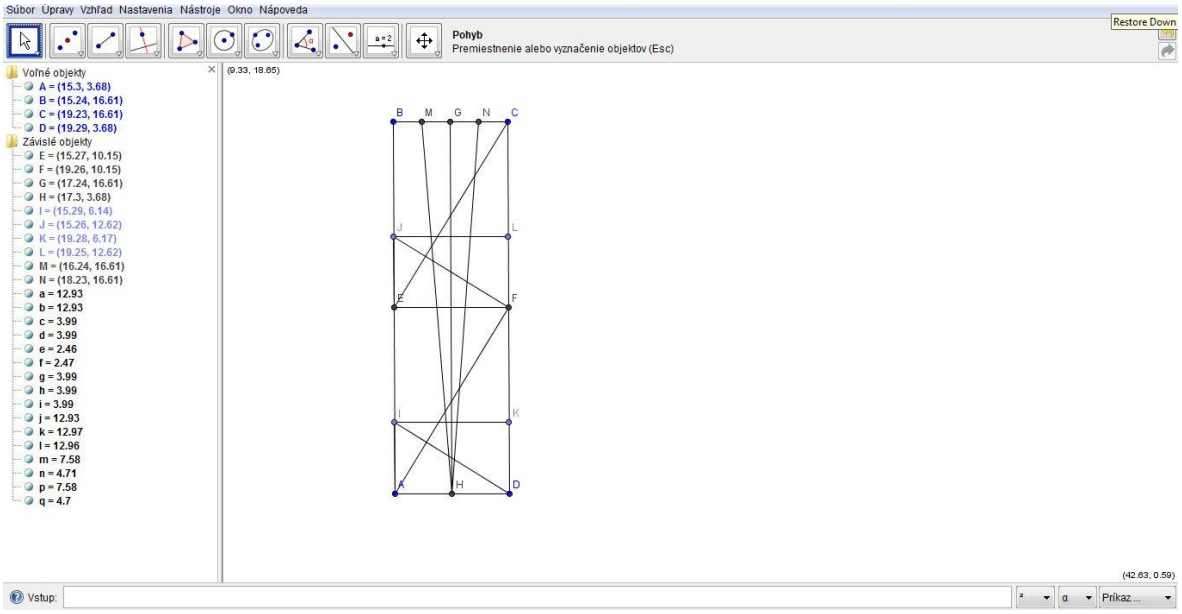

Fig. 2 Two gold rectangles with the complementary lines for the creation of final image.

We create complementary points and complementary circles. We separate side BC into four parts with the use of central symmetry. We lead a complementary line into the point H which is the centre of base AD. Consequently, we connect all marginal points JL, EF, IK, AF, AK, DI, DE, FJ, BF, CE, EL.

We draw a circle with the centre in point O, and, consequently, half-circle A1S1E, where S1 = |ID| is intersection of the line segment |AF|. We do the same specularly for the point D. We use following half-circles for half-circle E1ET, where we obtain point E1 from central symmetry |IE| and point T by intersecting of the circle with the centre in O and line |MH| (Fig. 3).

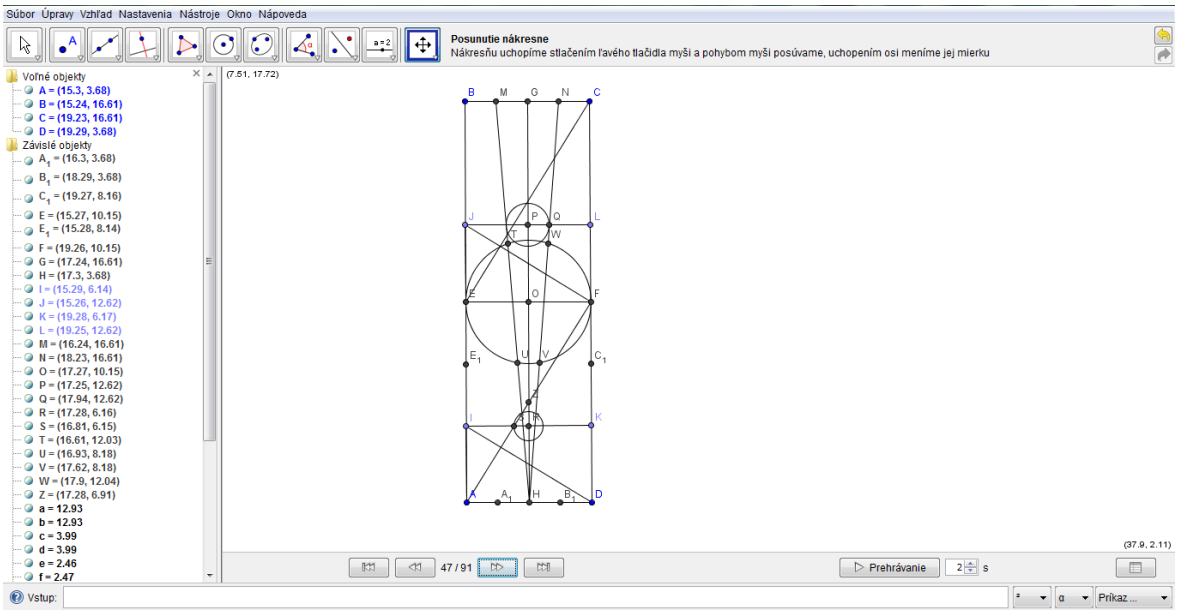

Fig. 3 Complementary lines no.1

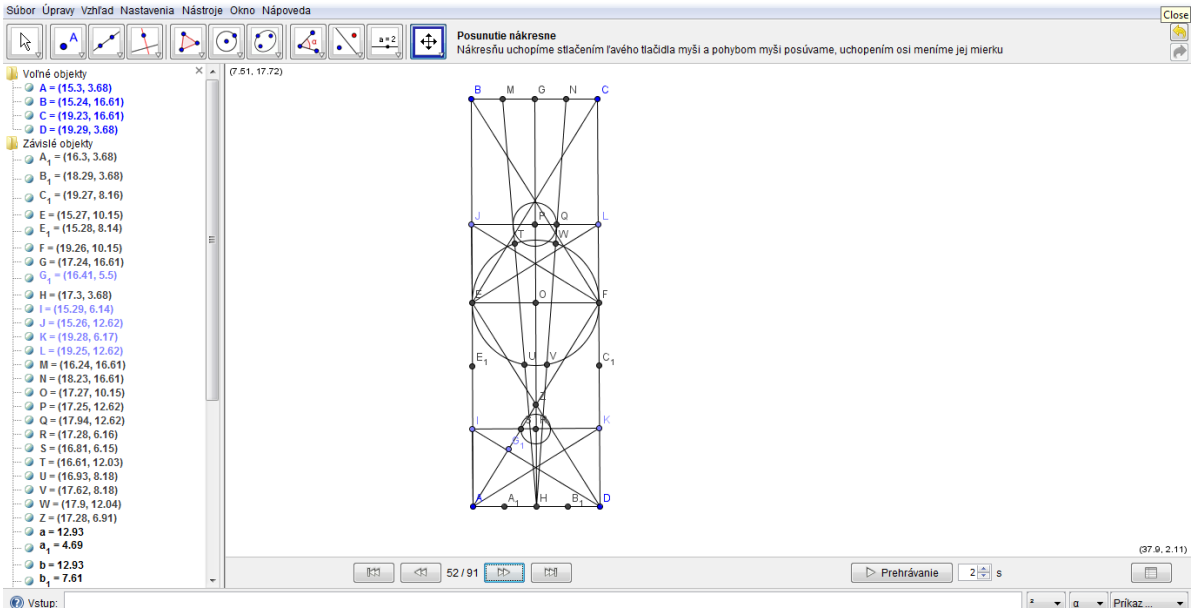

Fig. 4 Complementary lines no. 2

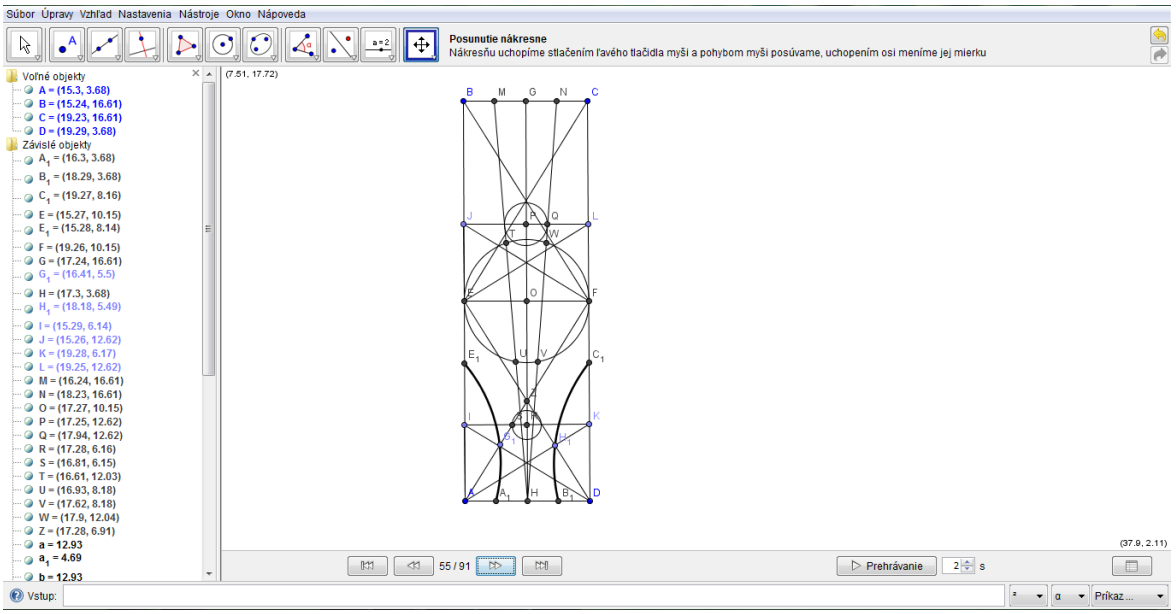

Fig. 5 Complementary lines no. 3

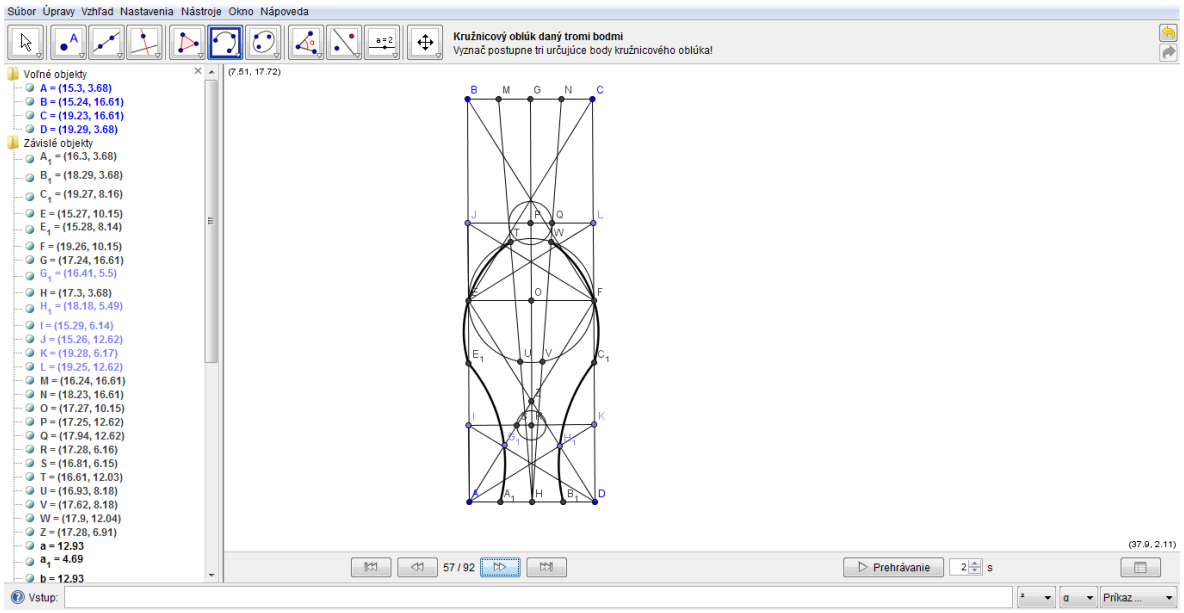

Fig. 6 Complementary lines no. 4

For visually transparent picture, we highlight the outlines and hide the complementary lines (Fig. 7).

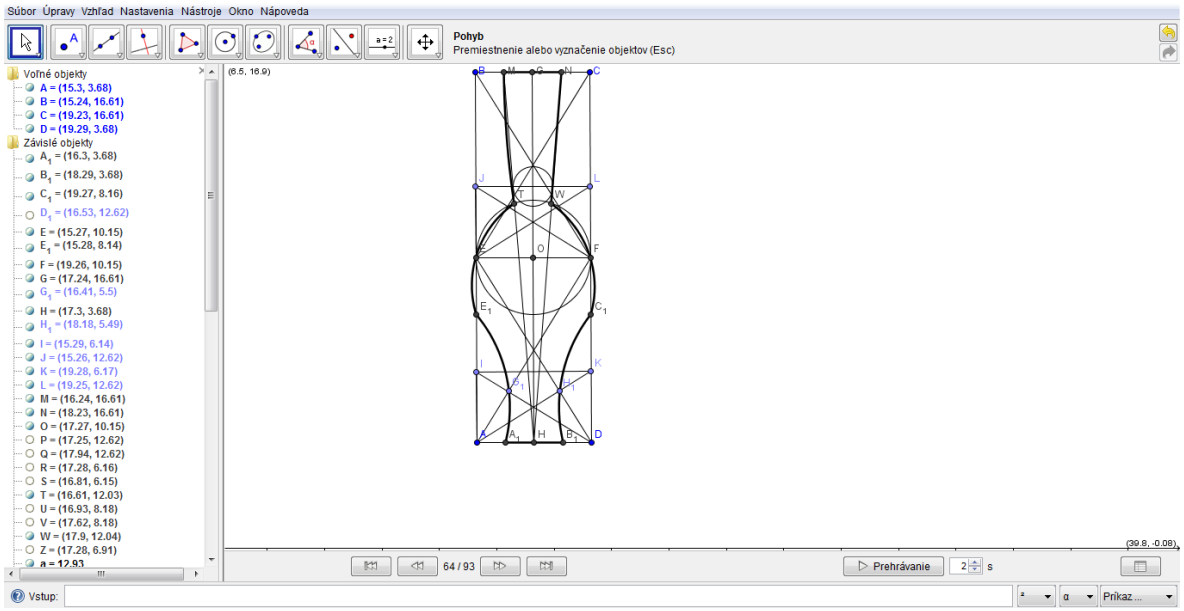

Figure 7: The final version with complementary lines

After completing the drawing of final version of vase, we construct ground socle of the antique vase.

Into the circle with the diameter ***a = 4cm***, which represents side AD, we inscribe the square with the centre of each side. We connect these centres into another square; inscribe two circles which represent ground socle of the antique vase (Fig. 8).

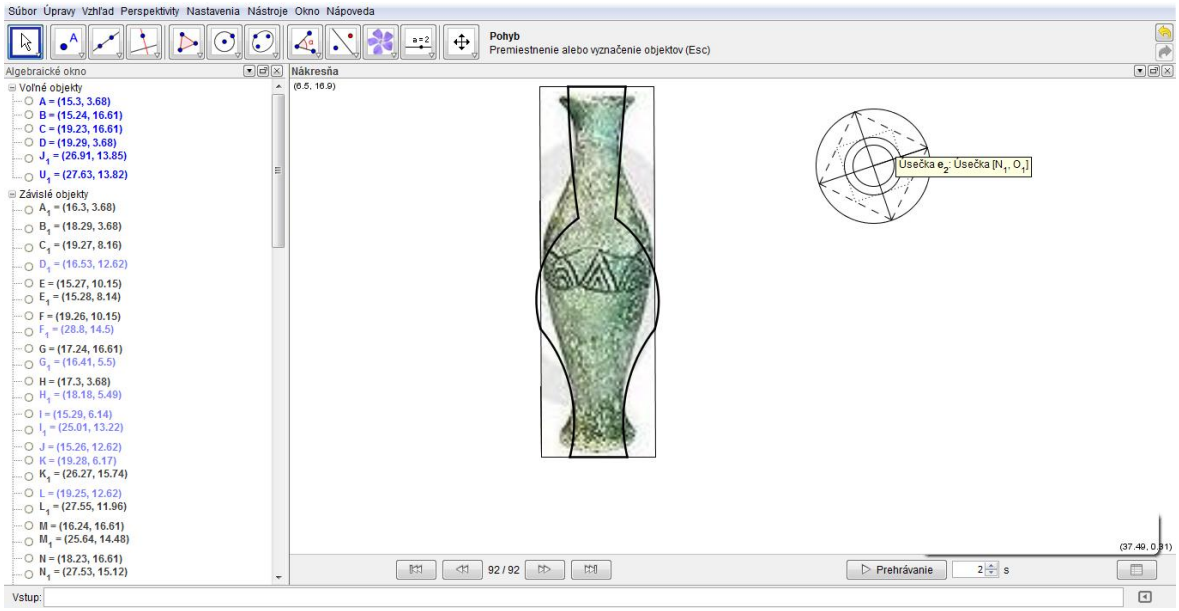

Fig. 8 The final version with a ground socle of the vase.

Task 2

Draw an antique ewer with the use of half-circles in geometric program GeoGebra, according to the model (Fig. 9). Try to construct picture as realistically as possible. Do not forget the handle of the ewer.

Fig. 9 An antique ewer.

Task 3

Design an antique vase in minimally two different ways (Fig. 10). Be careful about proportions, visual similarity. Save the drawn version in the geometrical program. You will be presenting one of your drawings in the software GeoGebra, where you will be solving a task.

Fig. 10 An antique vase

Conclusion

To sum up, we are able to review interactive approach in teaching with the use of unconventional pictures, unconventional connections, or connections which are not normally presented. These ideas force students to find new forms, use less common functions of the program and also revaluate, find, think about new solution alternatives, encourage self-cogitation, imagination, and, last but not least, they support interdisciplinary relationships.

We hope that with this short illustration, we introduced the connections among various fields and the possibility of the programme usage not only while solving the tasks in various fields, but also in every-day life, for example in designing different accessories.

References

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