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DEVELOPMENT OF HUMAN FIGURE PROPORTIONS SYSTEM AND ITS APPLICATION IN ART PEDAGOGY

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Abstract

We adhere to the concept of the phased formation of mental actions developed by the Soviet psychologist P. Ya. Halperin. The confident work of an artist without a model, using only imagination, is a prime example of fully formed mental actions. For this, an artist should know by heart three interrelated things: proportions, shapes and mechanics of movement of a human figure. In the academic system, when teaching these fundamental things, the emphasis is on the long-term development of observation and intuition. In addition, there are schemes of proportions, intended for the training of artists. But they are rarely used in practice. The reason is that these schemes do not give students a complete system of reference points. Artists and teachers more than once addressed the problem of proportions. However, the topic remains relevant. In the framework of the modern discipline "Drawing" there are no separate tasks aimed at studying proportions. The discipline "Composition", although operates with the writing of sketches, also does not provide such training. Based on the study of Leonardo da Vinci's "Vitruvian Man" and other materials related to proportions, we were able to develop a complete system of reference points for constructing a human figure. Using this system, students from the very beginning build figures in different movements without using any additional samples.

Keywords: Academic drawing, Leonardo da Vinci, orienting basis of action, proportions of a human figure, Vitruvian man, silhouette graphics.

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1. Introduction

In 2019, it turned 500 years since the death of Leonardo da Vinci. His drawing of a human figure inscribed in a square and a circle is widely known (Arasse, 2019, p. 37). It is based on the text of the ancient Roman architect Vitruvius (2002). It is a proportions scheme of the human body. What is the practical meaning of proportional schemes, why does a modern artist need to know the proportions of a person's figure? The fact is that the artist, at least at the stage of working on sketches, draws without any models, relying only on his imagination. For this reason the artist should know by heart three interrelated things: proportions, design and movement mechanics of a human figure.

We adhere to the concept of the phased formation of mental actions developed by the Soviet psychologist Galperin (2002). The confident work of an artist without a model, using only imagination, is a prime example of fully formed mental actions. These actions, first of all, include the ability to build proportions.

Artists and teachers more than once addressed the problem of proportions (Bammes, 2017). However, the topic remains relevant. In the framework of the modern discipline "Drawing" there are no separate tasks aimed at studying proportions. The discipline "Composition", although operates with the writing of sketches, also does not provide such training.

2. Problem Statement

The problem of the research is to create a method for constructing a human figure in voluntary movements that is applicable in the learning environment.

Within the concept of a phased formation of mental actions, there are three main types of an orienting basis of an action (OBA).

1. Incomplete OBA.
2. Full OBA.
3. Generalized OBA

The first type is characterized by the fact that a student has to find the missing reference points by himself, through trial and error.

In the second type, reference points are set in full so accurately that the student can perform the action correctly on the first attempt. But transfer of this skill to other similar cases is difficult for him.

The third type of OBA differs from the previous ones in that it sets not only the algorithm for successful execution of an action, but also a general method suitable for a variety of actions of a given class.

Any scheme of proportions is an orienting basis for construction of a human figure. This is usually an incomplete OBA. Therefore, there is every reason to assume that the solution to the problem is to develop at first a complete, and then a generalized, indicative basis of an action on the construction of a human figure (See figures 01, 02 and 03).

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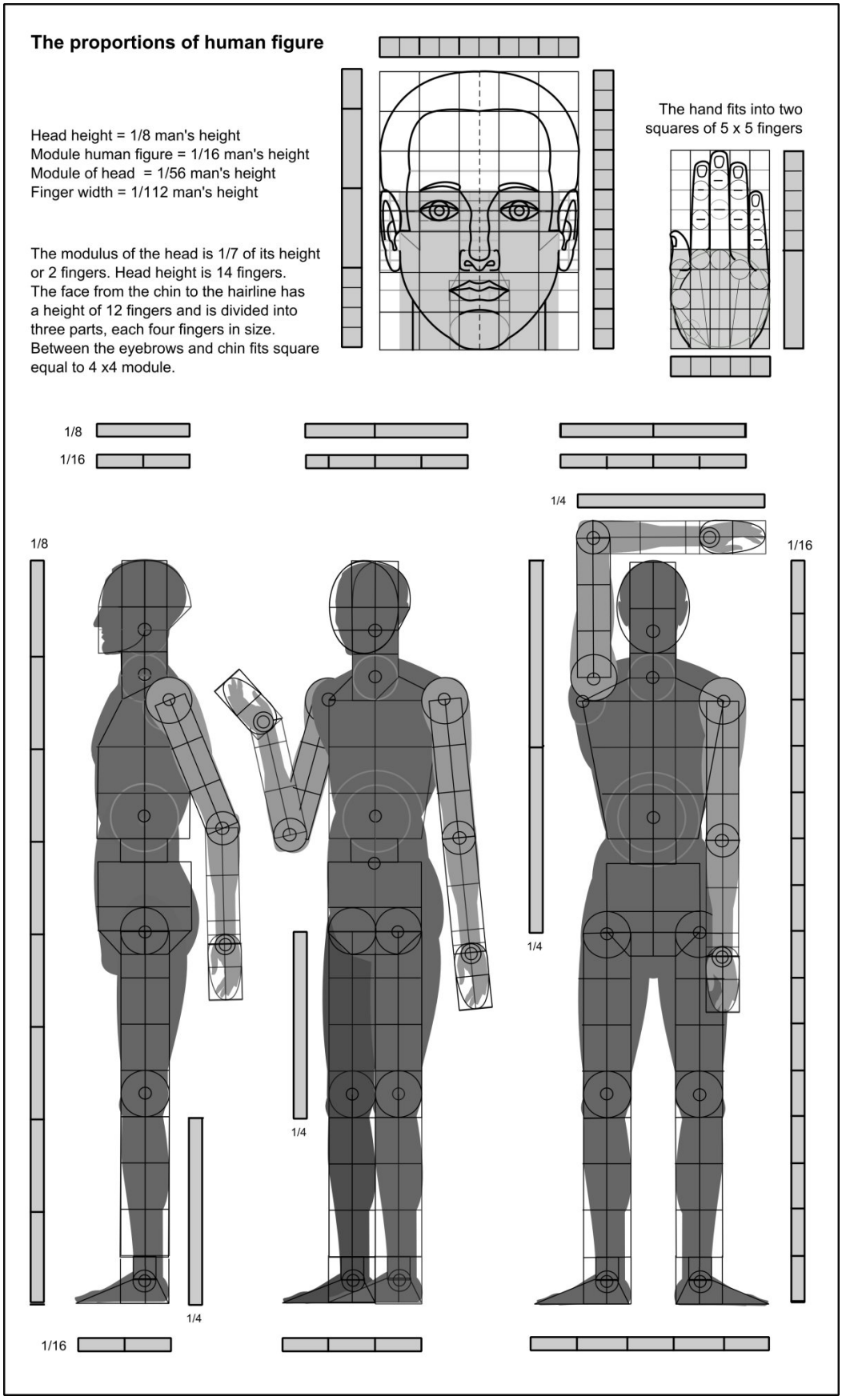

Figure 01. Diagram of a human figure proportions the centers of rotation of the joints and the general module for the head, wrist and the figure as a whole were found

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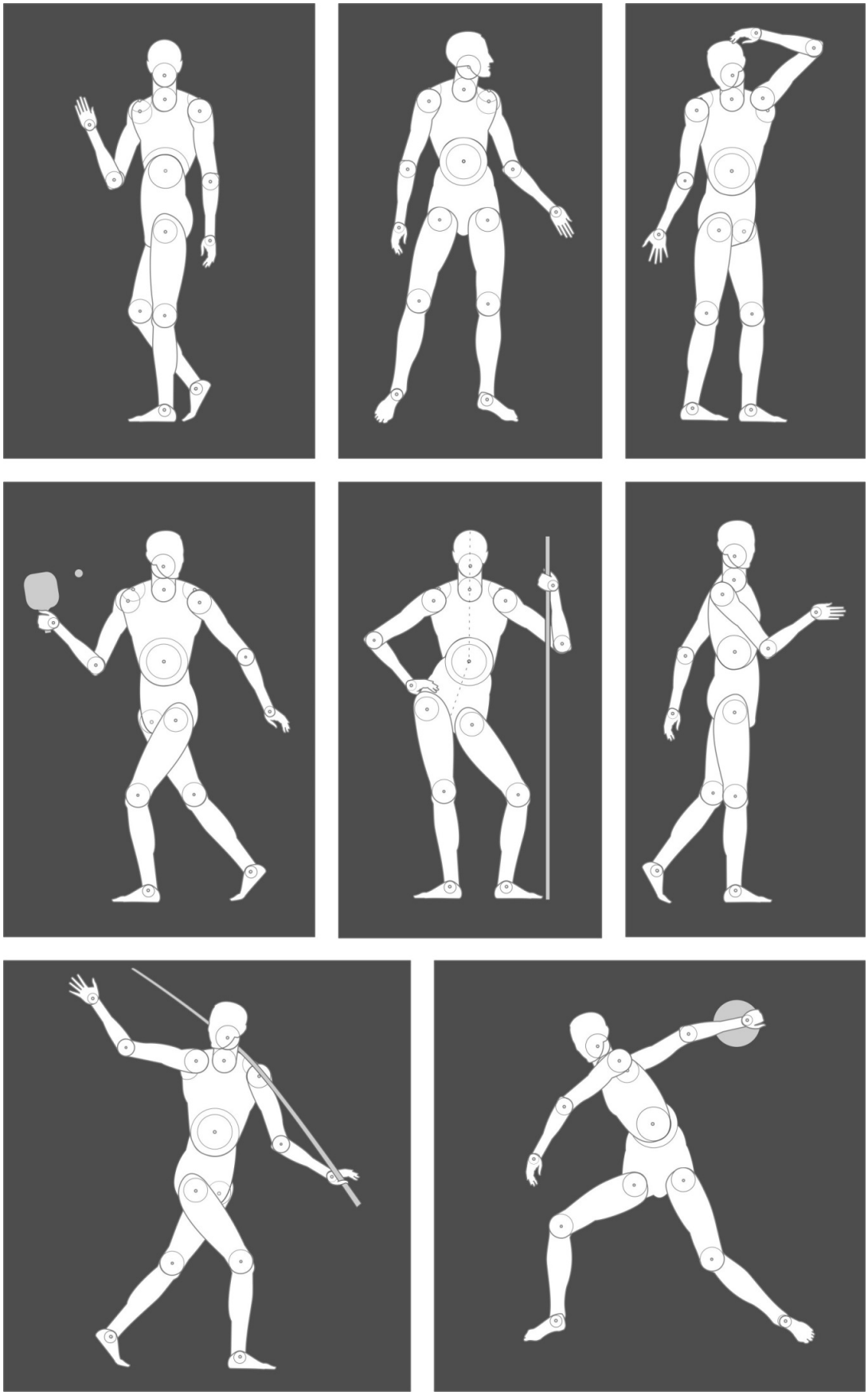

Figure 02. Movement of the figure, based on the scheme of proportions and specially prepared patterns

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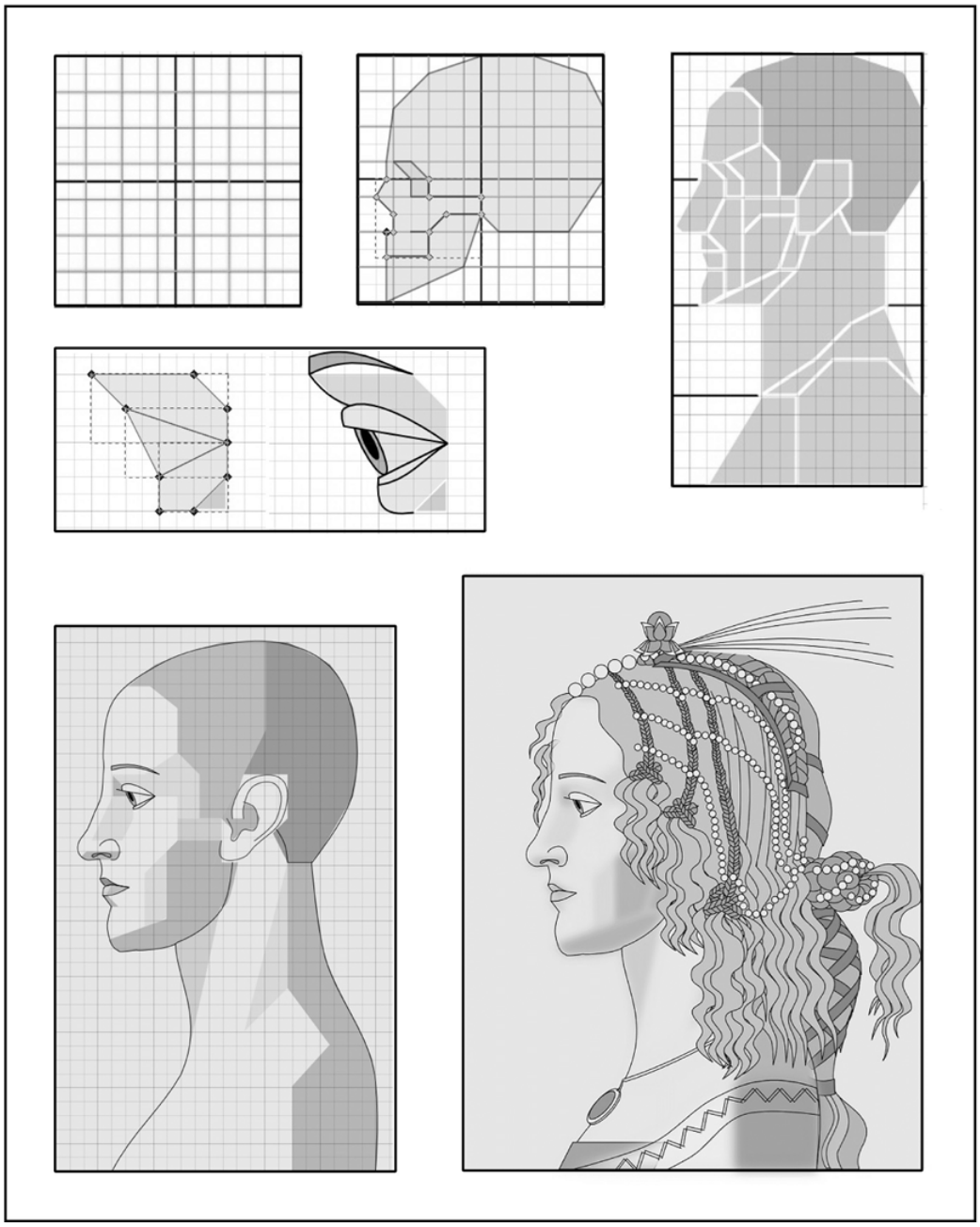

Figure 03. Fragments of the electronic manual "Fundamentals of graphics programs. Inkscape Editor"

3. Research Questions

First of all, let us consider the canon of proportions of Vitruvius - Leonardo from the point of view of the concept a phased formation of mental actions. Is this orienting basis complete and generalized? (Chivardi, 2019, p. 124)

A closer look at this drawing by Leonardo da Vinci reveals two types of markup.

One type of markup is associated directly with the figure. From the top to the bottom there is a series of horizontal lines dividing the figure into 4 equal parts. Horizontally, the distance is measured along outstretched arms. The axis of symmetry divides this distance into two equal parts. Two symmetrical

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vertical segments, applied in the area of the elbow joints, are separated from the total length by one quarter to the left and to the right.

Separate markings are applied to the horizontal located below the square in which the figure is inscribed. 1/4 of the entire length is marked on the left and right. This distance is divided into 6 equal parts, the outermost of these parts, in turn, are divided into 4 parts. Comparing this markup with the main scheme, one can understand that a quarter width of a square corresponds to the elbow (that is, with the forearm along with the hand). 1/6 of this quarter is palm, 1/4 of the width of the palm is equal to the width of the finger. The palm, as a measure of length in this case, corresponds precisely to four, not five fingers. To emphasize this, Leonardo da Vinci painted his hands with his thumbs pressed to his palms (Suh, 2017).

This means that the width of a finger is the smallest modulus of the whole human figure. The elbow is equal to 4×6 = 24 fingers. The height of the figure is equal to 24×4 = 96 fingers. The height of the head is equal to 1/8 of the height of the figure, i.e. 12 fingers.

Vitruvius mentions, that the face is 1/10 the height of height and, in turn, is divided into three equal parts. This is fully consistent with the picture of Leonardo. But this reveals the internal inconsistency of the scheme itself. It turns out that it contains two inconsistent modules: 1/96 and 1/30 of growth (Vitruvius, 2002, p. 74).

In addition, almost all the markings are done either along the axis of the figure, or along the axes of the arms, spread out to the sides. The values of the width of the head, neck, torso and limbs - are unknown.

Thus, the canon of proportions of Vitruvius-Leonardo is an incomplete orienting basis for the action of building a human figure (OBA of the first type).

According to the concept of the formation of mental actions, at the initial stages of learning tasks should be given in a material or materialized form. That is, students are presented with real objects or their substitutes in the form of models, drawings, diagrams. All this, of course, is accompanied by verbal explanations. And only at the last stage are assignments given in a purely verbal form.

In the process of teaching fine arts, three-dimensional and flat models are used. First, consider three-dimensional models.

1. Live model.
2. Sculpture.
3. Three-dimensional anatomical model.
4. Three-dimensional mobile dummy.

A common practical question for all models of this type: “How to transfer their absolute or relative dimensions from three-dimensional space to a plane?” There are at least three options for solving this problem: 1) orthogonal projection; 2) axonometric projection; 3) perspective (Mattesi, 2017, p. 14). However, all these methods of exact geometrical constructions are intended for the image of relatively simple in form and fixed objects. A human figure is more complex than any mechanism or architectural structure. Its exact construction requires a huge amount of measurements and calculations. This applies particularly to axonometry and perspective.

In such cases, contemporary artists use computer 3D editors. Yet, 3d-artists do not adhere to any specific scheme of proportions. For realistic images, they use references, that is, photos of live models. It is very similar to working from life when teaching academic drawing. With such methods, *the action of*

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building a figure does not at all go into its completed mental form, remaining forever at the initial materialized stage.

We, in this case, need a model that could be built at the final stage of training *only with the help of imagination*. None of the three-dimensional models are suitable for this, they are all overly complex.

We now consider planar models.

1. Figures of people in painting and graphics.
2. Anatomical tables.
3. Proportional schemes.
4. Flat mannequins.
5. Frame models.

Picturesque and graphic works are by nature planar. The huge number such models refers to the illusory-three-dimensional images. Introduction to the artistic process of full-scale sketches in Europe from about the 15th century this led to the fact that the appearance of the depicted figures began to change more and more. One can notice reductions in size of their individual parts, due to the rules of the observational perspective. Size reduction leads to distortion of the proportional system. Therefore, the study of proportions using illusory-three-dimensional models is fraught with even greater difficulties than when using models of truly three-dimensional.

At the same time, it is well known that the illusory-three-dimensional type of images was preceded by a purely planar type. The most characteristic examples of such a plan are the painting of ancient Greek ceramics, oriental miniature, and Old Russian icon painting. It should be noted that samples of this kind contain a rather large range of movements of the figures.

Consider now the next type of images - *anatomical tables*. The style of scientific illustrations in medical aids is flat. Illustrations can be full-color, very detailed, even with some volume modeling. But the authors of the anatomical tables, as a rule, avoid arbitrary angles of view and reduction in size. These figures, both in function and in shape, resemble technical drawings made in orthogonal projection.

Directly related to our topic are *proportional schemes*. What was the difference, for example, the ancient Egyptian canons of proportions from modern schemes? The fact, that Egyptian artists uniquely linked a proportional grid with a human figure. But the regular grid is no longer found in the drawings of Leonardo da Vinci and Durer. The grid also does not occur later, up to the modern proportional schemes.

A grid with square cell-modules makes sense if it is possible to combine the key points of the figure with its nodes. But this is It succeeds only then, when the axes of the whole figure and its parts are located strictly vertically and horizontally. Addition may be inclined axes constructed by connecting grid nodes. At any slightly more complicated tilting or turning of the figure, the connection with the grid is destroyed.

That is why square modules gave way to markup, made either directly on the figure, or on a separate vertical line drawn next to it (Kupriyanov, 2016).

This is a paradoxical situation. It is impossible to refuse a grid, - the proportional scheme becomes incomplete. Application the grid for voluntary movements is also impossible. The way to resolve this contradiction will be shown below, in the “Research Results” section (Kupriyanov, 2017, p. 9).

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A rather promising version of the model for building and studying proportions is *a flat dummy*. Unfortunately, this model has not seriously attracted researchers. Usually it is used in children's games as a flat movable doll. The proportions of such dummies are built in the most general terms, mostly intuitively.

The last option is a *frame scheme* (Chivardi, 2019). In its pure form, it is a combination of the axes of the main parts of the figure and the centers of rotation. There are no proportional divisions on the axes and forms.

Images can be not only artistic. The following series of visual representations is typical for a learning situation: a dummy, a staging, a plaster model, a live model, etc.

In the visual arts is a completely other series of visual representations. First of all, this is the main character, he is included in a certain action, like an actor on stage (Mattesi, 2017). Further, there may be minor characters in this scene, with its own special behavior and appearance.

The difference between educational and artistic situations is very significant. Thus, finding the path of transition from the academic visual representations to the artistic images is an urgent task.

During the study, we used the following types of graphics: silhouette, contour and halftone. Each species could include different technological options (Kupriyanov, 2017, p. 11).

1. Construction of figures in pencil on white paper.
2. Construction of figures on paper in a cage or on graph paper.
3. Building shapes on the computer.
4. The cutting flat moving models out of cardboard.
5. A collage of white and colored paper.

4. Purpose of the Study

First, we found out that the “Vitruvian Man” scheme requires additions, study and coordination of details, as well as calculation of the centers of rotation of the joints. The second point is related to limitations. The model of the figure must be planar and uniquely associated with the grid of proportions. The figure and its parts should be depicted in three fixed turns: full face, in profile, three quarters.

Thus, *the purpose of the study is to develop at first a complete, and then a generalized, orienting basis for constructing a planar image of a human figure in different movements*.

Further, this basis should be tested in different technological conditions.

5. Research Methods

1. The study of literature related to the topic of proportions, design and mechanics of movements of a human figure.
2. The study of various types of models applicable in the learning process.
3. The study of various types and technologies of graphic images.
4. Formative experiments based on the developed techniques.

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6. Findings

One of the biggest obstacles in the work was the contradiction described above between the modular grid and the freedom of movement of the depicted figure. The solution is as follows. Based on anatomical information, the human figure can be divided into relatively fixed, shape-retaining parts. In turn, nothing prevents to connect each of the individual parts with a modular grid. And, if the grids of all the fragments are made on a single scale, then the whole figure can be reassembled by fastening the parts with movable joints. In this design, the mesh applied to the moving parts will rotate with these parts. In order for the figure not to deform during the movement, it is necessary to single out unchanged regions of rotation. They are circles described around the centers of rotation of the joints and consistent with the entire system of proportions (Kupriyanov, 2017, p. 17).

The second obstacle was connected with the initially incorrectly chosen type of graphics. Following the traditions of the image of proportional diagrams, we first used contour graphics. But the contours of external forms in different movements are changeable, and they cannot be associated with a flat mechanical model. When moving to silhouette graphics, this obstacle was removed.

To bring the proportions of the figure into a consistent look, we chose the minimum module. It corresponds to the minimum module of the "Vitruvian Man" scheme. This is the width of the finger. According to this scheme, the height of the head is 12 fingers. But, as mentioned above, this separation is not consistent with the size of the parts of the face. However, it is known that the optimal proportion for a human head in a full face turn is 7/5. In this grid, the module is the width of the eye. If we take the width of the eye equal to two fingers, then the height of the head will be equal to 14 fingers, and the width to 10 fingers. In this case, the face occupies 12 fingers in height and is divided into three equal parts, each is 4 fingers.

The ratio of growth to the minimum module increases. The growth in the scheme we modified is no longer 96 fingersbut 112 fingers (Figure 01).

As commonly known, the flexibility of the spine is ensured by the fact that the cervical, thoracic and lumbar sections all together include 24 vertebrae. The proportional model constructed by us has only three centers of rotation along the entire spine. At the same time, we managed to achieve reliability of the silhouette of a figure in different movements.

Turns of the figure (twisting the spine around the vertical axis) are achieved by combining the silhouettes of the head, the neck, chest and pelvic region, built on a grid in three different angles: full face, in profile, three-quarters (Figure 02)..

To date, we have developed four versions of training methods related to the construction of proportions and movements.

1. Constructing the proportions of the human figure in pencil on paper
2. Technique of layer-by-layer construction of the head on a computer. (Figure 03).
3. Method of manufacturing flat mannequins
4. Collage technique.

How to organize the transition from the educational visual presentation (model) to the artistic image (character)? It requires almost no effort other than the effort of imagination. The figure of an athletic physique, standing straight, with arms extended along the body is usually depicted on the schemes of

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proportions. The question is who is it? It could be a soldier at a medical examination. This may be an athlete before setting a record. This may be the hero of ancient Greek mythology (Sapozhnikov, 2015).

So, an artistic image arises at the moment when we ask the question “Who is this?” And answer it.

Two characters combined by interaction are already a stage. Details of the characters can be supplemented and refined in the process of working above the scene. Therefore, we complement our training sessions not only with templates for assembling figures, but also with templates for attributes.

7. Conclusion

In order to summarize the described practice, we can draw the following conclusions.

1. The conception of a phased formation of mental actions is an effective method for studying pictoral activity and the learning process associated with it.

2. The proportional scheme of the “Vitruvian Man” can be adapted to the conditions of modern teaching of fine arts.

3. Silhouette graphics from a methodical point of view is the simplest type of graphics. Therefore, learning to draw must begin with learning of silhouette graphics.

4. The generalized orienting basis of the action to build a human figure (OBA of the third type) can be developed and applied in practice. In this case, we managed to implement it for collage technique.

References

Arasse, D. (2019). *Léonard da Vinci: le rythme du monde* [Leonardo da Vinci: the rhythm of the world]. Paris: Hazan.

Bammes, G. (2017). *The Complete Guide to Anatomy for Artists & Illustrators*. Kent: Search Press, Wellwood North Farm Road, Tunbridge Wells.

Chivardi, G. (2019). *Drawing human anatomy*. London: Studio Vista.

Galperin, P. Ia. (2002). Lektsii po psikhologii [Lectures on Psychology]. Moscow: Vyisshaya shkola.

Kupriyanov, N. I. (2016). Podgotovka dizaynera: problemy akademicheskoy grafiki i komp'yuternoy grafiki [Training of designer: the problems of academic drawing and computer graphics]. *Dizayn. Kosmos, Arkhitektura,* 56-66.

Kupriyanov, N. I. (2017). *Proportsii figury cheloveka* [Human figure proportions]. Ufa: BGPU.

Mattesi, M. D. (2017). *Force: the key to capturing life through drawing*. Burlington: Elsevier.

Sapozhnikov, A. P. (2015). *Polnyy kurs risovaniya* [Full course of drawing]. Moscow: ALEV-V.

Suh, A. H. (2017). *Leonardo's Notebooks: Writing and Art of the Great Master*. New York: Hashet Book Group.

Vitruvius, P. (2002). *Ten books on architecture*. Cambridge: University Printing House.