Tampere University of Applied Sciences

Constructive Drawing

Tools and Methods for Creating Human Figures in Perspective

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BACHELOR'S THESIS
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Degree Programme in Media and Arts
Interactive Media

ABSTRACT

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Tools and Methods for Creating Human Figures in Perspective

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Understanding linear perspective is a fundamental skill when the goal is to create the illusion of depth on a flat surface. This requires a lot of analytical thinking, spatial awareness, and good hand-eye coordination. The learning process can feel very technical and distant from the concept of figurative art, and this is one of the main reasons students skip the fundamentals, only to come back later after realizing how important it is.

This thesis goes through the basic principles of linear perspective which form the basis for the presented constructive drawing method. Learning to visualize the three-dimensional nature of objects is at the core of this method.

The purpose of this thesis was to demonstrate the importance of understanding linear perspective as a part of the creative process when drawing human figures. The focus was to show how to constructively draw the fundamental framework of human figures rather than create detailed and fully rendered artwork.

The findings indicated that the tools and methods presented in this thesis can help to create an efficient and progressive learning process.

Students and professionals involved with representational drawing can use this thesis as a guideline for the study of drawing human figures in perspective.

Key words: linear perspective, drawing, constructive drawing, human figures

CONTENTS

1 INTRODUCTION

Understanding perspective is a fundamental skill for all students and professionals involved with representational drawing. This includes a variety of fields, such as illustration, animation, fine arts, architecture, and product design. Linear perspective is based on mathematical principles, and it contains a lot of measuring, accuracy, and analytical thinking. The learning process can feel quite technical and overwhelming at times, and this is one of the main reasons people skip the theory of perspective, only to come back later after realizing how beneficial it is. The ability to draw things in three dimensions on a two-dimensional surface requires a basic understanding of linear perspective principles.

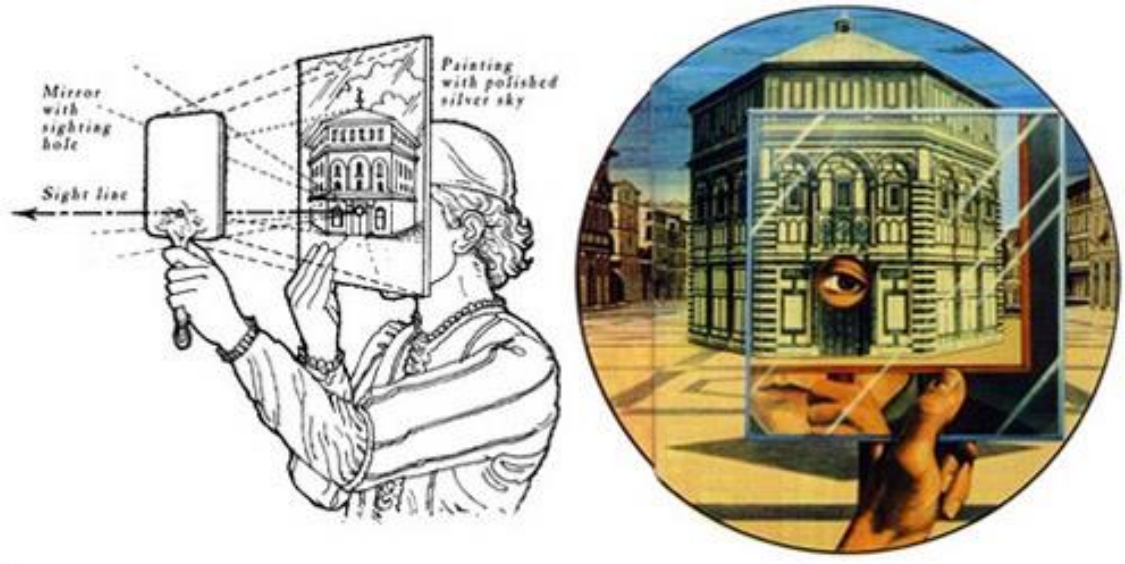
Drawing human figures is one of the most popular subjects among new artists. However, learning is often started by focusing on details and rendering before understanding the underlying forms of the body. Human figures are very complex, and to fully grasp the body's fundamental structure, artists should be first able to visualize them in the simplest geometrical shapes. According to anatomy and figure drawing teacher George Bridgman (1920), the conception of the figure must begin with the thought of body parts as blocks and their relation to each other. (Bridgman 1920, 12.)

This thesis focuses on a method called constructive drawing. Constructive drawing is a method where artists start by creating simple, primitive shapes to represent the form they are drawing. Understanding the construction of each element and grasping the three-dimensional nature of objects are at the core of this method. Comprehension of anatomy, principles of perspective, and proportions are essential to this approach (Chapman 2020). The constructive method is very efficient, especially for artists who pursue drawing human figures from memory and imagination.

This thesis aims to give the reader a systematic approach to drawing human figures by presenting different methods and interactive applications that can help to make the learning process efficient and enjoyable. The authors and methods presented in this thesis were chosen to reflect my own path of study.

2 A BRIEF HISTORY OF LINEAR PERSPECTIVE

Florentine architect Filippo Brunelleschi is generally credited as the first person to describe a precise system of linear perspective in the early 1400s. In 1420, Brunelleschi demonstrated his discovery of linear perspective with two panels he had painted that included reversed images of Florence Baptistery and the Palazzo Vecchio. Brunelleschi drilled small eye holes in the middle of these panels and had an observer look through the back of them to view the same scenery he had painted on the panel. A mirror was then placed in front of the panel to reflect Brunelleschi's painting through the hole, and the observer saw the striking similarity between reality and the artwork (Picture 1). (Edgerton 1975, 125-127.) The earliest example of Brunelleschi's technique's direct application is Italian Renaissance painter Masaccio's 1425 painting, *Holy Trinity*, exhibited in the Dominican church of Santa Maria Novella in Florence, Italy.



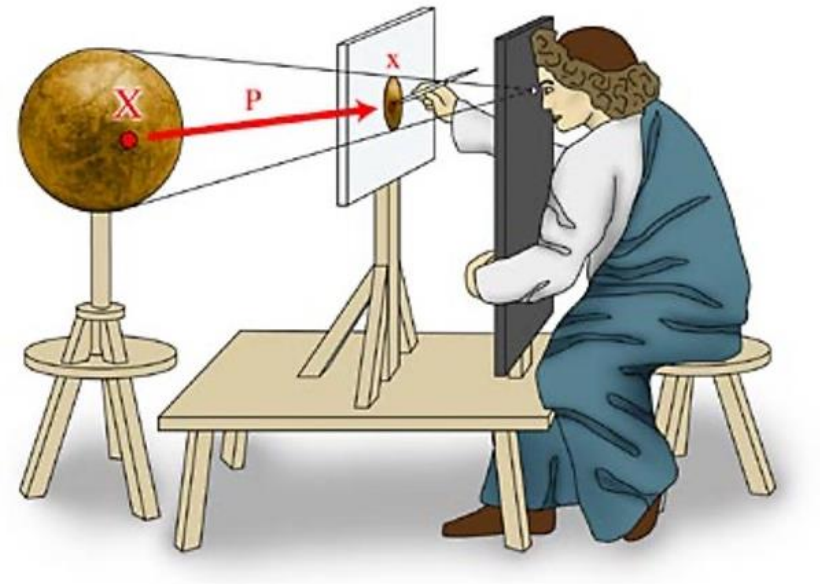
PICTURE 1. Brunelleschi's linear perspective experiment (Rowe n.d.)

Another architect from Florentine, Leon Battista Alberti, was the first art theorist to write an exposition on the principles of perspective. In his 1435 book, *Della Pittura*, Alberti demonstrates how objects appear smaller as they recede, and objects of equal distance from one another appear to merge closer together the farther they recede into the distance. Alberti relied on mathematics as the common ground of art and science, and in his theory, all objects can be measured

in proper geometric proportions to one another. (Powell 2013, 4.) Alberti's book had a significant influence on painters during the Renaissance.

Piero della Francesca, a mathematician, and a painter from Florentina, further developed Alberti's theories in his 1474-1482 treatise, *De Prospective Pingendi*. *De Prospective Pingendi* was the earliest opus devoted to perspective, including arithmetic's, algebra, innovative solid geometry, and perspective work. The treatise showed how to systematically plot the outlines of forms onto a foreshortened plane and use the plane and elevation of solid bodies to project them point-by-point onto an intersecting plane from a fixed viewpoint. Della Francesca used illustrated figures to explain the mathematical concepts of perspective, making his treatise easier to understand than Alberti's. Della Francesca was the first to accurately draw the Platonic solids as they would appear in perspective. (Kemp 1997, 128.)

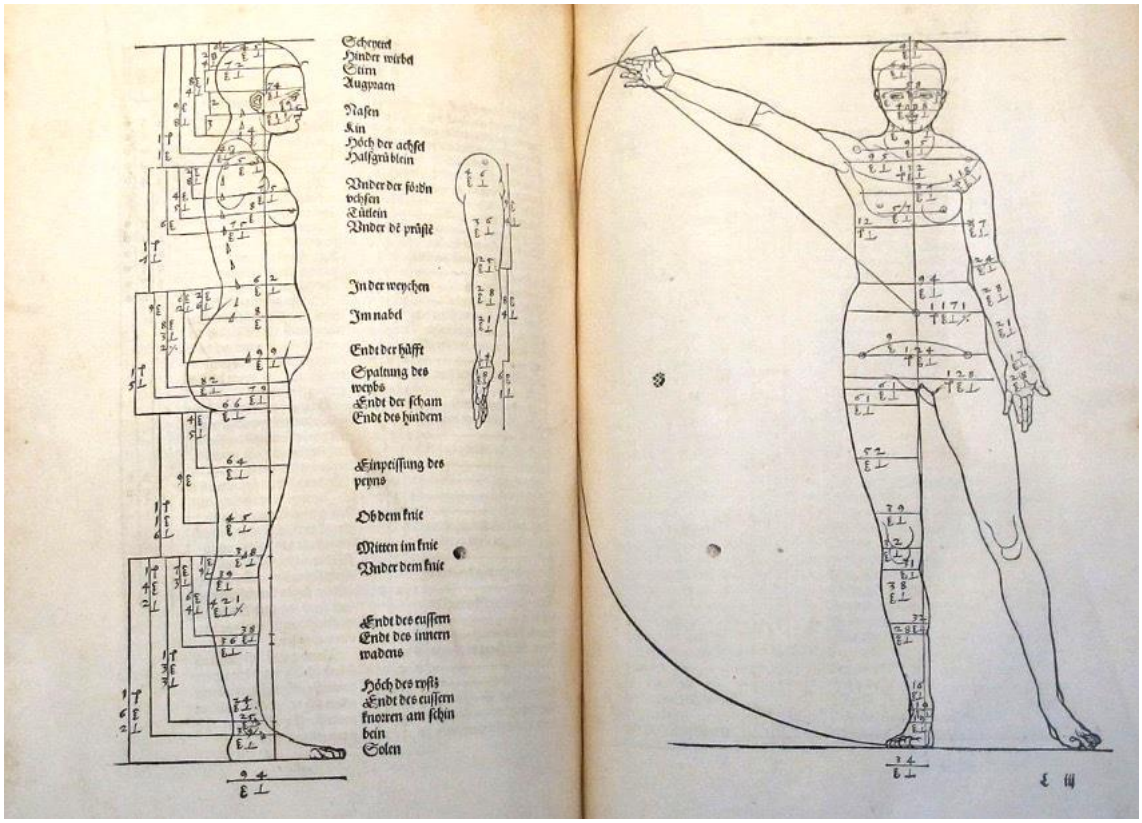
Leonardo da Vinci was heavily influenced by Alberti and Francesca, and based on their theories, he developed a machine called perspectrograph (Picture 2), an optical instrument designed to help artists create perspective drawings. Perspectograph included a pane of glass that was placed into a frame that held a small viewing slot. The artist could look through the viewing slot with one eye and sketch the outline of the scene on the glass. (Lienau 2013.)



PICTURE 2. Perspectograph (Criminisi & Thomas 2003)

The first known diagram of two-point perspective was made by a french scholar, Jean Pelerin, who wrote under the name ‘Viator’. Pelerin’s 1505 treatise, *De Artificiali Perspectiva*, was the first printed treatise on perspective. The basis of Pelerin’s construction was the distance point method that required a vanishing point and two distance points on either side. (Janson 2021.)

Albrecht Dürer, a German painter, was the first Northern European to treat matters of visual representation in a scientific way. Among Dürer’s mathematical capabilities was an understanding of projective geometry, unparalleled by any artist of his time. In 1515 Dürer created the first world map projected on a solid geometric sphere and the first printed celestial map in Europe. Between 1525-1528 Dürer published two famous books called, *The Four Books on Measurement* and *The Four Books on Human Proportion* (Picture 3). Both books assembled cutting-edge knowledge of geometry, perspective, and human physiognomy of the time. (Luecking 2013.)



PICTURE 3. Four Books on Human Proportions (Dürer 1528)

By the late 15th century, artists had a good overall understanding of perspective and were able to create a realistic world in their art. The works of Leonardo,

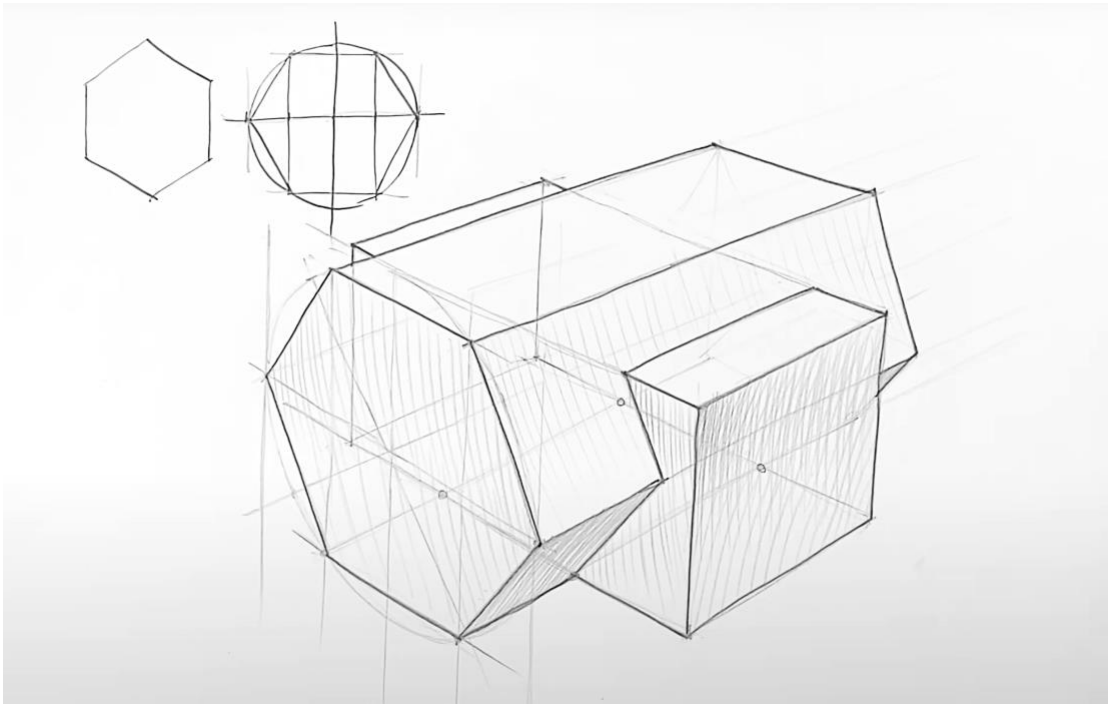
Michelangelo, Raphael, Botticelli, Donatello, and Titian represented artistic pinnacles that other artists widely imitated. For the next five centuries, The Baroque, Neoclassic, and Impressionist artists used the systems of perspective to create the illusion of depth as the basis of the great art of western culture. (Optical Art History n.d.) However, it wasn't until the post-Impressionist era that a significant change in direction took place. The Invention of the camera challenged the realistic window-like paintings, and a more abstract interpretation of perspective was born.

3 CONSTRUCTIVE DRAWING

In academic fine art teaching, students often understand the drawing techniques as a sequential implementation of three specific stages: layout, construction, and tonal drawing (Chistov 2015, 128). The term constructive drawing derives from the second stage, the construction stage. It is a method where drawing starts by creating simple, primitive shapes to represent the subject drawn. Understanding the construction of each element and grasping the three-dimensional nature of objects are at the core of this method. In addition, comprehension of anatomy, principles of perspective, and proportions are essential to this approach. (Chapman 2020.)

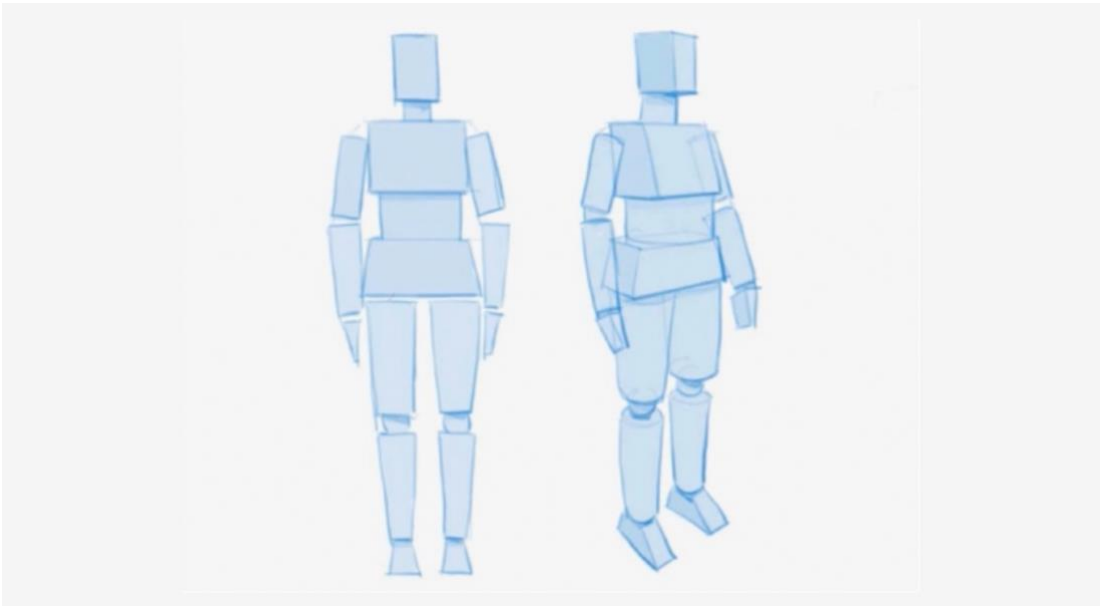
One of the tasks that an educational drawing should set and solve is the development of visual perception and volume-spatial thinking. Through systematic exercises, successively revealing the constructive basis of things, students should learn to understand the structure of each model that is the subject of their study.

Thinking and drawing shapes as transparent is one of the main principles of the method. Understanding the forms so well that artists can visualize even the invisible parts is a crucial skill, for example, when connecting or intersecting different shapes (Picture 4). Contours emphasize the three-dimensionality of the forms and mark the proportion lines to help with measurement and foreshortening. Locating the centerline of the subject drawn is crucial because it defines how additional shapes are placed correctly in perspective. Measuring shapes can be done either as a width-to-height ratio or by comparing the relative sizes of different objects to each other. Understanding the symmetry of forms is also important because many forms of animate and inanimate nature have different symmetrical structures, such as bilateral symmetry inherent in animals and humans, radial symmetry in flowers, and translational symmetry in shells (Chistov 2015, 129). The concept of symmetry is simple when the subject is viewed in orthographic perspective but gets complicated with linear perspective because the symmetrical features are foreshortened.



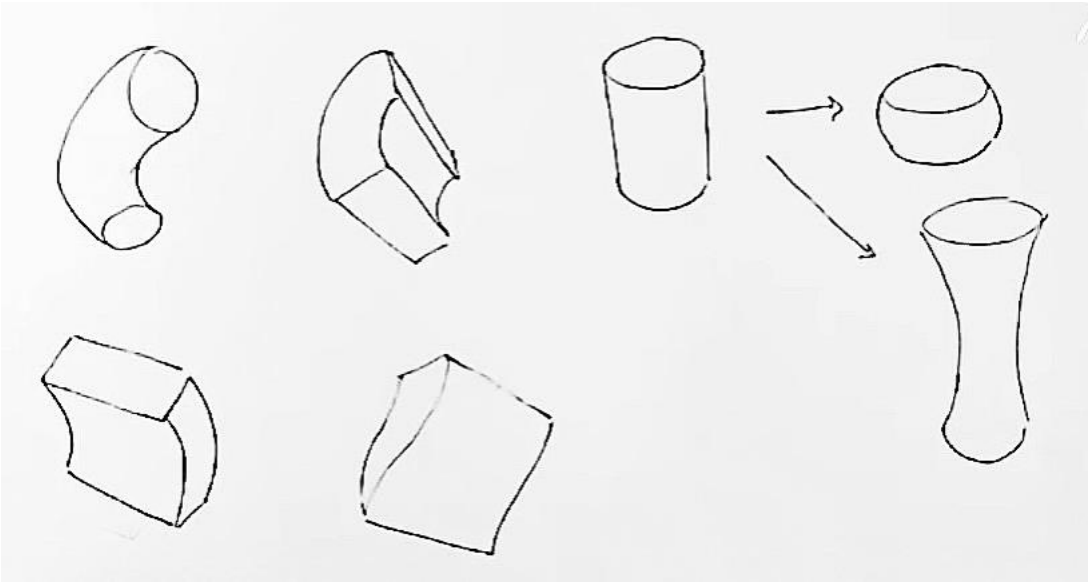
PICTURE 4. Constructive drawing, intersecting objects (London 2021)

The ability to visualize all kinds of subjects in their simplest geometric shapes is essential, especially when drawing something as complex as human figures. When the human figure is simplified by connecting geometric shapes (Picture 5), it becomes easier to construct the muscles on top and create different poses from memory and imagination. Most angles and foreshortened views can be simply broken down by using basic shapes to construct.



PICTURE 5. Connecting geometric shapes (Douglas 2021)

One of the most challenging things in the constructive drawing method is learning to manipulate shapes. According to concept art teacher Antonio Stappaerts (2021), shape manipulation is an essential skill in people's artistic training (Stappaerts 2021). Manipulation can be done with primitive shapes by bending, twisting, squishing, or stretching and with more complex organic shapes by modifying contour lines (Picture 6). Shape manipulation allows the artist to make their drawings looser and more dynamic, and many of the manipulation methods apply to human figures. Unfortunately, it can be hard to find physical models representing this type of dynamic modification of simple geometric objects. However, reference images can be created with the help of 3D software.



PICTURE 6. Primitive shape manipulation (Stappaers 2021)

Although constructive drawing is based on building with the simplest geometrical shapes, they are only used as a guide for correctly placing different features of the subject drawn. After a comprehensive understanding of linear perspective and constructive methods, drawing the fundamental framework is no longer necessary because it can be seen in the mind's eyes. This gives the artist the ability to draw fast without constantly measuring proportions and using references. The illusion of depth can then be created no matter which part of the artwork is used as the starting point. A skillful artist can start from the details and still reach accurate proportions and overall construction.

4 FROM OBSERVATION TO IMAGINATION

4.1 Drawing what you see vs. Drawing what you know

Drawing academy teacher Vladimir London sees the concept of drawing what you see as depicting a perception of a real object intuitively, without analyzing its construction, proportions, anatomy, and spatial relationships (London n.d.). In simple terms, drawing what you see means imitating or copying the observed subject. This, of course, requires a reference photo or a live subject. In the process of copying, visible shapes need to be closely observed and drawn precisely, which requires good eye-hand coordination and fine motor skills, and ideally results in a recognizable picture. The generally accepted idea is that the closer that drawing resembles an original subject, the more realistic such artwork is.

The problem with this method is that, without analytical thought and comprehension of the fundamental structures, it is difficult to develop skills to create more depth and draw without a reference photo or a live subject. Of course, using references for learning is essential, but the process is more progressive when the subject's structure and relation to perspective are also studied.

4.2 Drawing from memory and imagination

According to fine art teacher Jack Faragasso (1970), memory and imagination are often confused because the imaginative state is fleeting, does not last long, and is constantly interrupted by input from the five senses. Faragasso sees memory and imagination as faculties of two separate minds, a rational mind and a subconscious mind from which only one can be operating at any given time. Furthermore, drawing from memory contains a mental image recreated on paper, while there is no preconceived image when working from imagination. (Faragasso 1970, 1.)

Visual memory is generally seen as fragments and collections of images that are stored in the mind. In contrast, the concept of imagination occupies an

intermediate position somewhere between perception, thinking, and memory (Kara 2015, 277). In scientific studies, visual imagination is defined as visualizing something that exists in the world. However, many practicing artists describe it as a much richer and more complex ability, strongly linked to personality and emotion, and often exercised during creation rather than passive visualization. Some talk about seeing in the mind's eye, and this place in consciousness does not feel the same as memory. This place is fed by images of the world but does not simply reproduce them. Instead, the images connect with thoughts, ideas, and feelings. (Aldworth 2018, 175.)

Fine art teacher Stan Prokopenko (2017) describes the concept of drawing from imagination as taking things from memory and connecting them in a new way (Prokopenko 2017). Drawing three-dimensional artwork from imagination is one of the most challenging skills artists can achieve. The ability to imagine something vividly and see it clearly in the mind's eye is inherent to most people but replicating it on a two-dimensional surface takes a lot of dedication and practice. Observing a reference picture or a physical model and then imagining and drawing it from other angles is one efficient learning method to draw from memory and imagination. This process should be started with the most rudimental objects, such as boxes and ellipses, and continue to manipulate and connect these simple forms to represent abstract ideas or the framework for the desired drawing.

If the goal is learning to draw three-dimensional artwork from memory and imagination, practicing spatial awareness and understanding linear perspective is essential. Observing surrounding nature and analyzing different objects in everyday life is an excellent way to build a visual library. Drawing from memory and imagination allows artists to stretch their creativity, leading to more developed problem-solving skills and critical thinking.

5 PERSPECTIVE BASICS

5.1 GROUND PLANE

In linear perspective, the ground plane (Figure 1) is the horizontal plane that is receding to the horizon. It is representing the ground on which the viewer is standing, and it is usually drawn to represent the location of the observer's feet.

5.2 STATION POINT

The station point (Figure 1) is the stationary point from which a viewer is related to the object that is being observed. It can be thought of as the point of reference to which all things in the composition can be related. Objects diminish in size as they increase in distance from the station point. Station point has a key role in determining how the viewer understands the composition and relates to the subject matter.

5.3 LINE OF SIGHT

The line of sight (Figure 1) is an unobstructed line of view extending from a viewer to some object in the distance. It represents the view from eye level and starts at the same height as the horizon line.

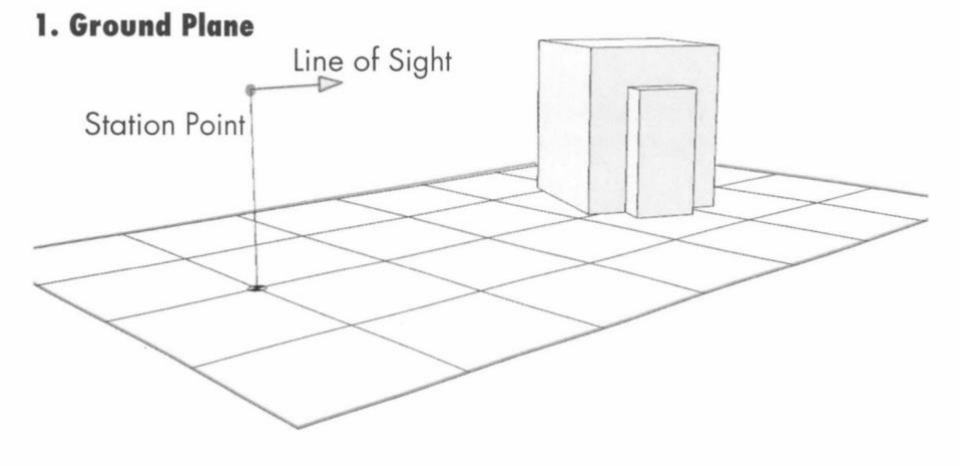


FIGURE 1. Ground plane, station point, line of sight (Shtyrmer n.d.)

5.4 PICTURE PLANE

The picture plane (Figure 2) is an imaginary transparent plane located between the station point and the object viewed at eye level. The plane corresponds to the physical surface of the work. The orientation of the picture plane is always perpendicular to the line-of-sight axis. Picture plane helps to establish the viewer's frame of reference to the scene.

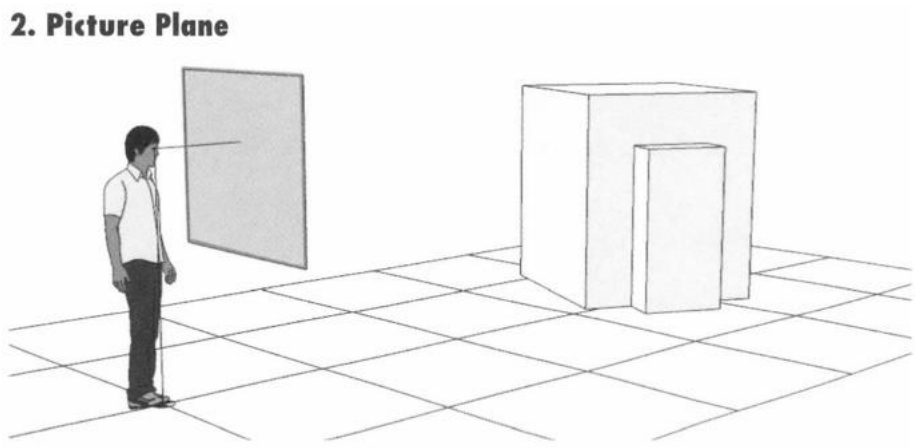


FIGURE 2. Picture plane (Shtyrmer n.d.)

5.5 CONE OF VISION

Cone of vision is defined as the scope of what the observer can see clearly when looking into a scene. People have an approximately 60-degree angle of undistorted vision that extends as an imaginary cone in front of the eyes (Figure 3). The objects that are drawn outside of the cone of vision become distorted.

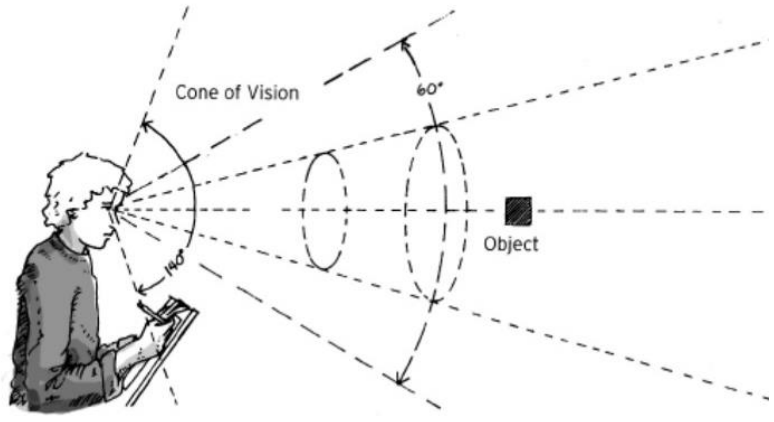


FIGURE 3. Cone of vision (Montague 2009)

5.6 HORIZON LINE

The horizon line (Figure 4) represents the viewer's eye level or delineate where the sky meets the ground. Horizon line runs across the drawing surface horizontally. The term horizon line generally refers to artwork that displays outdoors while the term eye level is used when the scene is indoors. The position of the horizon line in the picture depends on the elevation from which the subject is viewed.

5.7 VANISHING POINT

The vanishing point (Figure 4) is a point on the horizon where receding parallel lines appear to converge. It is a point in fictional space that is supposed to appear the furthest from the observer, a point beyond which the human eye cannot see. All objects seem to become smaller as they move toward the vanishing point. Vanishing point is one of the most important points to establish to draw objects accurately.

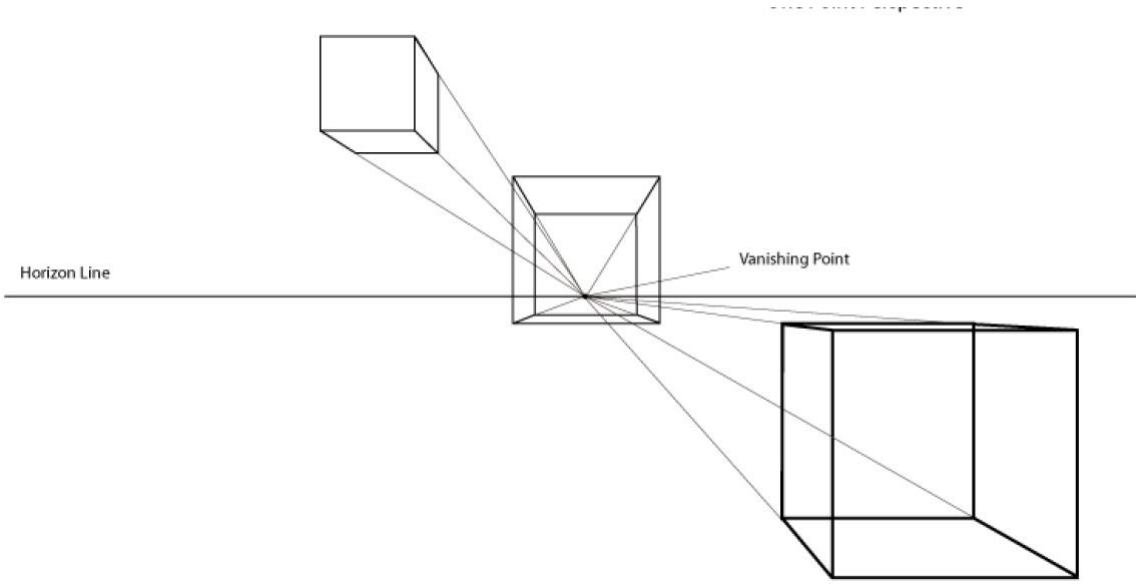


FIGURE 5. Horizon line, vanishing point (Browns 2010)

5.8 ONE-POINT PERSPECTIVE

One-point perspective (Figure 5) is based on the concept that all the lines converge to a single vanishing point. In one one-point perspective, the height and

width of the objects are parallel to the picture plane, and only one dimension of the three-dimensional subjects seems to recede to the vanishing point.

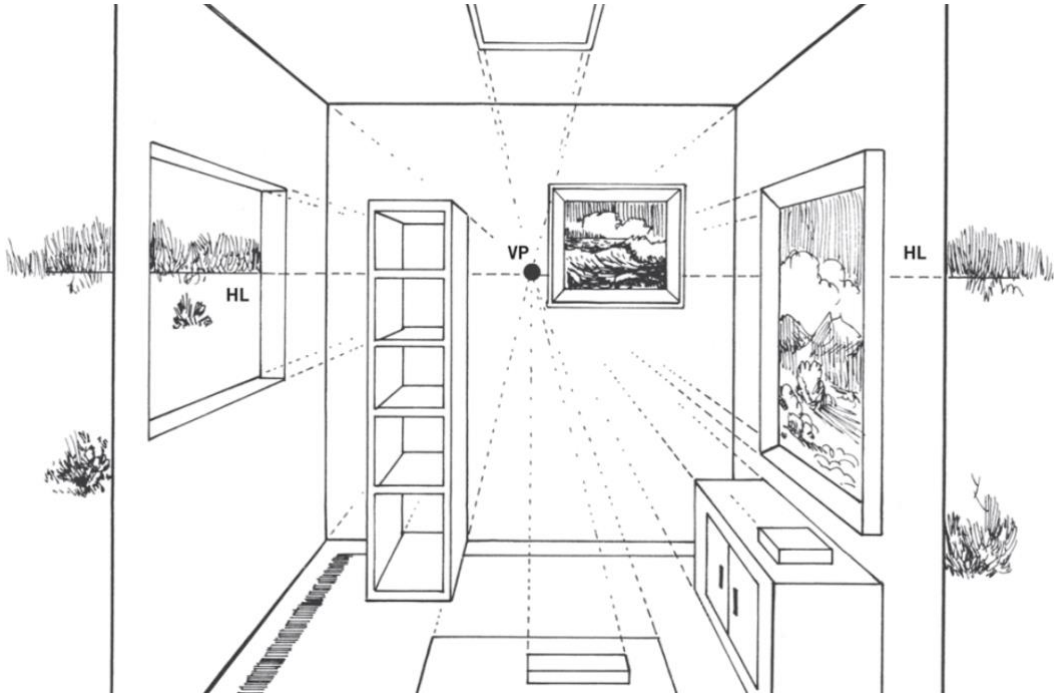


FIGURE 5. One-point perspective (Powell 2013)

5.9 TWO-POINT PERSPECTIVE

Two-point perspective is based on the concept that all the lines converge to two vanishing points (Figure 6). In two-point perspective only the height is parallel to the picture plane and the other dimension recedes to the vanishing points.

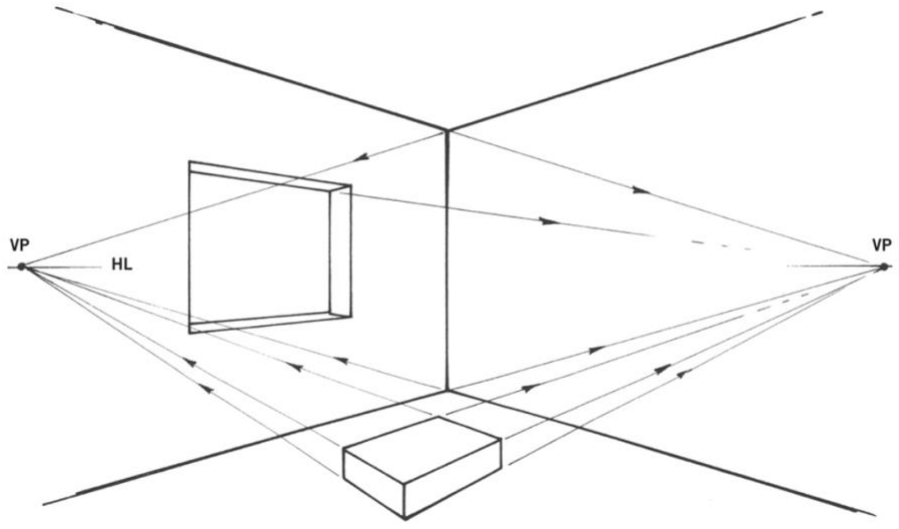


FIGURE 6. Two-point perspective (Powell 2013)

5.10 THREE-POINT PERSPECTIVE

Three-point perspective is based on the concept that all the lines converge to three vanishing points (Figure 7). Three-point perspective is most used when drawing from a low or high eye level. In one and two-point perspective, the picture plane's angle is fixed in relation to the ground plane, whereas in three-point perspective, the picture plane seems to be set in different angles.

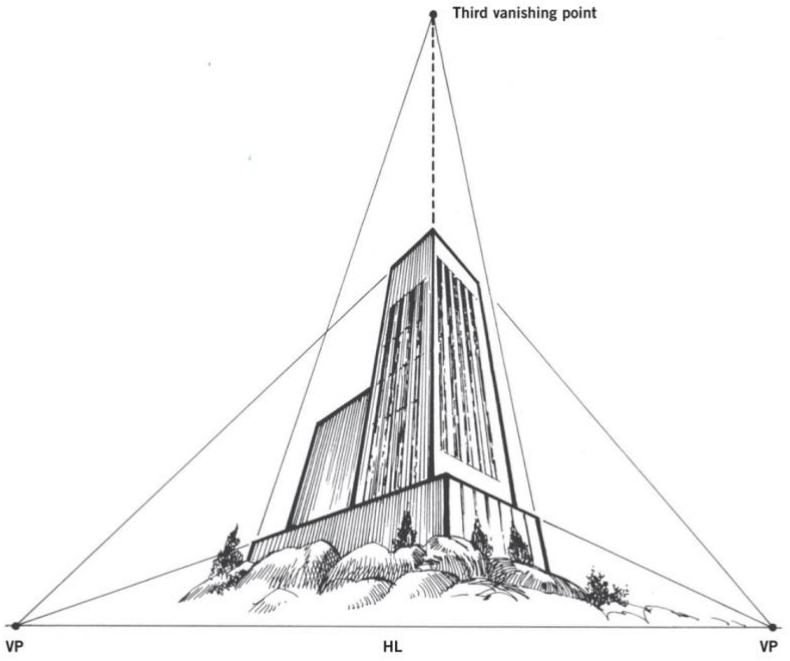


FIGURE 7. Three-point perspective (Powell 2013)

5.11 CURVILINEAR PERSPECTIVE

Curvilinear perspective (Figure 8) is a type of linear perspective based on the concept that all the lines converge to four or five vanishing points. The vanishing points in the four-point perspective are located on both sides of the horizontal and vertical lines while in the five-point perspective fifth vanishing point is added to the center. The system uses curving perspective lines instead of straight converging ones to approximate the image on the eye's retina, which is itself spherical.

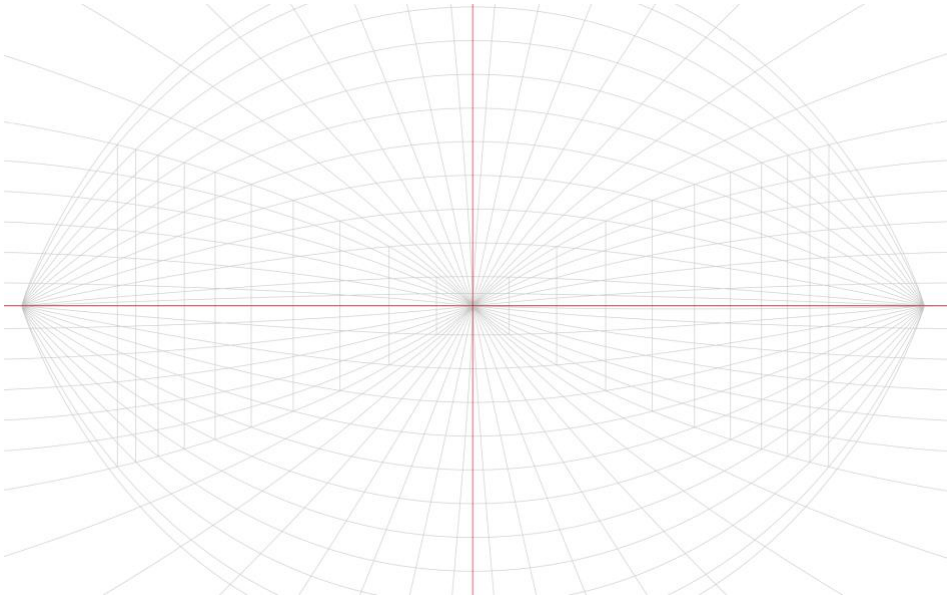


FIGURE 8. Curvilinear perspective (Brehm)

5.12 FORESHORTENING

Foreshortening is a technique used in perspective to create the illusion of an object receding strongly into the distance. The illusion is created by the object appearing shorter than it is, making it seem compressed. (Figure 9)

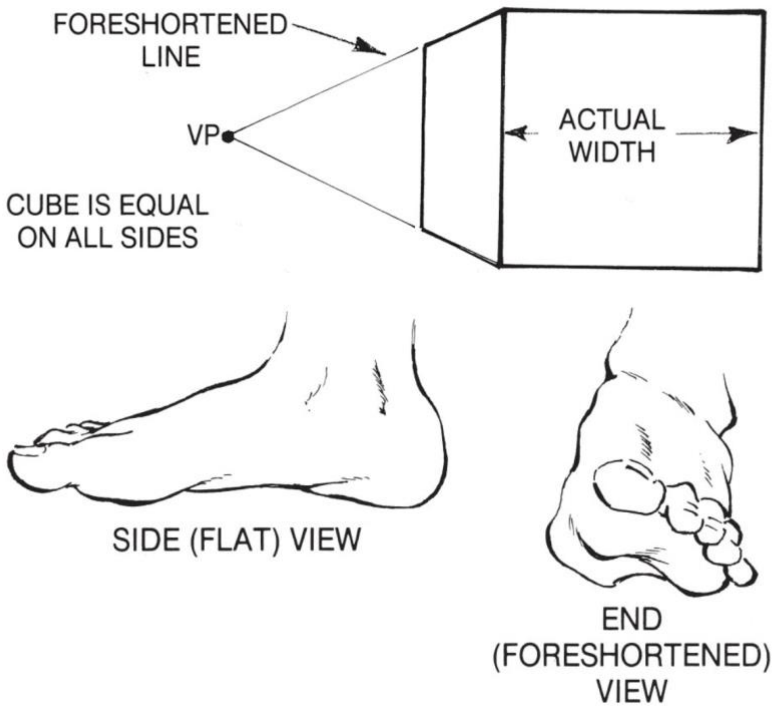
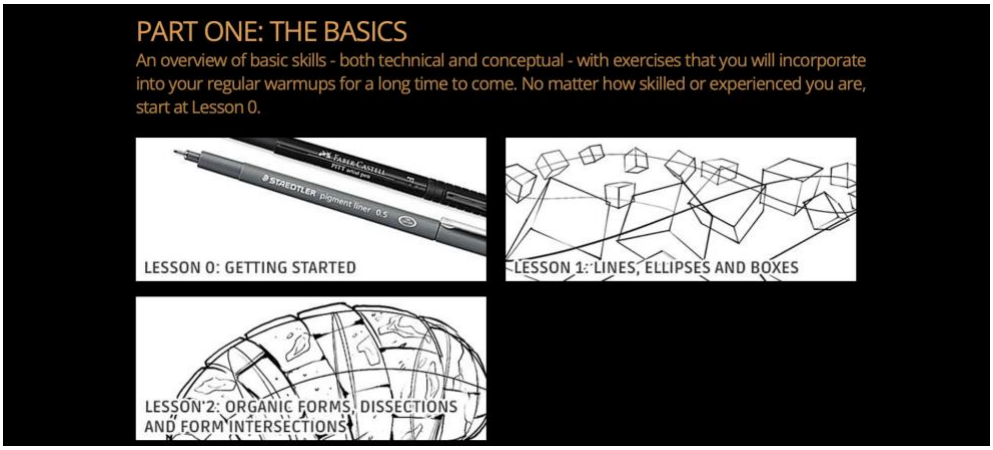


FIGURE 9. Foreshortening (Powell 2013)

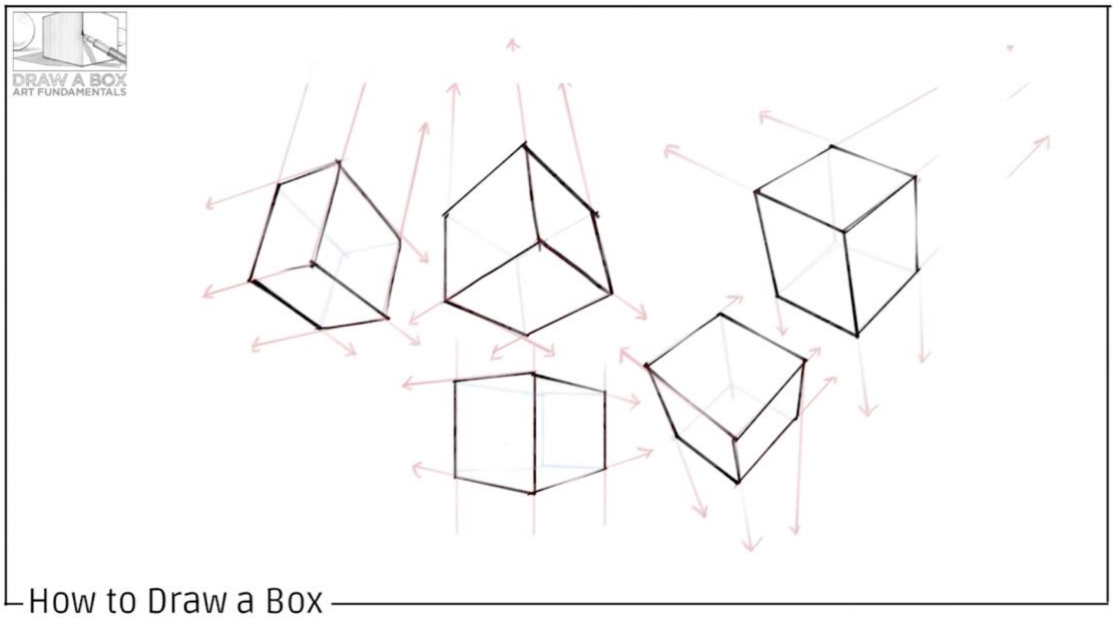
6 DRAWABOX, CONSTRUCTIVE METHODS IN PRACTISE

Drawabox is an educational online resource that provides free exercise-based lessons focusing on linear perspective, organic forms, and using constructive drawing methods. Compared to traditional drawing books, the platform offers many benefits. Drawabox has a strong community that helps other students by critiquing their work. Students can comment drawings and discuss about the assignments and all related topics on the site. The platform also contains a large collection of links to other very useful sites and sources. In addition to all the free materials, the teacher of Drawabox provides in person critiques behind a paywall.

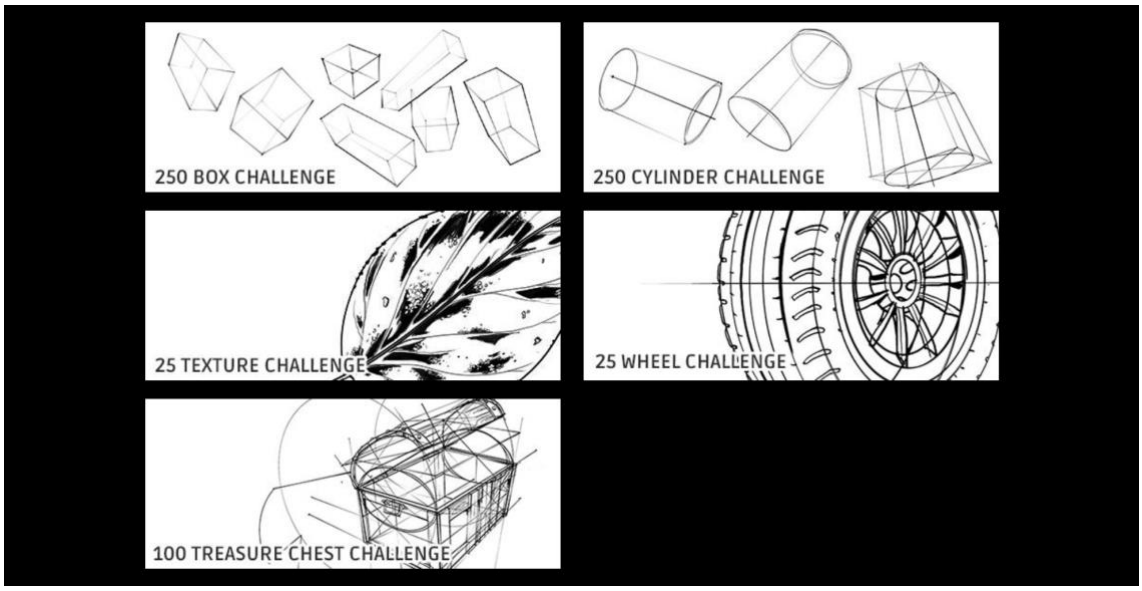
The lessons are well designed with clear guidelines and step-by-step instructions including images and videos. The course starts by introducing the most fundamental skills; how to hold a pen, use the arm, mark-making, and line quality (Picture 7). Understanding linear perspective is at the core of the lessons. The concepts of horizon lines, vanishing points, foreshortening, and distortions are demonstrated with easy-to-follow examples. Each lesson has assignments where the information is put to practice, and after completing a section there are challenges and drills that include large amounts of repetition. One of the first milestones is the 250-box challenge, where students draw 250 boxes from different angles. Even though the challenge may sound easy, drawing a box in perspective from different angles is one of the most difficult skills for beginners to achieve. The progression of the whole course is based on understanding how to draw a box (Picture 8), and the forms and challenges become more complex as the course advances (Picture 9).



PICTURE 7. Drawabox (Drawabox)

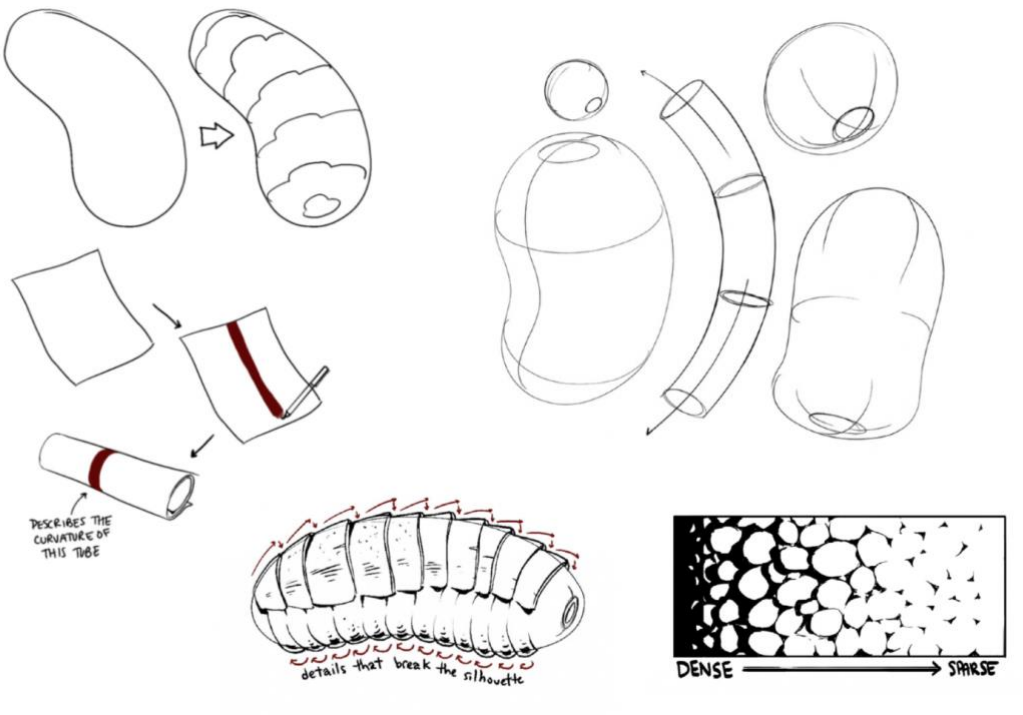


PICTURE 8. Box (Drawabox)



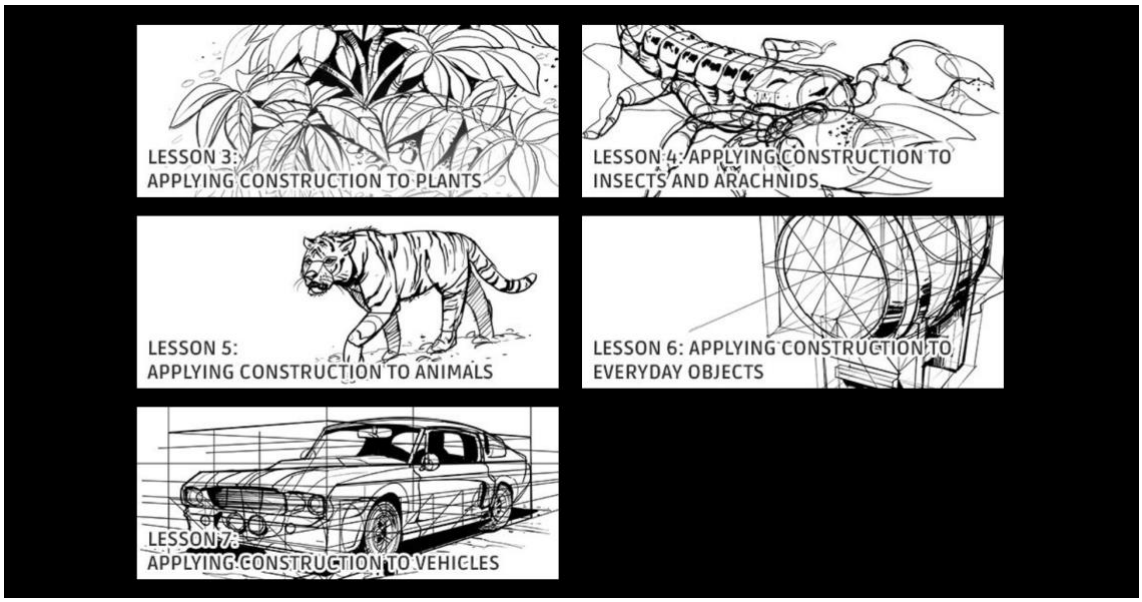
PICTURE 9. Challenges and drills (Drawabox)

After completing the first lessons with boxes and cylinders, more organic forms are introduced. The concept of contours, centerlines, silhouettes, and textures are explained (Picture 10). Instead of shading, the course pursues to demonstrate how to make the forms feel 3D by drawing through forms, using contour lines, and purposely crafting the silhouettes of objects. However, shading achieved with textures specific to the surface is seen as an acceptable method.



PICTURE 10. Organic forms, silhouettes, centerlines, textures (Drawabox)

Constructive methods are introduced by exploring how complex objects can be broken down into their fundamental components. The focus is not on learning how to draw a specific subject matter, but rather to understand the construction from different perspectives. The concept of constructional drawing is applied to many different topics, like plants, animals, and vehicles (Picture 11).

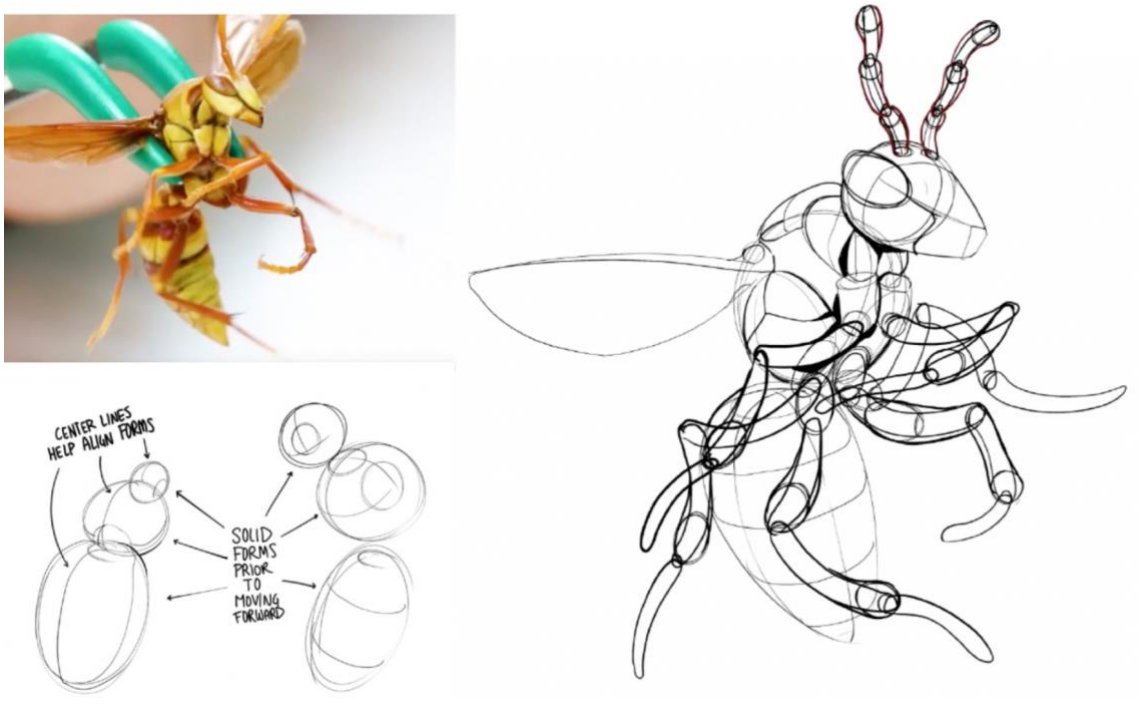


PICTURE 11. Constructive methods (Drawabox)

The plant section includes demonstrations of various plants (Picture12) and mushrooms. The importance of drawing through forms becomes evident in this lesson as the leaves are constructed to overlap one another. The main characteristics of different plants, branches and leaves are presented with detailed examples.

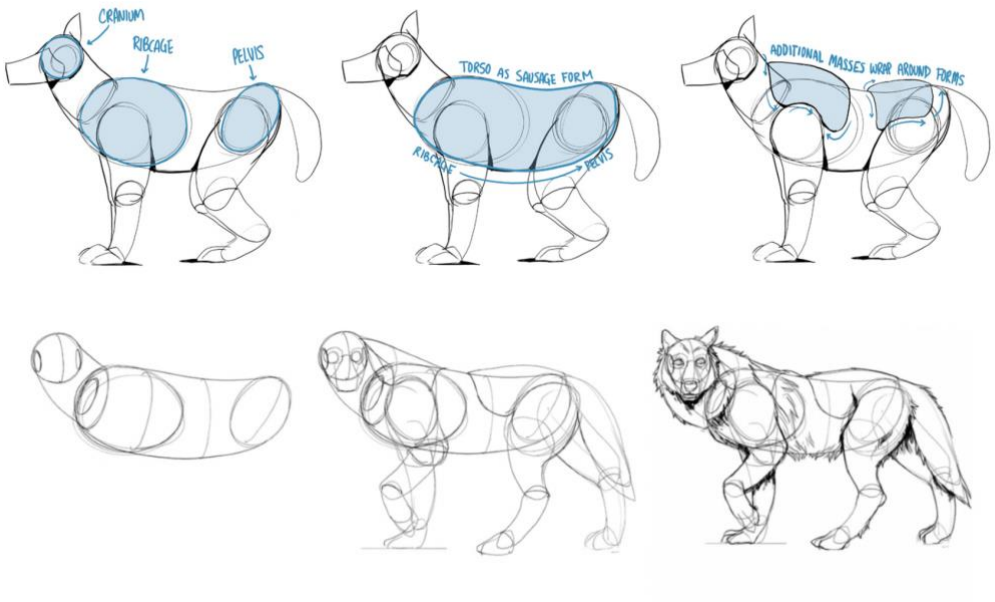
PICTURE 12. Constructing plants (Drawabox)

The insect and arachnids section includes various demonstrations from wasps to scorpions emphasizing construction with solid forms (Picture 13).



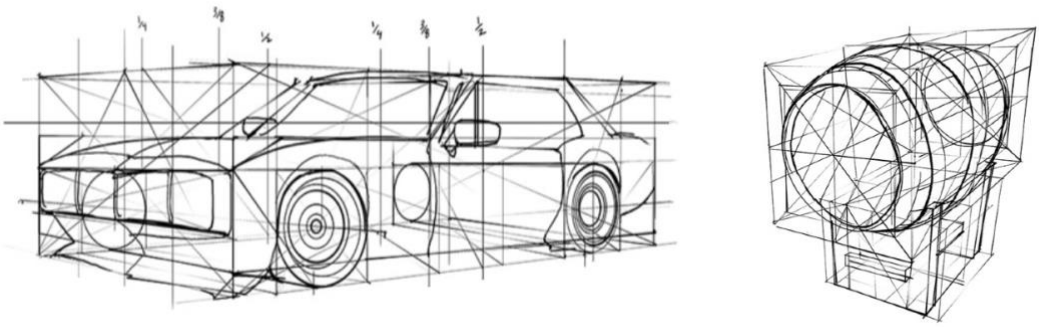
PICTURE 13. Constructing insects (Drawabox)

The concept of thinking the torso as a sausage form is introduced in the animal construction lesson (Picture 14). The sausage form includes the two major masses of the body: ribcage and pelvis. Additional masses are placed by wrapping them along the body's surfaces, which reflects awareness of the relationships between forms. The concept is demonstrated with various examples from smallest mammals to bears and elephants.



PICTURE 14. Constructing animals (Drawabox)

The last sections includes a collection of everyday objects and different vehicles (Picture 15). While the previous lessons mainly focus on freehand exercises without the use of any drawing tools, rulers are now recommended for drawing precise construction lines.



PICTURE 15. Constructing vehicles. (Drawabox)

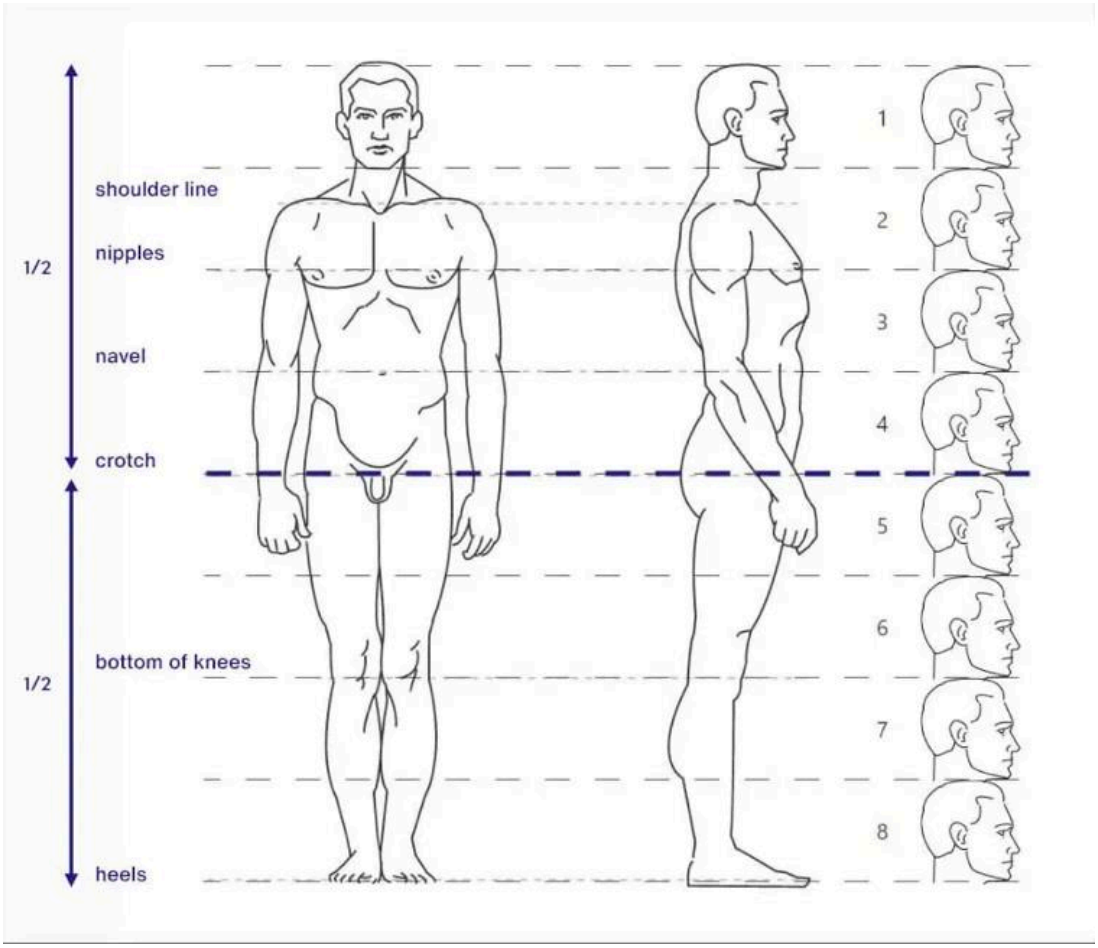
7 CONSTRUCTING THE HUMAN FIGURE

7.1 BODY PROPORTIONS

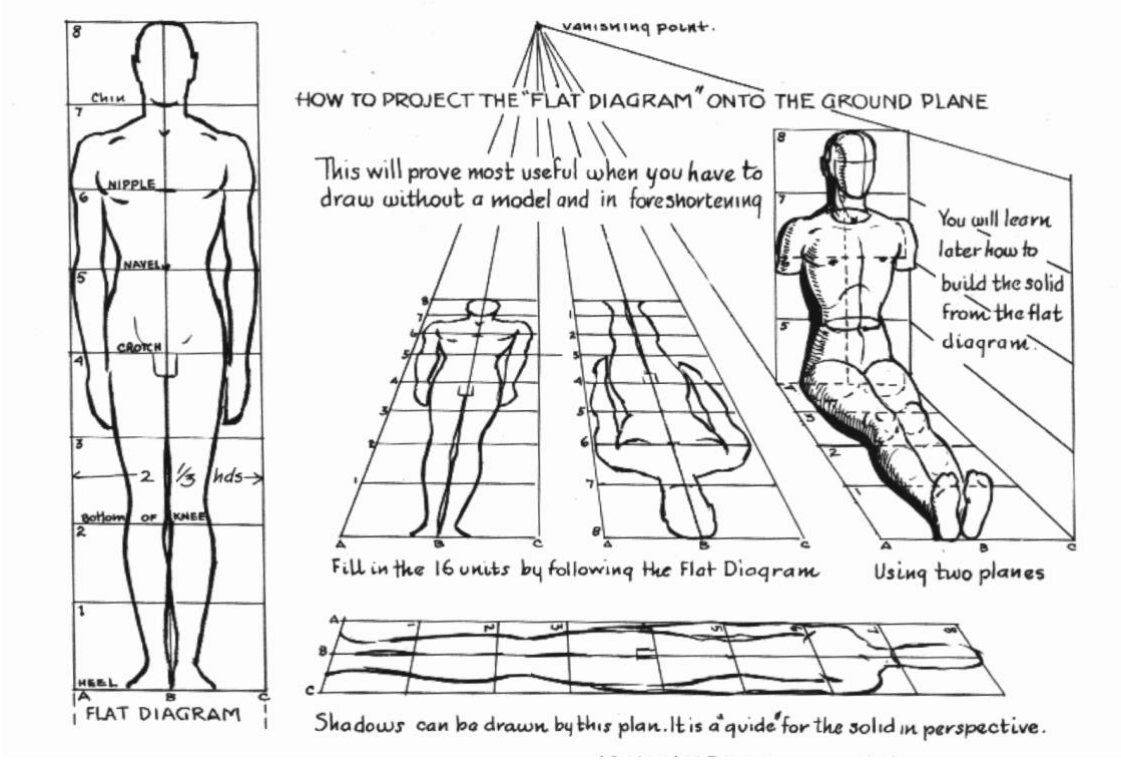
Proportions are the relationships, or ratios, between a subject's heights, widths, and depths. As part of artistic anatomy, the study of body proportions explores the relation of the human body elements to each other and the whole. Even though a significant variation in anatomical proportions can be found between people, certain body proportions have become standard in figurative art. Human proportions can be measured in various ways, but eventually, all the proportions are relative. (Fridman n.d.)

In figure drawing, the basic unit of measurement is the head, which is the distance from the top of the head to the chin. Realistic adult proportions are usually 6 – 7.5 head units, but for long time artists have been using the idealized eight head unit approach that originated in ancient Egypt and Greece and later during the renaissance. Although this method does not correspond to a human's realistic proportions, it still gives a somewhat realistic impression. The eight head tall figure will generally have considerably longer legs and give the appearance of a heroic action figure. (Anatomy for sculptors n.d.)

When the body is observed from an orthographic perspective, all the lines are parallel, and the proportional relationships between parts of the body do not depend on the viewer; in other words, the perspective is turned off. An orthographic projection represents a three-dimensional subject using several two-dimensional views of the subject (Picture 16). When the human body is perceived in real life by the lens of the human eye, the relations of body parts are affected by deformations of the perspective or lens distortions. The body proportions change depending on the angle and the distance from where the human figure is being observed. The closer the subject is, the more it will be foreshortened (Picture 17). (Anatomy for sculptors n.d.) Memorizing the human figure's main landmarks and general proportions can significantly help when drawing from memory and imagination.



PICTURE 16. Human proportions in orthographic projection (Anatomy for sculptors)



PICTURE 17. Human proportion in perspective (Loomis 1943)

7.2 MANNEQUINIZATION

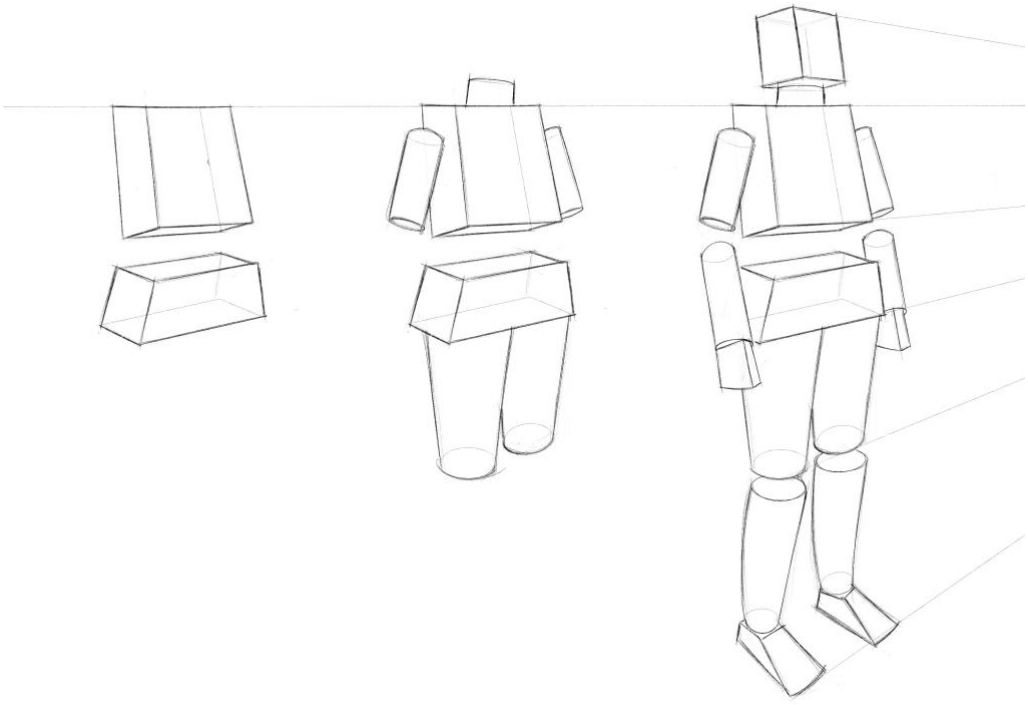
A classic drawing mannequin is a jointed wooden model representing a simplified human figure that is used as a reference for learning how to draw the model from different angles and positions. Modern drawing mannequins include a large selection of different body types with anatomical details and customizable features (Picture 18). However, no matter how detailed the mannequin is, the constructive drawing process starts by blocking in the largest body parts as simplified forms.

PICTURE 18. Drawing mannequins (Fruugo)

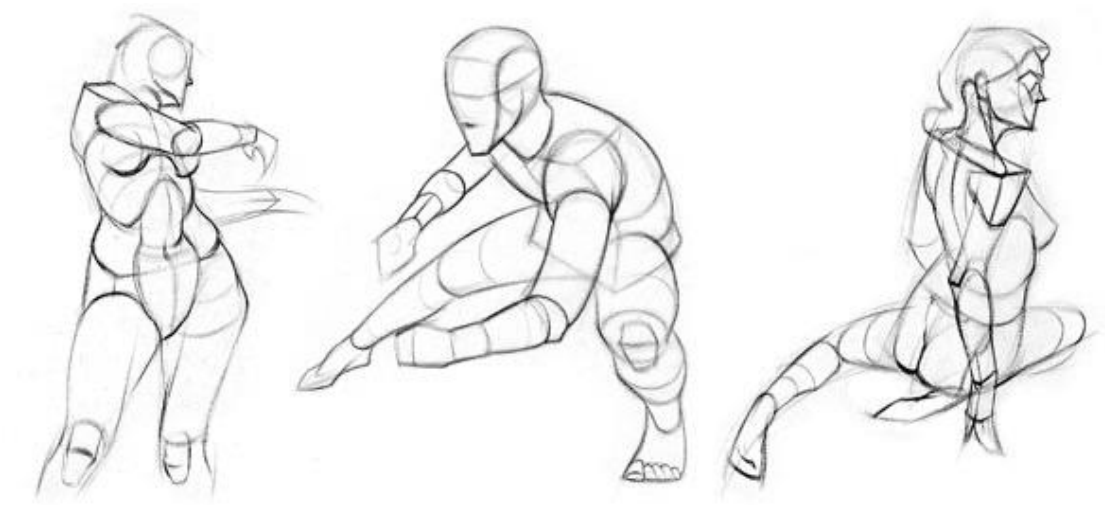
Mannequinization means constructing the human figure using simple three-dimensional forms that interlock together (Prokopenko, 2017). It is a fundamental part of the drawing process that helps achieve depth and volume in drawings. Simply relying on contours to draw the figure quickly results in flat artwork without any dimension. Constructing the body as forms in perspective will give the drawing a sense of solidity, making it easier to start shading. In addition, establishing precise plane changes makes it much easier to imagine the angle of each body part relative to the light source. In his excellent book series *Framed Perspective*, best-selling author, and artist Marcos Mateu-Mestre (2016) states, “Without a clear understanding of the volume of whatever you draw, the application of convincing anatomy, lighting and perspective will be incredibly difficult” (Mateu-Mestre 2016).

According to art instructor Andrew Loomis (1943), drawing the mannequin is used as a lay figure to indicate joints and the general proportion of framework and masses. When drawing a mannequin, there is no need to be concerned with the actual muscles or how they affect the surface because the frame and masses can later be divided into bones and muscles. This way, it is easier to grasp the placing and functions of the muscles. The purpose of the mannequin is to have a direct and quick way of indicating or setting up an experimental figure rather than go through the whole procedure of figure drawing every time. Mannequin drawings are used more often than careful anatomical renderings, and when they are drawn with proportions, it is easier to treat them in perspective. (Loomis 1943.)

Depending on the skill level, the drawing process can be started from any part of the body, but generally the largest parts; ribcage and pelvis, offer a good starting point for the constructive method. The ribcage and pelvis are simplified as boxes that show the largest plane changes of the body (Picture 19). Once the mannequin is understood from different angles in the simplest forms, more organic forms can be introduced (Picture 20).

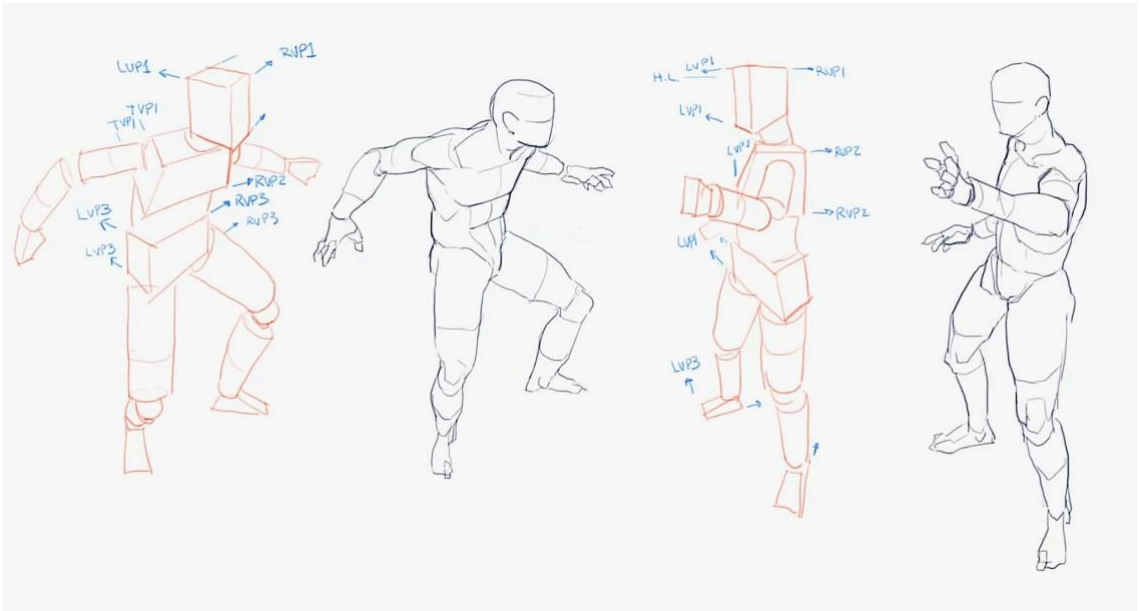


PICTURE 19. Simplified mannequin



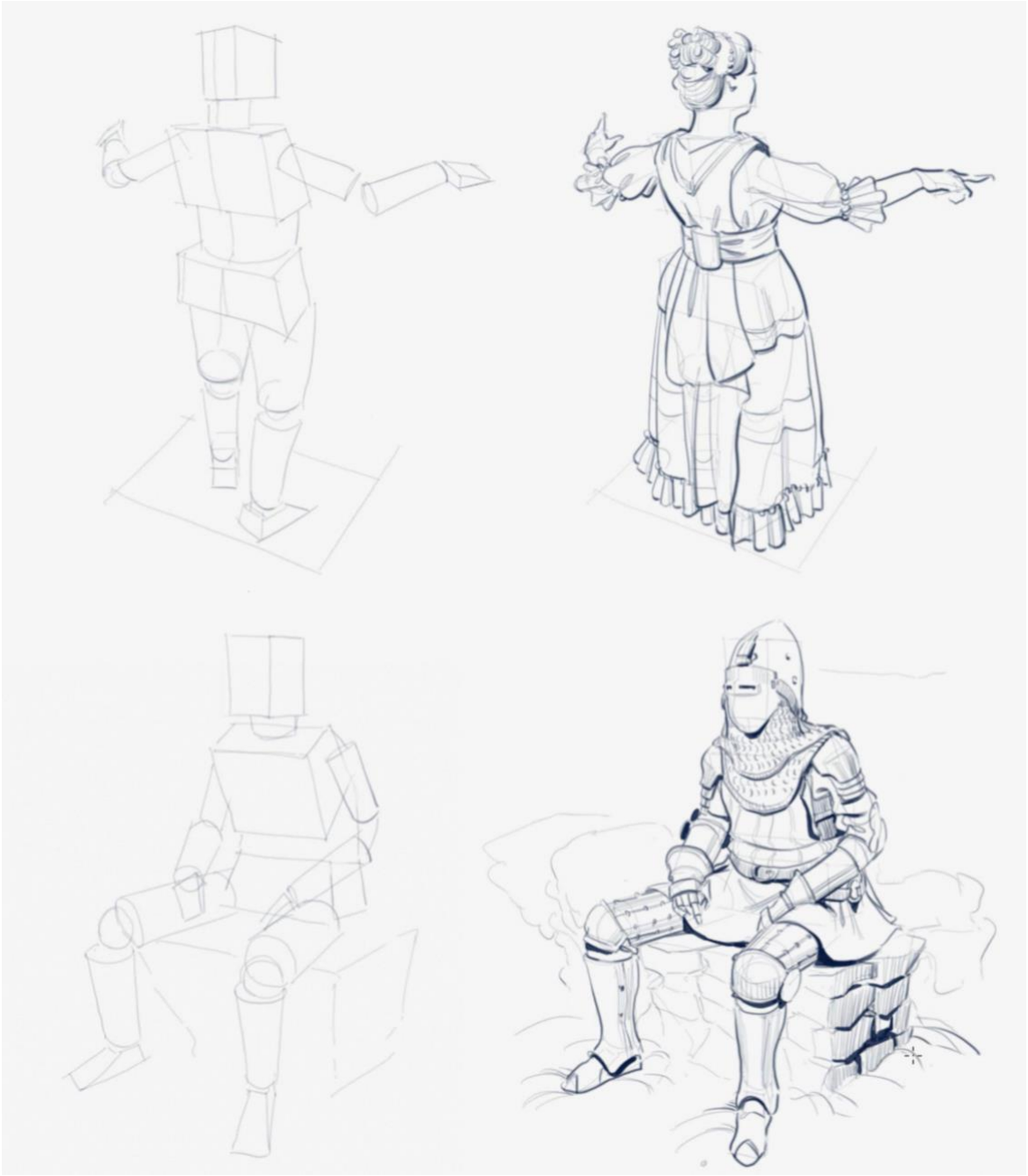
PICTURE 20. Organic mannequins (Prokopenko 2013)

When body parts are positioned in different orientations, they create multiple vanishing points. Some vanishing points converge above or below the horizon line when objects are tilted (Picture 21).



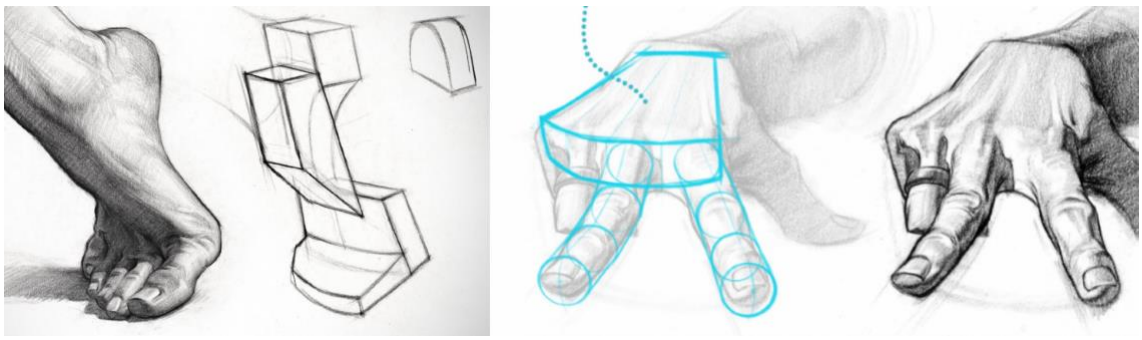
PICTURE 21. Organic mannequins (Douglas 2018)

The mannequin provides an easy and quick way to create the basic framework for characters in different poses (Picture 22).



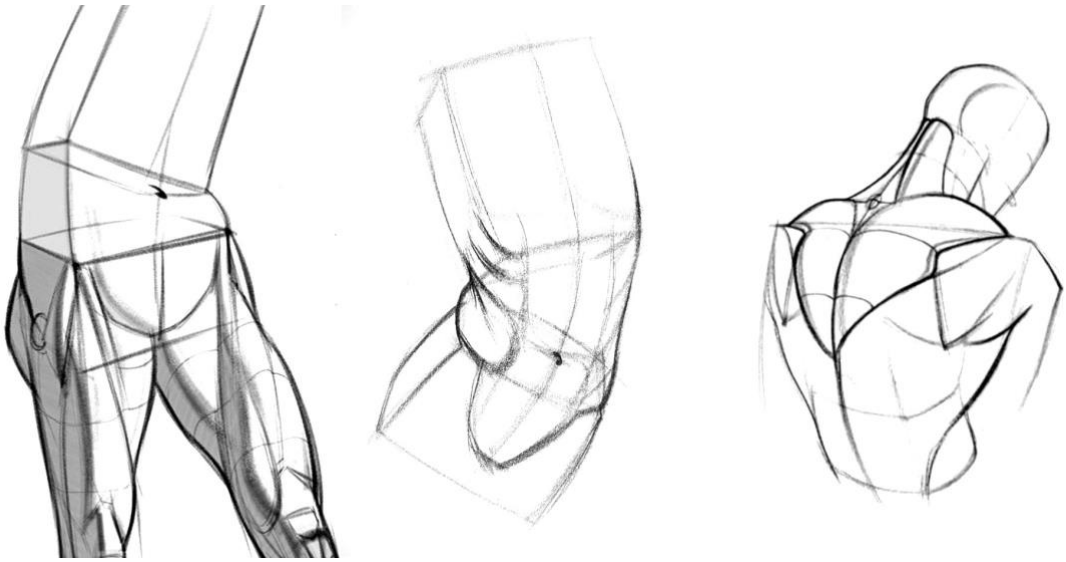
PICTURE 22. Building a character from mannequin (Douglas 2018)

All body parts can be simplified to geometric forms in multiple ways. The main point of simplification is to visualize the form in a way, that makes it easier to handle and modify in perspective (Picture 23). Forms drawn with contours help to show proportions when objects are foreshortened.



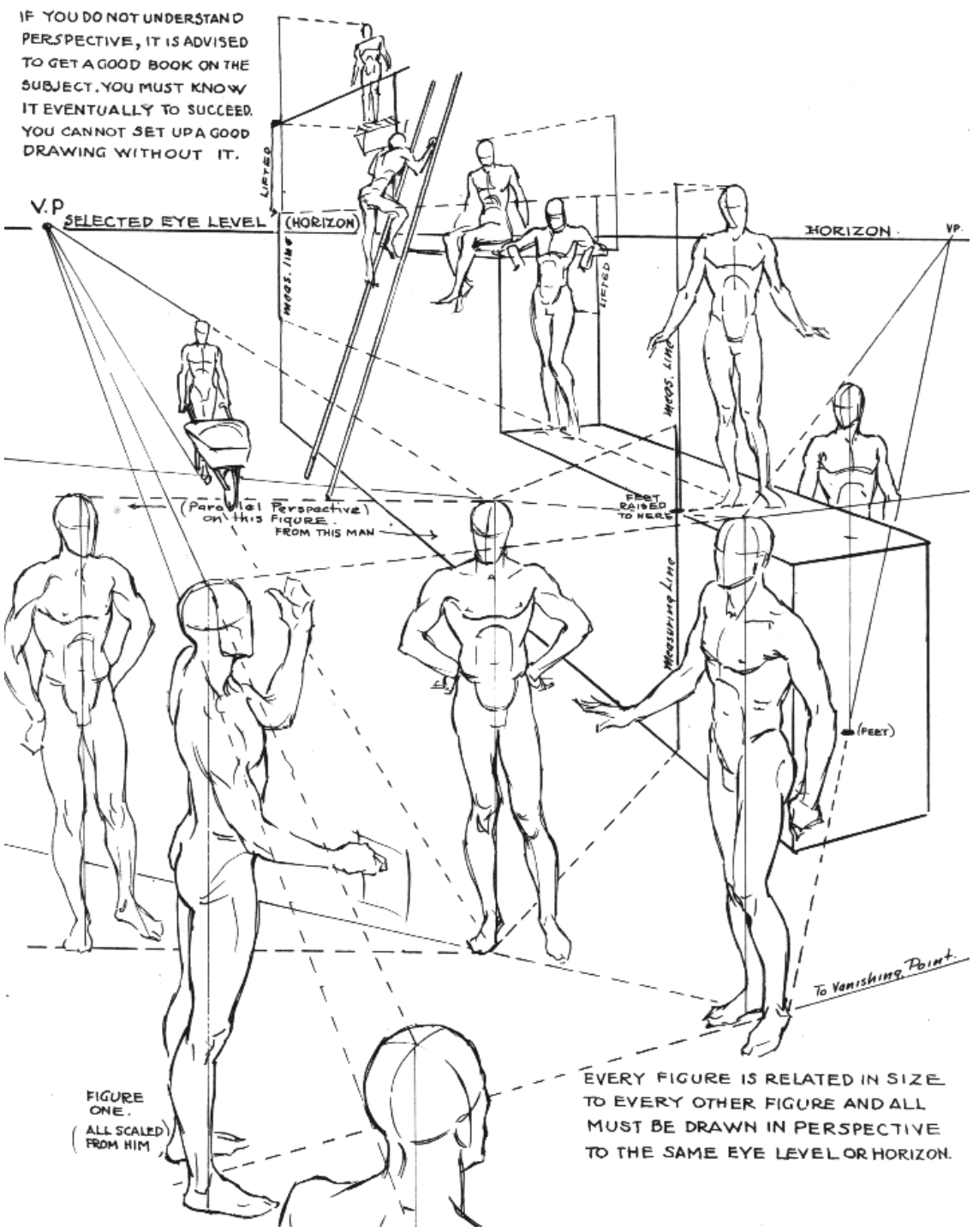
PICTURE 23. Simplifying body parts to geometric forms (Prokopenko 2020)

The muscles are attached to the box and cylinder-shaped major forms of the body as additional masses (Picture 24) similarly as previously demonstrated in the drawabox animal section. It is important to learn the location of the attachment points of muscles and how they wrap around the major shapes in relation to each other. Human anatomy is one of the most challenging things to draw. However, when the underlying simplified major forms are understood in perspective, the process of attaching the muscles correctly becomes much easier. The muscle forms are very organic and constructing them with contours gives them a sense of depth and perspective.



PICTURE 24. Muscles attached to the major forms (Prokopenko 2016)

Once the body is understood comprehensively, the mannequin can be drawn in the desired anatomical detail quickly. The horizon line should always be placed first when drawing a scene. The mannequin is positioned in relation to the horizon line and the size of each mannequin is in relation to each other (Picture 25).



PICTURE 25. Mannequins in perspective (Loomis 1943)

8 CLASSIC METHODS

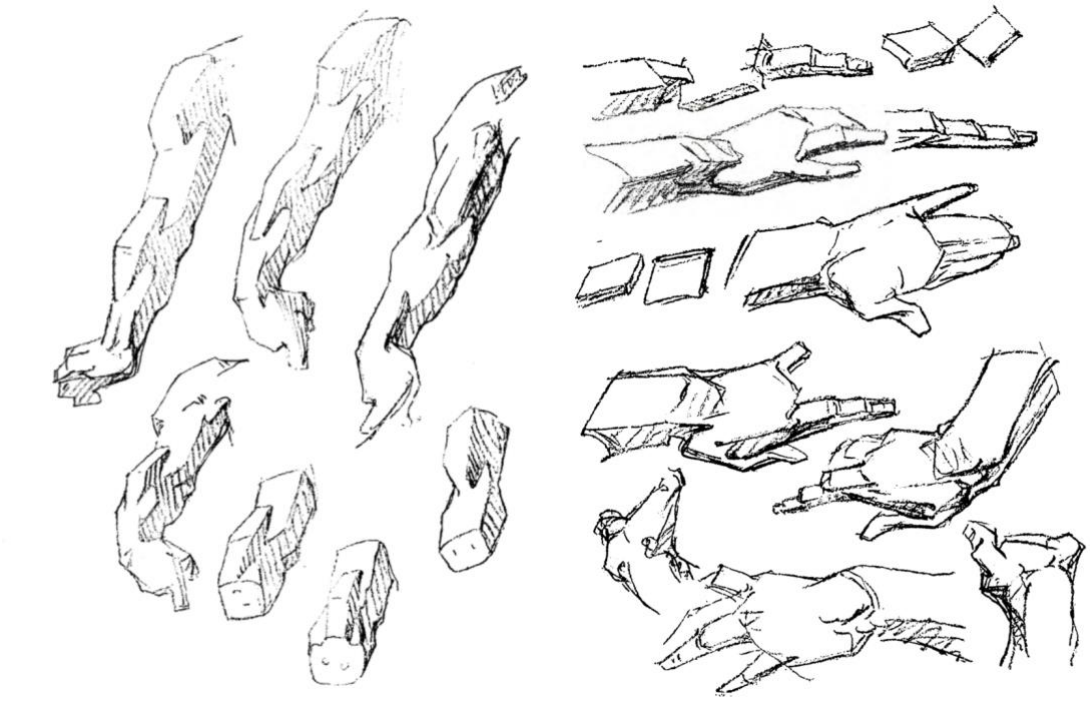
8.1 BRIDGMAN CONSTRUCTIVE ANATOMY

George Bridgman (1865–1943) was a Canadian-American painter, writer, and anatomy and figure drawing teacher. Bridgman taught anatomy for artists at the Art Students League of New York for some 45 years. *Constructive Anatomy* is a collection compiled by Bridgman's former students that include pedagogical drawings and thoughts about human anatomy. Countless artists and students since the 1920's have used this book for a solid foundation and understanding of human anatomy.

According to Bridgman (1920), the conception of figure must begin with the thought of body parts as masses and their relation to each other. The concept of mass comes first, the planes of the mass second, and the lines that construct the planes last. He states, "Think in masses, define them in lines". (Bridgman, 1920.)

The method demonstrated in *Constructive Anatomy* is focused on understanding the anatomy as three-dimensional forms that wedge, or in other words, interlock into each other and flow through the body (Picture 26). Wedging and passing forms help students understand the body's structure and how certain muscles and bones overlap one another. Interlocking forms together also brings more depth to the figures. Bridgman simplifies body parts to shapes and then uses exaggeration to emphasize the roundness of the rib cage or the squareness of the pelvis. The exaggeration makes the figures very dynamic, and it shows which parts of the body are bony and which are muscular. Bridgman also often emphasized the body's gesture by twisting forms (Picture 27).

Perspective teacher Marshall Vandruff (2020) sees Bridgman's methods as most useful when the goal is to invent imaginary figures that are anatomically sound. In contrast, Bridgman's methods are also some of the most difficult for beginners because the simplified drawings leave out so much information. However, according to Vandruff, leaving out details does have an advantage. He states, "Students who pursue detail at the expense of structure never master drawing". (Vandruff 2020.)



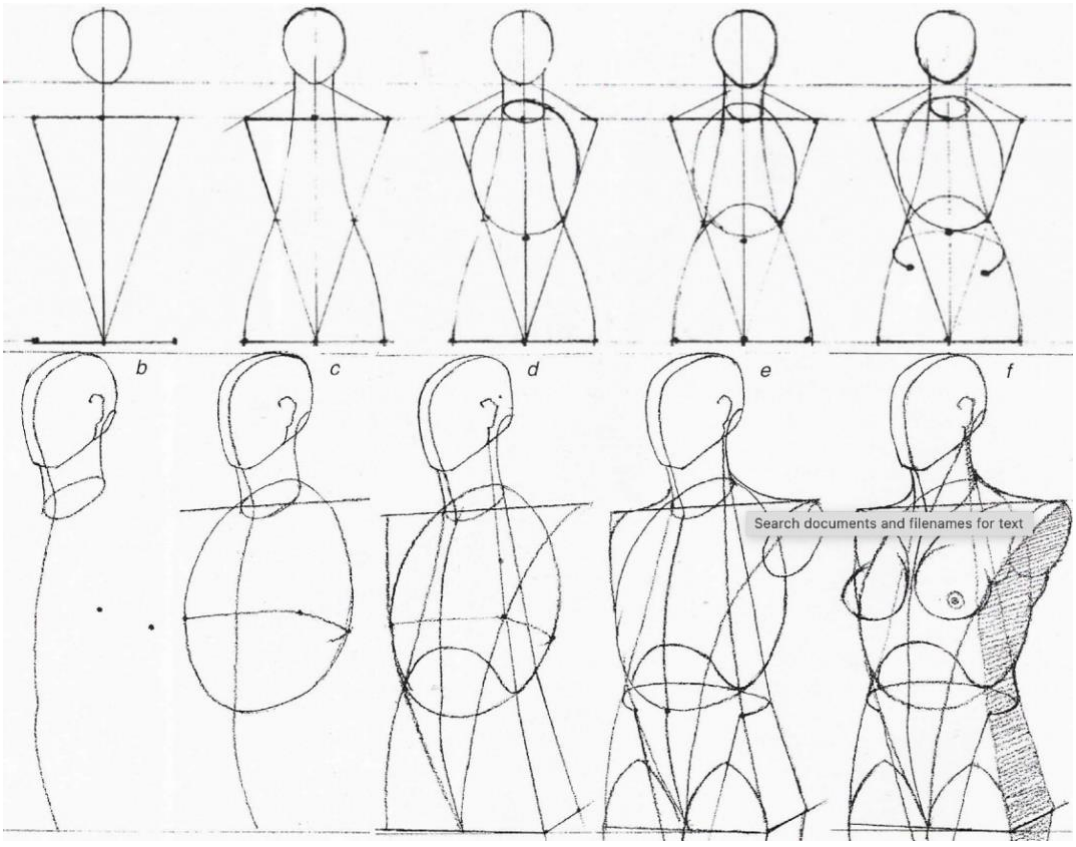
PICTURE 26. Wedging (Bridgman 1920)

PICTURE 27. Twisting forms (Bridgman 1920)

8.2 THE REILLY METHOD

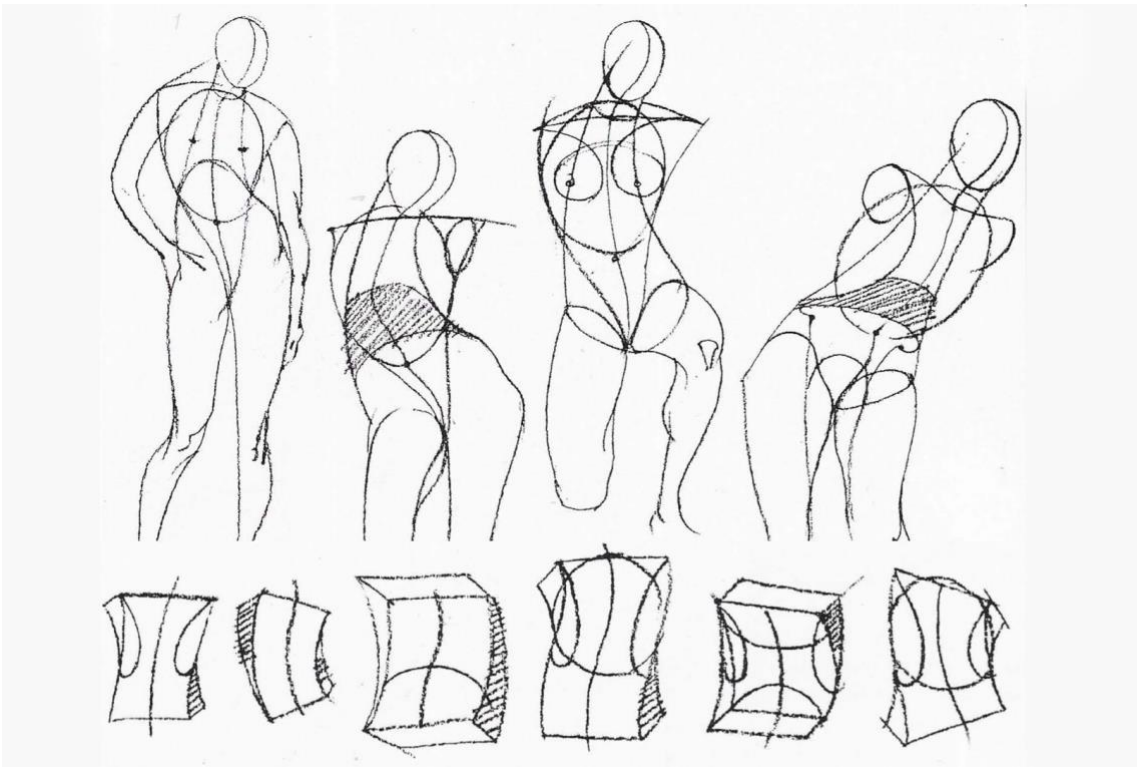
Frank J. Reilly was one of the most influential art teachers in the United States and the founder of the Frank J. Reilly school of art. Reilly was a student of George Bridgman, and he continued Bridgman's figure drawing class after he passed away in 1943. The Reilly approach is based on constructive methods and diagrams emphasizing lines and shape design. In addition, it follows basic art principles of rhythms, harmonies, and consistencies. Reilly's approach has become popular among professional illustrators and fine art applications.

Reilly's method to figure drawing shows the logical sequence of constructions, starting with structural lines that form the body's framework to which primary forms are placed (Picture 28). The forms are then divided into planes that connect the corners of the form and create tangents with other planes. This helps to understand how lights and shadows fall on the forms to create the illusion of depth. In addition to defining forms and planes quickly, this method aims to help the artist think about the relationships and proportions of the various body parts in perspective.



PICTURE 28. Constructional lines and planes (Faragasso 1998)

Reilly emphasizes the importance of understanding the large forms of the human figure and how they react to the movement (Picture 29). According to Reilly's former student Jack Faragasso (1998), most beginners miss the twisting and bending of the major forms of the torso because they don't understand the structure. If the structure is not comprehended, the drawings tend to lack the three-dimensional aspect of the form in action. (Faragasso 1998.)



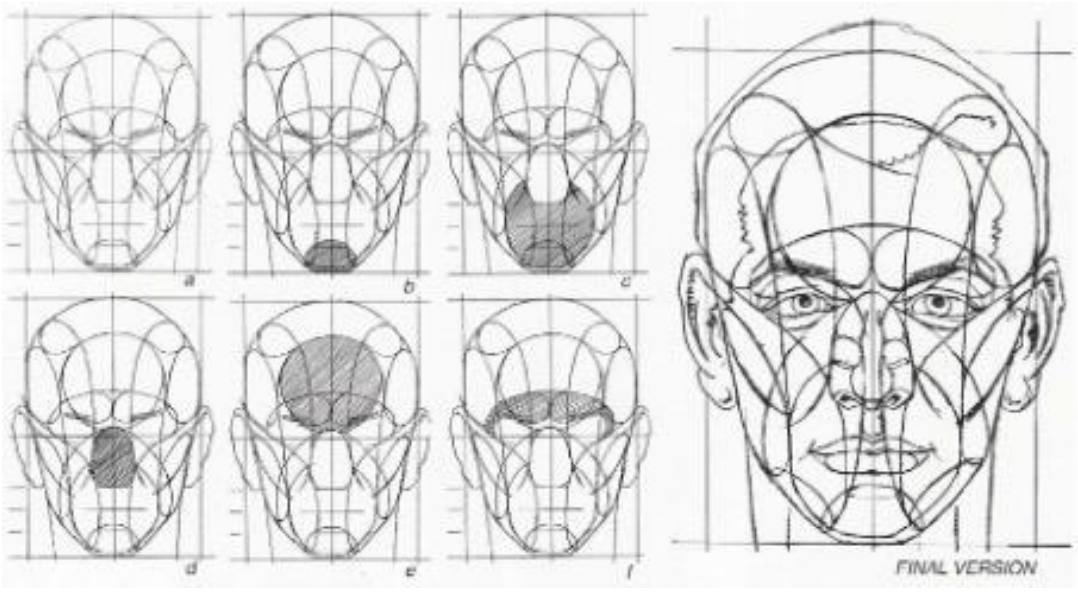
PICTURE 29. Twisting forms (Faragasso 1998)

Fine art teacher Jeff Watts (2018) calls Reilly's diagrams abstractions, and many artists often refer to Reilly's methods simply as abstractions. According to Watts, abstractions change the way artists think of design by showing the relationships of anatomical features and how they interact together. It is a new, fast way of comparing relationships without constantly measuring. The fluidity of the abstraction lines gives a more intuitive approach to learning figure drawing and enables the artists to create very dynamic drawings quickly. (Watts 2018.) Reilly's methods require a thorough understanding of linear perspective and anatomy but can provide an efficient and enjoyable way to learn figure drawing. The diagrams can also be used for other subjects than human figures to give designs more flow.

Reilly's method to head drawing is a linear representation of the head using flowing rhythmical curves that trace the connections between shapes and features (Picture 30). It is a tool that helps improve the construction of drawings, especially when drawing the head from extreme angles. The lines of the head diagram describe the forms, edges, and shapes of the planes, which are mainly based on the skull structure and facial muscles. (Faragasso 2018.) Shadows always begin and end at the edges of the planes, which makes this method very efficient in locating similar values in different parts of the head. Values of shading change between the planes, sometimes to great degree, sometimes to a minimal degree depending on the anatomical construction and lighting.

The process starts with the large head shape marked with the center line and basic proportions of the facial features. Next, the rhythm lines connect the facial features and divide the forms into planes, progressing from the largest shapes to the smallest subdivisions. The curvature of the lines can be adjusted depending on the model, and while certain forms may be more dominant than others, the main structure of the diagram stays the same.

Caricature artist Court Jones (2016) sees the abstraction as a method that helps to reduce the complex forms of a rough sketch to something easier to manage and analyze. The diagram quickly shows if some features are unbalanced or misplaced. (Jones 2016.)

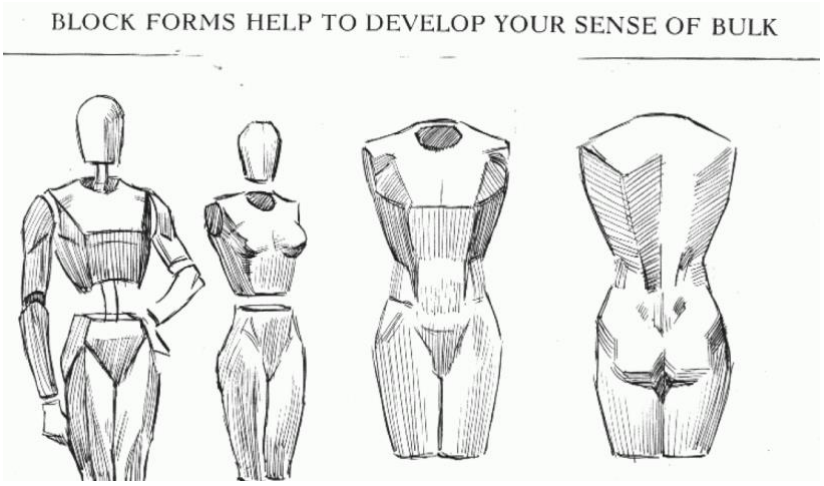


PICTURE 30. Reilly's head diagram (Faragasso 1998)

8.3 THE LOOMIS METHOD

Andrew Loomis was an American illustrator, art instructor, and student of George Bridgman. His commercial work included many of the largest companies like Coca-Cola and was featured prominently in advertising and magazines. However, Loomis is best known as the author of a series of instructional art books printed throughout the 20th century. Many of the books exhibit Loomis's own personally crafted techniques that help artists draw human figures.

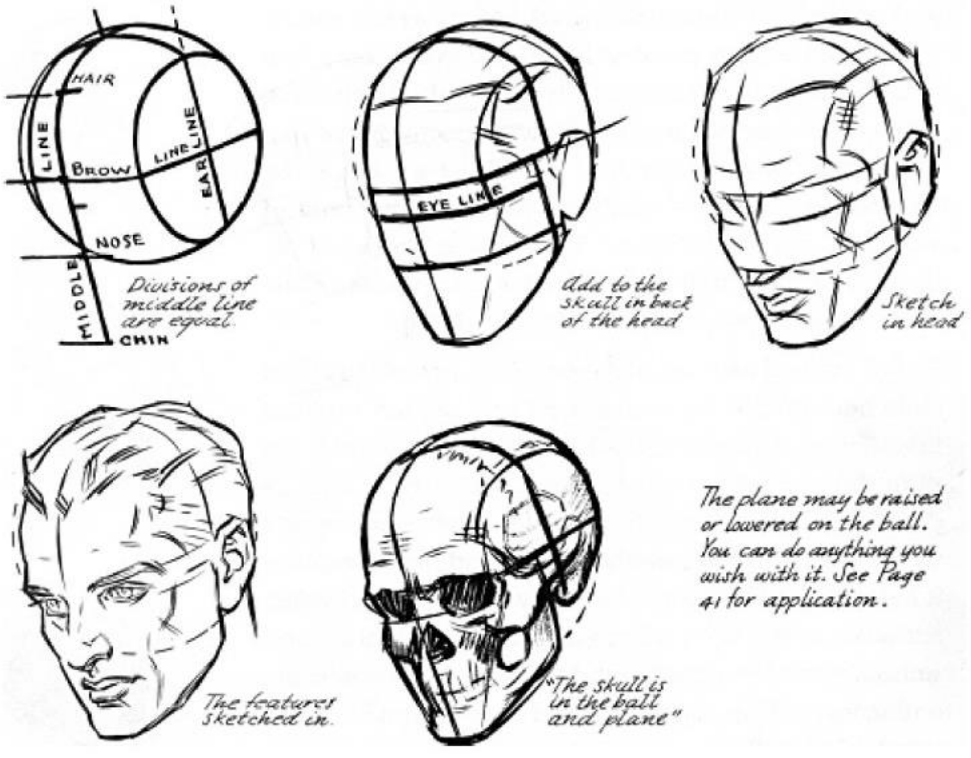
Loomis uses constructive methods by simplifying the body into forms and planes. He often compares figure drawing to sculpting and uses the mannequin as a framework to show how mass, bulk, and weight is built on it (Picture 31). In his book *Figure Drawing for All it's Worth* (1943), he states, "We can start with a big block, as the sculptor would start with a block of stone or marble. We then subdivide the big, straight planes into smaller ones until the rounded effect has been produced". However, although the methodology is similar to sculpting, Loomis emphasizes that the drawings should not be too polished to retain the figure's structural qualities and artistic interpretation. According to Loomis, tracing lines or copying without building won't produce good results. The correct assembling of the parts of the figure is much more important than individual features and details. Even though anatomical knowledge is essential, understanding perspective and the fundamental framework of the body is primary. (Loomis 1943.)



PICTURE 31. Blocking forms on mannequin (Loomis 1943)

One of the most popular Loomis methods used by artists is the so-called divided ball and plane method of head drawing (Picture 32). The method demonstrates how to construct the ball and plane as a unit that can be tilted or turned in any direction. The ball and plane are designed to give the appearance of the actual bone and muscle structure that helps to place the features of the face. The focus is not on how the head features look but rather on how they are positioned and constructed in relation to the pose of the head. Because the model is a simplified version of the actual human head, it is easier for the artist to manipulate and exaggerate proportions while sketching. This is very useful when for example creating caricature drawings.

In his 1939 book, *Fun With a Pencil*, Loomis demonstrates a variety of types and characters that are possible through building by the divided ball and plane method and states that each looks different mostly because of the skull rather than the features. The real value of this method is that it makes the accurate construction of the head possible without a model or a reference. When a model is used, it allows the artist to render the face type recognizable with certainty. (Loomis 1939, 38.)

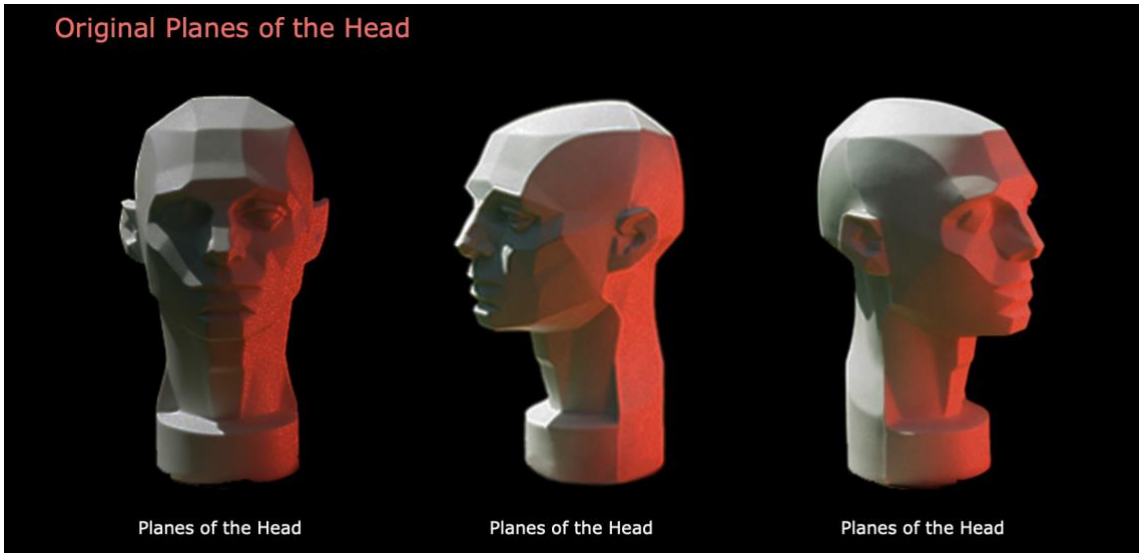


PICTURE 32. The divided ball and plane method (Loomis 1939)

9 PLANES OF THE HEAD, THE ASARO HEAD

The Asaro head is a simplified plastic model of a human head (Picture 33), designed in 1976 by American painter and art teacher John Asaro. It is one of the most widely used tools for studying portraits. The model represents a simple geometric stylization of the planes of the head, and it is used as a tool for learning in an effective and orderly progression how to draw the human head. The planes help artists understand how light and shadows create form when viewed from different angles. The Asaro head applies to both sexes and all races, with variations only in proportion. The left half shows the basic structure of the head's planes as seen in rounded and or younger faces. The right half shows a more complex structure characteristic of a thinner and older face. (Planes of the Head n.d.)

Understanding and memorizing the planes helps develop the ability to draw human heads from memory and imagination. The planes emphasize the precise alterations in values that are easier to remember than placements of gradual shadows. Drawing from a physical model such as the Asaro head develops observational skills more efficiently than drawing from a photo reference because eyes can see all the dimensions and volume naturally.

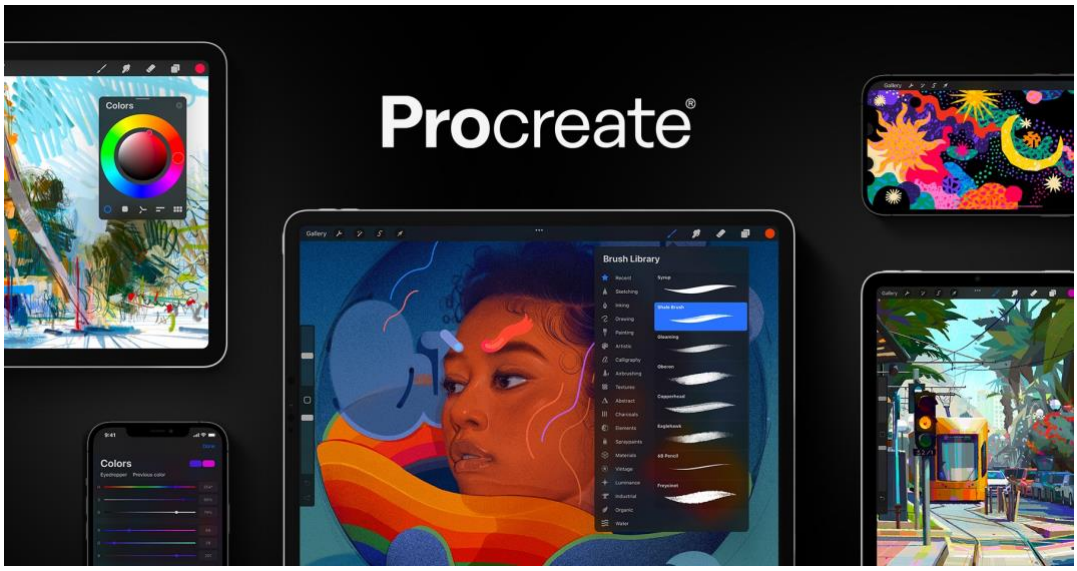


PICTURE 33. The Asaro head (Planes of the Head n.d.)

10 APPLICATIONS

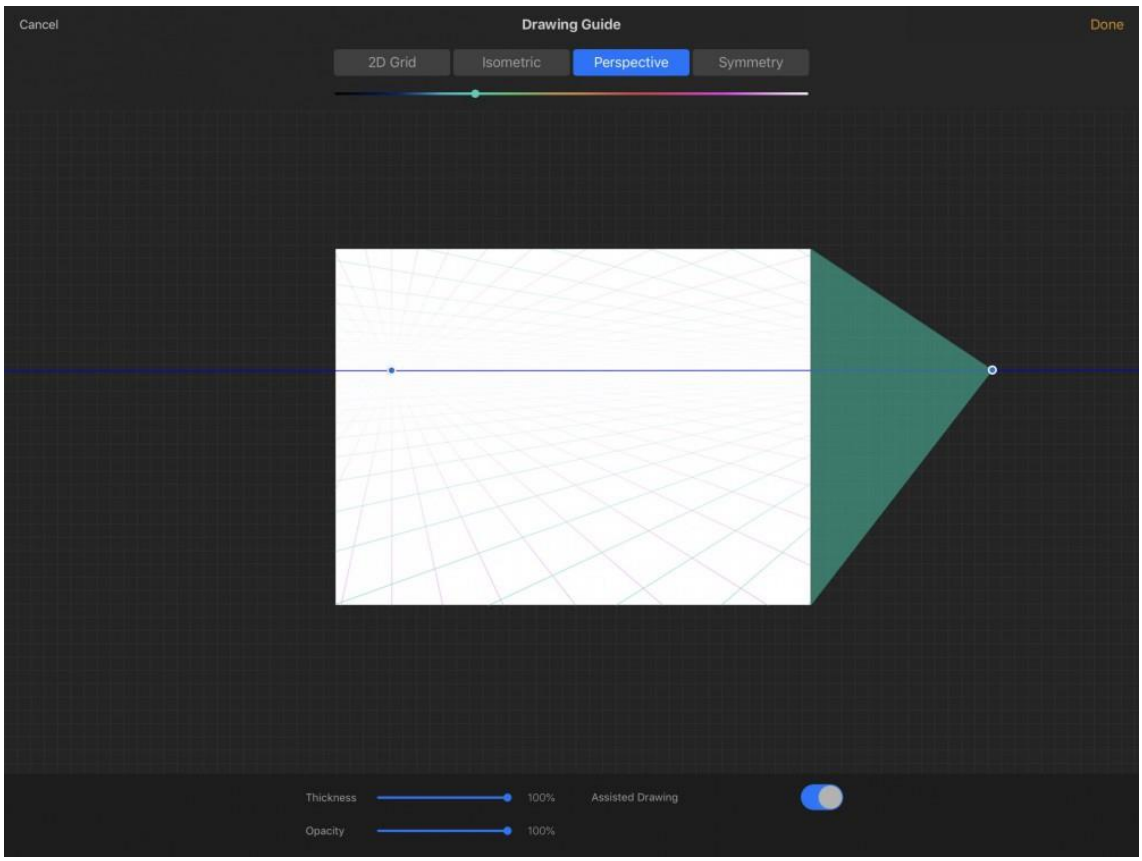
10.1 PROCREATE, PERSPECTIVE DRAWING GUIDES

Procreate is a pixel graphics application made for digital drawing, painting, illustration, and animation (Picture 34). The application was designed in response to the artistic possibilities of the iPad and for many artists who rely on Procreate, the applications responsiveness, particularly when used with an Apple Pencil, makes it feel similar to making art on paper. The natural feeling combined with portability, functionality, and easy integration with existing workflows has tipped the scales in the application favor, even among veteran commercial and fine artists. Procreates interface is very intuitive and easy to use. The application includes customizable brush, color, and menus that give users complete creative control over their projects.



PICTURE 34. Procreate (Procreate)

Drawing guide is a feature in Procreate that enables the user to create customisable guidelines with four different modes: 2D Grid, Isometric, Perspective, and Symmetry (Picture 35). The perspective mode includes a horizon line and up to three adjustable vanishing points, giving the option of one-point, two-point, or three-point perspective. The thickness, opacity and colour of the guidelines can be adjusted to change the appearance. Drawing guide also includes a feature called Drawing Assist that forces all the strokes drawn to follow the guidelines.

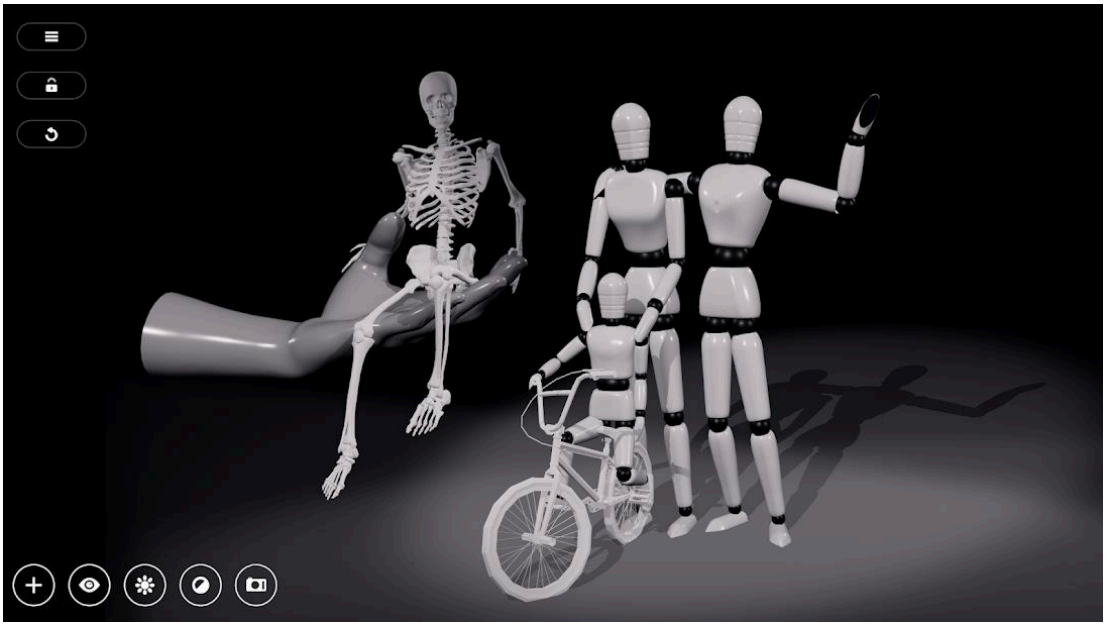


PICTURE 35. Perspective guide (Procreate)

Perspective guide provides an excellent way to quickly visualize different viewpoints inside a gridded picture that creates a feel of space. While many artists seem to use perspective guides to check and refine sketches to correct perspective, it can also be used to guide the whole drawing process starting from the sketch. According to comic artist Robert Marzullo (2016), the greatest advantage of using perspective guides in Procreate is that the vanishing points can be placed far from the canvas, which is very difficult when drawing on paper (Marzullo 2016). However, in 2020 Digital Arts article *The Perspective Drawing Techniques of Top Illustrators*, illustrator Guy Shields (2020) points out that when working with a perspective grid, artists often align all the objects to the initial vanishing points that can create a stiff appearance to the artwork. It is visually more interesting and convincing if some objects are unaligned by using independent vanishing points on the same horizon line. (Hassel 2020.) Most graphic applications include similar perspective guides and while they are beneficial for learning and creating accurate drawings, students shouldn't rely barely on drawing with guides.

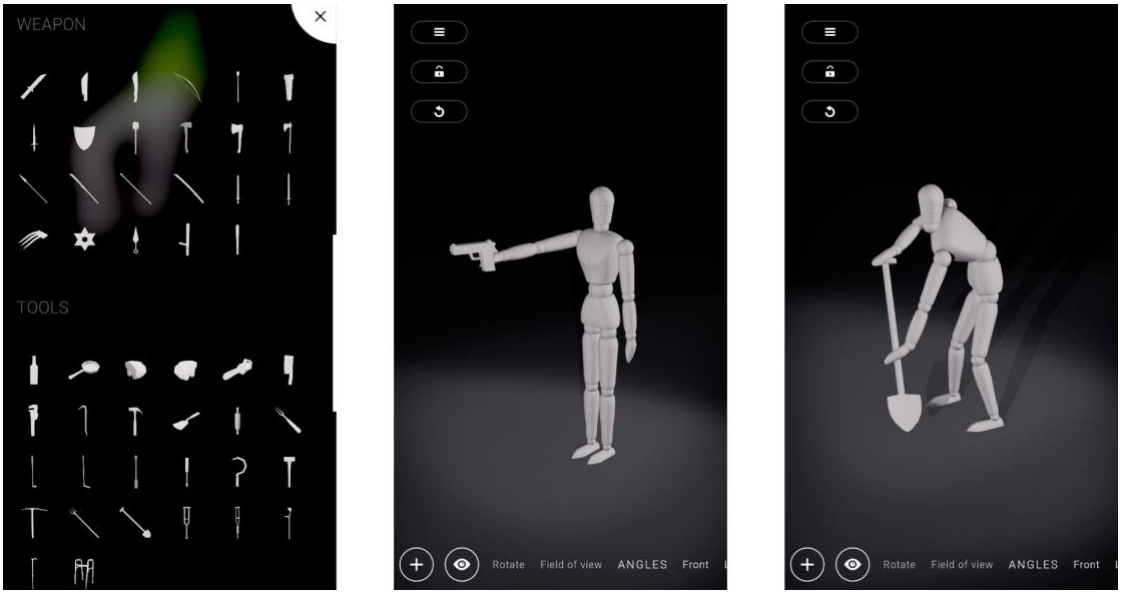
10.2 MANIKIN

Manikin is a 3D posing tool application containing a collection of models and tools to help professional artists and amateurs draw human figures and different objects in perspective (Manikin App). Manikin enables artists to create scenes with multiple characters and accessories to quickly visualize sketches and generate storyboards with screenshots or framing illustrations (Picture 36). The application was born out of the need for an interactive human figure reference that helps to understand challenging aspects of perspective like foreshortening, proportion, and depth. The perspective guides show how the proportions of the mannequin's change depending on the angle they are viewed. In addition to mannequin models, the application includes posable hands, skeletons, weapons, tools, furniture, and other objects. Multiple lighting and camera options give the user complete control over angles and shadows. The combination of libraries with various objects and adjustable lighting makes the application an excellent tool for learning how light falls on forms. One of the most valuable features of the application is the animation references library, which has an extensive selection of figures and hands in motion. The user interface is intuitive, visually pleasing, and easy to navigate. Manikin is currently available on Mac, iPhone, and iPad.



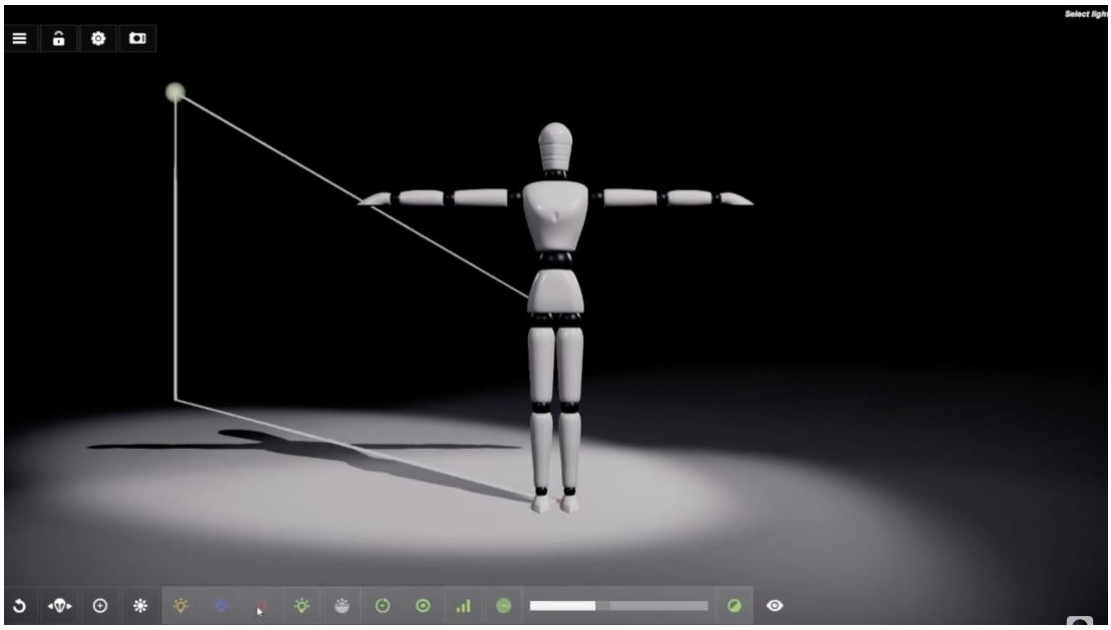
PICTURE 36. Manikin App on iPad (Manikin App)

The application includes libraries with a selection of different props, like weapons and tools for user to choose from. The props can be linked to the mannequins to follow the movement of the body (Picture 37).



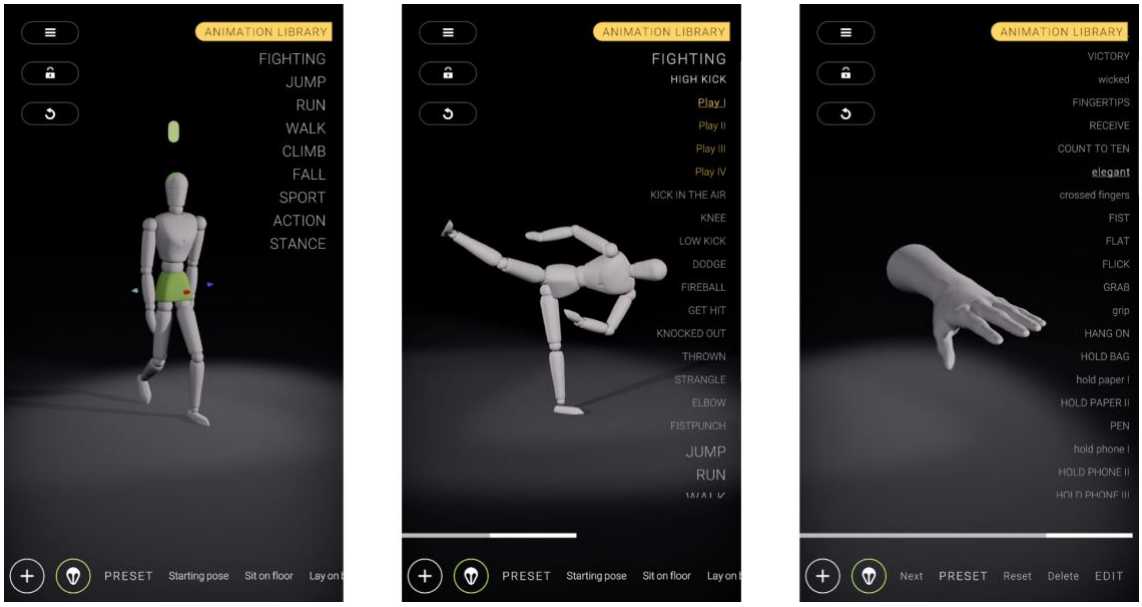
PICTURE 37. Props on iPhone (Manikin App)

Lighting options include global lighting and four adjustable spotlights that allow the user to create dynamic shadows and realistic depth (Picture 38). Multiple lights can be used simultaneously with separate settings of colour, intensity, and target points. Screenshots can be taken without the background and quickly transferred to digital drawing software's.



PICTURE 38. Lighting on Mac (Manikin App)

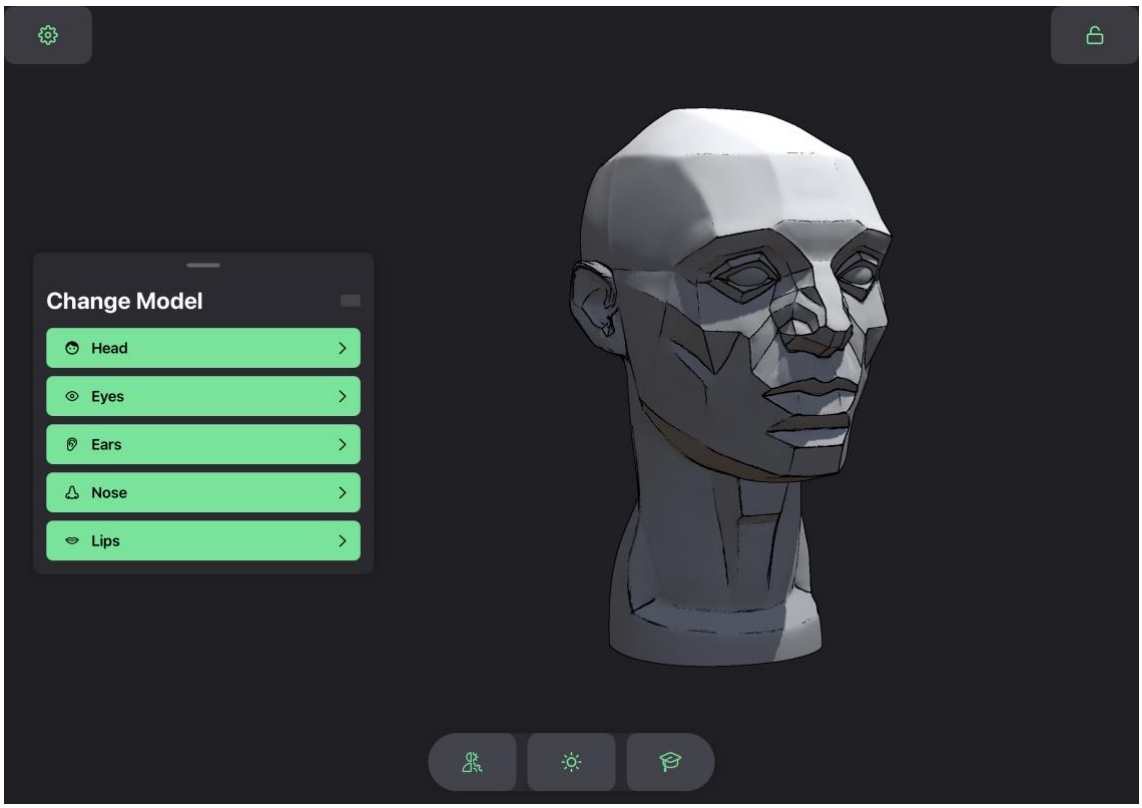
The animation references offer an extensive selection of figure studies on motion Picture 39). The references include activities like fighting, jumping, running, walking, climbing and the figures can be viewed from any angle during the motion. Hands have a separate library that includes different gestures like holding a phone and counting with fingers. Body movements are not easy to imagine even for experienced artis and therefor Manikin is a great tool especially for animators.



PICTURE 39. Animation reference library on iPhone (Manikin App)

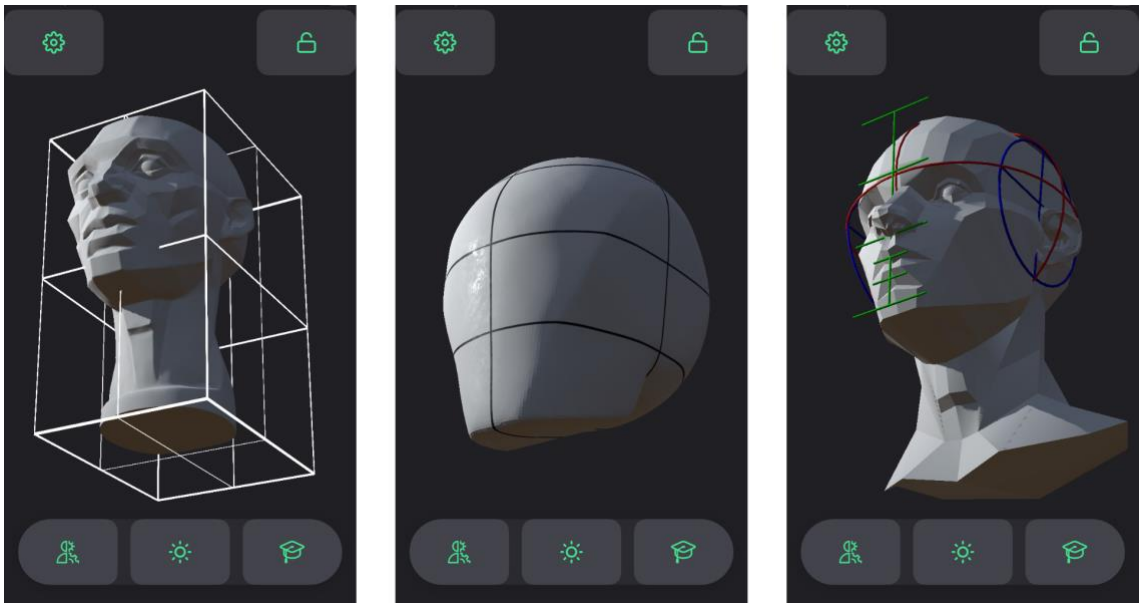
10.3 HEAD MODEL STUDIO

Head model studio (Picture 40) is an application designed to help artists in learning to understand the structure of human heads in detail from simple planes to complex geometry. The application is strongly inspired by the Loomis, Reilly and Asaro methodologies. (Head Model Studio App.) User can choose from 25 different 3D models that can be rotated, tilted, and zoomed to view the model from different angles. The features of the head can also be viewed separately to study the details more accurately. In addition to Loomis, Reilly and Asaro based models, the application includes skulls, classical statues and models that represent different ethnicities. Educational mode is included that has pre-made scenes to help the user get started. The user interface is easy to use, visually clear and it offers a quick way to display reference while practising drawing. Head model studio is currently available on iPhone and iPad.



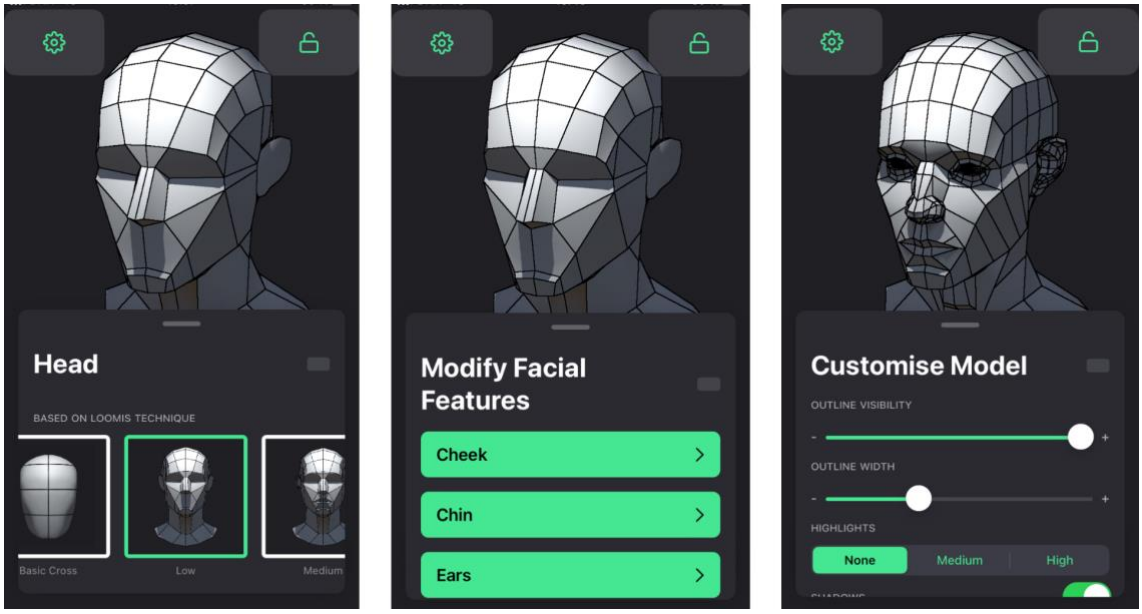
PICTURE 40. Head Model Studio on iPad (Head Model Studio App)

The models can be viewed with different guides and grids that help to understand the proportions and relation to perspective (Picture 41). Visibility of the plane changes can also be enhanced by adjusting the opacity and width of the outlines.



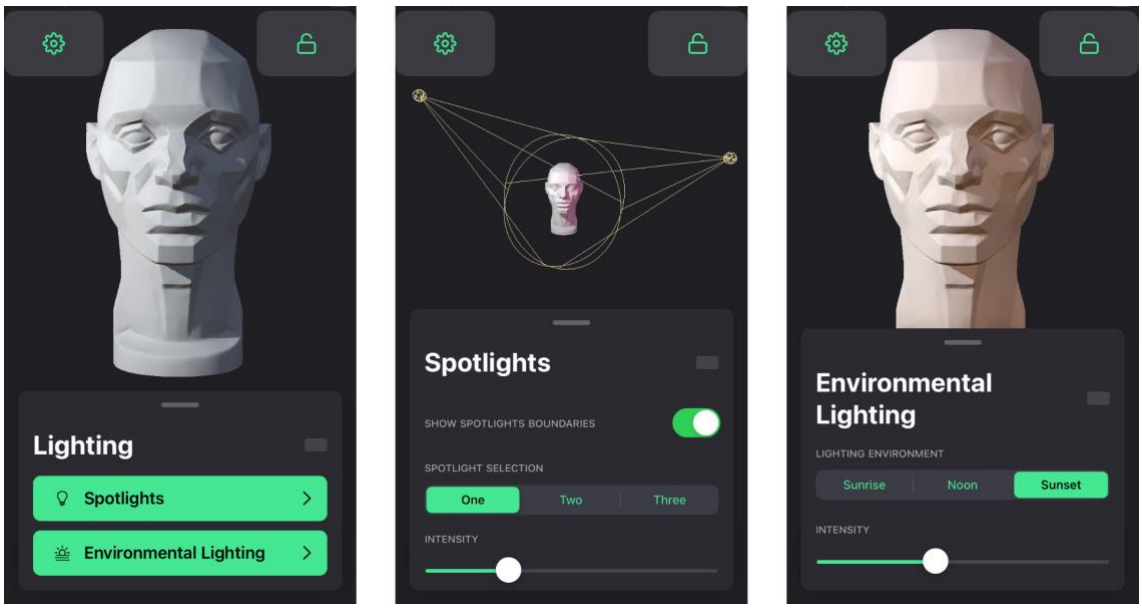
PICTURE 41. Perspective guides on iPhone (Head Model Studio App)

The Loomis head is available in five different levels from a basic sphere to complex polygonal model. All the facial features of the model can be adjusted in a variety of ways (Picture 42).



PICTURE 42. Loomis head on iPhone (Head Model Studio App)

There are two alternatives to lighting, spotlights, and environmental lighting (Picture 43). User can choose up to three different spotlights simultaneously with different colors and intensities. The environmental lighting includes sunrise, noon, and sunset modes with adjustable intensity.



PICTURE 43. Lighting on iPhone (Head Model Studio App)

11 CONCLUSION

The benefits of constructive drawing methods in the field of representational drawing have become evident during the process of this study. As stated in the introduction, the main goal of this thesis was to demonstrate the importance of understanding linear perspective as a part of the creative process when drawing human figures. It was discovered that the ability to break down and visualize complex structures in simple geometrical forms is one of the most efficient ways to develop spatial awareness.

Learning linear perspective is not easy, but it is a fundamental skill that should be practiced before trying to render finalized artwork. The presented examples showed that understanding the forms that are being rendered is crucial because the form defines how light falls on it and shadows appear. All the authors that were covered in the thesis emphasized the importance of defining forms with planes.

Constructive drawing methods can significantly enhance the artist's ability to create the illusion of depth on a two-dimensional surface, especially when drawing from memory or imagination. The line between drawing from memory and imagination was shown to be blurry, but comprehension of linear perspective improves both abilities.

The applications can be used to enhance learning and make the process more enjoyable. Compared to physical models, the applications provide a quick and easy way to view models from different angles and lighting. However, using physical models as a reference can develop observational skills significantly better because all the dimensions and volume is seen naturally. Using these tools and models together as well as drawing from references and life is an excellent combination to practice spatial awareness and keep the process exciting. In contrast, learning somewhat challenging methods should be balanced with non-technical, intuitive, and expressive drawing sessions.

After learning the basics of linear perspective and constructive drawing, artists can combine different methods to develop their intuitive way of drawing. Intuitive

drawing means that the artist no longer needs to focus on technical features such as measuring proportions and angles. Instead, all the information can be visualized accurately without using construction lines.

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