

“STRUCTURAL VISUALIZATION” DRAWING AS AN EDUCATIONAL TOOL TO DEVELOP INNOVATIVE SKILLS OF ANIMATED CHARACTER CONCEPT DESIGNER

” الرؤية البنائية ”

الرسم كأداة تعليمية لتطوير المهارات الإبداعية لمصمم فكرة الشخصية المتحركة

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ABSTRACT

This paper discusses creative and extended usages of drawing, emphasizing its role in consolidating Concept character design for Animation. With expectation to expand the perception of drawing as a distinct base in Concept design’s innovative process, this paper is presenting methods and applications that can help in student learning process.

The aim of this paper is to give a systematic approach to produce a consistent, beneficial results in teaching drawing, by presenting analytical and practical approach focusing on Structural Visualization and its role in developing student’s skills to create Concept character design for Animation. The result of this paper indicates that through practical exercises, based on learning to visualize the three-dimensional nature of objects, we can improve visual sharpness, upgrade manual skills and cognitive methods that empower students to enhance their innovative and artistic skills. It is recommended that in order to cultivate student’s own artistic style; they need to have an accumulation of experiences and styles by studying and analyzing pioneers’ works in the field of concept character design.

KEYWORDS

Concept character Design; Structural Visualization; Teaching drawing methods.

المخلص

تتناول هذه الورقة البحثية الاستخدامات المبتكرة والموسعة للرسم، مع التركيز على دورها في تعزيز تصميم الشخصيات المستخدمة في الرسوم المتحركة. مع توقع اتساع افاق إدراك الرسم كركيزة مميزة في العملية الإبداعية للتصميم، تقدم هذه الورقة الأساليب والتطبيقات التي يمكن أن تساعد في عملية تعلم الطلاب للرسم معتمداً على إدراك المنظور الخطي. الهدف من هذه الأطروحة هو إعطاء نظام منهجي لإنتاج حصيلة متنسفة ومفيدة في تدريس الرسم، من خلال تقديم منهج تحليلي وعملي يركز على الرؤية البنائية ودورها في تطوير مهارات الطالب لابتكار تصميم شخصية تصلح للرسوم المتحركة. تشير نتيجة هذه الورقة إلى أنه من خلال التمارين العملية القائمة على عملية تعلم وإدراك الطبيعة الثلاثية الأبعاد للأشياء، يمكننا تحسين المهارات البصرية، واليدوية، وتطوير الأدوات المعرفية التي تمكن الطالب من تحسين المستوى الإبداعي والفني. يوصى البحث بأنه من أجل تنمية الأسلوب الفني الخاص بكل طالب؛ فإنه يحتاج إلى تراكم الخبرات والأساليب الغنية من خلال دراسة وتحليل أعمال الرواد في مجال تصميم شخصيات الرسوم المتحركة.

الكلمات المفتاحية

تصميم فكرة الشخصية؛ الرؤية البنائية؛ طرق تدريس الرسم.

1. INTRODUCTION

The term **Structural Visualization** refers to the way of drawing elements by starting to understand the basic shapes that form the three-dimensional structure of the objects. The most important thing is to fully understand the principles of anatomy, proportions, and perspective in order to achieve the most benefits of this method. In drawing, students must begin with a general understanding of the entire shape before concentrating on its specific parts and details. This is called working from the general to the specific.

It is believed that drawing is a very significant mean for the enhancement of vision, cognition, design, exploration and innovation. Through operational practices we can improve visual acuity, enhance manual skills and cognitive tools that allow the student to strengthen innovative and artistic work. As drawing instructor, we have been exploring the role of drawing as an “expanded approach” in the teaching/learning methods and as a creative methodological approach in project-based learning.

Concept animated character design is a kind of visual art used to convey an idea in movie, video games, animation, and other forms of media. It is a process done before the execution of the final result. Though they are frequently mistaken, concept design refers to early world-building artwork used to inspire the development of media production. Therefore, it is not the same as visual character design development. Character concept art necessitates certain artistic skills and much research before putting pencil to paper. Concept designer will develop numerous character design draughts before settling on a finished piece as skills and research accumulates.

2. PROBLEM STATEMENT

The greatest challenge that faces Concept animated character designer is dynamically posing their characters at difficult angles. They must be able to understand them as ‘form’ so that they can take their pose, turn it and view it from any angle. This three-dimensional paradigm of thinking called as “Structural Visualization” will allow them to almost design the character to be animated into any position, as well as to interpret it from variety of different viewpoints.

3. AIMS AND OBJECTIVES

- This paper aims to show how linear perspective helps to understand human figure within the process of creativity.
- The paper focuses on working from the general to the specific, by starting to draw the basic shapes of the figure rather than concentrate on its specific parts and details.
- This paper aims to proof that Structural Visualization depends on understanding the basic principles of anatomy.
- This paper is presenting methods and applications that can help in student learning process.

4. METHODOLOGY

An analytical and practical approach to present innovative teaching techniques of Structural Visualization and its role in consolidating Concept character design for animation, by providing techniques and implementations that can help in student learning process.

5. STRUCTURAL VISUALIZATION

The Structural Visualization technique is very effective, mainly for students who draw human figures that can be used in animation's character design from their memory and imagination. Drawing the primitive shapes of the figure is a method that goes by many terms: the mannequin approach, the armature approach, "blocking in," constructing the figure, structuring the figure, preliminary drawing, and so on. However, all these terms point to the same basic aim, which is a process where art students start establishing simple, basic shapes to impersonate the form they are drawing, helping to create a base structure for the figure. Perception of perspective, anatomy, and proportions are fundamental to this method.

5.1. Advantages of Structural Visualization

The following part presents some of the advantages of creating structural visualization from a life model or a reference image.

5.1.1 Placing the figure on the page

Creating a lightly structural visualization of the figure on the page will give a preview of how the finished drawing will look. It is much easy to readjust something compositionally when the drawings are light enough to be wipe out.

5.1.2 Fast verification of proportions

Structural visualization of the figure helps to quickly evaluate the basic proportions before working with the details of the figure. By creating a light structure first, it'll be obvious whether anything needs to be modified structurally or proportionally before the implementation of anatomical details.

5.1.3 Making adjustments within the pose

When working from a model or a reference image and realizing some awkwardness in parts of the pose, it is possible to adjust the drawing to add more dynamics to the pose or to make the overall composition more interesting.

5.1.4 Constructing from memory or imagination

It is important to work with Structural visualization to help drawing figures from memory. It is possible to draw a pose from memory or imagination and then add the anatomical details. This is a helpful skill for creating a sequence for a storyboard or character design.

5.2. Methods of Structural Visualization

The structure of the human body is very sophisticated, and in order to fully understand the body's basic structure, first, students should be capable of visualizing them in the primitive geometrical shapes through the following methods:

5.2.1 Perspective awareness:

- Perception of linear perspective is an essential skill when creating the illusion of depth. This step is very important in order to create anything believable and properly communicate down to the pipeline in the concept art industry such as the 3D modelers or animators or environment artists.
- It is essential to conceive the basic geometrical shapes of any object, particularly when drawing human body. The following figure (1) shows that by simplifying the human body into linked basic forms, it is convenient to build more detailed muscular poses from memory or imagination.

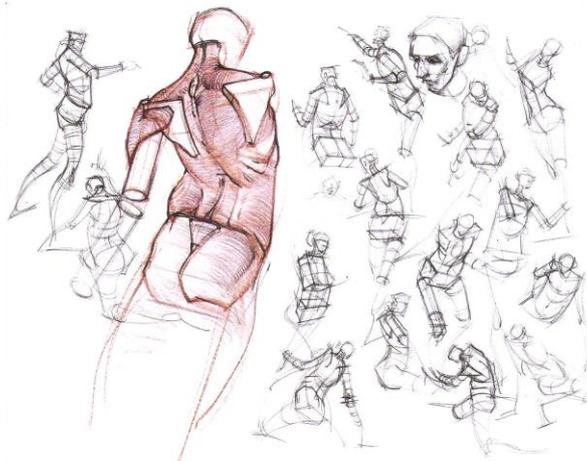


Figure 1, Simplified human figure (Source: Michael Hampton, 2009)

- Drawing transparent body shapes, as in Figure (2), is a very important principles of this step. The main skill required is to fully comprehend the forms so that students can depict even the hidden parts.

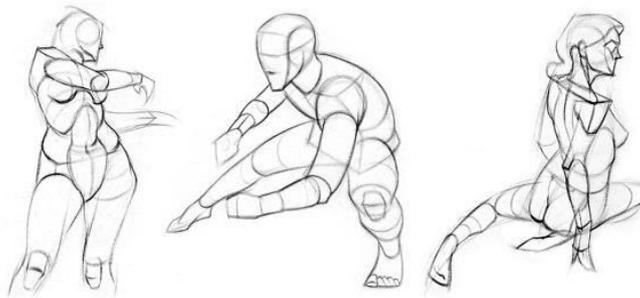


Figure 2, Visualizing transparent body parts (Source: Prokopenko, 2013)

- Identifying the centerline of the figure is important because it determines how supplementary shapes are drawn accurately in perspective. Figure (3) shows the centerline of human figure.

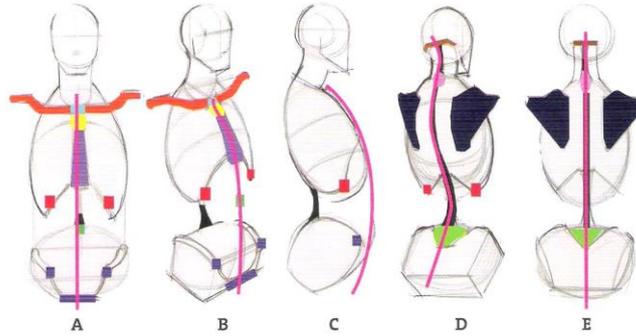


Figure 3, The centerline of human figure (Source: Michael Hampton.2009)

- Measuring human proportions, as in Figure (4), can be executed either by comparing the ratio of various shapes to each other, or by comparing the ratio of height- to-width.

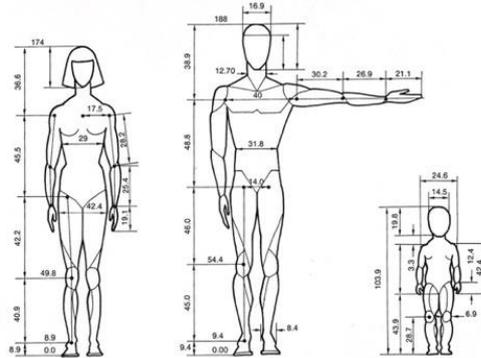
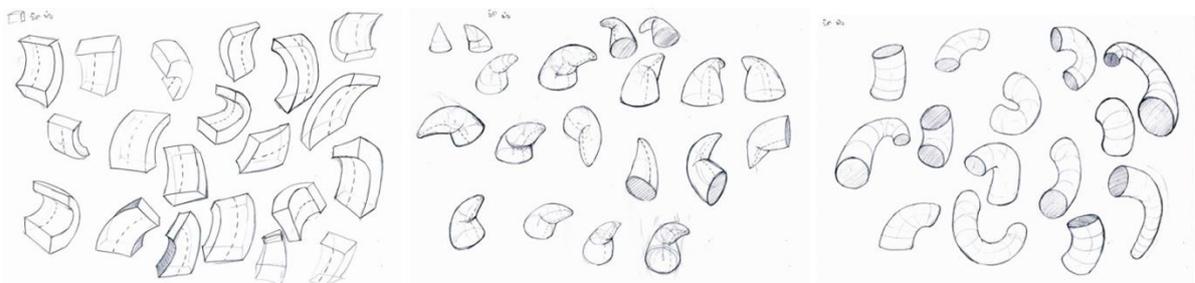


Figure 4, Human proportions (Source: BenTs-sTock)

<https://www.deviantart.com/bents-stock/art/Human-proportions-26414733>

5.2.2 Manipulation

The most significant thing about structural visualization is learning how to handle shapes. Manipulation process can be done by curving, coiling, squeezing, or extending as shown in the next figure (5). Shape manipulation helps the student to draw more looser and more dynamic shapes.



*Figure 5, Manipulating basic shapes by curving, coiling, squeezing, or extending (Source: R00KIE-N
Published: Mar 1, 2022 <https://www.deviantart.com/r00kie-n/art/Squish-Stretch-014-Box-Bend-908517264>)*

Manipulation of human figures can be created with the help of reference images of athletic models. The next figure (6) represents this type of dynamic adjustments of basic geometric forms.



Figure 6, (author: reference images of athletic models used to demonstrate dynamic modification of simple geometric objects)

5.2.3 Observation

Observing a multitude of references is highly recommended, specially human figures with complex structure, then simplifying them into basic shapes, then manipulating them into more complex shapes either by bending or twisting or squish and stretch. The main goal of simplification is to conceive the shape in order to makes it easier to manipulate and modify in perspective. Drawing shapes with contours helps to demonstrate objects with foreshortened proportions. Using cuboids to represent the ribcage and pelvis helps to simplify the major changes of the body. Figure (7) shows how the human body is broken down into the various simple forms for describing the pose. This aids in the initial stages of describing a figure by working out the correct proportions of the various body parts and figuring the pose.



figure 7, Human figure break down (Source: Michael Hampton 2009)

5.2.4. Education

Concentrating more on knowledge - about the subject of interest - by focusing on research and studying intensively the anatomy of human or animal figure, or the structure of plants or machines.

Reinforcing education helps to better fine-tune the shapes constructed to become much better in designing characters.

5.2.5. Imagination

“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” (Mauri Mela, 2022). The idea of using imagination in drawing is based on picking things from memory and binding them together in a new way. Drawing from memory and imagination helps to expand student’s creativity, thereby develop more skills such as problem-solving and critical thinking.

The most effective learning method to draw from imagination is to use reference images of human body to analyze them by using simple three-dimensional shapes such spheres, cubes and cylinders, then redraw them from deferent angles by manipulating and combining these basic shapes to visualize new poses and ideas.

5.3. Applications of Structural Visualization

The next part of this paper tackles drawing teaching strategy through systematic exercises, aiming to reconstruct human figure and mechanical objects in an innovative approach to create a **Cyborg based animated character**. Depending on the prerequisite previous drawing levels based on the development of visual cognition and volume-spatial awareness. The advanced and final drawing level is dedicated to studying **structural visualization of human figure**. By practicing intensive exercises, and providing specialized artistic references related to human body structure, which reinforced student’s perception, students are capable of manipulating the structure of any model in designing animated character. The teaching system is based on three main parts:

- **First part:** is dedicated for studying structural visualization of human figure.
- **Second part:** tackles understanding and analyzing machines by pulling apart its components.
- **Third part:** is concentrated on teaching concept of designing animated character using the information and skills gained from the previous parts.

The exercise-based projects are then organized according to the previous parts as follows:

5.3.1 First Project: studying structural Visualization of human figure.

The operational steps are divided into five exercises based on some of the basics mentioned by ‘Valerie L. Winslow’ in his book “Classic Human Anatomy in Motion, The Artist Guide to The Dynamic of Figure Drawing 2015”. And what was mentioned by “Michael Hampton” at 2009 in his book “figure drawing – design and invention”. These books were among others presented as art references. The next part reviews points discussed with students illustrating the procedural processes of each exercise.

• **Exercise (1):**

Locating the centerline “axes” of the body: The students as shown in **(figure 25)** started by studying some models and locating the centerline as shown in the structural diagram which illustrates a classical pose with various angles. The diagram in figure (8) shows the various axes and their angles.

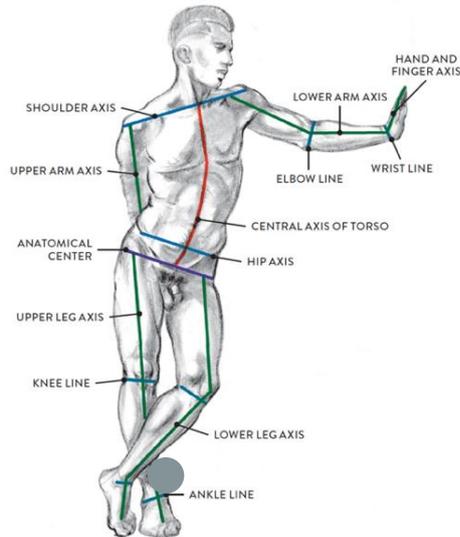


Figure8, The various axes and their angles. (Source: Michael Hampton.2009)

• **Exercise (2):**

Analyzing the body into three dimensional shapes, to create an armature for the later application of details. After explaining the body’s four basic ways to change position, which are turning, tilting, tipping, and twisting. Students, as shown in Students’ Application section in **(figure 20)** and **(figure 25)**, are capable to grasp the core principles of these positions, then construct the human figure by simplifying it into basic shapes as a cylinder or boxes to represent the rib cage, torso, or head. The elongated cylinders or boxes used to represent the upper and lower arms and legs as shown in **figure (9), (10) and (11)**

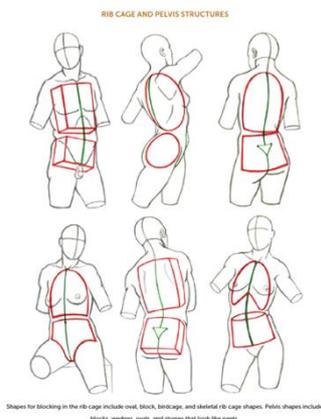


Figure (9)

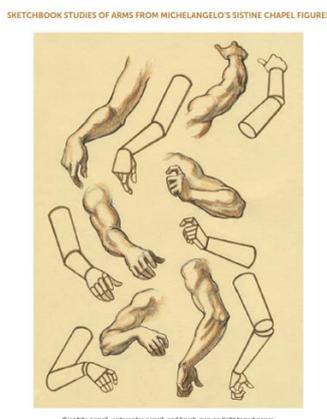


Figure (10)

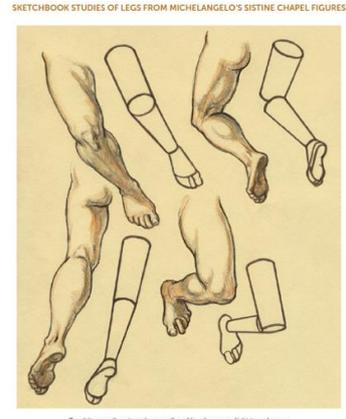


Figure (11)

Construction of human figure (Source: Valerie L. Winslow, Classic 2015)

• **Exercise (3): Structures for the Hand**

The students then study the structural visualization of the hand to establish how it is placed spatially, and try to discover the foreshortened items, which happen in many views of the hand. Elongated shapes or cylinders are used as constructional shapes for the fingers. The examples in figure (12) show just a few of the many combinations of shapes that is used to explain the concept of constructing hands.

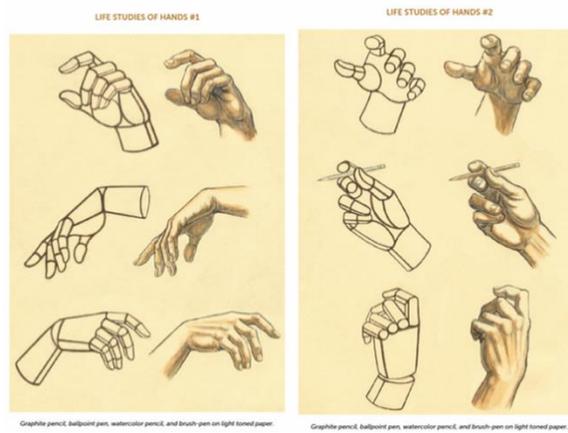


Figure 12, structure of hands, (Source: Valerie L. Winslow, 2015)

• **Exercise (4): Structures for the foot**

The students study the structural shapes of the foot to establish how they are positioned spatially, on so many different shapes in different poses. Figure (13) demonstrates the shapes chosen when blocking in the foot therefore depend on the foot’s position. They take Elongated triangles for side views, wedge shapes for front views, “bootie” or sock shapes for three quarter views.

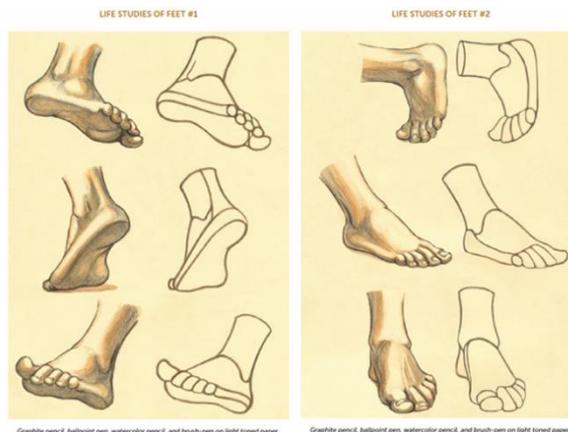


Figure 13, structure of foot, (Source: Valerie L. Winslow, 2015)

- **Exercise (5): Structures for the head**

Students understand how the placement of the midline changes according to whether the head is confronting front, turning to the left or right, or leaning up or down. Figure (14) shows the explanation of the various angles of the head.

Then students recognize that the horizontal location and orientation of the brow line, eye line, nose line, and mouth line divert and lean depending on the angle of the head. They identify that when the head is facing up or down, these lateral lines will pursue the overall arch of the head's structure. Students are then capable of drawing the head in any position by simplifying it into a basic shape using an oval, cylinder or box. Figure (15) demonstrates the head's position through basic cylindrical shape.

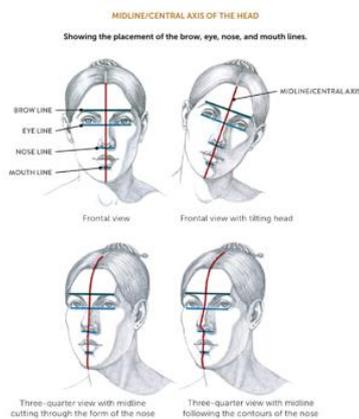


Figure 14, various angles of the head,
(Source: Valerie L. Winslow, 2015)

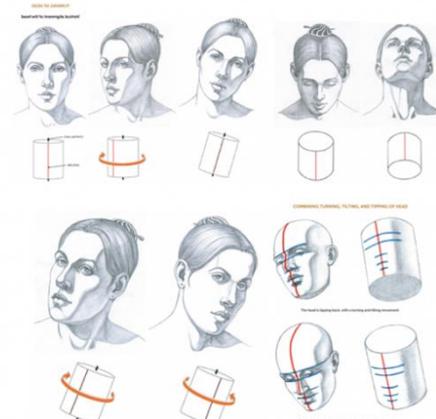


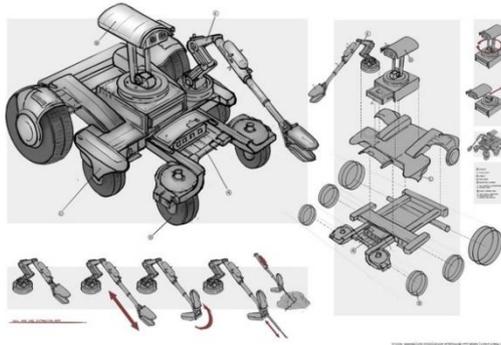
Figure 15, The head's position through basic cylindrical shape. (Source: Valerie L. Winslow, 2015)

5.3.2. Second Project: Structural Visualization of Machine's Parts.

Students in this part learn how to use various photo references of machines as a base to efficiently produce a concept design of a cyborg animated character. By manipulating photos into shapes, the more mechanical parts extracted, the more the design can quickly reach a level of constructive believability. This process is executed through.

- **Exercise (6): dragging out pieces.**

Students start by picking up pictures and searching for images of things that have distinct poses and light and shadow sides. After that, they select individual parts of the images that have solid forms. pulling the object apart helps them to comprehend how an object is placed together. For example, machines will usually have an outer cover that protects the working parts, with a base beneath it that includes all parts. Figure (16) shows the extraction of parts for the Ugv (unmanned ground vehicle) Published on Oct 4, 2015 by Steven-Ashford.



Figure(16, Data Extraction Ugv (unmanned ground vehicle) Published: Oct 4, 2015 by Steven-Ashford <https://www.deviantart.com/steven-ashford/art/Data-Extraction-Ugv-unmanned-ground-vehicle-564157365>

5.3.3. Third Project: Designing Animated Concept Character

After the completion of studying the construction of human body and the mechanical parts of a machine, students are now ready to accomplish the conceptual design of the animated character.

We believe in order to cultivate student’s own artistic style; they need to have an accumulation of experiences and styles from pioneers of the field of concept character design. Then use them to their advantage to harvest creations from their own artistic style. Students started by studying and analyzing pioneers’ work in order to understand their shape language, some of their ideation, or ways of manipulating shapes. Learning how to create remarkable and believable artwork by taking a deeper look into concepts such as the center of balance and line of movement.

The following part presents some of the examples discussed as an inspirational model derived from the early concept drawings of Blue-Sky Studios, 20th Century Fox “**Robots**” movie 2005. Figure (17) “**Rodney**” the main character designed by “**Peter de Sève**”. Figure (18) “**Piper**” designed by Michael Knapp. Figure (19) “**Buffer**” by Michael Knapp.



Figure 17, Blue Sky Studios, 20th Century Fox ,Rodney, Early Concept Drawing by Peter de Sève <http://unghiutefalseinbucuresti.blogspot.com/2011/07/robots-2005-character-development.html>

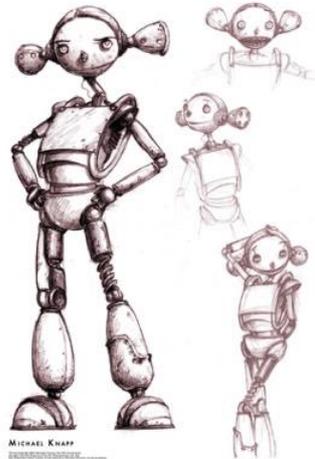


Figure (18) Blue Sky Studios, 20th Century Fox Piper by Bill Joyce & Michael Knapp
<https://michaelknapp.com/robots/>



Figure (19) Blue Sky Studios, 20th Century Fox, Buffer by Michael Knapp <https://michaelknapp.com/robots/>

- **Exercise (7): Experimenting with shapes.** With the structural shapes of the human body ready set up, students take the basic forms of the machine and begin connecting, spinning, squeezing, and extending them like lego pieces to create compound shapes. First, they should figure out how to balance the joints properly. Then, create several variations of how the character should look like.
- **Exercise (8): Finetuning the Appearance.** After accomplishing experimenting with shapes, students are now ready to start adding more details to emphasizes the concept design of the character.

6. STUDENTS' APPLICATION OF CONCEPT CHARACTER DESIGN

The applications presented in the next part is a development of project-based experiences in a Bachelor Course of Graphic Design at El Zahraa collage for women in Sultanate Oman, which had a practical syllabus aimed to generate a baseline for learning and practicing of drawing and

design for three successive levels. Teaching Representational Drawing in the first and second levels. Then character design in the third advanced drawing level.

In this application, the students relied on all previous experiences presenting a concept character design through four steps:

- Step one: Analyzing Human figure.
- Step two: Analyzing a machine.
- Step three: Experimenting with shapes.
- Step four: Finetuning the Appearance

6.1. Aisha El-Ghilaney's Project

The student presented a concept design of a **Surveillant Cyborg Character** through the following steps:

6.1.1. Step one: Analyzing Human figure.



Figure 20, structural visualization of human body

6.1.2. Step two: Analyzing a machine.

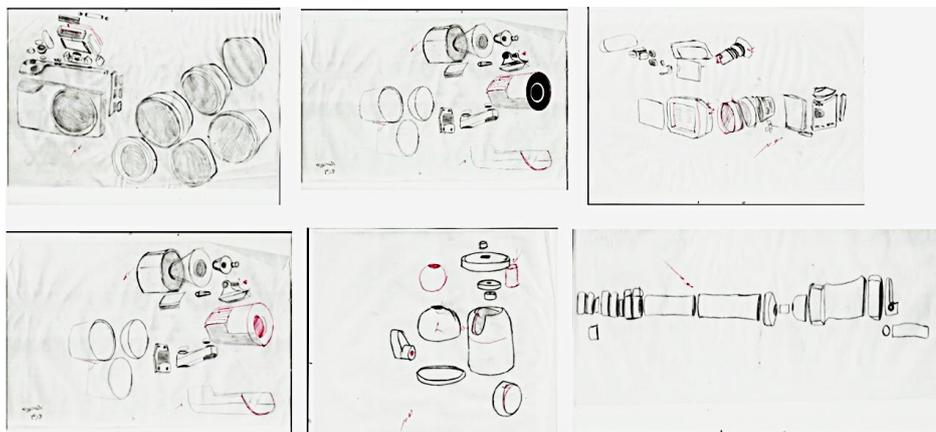


Figure 21, structural visualization of cameras

6.1.3. Step three: Experimenting with shapes.

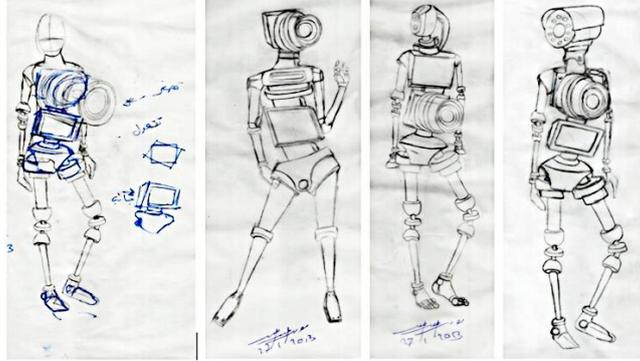


Figure 22, early experiments

6.1.4. Step four: Finetuning the Appearance



Figure 23, shading experiments with color pencil



Figure 24, digital experiments with adobe illustrator

6.2. Sara Abd El Naser Project

The student presented a concept design of a **Tailor Cyborg Character** through the following steps:

6.2.1. Step one: Analyzing Human figure.



Figure 25, structural visualization of human body

6.2.2. Step two: Analyzing machines.

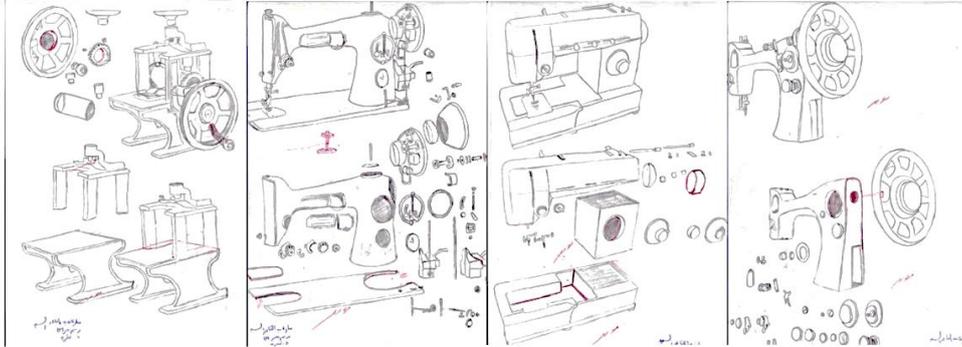


Figure 26, structural visualization of sewing machines

6.2.3. Step three: Experimenting with shapes.

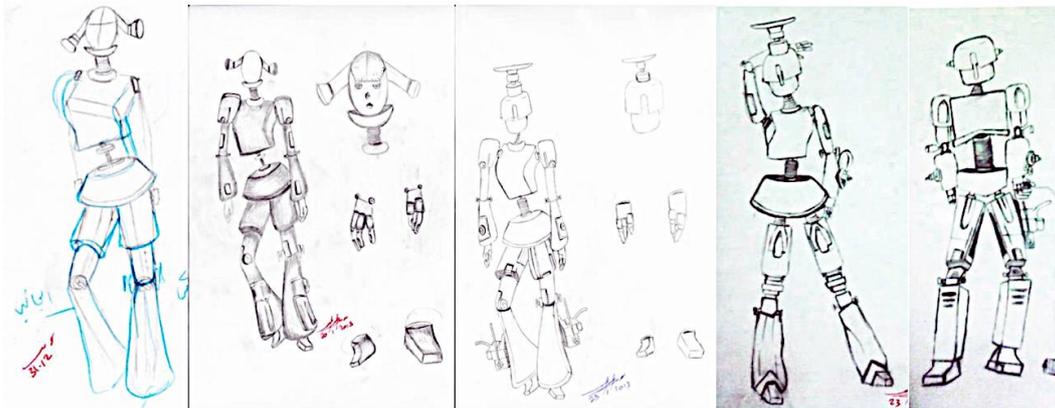


Figure 27, early experiments

6.2.4. Step four: Finetuning the Appearance

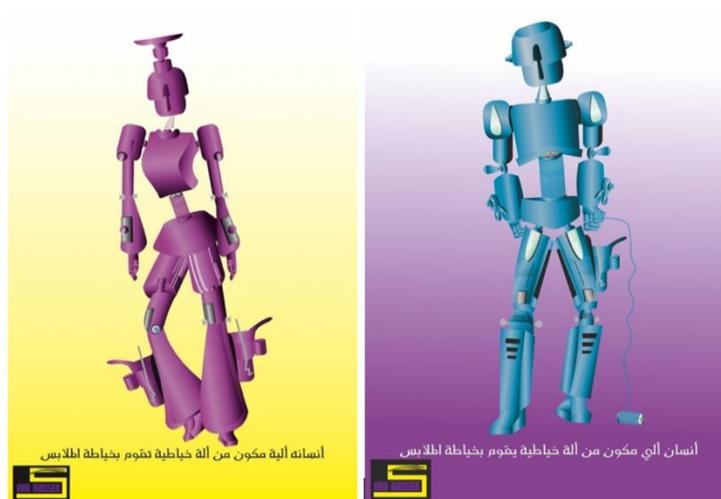


Figure 28, digital experiments with adobe illustrator

7. CONCLUSION

- The advantages of **Structural Visualization** approach in the area of concept character design for animation have become obvious during the application of this study.
- By the end of this paper, it was proofed through students' practical exercises, that by applying shape manipulation, they succeeded in achieving the main goal of the teaching strategy.
- The presented examples showed that **perspective awareness** is a basic skill that should be exercise before attempting to presenting finished artwork.
- It was proofed that the capability to analyze and visualize compound structures into basic three-dimensional shapes is considered the most effective methods to develop spatial perception.
- Using real models as a source can enhance observational skills considerably, due to the real-life dimensions and volume perception.
- Observing a multitude of reference images is highly recommended, especially human figures with complex structure.
- Students gained an accumulation of experiences and styles by studying and **analyzing pioneers' works**. Understanding their shape language, some of their ideation, or ways of manipulating shapes, using them to harvest creations from their own artistic style.
- **Structural Visualization** methods can remarkably boost the students' potentials to generate concept character design for animation, especially when drawing from memory or imagination.
- This process can be used to improve educational skills and make the learning-teaching process more interesting.

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