

SKETCH AS A TOOL OF THOUGHT IN ART AND SCIENCE

Silvia Nuere¹, Esperanza Macarena Ruiz Gómez²,
Laura de Miguel Álvarez²

¹ Universidad Politécnica de Madrid – UPM

² Universidad Complutense de Madrid – UCM

ABSTRACT

Professors from different studies such as fine arts, engineering in industrial design and digital graphic design and from different universities (Politécnica de Madrid, Complutense de Madrid and Internacional de La Rioja) have participated in an educational innovation project dealing with sketching as a starting point to creation. Teachers from the Universidad Complutense de Madrid and the Universidad Politécnica de Madrid proposed to their students exchange experiences. Students from industrial design went to classes to the Fine Art Faculty and fine art students had to deal with an industrial design proposal.

The aim of the experience is to know how students from different studies manage drawing tools to start their work; drawings to finally paint a still life, drawings to understand volume in a sculpture plaster model to reproduce it with clay, and sketches to propose a Christmas ornament made with wood.

After the experience, drawings from exercises from the three universities have been analyzed to establish similarities and differences in the use of visual language (points, lines, planes, surfaces, and color, between others). Fine art students use the lines with ease, hints, light with the inclusion of color spots as part of the approach to the solution. Industrial design students, on the other hand, consider the line as an essential element in their drawings, well-marked, clearly delimiting the edges of the object, integrating color as an addition rather than as an integrating element. And finally, but not last, students from digital graphic design use lines as a language to propose fast schematic approaches, lines as added texts, and generally a lack of color.

Even though each field of knowledge has some particularities, we think that the drawing approach is essential to face creations no matter their essence. Sketches in early stages mean to face problems, to think and to translate ideas into a two-dimensional surface.

Keywords: *Drawing as thought, Fine arts, Graphic design, Industrial design, Sketch, Visual language*

Introduction

As we are going to deal with drawing and sketch, we will start analyzing their concepts to establish a reference start point.

Dictionaries definitions of drawing don't give too much information. In the Oxford Dictionary, we find a brief definition but with a very broad concept, as it says, "a picture made using a pencil or pen rather than paint". In the Spanish Dictionary (RAE, s/f), drawing is related to the proportions of the image drawn or painted. For the word sketch we read it is "a simple picture that is drawn quickly and does not have many details" (Oxford) or "Project or general note prior to the execution of an artistic work" (RAE, s/f). So, looking for a more extensive definition we have found different authors that explain in a wider sense the meaning of drawing or sketch. As Torres, Serra, Llopis, García and Cabodevilla (2014) mention "drawing is not only the way to express something, but also to feel something".

Considering drawing as an expression that precedes oral language, it is linked to the intimacy of being, part of an individual freedom and builds paths of experimentation where self-recognition of oneself is made to configure a vision of what has not been visible yet. (Monsalve Pulido, 2010).

In the sketch, [...] there exists an early image of what is possible to grasp, but it is made from a white, blind space, where the hand tries to reach an imprecise outline that produces a certain fear to be considered, [...] It is an exciting drawing, tactile, full of erroneous perceptions which force permanent changes of direction (Gómez Molina, 1995) Sketch does not only belong to the field of graphic experience, all people can use the sketch as a beginning of a first idea (Torres, et al., 2014).

Gómez Molina introduces us to Bruce Nauman's definition for the Drawing & Graphics Exhibition at the Boysman-Van Beuningen Museum in Rotterdam in 1991 where "Drawing is equivalent to thinking. Some drawings are made with the same intention as writing: they are notes that are taken." The validity of the drawing will not depend so much on its autonomous value as a work of art, but on its link to the process by which the artist transforms it into a significant part of it. (Gómez Molina, 1995).

Drawing is always established as the fixation of a gesture that specifies a structure, which is why it links with all the primordial activities of expression and construction linked to knowledge, to the description of ideas, things and interpretation phenomena based on explanation of its meaning through its configurations (Gómez Molina, 1995). We can say then that the act of drawing, understood beyond purely aesthetic representations, it is a way of building knowledge for those who carry it out (de Miguel & Nuere (2020).

In a letter sent to John Berger (2011), James Elkins mentioned how yesteryear drawing was fundamental to art. According to him this was the way Miguel Angel understood it and named it as design. Later, in the French Academy, and the others that followed it, drawing was the base of all that was taught. He considers it a whole complex philosophy of marks, signs and traces unfolds in drawing. The drawing is the place where blindness, touch and resemblance become visible, and it is also the point of the most delicate negotiations between hand, eye, and mind. As much as he likes writing, it is the drawing that shows him everything that can be said with a single mark, apparently careless. To which John Berger replies that drawing is much older than any written language or architecture and goes back to Paleolithic art.

Drawing is an action, a primitive impulse that responds to the need to capture an idea on a support. It can be seen in cave representations, where we see figures marked on the rocks, simplification of forms, models of simple but explicit spontaneous expression.

All over the art history we can find several drawing approaches, from the prehistoric era till the 21st century. We can see different styles in the drawings and a variety of techniques. As an example, we have warriors chasing animals in the cave of the Horses in Castellon, Spain (see Figure 1).



Figure 1. Schematic representation of Warriors in the cave of the Horses

For John Berger part of the animals reproduced in prehistoric caves are in interaction with the human figure. There is no fear before them, and there is respect, and a need to capture that mutual presence. Following this line of thought, a direct relationship with the need to leave a mark

can be determined. This marking action is a form of drawing (Tappan, Larrechart, & Muñiz, 2015).

We can consider drawing as that first marking gesture, accessible to anyone due to the simplicity of the means used.

From the schematic representation of the warriors of the cave of the Horses in the province of Castellón in Spain, to the sketches done to prepare a canvas from Gustave Klimt (see Figure 2), these pieces are the clarification of an idea placed on a two-dimensional support. In the case of the Gustave Klimt drawing, it is the starting point of the later work 'The Three Ages' from 1905.

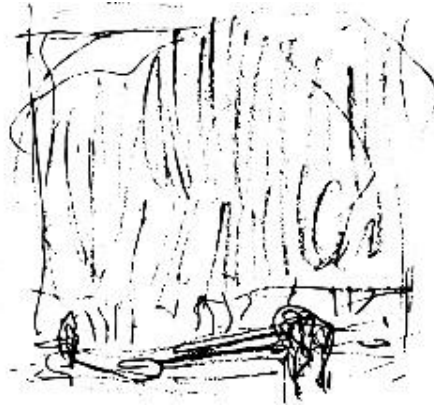


Figure 2. Schematic vectorization of the Landscape sketch from Sonja Knips' sketchbook. Page 55, private ownership

First drawings are quickly done. It is about composition, ideas, elements that later will make part of a bigger work. Maybe, only the author can really understand the meaning, the shapes and lines put together on a piece of paper.

“For the artist to draw is to discover. It is the very act of drawing that forces the artist to look at the object in front of him, to dissect it and put it back together in his imagination, or, if they draw from memory, what forces them to delve into it, until he finds content of their own store of past observations (Berger, 2011).

Drawing, therefore, allows us to explore a wide variety of solutions, allows us to grasp the world around us and communicate ideas. In the case of the industrial designer, these sketches can be accompanied by words.

For Saussure (2008), language has the function of transmitting information, ideas, feelings, subjectivities and realities and drawing is a way of communication to rework the imaginary and refresh our view of reality since it is a transmitter of ideas, sensations, feelings, and subjectivities. Drawing as a strategy helps to define forms within the course of projecting visual ideas.

The forms of drawing open new ways of thought, they release the mind and consequently active the intelligence. It is a creative act and, as a result, it is a state to build alternative thoughts, an emotional state that lives entirely with the human being.

“We trace on a support, we discover a curiosity, an unconscious desire to project one’s thoughts. The words and images become increasingly clear as we break through the ingenuity barrier, they become something conscious. Drawing is a language that becomes a purely expressive activity.” (Torres, et al., 2014) (p. 2511)).

“I can’t draw, and I shouldn’t do it. We would never do that with language. No one would say: Well, this just didn’t come out like a poem. I shouldn’t speak. Because we know language is a way to think and get in touch with others. Well, and so is drawing.”

Ralph Ammer 2019, minute 0’47”

As Ralph Ammer (2019) mentions, drawing is usually considered the dark corner of the art world, but it is not about artistic excellence or personal self-expression, it is a way to think in pictures. Different professions use drawing as a way of putting their imagination into a paper, a way to transmit their ideas. They think visually. Drawings support the visual thinking and instead of building sentences, we can build compositions with shapes that mean something. Visual thinking is very powerful because you can imagine something without having to make it (TEDxTUM, 2019).

While reading requires a linear lecture getting the meaning as you go through, drawing allows you to understand the meaning immediately. The graphic content allows our eye to move freely to combine the shapes and their arrangement in the composition with the ideas that it extracts from them (de Miguel & Nuere (2020).

“Being a sketcher was for a long time a trade. Mastering it, the one who drew could capture the forms of reality and fix them in a document [...] drawing has always been a tool rather than an art, a specialized activity of inquiry and construction of form” (Tappan, Larrechart, & Muñiz, 2015, p. 10)

For Betty Edwards (2000), the arts are essential for learning specific, visual, and perceptual ways of thinking, just as reading, writing, and arithmetic are essential for learning specific, verbal, numerical, and analytical ways of thinking. Both ways of thinking are vital when it comes to acquiring the skills of critical thinking, extrapolation of meanings and problem solving.

In Dessau, in 1925, analytic drawing, taught by Wassily Kandinsky, was as an education in the look, the precise observation and the exact representation not of the external aspect of an object, but of the constructive elements, the laws that govern the forces (tensions), that can be

discovered in certain objects and their logical construction. It was an education in observing and reproducing relationships with clarity, in which 2D phenomena are an introductory step towards the three-dimensional (Pipes, 2008, p. 39).

As Barbara Rose, commissioner of the exhibition 'Robert Morris. Drawing as thought' in 2012 in the IVAM (Institut Valencià d'Art Modern), wrote, Rober Morris defined drawing in such a way as philosophical research, conceptual premise, preparatory sketch, work diagram, physical register process, and finally as a principal means to solve aesthetic problems. But even though Morris has a prodigious production of critical articles, she believes that his true vehicle thought are the drawings in which he faces both aesthetic and existential problems (Institut Valencià d'Art Modern – IVAM, 2011).

The design process is based on the use of a variety of means in the extensive simulation of design hypotheses. A designer's ability to spend time effectively in visually manifesting their ideas to themselves and others is crucial to their professional operation. (Pipes, 2008).

The process of a designer starts with a basic sketch drawn by hand on a notepad or in some cases; it could be a digital image of the product in two or three dimensions. It is the case of the kettle "Pito" from Frank O. Gehry for Alessi (see Figure 3: <https://eu.alessi.com/es/products/pito-kettle>), where the designer started with some simple sketches to outline the shape, without taking into consideration materials, manufacturing or other aspects involved in this profession.

Designers can start drawing and drawing to the point that you can see the evolution of the idea, small changes, as if you were in the mind of the designer (Campos, 2012).

The essence of the final kettle design from Frank Gehry is already captured on paper during its development, as we can see on the first image on the upper left (see Figure 4).



Figure 3. Pito, Frank O. Gehry for Alessi (1992)

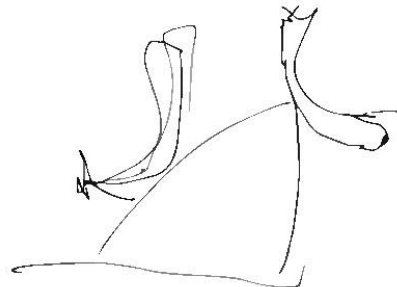


Figure 4. Simplification of the sketch of Gehry

This simplification sketch we interpreted of the Mini project from Alec Issigonis (see Figure 5) shows the designer's thinking behind the groundbreaking design.

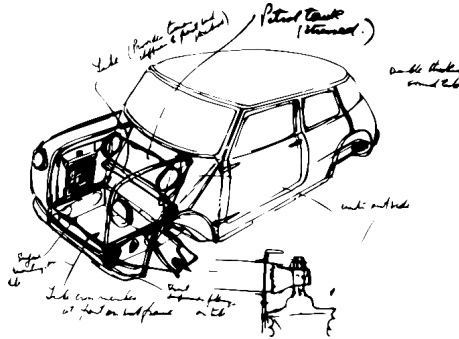


Figure 5. Vectorization and simplification of the original sketch by Alec Issigonis (Prototype Mini project 1958) (Rodgers & Milton, 2011)

Written contributions can be essential for a better understanding of the image. Drawing does not settle the thought completely, but it gives visible form to concepts or ideas that until now were only mental. The technical quality does not matter, nor its aesthetic values, but rather the close link between the author that gives it meaning and value in its development (p. 27). The drawing may not exactly define the thought, but through some signs, gestures, strokes, and they can bring it closer and make it more concrete (Gómez Molina, 1995).

Drawing is a tool used in a lot of disciplines as architecture, design, engineering, or arts. Visual elements of this language can define and organize structures and spaces that knock into shapes. Points, lines, planes define and give volume to the environment objects. Drawings are representation tools, schemas, concepts, diagrams, or structures (Barrera, 2017).

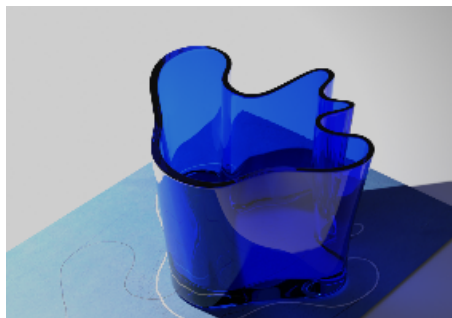


Figure 6. Interpretation in 3D, of the sketch draw from Alvar Aalto. 3D Render. Silvia Nuere

Thanks to a sketch of Alvar Aalto, we have been able to render a 3D interpretation of a possible vase design similar to the famous world known (see Figure 6).

Drawing enables designers to develop and evaluate their ideas on paper. They can serve also for later discussion and be an iterative development (Rodgers & Milton, 2011).

The act of drawing works as a means of firming up an idea and giving it form. The most usual tools are pens or pencils and paper. They allow immediacy in a willfully fluid, dynamic, and expressive manner, free from constraint (Rodgers & Milton, 2011). Sometimes they may need explanation, and that is why you can see writing notes on them.

First drawings place emphasis on the external form, relation between parts, proportion, and important aspects. Knowing how to see is understanding how to think, because knowing how to see is thinking what is seen. It is an intelligent action, but it is also a reference of future ideas or ideas about the future, of our desires, dreams, and fears (Gómez Molina, 1995).

Drawing for Beuys already exists in the thought. If the complete and invisible meanings of thought are not in a form, a good drawing will never result. His idea about drawings, as a special form of materialized thought, is the following: they are the beginning of the change of the material condition of the world through, for example, sculpture, architecture, mechanics, or engineering, where the drawing is not reduced only to the traditional artistic conception (Bernárdez Sanchís, 1999).

Methodology

Project proposal

“All perception is also thought; all reasoning is also intuition; all observation is also invention”. Rudolf Arnheim (Arnheim, 1984, p. 18)

Professors from different studies such as fine arts, engineering in industrial design and digital graphic design, and from different universities have participated in an educational innovation project dealing with sketching as a starting point to creation.

Teachers from the Universidad Complutense de Madrid (UCM) and the Universidad Politécnica de Madrid (UPM) proposed to their students exchange experiences. Students from industrial design went to classes to the Fine Art Faculty and fine art students had to deal with an industrial design proposal (Both groups are from the second academic year in their studies). Another experience was set in the sculpture classroom.

The aim of every experience is to understand how students from different studies manage drawing tools to start their work in different approaches as:

- drawings to finally paint a still life
- drawings to understand volume in a sculpture plaster model to reproduce it with clay
- sketches to propose a Christmas ornament made with wood

At university, there are studies that, despite transmitting different knowledge, go through similar processes, usually related to the ideation of an artwork or product design.

Therefore, this project seeks to enhance the existing synergies between students and teachers belonging to the Higher Technical School of Industrial Engineering and Design of the Polytechnic University of Madrid, to the Faculty of Fine Arts of the Complutense University of Madrid, and to the International University of La Rioja. Art and science to a greater or lesser extent have created synergies since Classical Antiquity and we consider that both fields have important union points that can be highlighted from the academic training.

The research is focused on the first academic years, where art and science deal with a common visual language in the process of creation. Fine art students will draw to outline a sketch for a painting or establish a study for a still life or landscape. Design students will also need freehand sketching to start a project as a first approach to the future product. Both students, even if they belong to different studies will go through a drawing process, but the way they use to express their ideas can be different. This is the starting point of the research, analyzing the way lines, textures, planes, color, and light are apply in their studies. Apart from two-dimension representation they also can deal with three dimensions through sculpture.

But it is not only about students, but also about teachers. Each field of knowledge requires some points to be highlighted, so they will establish some preferences in their proposals. Even though many learning codes are common to one another and essential in the basic student academic formation, we compare and look for similarities and differences in the students' works after bringing industrial design students to fine art workshops and proposing industrial design exercise to fine art students. Even though students apply teachers concepts it is also beneficial to enhance the expressive capacity of the student and to establish multiple connections between languages. Interdisciplinarity is fundamental, and the search for new connections while teaching will enrich the process. This means that, whenever possible, we must try to organize mixed classes between different subjects of different universities (Nuere & de Miguel (2021)).

Also, through sculpture workshop (see Figures 7 & 8), students from engineering in industrial design try out a different way of dealing with three dimensions, even though these students are accustomed to face three dimensions through computers or 3d software to represent products.



Figure 7 & 8. Students from the Higher Technical School of Industrial Design (UPM) working in the sculpture classroom

The experience evaluation is analyzed from a qualitative approach of the results obtained from the students. We look for the tools related to drawing, as line, form, color, every student uses, and the expressiveness they reflect on their works. We made a comparison, not only watching the results, but also attending the way they draw while doing it.

The experience was set with students from the degree of Fine Arts, in the subject “Painting processes” from the second year, with two groups, a total of 63 students. From the degree in Engineering in Industrial Design, there were also two groups from the second year, in the subject “Basic Design”, and also two groups with a total of 55 students, and from the International University of La Rioja, students were from the subject “Final Degree Project” with a total of 15 students. They participated in the different activities organized in different sessions.

An approach to the application of these skills is also studied in online studies to see how new technologies can also favor expressiveness and representation, regardless of the medium used for their learning.

This gaze towards the “other”, from fine arts to industrial design and vice versa seeks aesthetics from the functional vision and functionality from aesthetics becoming an important complement as well as a new stimulus for students.

Therefore, from the great harmony between these different fields of knowledge, our main objective has been to research the visual freehand sketching language in an artistic, industrial, or digital design work as a thought process.

Fine art students search for expressivity, freshness, spontaneity, concepts that will favor a specific way of drawing. Instead, designer students look for accuracy, marked lines, dimensions, proportions, and geometric representation. Different approaches learned by their teachers, but with this experience they will have a different way of watching and expressing themselves through their drawings.

Results

We will differentiate every proposal to establish ways of proceeding in each one, to finally converge to an analysis in which we will set the different ways of approaching a drawing study.

Experience in the Sculpture classroom

They had two sessions of three hours to do it. In this case, Professor Óscar Alvariño gave them a master class to understand the process to make it possible (drawing and sculpting). He even did it with them so they could see first-hand (see Figure 9). In this case not all students from industrial design attend it.



Figure 9. Professor Óscar Alvariño in the sculpture class

The first approach to start a sculpture is to draw the model from different viewpoints so they can analyze the structure, proportions, angles, textures, light, and shadow to understand volumes (see Figures 10 & 11).



Figure 10. Pablo Jiménez Bermejo



Figure 11. Series of 3 drawings from María Concepción Martín

For all of them it was the first time they approach the creation and copy of a three-dimensional plaster model. They worked with special plasticine (see Figure 12 & 13).



Figure 12. Mario Cancho and María Concepción Martín



Figure 13. Final sculpture. Noémí Abarca de las Muelas

In the Sculpture experience, drawings obtained have lines that delimit the contours of the figure. The form fits into the two-dimensional support. Light and shadow values are sparse in the figure. It seems that the spatial training of the students of the degree in engineering in industrial design and product development facilitates the understanding of the volumes of the sculpture and therefore, being the first time, the ability to reproduce the sculpture is quite good.

Experience in the Painting classroom

Another exchanging experience was mixing students from fine arts and engineering in industrial design in a painting classroom in the subject “Painting processes” (see Figures 14 & 15).



Figure 14 & 15. Professor Macarena Ruiz Gómez and Students from the Higher Technical School of Industrials and Design (UPM) working in the Painting classroom together with the students of the Faculty of Fine Arts, UCM

Starting from some guidelines set by the teacher, whether studies of light, volumes, structure, chromatic harmonies, students seek to understand and assimilate what they are observing, as well as the achievement of competences.

They start with a writing study of what is being seen, about light and shadow, including different grey scales, to understand the elements (see Figure 16 & 17). This can be compared to the notes industrial design uses to explain their sketch. They made fast sketches with explanatory notes.

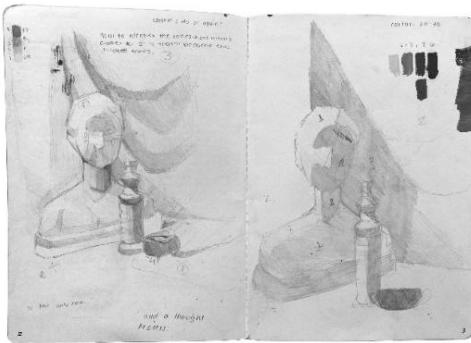


Figure 16. Ana Meza Alarcón – Fine arts

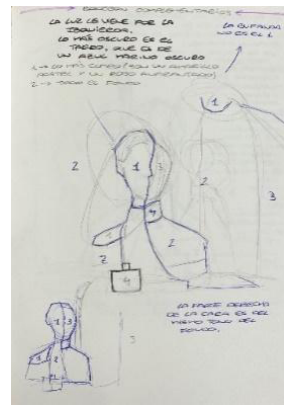


Figure 17. Sara Mora García – Fine Arts

In the sketches of still lives we find fast sketches with explanatory notes. Fine art students use elements to code like 3 or 4 different grey scales (see Figure 18). They tend to draw with grey zones avoiding marked lines. They considered the objects as simple geometric volumes (see Figures 19, 20 & 21).

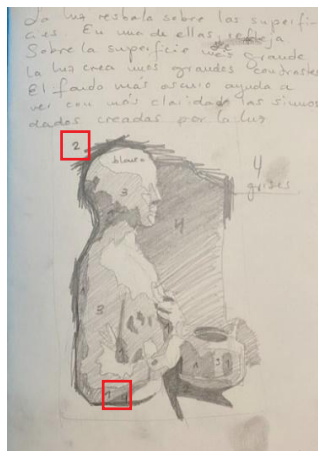


Figure 18. Carlota Dublin Manrique – Fine arts



Figure 19. Pilar Casillas – Fine Arts



Figure 20. María Díaz Gámez – Fine Arts

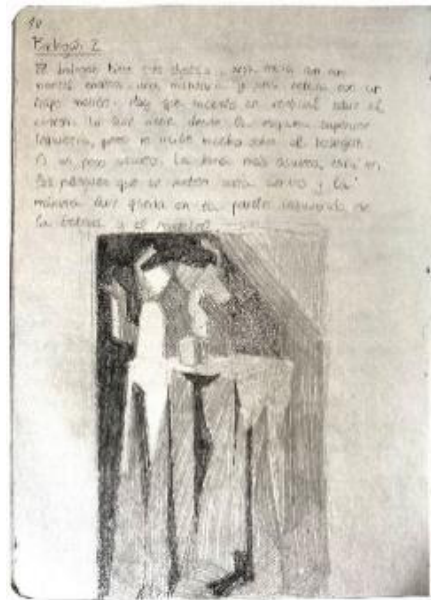


Figure 21a & 21b. Paula Hernando – Fine Arts

In the first approach, Industrial design students try to draw details, without clearly differentiating big zones of grey values. In general, they don't look for geometric form simplification. Most of industrial design drawings seek for details, make grey gradations instead of clearly differentiating grey zones (see Figures 22 & 23). The background is not always taken into consideration (see Figure 24). For industrial design, lines seem essential to delimitate shapes and objects (see Figures 25 & 26).

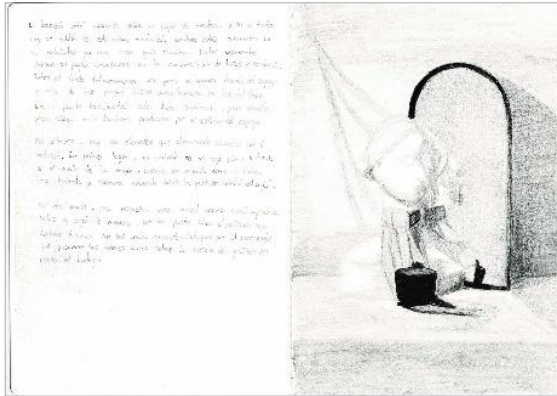


Figure 22. Pablo Calleja Gil – Industrial Design

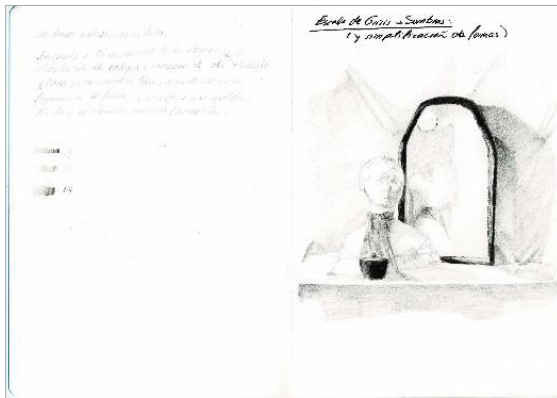


Figure 23. Cristina Cagigas – Industrial Design



Figure 24. Aomin Chen Yang – Industrial Design



Figure 25. Laura Triguero Miota – Industrial Design

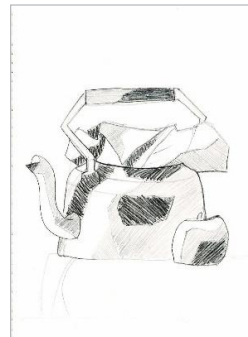


Figure 26. Rodrigo Bastante – Industrial Design

This work has been mainly channeled from the drawing, however, in some cases they also did an approach to color, every student with the tools they feel more comfortable (oil painting for fine art students (see Figure 27 & 28) and markers for industrial design students (see Figure 29)).



Figure 27. Paula Hernando – Fine Arts

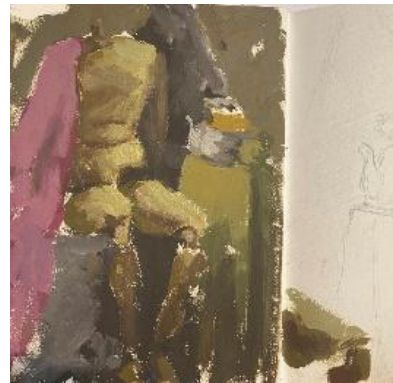


Figure 28. Paula Nuñez González – Fine arts



Figure 29. Pablo Calleja Gil – Industrial Design

In addition to carrying out studies of light and simplification of structures, they have made some tests of color, studies of chromatic harmonies to be able to arrange the observed elements in a more agile way and not get lost in the parts, seeking a global vision of both elements as general tonality.

Color is applied as value zones. The student has worked in their notebook. Therefore, we can say that color can also be applied synoptically in the execution of sketches.

Experience with the industrial design proposal

The Industrial Design proposal is about the realization of a Christmas ornament made with wood (Medium Density Fiberboard).

Professor Silvia Nuere gave a master class about design methodologies to start a design process and explained the exercise proposal (see Figure 30).



Figure 30. Silvia Nuere giving a Master class about industrial design methodologies

This seminar was for most of the UCM Fine Arts students their first meeting point with another discipline, but they observed that from the beginning they recognized points of union regarding the process that they had been carried to follow.

The process is to start thinking about personal feelings in this time of the year. This first step will lead them to write concepts related to their experiences. Once they have chosen objects of personal interest, they will proceed to make an abstraction to finally merge into the ornament.

The final aim of the exercise is to have different wood pieces that mounted will give three-dimensional volume.

Drawing is essential in all the process as it is the way to express on a sheet of paper feelings, ideas, success, and failure.

Fine art students use marked lines, color to highlight elements or to indicate final options (see Figure 31).

Lines are protagonist, and they try to imagine how the figure will be in three dimensions, but they do not delve into the way in which the pieces can be put together. Not all the proposals were feasible as they did not determine how to assemble the pieces.

In many cases, fine art students use lines, orthographic representations, and many written notes to explain the sketches (see Figure 32).

In many Engineering in Industrial Design students' proposals, they draw using a system of representation as conical perspective, or orthographic projection (see Figure 33).

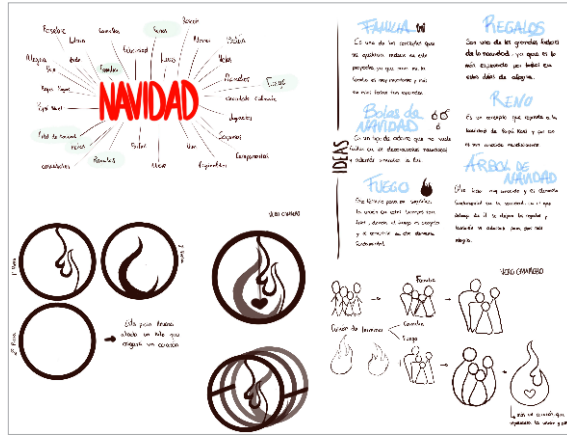


Figure 31. Verónica Alexandra Camacho – Fine arts

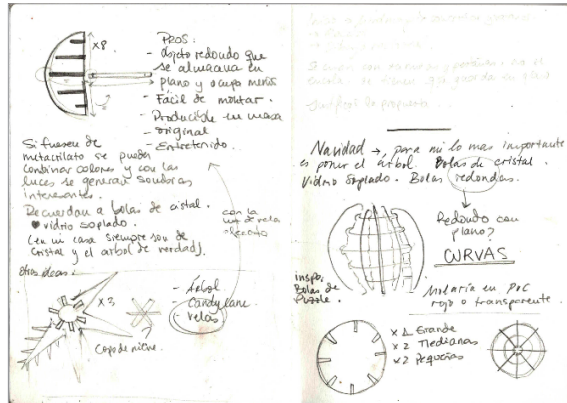


Figure 32. Gabby Grube – Fine arts

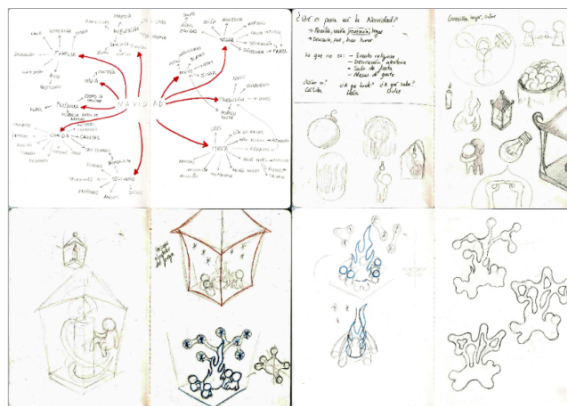


Figure 33a. Lian Xiaolei del Pino García – Industrial design

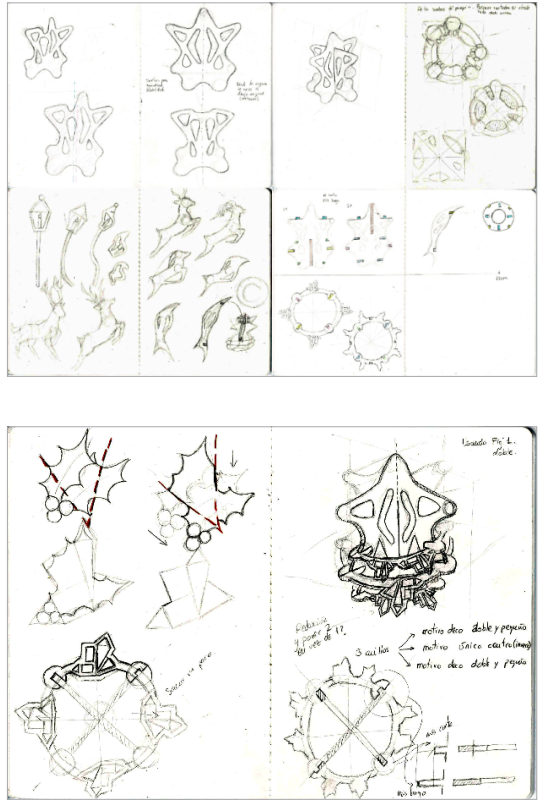


Figure 33b. Lian Xiaolei del Pino García – Industrial design

In the case of industrial design students, they elaborate a lot of fast sketches trying to perfectly explain their ideas and the way it will work in the end (see Figures 34). They try to approach visually their thoughts, with just few explanatory notes.

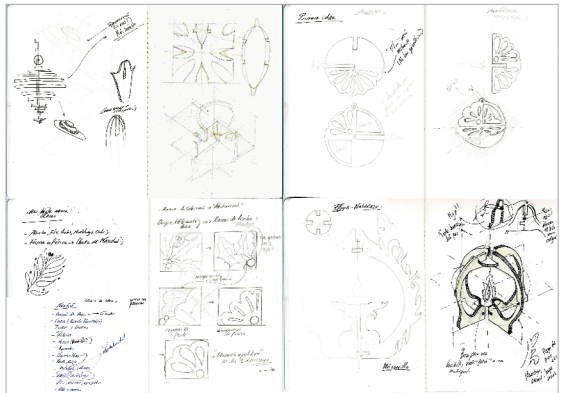


Figure 34. Cristina Cagigas – Industrial design

Digital graphic design analysis

Even though it was not possible to mix students from the Universidad Internacional de la Rioja (UNIR), as it is a 100% online university, we have analyzed the way graphic design students manage drawings.

There is a similarity with industrial design students, as they use lines as preferential visual language tool, accompanied with writing notes.

From the drawings of digital graphic design, we can outline that they use them as a fast sketch to set the ideas on the paper, to think graphically and to not forget any detail prior to the final result.

There is no color in the sketches as drawing is a simple approach to the idea they want to reach. The results are very schematic mixing figures and text. Drawings seem repetitive as they try to approach to the better solution they are looking for (Figure 35 & 36).



Figure 35. Cristina Martínez Terré – Digital Graphic Design

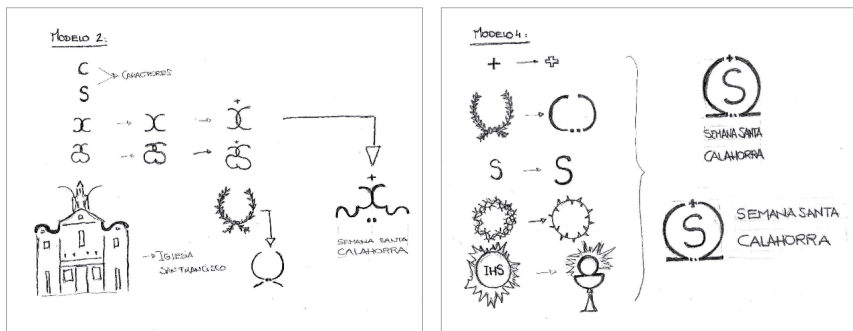


Figure 36. María Arantazu Marín Laseca – Digital Graphic Design

In the fine art experiences, all students drew what they saw, far from inventing or interpret the still, and they must stay close to the objects. In the Christmas ornament and in the digital graphic design they draw from imagination about their feelings in this moment of the year, or about what they want to reach with their proposals.

Discussion

In this research we have focused on the qualitative analysis of the way students from fine arts, engineering in industrial design and digital graphic design use drawings/sketches to face an interpretation and representation of a still life, to face an industrial design proposal or to establish the bases of a defined digital graphic design. Drawings have been studied to establish similarities and differences in the use of visual language (points, lines, planes, surfaces, and colors, between others), as the necessary elements to communicate ideas.

We have analyzed different ways of expressing themselves through different exercises. All of them can be considered as the first step approach to a later work.

To summarize, we will highlight the main finds we have reached out in each group of drawings.

Still-life drawings:

Fine art students:

- Drawings as color regions
- Volumes as geometric shapes
- Figure and background as a whole

Industrial design students:

- Start with lines that later they fill with grey scales (making gradients)
- They forget to treat the background as part of the final draw
- Difficulty to synthesize
- They treat the first approach as a final drawing

Christmas ornament:

Fine art students:

- Try to introduce elements of color
- Important features related to illustration
- Narrative works
- Orthogonal projections
- Difficulty to understand final 3D volume

Industrial design students:

- Line is the protagonist.
- Drawings are clumsy, fast without caring about the results.
- Written annotations important as they add information and clarify the ideas to the observer
- Ability to represent the object in three dimensions
- Low-quality model to understand the necessary joints
- Color as a filler

Graphic Design students:

- Lines as a language to propose fast schematic approaches
- Lines as added texts
- Generally, lack of color

The following tables (see Tables 1, 2 & 3) will summarize, according to John Willats, the essential visual elements used in the drawings comparing students from the three different degrees. Willats (1997) made a differentiation about the diverse ways in which people while drawing represent the visible elements of the world. He describes them in terms of drawing systems, as perspective, oblique or orthogonal projection, and denotations systems, as lines and points that will finally merge into shapes and regions.

Table 1. Fine Arts proposal concepts analysis

Fine Arts proposal				
denotation systems				drawing systems
	use of lines	regions	colour	orthogonal Projection(O) conical perspective (CP)
Fine arts students	no	clearly defined	as part of a different language	CP
Industrial design students	clearly defined edges	no	as colour regions	CP

Table 2. Industrial Design proposal concepts analysis

Industrial Design proposal				
denotation systems				drawing systems
	use of lines	regions	colour	orthogonal Projection(O) conical perspective (CP)
Fine arts students	yes, very marked	no, some to differentiate parts	yes	O
Industrial design students	yes, clumsy lines	no	no	CP

Table 3. Digital Graphic Design analysis

Digital Graphic Design analysis				
denotation systems				drawing systems
	use of lines	regions	colour	orthogonal Projection(O) conical perspective (CP)
Digital design students	marked lines	no	not at all	not applicable

Conclusions

Even though we have indistinctly talked about drawing or sketching, we want to highlight, that in an early approach to a future work, both can be meant. We are then interested in the starting point of approaching a problem through a representation of the visual or imagined world in a two-dimensional support.

Even if we deal with representation of real or imagined worlds, drawings allow us to fix the objects in a two-dimensional support. The idea of the sketch is common in all three disciplines, fine arts, engineering in industrial design or digital graphic design, no matter the exercise. We must capture the essential general ideas that we want to convey, by means of freehand sketching, materialized by lines, shapes, regions and notes if necessary to explain concepts.

The incorporation of writing comments contributes to the fluidity of their thought, as well as to express ideas. Synthesis of both surfaces and chromaticity helps ensure details are not lost.

Sketching as an interdisciplinary tool helps students not only to understand the benefit of drawing but also to analyze other ways of expressing their ideas.

As a knowledge tool, they increase the observation capacity, and organize their thought. While drawing an art piece, product or graphic design, drawing helps to generate ideas quickly, increases resolution capacity and gives fluidity.

Drawing is a language, understood as a series of graphic signs on a support. As a graphic statement, it has the purpose of communicating, representing or projecting. In the end, sketch becomes a tool of thought to convey ideas on a two-dimensional support.

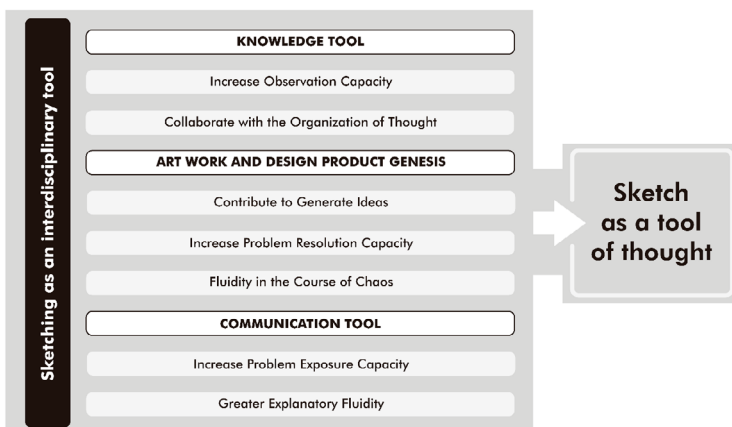


Figure 37. Visual conclusion of “Sketch as a tool of thought in art and science”

As a communication tool, drawing and sketching increase problem exposure capacity thanks to its immediacy, fluidity and to the sensation that mistakes, redrawing, and repetitive lines help along the process to reach the final idea/proposal (see Figure 37).

Drawing then is the same as thinking, it is a process of constructing images and shapes in space; it is a fundamental part of visual production, but it is the plastic form closest to thought. The idea is the stuff of thoughts, concepts, and mental images. Due to its formal and material qualities, the drawing is a translation of the action of thinking in a plan. Drawing is an action, an intelligent action because intelligence inscribes comparing things in order to resolve some issue

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