

## Trabajo Fin de Grado

Desarrollo de recursos gráficos para la docencia de  
design sketching  
Development of graphic resources for design  
sketching teaching

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# 1. Introduction

## 1.1. Abstract - Aim of the project

Design sketching is used in all the stages of the design process in order to explore formal and functional aspects of the product. This discipline involves analyzing, synthesizing and evaluating information. Thus, this research argues the need to study sketching in the design engineering field.

Furthermore, due to the COVID-19 pandemic educators have had to adapt to this new situation by using new technologies to teach from home. Consequently, this research aims to explore new ways of teaching and find an effective approach to distance teaching free-hand sketching.

## 1.2. Motivation

The COVID-19 pandemic has drastically changed many aspects of our lives. One of these aspects is the educational one. During this situation, teaching methods have had to adapt to online distance learning. This can be complicated in the case of subjects such as design sketching, which requires giving feedback to the students of their sketches and in this situation, lecturers are not able to supervise the students' drawings.

Therefore, it is important to study design sketches, the current methodology utilized and the implementation of new sketch design tools that are accesible for everyone fulfilling Sustainable Development Goal 9 from the 2030 agenda.

## 1.3. Research question & hypothesis

Given the current pandemic situation the following question comes to mind: How can we implement a better solution to distance teaching design sketching?

The following hypothesis is formulated; the situation would improve by making the lectures more appealing not only for industrial design students but also for professors making it more interactive and fostering the active participation of the pupils.

Moreover, the more personalised feedback students get, the more satisfied they will be since with this online situation the proximity with the professor and peers with whom they can share ideas and different points of view is lost. Different online platforms could be used to give support when giving a lecture or giving feedback. Furthermore, feedback could be given in a different way than the one used currently.

## 1.4. Methodology

The methodology followed is the one learned during the product design and product development engineering degree. It will be divided into five phases: research, product design specifications, concept development, final concept development and presentation and documentation of the results.

For the research, different papers and design sketching books have been consulted in order to obtain accurate information about what design sketching is and its context of use.

Comparative tables of the different design sketching learning methods have been elaborated to have a visual overview of which method is the best according to different criteria.

Also, students who are taking design sketching lectures during the 2020/2021 course have been asked to fill a survey to get feedback on what they think about the online lectures and how can these be improved.

Finally, a set of exercises were proposed to a group of undergraduate industrial design students in order to check if these exercises were a useful resource to integrate in the design sketching lectures and if they worked in an online situation.

# 2. Research

## 2.1. Introduction

In order to design graphic resources for a design sketching lecture, it is necessary to understand what is design sketching and why is it important in the product design field.

Thus, a research has been conducted and many papers have been examined to get an accurate definition of design sketching and its benefits.

## 2.2. Design sketching definition

Design sketching is an ubiquitous tool for designers to conceptualise, develop, externalize, record and communicate their ideas through the utilisation of graphical illustrations. [1]

The act of sketching is a means of communication and attracting attention, as well as providing a medium for storing information as it may facilitate archiving and retrieval of information generated earlier in the problem solving process. [2]

In the practice of engineering, engineers use sketching strategies not only to translate mental design ideas into graphical displays but also to create new ideas which may not exist prior to drawing.

## 2.3. The importance of design sketching

Sketching is of paramount importance along all the design process, from the earlier stages with more primitive sketches, to the development stages where we can find high fidelity representations of the product. Despite this fact, little research has been conducted in the sketching field.

Research has shown that sketching is essential in order to stimulate creativity. Sketches can provide a more integrated process, by providing better access to the earlier ideas and enhancing the use of information in previously generated ideas, facilitating the access to them. [3]

Sketching provides visual context and may facilitate archiving and retrieval of information generated earlier in the problem solving process. It also may enhance the use of information in previously generated ideas by enhancing the access to earlier design ideas. [4]

Therefore, it becomes apparent that it is necessary to educate engineering design students in free-hand sketching as it provides the creator with useful resources and tools to carry out this task.

## 2.4. Sketching in the educational field

As stated before, few research has been conducted in this area. As sketching is basic for engineering design, as it is involved on several stages (problem definition, concept solutions, analysis and evaluation and communication), it must be a skill required for future engineers and so to be taught.

According to the Engineering Design Graphics Division of the American Society for Engineering Education (ASEE), freehand sketch engineering objects is the second more important skill for graphical communication to be learnt for engineering students. [5]

Engineering students traditionally are assessed on their mathematical and verbal abilities and less by their visualization skills. In addition to this, if we take a look at the curricula of the industrial design engineering degree in Spain, it becomes apparent that sketching is being replaced by CAD tools to the point that in some cases, that sketching lessons are not even offered in the curricula. [6]

As a consequence of that, engineering graduates limits their capacity to analyze design solutions, as well that a negative effect on spatial abilities, visual spatial reasoning and then visual thinking problem-solving

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skills.

In collaboration with the University of Zaragoza, the Middle East Technical University, the University of Applied Sciences of Upper Austria and the University of the Arts of Poznan, an overview of the current curriculum of each university was made in order to analyse how are educators teaching the design sketching subject during this pandemic. The table allows to have a clear vision of the main characteristics of the design sketching lectures in each university.

This table can be found in Annex I: Research, section 3: Comparison of teaching methods (p. 7)

What can be noticed with this table is that every university that participated on this research teaches design sketching during the first year of bachelor as it is considered an essential skill to learn and that will be useful during all the bachelor's degree. Another important aspect is that in some universities, lecturers are using software such as Illustrator or Photoshop as a support for their lessons. These softwares allow the professor to draw with a graphic tablet and, by sharing their screens, students can watch how sketches are done.

Finally, we can say that professors have preferred to teach traditional sketching rather than digital in this situation and thus, weekly assignments and materials used remain the same as before the pandemic.

To get deeper in the teaching methods utilised at different universities, a comparison of the competences taught among different Spanish universities has been made. One of the most obvious findings was that there were some universities that did not offer design sketching courses (mostly called artistic expression courses), but they do all offer CAD courses.

As we can observe in the comparative table in Annex I: Research, section 3. comparison of teaching methods (p. 9), oral and written communication are present in every teaching guide. Creativity and problem solving are common competences in many of these guides as sketching is a creative tool not only used to copy objects from real life but to create new ones that solve a detected problem for users.

On the other hand, sustainability is barely regarded maybe because sketching is mostly used in the first stages of product design where materials and product lifecycle are not clearly defined. Also decision taking is something in which should be taken into consideration thus, as designers, students should be able to decide on whether a design is valid or not.

It is a bit worrying that the basic knowledge of the profession and the ability to apply the knowledge in the professional practise are only considered in two of the documents as we should take advantage of the practical contents of design sketching to orient them to the professional field.

To sum up, we can say that the specific competences focus on communicating ideas in an effective way, synthesising the knowledge acquired through the utilisation of tools learned in the subject, considering proportion and fitting, lines, lights and shadows, colours and textures.

## 2.5. Other methods used to learn design sketching

Knowledge in this area can be acquired through online workshops and through books. A table has been made to compare different books and courses and the contents they offer. See Annex I: Research, section 3: Comparison of teaching methods (p. 12 and 14).

All these methods follow a similar structure:

We can learn with these courses and books are the basic principles of perspective through observation by breaking any form down into its basic volumes. Then, they teach you how to use different types of lines as communication elements to produce quality sketch lines. Moreover, we can go deeper and learn how to

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use markers for simple shading and rendering the product to simulate materials and textures. Lastly, the use of shading to make more realistic sketches is present in all of them which is an essential step before and while rendering the product.

In conclusion, the courses and books do not cover all the contents taught at university but they are useful to have some basic knowledge on how to sketch. However, we cannot learn how to make presentation panels with stand out backgrounds and form exploration of the product. These books and courses are only meant to learn to draw the same product in different perspectives.

Based on the research made, the best way to learn design sketching is by attending lectures since there is teacher-student interaction, so all the doubts concerning sketching can be solved and also students have granted to acquire a series of competences by having taken this course. In addition, a complete study program is offered.

The next option would be online design sketching courses. Here the interaction between teacher and student disappears. But still, they are interactive to some extent, as the student can follow step by step what the teacher is doing. The program is less complete than the one offered at universities since almost none of the online courses teach how to make presentation panels with stand out backgrounds and they do not stimulate creativity through formal exploration.

The least optimal learning method would be sketching books which are not interactive and their program is more incomplete than the ones from other methods.

### 2.6. Sketching during the pandemic

Bachelor students who are currently studying design sketching were asked to fill up a survey to know their opinion about the online lectures during the pandemic. See Annex I: Research, section 5: survey (p. 17-20)

Sketching and drawing in the first year are essential as they lay the foundations for product design. Sketches are a tool which pupils will use during all the degree as well as their professional career no matter if they are digital or traditional.

Although traditional sketching is preferred over digital sketching, many students think about starting to learn how to use a graphic tablet in their sophomore year. It seems digital sketching is a step further in the line of progression. This can give a hint to introduce graphic tablets later on in the degree or maybe begin to teach hybrid methods (combining digital and traditional sketching). This can be challenging as 38% of the pupils who do not own a graphic tablet cannot afford one.

Nevertheless, the most important thing revealed is the lack of feedback during the sessions due to the online situation. This is crucial for students so they can improve their technique. If they do not show an improvement in their sketches, the lessons will end up being useless.

The majority of the students have found the lessons easy to follow or with a medium difficulty, so the dynamics of the class will have to be revised to enhance the learning of those who have found the classes a bit difficult to follow up.

As a final highlight, students would like more time dedicated to form exploration.

# 3. Design specifications

As a result of the previous research conducted and the feedback given through the survey, a set of design specifications have been extracted and translated into a table.

Design specifications can be divided into three groups: the technological component; on the other side we have the user who has to utilise this technology and the structure and methodology that the lessons have to follow.

| Technological   | User  | Structure and methodology  |
|---|---|--|
| <p>It has to allow instant educator-student feedback.</p> <p>It has to adapt to the current situation of pandemic but also it has to be useful in other situations where online learning is required.</p> <p>It has to be inclusive for all the users, so graphic tablets are out of topic.</p> | <p>Users have to be comfortable using the tools created for the class.</p> <p>It has to allow all users to participate.</p> | <p>It has to allow to teach how to draw.</p> <p>The structure and the activities of the class has to be easy to follow.</p>  |
| <p>It has to be interactive.</p> <p>It does not have to entail a workload for the student or the teacher.</p> <p>It has to allow student-student feedback.</p>  | <p>It has to have a motivating component for the student.</p>   | <p>It has to allow to learn from other students.</p> <p>It has to allow to create a collaborative environment.</p> <p>It has to allow students to explore different techniques</p> |

Table 1: Desirable and critical design specifications

 Critical design specifications

 Desirable design specifications

At least, all the critical design specifications must be solved to improve the current situation of online classes. In order to achieve this, more research and idea generation has to be made.

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## 4.1. Platforms which allow feedback

In order to have a suitable concept for this situation, more research has to be conducted. Thus, feedback is the cornerstone to improve the online design sketching lectures and should be investigated how can students get more feedback through online platforms.

Meaningful online feedback is necessary in an online learning environment because it provides a constructive work reflection to the students. Instructors who provide online learners with constructive feedback help learning participants process new ideas and information while improving self-efficacy.

Students can obtain feedback from their educator, their peers or external feedback.[7]

**Instructor feedback:** instructor feedback is of paramount importance for students as instructors who provide thoughtful online feedback provide learners with explicit expectations for the performance outcomes for their work and an opportunity to understand areas where academic improvement is needed.

**Learner-learner feedback:** peer feedback is also essential. Sharing ideas and compare your work with others can help analyzing review and synthesise your own work. Therefore it is important to provide a collaborative milieu for students. Rubrics can be developed to encourage and guide peer feedback.

**External feedback:** external feedback from non-expert people in the field can be also useful to see things from a different perspective. That ensures your work is going to be understood by all kinds of public.

Among all the video call platforms investigated, the most effective to learn online is Zoom (see Annex: III, section 1: platforms which allow feedback p. 26). Both the professor and the pupils can share their screens to show their ideas and allows instant feedback. Another important feature of Zoom is the break-up groups which can be effective to obtain feedback from peers in an organized way (small groups are less chaotic) as well as for co-evaluating them and share ideas.

The professor can join any small group whenever he or she wants to provide individual feedback, which students have been missing during online classes.

A good complement for this tool would be an online portfolio. Otherwise students would have to show their paper sketches through the webcam, which is translated into low effectiveness.

The pupil would upload a photo to his or her portfolio, share the screen and ask for feedback. Also, for evaluating the pupils' work, the educator could follow their students so he or she would be able to see the progress made.

In addition, sharing their work online, allows even more feedback from a broader audience but it is important that this audience is specialised so feedback can be given in a more constructive way from which students can leverage.

For all these reasons, Behance is the best tool among the ones analyzed. (see Annex: III, section 1: platforms which allow feedback p. 27)

To sum up, educators and students would make use of two tools: Zoom and Behance. These tools do not require much effort to be used, they are user friendly. Zoom allows feedback from classmates and from the teacher and Behance allows feedback from peers and specialised audience. Behance is also a useful tool for the students' future career.

## 4.2. Form exploration

In order to create a successful form exploration lecture. We need to understand what does the concept of



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form exploration mean.

An important step in design is the form exploration of the product. Products communicate features such as functionality with shape, colour and texture. Sketching does not only consist on copying objects that already exist but to explore and modify them in order to get an aesthetical or functional improvement out of them.

Thus, form exploration allows to examine and scout hypotheses, assumptions and preconceptions about our designs by experimenting with variations of an idea. It is also a useful tool to detect and explore potential solutions through an iterative process.

Form exploration can serve for multiple purposes such as searching for empathy and emotional bonds or new ways of consuming or using a product.

There are different techniques that can be used to obtain new shapes and results. Some of them are: [8]

**Addition:** the product presents a sum of similar elements.

**Subtraction:** The product's overall shape is perceived as the absence of other shape. **Fusion:** a union between different shapes is produced resulting in an hybrid form.

**Torsion, bending, tension, expansion and transformation:** a variation is produced and the form changes modifying its initial structure.

Other way of carrying out form exploration is through imposing restrictions. Some of the restrictions that can be applied are:

**Time:** sketching within a limited amount of time will affect the lines and the details shown in the sketch.

**Drawing support:** by changing the size and the texture of the paper, results will be different.

**Tools:** by changing the sketching tools (e.g. pen, pencil) for others (e.g. brush) parameters such as the strokes, the thickness and quality of the lines will vary.

**Others:** sketching without any references, sketching the product upside-down, sketching with non-dominant hand, working only with straight lines, etc.

## 4.3. Lecture's structure at the University of Zaragoza

Professors have had to restructure the lessons to adjust to the current situation and thus, change the way they teach them. Leaving behind the traditional way of teaching design sketching is, undoubtedly a challenge. Online learning is completely new for most of the educators and students and requires intensive work to prepare and adapt the lessons to this format.

As for now, the lessons follow this structure:

**Planning:** The professor explains the different parts in which the practice will be divided into.

**Theoretical input:** first, the teacher gives a brief explanation about what the practice is going to be about and explains some theoretical contents related to the topic.

**Composition:** students have time to think about how their composition (perspectives, number of sketches, details...) is going to be, which format (vertical, horizontal, A3, A4, A5...) will bring the best results.

**Sketching:** Pupils sketch based on the theoretical input and examples shown before. When time is finished, they take photos and upload them to moodle.

**Feedback:** the professor downloads the images from moodle, opens them into illustrator and sharing his or her screen, gives feedback, points out the mistakes and corrects them by painting over them.

# 4. Concept development

This structure might seem correct but feedback should not be a phase but should be an element present in every phase. If feedback is only given at the end of the lesson, students do not have the opportunity to correct their mistakes while sketching. This is shown as a clear disadvantage for pupils in order to improve their sketches before being evaluated.

Also, the professor cannot give individualised feedback to everyone due to the great number of students. That is why it is needed to think about other ways of giving feedback. Next, a couple of ideas for giving feedback will be commented and developed.

## 4.4. Ideas for giving more feedback

### 4.4.1. Break-up rooms

Platforms such as Zoom and MS Teams (in this case we will work with Zoom) have the option to create smaller rooms to perform tasks in smaller groups. The theoretical part would be taught in the main room whilst the sketching part could be taking place in smaller rooms with the purpose that students can exchange ideas and opinions and give feedback to each other. The instructor can enter these rooms whenever he or she wants to provide feedback.

Zoom also has a button called "ask for help" which notifies the teacher if there is a group which has any doubt and go assist them.

### 4.4.2. Rubrics

As said before, it is impossible for teachers to give individualised feedback. Thus, rubrics can be a useful tool to give feedback yet they are often underutilized in the learning process. Rubrics are a way to efficiently give guidelines, go through the criteria of a project and assess where the student met the criteria and with what quality.

Students can see the rubric and check their level of achievement objectively. After this, they identify by themselves the categories that scored the lowest. These categories may be the best areas to focus on, as they provide the greatest opportunity for improvement.

Rubrics not only allow the student to assess his or her own work but to assess others' work. So co-evaluations among peers can be implemented following these rubrics.

A set of criteria for grading assignments has been designed which can be used by teachers when marking, and by students when planning their work. It is an attempt to communicate expectations of quality around a task. In other words, it is expected to serve as a way of giving indirect feedback. The criteria selected are fitting and proportion, line, shading, stand out backgrounds, form exploration and presentation panels.

This rubric is meant to serve for every design sketching assignment. Later on, a rubric specific for form exploration will be developed.

|                        | Excellent   | Advanced  | Developing  | Needs improvement  |
|------------------------|---|---|---|--|
| Fitting and proportion | Correct use of planes, lines and grids to fit the product. Everything is proportional. All elements in the composition are correctly proportioned and work together within the frame to communicate unity and a visual equilibrium. | Correct use of planes, lines and grids to fit the product. Everything is proportional. Some elements are not well represented.      | Proportions of the sketch somewhat resemble the size and shape of the sketched object. Minimal use of lines, planes and grids.              | Lack of understanding or skills in applying correct proportion measurements. The use of planes and grids is not evident.                                   |
| Line                   | Variations in line weight (heavy, light, thin, dark, etc.) and appropriately used and well controlled in all areas of the sketch.   | Variations in line weight but there is a lack of emphasis in certain areas with minor importance.                                   | Little variations in line weight with a lack of emphasis in important areas of the sketch.  | There is little or no variation in line weight, which results in many lines "expressing" the same. Lines may communicate a lack of an intentional process. |
| Shading                | Correct application of lights and shadows, very close to reality.   | The sketch has strong, well-done shading but additional shading is needed to create a more realistic three-dimensional appearance.  | Little or no variation of shading techniques. Inconsistent or poorly applied shading.   | No evidence of shading in the sketch.  |
| Stand out backgrounds  | The background is appropriate and stands out but without being the main focus of the work.  | The background is appropriate and stands out but there is room for improvement.   | The background does not totally match the product represented, colours are too flashy or divert the attention from the product.             | The student does not apply any stand out background or it is inappropriate.  |
| Form exploration       | Considers shape, materials, ergonomics, shows details and the design is original and easy to interpret. There is a variety of sketches.   | Considers shape, materials, ergonomics, shows details but the design requires effort to understand. There is a variety of sketches. | Considers shape, materials, ergonomics, but there is a lack of details and the design requires effort to understand. Two or three sketches. | Limited consideration of shape, materials, ergonomics, there is a lack of details and the design requires effort to understand. One or two sketches.       |
| Presentation panels    | Neat, clean work with no wrinkles or stains. The composition of the reticle is optimal.   | Neat, clean work. The composition of the reticle is good but can be improved.   | Poor, messy appearance. The composition of the panel is good but can be improved.   | Broken, wrinkled, stained or smudged panel. Not using the correct physic support for the panel (foam board or similar). Messy composition of the reticle.  |

Table 2: Design sketching rubric

# 4. Concept development

## 4.5. Proposal of exercises

### 4.5.1. Participants

To make classes more dynamic, a series of exercises will be proposed. To report the efficacy of these exercises, a sample of undergraduate industrial design students has been selected. An online session was arranged in order to carry out these exercises.

The criteria for the participant selection were the following:

- Successfully completed design fundamental courses and sketching courses.
- Enrolled as a full-time student in the degree program (Industrial Design Engineering and product development).

Each of the students selected have different profiles; one part of the sample has a more technical background while the other part has a more artistic background.

Students with an artistic background are said to find easier to create new designs and variations whilst students with a technical background are said to be stagnated during this explorative process.

### 4.5.2. Purpose

One of the main ideas is to help these technical background students to comprehend the creative process and encourage them to explore different alternatives. The thresholds typical from their background can hinder the creative process and thus, these exercises are thought to foster creativity among the students.

Another point to achieve with these exercises is to guide students through the process of form exploration as many of them do not know how to take the first step with this procedure.

### 4.5.3. Task environment

To check if the methodology used would be effective for online courses, the experiment took place online. Each participant was at home with their computers and webcams turned on. The subjects were provided with plain drawing paper, pens, pencils, coloured markers and other analog tools commonly used as media during sketching activities.

### 4.5.4. Procedure

The participants were given an introduction related to the aims and objectives of this research, their rights and obligations as a participant and the task procedure. After this, a brief explanation about what is form exploration was made. Then, a summary of what are restrictions when drawing was made.

The way to proceed was the following:

The lesson consisted on series of 7 exercises were proposed to 11 participants. Due to limitations of time, each exercise had a restriction of time (5 or 10 minutes). All the participants would do the same exercise at the same time and were controlled to avoid them cheating by looking up images on the internet.

The product selected for participants to draw was a salt cellar. The starting product needed for the first exercise was the one shown below:



Picture 1: salt cellar

# 4. Concept development

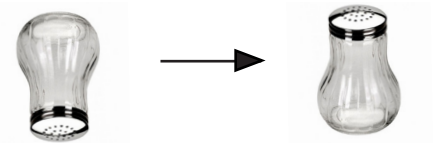
When finished, all students were told to answer a short survey in order to have feedback about the exercises proposed in order to make improvements. After collection of data, every participants' results were matched and compared.

The lesson objectives were to communicate different design ideas effectively, to check how different constraints can affect design and to review the different strategies used by students when it comes to form exploration.

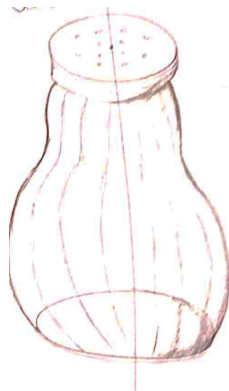
## 4.5.5. Exercises

To check the exercises more in detail see Annex IV: concept development, section 3: proposal of exercises (p. 33- 46)

**1. Draw the upside-down salt cellar in a normal position. (10 min)**  
**Restrictions: position of the product (perspective), time.**



Picture 2: salt cellar by participant 1



Picture 3: salt cellar by participant 6

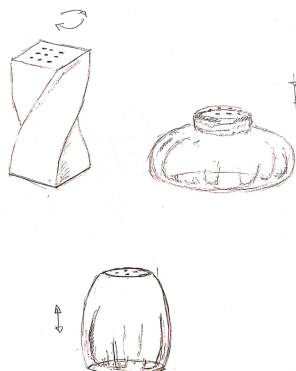


Picture 4: salt cellar by participant 9

Observations: The exercise resulted in a subtle but yet notorious difference in the forms, even though they all had the same object as reference. The greater difference observed is in the curve lines and lower part of the product. Shading also makes the product look better.

Another aspect is the strokes. In general, the thickness of the line is better controlled by those students who have an artistic profile.

**2. Draw 3 salt cellars using torsion, addition, subtraction, etc. Each salt cellar has to have at least one of these transformations. (10 min)**  
**Restrictions: transformation, time.**



Picture 5: salt cellar by participant 1



Picture 6: salt cellar by participant 8



Picture 7: salt cellar by participant 11

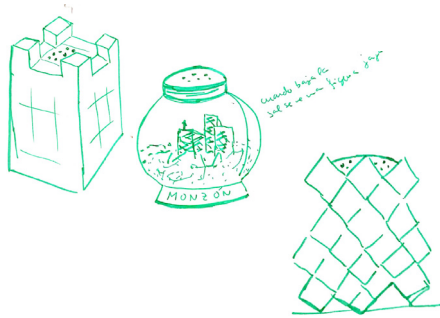
# 4. Concept development

Observations: Students with technical background did not show any problem making this exercise.

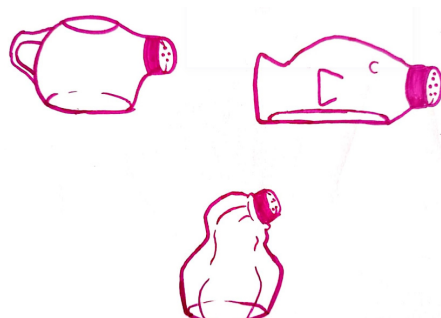
It is noticeable that some salt cellars are alike (see participant 7 and participant 11, participant 1 and participant 8, participant 2 and participant 7 and participant 10 and participant 11). As it has been highlighted before, none of the students could see the sketches of their mates as they were in different physical locations.

## 3. Draw 3 different salt cellars using a marker. (5 min)

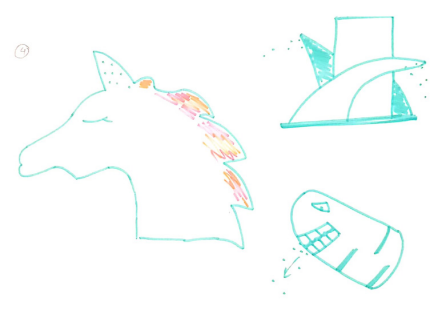
**Restrictions: tool (marker), time**



Picture 8: salt cellar by participant 7



Picture 9: salt cellar by participant 5



Picture 10: salt cellar by participant 9

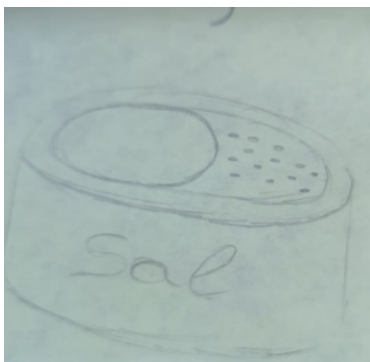
The main purpose of this exercise was to make the students to keep on sketching regardless of the mistakes they could have made. The added difficulty of time restriction fostered the quick flow of ideas.

In this exercise, technical profile students began to present some difficulties as they had already drawn 4 salt cellars and they began to run out of ideas.

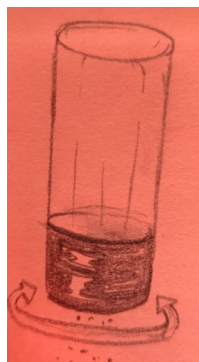
Some of them began to copy objects around them and translate them into brand new salt cellars.

## 4. Draw a salt cellar in a post-it. (5 min)

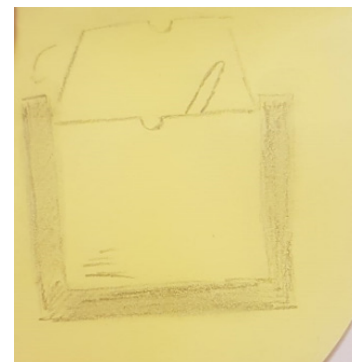
**Restrictions: size, time**



Picture 11: salt cellar by participant 3



Picture 12: salt cellar by participant 5



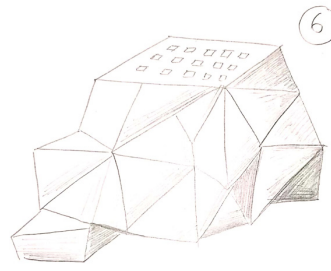
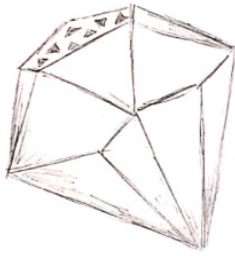
Picture 13: salt cellar by participant 9

Observations: exercise number 4 was less stimulating. None of the students had any impediment sketching in a smaller surface. Yet we can see that most of the designs are simpler and the use of lines and details has been reduced significantly.

Maybe it was not as challenging because since the beginning participants were making small sketches in an A4 format. Changing the paper format to an A3 in order to make the sketches bigger and then changing into a post-it would have been more effective.

# 4. Concept development

## 4. Draw a salt cellar in a post-it. (5 min) Restrictions: size, time

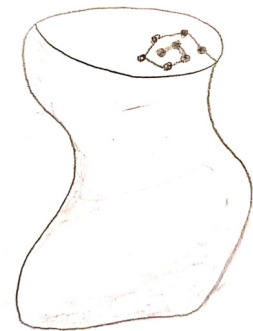
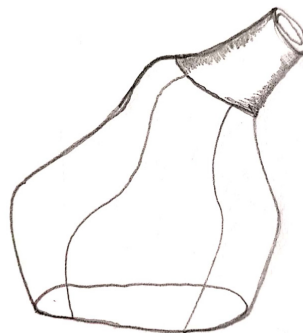


Picture 14: salt cellar by participant 4    Picture 15: salt cellar by participant 8    Picture 16: salt cellar by participant 9

Observations: exercise number 5 showed interesting results. The use of geometric shapes such as triangles is quite common. 5 out of the 11 sketches are composed with triangles.

With this restriction, we can see more original results than with any other restriction. This might be because the use of straight lines forced students to change their thinking patterns.

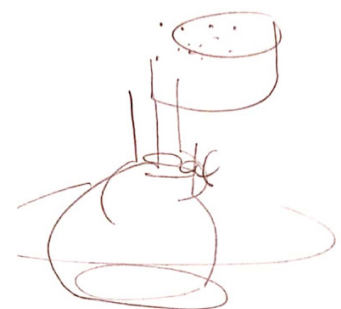
## 6. Draw a salt cellar without lifting the pencil from the paper. (2 min) Restrictions: technique (not lifting the pencil from the paper), time



Picture 17: salt cellar by participant 3    Picture 18: salt cellar by participant 5    Picture 19: salt cellar by participant 7

Observations: the restrictions imposed made the participants go for simpler curvy designs in its majority. The thickness of the lines is not that well controlled as they look really homogeneous, maybe due to the lack of time.

## 7. Draw a salt cellar without looking at the paper. (2 min) Restrictions: technique (not looking at the paper), time



Picture 20: salt cellar by participant 2    Picture 21: salt cellar by participant 4    Picture 22: salt cellar by participant 6

# 4. Concept development

Observations: the purpose of this last exercise was to see if the students could find a new form “by accident”. However, it did not result as expected.

Drawing without looking at the paper is such a complex exercise to put into practise that most of the times it end up being a failure.

## 4.5.6. Conclusions of the experiment

A survey was made to know the opinion of the participants about the exercises. To check the survey results see Annex III: Concept development, section 3: proposal of exercises (p. 47-48).

The exercises resulted to be entertaining and stimulating for students and at the same time fostered form exploration. However, there have been exercises that worked better than others.

Exercise number 1 was not well rated by participants, probably because they had to copy an object instead of creating something new. Exercise number 4 was not that well rated because, according to participants, it was not a big deal drawing in a small area, so they were not forced to think differently and be creative. Exercise number 7 did not show the results that were expected due to the complexity of the given task.

The exercises that worked the best were 2, 3, 5 and 6 because they forced students to think in totally different ways. Exercise 5 was the least well rated among these exercises. However it showed the most interesting results.

The main difference noticed between participants with artistic and technical background was the amount of time needed. While artistic profile students finished the exercises earlier, technical background students spent more time ideating in their minds what they were going to sketch. Another aspect that has been noticed is that technical profile participants began to lack ideas in the third exercise. Maybe it would be useful for them to share their work and see their mates work to get more inspired. Also, we must point out that while going deeper into form exploration, functionality began to fade.

After that, the utility of a rubric was argued as during the session, there were several doubts about how students should sketch. To support this hypothesis, the survey showed that 10 out of 11 participants considered that a rubric would have been useful. This might be helpful especially students who are less creative to have some guidelines at the time of sketching.

Finally, it must be said that as all the students belonged to the same university, the results could be biased as they all were taught with the same methods. Unfortunately, no other universities were willing to participate in the experiment.

To sum up, exercises 1 and 7 will be disregarded and the rest of the exercises will be kept as a proposal. Moreover, another exercise will be added. So the list of activities will be the following:

1. Draw 3 salt cellars using torsion, addition, subtraction, etc. Each salt cellar has to have at least one of these transformations. (10 min)
2. Draw 3 different salt cellars using a marker. (10 min)
3. Draw a salt cellar in a post-it. (5 min)
4. Draw a salt cellar using only straight lines (5 min)
5. Draw a salt cellar without lifting the pencil from the paper. (2 min)
6. Having two reference objects, merge the different features of each one to create a new product. (10 min)



|   | Excellent   | Advanced  | Developing   | Needs improvement  |
|---|---|---|--|--|
| Fitting   | Correct use of planes, lines and grids to fit the product.  | Correct use of planes, lines and grids to fit the product but some elements are not well represented.                                     | Minimal use of lines, planes and grids to represent the object.  | The use of planes and grids to fit the product is not evident.   |
| Line  | Variations in line weight (heavy, light, thin, dark, etc.) and appropriately used and well controlled in all areas of the sketch. | Variations in line weight but there is a lack of emphasis in certain areas with minor importance.   | Little variations in line weight with a lack of emphasis in important areas of the sketch.                         | There is little or no variation in line weight, which results in many lines "expressing" the same. Lines may communicate a lack of an intentional process. |
| Shading   | Correct application of lights and shadows, very close to reality.   | The sketch has strong, well-done shading but additional shading is needed to create a more realistic three-dimensional appearance.        | Little or no variation of shading techniques. Inconsistent or poorly applied shading.                              | No evidence of shading in the sketch.  |
| Transformations: addition, subtraction, torsion, change of proportions, straight lines... | Different transformations shown in the sketches and applied to the whole product.   | Wider range of transformations applied in the sketches but only in a part of the product.   | Sketches show a little range of transformations in some parts of the products.                                     | Very little or no transformations applied.   |
| Functionality   | The product is original in form and completely functional.  | The product is original in form but some functions could be improved.   | Some functions of the product are difficult to perceived or not perceived at all.                                  | The product is not original nor functional at all. The function of the product is not perceived.   |
| Ergonomics  | The product is ergonomic (easy to hold/grab, to use, it has the right proportions and size...).                                   | The product is ergonomic but there are some details that could be improved.   | Some ergonomic aspects have not been considered in the design.   | The form variation hinders or worsens ergonomics.  |
| Organised layout  | Attractive and original layout. Organised sketches. It's easy to locate important elements and the final design.                  | Attractive and original layout. Organised sketches. It's easy to locate most of the important elements but not which is the final design. | Attractive and original layout. Sketches are a bit messy. It's difficult to locate some of the important elements. | The sketches are cluttered and somehow confusing. It's difficult to locate the important elements and the final design.                                    |
| Creativity and originality  | New and innovative approach to the topic; student has created own design and product.   | Student adapts others' ideas to create own design; some originality shown.  | Student adapts others' ideas to create own design; very little originality shown                                   | Creativity and originality absent  |

Table 3: Form exploration rubric

# 5. Final concept

## 5.1. Lecture structure

### 5.1.1. Before the lecture

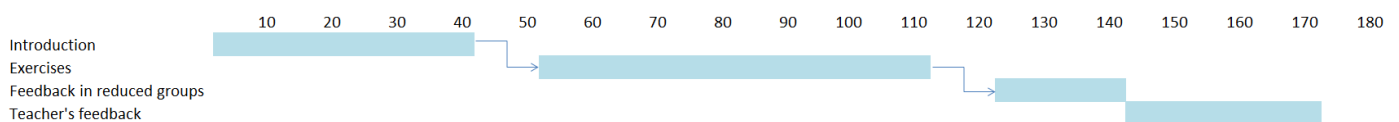
Before the lesson starts, students would be asked to create a Behance account in order to upload their sketches and send their username to the lecturer so he or she can follow them in order to check their work. The sketches done during the lessons would be uploaded to this platform so students can get feedback not only from the lecturer but also from their classmates, career colleagues and more specialised public.

They would also be asked to download Zoom since this would be the platform selected to carry out the design sketching practical lessons.

### 5.1.2. During the lecture

Currently, design sketching lessons at the University of Zaragoza last 3 hours and are being held online. According to this time frame and the circumstances, the lesson will be divided into three different parts, with a 10 minute break between each of the parts.

In order to make clear how the organisation of the class will be, a Gantt's diagram has been designed and displayed.



The lesson's modules will be:

**1. Theoretical input:** A brief introductory power point based explanation to form exploration with visual examples. (40 min). This presentation will be elaborated in Annex IV: Final concept development (p. 55-76)

**Break** (10 min).

**2. Exercises:** the exercises proposed will be made by students (60 min). The product chosen will be a perfume bottle as it is a simple product that can be drawn in less than 10 minutes. Each exercise has its own restrictions in order to foster creativity.

1. Draw 3 perfume bottles using torsion, addition, subtraction, etc. Each salt cellar has to have at least one of these transformations. (10 min)
2. Draw 3 different perfume bottles using a marker. (10 min)
3. Draw a perfume bottles in a post-it. (5 min)
4. Draw a perfume bottle using only straight lines (5 min)
5. Draw a perfume bottle without lifting the pencil from the paper. (2 min)
6. Having hair dryer and a salt cellar, merge the different features of each one to create a new perfume bottle. (10 min)

**Break** (10 min).

**3. Feedback:** feedback will be divided into two different parts:

**3.1. Peer-to-peer feedback** (20 min): The session would be carried out via Zoom. This platform allows the creation of reduced groups in which students can work and collaborate. They would individually assess their own work with the help of the form exploration rubric elaborated and then, in groups of 4-5 people (4-5 minutes per person), they can show their concepts, previously uploaded to Behance and

# 5. Final concept

by sharing their screen, and do a peer-to-peer evaluation of their group mates (they can also rely on the rubric to do this). The lecturer can go into these smaller groups in order to give more personalised feedback.

**3.2. Teacher-student feedback** (30 min): When the 20 minutes of peer-to-peer evaluation are finished, all the students would return to the main room where the lecturer can give more feedback to those who are willing to get it during 30 minutes. The lecturer would download the sketches from Behance and with the help of a tool such as Sketchbook, Photoshop or Illustrator, he or she can draw over the drawing and point out the mistakes made by the students.

## 5.1.3. After the lecture

Students will be told to upload their final designs to their virtual portfolio in Behance so the professor can have a closer look and evaluate them.

# 6. Conclusions

I am very satisfied with the results of this project. When I was in my first year of bachelor, I enjoyed design sketching lectures a lot. They allowed me to communicate my ideas and to develop graphic resources that have been useful throughout my bachelor years. Thus, I was really motivated to make this project. I wanted to give the students the same experience that I had or at least improve the current experience they are having with online design sketching lectures.

The aim of this project was to improve design sketching courses in this pandemic situation. Thus, I wanted to ensure interactivity, idea sharing, consistent feedback and a better way to introduce students to form exploration.

I also was very glad to count on different universities as partners to help for this project, even though they could have participated more. It has been a very enriching experience to get deeper into different design sketching teaching methods.

Design sketching is considered an essential skill for industrial designers. Through this work, different ways of teaching design sketching have been shown and it has been demonstrated that despite the pandemic situation, we can get support from online platforms to continue teaching this discipline.

Feedback is something that was absent during the online-lectures situation. Thus, the importance of an online portfolio to get external feedback and peer-to-peer feedback has to be highlighted.

The exercises proposed turned up to have very interesting results; they made students think in a different way and fostered form exploration. However, the results may be biased as the students belonged to the same university and they have been taught with the same methodology. I could not get the other universities to participate in this experiment which would have made it more enriching and complete.

Finally, it can be said that all the critical design specifications and many of the desirable ones have been met but to make sure of it, the lecture must be put into practise to check which aspects of the project are functioning well and which ones do not work.

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[7] **Article title:** Why Meaningful Online Feedback Is Important - eLearning Industry  
<https://elearningindustry.com/meaningful-online-feedback-important>

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