Anexos

Estudio sobre envases de esmalte de uñas y rediseño según criterios de usabilidad y ergonomía

Study on nail polish containers and redesign according to usability and ergonomics criteria

Autor

Lucía García García-Lisbona

Director

Zsolt Petér Balogh

Ingeniería en Diseño Industrial y Desarrollo de Producto

EINA – Escuela de Ingeniería y Arquitectura

2022

Table of contents

FINAL PROJECT

Study on nail polish containers and redesign according to usability and ergonomics criteria

ANNEX I.

Ergonomic test

AUTHOR

Lucía García García-Lisbona

DIRECTOR: Zsolt Peter Balogh

Budapest University of Technology and Economics

Academic year 2021/2022

Introduction to the experiment

In this experiment I wanted to see the differences in how people use different products (to write or similar activities) to find some ideas on how to design my product in the most comfortable way possible.

I selected six very different objects (nail polish, marker, pencil, Tippex, water brush and a shape created by me with clay) to see how the hold differs from one another and how the testers differ between themselves.

	PERIMETER *(MM)*	SECTION (SHAPE)	LENGTH *(MM)*	HARDNESS	SECTION
NAIL POLISH	82	Round	30	Hard	Ø 26mm
TIPPEX	60	Oval	90	Soft	
PROMARKER	53	Round	85	Hard	Ø 17mm
PENCIL	24	Hexagonal	100	Hard	Ø 7mm
WATERBRUSH	50	Oval	85	Soft	
SHAPED CLAY	60	Triangular	45	Rigid but soft	

Detailed experiments

The idea was to use paint to get the finger's position in different cases. Two experiences were done by the same participants:

A. The paint is put on the object, and after the users holds it, they will press their fingertips on a paper template
    - Here we will be able to tell the relative position of the object in the user's hand – how the object behaves in the hand

B. A piece of paper covers the object. The paint is put in the fingerprints of the users and they will grab the object, leaving their fingerprints on the paper as they are holding it.
    - Here we will be able to tell where the fingers position in relation with the object itself, as well as a bit of the pressure applied – how the fingers interact with the object and where

NOTE: The middle finger only works as a support and the print left by him is on the side of the finger (not the fingertip). In the prints, that finger has rolled to the side just to get the "projection" -it does not mean it is floating.

Definition of testers

The people selected to try this experiment were chosen to have a wide variety of results. The majority are women because this product will probably be used by a feminine majority (even though I'm redesigning it to get a more "unisex to reach to a wider public

1. Woman, 50 years old, right-handed
2. Woman, 22 years old, right-handed
3. Woman, 27 years old, right-handed
4. Woman, 18 years old, right-handed
5. Man, 21 years old, left-handed*

In the pictures, starting from the top left corner, they appear in the following order: 1-2, 3-4 and 5.

*As this subject is left-handed, his fingerprints are reversed in relation with the right-handed ones. The results are not rotated so it preserves the original format, but the conclusions are made having that in mind (thinking on the inverted prints).

Selected objects

For an easier examination and analysis of the experiments, the prints will be organized between every object. Also, for better understanding of the experiments, the pictures from the first one will be called A and from the second one B (as mentioned earlier).

Figure 1. Nail polish

Figure 2. Correction pen

Figure 3. Water brush

Figure 4. Marker

Figure 5. Pencil

Figure 6. Shaped clay

Results and analysis

OBJECT 1. Nail polish

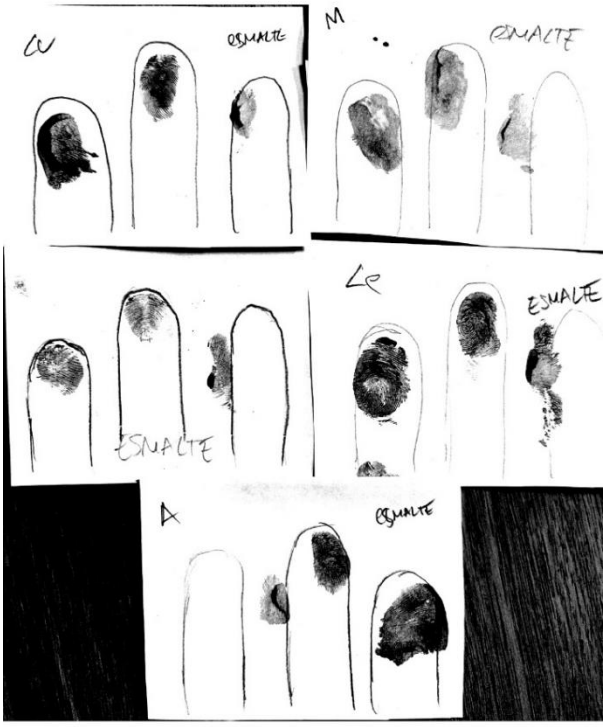


Figure 7. Paint on nail polish cap, user stains his fingers [Test A]

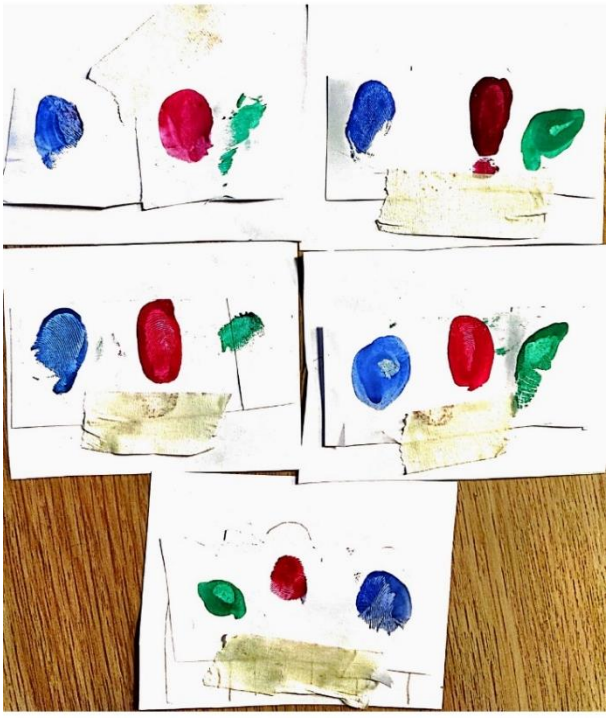


Figure 8. Paint on fingers, user leaves prints on nail polish cap [Test B]

With this object, the user grabs the cap almost with the tip of the fingers (shown in how close to the fingerprints are to the tip of the finger silhouette). Also, apart from the thumb (which is bigger because, thanks to its bigger shape and function, helps with the stability), the rest of the used fingers only used a small fraction of themselves (again, just the tips).

The side of the middle finger only serves as support: it is thinner and longer, and that has to do with how the user tends to equilibrate their tool. We can see that there is a notable separation between the fingers and where they grab the object (between thumb and index).

As there is not a long handler (where the hand also will serve itself as support), the application becomes more delicate and there is more precision needed, as well as it moves more. Also, together with the fact that the diameter is very big (more than 2cm), it is kind of more uncomfortable to use. A slippery surface does not contribute, but it is a very light material. The brush is a couple cm below and is much thinner, so there is not a lot of control from the top of the hand.

OBJECT 2. Correction pen

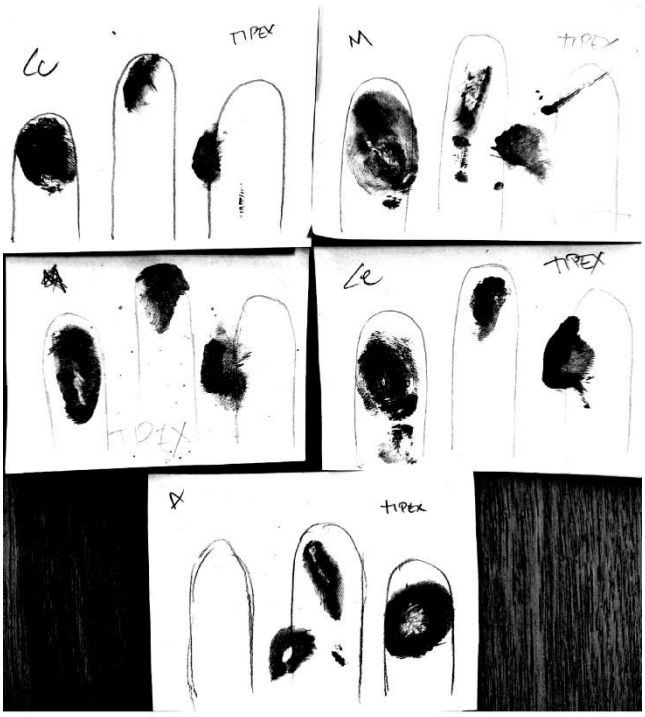


Figure 9. Paint on correction pen, user stains his fingers [Test A]

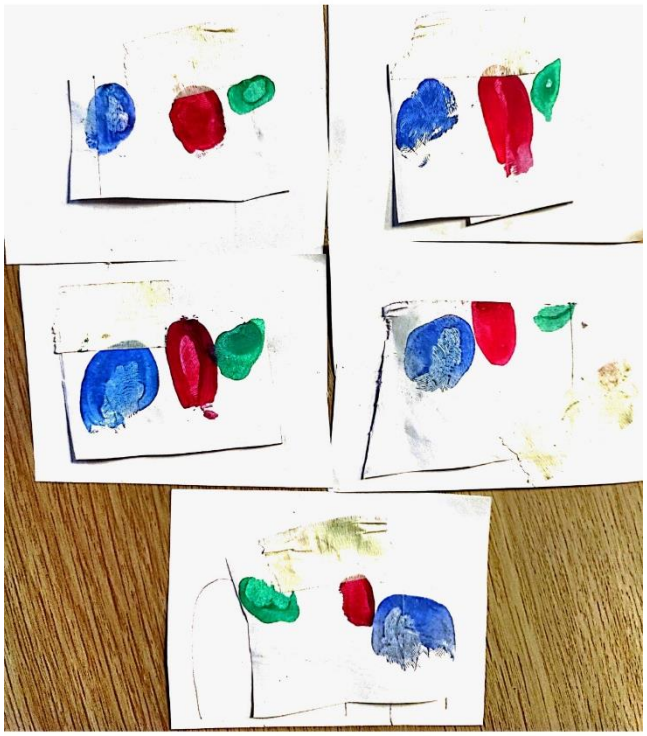


Figure 10. Paint on fingers, user leaves print on correction pen [Test B]

There is a clear vision on how the fingers press onto the object. As this product relies on the user applying pressure (in order to get the liquid off), the section is bigger and has slightly flat sides. Even if it is wider than a usual pen, as the plastic is a bit flexible is does not become uncomfortable on the hand.

We can see that in this object the middle finger again works as support, but the usable area is quite smaller than in other products. This may be because of the shape of the section: as it is a vertical oval, it is only its lowest point who stands on the finger (with this I mean not a big section is the one that works as support). Also, as said before, the action relies on the pressure applied by the thumb (specially) and index finger, so the middle one does not have a relevant action. Because of the low connection between middle finger and pen (and round section), this product may lose balance and slide between the rest of the fingers.

About the index finger, in both A and B we can see that its prints are very straight, by which we can conclude that is for controlling better the precision of the pen (also, the grab of the pen is quite close to the tip so the precision increases).

The fact that it has a "position" to be used (vertical section, flat on the sides) can be a bit inconvenient.

OBJECT 3. Water brush

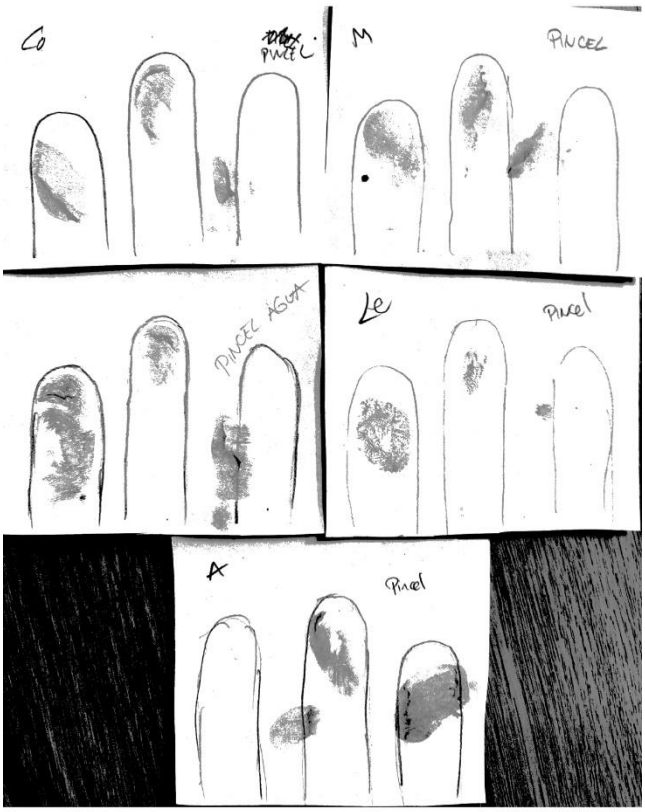


Figure 11. Paint on water brush, user stains his fingers [Test A]

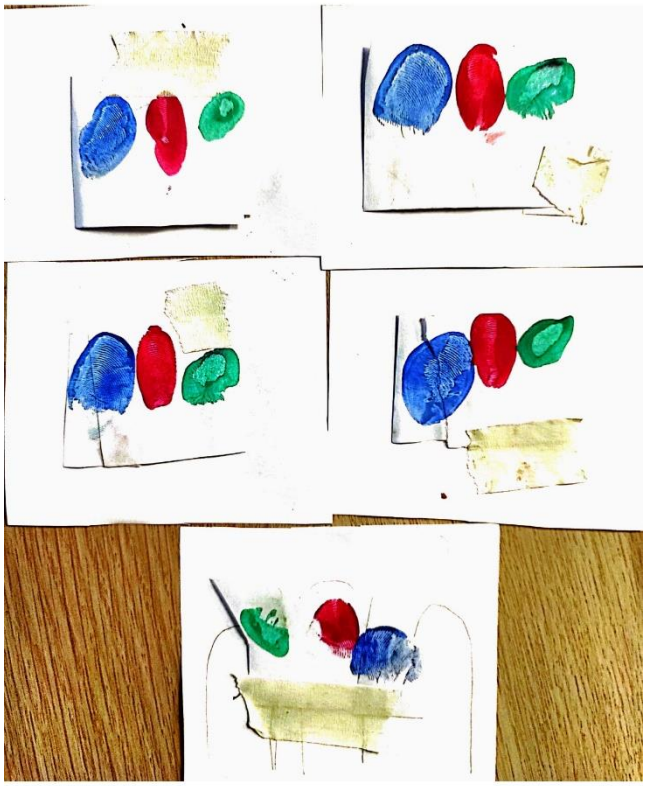


Figure 12. Paint on fingers, user leaves print on water brush [Test B]

These prints are very close to the ones from the correction pen. This has to be with the basics of the product, as they are quite similar.

Again, the section is a vertical oval (smaller than the correction pen) so the sides are slightly flat. This helps with the application of pressure as it did earlier, again noticed in the shape of the thumb fingerprints (big and very round).

One of the main differences between this object and the object 2 is the relative position between the fingers: as the perimeter of the brush is smaller, the fingers are much closer than in the earlier experiment. This could be beneficial (more control of the tool) but also kind of a con (the fingers get tired in less time).

There is not much more to comment because the main characteristics work with the other experiment, nothing else apart from this one being a little bit harder to press (the material of its walls is thicker).

Again, having a "position" to be used (vertical section, flat on the sides) can be a bit inconvenient.

OBJECT 4. Marker

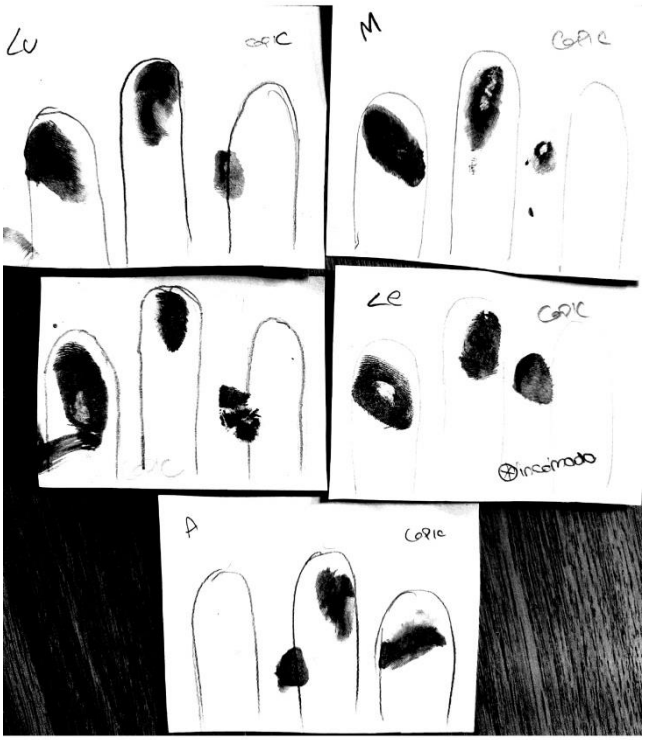


Figure 13. Paint on marker, user stains his fingers [Test A]

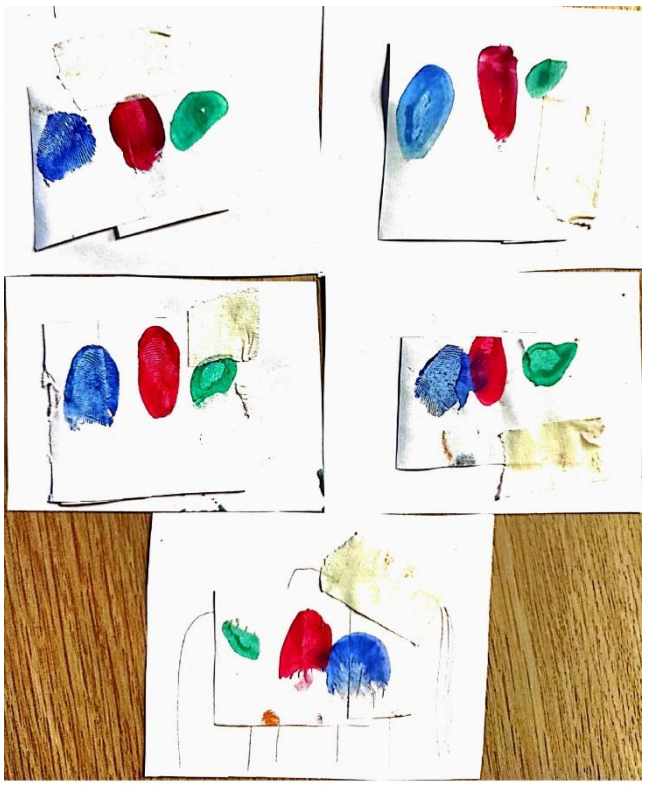


Figure 14. Paint on fingers, user leaves print on marker [Test B]

This marker has a round section and, as usual pens and markers, is completely rigid. Due to this and its section being quite big (approx. 1.5-2cm), it can be a bit uncomfortable to use for a long time, specially also due to its hardness to the touch (not flexible). These markers are frequently used in Industrial Design drawings or similar fields, where the main goal is to paint quick with straight lines and big surfaces (that is why they have 2 ends, one with a pointy tip and one chiseled flat). It does not fit with the main goal in the product I am designing but it was interesting to compare the characteristics of this pen against other products.

The fingerprints share similar patterns with previous objects. Here we can see that in most of them thumb and index finger share the same amount of pressure and global size -this is related to their function here is the same, not like in the objects 2 and 3 where they had each a different relevance. They are facing the front, something that tells us that here the main activity is precision and controlling the result (writing), while in the previous experiments the hand can use move more freely. The middle finger, again, works as support and it defers on the user on how they put them to gain balance and control.

A good quality is its symmetry: as it is round, all the fingers share the same amount of space and it is easy to grab. The con could be it could turn in the hand much easily.

OBJECT 5. Pencil

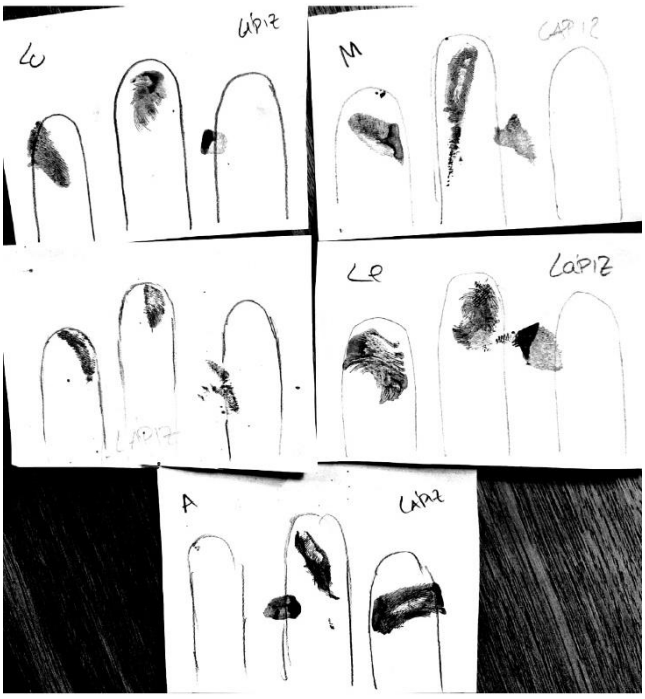


Figure 15. Paint on pencil, user stains his fingers [Test A]

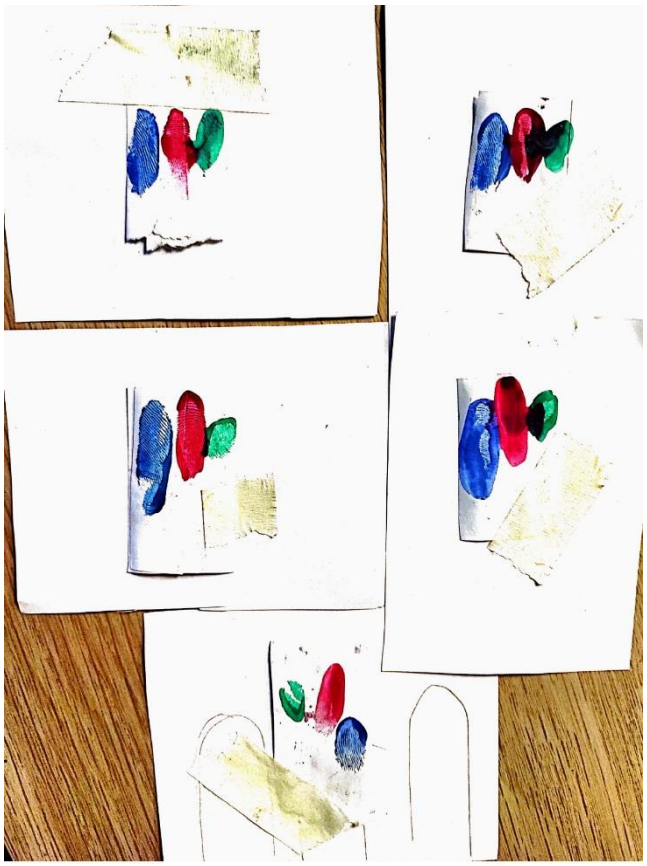


Figure 16. Paint on fingers, user leaves print on pencil [Test B]

Here with the pencil, we can appreciate very easily the differences with previous objects. As this object has a very small diameter, all the fingers are touching and very close to each other. The pencil does not have interior mechanisms or a complex functionality, so we can grab it as close to the tip as we want because there is place to do it -and we can see that in B: all the fingerprints are in a very straight line close to the end of the paper. In most cases they are touching:

From A we can determinate that even if the users place their fingers in very similar positions from one another, the bits of the fingers used are not always the same: this talks about the personal hold of the pencil, as well as their finger size. Again, it is more frequent thar thumb and index finger have a more defined place in this activity and middle finger act as support, but we could say that in this case this responsibility is shared (similar areas, similar shapes). It is probably due to the shape itself of the objects, which asks for a closer grab to gain precision and control.

The main idea behind this product in the experiment was to test how a very thin object behaves in the hand of the users and what its reaction could be.

OBJECT 6. Shaped clay

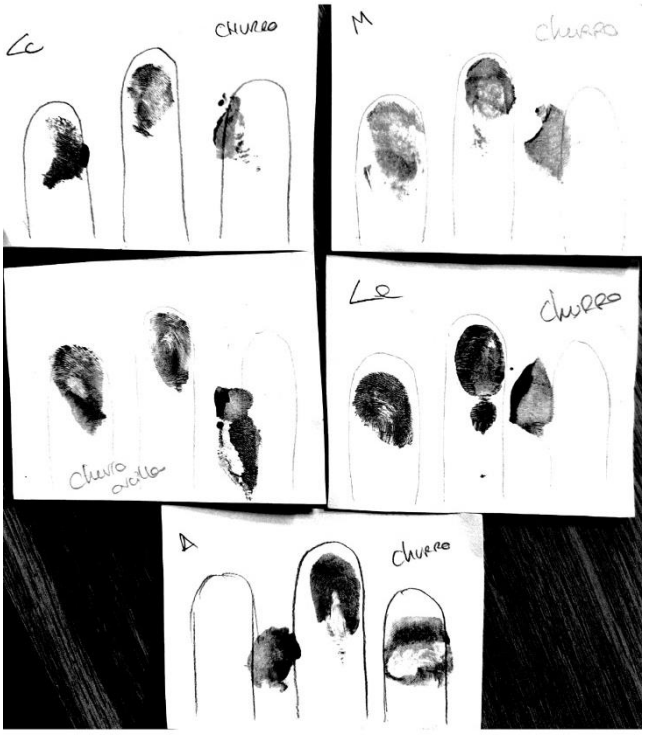


Figure 17. Paint on shaped clay, user stains his fingers [Test A]

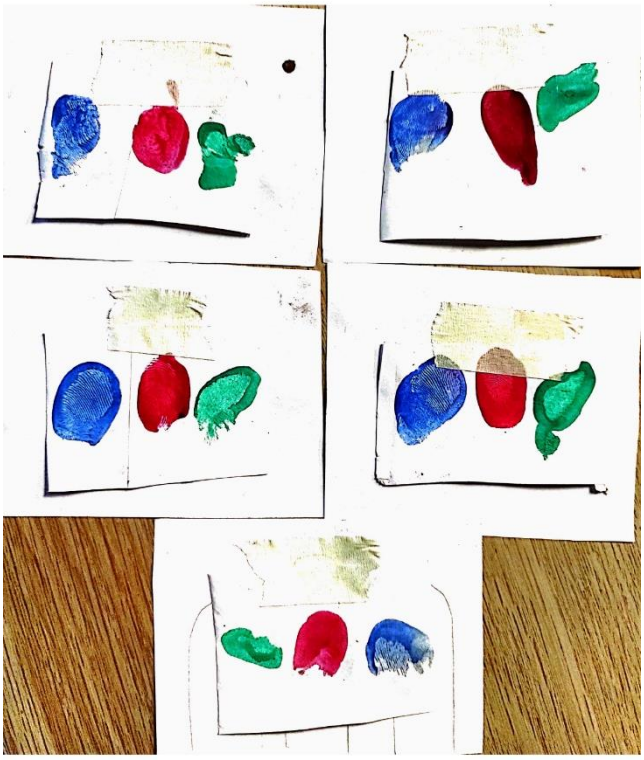


Figure 18. Paint on fingers, user leaves print on shaped clay [Test B]

To play with anthropometric ergonomics, I wanted to see how a shape that could be adapted to the fingers would behave. After playing with clay for a bit trying for different shapes, I molded a test tube with a triangular section with more or less 1.5cm for each side.

Being a triangle shape, the hand adapts in a natural way to that position when each finger claims one of the sides. Even the finger who works as a support gets a much more regular surface. This comes with a more equilibrated product thanks to this extra support.

The fingerprints confirm this theory: in both figures A and B, the prints are almost identical for each finger, telling us that in every case they share the same amount of pressure and relevance (what can lead to the idea that the product is better equilibrated and its weight better distributed). Also, the fingerprints left by the fingers on the object (exhibit B) are --- distributed and they share a constant space between them (contrary to what can be seen in *Figure 8*). This is thanks to the regular triangular shape of the section, and, together with all the previous effects mentioned, it is a good sign for the comfort and health of the hand itself.

On a different matter, this triangular shape prevents the product from rolling around the fingers or slide trough them.

Conclusions

In no specific order:

The triangular shape is the section that, according to the fingerprint tests, better worked in terms of adaptation to the shape of the hand itself.

The section size should be medium: not big but not small either, enough for the whole fingertips to fit in the sides of the shape (talking about the triangular shape).

If the product requires to apply pressure, to have flatter sides helps because it is more natural to push (also, the fingertips adapt better). They should not be completely flat but a middle ground between that and concave (if they are completely flat the user must apply much more strength).

A symmetrical and regular shape is better: the user does not have to adjust the product or grab it in a specific way.

If the section is not round, it will be harder for the object to roll and slide though the fingers and the user would not have to try to keep it in place.

The handle should be at least 6-7 cm long, enough for it to rest on the base of the thumb (where it meets the rest of the hand).

The closer the user can grab the tip of the object the better control he will have.

The middle finger only works as support: if there is a better surface for the object to rest, the hold of the object itself will be more comfortable and it will add to a better balance.

If the product requires to apply pressure and the material should be flexible, it should not be very hard to the touch because it will add to the strength the user must do with the thumb and he will get tired in less time.

If there is a clear place for the fingers to fit in, the user will find the neutral position much more comfortable and easier to grab.

The more surface (touch) between the object and the fingertips, the steadier the hold will be.

FINAL PROJECT

Study on nail polish containers and redesign according to usability and ergonomics criteria

ANNEX II.

Plans

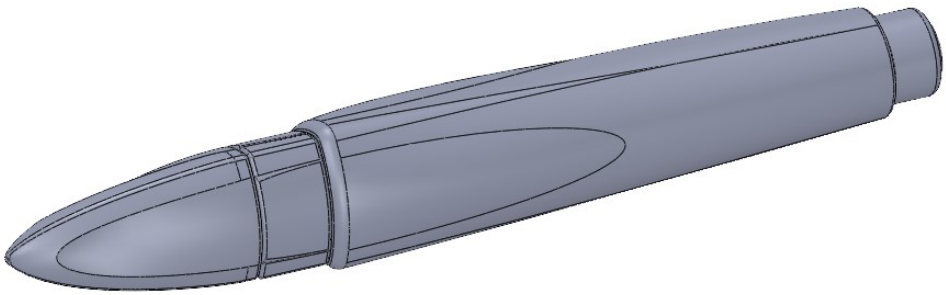
AUTHOR

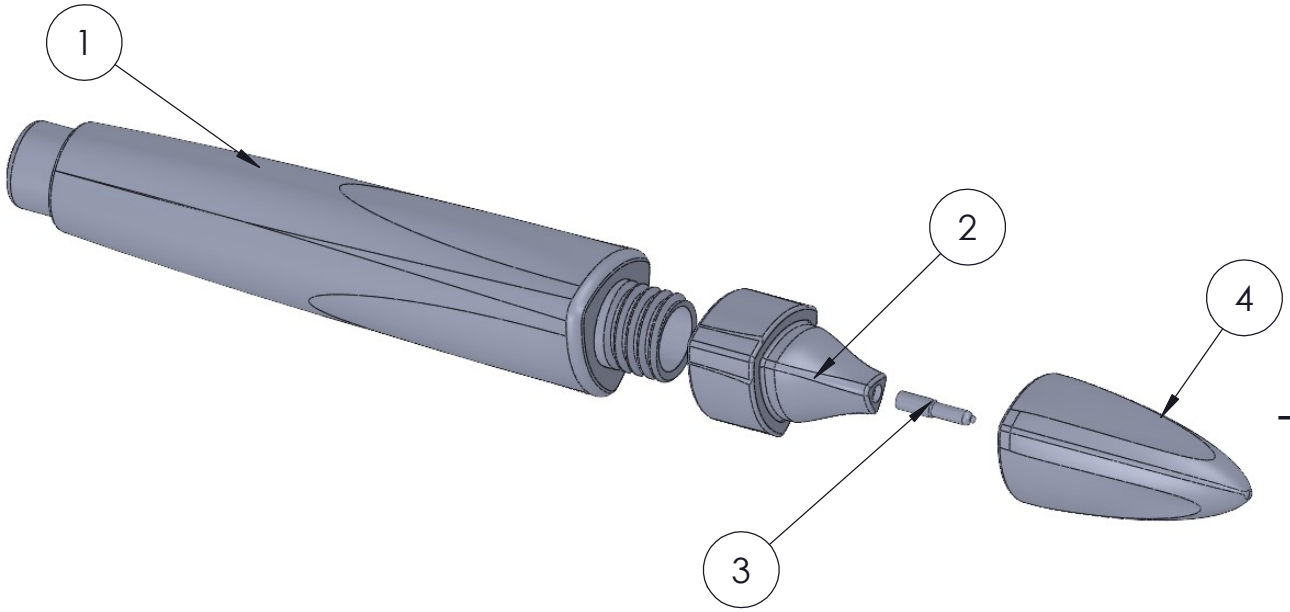
Lucía García García-Lisbona

DIRECTOR: Zsolt Peter Balogh

Budapest University of Technology and Economics

Academic year 2021/2022





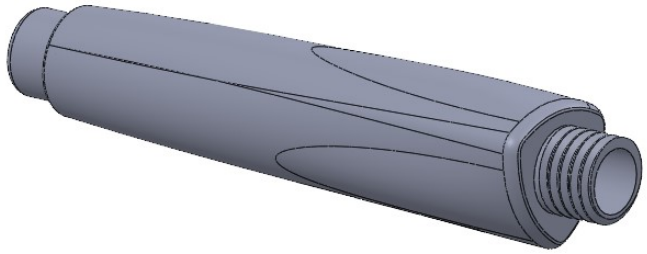
N.º DE ELEMENTO	N.º DE PIEZA	DESCRIPCIÓN	CANTIDAD
1	Body		1
2	Top		1
3	Cap		1
4	Nib		1

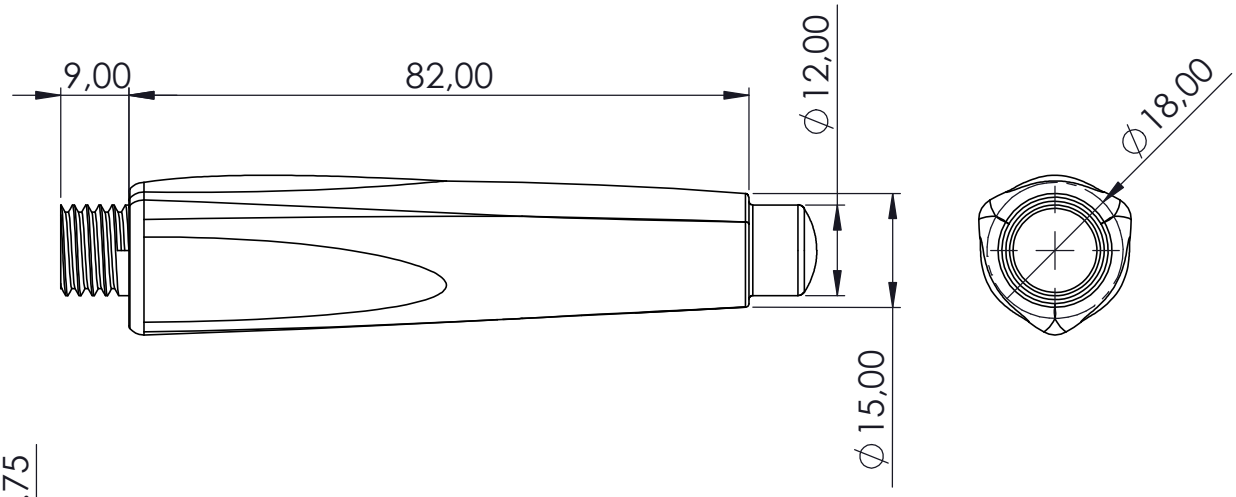
	Fecha	Nombre	Firma:
Dibujado	05/27/2022	Lucía García García-Lisbona	
Comprobado			

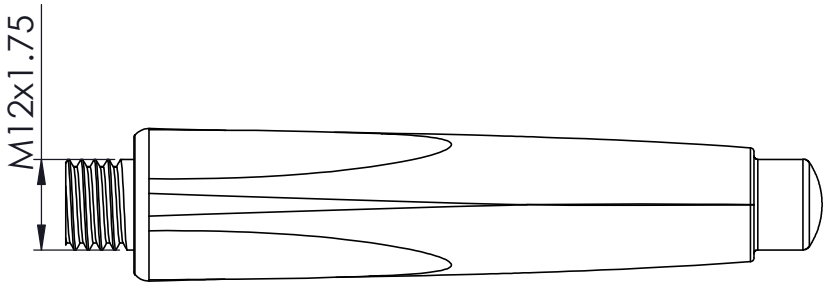
Escuela de Ingeniería y Arquitectura
Universidad Zaragoza

Escala	Titulo	N° Alumno
1:1	**Nail polish "ARADI"**	Curso 4°
		Plano N° 1

A4







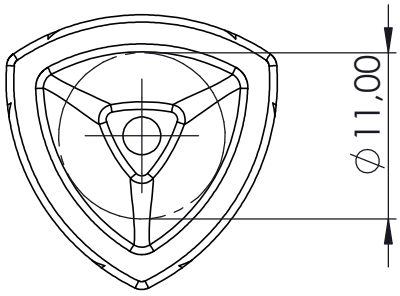
N.º DE ELEMENTO	N.º DE PIEZA	DESCRIPCIÓN	CANTIDAD
1	Body		1

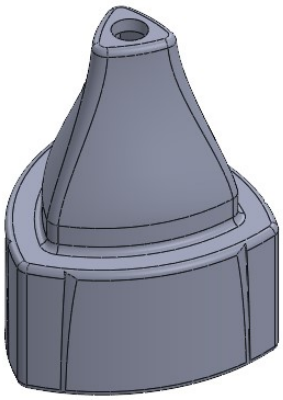
	Fecha	Nombre	Firma:
Dibujado	05/27/2022	Lucía García García-Lisbona	
Comprobado			

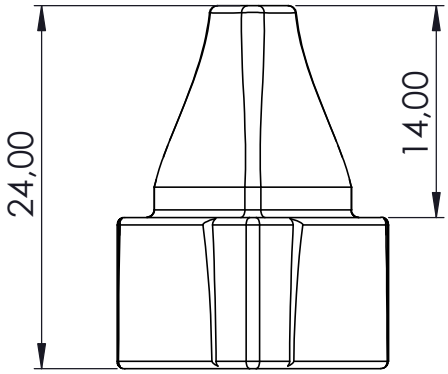
Escuela de Ingeniería y Arquitectura
Universidad Zaragoza

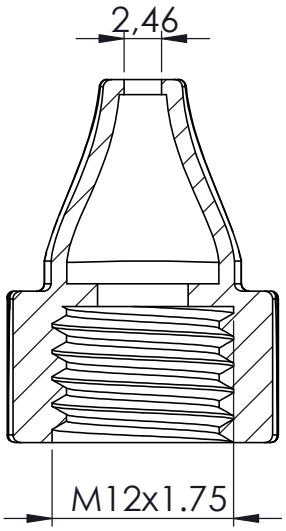
Escala	Titulo	N° Alumno
1:1	**Nail polish "ARADI"**	Curso 4°
		Plano N° 2

A4

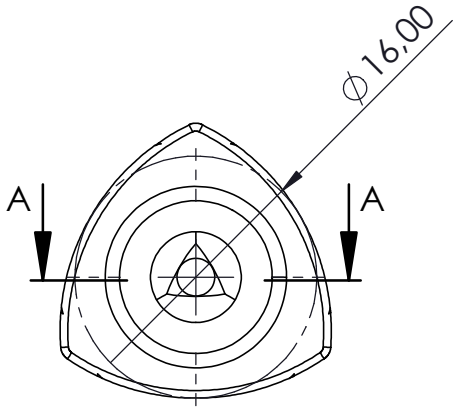








SECCIÓN A-A



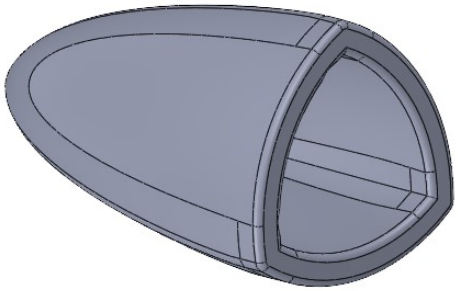
N.º DE ELEMENTO	N.º DE PIEZA	DESCRIPCIÓN	CANTIDAD
2	Top		1

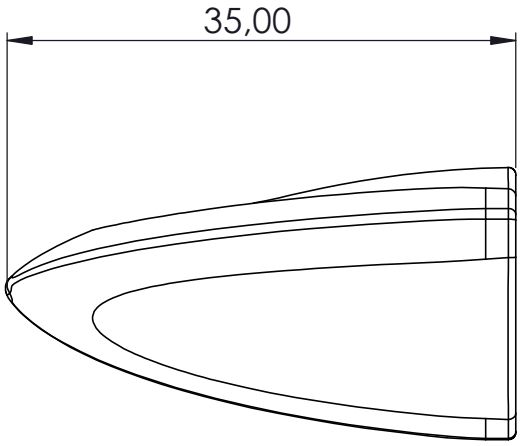
	Fecha	Nombre	Firma:
Dibujado	05/27/2022	Lucía García García-Lisbona	
Comprobado			

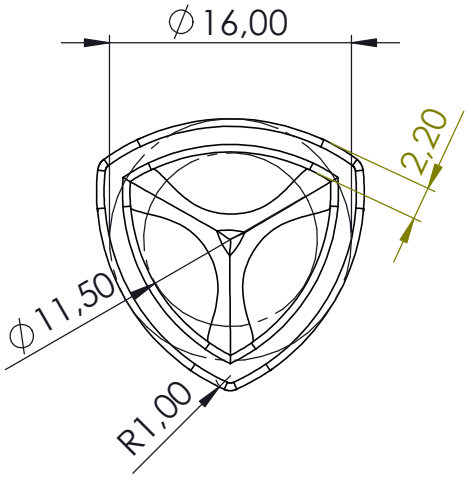
Escuela de Ingeniería y Arquitectura Universidad Zaragoza

Escala	Titulo	N° Alumno
2:1	**Nail polish "ARADI"**	Curso 4°
		Plano N° 3

A4







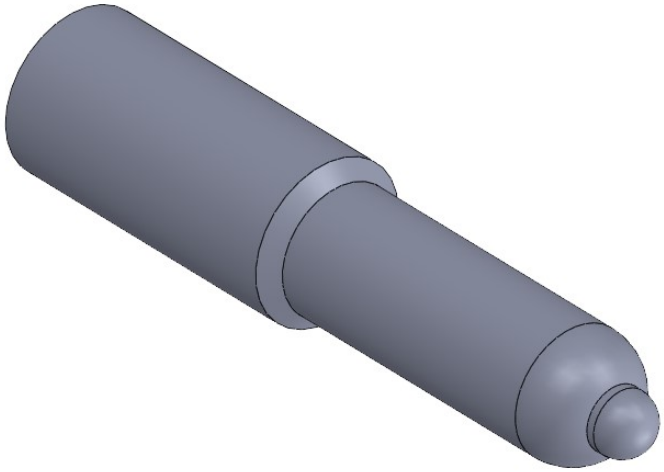
N.º DE ELEMENTO	N.º DE PIEZA	DESCRIPCIÓN	CANTIDAD
3	Cap		1

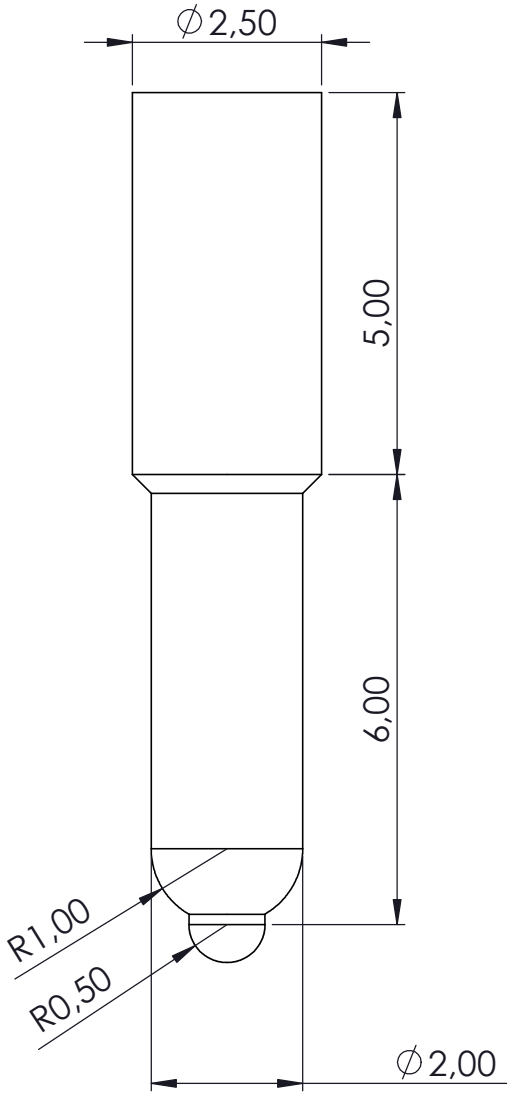
	Fecha	Nombre	Firma:
Dibujado	05/27/2022	Lucía García García-Lisbona	
Comprobado			

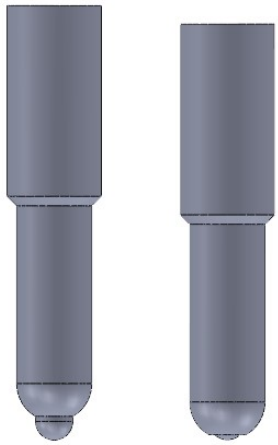
Escuela de Ingeniería y Arquitectura
Universidad Zaragoza

Escala	Titulo	N° Alumno
2:1	**Nail polish "ARADI"**	Curso 4°
		Plano N° 4

A4







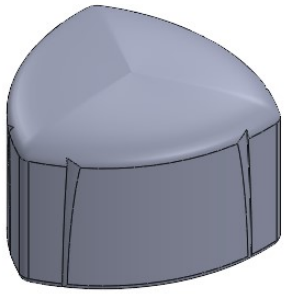
N.º DE ELEMENTO	N.º DE PIEZA	DESCRIPCIÓN	CANTIDAD
4	Nib		1

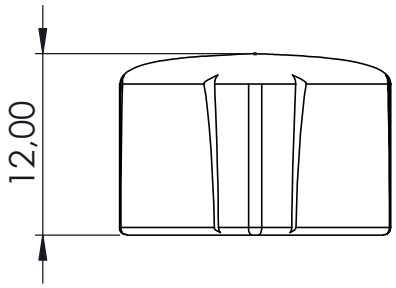
	Fecha	Nombre	Firma:
Dibujado	05/27/2022	Lucía García García-Lisbona	
Comprobado			

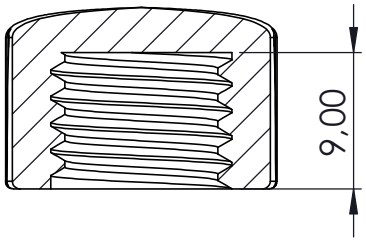
Escuela de Ingeniería y Arquitectura Universidad Zaragoza

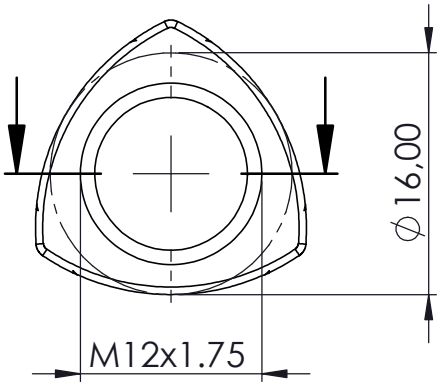
Escala	Titulo	N° Alumno
10:1	**Nail polish "ARADI"**	Curso 4°
		Plano N° 5

A4









N.º DE ELEMENTO	N.º DE PIEZA	DESCRIPCIÓN	CANTIDAD
5	Small cap		

	Fecha	Nombre	Firma:
Dibujado	05/27/2022	Lucía García García-Lisbona	
Comprobado			

Escuela de Ingeniería y Arquitectura
Universidad Zaragoza

Escala	Titulo	N° Alumno
10:1	**Nail polish "ARADI"**	Curso 4°
		Plano N° 6

A4