Tetra Pak

A Study In Methods For Usability Evaluation Of Package openings

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ISRN: LUTMDN/TMAT-5096-SE

EAT 2006

Abstract

Tetra Pak AB is one of the world's leading suppliers of food processing and packaging systems. This company works for and with its customers to provide preferred processing and packaging solutions for food. The purpose of this thesis was to investigate methods for benchmarking and user testing for Tetra Pak when designing plastic caps and carton perforations.

This study had two goals: to find out the best plastic cap on the Swedish market and the best perforation among 4 different sorts, both by carrying out some usability tests. They wanted also to detect which package required the less strength trough other tests in order to compare the results of both tests and perhaps draw a link between them.

The first step was to carry out a benchmarking survey on all the plastic caps following the required specifications: screw cap, one step opening, still content. The second step was to choose 10 products which would be tested in the test laboratory of the Ingvar Kamprads Design Centrum in Lund. At the same time, a carton package with four different perforations provided by Tetra Pak has been tested too.

10 people were participating in a user study. Among them there were 5 men and 5 women, 5 young people (20-29 years old) and 4 seniors (50+ years old). The test was conducted according to the test plan from the company. Each test was recorded and analyzed.

Half of the participant agreed on the easiest cap to open and had a strong preference to this bottle. For the carton packages, 70 percent picked the first version of the carton package as the easiest to open. Some strength test on the carton packages measuring the required strength to open each package showed that the first version needed actually the less strength.

As a conclusion, there are some recommendations for the designers about the choice of cap and perforation. A proposition of optimization of the test plan is also given to the usability engineers.

Sammanfattning

Tetra Pak är ett av världens ledande företag inom process, förpackning och distribution av livsmedel. Företaget arbetar i strategiskt partnerskap med leverantörer och kunder för att utveckla effektiva, innovativa och miljöanpassade förpackningar till miljontals människor världen över. Syftet med detta examensarbete var att undersöka metoder för marknadsstudier och användartest för Tetra Pak om plastkorkar och kartongperforeringar.

Den här studien fokuserar på två saker: att ta reda på vilka korkar som finns på den svenska marknaden och vilken perforering bland 4 olika sorter som är bäst, genom att utföra ett användartest. Företaget vill också veta vilken förpackning som kräver minst styrka för att jämföra resultaten från båda experimenten och kanske hitta en samband mellan dem.

Det första steget var att utföra en marknadsstudie för alla plastkorkar på marknaden med följande specifikationer: skruvkork, en-stegs-öppning, ej kolsyrat innehåll. Det andra steget var att välja 10 flaskor som testades på Ingvar Kamprads Design Centrums testlab. På liknande sätt testades kartong-förpackningar med 4 olika perforeringar, preparerade av Tetra Pak.

I användartestet deltog 10 personer. Bland dem fanns 5 män och 5 kvinnor, varav 5 var 20-29 år, och 4 var över 50 år. Testen utfördes enligt en testplan som utvecklats på Tetra Pak. Varje test analyserades från video-inspelning.

Hälften av de medverkande var överens vilken kork som var lättastast att öppna och var mest attraktiv. 70 procent av deltagarna ansåg att version 1 av kartongförpackningarna var lättast att öppna. En test som mätte hur mycket kraft som behövs för att öppna varje förpackning visade att förpackning 1 krävde minst styrka.

Som avslutning på arbetet finns det några rekommendationer för formgivarna om kork och perforering. Ett förslag om förbättring av testplanen ges också.

Acknowledgment

I would like to thank the people that helped me during this master thesis.

- My academic tutor **Joakim Eriksson**. It would not have been possible to accomplish this work without him. He arranged my first contact with the company, gave me advices and solutions when something hindered the progress of my work.
- **Erik Sebelius**, my tutor from Tetra Pak, for some comments on my work who made me carry on. I want to apologize for not having recognized him in the airport.
- **Sofia Henstrand**, another engineer from Tetra Pak, for her feedback and lots of support.
- **Elise Roudier**, TIME student at LTH, for her massive assistance during the usability tests, her good advices, and her huge help about this report.
- **Benjamin Destison**, TIME student as well for his support and listening.
- **Lennart Strömberg**, teacher at the machine construction department, for letting me borrow lots of instrument for my test.
- All the participants of the usability test that includes some teachers of the design department and some good friends.
- **Kristina Grossmann** and her team, who supported me throughout my studies in LTH.

Table of content

1. Introduction

This section is an introduction to the background, purpose, limitations and the method of this thesis.

1.1. Background of the company

AB Tetra Pak was established in Lund, Sweden, by Ruben Rausing and Erik Wallenberg in 1951. They sold their first machine in September 1952. Tetra Pak has nowadays more than 20 200 employees and is present in more than 165 countries.

Tetra Pak is one of the world's leading suppliers of food processing and packaging systems. Their goal is to provide safe, innovative and high-quality food products. Tetra Pak is known for their long-life carton packaging systems and their aseptic technology. They always try to improve their package as for example the opening part [1].

However the plastic packages tend now to compete with the carton packages. Those kinds of packages spread indeed dangerously on the market. Tetra Pak is now considering the plastic bottles as an opportunity to extend its range of products. This work contains thus a study of the caps' market.

1.2. Purpose and problem statement

Tetra Pak works for and with its customers to provide preferred processing and packaging solutions for food. The purpose of this thesis was to investigate methods for benchmarking and user testing for the company when designing plastic caps and carton perforations.

This study had two goals: to find out the best plastic cap on the Swedish market and the best perforation among 4 different sorts, both by carrying out some usability tests. They wanted also to detect which package requires the less strength trough other tests in order to compare the results of both tests and perhaps draw a link between them.

The following questions were necessary to be investigated during my work:

- What kind of plastic cap can we find on the market?
- Which one is considered the best by the user?
- Does the force needed to open the cap affect their judgment?
- Which carton package is seen as the easiest to open?
- Is this package the one that requires the less strength to open it?
- Is the test plan optimal?

1.3. The requirements from the company

First of all Tetra Pak wanted me to do a survey of plastic screw caps on plastic bottles, excluding carbonated drinks. Screw caps should be one-step opening including tamper evidence and should not include sport caps.

Then I should categorize and analyze the caps physical form and mechanical function. The areas of investigation should include:

- Size (height and diameter)- Proportions
- Tamper evidence
- Torque to open
- Friction of grip

Based upon analysis above, and subsequent discussions with Tetra Pak to establish choice criteria, I should choose packages to test on consumers. Selection should include a range of packages judged to be very good and ones very bad.

At that time I would test consumers in order to register consumer response and correlate them to design categorization and functional measurements, so as to observe and document problems and work around.

Finally I should sum up the results in form of clear recommendations and design guidelines of screw caps.

For the carton packages the tasks would only be to test the four different packages with perforation and find out which one is the easiest to open.

1.4. Difficulties and Limitations

I was faced to some difficulties during my thesis and I had to define some limitations.

During the first step of my thesis I had to do a survey of all the caps which could be interesting. It was sometimes hard to know the specifications of the cap only by looking at the product. For example, the caps had to be one step opening which means that the bottle must be opened only by one action (screwing the cap). The product was not taking in account if there was for instance a layer of aluminum on the neck of the bottle. The only way to figure this out was to open the bottle.

I had also some difficulties to have access to the products in the supermarkets. Some of them did not want me to take some pictures.

I was forced to limit my work for a matter of lack of time and of circumstances.

One of the purposes of the study was to compare the results from the usability tests and the one from the strength test. However to test the strength necessary to open the plastic bottle lasts too long. Those tests were in themselves a thesis. That was why I only took in consideration the results of the usability test regarding the bottle caps.

I wanted though to carry out an EMG (Electromyogram activity) instead of a strength test. In fact it is proved that there is a proportional link between the strength of a striated muscle contraction and the amount of electrical activity in this muscle[15] [18]. Then it would have been possible to figure out which bottle required the less strength by measuring the contraction of a muscle, and if this was the one that the participants prefer. Nevertheless I did not have enough time to carry out this test.

I had difficulties as well to find some participants and fix the number of participants that had to take part in the usability tests. The tests took place during the month of July and there were not so many people in the city of Lund at this time. As a consequence it was hard to be exigent about the choice of participants. My academic tutor helped me out and we solved the problem by

asking to some teachers of the design centre and setting the number of people interrogated to 10.

1.5. The eight-step plan

I chose to follow the chronological order of my work in this report (see figure 1.1). The problem statement was already explained in the introduction. I also realized some researches on the plastic caps. Then, I carried out a benchmarking survey of the plastic bottles in order to distinguish all the different caps on the Swedish market. It enabled me to pick some samples among all the sorts of caps. I was afterwards able to carry out some usability tests on the bottle and the carton packages produced by Tetra Pak. Finally I realized some strength tests on the carton packages. It was subsequently possible to determine some guidelines for developing the caps and improve the carton packages.

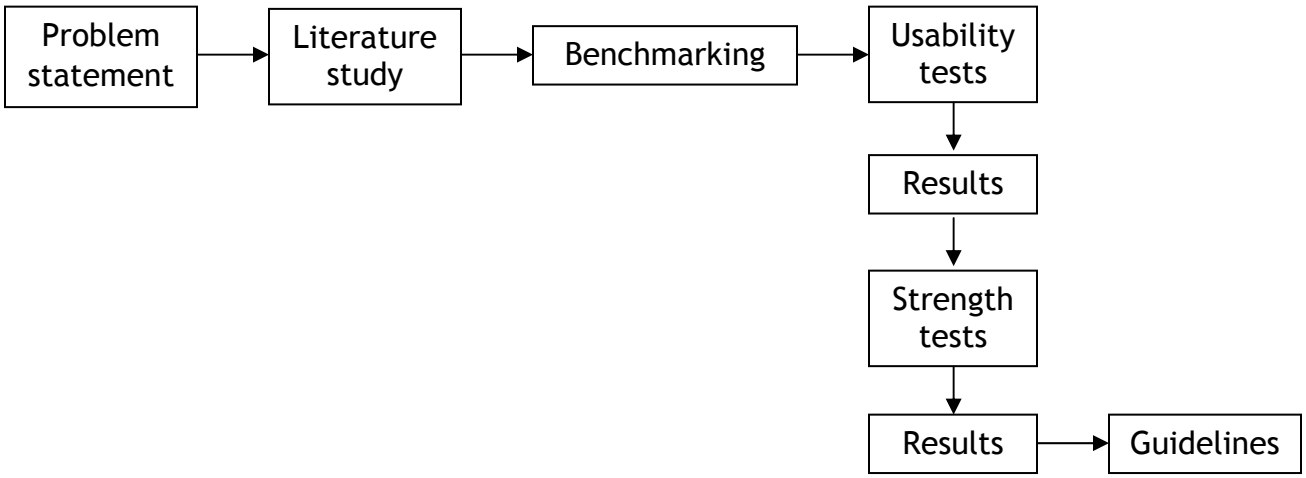

Figure 1.1: Outline of the thesis

2. Literature study

2.1. Knowledge on caps

On a bottle the cap represents the security of the whole entity. As a matter of fact the closure must resist to the different conditions that the bottle is exposed to from its filling to its selling, like the storage, the transportation, the handling… Moreover the closure must be easy to both open and close for the customer [2].

2.1.1. History

The first proof of the use of screw caps was the Espy patent in 1856. It described that a disk of cork, by being screwed down on the bottle neck, brought "the said cork in compressing contact around the upper edge or mouth" [2]. The plastic closures appeared around 1920 with the toothpaste tubes. The market grew thanks to the scientific improvement concerning the fabrication of plastic.

In 2002 the plastic closure represented 67% of the market against only 32% for the metal caps [3]. It is hard to know precisely how many caps are on the market now but some study forecasts a US demand growing 6% yearly through 2008, representing nearly 210 billions units and $ 6.8 billion. The threaded plastic caps and closures is planned to reach $ 2.4 billion in 2008 [4].

2.1.2. Description

Tetra Pak was interesting in the screwed plastic cap from all the plastic bottles containing beverage without any carbonate gas or alcohol, mainly water, soft juice, juice.

Those caps are called CT-closure for Continuous Thread [17]. The plastic cap usually has a tamper-evidence (TE) which shows if the bottle has been open before. It is a plastic device sealed at the bottom of the cap with the help of some fasteners, little pieces of plastic that bond the TE to the cap. These fasteners break when the user opens the bottle. The TE sometimes has

some inner-stoppers on the inside. Those are used to facilitate the separation of the TE from the cap by friction to the bottle (see figure 2.1).

Sometimes, in order to achieve a better seal the cap can have a liner. This is a mix of wad, such as pulpboard, and a facing material that protects the content of the bottle [5]. The liner is in form of a flat disc which is glued inside the cap. But most of the time, the plastic caps are linerless. Small protrusions eliminate the need for a liner [2].

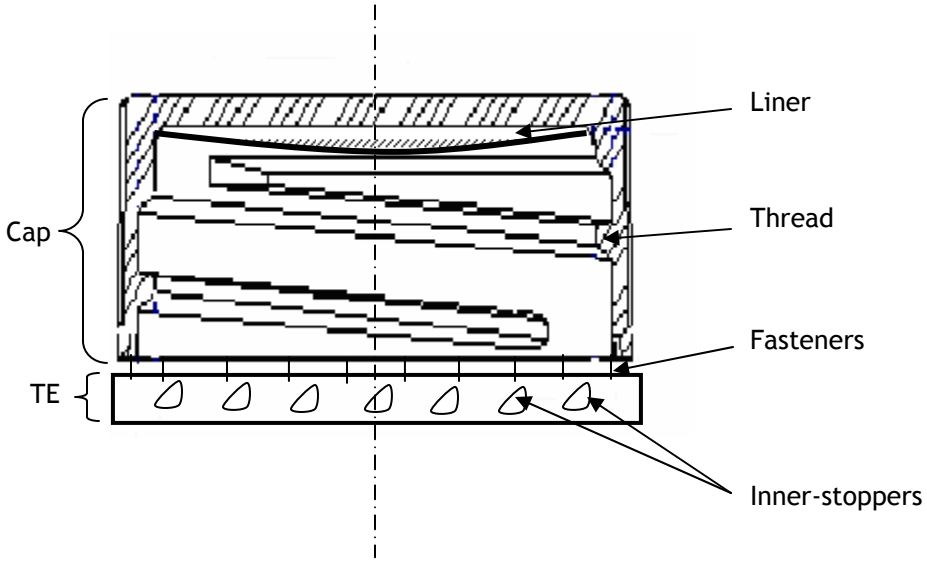

Figure 2.1: Schema of a closure [6]

2.1.3. The sealing process

The cap must be pressed on the top of the bottle neck with a sufficient pressure so that the seal is good enough to stay intact until it reaches the hands of the consumer. The tightness with which the cap is screwed on to the bottle is called the “tightening torque” [5]. This represents the torque applied to screw on the cap in spite of the friction and this can affect a pressure on the liner or the protrusion.

The aim is though to know the perfect tightening torque which makes that the bottle is still easy to open. As this torque is impossible to measure it under production, the opening torque has to be measured. This is the tests I could not do because it took too much time. In fact the removal torque changes

depending on how much time and at which temperature the bottle is stored before the tests. That is why it may take a long time to get the entire curve of evolution of this torque [6] [7].

An English study shows that it is possible to describe the opening of a bottle through an equation with human factor terms. This is an engineering approach to inclusive design [8]. But specific equipment is required and I did not have the knowledge to carry out those tests.

2.2. Definition of usability

The main definition of usability comes from the International Organization for Standardization (ISO DIS 9241-11):

"…Extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use. …" [9]

Some words need to be explained [10]:

- The effectiveness is the fact that the users finish the task
- The efficiency represents the fact that they should accomplish it with as little time and effort as possible.
- The satisfaction describes the fact that the system should be a pleasure to use.

Some measurable attributes of the packages will correspond to those three categories. They will be defined in the test plan.

3. The benchmarking study

3.1. The bottles

3.1.1. The first step: the survey

I had to search plastic bottles with plastic caps which contained still liquid excluding carbonated drinks. I restrained my researches to the drinks like water, juice, milk, soft juice, drink yoghurt, syrup, soup and sauce… that means every liquid that could be drunk or eaten. The screw caps had to be one-step opening with tamper evidence and present on the Swedish market.

I first looked on internet to select all the products that could fit to the specifications. I searched the websites of the Swedish dairies and breweries. I then decided to visit the supermarkets' websites to get a list of all the bottles sold on the Swedish market. I finally checked the websites of each trade that manufactures those products.

I obtained quite a long list of products that could be interesting. However, as I had to measure and compare the caps I was obliged to physically go to all the supermarkets in Lund to select the products that I could buy. Some products were in fact only sold in the north of Sweden or in some other parts of the country. Those products were not measured.

3.1.2. The second step: the investigation

I had now to categorize and analyze the caps' physical forms and mechanical functions. The parameters I was looking for were the following:

- Category (water, juice…)
- Brand (BOB, Skånemejerier…)
- Name (light saft, morotsjuice…)
- Volume (1L, 2L…)
- Type (PET bottle or HDPE bottle)
- Material (PET or HDPE)
- Cap's diameter

- Cap's height without the tamper evidence
- Design of the tamper evidence (how is it attached to the cap?, is it smaller than the cap? …)
- Cap's design (Are there lots of ribs? , how do they look like? …)
- Cap's color
- Cap's surface (rough or smooth?)
- Cap's nuance (bright or mat?)
- Some comments about the whole cap
- Cap's supplier (if known otherwise there is a question mark in the tables if I did not get any answer from the bottle's manufacturer)

The list resulted from the benchmarking is presented in the appendix A with the pictures of each product in the appendix B.

3.1.3. The third step: determination of the samples

It was important to group some products together in the initial lists. In that way it would be easier to select a few samples. I would then measure them more specifically. The later goal of the samples was to be used during the usability tests.

3.1.3.1. Methods

First of all I decided to concentrate myself only on the juices, waters, soft juices and yoghurts because the other categories were not significant (syrup, cat milk and dressing). Subsequently I suppressed also the products whose dimensions were unknown. Actually, I did not find those products in the shops but only on internet. Besides, it would have been difficult to buy them.

Then, I tried to find the suppliers of all the products. I was faced with a communication problem. The manufacturers sometimes did not want to share with me the name of the cap's supplier. It helped me anyway to group together different products with the same supplier in some categories.

After that, I classified the list of products by size of cap which was one important criterion for the strength measure. I assembled products of same

size together when they had the same supplier or the same design by analyzing their pictures and the collected data.

I also looked to the material because I wanted bottles in PET and HDPE with a significant number from each (6 PET and 4 HDPE).

It was then significant to choose bottles with about the same volume. As a matter of fact people who would test them would handle them as well. In order to get consistent results I chose to select bottles of around 0,5L only.

Nevertheless there were still a big number of unclassified products (alone in its own category). That is why it was essential to suppress some of them in order to obtain a concise and relevant listing.

3.1.3.2. The groups

Here is a sum up of all the groups, their characteristics and why I chose to form them this way.

- Group 1: It contains two bottles with the smallest cap I found on the market. I chose the ICA light soft juice because it gave the impression to be one of the hardest openings. The cap seemed indeed cheap and rough.
- Group 2: It regroups five products of the same dimensions: the soft juices BOB and Fun Light both produced by Procordia Food AB, the soft juices Stockmos and Hemköp and the juice Festis because the caps had the same design. The cap was square and coarse and the tamper evidence was smooth. I chose The BOB bottle because it was in all the shops and quite cheap
- Group 3: It gathers nine other products of the same dimensions than the precedent group. The cap was more rounded than those from the group 2 but still simple. I picked the blandsaft ICA for its cheap price.
- Group 4: The water Aqua d'Or. The particularity of the cap was its height which was quite short compared to others.
- Group 5: The water Evian. It had the same diameter than the bottle before but the cap was quite tall and the whole design was nicer.

- Group 6: The yoghurt Yoggi Yalla!. The designs of the cap and the tamper evidence were nice. The finishing was pleasant and the touching was agreeable.
- Group 7: It was the juice MER. Even if the tamper was simple, the cap looked exclusive.
- Group 8: There were four products in this group, the drinking yoghurts ProViva, Skånemejerier and Viktväkterna and the juice Brämhults. The caps might be all produced by Amcor White Cap. They were wider and shorter than a lot of beverages. I chose the one from Skånemejerier for a reason of price.
- Group 9: The drickyoghurt ICA. The cap was quite large but rough and straight. It was also an HDPE bottle.
- Group 10: The drickyoghurt Willys. It was the wider cap and the smallest bottle which makes it an interesting sample.

3.1.3.3. The further investigation

I bought a sample of each group. I then measured in a more careful way the following dimensions. The list of the samples and their measures are related in the tables 3.7 and 3.8.

Measures concerning the cap:

- The extern diameter
- The intern diameter excluding the thread
- The height without the tamper evidence
- The thickness which represents $\frac{extern\Theta - \text{int}\, ern\Theta}{2}$
- The color
- The surface and nuance
- The number of ribs on the surface (small plastic parts on the surface of the cap that facilitate the handling)
- A description of the whole design

- The thread's thickness
- The thread's pitch (space between two crests of the thread)

The measures are explained on the following figure

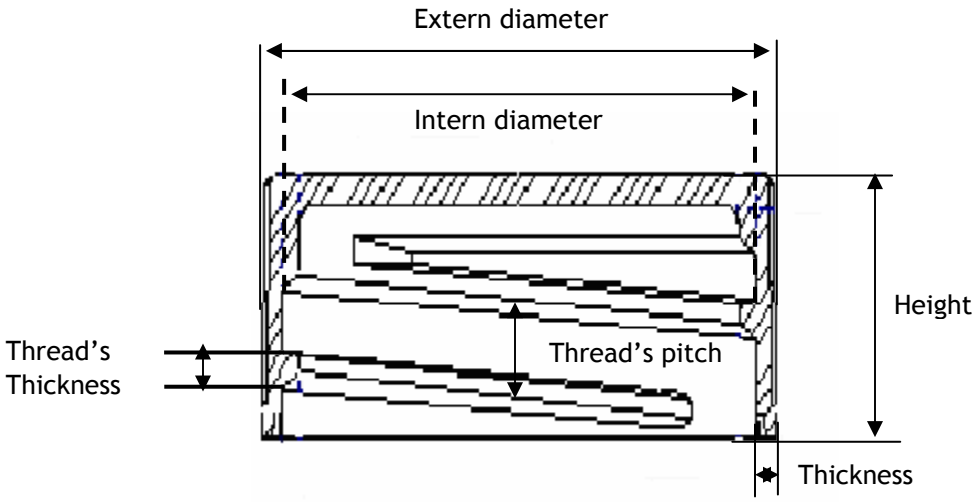

Figure 3.1: Schema of a cap with its dimensions [6]

Measures concerning the tamper evidence:

- The diameter
- The height
- The number of fasteners (small parts of plastic which link the tamper evidence to the cap), see figure 3.2
- The number of inner stoppers (on the inside of the tamper evidence there are sometimes some parts of plastic that enable friction between the neck of the bottle and the tamper evidence. In that way when the tamper moves, the inner stoppers slow it down. It is a good way to facilitate the cap to be separated from the tamper.)
- The position after the first opening

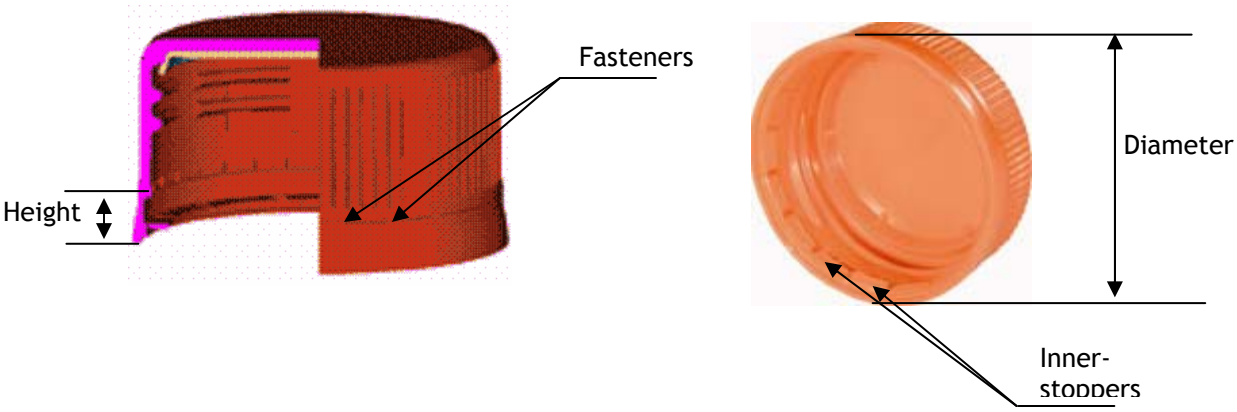

Figure 3.2: Picture and schema of a cap with its tamper evidence [14]

Measures concerning the liner or protrusions on the inside of the cap:

- The form (inner ring means that the cap is linerless and has some protrusions)
- The diameter
- The height

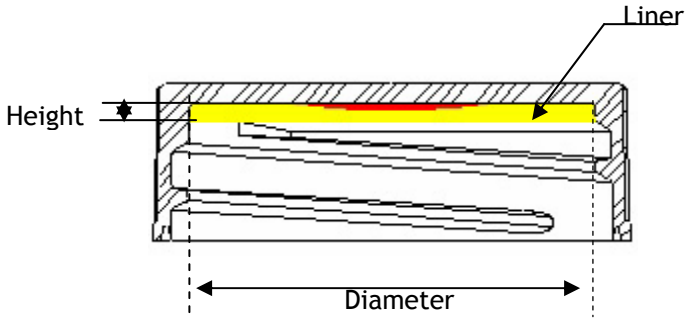

Figure 3.3: Schema of a lined cap with its dimensions [12]

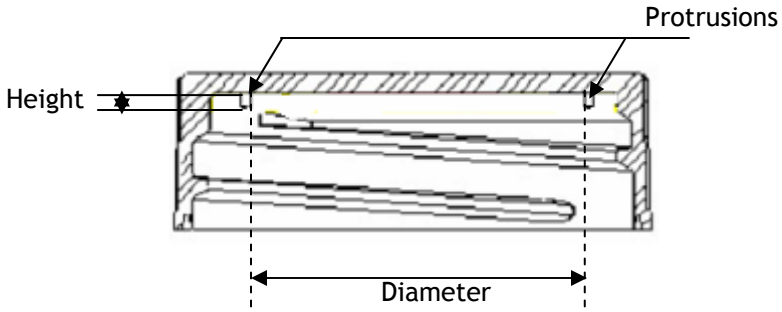

Figure 3.4: Schema of a linerless cap and its dimensions [6]

Measures concerning the bottle:

- The material
- The type
- The raw diameter (extern diameter without the thread), see figure 3.5
- The extern diameter (including the thread)

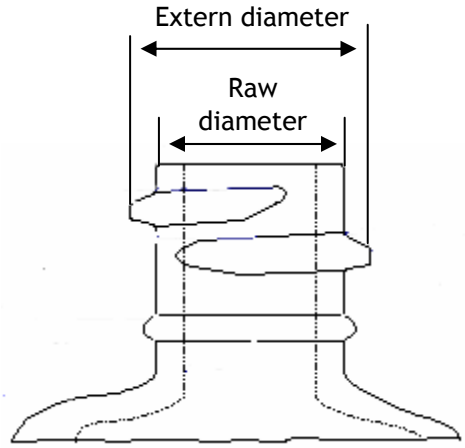

Figure 3.5: Schema of a bottle neck with its dimensions [6]

- The height
- The circumference (sometimes I took two measures and wrote them separated by a "_" because the bottle was not a straight cylinder. While opening the bottle the user could hold the bottle on its smallest diameter (on the grip circumference) or the biggest (the base circumference), see figure 3.6)

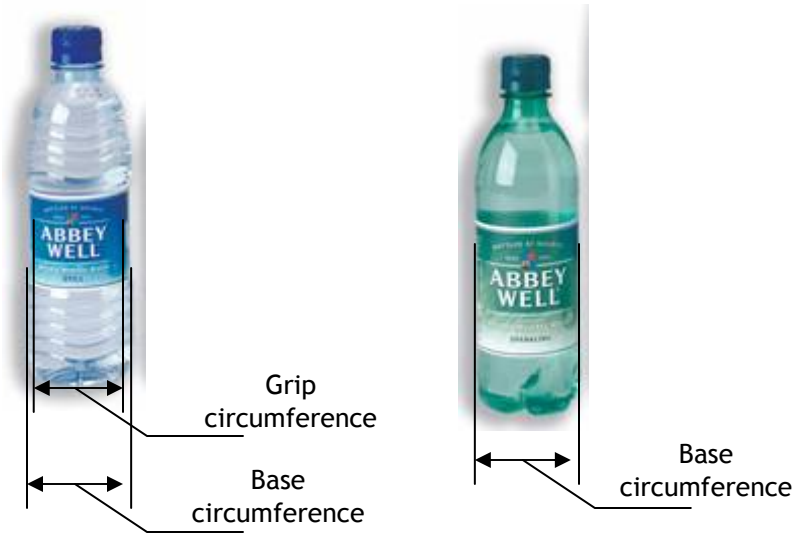

Figure 3.6: Pictures of two bottles and their dimensions [16]

Measures concerning the opening action:

- The course to open the bottle (it represents the number of tours that are necessary before the cap is separated from the bottle. It can also be measured in millimeters that corresponds to the distance done by a point on the extern surface of the cap where were the fingers)
- The opening strength (I put "+" when I found the bottle easy to open, "++" when it was a little harder and "+++" when it was really hard. Some caps seemed very easy and some of them were very bad.)

Table 3.7: Measures of the samples – the cap

Caracteristics					Cap									
Gp	Letter	Cat.	Brand	Name/ Volume	Ø extern	Ø intern	height	thick.	colour	surface/nuance	ribs	whole design	thread thick.	thread pitch
1	A	soft juice	ICA	light 0,5L	30,5	27,7	12	1,4	grey	mat, rough	72	simple and coarse, rounded	0,6	4,1
7	B	juice	MER	0,5L	39	36,2	10,8	1,4	black	bright, rough	112	simple and rounded	0,8	3
4	C	water	aqua d'or	0,5L	32,2	30	12,5	1,1	transparent	mat,rough	72	simple and coarse, rounded	0,7	3
3	D	soft juice	ICA	blandsaft 0,6L	30,2	27,8	13,5	1,2	black	bright, rough	144	smooth and rounded	0,9	3,2
5	E	water	evian	0,5L	31,4	30	12,4	0,7	blue transparent	mat,rough	72	simple and coarse, rounded	0,9	3
2	F	soft juice	BOB	blandsaft 0,5L	30	27,4	13,7	1,3	red	mat, rough	120	smooth but square	1,1	3
8	G	yoghurt	skane mejerier	350 mL	39,8	37	11,3	1,4	blue	mat, rough	128	simple and rounded	1	4
9	H	yoghurt	Willys	240 mL	40	36,8	10,8	1,6	red	mat, rough	120	rounded and simple	0,7	3,5
10	I	yoghurt	ICA	468 mL	40,3	38,1	9,8	1,1	white	mat, rough	100	straight and coarse	0,7	3,1
6	J	yoghurt	Yoggi	yalla! 350mL	36,6	33,4	12	1,6	white	mat, smooth	90	smooth and nice, ribs towards the center of the cap	0,9	3,3

I gave the bottles some letters, A to J, in order to recognize the bottles during the test.

Table 3.8: Measures of the samples – the TE, the liner, the bottle and the opening action

Caracteristics					Tamper evidence					Liner			Bottle						Action	
Gp	Letter	Cat.	Brand	Name/ Volume	Ø	height	fasteners	inner stoppers	after use	form	Ø	height	mat.	type	Ø raw	Ø extern	height	circumference	course to open	opening strength
1	A	soft juice	ICA	light 0,5L	30	5,5	12	0	stucked on the bottle by compression	inner ring	20	3	PET bottle	PET	25	28	202	65	1 2/3 tour 157 mm	++
7	B	juice	MER	0,5L	38	5,2	16	13	in a ring Ø4,5	inner ring	29	3,3	PET bottle	PET	34	36	238	65	1/2 tour 61 mm	+
4	C	water	aqua d'or	0,5L	32	4	12	6	in a ring Ø5	inner ring	23	3,5	PET bottle	PET	28	30	238	62_59	0,6 tour 60 mm	+
3	D	soft juice	ICA	blandsaft 0,6L	29,3	5	12	6	in a ring Ø4,5 but stucked by compression	inner ring	24	2	PET bottle	PET	25	28	202	69	1 5/6 tour 172 mm	+++
5	E	water	evian	0,5L	32,2	3,5	8	0	in a ring Ø4	inner ring	23	4,6	PET bottle	PET	28	30	230	63_56	0,55 tour 56 mm	+
2	F	soft juice	BOB	blandsaft 0,5L	31	4,1	24	17	in a ring Ø4,5	gray disc	25		PET bottle	PET	24,7	27,5	238	59	1,6 tour 150 mm	+
8	G	yoghurt	skane mejerier	350 mL	41	5	8	0	in a ring Ø6	blue disc	33		HDPE bottle	HDPE	35	37	198	54	0,7 tour 87 mm	+
9	H	yoghurt	Willys	240 mL	39	4,5	12	6	in a ring Ø4	inner ring	31	5,5	HDPE bottle	HDPE	35	37	146	54_46	0,55 tour 70 mm	++
10	I	yoghurt	ICA	468 mL	40	3,5	16	8	in a ring Ø4,5	inner ring	32	4	HDPE bottle	HDPE	36	37,7	195	63_53	0,4 tour 47 mm	+++
6	J	yoghurt	Yoggi	yalla! 350mL	37	3,3	7 and 2 hooks	6	in a ring Ø4	inner ring	27	4,2	HDPE bottle	HDPE	31,5	33	200	65	2/3 tour 77 mm	+

3.2. The carton packages

I did not have to do a market survey for the carton packages. Tetra Pak delivered me several carton packages with the same form but perforated in four different ways. They measured themselves the different required strength to tear each perforation. One perforation corresponds to one particular strength. It was then possible for them to order the packages from the easiest to the most difficult to open (1 to 4). I covered the number of the packages with a white tape so that the participant of the test was not able to sort them, see figure 3.9 and 3.10. I gave them some symbols (in the order 1 to 4: ●, ▲, ■, *) in order to distinguish one package from the others.

Figure 3.9: Picture of a carton package before covering (#1)

Figure 3.10: Picture of a carton package after covering

The difference about the perforation is the space between each straight done by the machine, see figure 3.11. None of the participants looked carefully on the perforation. They did not see the dissimilarity.

I found another package on the market manufactured by another company than Tetra Pak. I wanted to compare it to the ones that Tetra Pak gave me but I did not find the time to do it. It was a concentrate of orange juice ICA. The package was done by Combibloc, see appendix K.

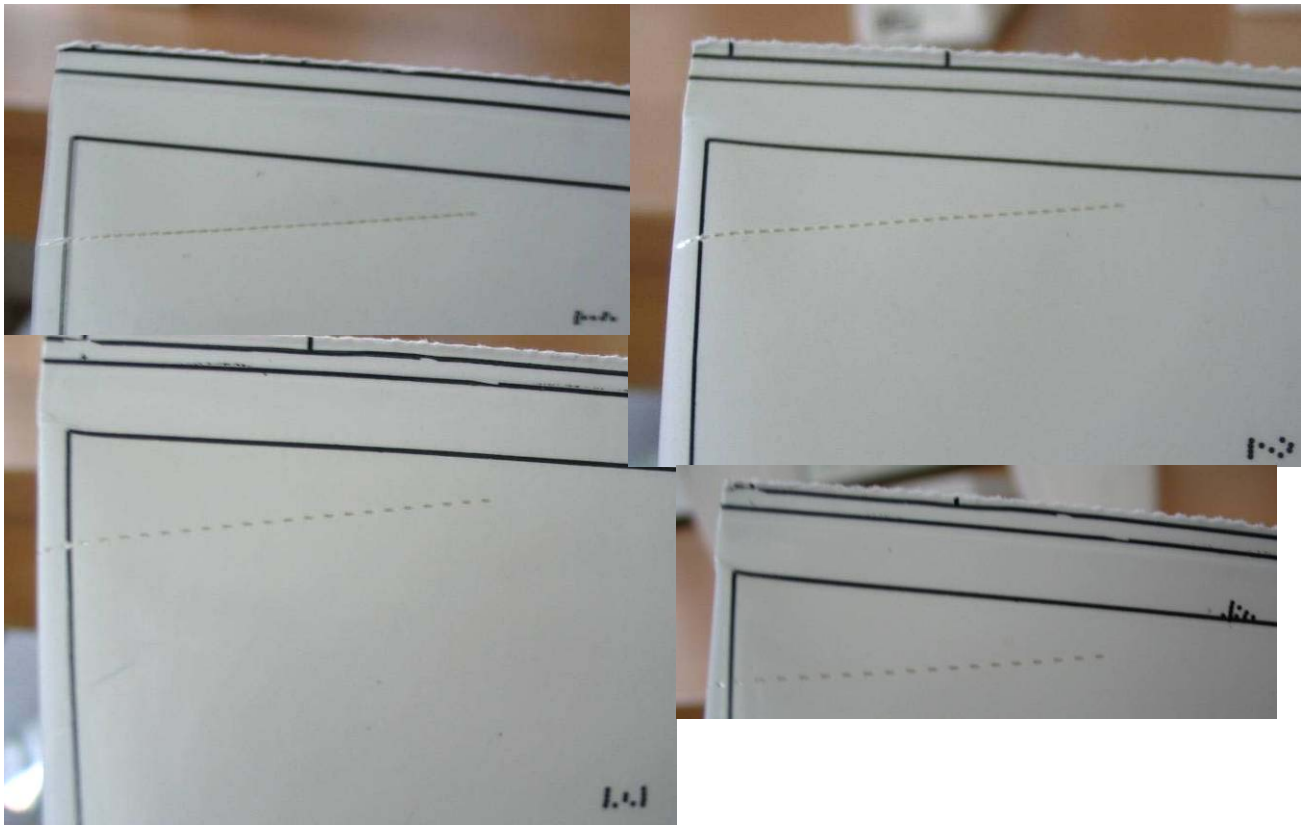

Figure 3.11: Picture of the different perforations (1, 2, 3, and 4)

4. Test plan for the usability test

4.1. Purpose of the test plan

The aim of this test plan was to provide a detailed description of a research methodology to evaluate the usability of packages manufactured by Tetra Pak and their competitors. The methodology focused on how able the packages were for the consumers to open. I studied though the ease of opening and closing the package.

Measurement of these usability indices included both hard (e.g. measuring actual amount of strength) and soft (e.g. consumer perceptions) measures of usability. This plan provided the details of a research methodology that aimed at examining how usable packages were with regards to "opening and closing".

4.2. Participants and Researchers

4.2.1. Participants

Each usability test required 10 participants who are testing both packages with caps and packages with perforation. The number of the participants was roughly equally distributed with regards to age and gender. The plastic and the carton packages were mostly intended to young people because of their small size so that I focused tests on participants between 18 and 29 years old. It was however interesting to interview old people because they are generally weaker (over 50). I obtained thus two different target groups of respectively five young people and four old people. I interviewed one other participant between 30 and 39 so that I got five women and five men, see table 4.1.

Table 4.1: Participants' characteristics

Participant	Gender	Age	Workarea
1	Man	60+	Research and development Education/Training
2	Woman	50/59	Administration/Office
3	Man	50/59	Administration/Office Education/Training Research/devlopment
4	Woman	18/29	Student
5	Man	18/29	Student
6	Man	60+	Education/Training Legal/Law enforcement/Security
7	Woman	18/29	Student
8	Man	18/29	Student
9	Woman	30/39	Administration/Office
10	Woman	18/29	Student Administration/Office

4.2.2. Researcher

I and Elise Roudier, TIME student at the same grade as myself, were present during the testing session for each participant. My responsibilities were to:

- Identify and recruit suitable participants
- Co-ordinate the testing facilities
- Co-ordinate the testing session
- Prepare the usability lab for the test
- Administer the test with individual test participants (one researcher will direct the participant, the other will record the data)
- Code and enter data

I was the guide during the tests and stayed in the room with the participants while Elise was recording the test.

4.3. Testing Procedure

4.3.1. Testing facilities

The usability test was carried out at a specially set-up lab, in order to provide a appropriate environment for testing. The lab contains two rooms separated by a one-way mirror. The observation room contains video recording equipment. The testing room includes several cameras, located at various angles to capture various elements of the testing session.

4.3.2. Equipment and materials

The following equipment was used for the test sessions:

- A weighing device to measure the amount of spillage.
- 2 tumblers for participants to pour into.
- A large, relatively flat container, in which the tumblers were placed on the table. This was used to limit the spillage.
- Video cameras.
- The various testing packages that I already described in the paragraph 3.2.

4.3.3. Test session

Each participant's session was organized in the same way to facilitate consistency.

4.3.3.1. Introduction

Each participant was tested individually. I began by emphasizing that the test was carried out by an independent researcher. This meant that participants could be critical about any of the packages without feeling that they were criticizing the designer. I did not ask leading questions. I made clear that it was the packages, not the users that were being tested, so that, if participants had any trouble, it was the containers' problem, not theirs. All this was done prior to testing in order to make the participants feel comfortable within the testing session.

After the introduction had been completed, the participant was then presented with the exclusion questions and demographic questions (see Appendix C) that ensured that participants did not have prior knowledge that might influence their evaluations of the packages. These questions were also useful in screening for potential health issues that might have arise from the testing situation. After having completed the basic demographic measures, they had to sign the information sheet (see appendix D) which explained their rights as a participant in such a study. Then some anthropometric measures of the participants were taken, especially hand size, arm and wrist circumference

[12] [13]. The following drawings explain the measures taken on each participant during the test, see figure 4.2. The anthropometric measures are also reported in the table 4.3.

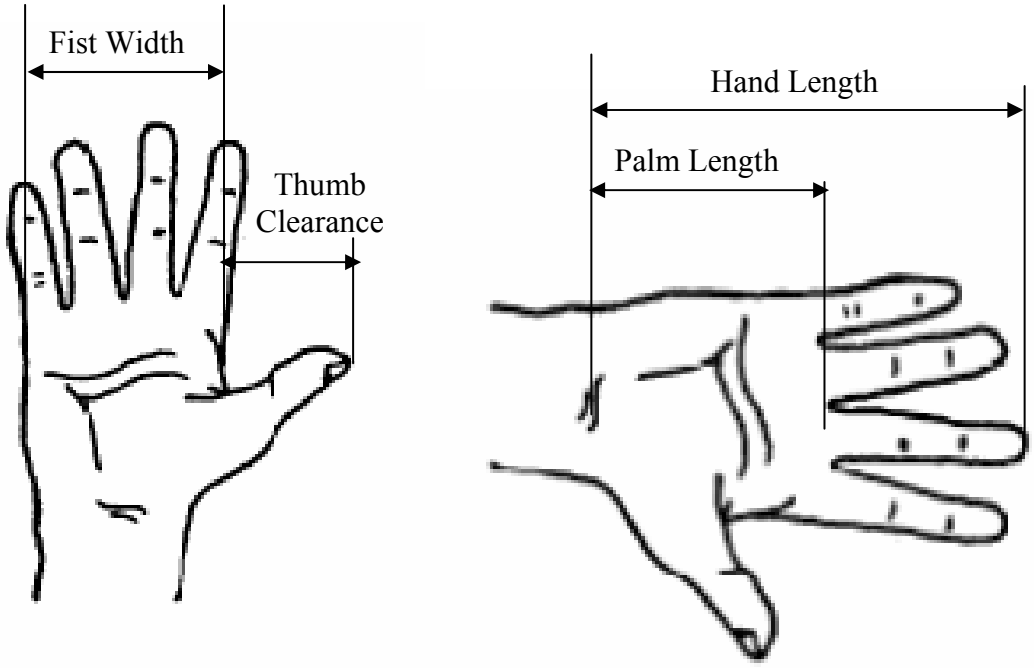

Figure 4.2: Explanation of the anthropometric measures of the hand [11]

Table 4.3: Summary of the anthropometric measures

Anthropometric data									
	All participants				Men	Women	Young	Senior	Dim
	Average	Median	Max	Min	Average	Average	Average	Average	
Weight	73,4	69,5	98	60	81,4	65,4	65,8	85,5	kg
Height	174,8	175	187	164	180	169,6	173	179	cm
Wrist circumference	16,9	17	19,5	15	18	15,7	16,2	18,4	cm
Elbow breadth	8	7,8	9,9	6,3	8,2	7,7	7	8,9	cm
Arm circumference	28,2	28,9	33	25	29,3	27,2	26,7	30,8	cm
Hand length	18,6	19,2	20	17	19,3	18	18,5	19,2	cm
Middle finger length	10,8	11	11,7	10	11,3	10,4	10,6	11,4	cm
Fist width	8,7	8,5	10,2	7,7	9,1	8,3	8,4	9,2	cm
Thumb clearance	7,4	7,5	7,8	6,3	7,5	7,2	7,4	7,6	cm

Participants could then take part in the tasks described below and related to the usability test.

4.3.3.2. Opening packages with caps

In order to examine the usability of the bottles, participants were asked to take part in two major tasks (i.e. the accuracy and speeded tasks). Participants were required to take the bottle, open it by screwing the cap, then close it and put it back on the table. The tasks were performed as during the everyday life.

Focus on accuracy

For the first task, participants carried out the opening task described above but they were told to do it as accurately as they could (i.e. ignoring time taken and avoiding spilling any liquid). The aim of this task was to examine how easy the bottle was to open when working accurately.

Focus on strength

For the second task, participants carried out the opening task described above but they were told to do it as quickly as they could (i.e. without taking care of spillage or accuracy). The aim of this task was to examine how easy the bottle was to open when working quickly.

Dependent measures

During the both tasks two different features were measured:

- The time spent to open and close the bottle (this was timed separately)
- Whether there was some spillage or not (yes/no)

Re-opening and re-closing

In order to examine the usability of the bottle with regards to "re-opening and re-closing", participants were asked to re-open and re-close the bottle five

times. This task was carried out just after the first opening. Its aim was to examine how easy it was to re-open and re-seal the bottle after initial usage.

Dependent measures

The above task provided the opportunity to measure dependently:

- The time to re-open and re-close
- The number of errors made

Perceived usability

After participants had completed the above tasks for each bottle, they had to complete a questionnaire in which they rated each bottle they had opened in terms of its usability. The questions rated two keys aspects: ease of opening and ease of handling (see Appendix E). After all the bottles were tested, the participants filled up a last questionnaire in order to know which bottle was the easiest one to open and handle (see Appendix F).

4.3.3.3. Opening packages with perforation

Participants were also asked to take part in the two major tasks (i.e. the accuracy and speeded tasks). This time, participants were required to take the package, open it, weigh it, pour liquid into the two tumblers and finally weigh the tumblers and the package. They had to pour up to a pre-defined mark on each tumbler/beaker. In order to control for splashes, I put some absorbent paper on the table.

Focus on accuracy

See the accuracy task for the bottles.

Focus on strength

See the speeded task for the bottles.

Dependent measures

This time, three features were measured:

- The amount of time taken to open the package

- whether there were some pillage or not (yes/no)
- The amount of liquid poured (it corresponds to the weights of each thumbler)

Perceived usability

After participants had completed the above tasks for each carton package, they also had to complete a questionnaire about the opening and the pouring from in terms of its usability (see Appendix G) and a final questionnaire (see Appendix H). Finally the participants received a debrief sheet (see Appendix I) that summed up their role in the test.

4.3.3.4. DATA

The dependent measures for each task above are shown below. They can be compared to the ISO definition. They include:

- The amount of liquid spilled (milligrams corresponding of millimeters as the content of the packages was water), the effectiveness attribute
- Whether or not there was any spillage (yes / no)
- Time spent to open, pour, or close. All time features were measured using the video tapes (seconds and milliseconds), the efficiency attribute
- Questionnaire responses (Likert scale 1 = strongly disagreed - 5 = strongly agreed), the satisfaction attribute
- List of words in each questionnaire. The participants had to ring some words in a list of adjectives that described the package they just used (included in the questionnaires of the appendix E and G).

5. Usability test's results

Each test lasted around one hour. It was though hard for the participants to stay focus and accurate for each package. It was sometimes difficult for them to really make a difference between the speeded task and the accurate one because it was easier to open the packages the way they were used to instead of forcing themselves to do it faster.

This means that I could not really trust all of the performance results. However the main purpose of these interviews was to find out the best products and to try to improve the test plan.

5.1. Analysis of the results for the bottles

Some of the bottles were particularly hard to open and 2 participants got hurt on the hand. The participants often made mistakes during the re-open and re-close task by doing it for example four times instead of five. These errors were due to a lack of concentration. What though was important during those tasks was to calculate the frequency of errors and measure the time spent on one re-opening or one re-closing.

5.1.1. The main results

The participants made clearly up their mind on the extreme bottles.

- 50% of the participants thought that the bottle Yoggi Yalla (J) was the easiest to open.
- The bottle J seemed to be the best one in term of usability.
- The bottle ICA light soft juice (A) seemed to be the worst.

The participants had to fill some questionnaires about each package and then a final questionnaire. In the following sections we will discuss the results of each questionnaire. The participants marked what they thought by putting a quote between 1 and 5:

1. I found it easy to open the package

Strongly Disagreed 1-------2-------3-------4-------5 Strongly Agreed NA

If they ring 1 (equal to 0%) they thought that it was really difficult to open the package and if they ring 5 (equal to 100%) they thought that it was really easy to open the package. The questionnaires from the appendix E, F, G, H is required to understand the results. A product which is particularly usable does not necessitate an average of 100%. In fact some questions are asked the other way around and demand a score of 0…

5.1.2. The results for each bottle

5.1.2.1. The bottle A (ICA light)

The results of the questionnaire for the bottle are referred in the table 5.2. There is the score for each question of the questionnaire from the appendix E (ex: Q1 is the first question: *I found it easy to open the package?*).

Participants did not find the bottle particularly easy to open with a mean score of 45%. The women especially did not think so, with a mean score of 20% and a median of 25% compared to the men (70%). The tamper evidence seemed to disturb a little the users; the mean score was only 57.5% but the median was 75%. The reason was that especially the women interviewed found that the tamper-evidence disturbed them during the opening (mean score 70%). The men on the opposite did not think so.

The cap did not seem particularly nice with an average quote of 2.4 (35%). The bottle was not that easy to close either with an average of 42.5% and the same difference between the men and the women.

On the same way, participants found the bottle rather hard to handle with an average of 57.5% and a

Figure 5.1: The cap from the first sample: ICA light soft juice

median of 75%.The women mainly agreed with an average of 70%. As a conclusion, the package was not easy to use with an average of 35%. As before, the women tended to find it really difficult to handle with an average of 15%.

Table 5.2: Summary of the results concerning the bottle A

	Bottle A																			
	All participants				Men				Women				Young				Senior			
	Average		Median		Average		Median		Average		Median		Average		Median		Average		Median	
Q1	2,8	45%	3	50,0%	3,8	70%	4	75%	1,8	20%	2	25%	2,6	40%	2	25%	3,5	62,5%	3,5	62,5%
Q2	3,3	57,5%	4	75,0%	2,8	45%	2	25%	3,8	70%	4	75%	3	50%	4	75%	3,25	56,25%	3,5	62,5%
Q3	2,4	35%	2,5	37,5%	2,2	30%	2	25%	2,6	40%	3	50%	2,2	30%	2	25%	2,5	37,5%	2,5	37,5%
Q4	2,7	42,5%	2,5	37,5%	3	50%	4	75%	2,4	35%	2	25%	2,4	35%	2	25%	3	50%	3,5	62,5%
Q5	3,3	57,5%	4	75,0%	2,8	45%	2	25%	3,8	70%	4	75%	3	50%	2	25%	3,5	62,5%	4	75%
Q6	2,4	35%	2	25,0%	3,2	55%	4	75%	1,6	15%	2	25%	2,2	30%	2	25%	3	50%	3	50%

The package was described as *common*, *time-consuming* and *hard to use*, as well as *annoying* and of *poor quality*, see table 5.3 where all the words concerning the bottle A picked by the participants are listed with the number of times (Frequency, written "Fqcy") each word was picked. The "first words" correspond to the ones that were ticked which described the most the experience of the participants with the bottle A. "The second words" are the other ones.

Table 5.3: Words picked in the questionnaires for the bottle A

Words use- Bottle A			
first words	Fqcy	second words	Fqcy
Common	3	Poor quality	4
Time-consuming	3	Annoying	4
Hard to use	3	Common	3
Appropriate	2	Painful	2
Simple	2	Time-consuming	2
Faulty	2	Controllable	2
Difficult	2	Dull	1
Painful	1	Effective	1
Efficient	1	Unpredictable	1
Frustrating	1	Unrefined	1
Unattractive	1	Efficient	1
Satisfying	1	Familiar	1
Annoying	1	Frustrating	1
Fun	1	Ineffective	1
Straightforward	1	Faulty	1
Slow	1	Rigid	1
Expected	1	Difficult	1
Poor quality	1	Satisfying	1
		Clear	1

If we compared the results of the questionnaires of each bottle, we find out that the bottle A was the one which had the minimum score in the questions 1, 3, 4 and 6 and the maximum score in the question 5. This meant that according to the first questionnaires, this bottle was the least easy one to open and to close, the least easy one to use. Its cap did not look nice and the package seemed the

hardest one to handle, see table 5.31. It was interesting to compare those results with the ones from the final questionnaire, where the participants had to compare all the bottles together.

5.1.2.2. The bottle B (MER)

The results for this bottle are summed up in the table 5.5. All participants agreed to say that the bottle was easy to open with a mean score of 77.5%. The tamper evidence seemed to slightly disturb the user with an average quote of 3.1. However we could notice quite a difference between the elderly and the young people. In fact people aged of 50 years old and more did not seem to be annoyed by the tamper-evidence with a mean score of 37.5%. In the meanwhile young people tended to be bothered by it with an average of 65% and a median of 75%.

Figure 5.4: The cap from the second sample: MER juice

The appearance of the cap seemed quite good with a quote of 3.6 in average. The bottle was really easy to close with a mean score of 85% and an unexpected median of 100%. In fact the seniors and the men really agreed on this point. Their quotes happened to be only between 4 and 5 and the median quote was 5. However the young people and the women were a little more reserved (mean score of 75%) but still agreed.

The package did not seem hard to handle with a mean score of 25%. But again the elderly seemed to strongly agree with a mean score of 6.25% and a median quote of 1. Nevertheless people between 20 and 29 years were note so sure with an average of 40% and a median of 50%.

Finally, the bottle was really easy to handle with an average quote of 4.2.The men and the seniors agreed totally with both medians of 100%.

Table 5.5: Summary of the results concerning the bottle B

Bottle B																				
	All participants				Men				Women				Young				Senior			
	Average		Median		Average		Median		Average		Median		Average		Median		Average		Median	
Q1	4,1	77,5%	4	75%	4,4	85%	5	100%	3,8	70%	4	75%	3,8	70%	4	75%	4,5	87,5%	4,5	87,5%
Q2	3,1	52,5%	3	50%	2,8	45%	3	50%	3,4	60%	3	50%	3,6	65%	4	75%	2,5	37,5%	2,5	37,5%
Q3	3,6	65%	4	75%	3,8	70%	4	75%	3,4	60%	3	50%	3,4	60%	3	50%	3,75	68,75%	4	75%
Q4	4,4	85%	5	100%	4,8	95%	5	100%	4	75%	4	75%	4	75%	4	75%	5	100%	5	100%
Q5	2	25%	2	25%	1,6	15%	1	0%	2,4	35%	2	25%	2,6	40%	3	50%	1,25	6,25%	1	0%
Q6	4,2	80%	4	75%	4,6	90%	5	100%	3,8	70%	4	75%	3,8	70%	4	75%	4,75	93,75%	5	100%

Table 5.6: Words picked in the questionnaires for the bottle B

Words use- Bottle B			
first words	Fqcy	second words	Fqcy
Easy to use	6	Common	4
Familiar	3	Appealing	3
Fun	2	Appropriate	2
Useful	2	Efficient	2
Simple	2	Satisfying	2
Clean	2	Simple	2
Empowering	2	Simplistic	2
Convenient	2	Pleasant to touch	2
Unpredictable	1	Empowering	1
Difficult	1	Expected	1
Appealing	1	Frustrating	1
Fast	1	Attractive	1
Appropriate	1	Clear	1
Rigid	1	Convenient	1
Responsive	1	Effortless	1
Smooth	1	Straightforward	1
		Time-consuming	1
		Time-saving	1
		Understandable	1
		Rigid	1
		Hard to use	1
		Innovative	1

6 of the 10 participants described the cap and bottle as *easy to use*, see Table 5.6. The elder men found it *empowering* and the young people were more *familiar* with it. In general it was also *common* and *appealing*. In comparison with the other bottles, it was one of the easiest ones to close. The men and the seniors said that it was one of the easiest to use and the elderly found the cap one of the nicest, see Table 5.31.

5.1.2.3. The bottle C (Aqua d'Or)

The bottle appeared to be particularly easy to open with a mean score of 85% and a median of 100%, see table 5.9. This statement was manly supported by the men with a median of 100% and less by the young people in general with

Table 5.8: Words picked in the questionnaires for the bottle C

Words use- Bottle C			
first words	**Fqcy**	**second words**	**Fqcy**
Easy to use	7	Common	5
Satisfying	3	Effective	4
Appealing	2	Appropriate	3
Appropriate	2	Attractive	3
Effective	2	Useful	3
Fast	2	Clear	2
Simple	2	Controllable	2
Smooth	1	Convenient	2
Clear	1	Easy to use	2
Controllable	1	Efficient	2
Efficient	1	Empowering	2
Empowering	1	Expected	2
Familiar	1	Fast	2
Reliable	1	Reliable	2
Responsive	1	Responsive	2
Time-saving	1	Desirable	1
		Effortless	1
		Familiar	1
		Pleasant to touch	1
		Rigid	1
		Satisfying	1
		Shiny	1
		Simple	1
		Straightforward	1
		Time-saving	1

Figure 5.7: The cap from the third sample: Aqua d'Or water

an average and a median of 75%. Moreover the tamper-evidence did not disturb the participants at all with an average quote of 1.2. They were not particularly fond of the appearance of the cap; they had indeed no opinion (50% in average).

The bottle seemed really easy to close too with a mean score of 82.5%. The men and the elderly strongly agreed with a median of 100% while the women and the young people were less convinced with only a 75% statement.

However they all agreed to say that the package was easy to handle. The mean score was 22.5% and the median was 25%. Afterwards they found the package easy to use with an average quote of 4.4 (85%). But, like before, the

men and seniors strongly agreed this statement compared to the others with both average around 90%.

Table 5.9: Summary of the results concerning the bottle C

Bottle C																				
	All participants				Men				Women				Young				Senior			
	Average		Median		Average		Median		Average		Median		Average		Median		Average		Median	
Q1	4,4	85%	5	100%	4,6	90%	5	100%	4,2	80%	5	100%	4	75%	4	75%	4,75	93,75%	5	100%
Q2	1,2	5%	1	0%	1	0%	1	0%	1,4	10%	1	0%	1,4	10%	1	0%	1	0%	1	0%
Q3	3	50%	3	50%	3,6	65%	4	75%	2,4	35%	3	50%	2,8	45%	3	50%	3,25	56,25%	3,5	62,5%
Q4	4,3	82,5%	4	75%	4,6	90%	5	100%	4	75%	4	75%	4	75%	4	75%	4,75	93,75%	5	100%
Q5	1,9	22,5%	2	25%	2	25%	2	25%	1,8	20%	2	25%	2	25%	2	25%	2	25%	2	25%
Q6	4,4	85%	4,5	87,5%	4,6	90%	5	100%	4,2	80%	4	75%	4,2	80%	4	75%	4,5	87,5%	4,5	87,5%

The package was first described as *easy to use* and *satisfying*, then as *common* and *effective*, see Table 5.8. In general the bottle was considered as the easiest one to use. And according to the men and seniors it appeared to be also the one on which the tamper evidence disturbed the least, see table 5.31.

5.1.2.4. The bottle D (ICA blandsaft)

It appeared that the participants' opinions about this bottle were not really convincing, see Table 5.10. For all the questions the mean score and the median were around 50%. However the young people found the bottle less easy to open than the other with an average of 35% and a median of 25%. The

Table 5.10: Summary of the results concerning the bottle D

Bottle D																				
	All participants				Men				Women				Young				Senior			
	Average		Median		Average		Median		Average		Median		Average		Median		Average		Median	
Q1	2,9	47,5%	3	50%	3,2	55%	3	50%	2,6	40%	2	25%	2,4	35%	2	25%	3,25	56,25%	3,5	62,5%
Q2	2,7	42,5%	3	50%	3	50%	3	50%	2,4	35%	3	50%	2,8	45%	3	50%	3	50%	3	50%
Q3	3,1	52,5%	3	50%	3,2	55%	3	50%	3	50%	3	50%	3	50%	3	50%	3,5	62,5%	3,5	62,5%
Q4	2,9	47,5%	3	50%	3,2	55%	3	50%	2,6	40%	2	25%	2,6	40%	2	25%	3	50%	3	50%
Q5	2,9	47,5%	3	50%	3,2	55%	3	50%	2,6	40%	2	25%	3	50%	3	50%	3	50%	3	50%
Q6	2,9	47,5%	3	50%	2,8	45%	3	50%	3	50%	3	50%	2,8	45%	3	50%	3	50%	3	50%

women thought that the tamper-evidence did not disturb them so much with a mean score of 35%. And from the elderly point of view, the cap looked quite nice with an average quote and a median quote of 3.5 (62.5%).

Figure 5.11: The cap from the fourth sample: ICA blandsaft

Table 5.12: Words picked in the questionnaires for the bottle D

Words use- Bottle D			
first words	Fqcy	second words	Fqcy
Slow	4	Common	3
Simple	4	Rigid	2
Common	3	Convenient	2
Unattractive	2	Useful	1
Time-consuming	2	Understandable	1
Hard to use	2	Unattractive	1
Easy to use	2	Satisfying	1
Difficult	2	Reliable	1
Appropriate	2	Poor quality	1
Rigid	1	Frustrating	1
Poor quality	1	Familiar	1
Pleasant to touch	1	Expected	1
High quality	1	Easy to use	1
Fun	1	Dull	1
Familiar	1	Difficult	1
Controllable	1	Clear	1
		Clean	1

The bottle was described as *slow* but *simple* and *common*, see Table 5.12. According to the men, the bottle was the hardest to open, to handle and to use, see table 5.31.

5.1.2.5. The bottle E (Evian)

The bottle appeared quite easy to open with a mean score of 77.5%, see Table 5.14. There was nevertheless a difference between women and men, and young and elder. Men and seniors strongly agreed with an average

Figure 5.13: The cap from the fifth sample: Evian water

around 90% and a median of 100% while women and young people were a bit more shared with a mean score around 70% and a median of 75%.

Table 5.14: Summary of the results concerning the bottle E

Bottle E																				
	All participants				Men				Women				Young				Senior			
	Average		Median		Average		Median		Average		Median		Average		Median		Average		Median	
Q1	4,1	77,5%	4	75%	4,6	90%	5	100%	3,6	65%	4	75%	3,8	70%	4	75%	4,75	93,75%	5	100%
Q2	1,6	15%	1	0%	1,6	15%	1	0%	1,6	15%	2	25%	2,2	30%	2	25%	1	0%	1	0%
Q3	3,6	65%	4	75%	4	75%	4	75%	3,2	55%	3	50%	4	75%	4	75%	3,25	56,25%	3,5	62,5%
Q4	3,9	72,5%	4	75%	4,4	85%	5	100%	3,4	60%	4	75%	3,4	60%	4	75%	4,5	87,5%	4,5	87,5%
Q5	2,1	27,5%	2	25%	2,2	30%	2	25%	2	25%	2	25%	2,2	30%	2	25%	1,75	18,75%	2	25%
Q6	3,9	72,5%	4	75%	4,2	80%	4	75%	3,6	65%	4	75%	3,8	70%	4	75%	4,25	81,25%	4	75%

The tamper-evidence did not at all disturb them. At this point the seniors were totally convinced with only quotes of 1 while young people were less with a mean score of 30% and their maximum quote reached 4. But they all agreed that the cap looked quite nice with an average of 65% and a median of 75%.

Table 5.15: Words picked in the questionnaires for the bottle E

Words use- Bottle E			
first words	Fqcy	second words	Fqcy
Fast	4	Efficient	3
Time-saving	2	Common	3
Simple	2	Clean	3
Empowering	2	Appropriate	3
Easy to use	2	Useful	2
Convenient	2	Time-saving	2
Clean	2	Satisfying	2
Appealing	2	Reliable	2
Satisfying	1	Effective	2
Rigid	1	Controllable	2
Pleasant to touch	1	Understandable	1
Effortless	1	Responsive	1
Effective	1	Pleasant to touch	1
Dull	1	High quality	1
Difficult	1	Fun	1
Common	1	Fast	1
Clear	1	Familiar	1
Attractive	1	Expected	1
Appropriate	1	Empowering	1

The bottle seemed quite easy to close with a mean score around 75%. The men found it much easier than the women, with an average quote of 4.4 and a median quote of 5. It was not hard to handle it; the quotes were all around 2 (25%). It was easy to use; the quotes were all around 4 (75%).

The first description of the bottle was that it was *fast*. Participants found also it *common*, *clean*, *appropriate* and *efficient*, see Table 5.15. For the elder people the tamper evidence was one of the best one. The young people thought that the cap was one of the nicest, see table 5.31.

5.1.2.6. *The bottle F (BOB saft)*

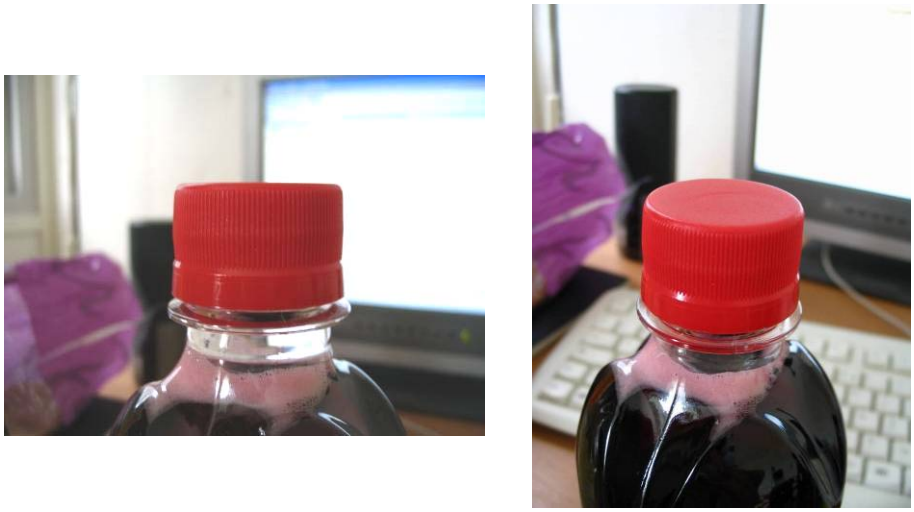

Figure 5.16: The cap from the sixth sample: BOB soft juice

All participants found the bottle particularly easy to open with a mean score of 70% and a median of 75%, see table 5.17. The tamper evidence did not seem to disturb them so much; the mean score was only 40% but the median was 50%. The cap as well looked OK with an average quote of 2.8.

Table 5.17: Summary of the results concerning the bottle F

	Bottle F																			
	All participants				Men				Women				Young				Senior			
	Average		Median		Average		Median		Average		Median		Average		Median		Average		Median	
Q1	3,8	70%	4	75%	4	75%	4	75%	3,6	65%	4	75%	3,4	60%	4	75%	4	75%	4	75%
Q2	2,6	40%	3	50%	2,4	35%	2	25%	2,8	45%	3	50%	3,2	55%	3	50%	2,25	31,25%	2	25%
Q3	2,8	45%	3	50%	2,6	40%	3	50%	3	50%	3	50%	2,6	40%	3	50%	3	50%	3	50%
Q4	3,3	57,5%	3,5	62,5%	3,6	65%	4	75%	3	50%	3	50%	3	50%	3	50%	3,25	56,25%	3,5	62,5%
Q5	2,1	27,5%	2	25%	2,4	35%	2	25%	1,8	20%	2	25%	2,2	30%	2	25%	2,25	31,25%	2,5	37,5%
Q6	3,5	62,5%	3,5	62,5%	3,4	60%	3	50%	3,6	65%	4	75%	3,2	55%	3	50%	3,5	62,5%	3,5	62,5%

However the bottle seemed a little bit harder to close than to open with a mean score of 57.5%. While the women did not have any opinion about it (50%), the men complained a little more about it with an average of 65% and a median of 75%.

Table 5.18: Words picked in the questionnaires for the bottle F

Words use- Bottle F			
first words	**Fqcy**	**second words**	**Fqcy**
Common	4	Common	3
Time-consuming	2	Time-consuming	2
Slow	2	Simple	2
Simple	2	Familiar	2
Rigid	2	Difficult	2
Convenient	2	Clear	2
Unattractive	1	Understandable	1
Simplistic	1	Slow	1
Reliable	1	Rigid	1
Poor quality	1	Frustrating	1
Pleasant to touch	1	Faulty	1
High quality	1	Expected	1
Hard to use	1	Effective	1
Friendly	1	Easy to use	1
Fast	1	Appealing	1
Familiar	1		
Expected	1		
Effortless	1		
Effective	1		
Easy to use	1		
Dull	1		
Controllable	1		

It appeared though easy to handle with an average and a median quotes around 2. But the bottle did not look that easy to use with a mean score and a median of 62.5%. The package was mainly described as *common*, see table 5.18.

5.1.2.7. The bottle G (yoghurt Skånemejerier)

Participants found the bottle quite easy to open with a mean score of 65% and a median of 75%, see table 5.19. Here there was an important difference of opinion between men and women. While the women were not so convinced (average quote around 3), the men strongly supported the statement

Table 5.19: Summary of the results concerning the bottle F

Bottle G																				
	All participants				**Men**				**Women**				**Young**				**Senior**			
	Average		Median		Average		Median		Average		Median		Average		Median		Average		Median	
Q1	3,6	65%	4	75%	4,4	85%	4	75%	2,8	45%	3	50%	3	50%	3	50%	4,25	81,25%	4,5	87,5%
Q2	2,1	27,5%	1,5	12,5%	1,6	15%	1	0%	2,6	40%	3	50%	3	50%	3	50%	1,25	6,25%	1	0%
Q3	3,6	65%	4	75%	4	75%	4	75%	3,2	55%	3	50%	3,8	70%	4	75%	3,5	62,5%	3,5	62,5%
Q4	4	75%	4	75%	4,8	95%	5	100%	3,2	55%	4	75%	3,4	60%	4	75%	4,75	93,75%	5	100%
Q5	2,1	27,5%	2	25%	1,4	10%	1	0%	2,8	45%	3	50%	2,6	40%	2	25%	1	0%	1	0%
Q6	3,9	72,5%	4	75%	4,4	85%	4	75%	3,4	60%	4	75%	3,2	55%	4	75%	4,75	93,75%	5	100%

with a mean score of 85%. A large difference could be noticed between the young (average 50%) and the elderly (81%).

The tamper evidence did not appear to disturb the users; the mean score was only 27.5% and the median was 12.5%. The reason was again that the men and seniors interviewed found that the tamper-evidence was not a barrier at all (average around 10% and median of 0%). But the women and the young people were neutral on this question (quotes of 3).

Table 5.21: Words picked in the questionnaires for the bottle G

Words use- Bottle G			
first words	Fqcy	second words	Fqcy
Attractive	3	Clean	3
Appealing	2	Useful	3
Appropriate	2	Appealing	2
Easy to use	2	Convenient	2
Effective	2	Effective	2
Fast	2	Appropriate	1
Pleasant to touch	2	Attractive	1
Simple	3	Clear	1
Clean	1	Controllable	1
Controllable	1	Dull	1
Convenient	1	Easy to use	1
Difficult	1	Efficient	1
Empowering	1	Empowering	1
Frustrating	1	Expected	1
Hard to use	1	Fast	1
High quality	1	Pleasant to touch	1
Rigid	1	Simple	1
Slow	1	Stimulating	1
Smooth	1	Time-saving	1
Understandable	1		

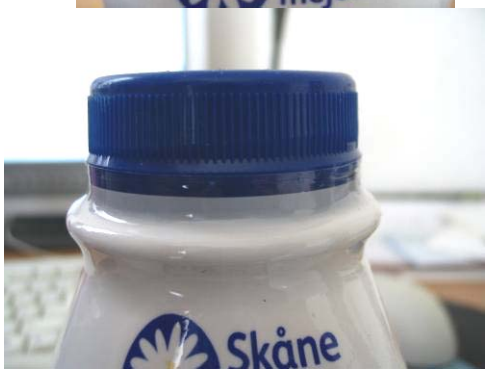

Figure 5.19: The cap from the seventh sample: Skånemejerier drickyoghurt

The men found the cap quite nice with a mean score of 75% and a median of 75%. The women were not so sure with an average quote around 3. The bottle seemed really easy to close as well with an average of 75%. And according to what the men thought about the opening they really approved the easiness of the closing with a mean score of 95% and a median of 100%.

The bottle seemed quite easy to handle with an average of 27.5%. Despite the women were not involved in this statement, the men supported it by a mean score of 10% and a median of 0%. Finally it was also easy to handle with

an average quote of 4. This time, the young and the seniors were split with respectively mean scores of 55% and 93.75%.

The package was described as *attractive* and then *clean* and *useful*, see table 5.21. As far as the men were concerned this bottle was one of the easiest ones to close and they shared the seniors' point of view: it was the easiest bottle to handle, see table 5.31.

5.1.2.8. The bottle H (Willys drickyoghurt)

All participants agreed to say that the bottle was easy to open with quotes between 3 and 5 and a mean score of 75%, see table 5.24. They had not a particular judgment on whether the tamper-evidence disturbed them or not with a mean score of 45% and a median of 50%. The quotes spread between 1 and 5.

Table 5.22: Words picked in the questionnaires for the bottle H

Words use- Bottle H			
first words	**Fqcy**	**second words**	**Fqcy**
Attractive	3	Effective	4
Easy to use	3	Appealing	2
Fast	3	Attractive	2
Simple	3	Clean	2
Convenient	2	Clear	2
Pleasant to touch	2	Controllable	2
Appropriate	1	Efficient	2
Effective	1	Fast	2
Effortless	1	Time-saving	2
Empowering	1	Appropriate	1
Familiar	1	Difficult	1
Flexible	1	Easy to use	1
Friendly	1	Familiar	1
Hard to use	1	Fun	1
High quality	1	Innovative	1
Poor quality	1	Pleasant to touch	1
Rigid	1	Responsive	1
Satisfying	1	Satisfying	1
Smooth	1	Simplistic	1
Understandable	1	Straightforward	1
		Useful	1

Figure 5.23: The cap from the eighth sample: Willys drickyoghurt

The men liked the appearance of the cap with an average of 80%.The women were more indecisive. The men considered that the bottle was really easy to close with quotes only between 4 and 5 and a median of 100%. The women agreed on a weaker way (75%).

All the participants believed that the package was easy to handle with a mean score and a median of respectively 20% and 25%. They also feel that the bottle was easy to use with an average of 77.5%. The men completely agreed (median 100%). This was perhaps due to the form of the bottle. It is quite a little one and it has a smooth shape which fits to your hands so it is easy to hold it.

Table 5.24: Summary of the results concerning the bottle H

	Bottle H																			
	All participants				Men				Women				Young				Senior			
	Average		Median		Average		Median		Average		Median		Average		Median		Average		Median	
Q1	4,1	77,5%	4	75%	4,2	80%	4	75%	4	75%	4	75%	3,8	70%	4	75%	4,25	81,25%	4,5	87,5%
Q2	2,8	45%	3	50%	2,8	45%	3	50%	2,8	45%	3	50%	3,2	55%	3	50%	2,75	43,75%	2,5	37,5%
Q3	3,8	70%	4	75%	4,2	80%	4	75%	3,4	60%	3	50%	4	75%	4	75%	3,75	68,75%	4	75%
Q4	4,2	80%	4	75%	4,6	90%	5	100%	3,8	70%	4	75%	4,2	80%	4	75%	4	75%	4,5	87,5%
Q5	1,8	20%	2	25%	2	25%	2	25%	1,6	15%	2	25%	2,2	30%	2	25%	1,5	12,5%	1,5	12,5%
Q6	4,1	77,5%	4	75%	4,2	80%	5	100%	4	75%	4	75%	3,8	70%	4	75%	4,25	81,25%	4,5	87,5%

The package was described as *attractive*, *easy to use*, *fast*, *simple* and finally *effective*, see table 5.22. It appeared that the cap looked the nicest. The women found it one of the easiest to handle, see table 5.31.

5.1.2.9. The bottle I (ICA drickyoghurt)

Participants did not consider the bottle as easy neither hard to open, with a mean score of 50%, see table 5.25. But, this statement was caused by the indecision of the women and the young people because the men and the elderly considered the bottle as quite easy to open with an average quote around 4.

Figure 5.25: The cap from the ninth sample: ICA drickyoghurt

The tamper-evidence disturbed in average quite a lot the users with a mean of 70%. But again the women and the young people (median of 75%) seemed much more annoyed than the men and the elderly (median of 50%).

Table 5.26: Summary of the results concerning the bottle I

	Bottle I																			
	All participants				Men				Women				Young				Senior			
	Average		Median		Average		Median		Average		Median		Average		Median		Average		Median	
Q1	3,1	52,5%	3	50%	3,4	60%	4	75%	2,8	45%	3	50%	2,6	40%	3	50%	4	75,0%	4	75%
Q2	3,8	70%	4	75%	3,4	60%	3	50%	4,2	80%	4	75%	4	75%	4	75%	3,25	56,25%	3	50%
Q3	3	50%	3	50%	3,6	65%	3	50%	2,4	35%	2	25%	3	50%	3	50%	3,25	56,25%	3,5	62,5%
Q4	4,2	80%	4	75%	4,4	85%	4	75%	4	75%	4	75%	3,8	70%	4	75%	4,75	93,75%	5	100%
Q5	1,7	17,5%	2	25%	1,6	15%	2	25%	1,8	20%	2	25%	2	25%	2	25%	1,25	6,25%	1	0%
Q6	3,5	62,5%	4	75%	4	75%	4	75%	3	50%	3	50%	3,2	55%	3	50%	4,25	81,25%	4	75%

Moreover the women did not like the appearance of the cap with a mean score of 35% and a median of 25%. It did not bother the men (50%). They finally all agreed to state that the bottle was easy to close with a mean score of 80%. The elderly strongly approved the statement with quotes spread between 4 and 5 only.

Table 5.27: Words picked in the questionnaires for the bottle I

Words use- Bottle I			
first words	**Fqcy**	**second words**	**Fqcy**
Faulty	4	Common	2
Annoying	3	Easy to use	2
Appropriate	2	Frustrating	2
Dull	2	Hard to use	2
Fast	2	Attractive	1
Hard to use	2	Clean	1
High quality	2	Convenient	1
Clear	1	Difficult	1
Common	1	Distracting	1
Difficult	1	Effective	1
Empowering	1	Efficient	1
Flexible	1	Effortless	1
Painful	1	Empowering	1
Pleasant to touch	1	Familiar	1
Poor quality	1	Inadequate	1
Rigid	1	Simplistic	1
Satisfying	1	Slow	1
Simple	1	Time-consuming	1
Smooth	1		
Useful	1		

They thought that the bottle was easy to handle with a mean score of 17.5% and a median of 25%. The seniors were again a little more excessive with quotes only between 1 and 2.

Nevertheless even if participants assumed in average that the package was quite easy to use, with a mean score of 62.5% and a median of 75%, the women and the young people stayed uncertain with mean quotes around 3. They described the package as *faulty* and

annoying, see table 5.27. Its tamper-evidence annoyed them the most, see table 5.31.

5.1.2.10. The bottle J (Yoggi Yalla!)

This bottle had really extreme high scores, see table 5.30. All participants had quite the same opinion. They thought that the bottle was exceptionally easy to open with a mean score of 97.5% and a median of 100%. The quotes spread between 4 and 5. The tamper-evidence did not disturb them at all with a mean quote of 1.1 and a median of 1. The quotes were between 1 and 2.

Table 5.28: Words picked in the questionnaires for the bottle J

Words use- Bottle J			
first words	**Fqcy**	**second words**	**Fqcy**
Easy to use	6	High quality	4
Fast	3	Advanced	3
Attractive	2	Appealing	3
Efficient	2	Convenient	3
Simple	2	Effective	3
Advanced	1	Satisfying	3
Clear	1	Attractive	2
Controllable	1	Clear	2
Convenient	1	Impressive	2
Cutting edge	1	Pleasant to touch	2
Distracting	1	Useful	2
Effective	1	Clean	1
Fashionable	1	Common	1
High quality	1	Complex	1
Pleasant to touch	1	Controllable	1
Reliable	1	Creative	1
Rigid	1	Easy to use	1
Satisfying	1	Efficient	1
Sophisticated	1	Effortless	1
Time-saving	1	Empowering	1
		Engaging	1
		Fashionable	1
		Innovative	1
		Responsive	1
		Rigid	1
		Simple	1
		Sophisticated	1
		Time-saving	1
		Understandable	1

Figure 5.29: The cap from the tenth sample: Yoggi Yalla!

Table 5.30: Summary of the results concerning the bottle J

Bottle J																				
	All participants				Men				Women				Young				Senior			
	Average		Median		Average		Median		Average		Median		Average		Median		Average		Median	
Q1	4,9	97,5%	5	100%	5	100%	5	100%	4,8	95%	5	100%	4,8	95%	5	100%	5	100%	5	100%
Q2	1,1	2,5%	1	0%	1,2	5%	1	0%	1	0%	1	0%	1,2	5%	1	0%	1	0%	1	0%
Q3	3,8	70%	4	75%	3,6	65%	4	75%	4	75%	4	75%	4	75%	4	75%	3,5	62,5%	3,5	62,5%
Q4	4,4	85%	4,5	87,5%	4,4	85%	4	75%	4,4	85%	5	100%	4,2	80%	4	75%	4,5	87,5%	4,5	87,5%
Q5	1,5	12,5%	1	0%	1,4	10%	1	0%	1,6	15%	1	0%	1,6	15%	1	0%	1,5	12,5%	1	0%
Q6	4,3	82,5%	4	75%	4,2	80%	4	75%	4,4	85%	4	75%	4,4	85%	4	75%	4	75%	4	75%

Table 5.31: Summary of the answers to the questionnaire for each bottle

Summary bottles																												
	All participants						Men						Women						Young						Senior					
	Max		Btl	Min		Btl	Max		Btl	Min		Btl	Max		Btl	Min		Btl	Max		Btl	Min		Btl	Max		Btl	Min		Btl
Q1	4,9	97,5%	J	2,8	45%	A	5	100%	J	3,2	55%	D	4,8	95%	J	1,8	20%	A	4,8	95%	J	2,4	35%	D	5	100%	J	3,25	56,25%	D
Q2	3,8	70%	I	1,1	2,5%	J	3,4	60%	I	1	0%	C	4,2	80%	I	1	0%	J	4	75%	I	1,2	5%	J	3,25	56,25%	A,I	1	0%	C,E,J
Q3	3,8	70%	H,J	2,4	35%	A	4,2	80%	H	2,2	30%	A	4	75%	J	2,4	35%	C,I	4	75%	H,J,E	2,2	30%	A	3,75	68,75%	B,H	2,5	37,5%	A
Q4	4,4	85%	B,J	2,7	42,5%	A	4,8	95%	B,G	3	50%	A	4,4	85%	J	2,4	35%	A	4,2	80%	H,J	2,4	35%	A	5	100%	B	3	50%	A,D
Q5	3,3	57,5%	A	1,5	12,5%	J	3,2	55%	D	1,4	10%	G,J	3,8	70%	A	1,6	15%	H,J	3	50%	A,D	1,6	15%	J	3,5	62,5%	A	1	0%	G
Q6	4,4	85%	C	2,4	35%	A	4,6	90%	B,C	2,8	45%	D	4,4	85%	J	1,6	15%	A	4,4	85%	J	2,2	30%	A	4,75	93,75%	B,G	3	50%	A,D

The cap looked quite nice with a mean score of 70%. The bottle was also really easy to close; the mean score and the median were around 85%. It was extremely easy to close with a mean quote of 1.5 and a median of 1. Finally the bottle was very easy to use; the mean score reached 82.5%.

The package was *easy to use* and *fast*. Participants depicted it as *a high quality, advanced, appealing, convenient, effective* and *satisfying* bottle, see table 5.28. It was the easiest bottle to open, one of the easiest ones to close, the easiest to handle, see table 5.31. The cap was one of the nicest and the tamper-evidence was the best one. The women found the easiest bottle to use too. It was obviously the best bottle.

5.1.3. The results from the final questionnaire

In this section the results of the questions from the final questionnaire are discussed, see Appendix F. Each question has its own subsection below.

5.1.3.1. Which bottle was the easiest one to open?

Half of the participants judged that the bottle J was the easiest one. The repartition women/men were quite equal but this decision includes 4 young people and only 1 senior. It could be explained by the fact that the bottle was seen as quite advanced. In fact, the elderly did not have a best bottle for this question. Their judgment was different for each of them. This statement was not surprising regarding to how they fill the questionnaires of each bottle.

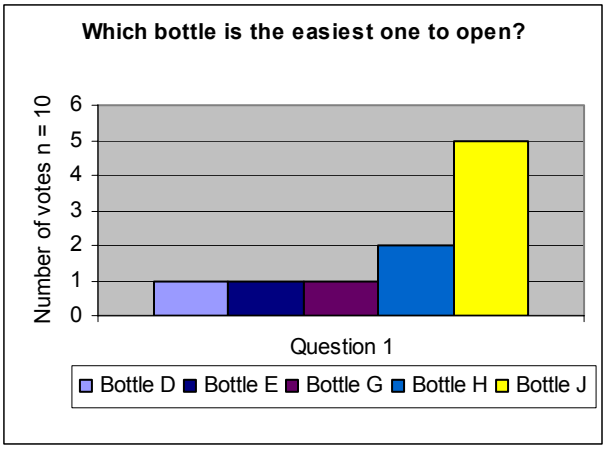

Figure 5.32: Answer to the first question

5.1.3.2. *Which bottle was the hardest one to open?*

The majority defended the fact that the bottle A was the hardest one to open. But the result was not as clear as in the question before. It was probably harder to find out what was the hardest than the easiest.

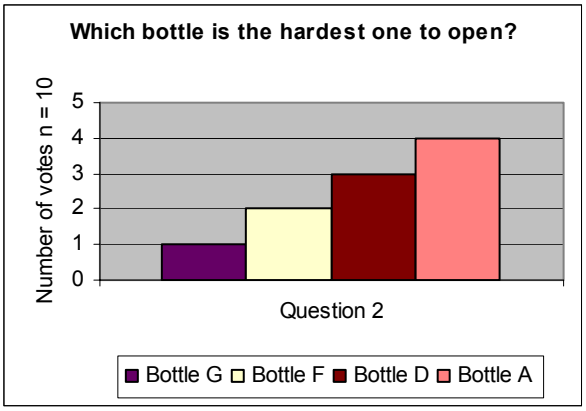

Figure 5.33: Answer to the second question

4 over 5 women picked the bottle A while 3 over 5 men picked the bottle D. It was both ICA bottles which could explain the choices. But the reason they chose the bottle D was often because they needed to screw the cap during a long time before they could open the bottle. For the bottle A, women often said it was because it hurt a lot. This result corroborates the previous results regarding the bottles A and D.

5.1.3.3. *Which cap looked nicest?*

There were two bottles which arrived on the first place: the bottle E and the bottle J which were picked both by 3 participants. 3 young people preferred the cap of the Evian bottle. 3 women chose the cap from the Yoggi bottle.

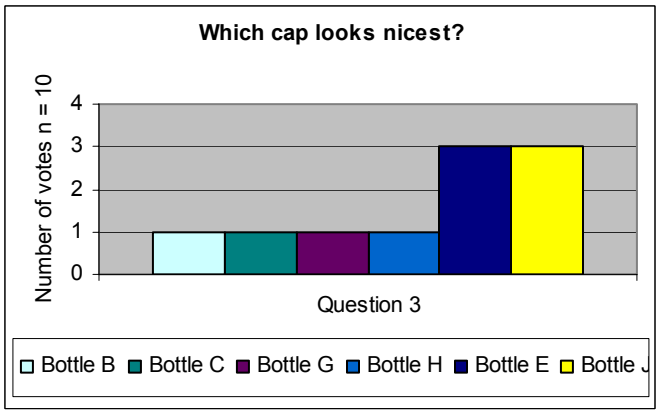

Figure 5.34: Answer to the third question

I expected this result but I was surprised that so few participants voted for the bottle H. Regarding to their first quote on the questionnaire about this bottle, it should have been a good choice.

5.1.3.4. *Which bottle seemed the easiest to handle?*

The bottle H got the best score. Participants found the Willys bottle the easiest to handle. The reason was probably its size. All the other bottles contained from 350 to 600mL. The bottle H contains 240mL. Its shape allowed also the user to get a good grip. However, the choice of the bottle H over the others regarding the easiness to handle was not that decisive. 3 participants chose the bottle E too.

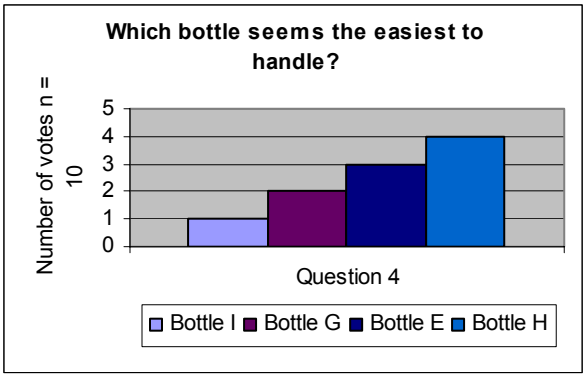

Figure 5.35: Answer of the fourth question

It was really surprising not to see the bottle J in the top on this question because regarding the quotes of the bottle, it seemed to be easy to handle.

5.1.3.5. *Which tamper-evidence seemed the best?*

A strong majority of participant chose the tamper-evidence from the bottle J. 8 participants over 10 found it was the best. From a closer look to its tamper-evidence the difference with the others was remarkable. There were some hooks.

The fact that some participants preferred this tamper-evidence did not surprise me regarding their answers about the bottle J. But the men said that the tamper-evidence from the bottle E was the one which disturbed them the least. So it was ironic to have such a big advantage for the Yoggi bottle. Nobody picked the bottle E.

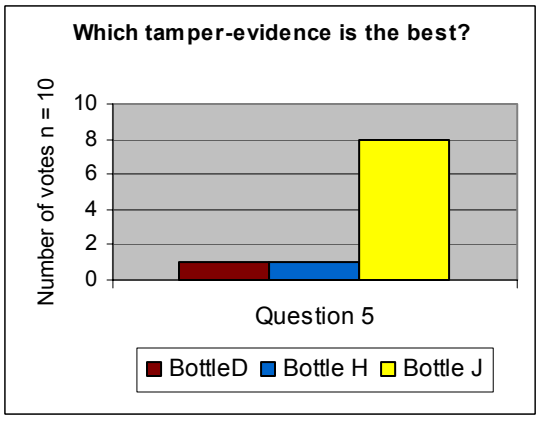

Figure 5.36: Answer of the fifth question

5.1.3.6. *Which bottle was the fastest to open?*

There was a slight preference for the bottles G and J that 3 participants chose. But the cap with the smallest course was the bottle I. The participant must have taken in account the easiness to open as well.

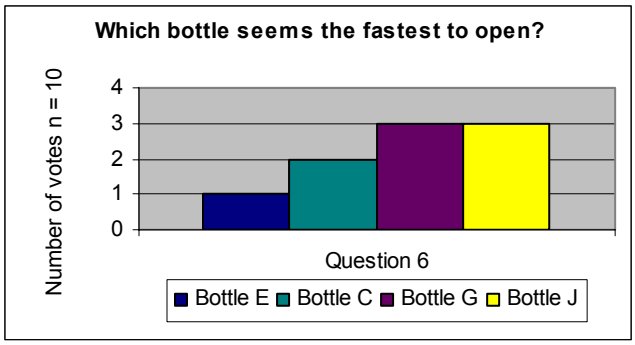

Figure 5.37: Answer of the sixth question

5.1.3.7. *Which bottle was the least painful to open?*

The bottle J was the least painful to open closely followed by the bottle B. This must have to deal with the design of the cap.

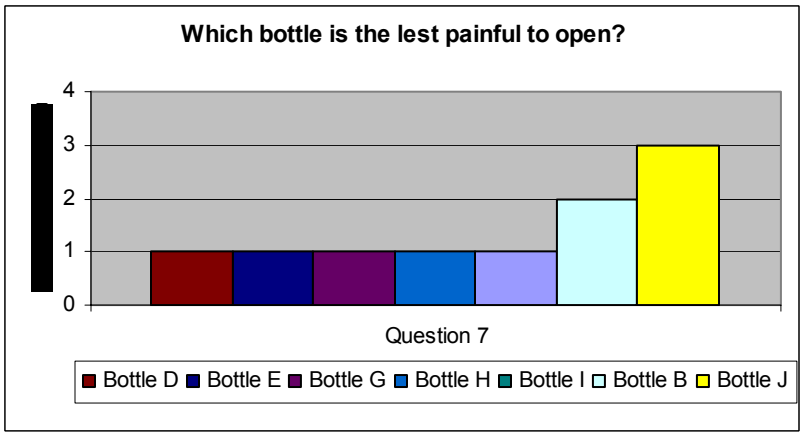

Figure 5.38: Answer of the seventh question

5.1.3.8. *Which bottle was the most painful to open?*

The bottle A was from far away the most painful one to open. It must be linked with the fact that the bottle A was considered as the hardest one to open and to close, the hardest to handle and its cap was the worst one.

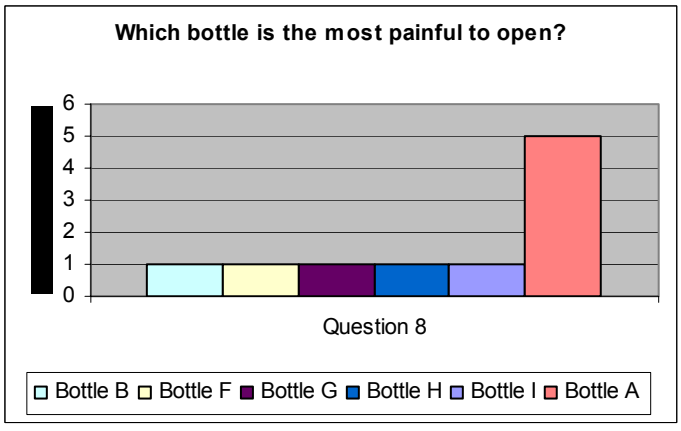

Figure 5.39: Answer of the eighth question

5.1.3.9. *Which bottle was the most irritating to open?*

The bottle A was also considered as the most irritating one to open for the reasons explained in the previous question. 4 participants picked it. But some chose the bottle F as well. It could be explained by the fact that they needed to screw the cap quite a lot to open it. Then some chose the bottle I which was regarded as one good bottle but its small size could have been annoying for some users.

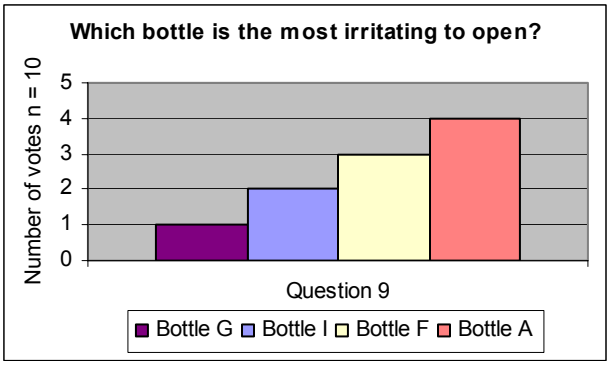

Figure 5.40: Answer of the ninth question

5.1.3.10. *What is the most important in your choice of cap?*

The first criterion which played a role was the easiness to open. Then people chose the tamper-evidence because it was important that the bottle was well sealed. After that participants concentrated themselves on the speed to open and finally the texture of the cap. They did not mind about the appearance and the color of the cap.

5.1.3.11. *Does the cap affect your choice when you buy a bottle?*

This was a multiple-choice question with different alternatives. I wanted to examine if the design of the cap matters when the participants bought a bottle. As it could be seen on the figure, only four participants thought that it might affect the choice. The rest of the participants have never thought about it or thought that it did absolutely not affect their choice.

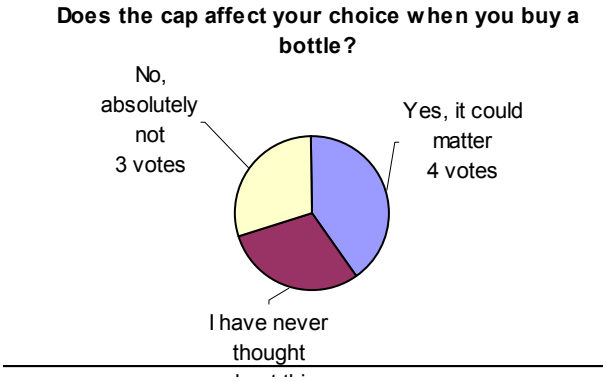

Figure 5.41: Answer of the eleventh question

The results from the final questionnaire are summed up in the table 5.42

Table 5.42: Results from the final questionnaire for the bottles

Final questionnaire																				
	Bottle A		Bottle B		Bottle C		Bottle D		Bottle E		Bottle F		Bottle G		Bottle H		Bottle I		Bottle J	
Q1	0	0%	0	0%	0	0%	1	10%	1	10%	0	0%	1	10%	2	20%	0	0%	5	50%
Q2	4	40%	0	0%	0	0%	3	30%	0	0%	2	20%	1	10%	0	0%	0	0%	0	0%
Q3	0	0%	1	10%	1	10%	0	0%	3	30%	0	0%	1	10%	0	0%	1	10%	3	30%
Q4	0	0%	0	0%	0	0%	0	0%	3	30%	0	0%	2	20%	4	40%	1	10%	0	0%
Q5	0	0%	0	0%	0	0%	1	10%	0	0%	0	0%	0	0%	1	10%	0	0%	8	80%
Q6	0	0%	0	0%	2	20%	0	0%	1	10%	0	0%	3	30%	1	10%	0	0%	3	30%
Q7	0	0%	2	20%	0	0%	1	10%	1	10%	0	0%	1	10%	1	10%	1	10%	3	30%
Q8	5	50%	1	10%	0	0%	0	0%	0	0%	1	10%	1	10%	1	10%	1	10%	0	0%
Q9	4	40%	0	0%	0	0%	0	0%	0	0%	3	30%	1	10%	0	0%	2	20%	0	0%

Q10		Tamper Evidence		Easiness to open		Speed to open		Texture		Appearance		Color	
	1	3	30%	4	40%	3	30%	0	0%	0	0%	0	0%
	2	3	33%	4	44%	1	11%	1	11%	0	0%	0	0%
	3	2	29%	0	0%	1	14%	4	57%	0	0%	0	0%
	4	0	0%	0	0%	3	60%	2	40%	0	0%	0	0%
	5	0	0%	0	0%	0	0%	0	0%	2	67%	1	33%
	6	0	0%	0	0%	0	0%	0	0%	1	33%	2	67%

Q11	1		2		3		4		5	
	0	0%	4	40%	3	30%	0	0%	3	30%

5.1.4. Time measurement

It was quite tough to measure precisely the time for each opening and closing. I took three measures at each moment to be more exact, see table 5.43. But sometimes it was less than 1s to measure so the error of measurement could be quite big.

Most of the time, the difference between two measures of the same moment was not more than 0.6s so the mean score could differ of 0.2s maximum from the reality. This represented not that much as soon as it was a measure of more than 1s.

5.1.4.1. The first opening

All the participants spent more time to open the bottle A as well accurately as speedily. On average they spent respectively 6.77 s and 5.55 s. The average time to open a bottle was 3.22s, 3.38s accurately and 3.06s speedily. So they spent almost the double to open the first bottle. The women had really some difficulties to open this bottle. For the men, the bottle D and F had not good

time neither. This confirmed what was pointed out from the questionnaires and comforted the participants in their conviction that the bottle A was the hardest one to open.

Contrary to what we expected, the bottle J was not always the fastest one to open. On average the bottle C and E seemed to be the quickest ones to open accurately with a mean score of a little less than 2 seconds. However the bottle J and the bottle C were the fastest one to open quickly with around 1.40s, half time that the average time to open one bottle. The men opened the bottle J the fastest but the women were quicker with the bottle E. This meant that the best bottle was not the one which was the fastest but just needed to be quick enough to open.

5.1.4.2. The closing

It was hard to tell which bottle was the fastest to close because the measures were quite close to each other. Two bottles, A and D, had however the worst time, around 3s while the mean score to close the bottles was more about 2s.

Table 5.43: Time spent on the bottle in seconds to open (O) it, close it (C), re-open and re-close (R)

Time																
		All participants			Men			Women			Young			Seniors		
Btl	Tasks	O	C	R	O	C	R	O	C	R	O	C	R	O	C	R
A	Accurate	5,55	2,63	5,47	3,57	2,30	5,94	7,34	2,95	4,17	4,91	2,35	4,68	3,63	3,00	6,11
	Speeded	6,77	3,28	5,04	4,56	3,26	5,38	9,33	3,30	3,92	4,61	2,93	4,66	5,32	3,98	5,44
B	Accurate	2,80	1,88	3,33	2,67	1,95	3,39	2,80	1,81	2,72	3,34	1,60	2,81	2,20	2,26	3,78
	Speeded	3,51	1,33	2,65	3,85	1,56	2,95	3,64	1,09	1,96	2,77	1,11	2,09	4,24	1,74	3,38
C	Accurate	1,94	1,67	3,01	1,84	1,87	3,49	2,06	1,47	2,11	1,91	1,21	2,20	1,82	2,32	3,86
	Speeded	1,41	1,31	2,28	1,53	1,49	2,60	1,30	1,13	1,64	1,38	0,96	1,89	1,59	1,67	2,78
D	Accurate	4,71	2,97	5,23	4,53	2,75	5,38	4,74	3,19	4,24	4,68	2,54	4,57	4,62	3,03	5,98
	Speeded	4,10	2,87	5,04	4,28	3,33	5,05	4,11	2,42	4,19	3,46	2,10	3,82	5,08	4,00	5,39
E	Accurate	1,97	1,85	3,44	2,11	2,14	3,88	1,84	1,56	2,51	1,70	1,53	2,81	2,27	2,40	4,12
	Speeded	2,01	1,39	2,61	1,62	1,75	3,02	1,95	1,04	1,83	2,30	1,19	2,12	1,68	1,72	3,06
F	Accurate	3,92	2,72	4,44	4,62	2,65	5,06	3,33	2,80	3,19	4,21	2,15	3,91	3,68	3,35	4,94
	Speeded	3,55	2,11	3,88	2,88	2,33	4,24	4,34	1,88	2,93	4,10	1,97	3,16	3,09	2,17	4,68
G	Accurate	3,41	1,95	3,48	3,15	2,41	3,77	3,77	1,49	2,66	3,46	1,83	3,12	3,14	2,26	3,96
	Speeded	2,14	1,97	3,71	1,93	1,61	3,05	2,05	2,43	3,62	2,25	2,05	3,68	1,94	1,63	3,58
H	Accurate	2,98	1,39	3,01	2,86	1,53	3,16	2,92	1,21	2,26	3,60	1,23	2,60	2,10	1,58	3,23
	Speeded	2,40	1,45	2,36	2,53	1,80	2,57	2,41	1,10	1,79	2,38	1,24	1,81	2,61	1,82	3,10
I	Accurate	4,31	1,65	2,84	3,79	1,94	2,95	4,98	1,37	2,27	4,33	1,57	2,43	3,34	1,93	3,21
	Speeded	3,31	1,35	2,35	4,04	1,65	2,80	2,93	1,04	1,59	2,26	1,35	1,91	4,45	1,46	3,01
J	Accurate	2,17	2,20	3,06	1,46	2,43	3,45	2,86	1,96	2,23	1,94	1,75	2,79	2,10	2,99	3,64
	Speeded	1,35	1,40	2,80	1,36	1,54	3,27	1,42	1,40	1,95	1,35	1,23	2,38	1,56	1,79	3,32

5.1.4.3. The re-opening / re-closing

As the participants re-opened and re-closed the bottles not always 5 times, I compared the time of one re-opening / re-closing. The women and the young people were quite fast compared to the men and the elderly.

For all the participants the bottle A and D were the worst with more than 5s to re-open and re-close them. The mean score for all the bottles was 3.5s. Here again the bottle J was not the first one. The bottle C and H were the fastest to re-open and re-close with less than 3s.

5.1.4.4. The faults

The results can be seen in the table 5.44.

The tamper-evidence

According to the questionnaires, the tamper evidence of the bottle J was the least in the way and the one from the bottle I annoyed the participants the most. I counted the number of times that they were disturbed by the tamper-evidence when they opened the bottle. The trend was the same. The worst bottle was the bottle I with 16 times. The bottle B was neither that good with 10 times. But the participants liked those bottles even if their tamper-evidences seemed to have disturbed them.

There were 4 bottles for which the tamper-evidences never bothered the participants: C, D, G, J. The only surprising result was that the bottle D was considered to be one of the most annoying bottle to open according to the questionnaires. The reason nevertheless did not come from its tamper-evidence.

The errors during the closing task

I considered that an error occurred during the closing part when the participant was obliged to open the bottle again in order to close it properly. I counted a small error when the participant just needed to screw off the cap a little to follow the thread correctly.

The bottles that the participants closed in a faultier way were the A, D and G with 6 to 7 participants who made together around 12 errors. That the bottle G was in the bottom could be explained because its thread was the shortest one.

The best bottles were E and I with only one error made. Even if its tamper-evidence is not good, the bottle I has a fine thread which prevented the participant from doing some errors while closing it. Its wide cap may also have helped.

I realized that the participants made a lot of small errors with the bottle J. They did not have to re-open completely the bottle each time but had some difficulties to put the cap in the thread directly. With the bottle A they had the biggest amount of small errors. All the participants had problems with those two bottles. It was surprising because the participants still thought that the bottle J was the best.

Table 5.44: Number of faults done by the participants

Bottle	Tasks	Total Errors opening	Total Errors closing	Total Errors TE	Small errors
A	Accurate	0	6	1	5 closing 1 opening
	Speeded	0	6	5	14 closing
B	Accurate	2	2	3	4 closing
	Speeded	1	1	7	3 closing
C	Accurate	0	3	0	2 closing 1 opening
	Speeded	1	4	0	2 closing 1 opening
D	Accurate	1	7	0	4 closing 1 opening
	Speeded	1	5	0	7 closing
E	Accurate	0	1	0	4 closing
	Speeded	0	0	1	1 closing
F	Accurate	0	3	1	5 closing
	Speeded	0	2	1	6 closing
G	Accurate	0	5	0	6 closing
	Speeded	1	6	0	7 closing 1 opening
H	Accurate	2	1	5	2 closing
	Speeded	0	2	2	2 closing
I	Accurate	0	0	8	3 closing
	Speeded	0	1	8	5 closing 1 opening
J	Accurate	0	2	0	9 closing
	Speeded	2	1	0	8 closing

5.1.5. Comments of the participants

The following is a summary of the comments from the participants during the questionnaires and tests.

- The bottle F (BOB soft juice) was annoying because the length of the thread was too important and so, many revolutions were required to open the bottle.
- The bottle H (Willys drickyoghurt) was quite easy to handle because of its wide cap.
- The bottle D (ICA blandsaft) had a soft cap.
- The cap got blocked on the bottle D. In fact the soft juice inside was sweet so that there was some crystallization around the thread.
- The bottle E (Evian water) seemed to look like the bottle C (Aqua d'Or water).
- The bottle G (Skånemejerier drickyoghurt) was fast to open because the thread of the cap was short, for the bottle H too.
- The bottle B (MER juice) had a big cap. It was though easy to turn.
- The cap of the bottle J (Yoggi Yalla!) slid really easily and that the thread felt really comfortable. Besides it felt thicker compared to the others.
- The cap of the bottle E was wide so that it felt easy to grip and to turn. Moreover, the tamper evidence let go the cap at once so that the participant did not stop turning the cap when she opened the bottle.

5.1.6. Conclusion

The answers from the final questionnaire speak for themselves. The best bottle was the Yoggi Yalla! (J). The participants were most comfortable with its cap. It was the easiest bottle to open. Besides its tamper-evidence was the most efficient and seemed advanced. The participants thought also that this bottle was one of the fastest ones to open.

However a great number of participants made small errors while they close this bottle. And the bottle J was not at all the best to handle. But anyway, this cap was considered as the best one.

5.2. Analysis of the results for the carton packages

As I said before, I put some tape on the packages so that the participants could not read the number of the package which could have influenced their point of view.

The participants had sometimes difficulties to remember the carton packages they just opened because it was at the end of the session. During the weighing task it was hard to get accurate values because there was always some water left in the glasses. All the results have though a tolerance of +- 1g.

5.2.1. The main results

The participants made clearly up their mind on the packages.

- 70% of the participants thought that the package ● (# 1) was the easiest to open.
- 70% of the participants thought that the package * (# 4) was the hardest to open.

The questions were of the same type as for the bottles, see Appendix G.

5.2.2. The results for each package

5.2.2.1. <u>The package ● (# 1)</u>

Participants thought that the package was really easy to open, with a mean score and a median of 87.5%, see table 5.45. The men and the elder people agreed absolutely with the statement (average quotes between 4.8 and 5) whereas the women and the young people were a little bit more indecisive with a mean score of 80% and a median of 75%.

On average, the participants found it particularly easy to grab the perforation with a mean score of 35% and a median of 25%. However, the elder people tended to find it more difficult with a mean score of 43.75% and a median of 37.5%. They all had the opinion that it was very easy to pour from the package with average quotes around 4.

The participants thought nevertheless that the package was okay to handle with a mean score of 47.5%. But the young people found it easier than the other. This could be explained by the fact that the package was quite little. On average they considered that the package was quite easy to use with a mean score of 62.5% and a median of 50%. But whereas the women and the elderly were shared (50%) the men and the young people were much more enthusiastic with mean score and median of 75%.

Table 5.45: Summary of the results concerning the first package

	Package #1																			
	All participants				Men				Women				Young				Senior			
	Average		Median		Average		Median		Average		Median		Average		Median		Average		Median	
Q1	4,5	87,5%	4,5	87,5%	4,8	95%	5	100%	4,2	80%	4	75%	4,4	85%	4	75%	4,8	93,75%	5	100%
Q2	2,4	35%	2	25%	2,4	35%	2	25%	2,4	35%	2	25%	2,2	30%	2	25%	2,8	43,75%	2,5	37,5%
Q3	3,9	72,5%	4	75%	4,4	85%	4	75%	3,4	60%	4	75%	4	75%	4	75%	3,8	68,75%	4	75%
Q4	2,9	47,5%	3	50%	2,8	45%	3	50%	3	50%	3	50%	2,8	45%	2	25%	3	50%	3	50%
Q5	3,5	62,5%	3	50%	4	75%	4	75%	3	50%	3	50%	4	75%	4	75%	3,3	56,25%	3	50%

Table 5.46: Words picked in the questionnaires for the first package

Words use- Package 1			
first words	Fqcy	second words	Fqcy
Easy to use	4	Convenient	2
Fast	3	Easy to use	2
Simple	3	Satisfying	2
Appealing	2	Advanced	1
Convenient	2	Appropriate	1
Dated	2	Confusing	1
Responsive	2	Controllable	1
Slow	2	Familiar	1
Annoying	1	Hard to use	1
Attractive	1	Inadequate	1
Controllable	1	Reliable	1
Distracting	1	Time-consuming	1
Efficient	1	Too technical	1
Empowering	1	Useful	1
Satisfying	1		
Smooth	1		
Sophisticated	1		
Straightforward	1		

They found the package *easy to use*, *fast* and *simple*, see table 5.46. It was considered as the easiest package to open, the easiest to pour from and one of the easiest to handle and to use. Its perforation was one of the best to grab. It seemed that this package was quite better. But I had to analyze the final questionnaire to see if the results corroborated, table 5.53.

5.2.2.2. *The package ▲ (# 2)*

Participants thought that it was really easy to open the package, with an average and median scores around 4 (75%), see table 5.47. But the women were a little indecisive with a mean score of 65% and a small median of 50%. The young people however were totally happy with this package with a mean score of 80% and a median of 100%.

Table 5.47: Summary of the results concerning the second package

	Package #2																			
	All participants				Men				Women				Young				Senior			
Q1	3,9	72,5%	4	75%	4,2	80%	4	75%	3,6	65%	3	50%	4,2	80%	5	100%	3,8	68,75%	4	75%
Q2	2,4	35%	2	25%	3	50%	3	50%	1,8	20%	2	25%	2	25%	2	25%	3	50%	3,5	62,5%
Q3	3,5	62,5%	3,5	62,5%	3,8	70%	4	75%	3,2	55%	3	50%	4	75%	4	75%	3	50%	2,5	37,5%
Q4	3	50%	3	50%	3,4	60%	4	75%	2,6	40%	3	50%	2,4	35%	2	25%	3,8	68,75%	4	75%
Q5	3,5	62,5%	3	50%	3,6	65%	4	75%	3,4	60%	3	50%	4	75%	4	75%	3	50%	3	50%

Table 5.48: Words picked in the questionnaires for the second package

Words use- Package 2			
first words	Fqcy	second words	Fqcy
Simple	3	Appropriate	2
Appealing	2	Easy to use	2
Controllable	2	Hard to use	2
Dated	2	Annoying	1
Easy to use	2	Clean	1
Faulty	2	Controllable	1
Satisfying	2	Difficult	1
Annoying	1	Effective	1
Convenient	1	Familiar	1
Distracting	1	Fast	1
Effortless	1	Faulty	1
Empowering	1	Ineffective	1
Expected	1	Responsive	1
Fast	1	Satisfying	1
Ineffective	1	Slow	1
Pleasant to touch	1	Time-consuming	1
Reliable	1	Useful	1
Responsive	1		
Rigid	1		
Slow	1		
Smooth	1		
Unpredictable	1		

On average, the participants found it quite easy to grab the perforation with a mean score of 35% and a median of 25%. However, the seniors and the men tended to find it more difficult with a mean score of 50% and a median of 62.5% and 50% respectively.

The participants thought that the package was quite easy to pour from with a mean score and a median of 62.5%. For this task it was the women and the seniors who were less convinced with average quotes around 3 while the other scores turn around 4.

On average the participants thought that the package was okay to handle with a mean score of 50%. But the men and the elder people found it much more difficult

than the others with a mean score around 65% and a median of 75%. About how easy it was to use the package, the results were the same as for the package ● (#1).

They described the package as *simple*, see table 5.48. It was considered as one of the easiest packages to use and the perforation was one of the easiest ones to grab, see table 5.53.

5.2.2.3. *The package ■ (# 3)*

Table 5.49: Summary of the results concerning the third package

	Package #3																			
	All participants				Men				Women				Young				Senior			
Q1	2,8	45%	3	50%	3	50%	3	50%	2,6	40%	2	25%	2,8	45%	3	50%	3,3	56,25%	3,5	62,5%
Q2	2,7	42,5%	2,5	37,5%	2,6	40%	2	25%	2,8	45%	3	50%	2,4	35%	2	25%	2,5	37,5%	2,5	37,5%
Q3	2,8	45%	3	50%	2,8	45%	3	50%	2,8	45%	3	50%	2,8	45%	3	50%	2,8	43,75%	2,5	37,5%
Q4	2,9	47,5%	3	50%	3	50%	3	50%	2,8	45%	2	25%	2,6	40%	2	25%	3,5	62,5%	3,5	62,5%
Q5	3	50%	3	50%	3,2	55%	3	50%	2,8	45%	3	50%	3	50%	3	50%	3	50%	3	50%

Table 5.50: Words picked in the questionnaires for the third package

Words use- Package 3			
first words	Fqcy	second words	Fqcy
Simple	4	Understandable	2
Slow	4	Common	1
Annoying	2	Complex	1
Dated	2	Controllable	1
Distracting	2	Difficult	1
Satisfying	2	Distracting	1
Complex	1	Easy to use	1
Easy to use	1	Efficient	1
Effective	1	Hard to use	1
Expected	1	Painful	1
Familiar	1		
Fast	1		
Faulty	1		
Frustrating	1		
Hard to use	1		
Responsive	1		
Time-consuming	1		
Unattractive	1		
Unpredictable	1		

Participants did not consider the package as easy neither hard to open, with a mean score of 45% and a median of 50%, see table 5.49. But, the women did not agree with this statement because they considered that the package was quite hard to open with an average of 40% and a median of 25%.

On average, the participants found it rather easy to grab the perforation with a mean score of 42.5% and a median of 37.5%. However, the women tended to find this more difficult than the man with a median quote of 3 whereas the men had a median quote of 2.

They all had the opinion that it was

not easy neither hard to pour from the package with average quotes around 3. The participants thought also it was okay to handle it with a mean score of 47.5%. But the women and especially the young people found it easier than the others, with a median of 25%. This could be explained by the fact that the package was quite little.

They all agreed that the package was acceptable to use with scores of 3. They found the package *simple* but *slow*, see table 5.50. It was the worst package to pour from regarding the participants' judgment. The elderly thought its perforation was the easiest to grab. The young people thought it was the worst package to use, see table 5.53.

*5.2.2.4. The package * (# 4)*

Participants agreed on the fact that the package was difficult to open with a mean score of 32.5% and a median of 25%, see table 5.51. Its perforation was hard to grab with an average and median quote of 4.

On average, the participants thought that the package was quite easy to pour from with a mean score of 57.5% and a median of 62.5%. The women however were less convinced with a median around 3 while the men scores turned around 4.

They did not find the package particularly easy or hard to handle with a mean score of 47.5%. On average, the participants thought that the package was quite hard to use with a mean score of 42.5% and a median of 37.5%. The men and the young people found it easier with quotes around 3. It was maybe because they are considered stronger than the women and the seniors.

People described the package as slow, annoying, faulty, hard to use and finally time-consuming, see table 5.52. It was considered as the hardest package to open, to use, to grab the perforation from. It seemed to be the worst package, compared to the grade given to the others, see table 5.53.

Table 5.51: Summary of the results concerning the fourth package

Package #4																				
	All participants				Men				Women				Young				Senior			
Q1	2,3	32,5%	2	25%	2,6	40%	2	25%	2	25%	2	25%	2,4	35%	2	25%	2,3	31,25%	2	25%
Q2	3,9	72,5%	4	75%	3,8	70%	4	75%	4	75%	4	75%	3,4	60%	4	75%	4,3	81,25%	4	75%
Q3	3,3	57,5%	3,5	62,5%	3,6	65%	4	75%	3	50%	3	50%	3	50%	3	50%	3,3	56,25%	3,5	62,5%
Q4	2,9	47,5%	3	50%	3	50%	3	50%	2,8	45%	3	50%	2,8	45%	3	50%	3	50%	3	50%
Q5	2,7	42,5%	2,5	37,5%	3	50%	3	50%	2,4	35%	2	25%	3,2	55%	3	50%	2,3	31,25%	2	25%

Table 5.52: Words picked in the questionnaires for the third package

Words use- Package 4			
first words	Fqcy	second words	Fqcy
Slow	4	Time-consuming	3
Annoying	3	Faulty	2
Faulty	3	Frustrating	2
Hard to use	3	Attractive	1
Appropriate	2	Difficult	1
Dated	2	Distracting	1
Poor quality	2	Effective	1
Simple	2	Hard to use	1
Clean	1	Poor quality	1
Complex	1	Rigid	1
Controllable	1	Slow	1
Familiar	1		
Painful	1		
Rigid	1		
Unpredictable	1		
Efficient	1		

Table 5.53: Summary of the answers to the questionnaire for each package

Summary Packages																												
	All participants						Men						Women						Young						Senior					
	Max		P.	Min		P.	Max		P.	Min		P.	Max		P.	Min		P.	Max		P.	Min		P.	Max		P.	Min		P.
Q1	4,5	87,5%	1	2,3	32,5%	4	4,8	95%	1	2,6	40%	4	4,2	80%	1	2	25%	4	4,4	85%	1	2,4	35%	4	4,8	93,75%	1	2,3	31,25%	4
Q2	3,9	72,5%	4	2,4	35%	1,2	3,8	70%	4	2,4	35%	1	4	75%	4	1,8	20%	2	3,4	60%	4	2	25%	2	4,3	81,25%	4	2,5	37,5%	3
Q3	3,9	72,5%	1	2,8	45%	3	4,4	85%	1	2,8	45%	3	3,4	60%	1	2,8	45%	3	4	75%	1,2	2,8	45%	3	3,8	68,75%	1	2,8	43,75%	3
Q4	3	50%	2	2,9	47,5%	1,3,4	3,4	60%	2	2,8	45%	1	3	50%	1	2,6	40%	2	2,8	45%	2	2,4	35%	1,2	3,8	68,75%	2	3	50%	1,4
Q5	3,5	62,5%	1,2	2,7	42,5%	4	4	75%	1	3	50%	4	3,4	60%	2	2,4	35%	4	4	75%	1,2	3	50%	3	3,3	56,25%	1	2,3	31,25%	4

5.2.3. The results from the final questionnaire

In this section the results of the questions from the final questionnaire (see Appendix I) are discussed. The results are summed up in the table 5.60. Each question has its own subsection below.

5.2.3.1. Which package was the easiest one to open?

75% of the participants judged that the package #1 was the easiest one. Each category had the package #1 as favorite. This was the package number 1. This confirmed that the closer the holes in the perforation are to each other, the easier it is to open.

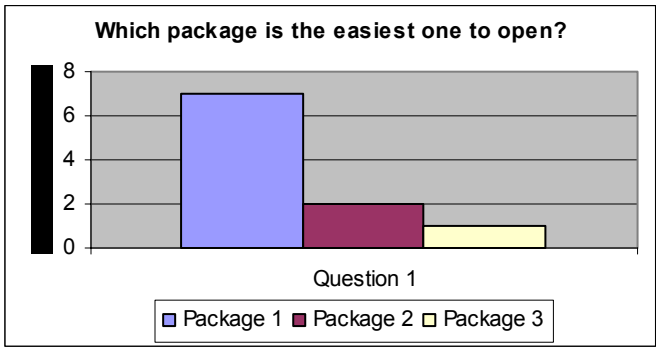

Figure 5.54: Answer of the first question

5.2.3.2. Which package was the hardest one to open?

75% of the participants had the opinion that the package #4 was the hardest one. All the categories of participants agreed. This was the package number 4. This confirmed that the more the holes in the perforation are far away from each other, the harder it is to open.

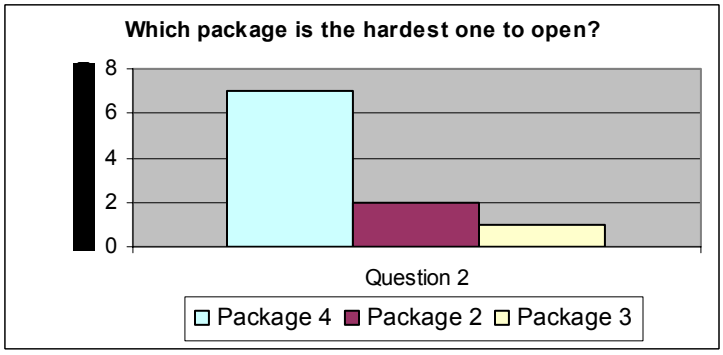

Figure 5.55: Answer of the second question

5.2.3.3. *Which package was the fastest one to open?*

75% of the participants judge that the package #1 was the easiest one. Each category had the package #1 as favorite. This confirmed how they filled the questionnaire of each package. Even if the packages look like the same, the difference of perforation influences the point of view of the participants about the whole package.

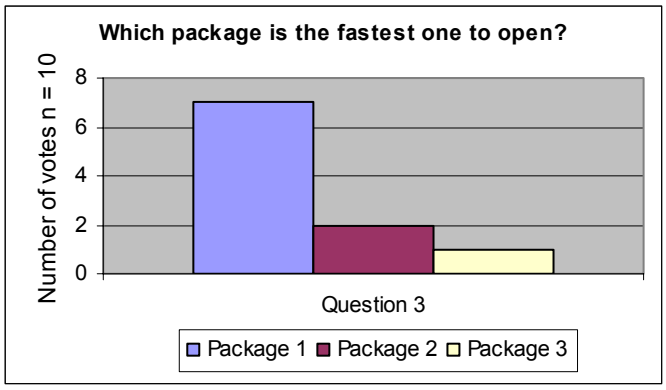

Figure 5.56: Answer of the third question

5.2.3.4. *Which package was the least painful to open?*

I obtained the same result as before. The easiest and fastest package to open was the least painful.

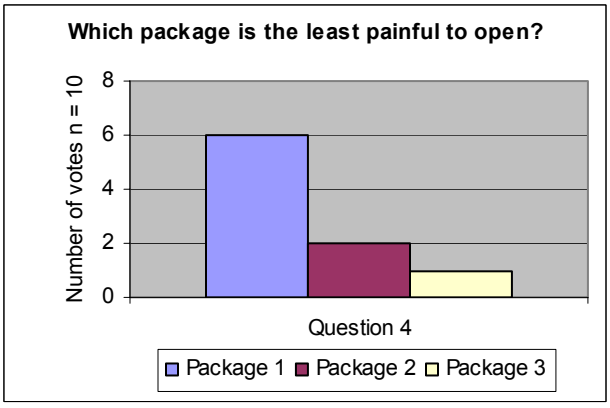

Figure 5.57: Answer of the fourth question

5.2.3.5. *Which package was the most painful to open?*

The hardest package to open was the most painful.

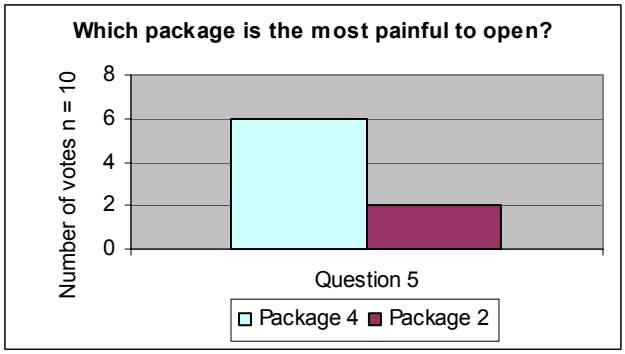

Figure 5.58: Answer of the fifh question

5.2.3.6. *Which package was the most irritating to open?*

The hardest package to open was the most irritating. There were 6 participants who picked this package. 2 men and a woman chose the package #2 which was quite surprising because it seemed a lot easier to open.

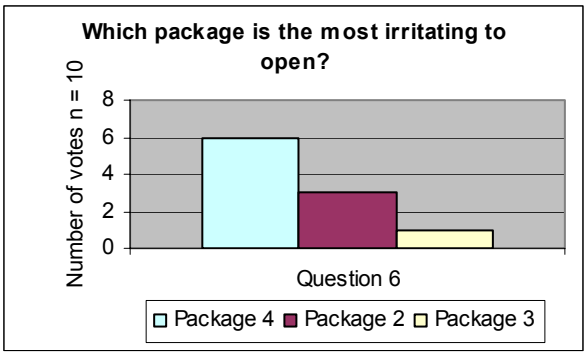

Figure 5.59: Answer of the sixth question

Table 5.60: Results from the final questionnaire for the packages

Final questionnaire								
	Package ■		Package ●		Package ▲		Package *	
Question 1	1	10%	7	70%	2	20%	0	0%
Question 2	1	10%	0	0%	2	20%	7	70%
Question 3	1	10%	7	70%	2	20%	0	0%
Question 4	1	11%	6	67%	2	22%	0	0%
Question 5	0	0%	0	0%	2	22%	7	78%
Question 6	1	10%	0	0%	3	30%	6	60%

5.2.4. Measurement of the dropped water

(See table 5.61)

5.2.4.1. *The opening task*

I could notice that, during the accurate sessions, all the participants spilled less water with the package #2 (▲) with a mean score of 0.2g. It was surprising not to see the package #1 (●) at this place. I assumed that, as the package was the easiest to open, the participants tore the perforation so easily that they spilled some water. With the second package, they had a better control.

The package #1 was almost the worst one with an average of 1g. But the median was 0. I could see that the maximum of dropped water was 5g. Without this participant, the mean score decreases from 1g to 0.5g which is much better. So, one extreme score changed the trend.

The package #4 (*) was without any doubt the one which participants spilled more water with when they opened it accurately. The mean score was 1.1g and the median was 1g. But it became the best one during the speeded session. When they opened it speedily, participants did not drop so much water. The mean score became 0.4g and the median was 0. This could be explained by the fact that the package was hard to open, so when the participants opened it slowly, there were some surges and a lot of water was spilled. On the opposite, when they opened it fast, it was smoother and less spillage occurred.

During these speeded sessions, as expected, more water was dropped from the first and the second package. For the package #3 (■), it seemed to be the same, the mean score raised from 0.8g to 1.1g. But the median diminished to 0g. We could observe that the maximum drop during the speeded session was 6g. Without this extreme score, the mean score was 0.5g so has diminished from the accurate session. I could say that this package followed the same rule as the fourth one.

I could observe that the young people had a really good control of the package during the speeded part because all the mean scores were less than 0.6g. They could work fast and effectively.

Moreover, the elderly and the men did almost not drop any water from the 3 first packages during the accurate part. They really could work slowly and carefully. The mean scores were less than 0.4g and all the medians were 0 for those 3 packages.

The men were really good during the speeded sessions as well. The 3 last mean scores were less than 0.75g. For the first package, the mean score was 1.5g. But only one participant dropped water with a maximum score of 6g. If I do not take in account this extreme score, the mean score becomes 0. The men controlled well their strength.

5.2.4.2. The pouring task

The scores were not very conclusive. All the packages were the same so that the pouring did not depend on the type of perforation. The obvious thing to notice was that on average, people dropped more water during the speeded task than during the accurate session. The mean score of the accurate pouring was around 1.4g and the one of the speeded pouring was 2.3g.

On average also, the last package was the one for which there was less spillage. It could be explained by the fact that it was the last package that the participants opened on both accurate and speeded sessions. They got used and poured more properly from this package.

But actually, I did not think that those results of dropped water were quite relevant because some participants took time to re-form the package after the opening so that I could not take for granted all those results. I thought that this pouring task would have been more interesting if it was not the same package. But I could not let the participants carry out this task with the bottles because their content had different fluidity so that the results would not have been analyzable.

5.2.5. Time measurement

(See table 5.62)

5.2.5.1. The opening task

The package #1 (●) and #2 (▲) were as expected the fastest one to open: 2.5s accurately and about 1.5s speedily. There was a slightly advantage for the first package.

The package #4 (*) was from far away the longest to open accurately with a mean score of 4s, around 1s more than the package #3 (■) but concerning the speeded opening, the time for those 2 packages was quite similar, around 2s.

5.2.5.2. The pouring task

By studying the time spent to pour water into the tumblers I could see which opening was the best. That meant that if the participants took their time, the opening could be done in a better way than with a fast opening so that it could allow pouring faster. This was important as well to take the amount of water dropped in consideration.

It was interesting to see that on average less water was dropped from the last package during the pouring action. I could also add that pouring from this package took the least time. The results had the same this trend during the accurate task as well as the speeded one.

5.2.6. Conclusion

The package #1 was the easiest one to open according to the participants. They added also that it was the fastest one to open. This was confirmed by the study of the time spent to open it.

However, the package #2 was not that much slower. This second package was the one with less spillage during the opening task compared to the first version of perforation. Maybe the first package was so easy that the users did not measure their strength and the opening was less controlled than with the other packages.

Those two packages were not the fastest one to pour from and actually the users dropped a lot of water from them during the pouring session. I found out that the fastest one to pour from was in fact the package #4, which is seen as the hardest one to open. I presumed that this opening was hard but done properly so that it was easier to pour from this package.

Table 5.61: Weight of poured water in grams during the accurate and speeded tasks when opening and pouring, for all the participants

	Accurate								Speeded							
	Δ opening				Δ pouring				Δ opening				Δ pouring			
p.	Average	Median	Max	Min	Average	Median	Max	Min	Average	Median	Max	Min	Average	Median	Max	Min
1	1	0	5	0	1,1	1	2	0	1	0,5	5	0	2,1	1,5	8	0
2	0,2	0	1	0	1,6	1,5	5	0	0,8	1	2	0	2,8	1	17	0
3	0,8	0,5	3	0	2,1	2	6	0	1,1	0	6	0	2,7	2,5	6	0
4	1,1	1	2	0	0,9	0,5	3	0	0,4	0	1	0	1,6	1	6	1
				Tot	1,425	1,25	6	0				Tot	2,3	1,25	17	0

Table 5.62: Time spent on the packages in seconds to open (O) it, to pour in the first or the second Tumbler (T) and all together (Pouring Action)

Summary Packages																				
	All participants					Men				Women				Young				Senior			
P.	Tasks	O	1st T	2nd T	Pouring action	O	1st T	2nd T	Pouring action	O	1st T	2nd T	Pouring action	O	1st T	2nd T	Pouring action	O	1st T	2nd T	Pouring action
1	Accurate	2,5	3,58	3,85	8,25	1,81	3,21	3,29	7,29	3,19	3,96	4,40	9,21	2,43	3,22	3,90	8,06	2,08	4,04	3,71	8,46
	Speeded	1,42	2,78	3,04	6,48	1,33	2,86	2,81	6,42	1,51	2,69	3,27	6,54	1,46	2,84	2,89	6,47	1,22	2,63	2,94	6,16
2	Accurate	2,6	3,32	3,43	7,59	1,62	3,05	3,10	6,96	3,58	3,58	3,76	8,22	2,82	3,54	3,53	7,83	1,93	3,00	3,43	7,39
	Speeded	1,77	2,58	3,21	6,25	1,68	2,54	3,59	6,53	1,85	2,61	2,84	5,97	1,32	2,39	3,39	6,31	1,97	2,59	2,96	5,97
3	Accurate	3,08	3,58	3,93	8,31	2,46	3,52	3,50	7,93	3,69	3,65	4,35	8,70	3,46	3,90	4,08	8,81	2,37	3,11	3,14	7,09
	Speeded	2,19	2,71	2,74	6,19	2,26	2,80	2,56	6,14	2,11	2,62	2,93	6,25	2,69	2,82	3,00	6,51	1,73	2,80	2,67	6,29
4	Accurate	4,04	3,21	3,47	7,18	3,76	3,75	3,89	7,98	4,32	2,66	3,05	6,38	3,73	3,47	3,94	8,08	3,88	3,15	3,17	6,62
	Speeded	2,17	2,2	2,84	5,57	2,17	2,20	2,84	5,57	2,24	2,02	2,87	5,41	2,14	2,04	2,51	5,21	2,14	2,54	3,43	6,31

5.3. *Evaluation of the test plan*

Many participants were irritated by the length of the list of words in each questionnaire. They thought it took though a long time to go through it in order to find the right words for the package they were testing. As there were a lot of bottles and packages to test, this list annoyed them. They also thought that some of the words were not appropriate.

I tried to shorten this list. I first tried to find out the frequency of each word, that is to say how many times each word was picked by the participants in all the questionnaires, describing the plastic bottles or the carton packages. It could be the words that were ticked or just the picked ones. As there were 14 packages (10 bottles and 4 carton packages) and 10 participants, the maximum frequency is 140.

Considering the following curve of frequency (Figure 5.63), I noticed that under a frequency of 6 times it was useless to conserve the words (from 1 to 5 times used). The curve kept still the same form and the words were not important.

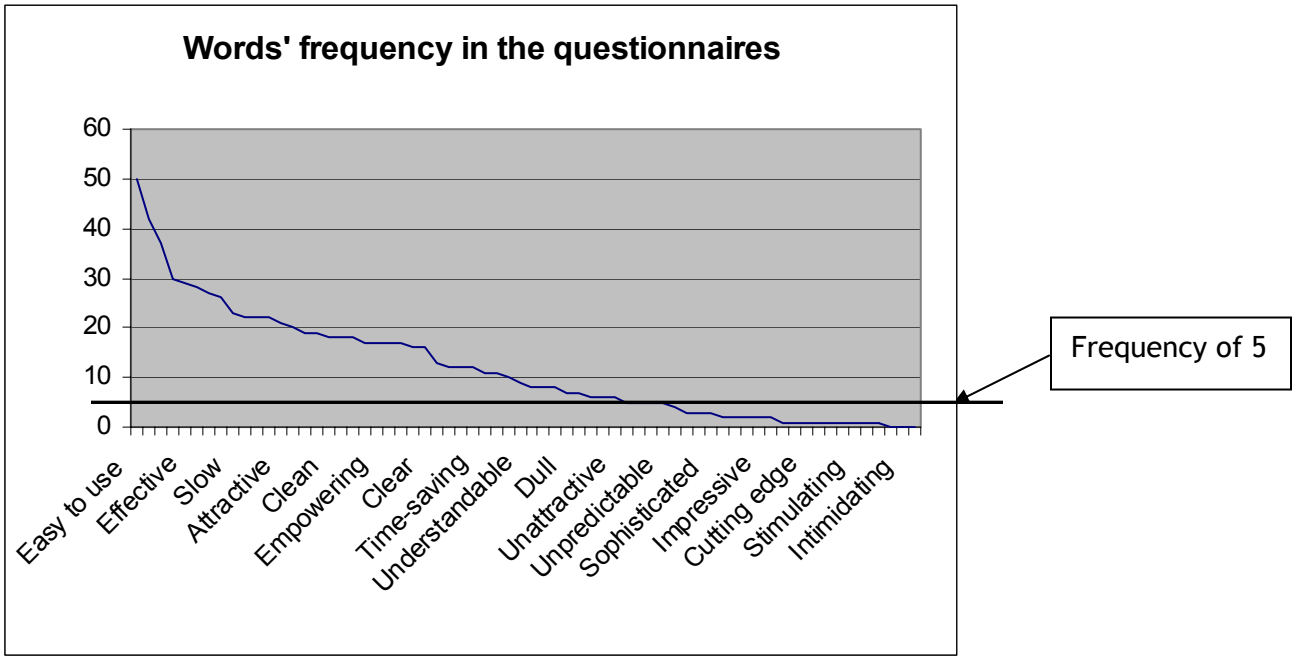

Figure 5.63: Words' frequency in the questionnaires (see data from table 9.2 in Appendix L)

However it was also important to know how many participants used each word. Perhaps one participant could have used the same word 10 times or 10 participants used once this word. The word's frequency would be the same but, in the first case, there would be no need to keep the word because it is only one person who thought that the word was appropriate. In the second case I would have to keep the word.

I thus calculated for each word how many participants used it. I got the following curve (Figure 5.64) and decided that a word that was used by less than 3 participants could be erased (0 to 2 participants).

I then mixed the two lists of words which had to be removed and I added to it some synonyms because it was worthless to have several words of the same meaning. The primary list had 66 words (see the questionnaire in the Appendix E and G).

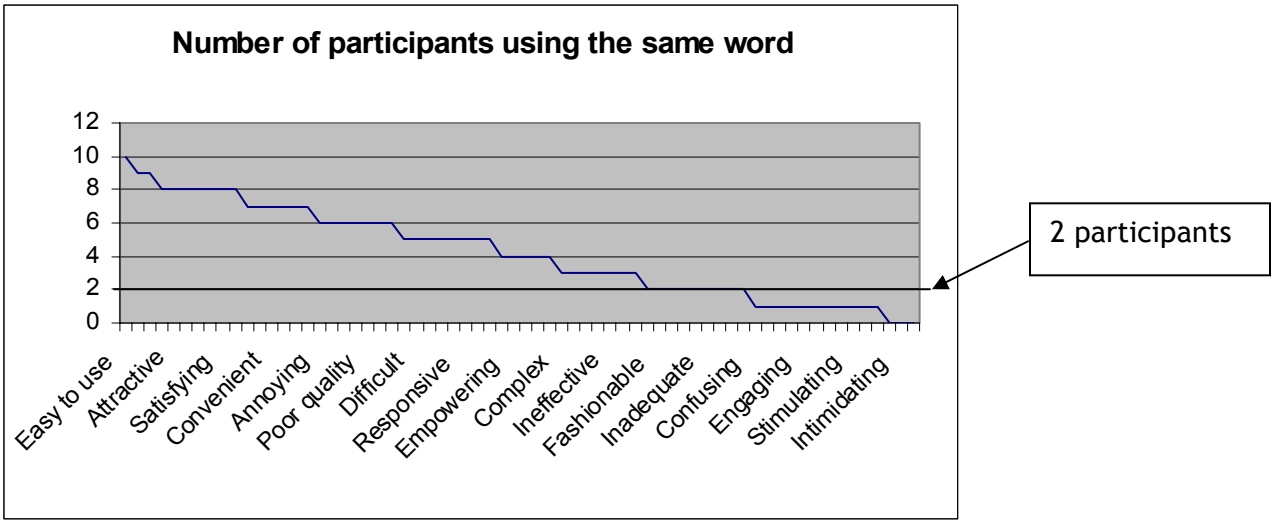

Figure 5.64: Number of participants using the same word (see data from table 9.3 in Appendix L)

After erasing I got a list of 33 words (see table 5.65).

The other changes I did on the test plan were minor. The difficulty I was faced to was to translate all the questionnaires from English to Swedish because most of the participants over 50 years old needed the Swedish version.

Figure 9.65: The new list of words from the test plan

Annoying	Appropriate
Attractive	Clean
Clear	Common
Controllable	Convenient
Distracting	Easy to use
Effective	Efficient
Empowering	Expected
Familiar	Fast
Faulty	Hard to use
High quality	Painful
Pleasant to touch	Poor quality
Reliable	Responsive
Rigid	Satisfying
Simple	Simplistic
Slow	Time-consuming
Time-saving	Unattractive
Useful	

6. The strength test for the carton packages

6.1. Description of the solution

The tool I used for this test is shown on the following picture (see figure 6.1). It is composed of two hooks, one of each side and two tubes of different diameter that can slide one in the other. There are some graduations on the smallest tube. As soon as the user pulls one of the hooks the small tubes slides in the other one and an identification mark shows the graduation representing the strength needed to pull the tube up to this point. There is a spring inside so that the tool comes back to its original position where the strength is null. The spring enables to recreate through the tool the real strength. In fact more the user pulls the hook more it is difficult. That is why a position of the tool corresponds to a specific strength.

Figure 6.1: Tool used during the strength test

One part of the tool would thus be pulled by the user. The other part would be linked to the package, particularly the perforation. The action of the first hook would result by the opening of the package. One problem came up: how should I attach the hook to the package?

6.1.1. The first try: the use of a plastic ring

The first idea I had was to pierce a hole in the perforation and tight a plastic ring through the hole and around the perforation. Then I just had to swipe the hook into the ring, see figures 6.2 and 6.3.

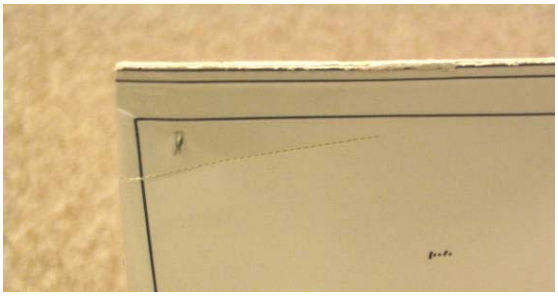

Figure 6.2: The first step: pierce a hole in the perforation

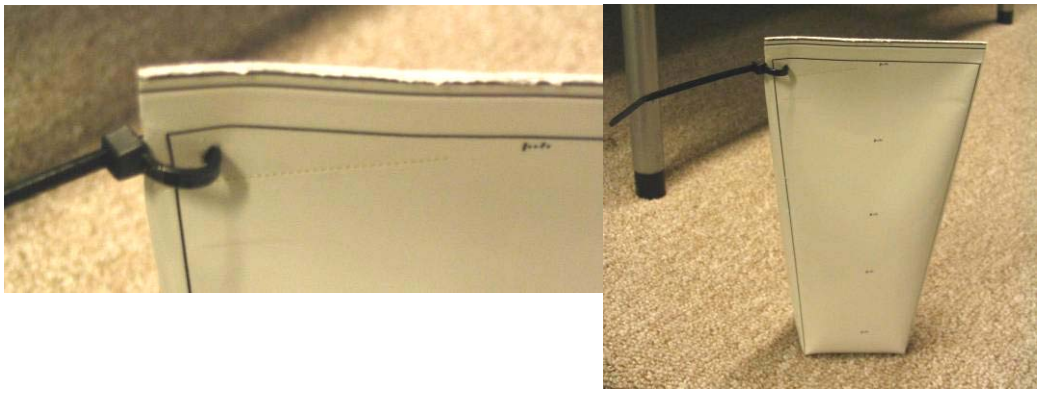

Figure 6.3: The second step: swipe a plastic ring through the hole

I did not succeed with this idea. The first problem was to figure out where to pierce the hole. Then there was a complication because some water flew off from the hole and damped the perforation. It was then more difficult to tear off the perforation. The last difficulty was that it was possible to open the first version of the carton packages with this solution, but as soon as the required strength increased, I could not open the package. In fact the plastic part tore the perforation.

6.1.2. The solution: the artificial thumb

It was now important to stick more to the reality. With the help of my tutor I came up with a solution to these first problems I was faced with: to build a tool that could embody the thumb of the user during the opening. It should avoid perforating the package and the surface in contact with the perforation should look like the form of the thumb.

The figure 6.4 is an explanation of the tool. It is composed of a bolt with nut (diameter 8) and 3 washers. One is torn in the form of a hook to get the

hook of the strength meter, and do not touch the package so its diameter was not important. Then there are two simple washers of different size. The one which is placed on the front (diameter 25) is bigger than the other (diameter 22). This configuration is aimed to represent the grip of the fingers on the perforation. It is then clamped on the perforation. Not the whole washers are mounted on the perforation. The resemblance with the contact area of the thumb is striking.

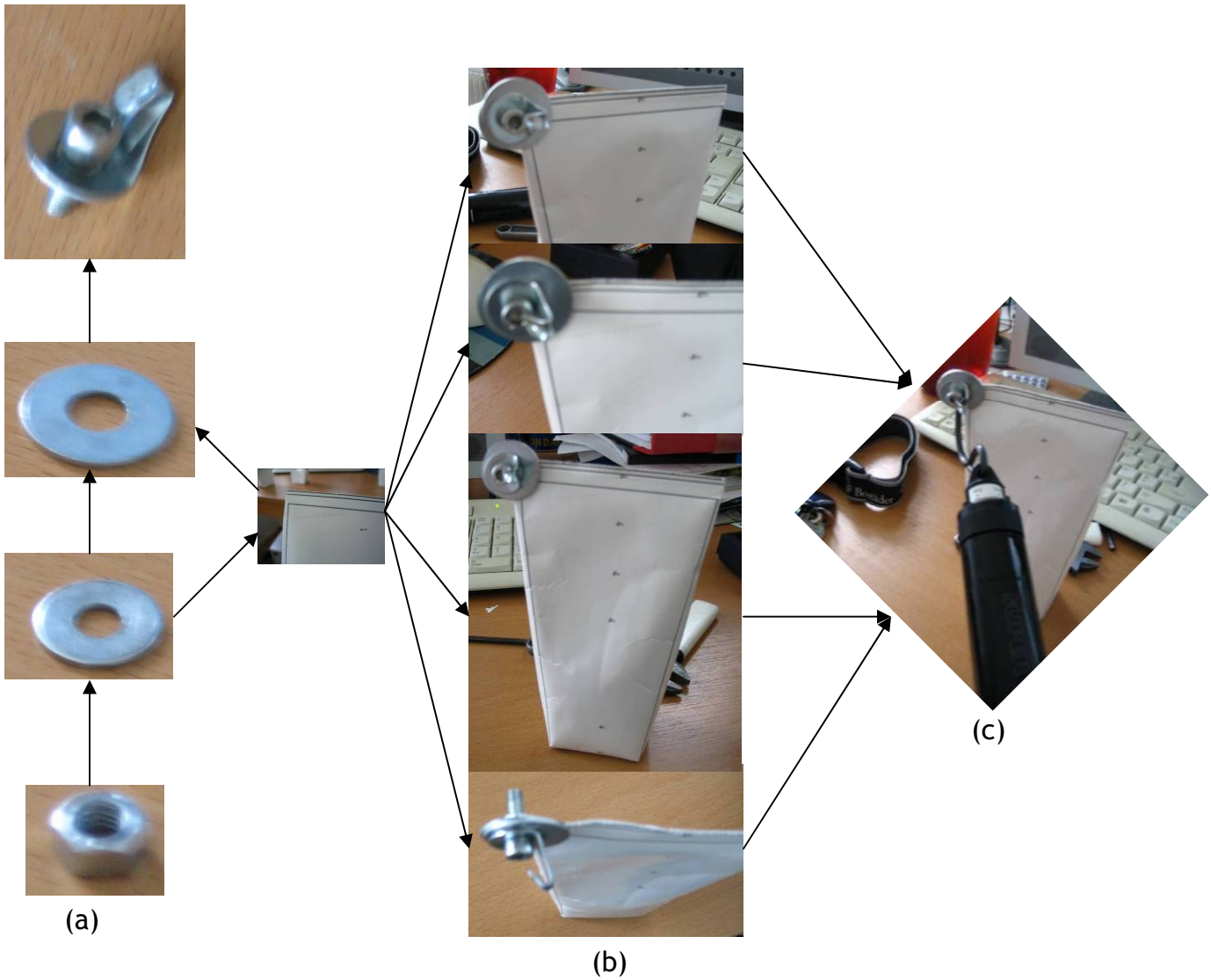

Figure 6.4: (a) Assembly of the tool, (b) the grip to the package and (c) the final result

6.2. Test results

I got the data from Tetra Pak (reference) when they realized the perforation. The purpose of the test was to take my own measures (practice) and compare it with the results of the usability test, see table 6.5, 6.6, 6.7, 6.8. I did the test on 10 packages of each version. My measures were less precise than the reference data. The deviation was higher. It was to notice that the measures stayed in the same order for the first and second packages but were useless for the two lasts packages. In fact it was hard to control my force while I was pulling. That is why there were some significant differences between two measures of the same package. Moreover the package # 3 and 4 were really hard to tear so those differences were considerable.

Anyway I obtained a trend. The first version of the packages was the one with the smallest strength: I got 12.7N instead of 13.82N for reference, with a bigger deviation than expected (2.4N compared to 1.73N). The strength required to open the second version was more important: I found 15.2N while the reference strength is 16.16N, but a better deviation than before (1.7N compared to 1.19N).

For the two last packages I obtained a deviation around 7N and 8.5N respectively which was far too much. The measures could not be analyzed and were considered useless. I took the reference measures for granted, around 25N both.

In a conclusion I can observe that the results matched the usability tests results. That means that the package that the people found the easiest one to open is the package which requires the less strength.

Table 6.5: strength test's result for the package #1

Name	Specimen No	Reference data from Tetra Pak	Data from the lab
		Peak Load (N)	Strength (N)
version 1	1	16,82	12
version 1	2	16,14	11,75
version 1	3	13,31	14,5
version 1	4	12,05	15
version 1	5	14,87	12
version 1	6	12,79	9,25
version 1	7	12,21	18
version 1	8	12,75	12,5
version 1	9	12,23	10
version 1	10	16,17	11,25
version 1	11	12,68	
	Mean	13,82	12,6
	Std Dev	1,73	2,5

Table 6.6: strength test's result for the package #2

Name	Specimen No	Reference data from Tetra Pak	Data from the lab
		Peak Load (N)	Strength (N)
version 2	1	16,21	16
version 2	2	17,1	17
version 2	3	17,96	14
version 2	4	15,55	13,5
version 2	5	16,93	16
version 2	6	18,11	15
version 2	7	15,67	14
version 2	8	13,97	18,5
version 2	9	15,73	12,75
version 2	10	15,12	15,5
version 2	11	15,43	
	Mean	16,16	15,2
	Std Dev	1,20	1,7

Table 6.7: strength test's result for the package #3

Name	Specimen No	Reference data from Tetra Pak	Data from the lab
		Peak Load (N)	Strength (N)
version 3	1	26,05	26,5
version 3	2	29,04	31,5
version 3	3	22,24	28,5
version 3	4	24	21
version 3	5	26,5	41
version 3	6	26,84	31,5
version 3	7	26,3	16,5
version 3	8	24,23	24
version 3	9	25,65	34
version 3	10	22,07	35,5
version 3	11	24,38	
	Mean	25,21	29
	Std Dev	1,97	6,9

Table 6.8: strength test's result for the package #4

Name	Specimen No	Reference data from Tetra Pak	Data from the lab
		Peak Load (N)	Strength (N)
version 4	1	27,25	29,5
version 4	2	24,36	19,5
version 4	3	25,07	44
version 4	4	23,59	46
version 4	5	25,87	34,5
version 4	6	27,49	26
version 4	7	28,46	45
version 4	8	22,47	29,5
version 4	9	32,41	28
version 4	10	24,37	29
version 4	11	20,8	
	Mean	25,65	33,1
	Std Dev	3,03	8,6

7. Conclusion

7.1. Conclusion for the plastic caps

The analysis of the usability test gave me one bottle which was more appreciated by the participants: the Yoggi Yalla! (J) (See figure 7.1).

First of all half of the participants agreed to say that it was the easiest bottle to open. One reason could be the whole design. The extern surface of the cap was really smooth and nice to touch. The material seemed harder than the other caps which made it feel stronger and thicker. As a consequence the cap slid easily on its thread. It made really a difference compared to the other caps.

Figure 7.1: pictures of the best cap

A good aspect was its tamper-evidence. It was considered as the most efficient. In fact I could notice that it was quite advanced with only two hooks and a few fasteners compared to the others. The tamper-evidence is an important part of the cap that the designers should not ignore.

The participants thought that this bottle was one of the fastest ones to open. But the course to open the bottle was not the shortest one (2/3 tour = 77 mm). And when the time spent to open it was not the best one. The bottle I (ICA drickyoghurt) was really the one with the shortest course on its cap (0.4 tours, around 40 mm). This was perceived during the measures of the time of the re-opening and re-closing. As the time to open is linked to the number of tour to do to

open the bottle, so the diameter of the cap, it should be good to try to shorten the course of the cap or widen the cap of the bottle J. In fact, the cap was not the widest with a diameter of 37 mm neither the tallest one with a height of 12.8 mm but it seemed to have been appreciated by all the participants.

Lots of participants made small errors whereas they closed this bottle. Perhaps it was because the diameter of the cap fitted perfectly the diameter of the bottle so that the user needed to me more precise during the closing. As it did not seem to annoy the users that much, there is no need to improve it.

The bottle J was not at all the best to handle. One reason for that was the shape of the bottle and its dimension: this bottle has a quite large diameter at the place that the user grabs it (65 mm). I had to get a closer look to the best bottles in this field: the Willys drickyoghurt (H) and the Evian water (E) (see figure 5.1.6). Their shape seemed more sophisticated and adapted to the grip of the hand. The diameter of the bottle was far narrower. It should be interesting to improve the shape of the bottle J.

It could be interesting to realize a strength test to measure the strength necessary to open each bottle. It could maybe confirm that the bottle J requires less strength than the others bottles. Otherwise the EMG tests could give a trend of strength. It is actually proved that there is a proportional link between the strength of a striated muscle contraction and the amount of electrical activity in this muscle. It would though be possible to order the bottles depending how high the activity in the muscles of the user is.

Another recommendation is to realize further tests with more people but only with some selected bottles: for example, the bottle J, the bottle H for its small size, the bottle E and C because of the shape of the bottle and the caps were quite appreciated. (See figure 7.1).

Figure 7.1: Bottles with a good shape, in the order, the bottle H, C and E

7.2. Conclusion for the carton packages

Considering the results from both tests (usability test and strength test), I recommend that the perforation of the first package is used for the future products.

During the usability tests a majority of the participants (7 over 10) thought that the first version of the perforation was the easiest one and the version 4 was considered as the hardest one. The strength test confirmed that the first package required the less strength. Even if there was not a big difference of strength between the two last packages but the participants felt that the version 4 was harder to open. I can though relate the opening strength to the easiness of opening with a quite sensitive degree.

I also noticed that the first package was the fastest one to open. This was confirmed by studying the time spent to open it. However, the package #2 was not that much slower. Moreover this second package was the one which the participants dropped less water with while they opened it compared to the first version of perforation. Maybe the first package was so easy that the user

did not measure his strength and the opening was less controlled than with the other packages. As a consequence it could be good to increase the number of versions that means to test a range of perforations with opening strengths between the first version and the second one (13.82N and 16.16N) in order to get a good compromise between the easiness to open and less water dropped during the opening.

Those packages 1 and 2 were not the fastest one to pour from and actually the user dropped a lot of water from them during the pouring session. I found out that the fastest one was in fact the package #4, which was seen as the hardest one to open. I presumed that its opening was hard but was done properly so that it was easier to pour from this package. If I attach myself only to the easiest to open, the package to keep in the future was the first one. But it could be good to realize further tests with more people to study further the pouring action. Is there really a link between the hardness to open and a good pouring?

7.3. Conclusion for the test plan

The way the questionnaire was built is quite efficient if the list of words is restrained to around 30 words. It is also good for the participants to answer to 6 questions maximum because it takes already some time.

Otherwise, it should be good to restrain the number of products tested to 5 because 10 was really too much. The tests lasted sometimes more than one hour which is actually quite long.

I measured the anthropometric data as it was explained in the test plan. My data did not give me anything as I only had 10 participants from different nationalities. So, it was quite hard to interpret something and to find some influence of the body size of the participants on their results and comments while avoiding falling into extreme presumptions or non-sense. I think that with more participants these data might help in understanding the results.

I did not test the drinking sessions since bottles contained soft juice or drinkyogurt… It should be interesting to review this testing method as well.

8. References

[1] Tetra Pak, *The Company*. 2006-09-07
www.tetrapak.com

[2] Joseph f. Hanlon, Robert J. Kelsey, Hallie E. Forcino. 1998. *Handbook of package engineering*. Lancaster, Pa: Technomic Pub. Third edition.

[3] US Industry Study, *Caps and closures with forecasts to 2007 and 2012*. Study # 1647, published February 2003. 2006-05-25
www.freedoniagroup.com/pdf/1647web.pdf

[4] The-infoshop.com, *report Caps and closures*. Published in September 2004. 2006-05-16.
www.the-infoshop.com/study/fd23747_caps_closures.html

[5] Aaron L. Brody, Kenneth S.March.1997. *The Wiley encyclopedia of packaging technology*. New York: Wiley, cop. Second edition.

[6]Bouchons MAC closures, Information Technique, *Technique du bouchon*. 2006-09-05.
www.mac.qc.ca/en/info_tech/info_tech_print.html

[7] Medical Packaging, *Change in removal torque with time and temperature*. 2006-04-27.
www.msu.edu/%7Etanprase/PKG%20452/PKG%20452%20Lab11%20Removal%20torque.pdf

[8]J. Langley, J. Wearn, R. Janson, Dr. A. Yoxall, Department of Mechanical Engineering, The University of Sheffield, UK. *Understanding the Roll-On-Pilfer-Proof Process*. 2006-05-15.
www.shef.ac.uk/mecheng/epas/News/ROPPInclusiveDesign.pdf

[9] ISO 9241-11. Ergonomic requirements for office work with visual display terminal (VDTs) - Part 11: Guidance on Usability. International Standard. First edition. 1994.
http://www.idemployee.id.tue.nl/g.w.m.rauterberg/lecturenotes/ISO9241part11.pdf#search=%22ISO%20DIS%209241-11%22

[10] Xristine Faulkner.1994. *Usability Engineering*. Grassroots series. Palgrave 2000

[11] Edward Stanfield, *Hands-On Architecture - Part II: Recommendations for standards*. 2006-09-07.

http://www.access-board.gov/research/HandsOnArch/recommendations.pdf

[12] Anthropometrics notes. 2006-09-07. http://www.roymech.co.uk/Useful_Tables/Human/Human_sizes.html

[13] Stephen Pheasant. 1996. *Bodyspace – anthropometry, ergonomics and the design of work*. London: Bristol, PA: Taylor & Francis. Second edition

[14] Alcoa closure systems international. 2006-08-30. http://www.alcoa.com/csi/europe/en/home.asp

[15] *Experiment 8, part1: Grip strength and Electromyogram (EMG) activity.* 2006-08-31. http://www.iworx.com/LabExercises/lockedexercises/LockedEMGGripStrengthNL.pdf#search=%22Experiment%208%2C%20part1%20Grip%20strength%20and%20EMG%22

[16] *Abbey Well Natural Mineral Water Bottle Plastic Still 1.5 Litres Ref 4848 [Pack 6].* 2006-09-05. www.office365.co.uk/Catering/505493-Abbey-Well-Natural.htm

[17] Stuart Feen, President, Plastic bottle corporation, *Necessity of obtaining closures samples and information prior to Plastic Bottle Corporation run.* 2006-09-07. www.plasticbottle.com/techinfo/article_necess.html

[18] John R. Wilson, Nigel Corlett. 2005. *Evaluation of human work*. CRC Press: Taylor & Francis group. Third edition.

9. Appendix

9.1. Appendix A: Benchmarking

BOTTLE						CAP								
Category	Brand	Name	Volume	type	material	Ø	height	tamper evidence	design	colour	surface	nuance	comment	supplier
Soft juice	BOB		0,5L/0,75L/1,5 L	PET bottle	PET	28	15	yes, smooth,	lots of small and not deep ribs	0,5L/1,5L: red, 0,75L: all	smooth	mat	There is a slogan on some of the caps: "mer frukt, mindre söcker". Simple and square. Not so attractive	Procordia Food AB
Soft juice	Björnekulla	saft	1,5L	PET bottle	PET	?	?	yes, smooth,	lots of small and not deep ribs	green	rough	mat	Square and coarse, not attractive	Björnkulla
Soft juice	Coop	saft	1.5L/0,6L	PET bottle	PET	28	15	yes, several spaces, some hooks, ergonomic	really lots of ribs but not deeper	red, green, yellow	smooth	mat	it is quite rundish and simple. A little too coarse. Too hard colours	Hälleförs Bryggeri
Soft juice	Coop	light saft	0,56L	PET bottle	PET	27	12	yes, lots of fasteners,	lots of ribs but alittle deeper	white	smooth	mat	it is quite rundish and simple. A little too coarse.	Hälleförs Bryggeri
Soft juice	Eldorado		1,5L	PET bottle	PET	28	14	yes, smooth,	lots of small and not deep ribs	red,yellow	rough	mat	looks like the euroshoper caps. Simple and roundish	Hälleförs Bryggeri
Soft juice	Euroshopper		1,5L	PET bottle	PET	28	14	yes, smooth,	lots of small and not deep ribs	yellow and red	smooth	bright	Quite simple but seems hard to screw. Little roundish	Hälleförs Bryggeri
Soft juice	Fun light		1L/0,5L	PET bottle	PET	28	15	yes, smooth,	lots of small and not deep ribs	all	smooth	mat	There is the logo on the cap. There is an assortiment of colour depending the flavour of the product inside. Too much straight and sharp perhaps	Procordia Food AB
Soft juice	Hellefors bryggeri	saft	1,5l	PET bottle	PET	28	14	yes, smooth,	lots of small and not deep ribs	yellow and red	smooth	bright	Quite simple but seems hard to screw. Little roundish like the euroshopper cap	Hälleförs Bryggeri
Soft juice	Hemköp		1L	PET bottle	PET	28	14	yes, smooth,	lots of small and not deep ribs	red	rough	mat	Really square and coarse, look like the BOB caps	Stockmos Fruktindustri AB
Soft juice	Hemköp		1L	PET bottle	PET	28	14	yes, some fastener, ergonomic	lots of small and not deep ribs	orange, green	rough	mat	roundish and more designed, regarded to the tamper evidence	Stockmos Fruktindustri AB
Soft juice	ICA	Light saft	1L/0,5L	PET bottle	PET	27,5	13	yes, demarqued,	some ribs but not so much and deeper	gray	rough	metallic	More rough, looks like a cheap cap and hard to twist	Pebas

Soft juice	ICA	gott liv,saft	0,6L/1,2L	PET bottle	PET	28	14	yes, smooth,	lots of small and not deep ribs	black	smooth	bright	There is the logo ICA in red on the top. Quite simple (looks like the fun ligth cap)	Stockmos Fruktindustrier AB
Soft juice	ICA	blandsaft	1,5L	PET bottle	PET	28	14	yes, smooth,	lots of small and not deep ribs	red	smooth	bright	There is the logo ICA in white on the top. Quite simple	Stockmos Fruktindustrier AB
Soft juice	Joarsbo	saft		PET bottle	PET	?	?	yes, smooth,	some ribs but not so much and deeper	red	rough	mat	This is really corase. Not really attractive	see Joarsbo
Soft juice	Kronans	saft		PET bottle	PET	?	?	yes, smooth,	lots of small and not deep ribs	red	rough	mat	This is really corase. Not really attractive	Fredrikssons
Soft juice	Robinsons	saft	1L	PET bottle	PET	31,5	15	yes, not so many fasteners,	some ribs but not so much and deeper	green	smooth	metallic	There is the logo robinsons on the top of the cap. More exclusive but it is reallt simple and coarse as if it was for children. A little too square	see Britvic
Soft juice	Stockmos	saft light	1,2L/ 1L	PET bottle	PET	28	15	yes, smooth,	lots of small and not deep ribs	red, light/ yellow, red, orange, green	smooth	mat	Simple and square. Not so attractive	Stockmos Fruktindustrier AB
Soft juice	Willys		1L	PET bottle	PET	28	14	yes, some fastener, ergonomic	lots of small and not deep ribs	all	rough	mat	roundish and more designed, regarded to the tamper evidence	Stockmos Fruktindustrier AB
Juice	Aqua d'Or	Is te		PET bottle	PET	?	?	yes, demarqued with little fasteners, smaller than the cap	rare ribs and quite marqued	yellow,orange	rough	mat	little roundish but simple.	Saturnus?
Juice	Brämhults	nypressade		PET bottle	PET	38	13	yes, just 3-4 fastener,	the ribs are deep	green or pink	rough	brighty	The cap is quite straight so it doesn't look so nice. There is a small hump on the grey cap which make it look better.	Amcor White Cap
Juice	Ekströms	Liva		PET bottle	PET	?	?	yes, some fatseners,smaller than the cap	separated ribs	yellow	smooth	brigt	little roundish but simple. The tamper is smaller than the cap so the grip is not so good	Procordia Food AB
Juice	Festis			PET bottle	PET	28	15	yes, smooth,	lots of small and not deep ribs	grey	smooth	metallic	The cap is a little transparent and pearly. The surface is smooth bu it can be some defects in the colour	Carlsberg?
Juice	Fuldi	morotsjuice	0,5L	PET bottle	PET	29	15	yes, not so many fasteners,	lots of small and not deep ribs	orange	rough	mat	the cap is a little roundish and simple.It looks like the cap from euroshopper	Primahandel?
Juice	Granini		0,5L	PET bottle	PET	?	?	yes, smooth,	lots of small and not deep ribs	red	rough	bright	Square and simple. Looks like the BOB caps	Granini?

Juice	Granini		1L	PET bottle	PET	?	?	yes, smooth,	less ribs more marqued	red	rough	bright	Square and coarse.	Granini?
Juice	Hellefors Bryggeri	Ice tea	0,5L	PET bottle	PET	?	?	yes, some fatseners,	lots of small and not deep ribs	yellow	rough	mat	Little roundish but simple .Like the Euroshopper cap	Hälleförs Bryggeri AB
Juice	Mer			PET bottle	PET	37	11,5	yes, small notches,	lots of small and not deep ribs	black or grey	rough	brighty black and metallic grey	The tamper is coarse. Mer is written on the top of the cap, quite exclusive	Coca Cola?
Juice	Nestea			PET bottle	PET	38	11,5	yes, demarqued with little fasteners,	lots of small and not deep ribs	blue, yellow or pink	rough	mat	There is a sign on the cap, a leaf. However it is still simple and coarse	Coca Cola?
Juice	Pomegreat			PET bottle	PET	39	12	yes, few fasteners,	lots of small and not deep ribs	white	rough	mat	simple. Looks like the MER cap.	Pomegreat?
Juice	Tropicana	Premium		PET bottle	PET	?	?	yes, smooth,	lots of small and not deep ribs	orange	rough	mat	little roundish but simple tamper.Like a Arla milk cap	Tropicana?
Water	Aqua d'Or	mineral vatten		PET bottle	PET	32	11	yes, smooth,	lots of small and not deep ribs	white	rough	transparent	Seems coarse even if it is roundish. Transparency doesn't look so exclusive	Saturnus?
Water	Evian		1,5L	PET bottle	PET	31	16	yes, quite smooth,	rare ribs	pastel blue	rough	a little brighty	There is also a sign. The form is though more roundish so nicer but it is quite transparent	Evian France?
Water	Guttsta Källa	stilla	1,5L	PET bottle	PET	?	?	yes, quite smooth,	lots of small and not deep ribs	blue	rough	a little brighty	Square and simple. Looks like the BOB cap	Guttstakalla ?
Water	Imsdal		1,5L	PET bottle	PET	28	15	yes, smooth,	rare ribs and quite marqued	dark blue	smooth	brighty	The form is more straight and strict, less attractive	Imsdal?
Water	Premier		1,5L	PET bottle	PET	?	?	?	?	?	?	?	?	?
Water	Signum		1,5L	PET bottle	PET	32	11	yes, fasteners quite separed,	lots of small and not deep ribs	white	rough	mat	transparent so little coarse. Not really attractive, square and simple.	Hälleförs Bryggeri
Water	VerdianA		1,5L	PET bottle	PET	28	11	yes, fasteners quite separed,	lots of small and not deep ribs	white	transparent	mat	little too rough and small. Not nice	?
Water	Vittel		0,5L/1,5L	PET bottle	PET	31	13	yes, little demarqued,	less ribs more marqued	blue	rough	mat	There is a sign on the cap showing its exclusivity but it is a very straight cap, not very nice	Vittel France?

Yoghurt	Arla	Mellanmjölk	HDPE bottle	HDPE	?	?	yes, smooth,	lots of small and not deep ribs	metallic grey	rough	bright	The cap looks quite nice because of the colour but it is really simple.	Arlafoods?
Yoghurt	Arla	Islatte, Ischoko, smoothie	HDPE bottle	HDPE	?	?	yes, smooth,	lots of small and not deep ribs	brown, gold, white	rough	bright	Quite simple but not coarse and little too square.	Arlafoods?
Yoghurt	ICA	dryckyoghurt	HDPE bottle	HDPE	40	11 and 15 with tamper	yes, lots of fasteners,stuck in a small space of a ring	separated ribs	white	rough	mat	It is rough and straight so not nice	Nöm AB
Yoghurt	Willys	dryckyoghurt	HDPE bottle	HDPE	4	11	yes, some fasteners	lots of small and not deep ribs	red	smooth	mat	simple and a little rounded	Stockmos Fruktindustrier AB
Yoghurt	ProViva	återhämtningsdryck	HDPE bottle	HDPE	38	12,5	yes,smooth,	lots of small and not deep ribs	blue	smooth	a little bright	simple, flat; not nice	Amcor White Cap
Yoghurt	skanemejerier	dryckyoghurt	HDPE bottle	HDPE	38	12,5	yes,larger than the cap,	lots of small and not deep ribs	blue	smooth	a little bright	simple, flat; not nice, the tamper is bigger than the cap so it is not so attractive.	Amcor White Cap
Yoghurt	Viktväktarna	dryckyoghurt	HDPE bottle	HDPE	38	12,5	yes,smooth,	lots of small and not deep ribs	blue	smooth	a little bright	simple, flat; not nice	Amcor White Cap
Yoghurt	yoggi	yalla!	HDPE bottle	HDPE	36	13	yes,ergonomic,4 little hooks, stuck in a small space of a ring	lots of small and not deep ribs	white	rough	mat	roundish design quite nice but stays simple.	Arlafoods?
Sirap	Dan Sukker	mjörk och ljus sirap	HDPE bottle	HDPE	31,5	13 and 18,2 with the tamper	yes, little technical, 2 little hooks, stays	little and not deep ribs	brown dark or light and white	rough	mat	The material is thick. It seems hard to open, lots of strengh.	AB Cerbo
Cat milk	Purina	milk	HDPE bottle	HDPE	36	9	there is a plastic upon the cap, no tamper?	seems smooth	white and blue	smooth	brighty	The caps looks like metal, there is a printed catleg on the top. The cap is easy identifying. Exclusivity and uniqueness	Purina Europé?
Cat milk	Whiskas	catmilk	HDPE bottle	HDPE	40	14,5	no tamper	separated and small ribs	pink	smooth	brighty	The caps has the same colour than the package and there is the logo of the brand on it. Recognition	Whiskas Europe?
Sauce	Jensen's Original	béarnaise sås	HDPE bottle	HDPE	33	16,5	yes, good style, can be put away after opening	coarse and demarqued ribs	gilded	rough	mat	It looks like luxious, the cap is shiny but coarse, because the material is thick	Jensens?
Sauce	Sweet Baby Ray's	Barbecue sås	PET bottle	PET	40	18,5	there is a cover in paper on the cap	no	white	smooth	brighty	The simplest ever. Not ergonomic but looks ok.	?

9.2. Appendix B: Pictures Of The Products On The Market

<u>*Soft Juice*</u>

BOB

Björnekulla

Coop

Eldorado

Euroshopper

Fun light

Hellefors bryggeri

Hemköp

ICA

Joarsbo

Kronans

Robinsons

Stockmos

Willys

Juice

Aqua d'Or

Arla

Brämhults

Ekströms

Festis

Fuldi

Granini

Hellefors Bryggeri

Mer

Nestea

Pomegreat

Tropicana

Water

Aqua d'Or

Evian

Guttsta Källa

ICA

Imsdal

Signum

VerdianA

Vittel

Yoghurt

Arla

ICA

ProViva

Skånemejerier

Vikt Väkterna

Yoggi

Syrup

Dan Sukker

Cat milk

Purina

Whiskas

Sauce

Jensen's Original

Sweet Baby Ray's

9.3. Appendix C: First Questionnaire

1. What is your age?

o 18-29
o 30-39
o 40-49
o 50-59
o 60+

2. What type of work do you do?
o Accounting/Finance/Banking
o Administrative/Clerical
o Creative Arts/Media
o Education/Training
o Engineering/Architecture/Design
o Human Resources
o Information Technology
o Legal/Law Enforcement/Security
o Marketing/Advertising
o Medical/Health Care
o Sales
o Travel/Hospitality/Restaurant
o Student
o Other

3. Do you, or does any member of your family, work for any of the following organizations:
o A market research firm or market research department?
o A company that manufactures or sells food or drinks packaging?
o None of the above.

4. Have you participated in a market research study such as a focus group on drinks' or food's packaging within the past six months?
o Yes
o No

5. Have you ever had allergic reaction to plastic, carton or other materials that are used in drink packaging?
o Yes
o No

6. Have you ever had allergic reaction to juices, yoghurt or other still drinks contained in drink packaging?
o Yes
o No

9.4. Appendix D: Information sheet

PURPOSE OF THIS STUDY

The purpose of this study is to understand how easy it is for people to open drinks and food packages. Your participation in this study will help Tetra Pak make packages easy to open. You are the evaluator of the package: we are not in any way evaluating you or your performance. If there are any problems, these will be problems with the package, not with you.

YOUR RIGHTS AS A PARTICIPANT

Your participation in this study is strictly voluntary.

- You may refuse to participate at any time without suffering any negative consequences;
- You may take a break at any time;
- You may ask questions at any time;
- There is no deception involved;
- Your answers are kept confidential.

INFORMATION WE WILL COLLECT

We will ask you to show us how you work with the packages. We will ask you to carry out certain activities and we will observe how you carry out those activities, and we will also interview you. This package evaluation session will be videotaped and notes will be taken to record your opinions and actions. You will be asked to complete a short questionnaire and to indicate opinion ratings for certain aspects of the package. The information from this evaluation will be used, along with that from other similar evaluations, to help Tetra Pak improve their packages. Tetra Pak will keep your name and comments confidential.

NON-DISCLOSURE

We may discuss ideas with you or show you user packages that are not yet in use. We are doing this so we can get your feedback only. Any information that you acquire relating to the products is confidential and proprietary. It is being disclosed to you only so you can be a participant in this study. By signing this form, you agree to maintain in confidence, for a period of five (5) years, all the ideas we discuss, the things you are asked to do, the prototypes we show you, and anything else about the session. What you can say is that you participated in a study to help improve a product. By signing this form, you also agree to assign to Tetra Pak all rights (including all rights of copyright or patent, if any) in ideas you present free of any obligation or further compensation by Tetra Pak.

If you have further questions about the study and how it was conducted you can get in touch with Joakim Eriksson via joakim.eriksson@design.lth.se.

YOUR AGREEMENT

To take part in the study, you must sign this form showing that you agree to these conditions.
Your name: Date:

Signature:

9.5. Appendix E: Bottle Questionnaire

Considering the package you have just used, indicate your degree of agreement or disagreement with the following statements by circle your answer. (NA means not applicable).

1. I found it easy to open the package

Strongly Disagree 1------2------3------4------5 Strongly Agree NA

2. The tamper-evidence disturbs me during the screwing

Strongly Disagree 1------2------3------4------5 Strongly Agree NA

3. The cap looks nice

Strongly Disagree 1------2------3------4------5 Strongly Agree NA

4. I found easy to close the package

Strongly Disagree 1------2------3------4------5 Strongly Agree NA

5. I found it difficult to handle the package

Strongly Disagree 1------2------3------4------5 Strongly Agree NA

6. Overall, I found this package easy to use

Strongly Disagree 1------2------3------4------5 Strongly Agree NA

Step 1: Read over the following list of words. Considering the cap you have just used, tick those words that best describe your experience with it. You can choose as many words as you wish.

- ▫Advanced
- ▫Annoying
- ▫Appealing
- ▫Appropriate
- ▫Attractive
- ▫Clean
- ▫Clear
- ▫Common
- ▫Complex
- ▫Confusing
- ▫Controllable
- ▫Convenient
- ▫Creative
- ▫Cutting edge
- ▫Dated
- ▫Desirable
- ▫Difficult
- ▫Distracting
- ▫Dull
- ▫Easy to use
- ▫Effective
- ▫Efficient
- ▫Effortless
- ▫Empowering
- ▫Engaging
- ▫Exclusive
- ▫Expected
- ▫Familiar
- ▫Fashionable
- ▫Fast
- ▫Faulty
- ▫Flexible
- ▫Friendly
- ▫Frustrating
- ▫Fun
- ▫Hard to Use
- ▫High quality
- ▫Impressive
- ▫Inadequate
- ▫Ineffective
- ▫Innovative
- ▫Intimidating
- ▫Painful
- ▫Pleasant to touch
- ▫Poor quality
- ▫Reliable
- ▫Responsive
- ▫Rigid
- ▫Satisfying
- ▫Shiny
- ▫Simple
- ▫Simplistic
- ▫Slow
- ▫Smooth
- ▫Sophisticated
- ▫Stimulating
- ▫Straightforward
- ▫Time-consuming
- ▫Time-saving
- ▫Too technical
- ▫Unattractive
- ▫Unconventional
- ▫Understandable
- ▫Unpredictable
- ▫Unrefined
- ▫Useful

Step 2: Now look at the words you have ticked. Circle three of these words that you think are most descriptive of the package (in the order 1 to 3).

9.6. Appendix F: Final Questionnaire For The bottles

1. Which bottle feels the easiest one to open?

☐ A ☐ B ☐ C ☐ D ☐ E
☐ F ☐ G ☐ H ☐ I ☐ J

2. Which bottle feels the hardest one to open?

☐ A ☐ B ☐ C ☐ D ☐ E
☐ F ☐ G ☐ H ☐ I ☐ J

3. Which cap is the nicest one?

☐ A ☐ B ☐ C ☐ D ☐ E
☐ F ☐ G ☐ H ☐ I ☐ J

4. Which bottle seems the easiest one to handle?

☐ A ☐ B ☐ C ☐ D ☐ E
☐ F ☐ G ☐ H ☐ I ☐ J

5. Which tamper-evidence is the best one?

☐ A ☐ B ☐ C ☐ D ☐ E
☐ F ☐ G ☐ H ☐ I ☐ J

6. Which cap seems the fastest one to open?

☐ A ☐ B ☐ C ☐ D ☐ E
☐ F ☐ G ☐ H ☐ I ☐ J

7. Which one is the least painful one to turn?

☐ A ☐ B ☐ C ☐ D ☐ E
☐ F ☐ G ☐ H ☐ I ☐ J

8. Which one is the most painful one to turn?

☐ A ☐ B ☐ C ☐ D ☐ E
☐ F ☐ G ☐ H ☐ I ☐ J

9. Which one is the most irritating one to open?

☐ A ☐ B ☐ C ☐ D ☐ E
☐ F ☐ G ☐ H ☐ I ☐ J

10. What is most important in your choice of cap? (Order 1 to 6)

☐ Appearance
☐ Easiness to open
☐ Speed to open
☐ Tamper evidence
☐ color
☐ Texture
☐ Other: ……..

11. Does the cap influence your choice of bottle?

☐ Yes, definitively
☐ Yes, it can matter
☐ Have never thought about that
☐ No, I do not think so
☐ No, absolutely not

9.7. Appendix G: Package Questionnaire

Considering the package you have just used, indicate your degree of agreement or disagreement with the following statements by circle your answer. (NA means not applicable).

1. I found it easy to open the package

Strongly Disagree 1------2------3------4------5 Strongly Agree NA

2. The perforation is difficult to grab

Strongly Disagree 1------2------3------4------5 Strongly Agree NA

3. I found it easy to pour from the package

Strongly Disagree 1------2------3------4------5 Strongly Agree NA

4. I found it difficult to handle the package

Strongly Disagree 1------2------3------4------5 Strongly Agree NA

5. Overall, I found this package easy to use

Strongly Disagree 1------2------3------4------5 Strongly Agree NA

Step 1: Read over the following list of words. Considering the cap you have just used, tick those words that best describe your experience with it. You can choose as many words as you wish.

- ▫Advanced
- ▫Annoying
- ▫Appealing
- ▫Appropriate
- ▫Attractive
- ▫Clean
- ▫Clear
- ▫Common
- ▫Complex
- ▫Confusing
- ▫Controllable
- ▫Convenient
- ▫Creative
- ▫Cutting edge
- ▫Dated
- ▫Desirable
- ▫Difficult
- ▫Distracting
- ▫Dull
- ▫Easy to use
- ▫Effective
- ▫Efficient
- ▫Effortless
- ▫Empowering
- ▫Engaging
- ▫Exclusive
- ▫Expected
- ▫Familiar
- ▫Fashionable
- ▫Fast
- ▫Faulty
- ▫Flexible
- ▫Friendly
- ▫Frustrating
- ▫Fun
- ▫Hard to Use
- ▫High quality
- ▫Impressive
- ▫Inadequate
- ▫Ineffective
- ▫Innovative
- ▫Intimidating
- ▫Painful
- ▫Pleasant to touch
- ▫Poor quality
- ▫Reliable
- ▫Responsive
- ▫Rigid
- ▫Satisfying
- ▫Shiny
- ▫Simple
- ▫Simplistic
- ▫Slow
- ▫Smooth
- ▫Sophisticated
- ▫Stimulating
- ▫Straightforward
- ▫Time-consuming
- ▫Time-saving
- ▫Too technical
- ▫Unattractive
- ▫Unconventional
- ▫Understandable
- ▫Unpredictable
- ▫Unrefined
- ▫Useful

Step 2: Now look at the words you have ticked. Circle three of these words that you think are most descriptive of the package (in the order 1 to 3).

9.8. Appendix H: Final Questionnaire For The Packages

1. Which package feels the easiest one to open?

☐ ■ ☐ ● ☐ ▲ ☐ *

2. Which package feels the hardest one to open?

☐ ■ ☐ ● ☐ ▲ ☐ *

3. Which package seems the fastest one to open?

☐ ■ ☐ ● ☐ ▲ ☐ *

4. Which one is the least painful one to open?

☐ ■ ☐ ● ☐ ▲ ☐ *

5. Which one is the most painful one to open?

☐ ■ ☐ ● ☐ ▲ ☐ *

6. Which one is the least irritating one to open?

☐ ■ ☐ ● ☐ ▲ ☐ *

9.9. Appendix I: Debrief Sheet

PURPOSE OF THIS STUDY

The purpose of this study was to understand how easy it is for people to use drinks and food packages. All the tasks that you participated in were aimed at assessing this usability. Your participation in this study will help Tetra Pak make the package easy to use. We would just like to reiterate that you were the evaluator of the package: we were not in any way evaluating you or your performance. If there were any problems, these were problems with the package, not with you.
The information you provided today will be used, along with that from other similar evaluations, to help Tetra Pak improve their package. Tetra Pak will keep your name and comments confidential.
Remember that by signing the consent form, you agreed to maintain in confidence, for a period of five (5) years, all the ideas we discussed, the things you were asked to do, the prototypes we show you, and anything else about the session. What you can say is that you participated in a study to help improve a product.

If you have further questions about the study and how it was conducted you can get in touch with Joakim Eriksson via joakim.eriksson@design.lth.se.

9.10. Appendix J: Moderator Guide

INTRODUCTIONS

Hi, welcome, thank you for coming. How are you? Did you find the place OK?
My name is Marion, I'm a student of LTH. I'm helping Tetra Pak understand how easy it is to open some packages. This is Elise Roudier, who will be helping us do the research today.
You are going to be helping us to test various drinks and food packages with regards to how useable they are. You will be helping evaluate packages on how easy they are to open. Your participation in this study will help Tetra Pak make their packages easy open. You are the evaluator of the package. We are not in any way evaluating you or your performance. If there are any problems, these will be problems with the package, not with you.
The procedure we're going to follow today goes like this; we are going to start by asking you to open and/or close various drinks and food packages. There are two different packaging: 10 bottles with a cap to screw and 4 carton packages with perforation. After that we will ask you questions about those packages.
Now I'd like you to sign a form for me. The form is what's called a statement of informed consent. It's a standard thing I give to everyone I interview. It sets out your rights as a person who is participating in this kind of research. As a participant in this research:

- You may refuse to participate at any time;
- You may take a break at any time;
- You may ask questions at any time;
- There is no deception involved;
- Your answers are kept confidential.

Please read over the form and if you're happy with the content, please sign it. Please let me know if you have any questions.

[Let the participant read and sign the form, one for them and one for me]

I will first take some measurement of your body. What are your weight and your size? I will now measure your wrist circumference. Go on with the elbow breadth, the arm circumference, the hand length, the fist width, the thumb clearance and the grip clearance.
[Anthropometric measures]

Any questions before we begin?

Opening packages with caps

Let's start!
Okay, the first thing I would like you to do is to open various bottles. We're going to start with a practice task so that you can get the idea of what we'll be doing.
Can you see the bottles on the table? What I would like you to do is to open one bottle and put the cap on the table. Then I'd like you to close it. After that I'd like you to re-open and re-close the bottle five times. There is two ways of doing it: accurately or speeded.

[The first task is accuracy]

I'd like you to work really accurately, and not worry about how long it takes. If you don't pay attention to what you're doing the test won't give us useful results so you need to work as accurately as you can. Do you have any questions?
Be ready to start and wait for the GO

[The second task is speeded]
I'd like you to work really quickly, and not worry about spilling any of the liquid. If you work slowly the test won't give us useful results so you need to work as quickly as you can. Do you have any questions?
Be ready to start and wait for the GO
Okay, great, well done.

Now we're going to do that activity with a proper test package.

[Repeat speeded or accuracy instructions as per the counterbalancing.]

Thank you for doing the tasks you just did, now we would like you to answer a few questions concerning your opinion of the package you we just using. Please complete this questionnaire as honestly as you can.
[Hand q-aire to participants]
[Repeat procedure for each bottle]
[Final q-aire to participants]

Opening packages with perforation

Let's start!
Okay, now I would like you to open various carton packages. We're going to start with some practice tasks so that you can get the idea of what we'll be doing.

Can you see the four variant of package on the table? Now I would like you to open the four packages in a row without paying attention of the spillage. The purpose is for you to try to get used to them and try to see the difference between each opening. After that I would like you to weigh each of them.

Be ready to start and wait for the GO
Okay, great, well done.

Then take one package that you just opened. Can you also see the tumblers/beakers in the bigger container? What I would like you to do is to pour the contents of the package into the first tumbler/beaker up to the red mark, then fill the second tumbler/beaker up to the red mark. Then I'd like you to put the package back on the table. Finally I want you to weigh each tumbler and the package at the end. You will pour following two ways, as before.

[The first task is accuracy]
I'd like you to work really accurately, and not worry about how long it takes. If you don't pay attention to what you're doing the test won't give us useful results so you need to work as accurately as you can. Do you have any questions?
Be ready to start and wait for the GO

[The second task is speeded]
I'd like you to work really quickly, and not worry about spilling any of the liquid. If you work slowly the test won't give us useful results so you need to work as quickly as you can. Do you have any questions?

Start when I say GO. …….. GO
Be ready to start and wait for the GO

Now we're going to do that activity with a proper test package.

[Repeat speeded or accuracy instructions as per the counterbalancing.]

Thank you for doing the tasks you just did, now we would like you to answer a few questions concerning your opinion of the package you we just using. Please complete this questionnaire as honestly as you can.
[Hand q-aire to participants]
[Repeat procedure for each package]
[Final q-aire to participants]

Thank you for your time.
[Debrief Sheet]

9.11. Appendix K: Another carton package from Combibloc

Figure 9.1: Aan existing package from Combibloc which can be tested

9.12. Appendix T: The new list of words

Table 9.2: Words' frequencies in the questionnaires (in red, the words to erase)

Word	No times use	Word	No times use	Word	No times use
Easy to use	50	Useful	17	**Unpredictable**	**5**
Simple	42	Annoying	16	**Complex**	**4**
Common	37	Clear	16	**Ineffective**	**3**
Fast	30	Poor quality	13	**Innovative**	**3**
Effective	29	High quality	12	**Sophisticated**	**3**
Appropriate	28	Responsive	12	**Fashionable**	**2**
Satisfying	27	Time-saving	12	**Flexible**	**2**
Convenient	26	Expected	11	**Friendly**	**2**
Slow	23	Frustrating	11	**Impressive**	**2**
Appealing	22	Reliable	10	**Inadequate**	**2**
Controllable	22	Understandable	9	**Confusing**	**1**
Hard to use	22	Dated	8	**Creative**	**1**
Attractive	21	Distracting	8	**Cutting edge**	**1**
Efficient	20	Effortless	8	**Desirable**	**1**
Rigid	19	Dull	7	**Engaging**	**1**
Time-consuming	19	Smooth	7	**Shiny**	**1**
Clean	18	Fun	6	**Stimulating**	**1**
Familiar	18	Painful	6	**Too technical**	**1**
Pleasant to touch	18	Unattractive	6	**Unrefined**	**1**
Difficult	17	**Advanced**	**5**	**Exclusive**	**0**
Empowering	17	**Simplistic**	**5**	**Intimidating**	**0**
Faulty	17	**Straightforward**	**5**	**Unconventional**	**0**

Table 9.3: Number of participants using the same words (in red, the words to erase)

Word	No participants	Word	No participants	Word	No participants
Easy to use	10	Time-consuming	6	**Fashionable**	**2**
Controllable	9	Clear	5	**Friendly**	**2**
Simple	9	Difficult	5	**Fun**	**2**
Appealing	8	Distracting	5	**Impressive**	**2**
Attractive	8	Expected	5	**Inadequate**	**2**
Common	8	Familiar	5	**Innovative**	**2**
Effective	8	Responsive	5	**Sophisticated**	**2**
Fast	8	Rigid	5	**Understandable**	**2**
Satisfying	8	Useful	5	**Confusing**	**1**
Slow	8	Advanced	4	**Creative**	**1**
Appropriate	7	Empowering	4	**Cutting edge**	**1**
Clean	7	Painful	4	**Desirable**	**1**
Convenient	7	Simplistic	4	**Engaging**	**1**
High quality	7	Unattractive	4	**Flexible**	**1**
Pleasant to touch	7	Complex	3	**Shiny**	**1**
Time-saving	7	Dull	3	**Smooth**	**1**
Annoying	6	Effortless	3	**Stimulating**	**1**
Efficient	6	Frustrating	3	**Too technical**	**1**
Faulty	6	Ineffective	3	**Unrefined**	**1**
Hard to use	6	Straightforward	3	**Exclusive**	**0**
Poor quality	6	Unpredictable	3	**Intimidating**	**0**
Reliable	6	**Dated**	**2**	**Unconventional**	**0**