optician2020

"Flexible and on-demand manufacturing of customized spectacles by close-to-optician production clusters"

DELIVERABLE D5.4
FINAL MINI-FACTORIES REPORT FROM THE CONSUMER VIEW

Factories of the Future collaborative project

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PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
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CONTENT

1.- INTRODUCTION

The purpose of this deliverable is to evaluate the benefits from the consumers' view of the Optician2020 fully personalised spectacles and to prepare a public report explaining these benefits for both the consumers and opticians.

This deliverable reports the evaluation of the results of the mini-factory performance from the consumer's point of view. The objective of this deliverable is to demonstrate the benefits of the Optician2020 fully personalized spectacles compared with the traditional assets from the users' point of view. This final report is the result of the work done during WP5 and WP6 demonstrations.

To do so, during the demonstration in both Southern and Central Europe clusters, partners have collected data surveys that allow to quantify the benefits for the consumer of Optician2020 fully personalised spectacles. Feedback questionnaires were designed and offered to the different agents implied both consumer and opticians.

In the following sections it will be explained: Section 2 introduces the capturing device and the codesign system users and opticians had used during the demonstrator to obtain the Optician2020 spectacles. Section 3 explains the overall impressions of the opticians about the whole Optician2020 process, and finally Section 4 fully analyses the questionnaires opticians and customers had fill during the demonstrator.

2.- THE OPTICIAN 2020 NEW BUYING EXPERIENCE /CUSTOMER PROCESS

The Optician 2020 novel paradigm for personalised spectacles delivery has been demonstrated in two mini-factory clusters, one in the Southern Europe, with an optician in Portugal, and one in Central Europe, with an optician in Switzerland. The demonstrators run during the period of November 2015 to July 2016, while data was collected until the end of the project, in September 2016. A total of 455 test users from Óptica Pita (Setubal, Portugal) and Lensworld (Bulle, Switzerland) were involved in the Optician2020 demonstration phase.

Customers were scanned with the Optician2020 face scanner to extract their corneal reflections position, nasal area reconstruction and 3D coordinates of anatomical relevant points, as well their prescription, used to personalize the spectacles.

After that, they can use the co-design system to select among the different available frames of the catalogue, customize their colour, choose the temples decoration and colour and the kind of lenses.

Finally, a review with the optician's advice of the selected configuration allows ordering the fully personalised Optician2020 spectacles.

To analyse the customer's opinion, expectations, wishes, etc. 3 surveys had to be fill: one once the order has been made, one once he/she receives the spectacles and the last one after one month of use.

The optician, who helped the user during the process, has to also fill 3 questionnaires to capture, from their professional view, the impressions they have about the customer's process.

2.1.- Capturing Process

The main objective of the scanner system is to build a 3D image of the user's face and then calculate a number of anthropometric measurements.

The process is guided by an iPad application that allows users to introduce data, to manage the right positioning in front of the scanner, and to help on troubleshooting problems. The device, handled by the optician, was very helpful in the process, as its lightness and fast processing gave the user a versatile tool to accomplish its task. No complains has been received by its use, only some minor problems related to the Wifi connection (a common issue in many wireless devices).

After the capturing process has finalized, the user is able to see its own face on 3D while the results of the scanning are sent to the co-design device.

The scanner, composed of cameras, computer, IR and visible lights, has been developed with a detachable head, so all these electronics resides in a relative small device that can easily be placed in different stands.

Compared to the scanning process in Made4U, the device performs more robust (no issues with cameras or other hardware), faster and more accurate. The process is now more independent of the ambient light conditions, but it should have to be improved in order to allow use it in any optician shop, as some complains has been received by the opticians use when the light conditions highly vary.
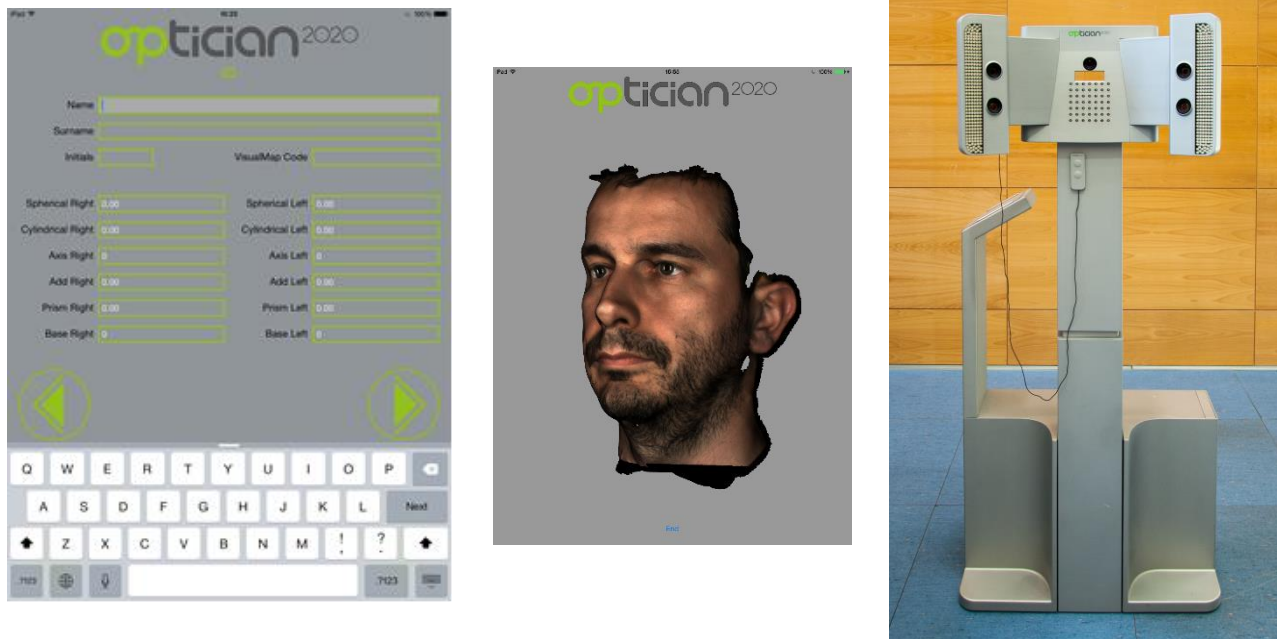
Fig. 1. From left to right: Data acquisition in the iPad device, 3D model shown to the user and Scanner device

2.2.- Co-design Process

The co-design system guides the client in the aesthetic personalization of frame and lens configuration process, including try-on of the virtual frames and lenses, as well as technical demonstrators of the benefits of coatings, materials and lens design.

The system combines two environments:

- **Self-personalization module** for the frame and lens aesthetics personalization. The client does not need an assistance of the optician during the aesthetic personalization and can try different combination of frames and lenses.

- **Optician-assisted module. Technical personalization.** For the configuration of technical aspects of the lenses and aesthetic advice, the optician assists the client.

The system includes a realistic virtual try-on to reduce the perceived risk of buying a non-existing spectacle. The composition of the virtual rendered images of the frames, wearing position and the pictures of the user face are attractive and credible. The client has the possibility to check how the personalized spectacle suits in him/her face, and customize some aspects of the frames and lenses.

The assisted co-design software is versatile and adapted to opticians selling process.

2.2.1.- Self-personalization module

2.2.1.1.- Recommendations for frame selection

The device recommends frames according client emotional expectancies in order to assist the client during the selection. The emotional concepts for recommendation are elegance, originality, lightness, youthful style and resistant. The system proposes for

each frame model a different configuration (base colour and decoration) according to the emotional concept expected by each client.
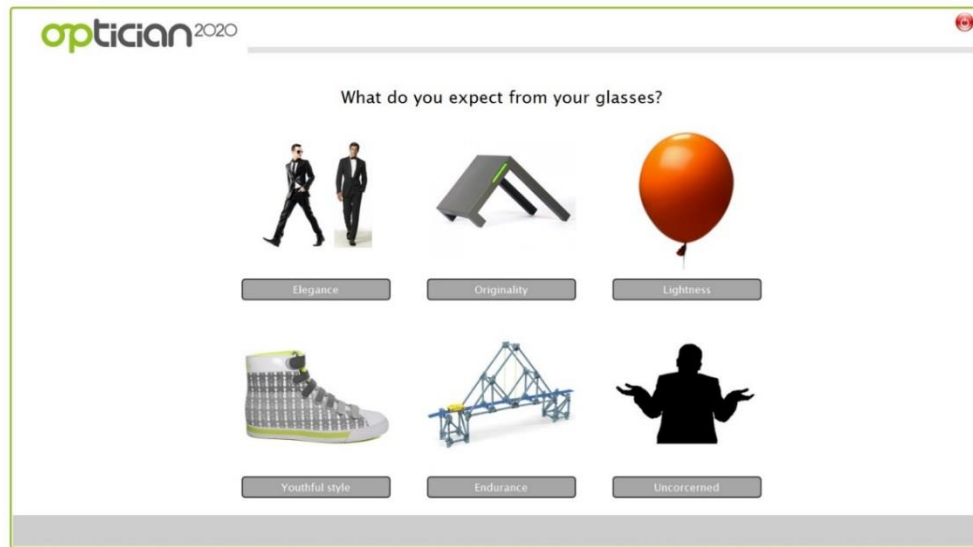

Fig. 2. Client emotional expectancies input

2.2.1.2.- Personal catalogue

Co-design system offers the client his/her personalized catalogue. This personalization is double:

- Dimensionally personalized frames. The client is able to try-on a virtual catalogue of personalized frame according to his/her anthropometrical dimensions.

- Filtered lens and frames catalogue. According to client anthropometrical dimensions and optical prescription, the system shows in the catalogue only the frame modes and lens model feasible from a manufacture point of view. This filtering process prevents the client to select options not feasible to his/her characteristics.
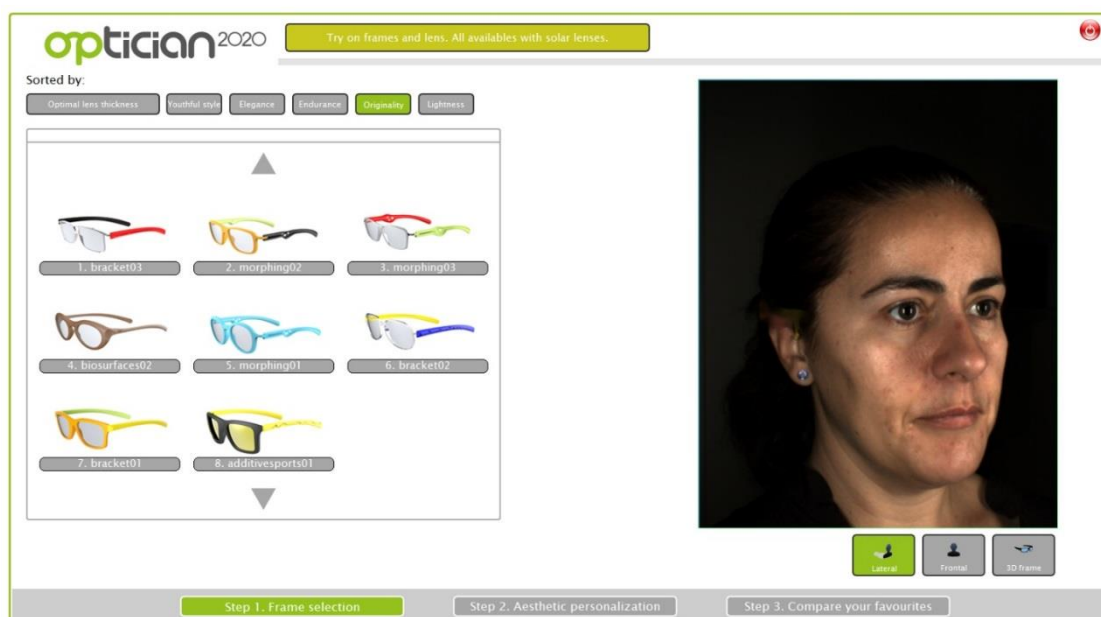
Fig. 3. Frame personal catalogue

2.2.1.3.- Aesthetical personalization for frames and lenses

Co-design system offers different colours to personalize the frame frontal and temples (polyamide). Two different finishing options of the material, brilliant and matt, are available for metallic frames. According to the frames selected, the user has the option to also select different decorations for the temples.

Regarding lenses, the client is able to choose the aesthetics and some functionalities of the lens. The catalogue includes solar lenses with different colours, anti-reflecting coatings with different residual colours, mirror coatings, photochromic, polarized lenses and transparent lenses.
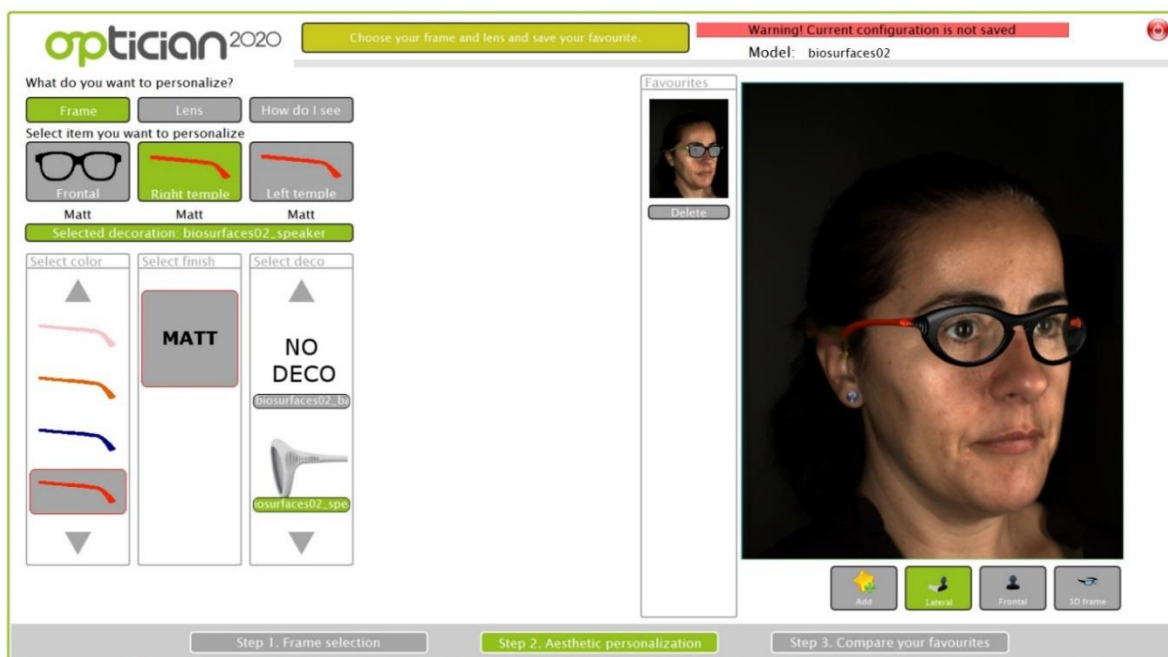
Fig. 4. Aesthetical personalization for frames
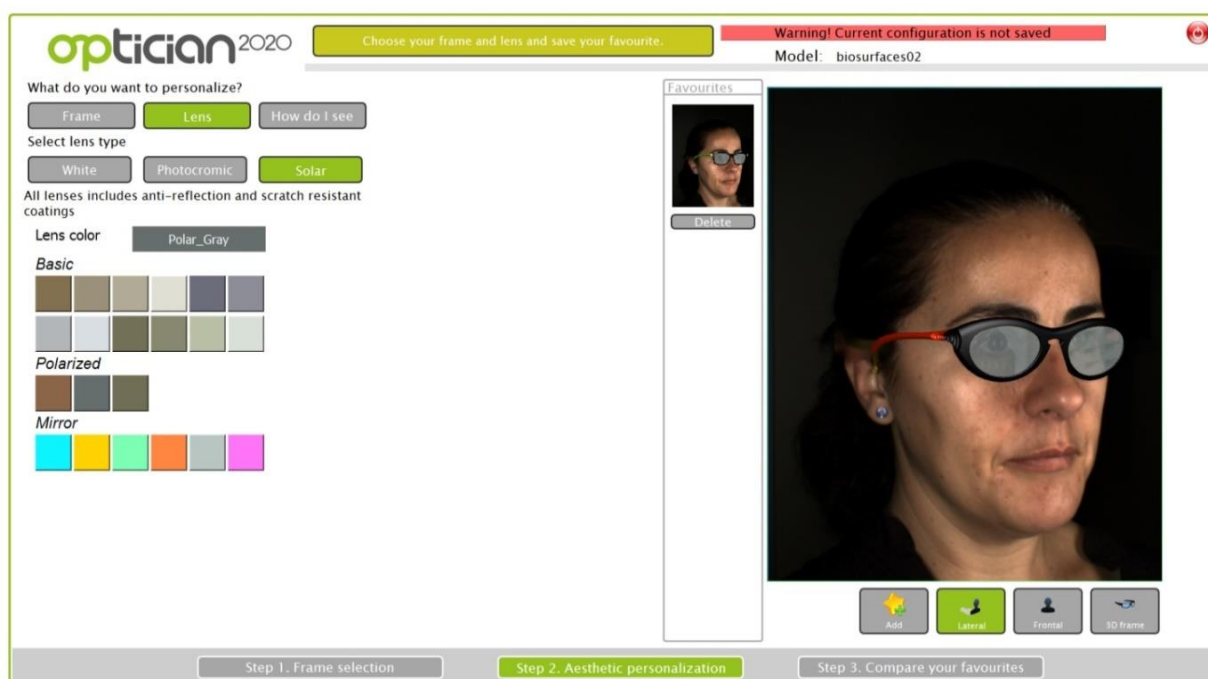
Fig. 5. Aesthetical personalization of lenses

2.2.1.4.- Assistance in lens configuration options: "How can you see"

The co-design system includes a module "How can you see". The system demonstrates the benefits in vision quality of the available configuration options for each type of lens.
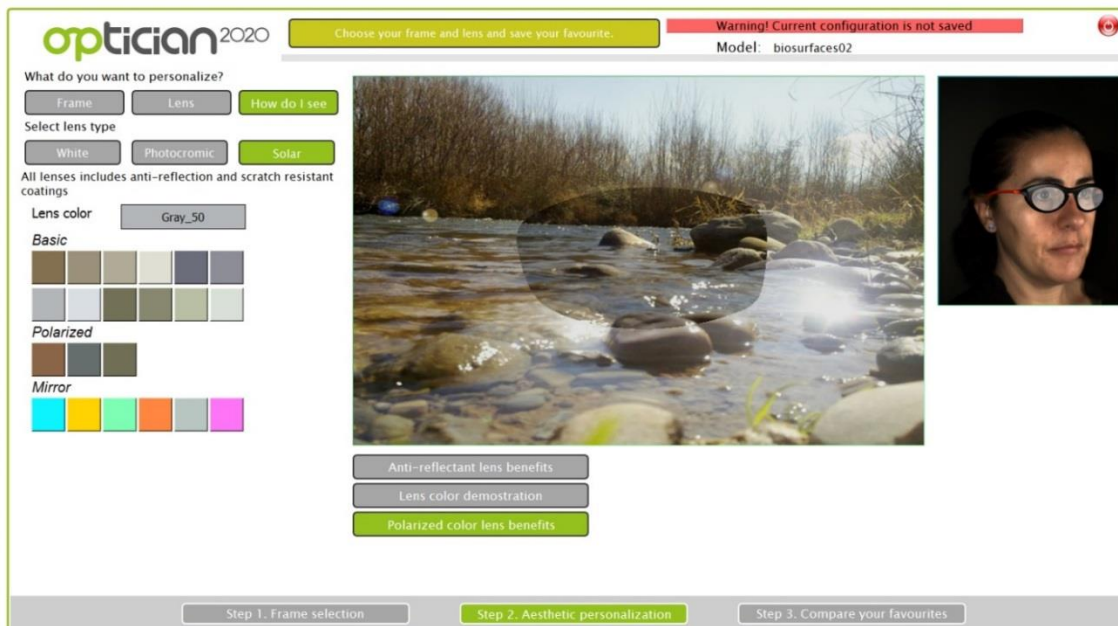

Fig. 6. How can you see

2.2.1.5.- Realistic virtual try-on

The virtual rendered images of the frames are attractive and credible, with an accurate wearing position over the pictures of the user face. A frontal and a lateral view of the client are available to try-on customized glasses and see how it affects the selected options. The client has the possibility to visualize the glasses with a 360° point of interactive view while he/she is changing colours, decorations and so on.

Fig. 7. 360° 3D glasses view

During the personalization process, the client has the option to save favourite configurations to compare between different models and options. When the client has configured up to four glasses he/she has the possibility to compare the "favourites" and check the details of each glasses.

2.2.2.- OPTICIAN-ASSISTED MODULE. Technical personalization

2.2.2.1.- Glasses selection according to aesthetic and lens thickness

In this screen, the client, together with the optician, selects a pair of glasses in order to continue the personalization process. The optician gives advice to the client about the lens thickness for each favourite glasses to select the glasses according to functional and aesthetics criteria. An edge thickness comparison between every lenses and every favourite frame is available to ease then selection.

2.2.2.2.- Assistance in lens material selection

Once the user selects its favourite frame, the system guides thought the technical personalization. The first technical aspect to select is the lens material. For the selected frames a sketch permits to compare the lens materials available. The sketch shows lens maximum edge thickness, lens minimum edge thickness and lens central thickness   to   compare.
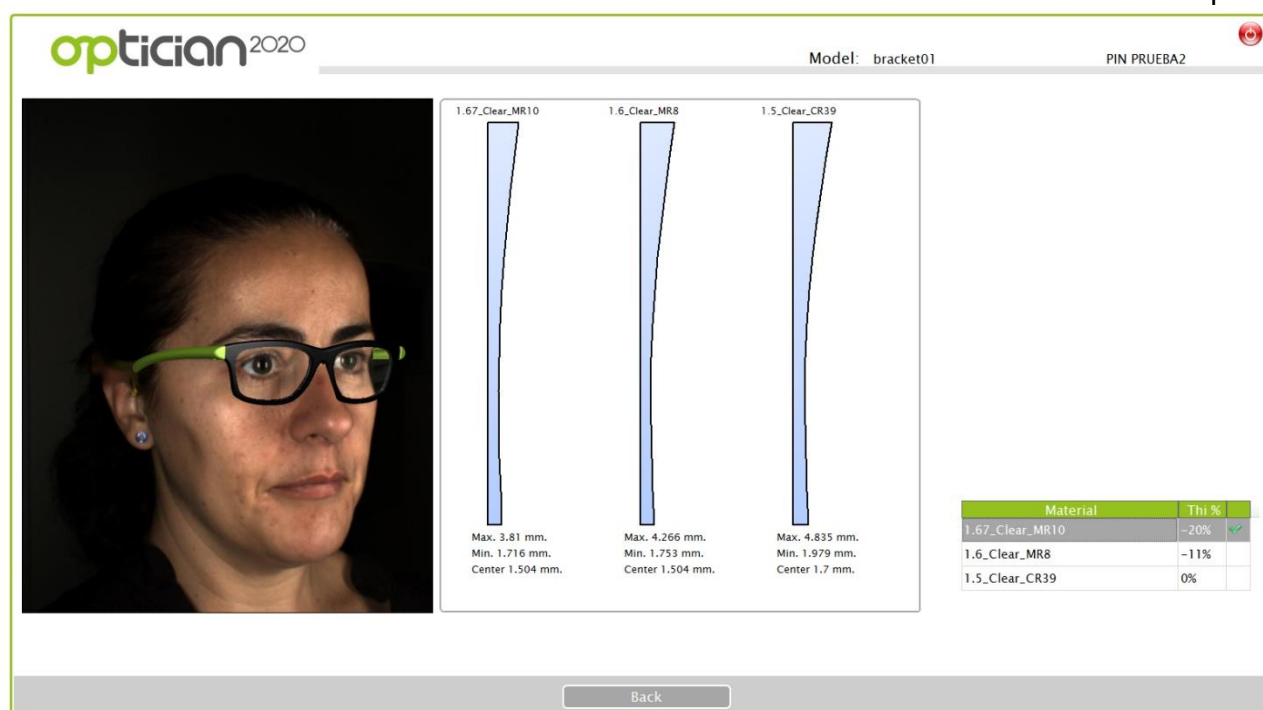

Fig. 8. Lenses info

2.2.2.3.- Purchase order

Once the customer is fully satisfied with the design, the spectacles are ready to be ordered by the client, generating a purchase order. The system assigns a job number to this purchase order. The job number will be the id of this order during the complete process, and it will allow tracking the state of the manufacturing order.

3.- OVERALL ASSESMENT BY THE OPTICIANS

Opticians PITA and Lensworld were asked to get their general feedback about the whole Optician2020 process and the spectacles that were delivered to their customers.

3.1.- Lensworld

The general feeling about Optician2020 process and spectacles is quite good. A high percentage of users though that the Optician2020 proposal was innovative and were satisfied with the process and the personalized spectacles. Both customers and Lensworld staff though the system was fast, accurate and innovative.

Lensworld staff was able to use the scanner and the co-design system easily. They were ready to handle the system after a short training. During the demonstration phase, they found some minor issues that did not impede to finish the process. The scanner did not detect only two customers, so they could not finish the process and obtain their customized spectacles. These cases were due to some out of the normal anthropometric parameters, like very high interpupilar distance or very big corneal reflections.

The minor issues they found were mainly related with the co-design system, with some crashes and some information display problems that can easily be solved with the help of the trace log stored in the system.

Regarding the UI flow control of the co-design system, while it has been simplified compared with the Made4U version, Lensworld's staff still found it is not intuitive enough to allow the users use it by their own, without the opticians support.

The scanner stage generally acted quick and robust, and customers found it was a very innovative and highly technical development. It had some environmental light issues, as it could not perform completely light conditions independent. Even the many improvements done to solve that same problem occurred in Made4U, it was not enough to avoid big luminance changes affect the scanning process. This could cause to make it difficult to place the scanner in opticians' shops without analyse and solve the complete lighting range.

The possibility to have real samples was highly appreciated by the customers to feel and touch them (80% of the customers showed their liking to this option).

They found the realism of the images and the simulated personalized spectacles was very high, with a small amount of users complaining about the colours of the real frame and the real lens colour compared with the virtual ones. As a suggestion, Lensworld proposes to show the customers face moving with the frame on, not only in frontal and side pictures.

In Fig. 9, there is a comparison between the real samples and the virtual ones shown during the co-design stage. As it can be appreciated, the similarity is quite high. There are some differences in the mirror lenses reflections, but this is due because it is very variable depending on the light conditions.

The accuracy of the measurements were high, especially the interpupilar distance and the height of the pupil.

Some users with narrow nose on the top and very large width in the base found unwearable the spectacles because the spectacles bridge was too small, as the nasal width is measured in the part of the nose located between the corneal reflections.

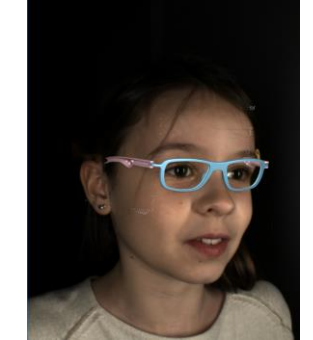**Real Glasses**

Virtual Glasses

Fig. 9. Real vs Virtual glasses

A high percentage of Lensworld customers (around 80%) were quite happy and excited about the models of the catalogue. Bearing in mind that this is a small set of models due to the projects nature, it is a very high acceptance. Some complains were related about this small number of models. Others about the colours, as they thought they were too strong/flashy. Some pastel colours in this case would have been appreciated.

A few customers complained about the frame designs, considering them too modern (they had preferred a more classic or rimless style).

3.2.- Pita

Pita already took part in the Made4U project, so their opinion about the improvements done in Optician2020 compared to Made4U is very important. Their general opinion is very positive, and they have appreciated a big step forward from Made4U to Optician2020 project.

As it happened in Lensworld, Pita stuff quickly acquired the necessary skill to handle both the scanner and co-design system. It was not needed to extend the training more than 1 hour per user.

They also have some problems during the scanning phase with a small amount of users (4.5%) that were not detected by the scanner. The scanner uses the corneal reflection to detect the customer's position in the calibrated space, so again, due to out of the normal characteristics of these users they were not able to be found properly.

Regarding the co-design system, they found it almost function well, with some minor problems. The customers appreciated this tool and they had a good experience.

After using all the systems (scanner, co-design and platform), Pita stuff were amused with the improvements and the Optician2020 experience. They felt also that the realism was much more accurate than the Made4U solution.
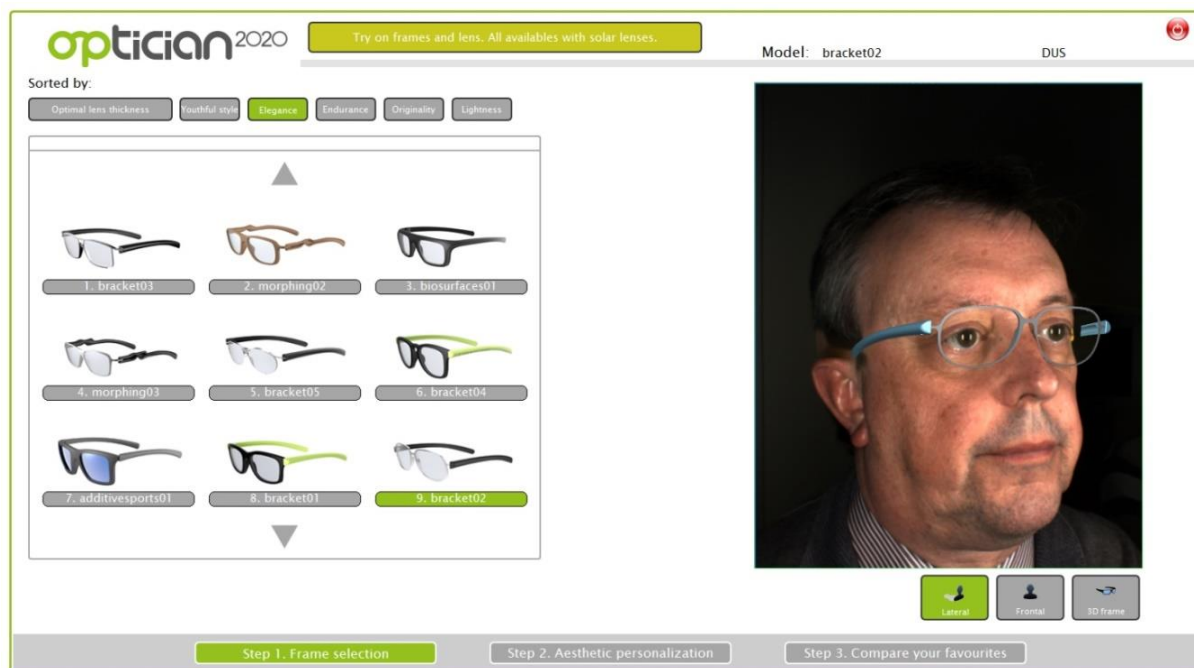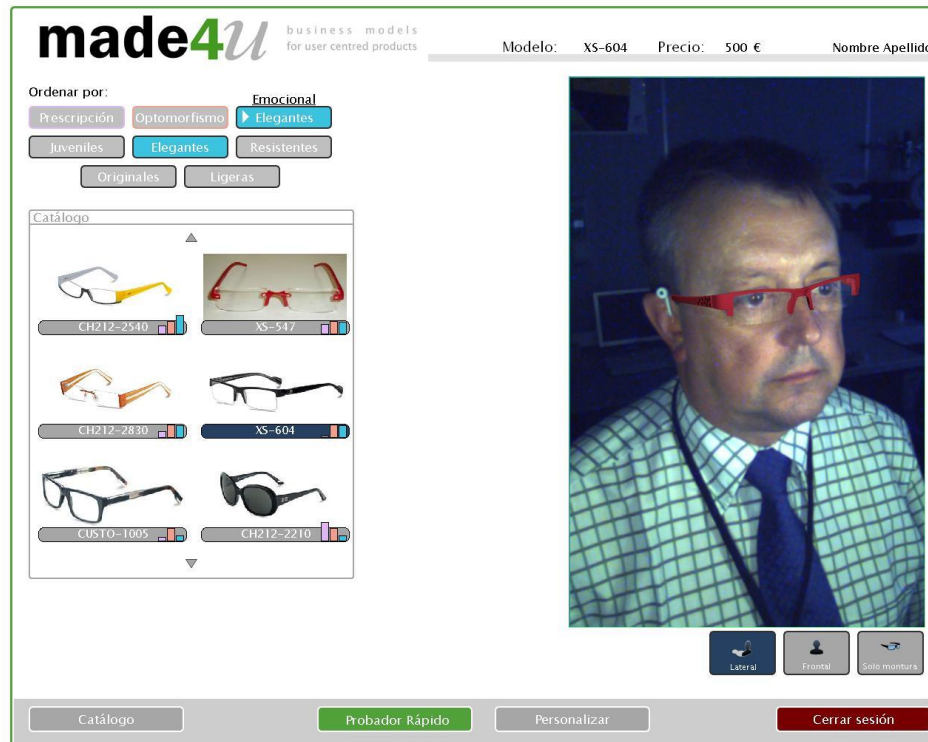
Fig. 10. Made4U vs Optician2020 co-design

As is can be seen in the previous illustration, the colour calibration process done in the scanner achieves an image with better white balance and more real colours. The increment in the camera resolution, the better optics, the digital erasing of the tool gadget and a closer and more natural plane also helps the user to have a better idea of what the glasses will look like when he/she would wear them.

Pita stuff also considered the information on the platform was useful, accurate and real time, necessary to track the orders.

The customers' general opinion about the catalogue was positive (especially for those who had already participated in the MADE4u project, they really appreciate the

improvements). Regarding the colours, the offer in general was enough, only some of them missed the white colour at the frame of the sunglasses. The colour of the lenses (mirror effect) really satisfied and surprised them.

Pita users had the same impression about the catalogue offer as Lensworld customers: they would have preferred more conventional and traditional shapes, but taking in account that it was a demo phase of an European project, they assumed that the offer should be reduced and more innovative.

They also appreciated the possibility to have real samples to manage the expectations of the customers. It helped them to know what they were going to receive as finishing of the materials.

4.- DETAILED ANALYSIS OF CONSUMERS AND OPTICIANS EVALUATION

This section provides a detailed analysis of the feedback received both by end-users and opticians. First details on the collected data are presented. Then, analysis of customers surveys at the different stages of the process (purchase, delivery, after 1 month of use) is shown. Finally, analysis of conducted surveys on opticians is provided.

4.1.- Data collected

The questionnaires for the end customers consisted of questions about their impressions and feelings about the process, the product and its potential price. The questions for the opticians were mainly related to end customer segmentation data and time and perception checks.

The questionnaires were prepared using the online tool Survey Monkey, to ease the input and export of the data and its subsequent analysis. Likert Scale has been used is some of the questions to evaluate the user's level of agreement with the question, being 1 total disagreement to 5 total agreement.

The next Figure shows the total sample of users used for the surveys analysis (1.824 in total).
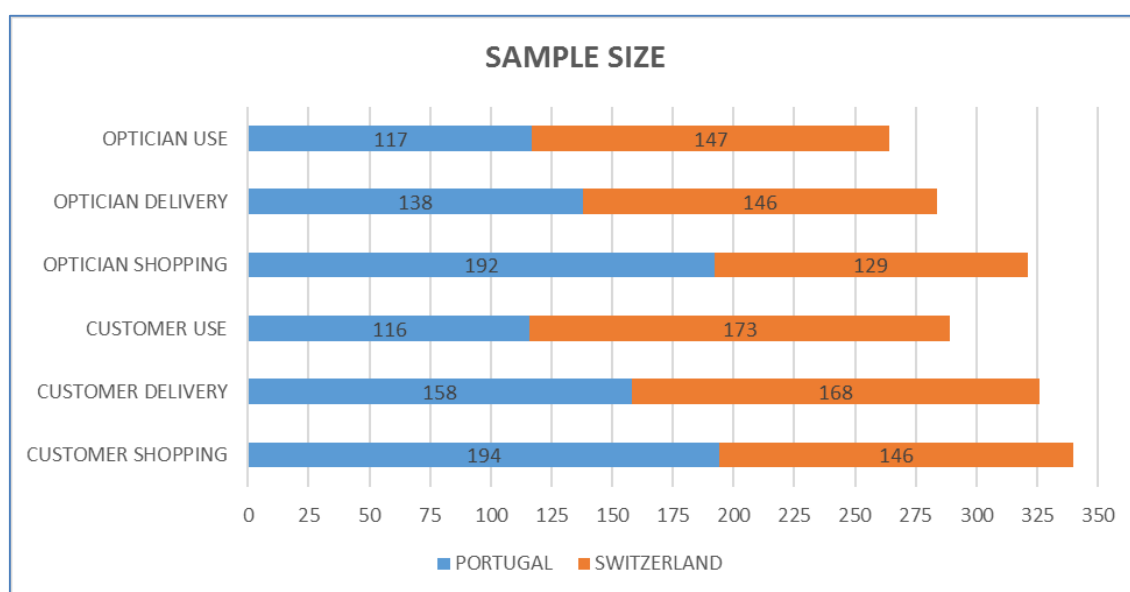
Fig. 11. Sample size

The gender distribution was quite uniform, showing an average of 56% of female customers and 44% of male customers (see Fig. 12).
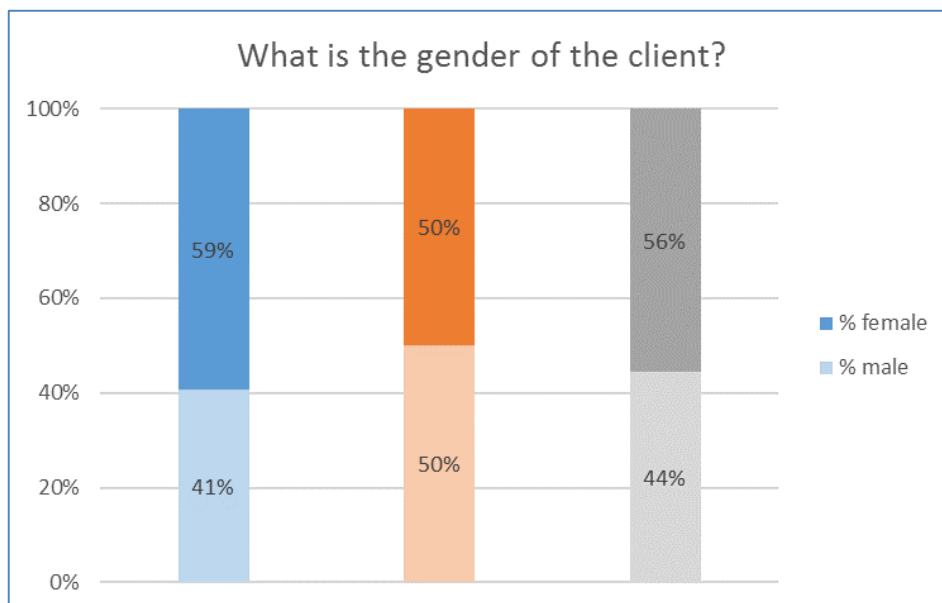

Fig. 12. Gender segmentation

Regarding the age distribution (see Fig. 13), in Switzerland the 50 percentile corresponds to 45 years, and 75 and 25 percentile to 56 and 30 years. In Portugal, these percentiles correspond to 40, 47 and 27 years, concluding that a younger population composes the Portuguese customer's sample.
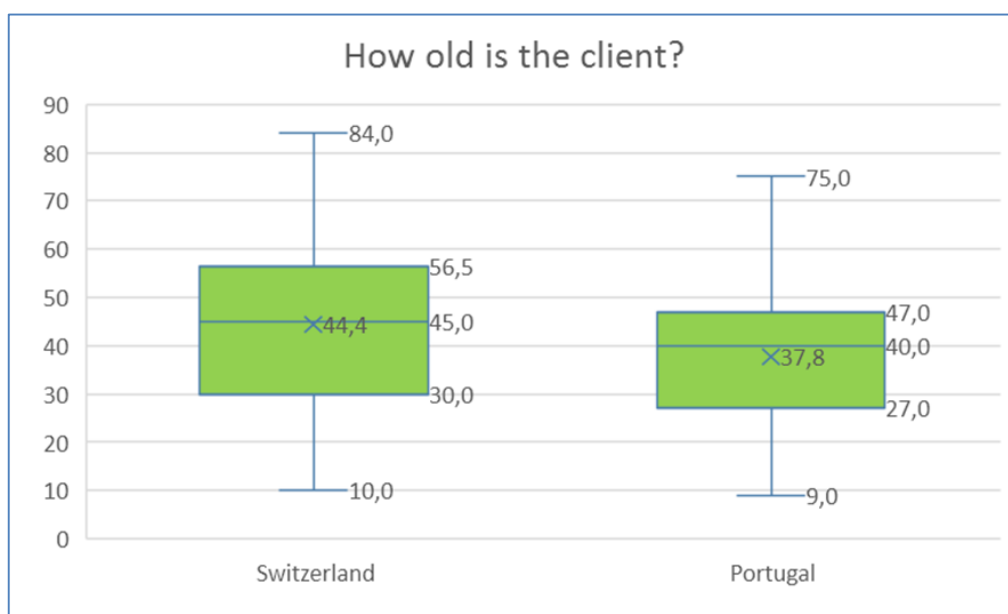

Fig. 13. Age Segmentation

4.2.- Analysis of costumer's surveys

4.2.1.- Customers after purchase

4.2.1.1.- Shopping experience

From the surveys made for the customers after completing the scanning, co-design and purchase stage, we can extract that the new shopping experience has a high acceptance level, with an average of 4.72 over 5 (being 5 the maximum acceptance).
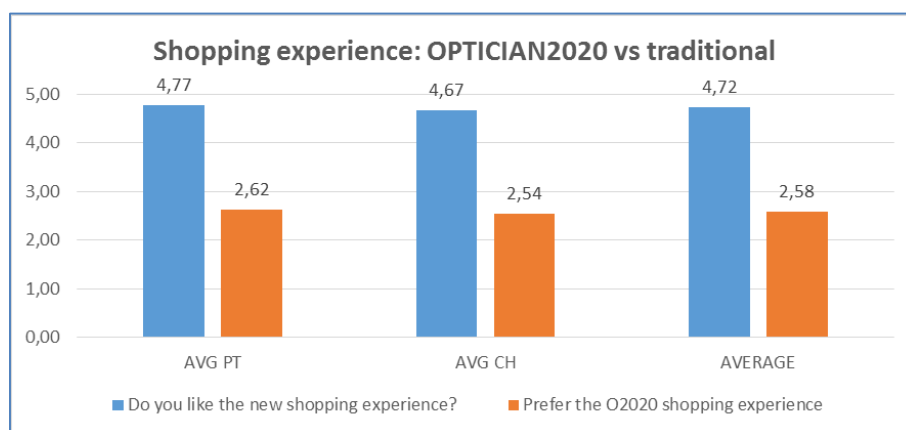
Fig. 14. Shopping Experience

Compared with the traditional experience, customer doesn't reflect a clear preference over the traditional one. Even that they clearly like the new experience, a 2.58 over 5 means that customers like the new shopping experience more or less the same as the traditional one.

4.2.1.2.- Innovation
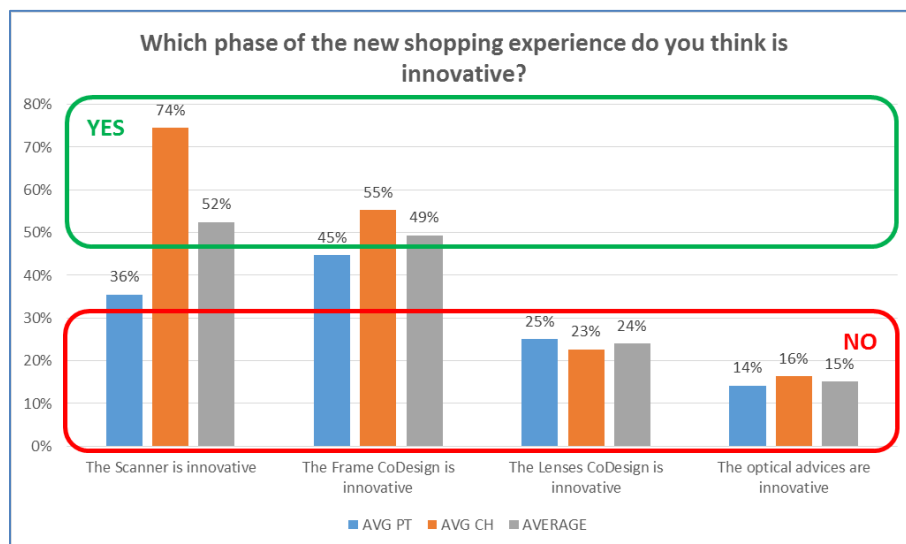
Fig. 15. Innovation

In Fig. 15, we can appreciate that the scanner stage and the frame customization stage in the co-design are considered as highly innovative, while the selection of the lenses and selection of technical features stage in the co-design are perceived at the cutting edge of innovation from the customers' point of view.

4.2.1.3.- Process time
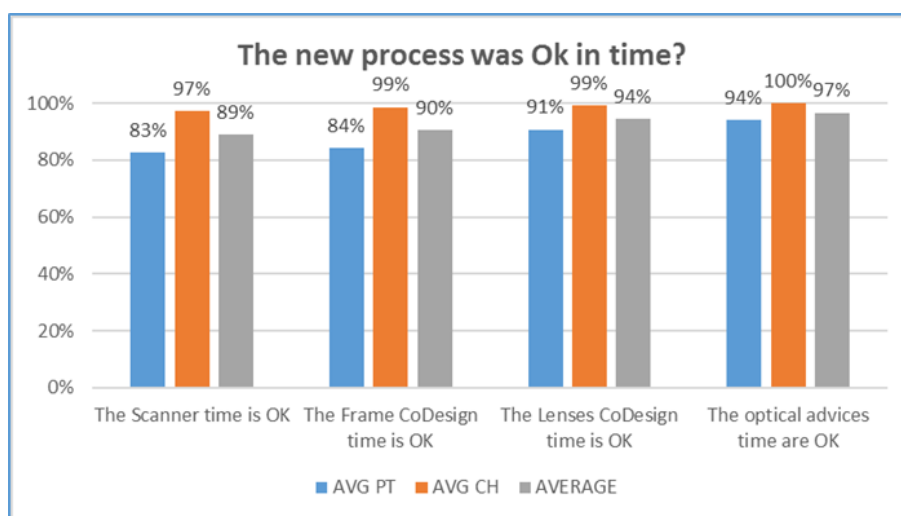
Fig. 16. Process time

The time spent in the whole purchase process (scanning and co-design) is considered as adequate by almost 100% of the customers.

4.2.1.4.- Price

Fig. 17. Price

Regarding the price, it's noticeable that when the customers are used to pay less in average for their spectacles due to cultural reasons, they have a bigger inclination to pay more for the new Optician2020 glasses, as is the case of Portuguese customers. By the other hand, Switzerland customers, which pay an average of 900€ per spectacles, are willing to pay less for their customized Optician2020 glasses.

4.2.1.5.- Benefits
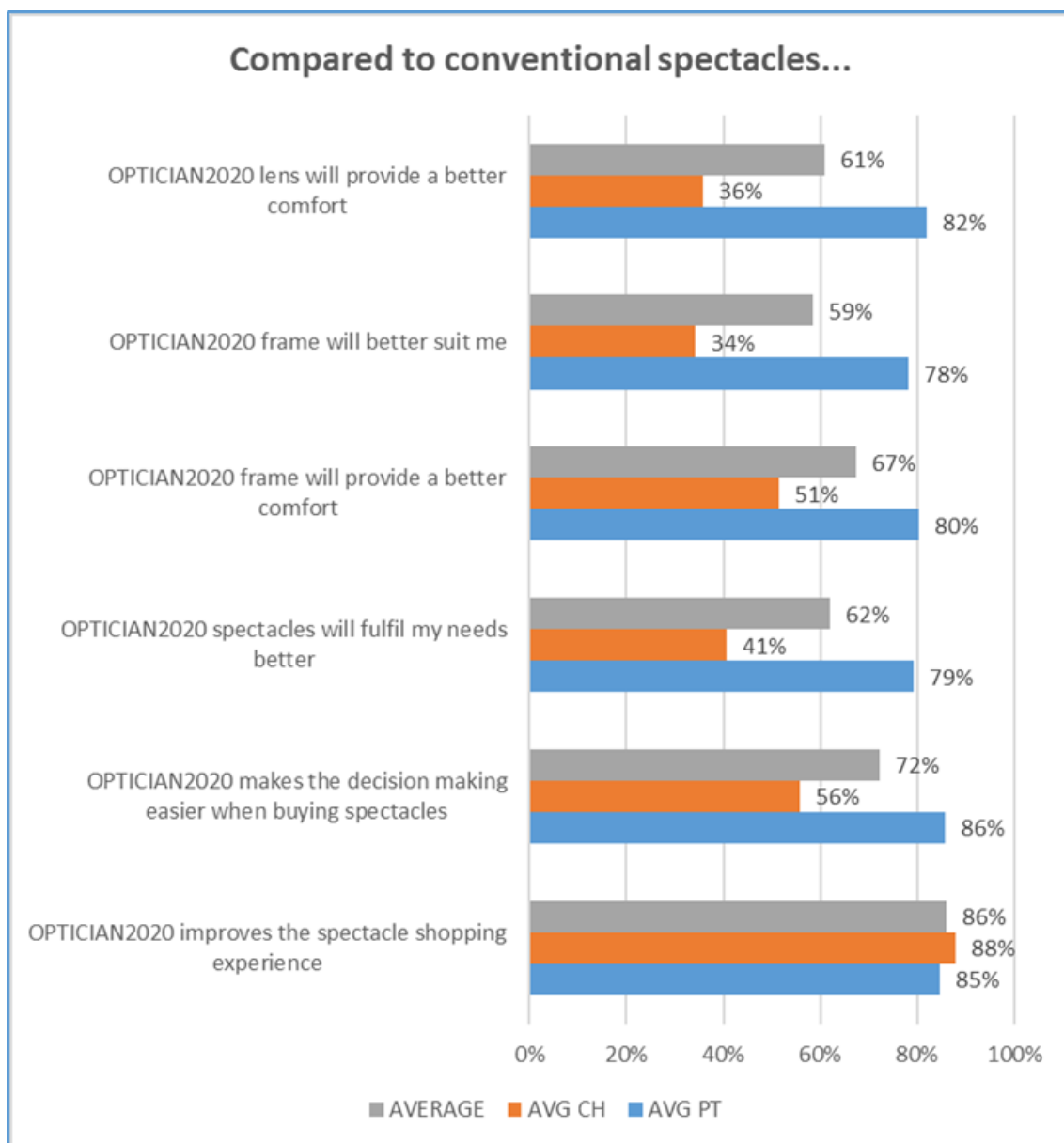
Fig. 18. Benefits

The benefits perceived from Optician2020 compared to the current shopping process vary significantly between Portugal and Switzerland customers. Portuguese customers think that Optician2020 will fit better their comfort and suit demands. Maybe due to the high price Switzerland customers pay for their spectacles they have more difficulties to perceive how this new product will improve compared to the current ones.

It's also noticeable that a high percentage of customers (more than 85%) consider that Optician2020 proposal will improve the spectacles shopping experience.
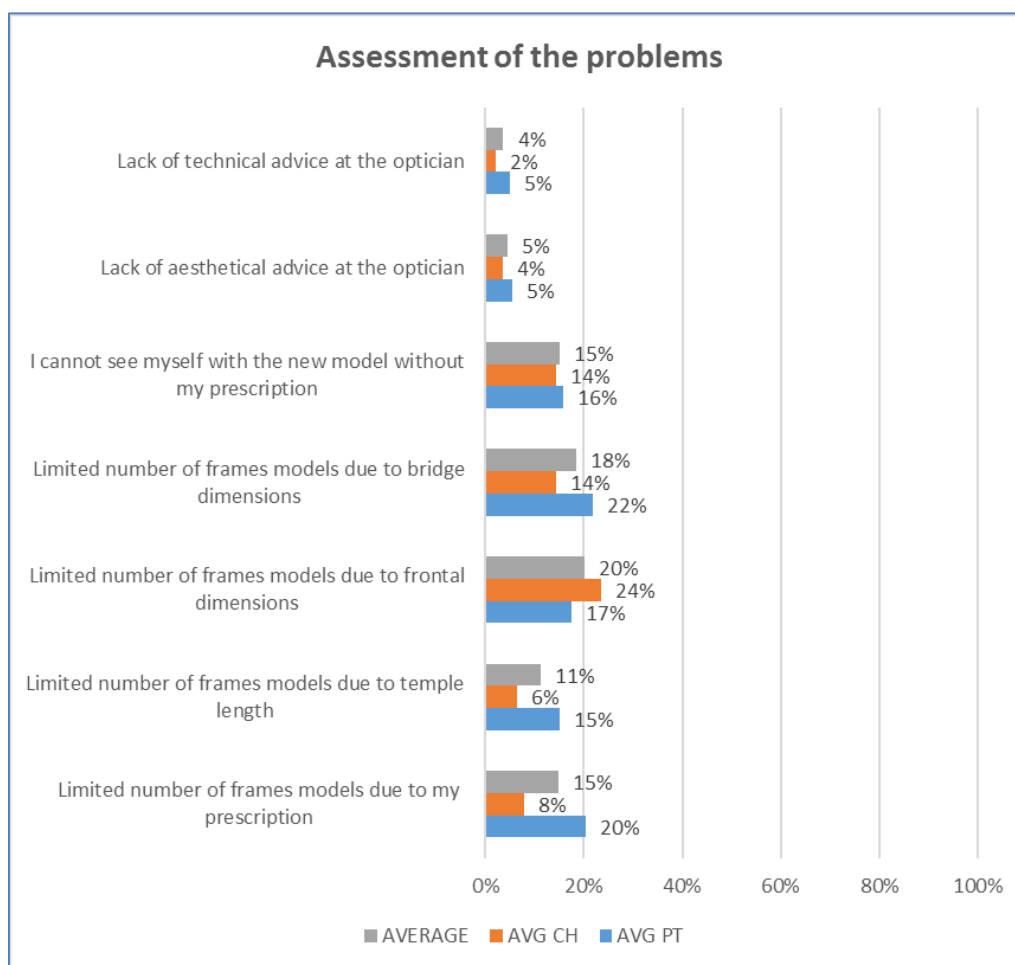
Fig. 19. Traditional shopping

The main problems related to the traditional shopping experience are the limited number of frame modes due to frontal dimensions and temple length, but they are not a common issue (around 20%). Another problem customers usually have is the impossibility of see themselves with glasses without their prescription. This problem is solved in Optician2020 experience, but probably due to some misunderstanding in the question, Portuguese customers still perceive this as a problem.
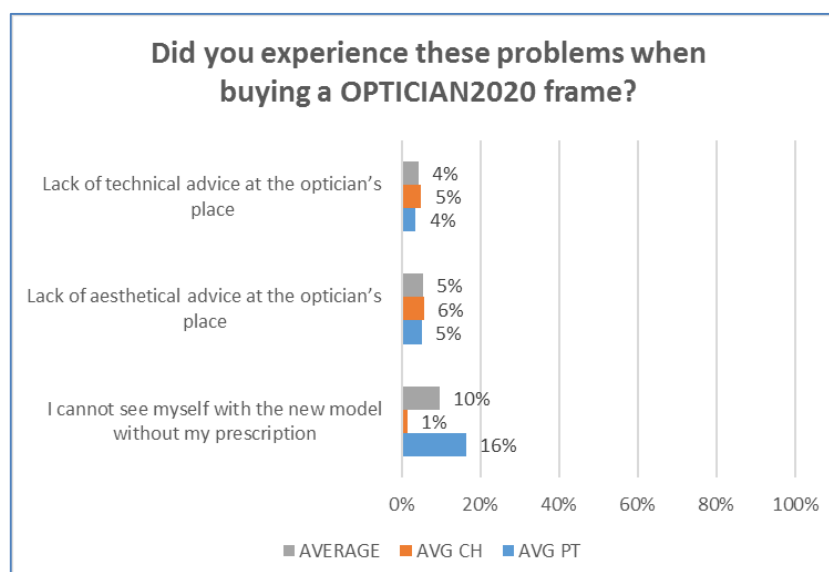
Fig. 20. Optician2020 shopping

4.2.1.6.- Scanning phase
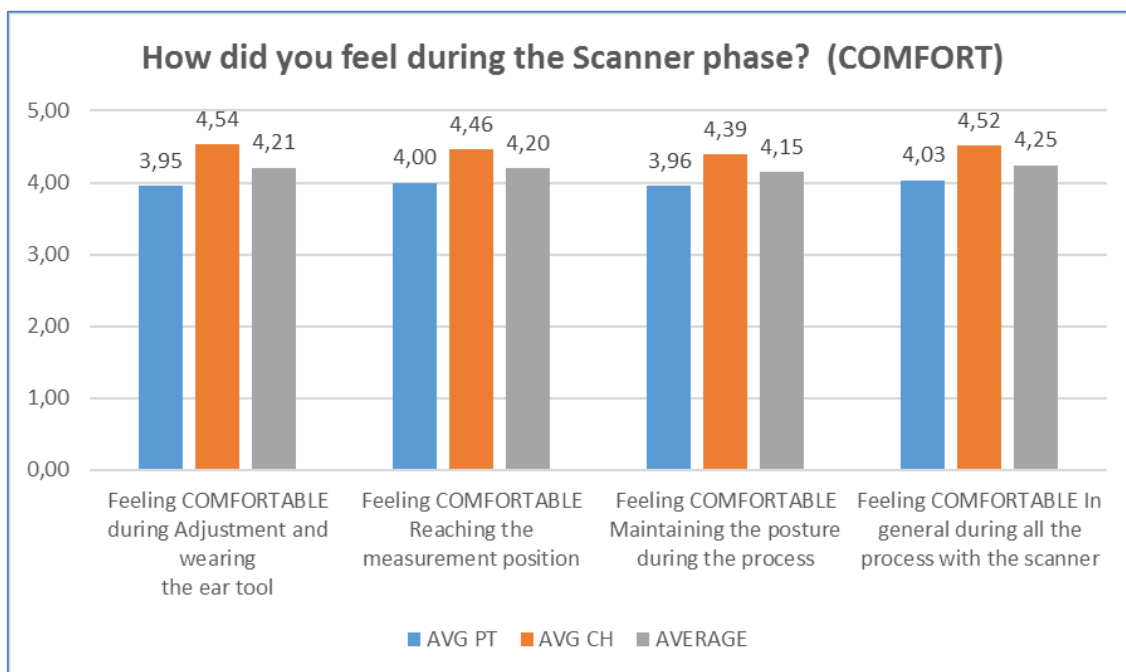
Fig. 21. Scanning comfort

The scanning stage can be considered as comfortable, given both Portugal and Switzerland customers assign a punctuation higher of 4 over 5.
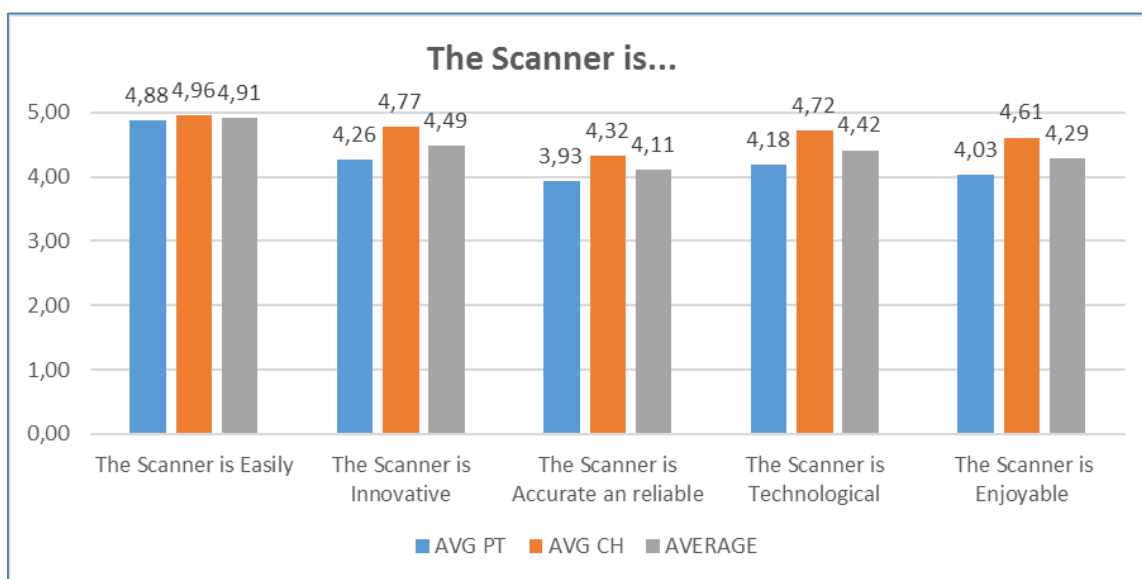
Fig. 22. Scanning opinion

This phase has been considered as easy (4.91 of average), innovative (4.49), accurate and reliable (4.11), technological (4.42) and enjoyable (4.29).

4.2.1.7.- Codesign phase
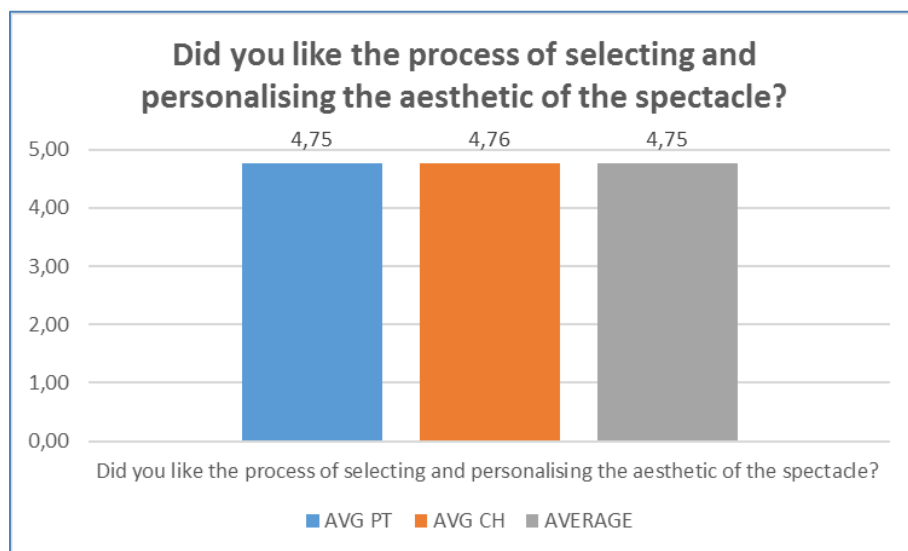
Fig. 23. Codesign Opinion

The co-design phase has been satisfactory for the customers, with an average valuation of 4.75 over 5.
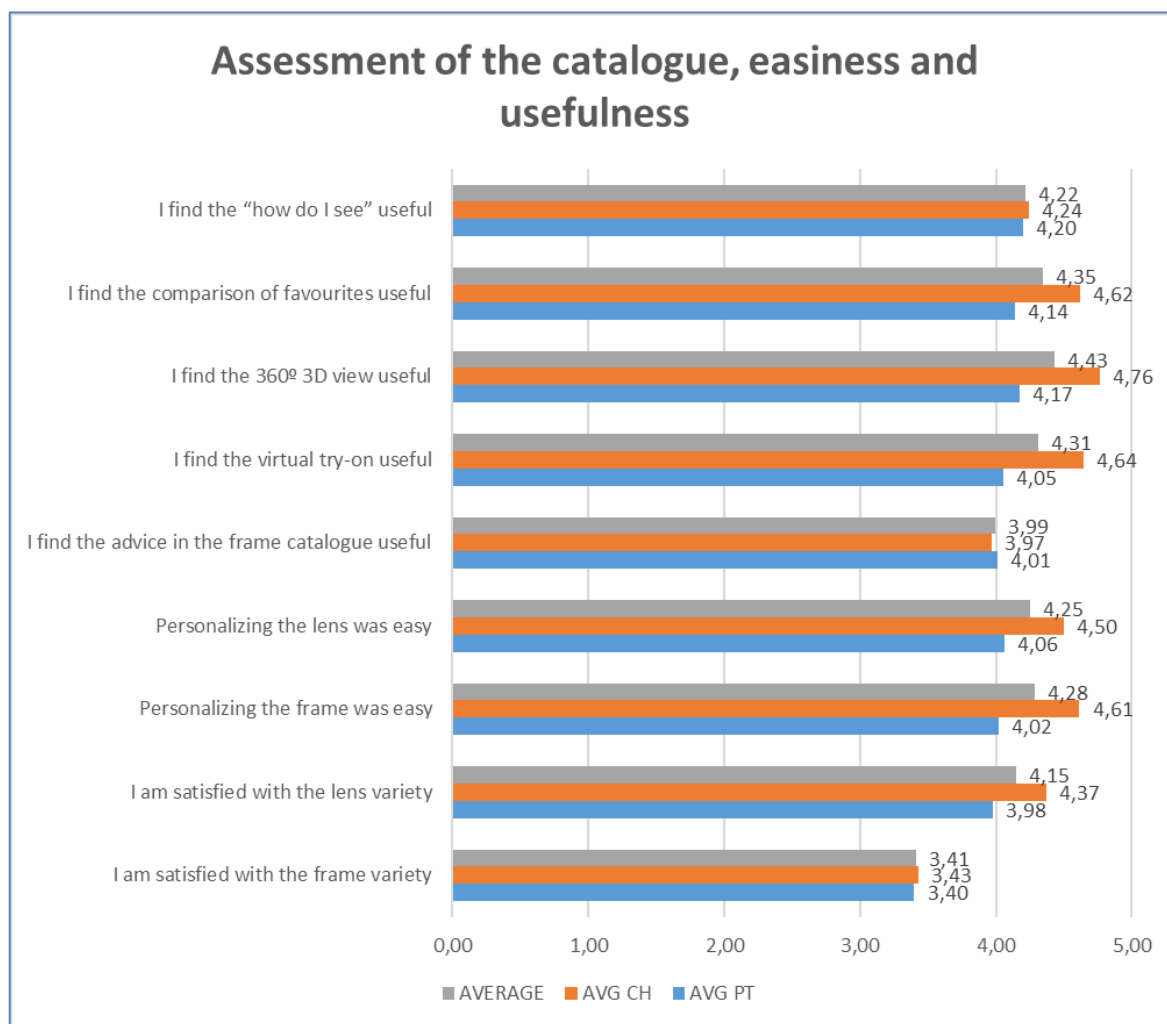
Fig. 24. Co-design assessment

All the stages of the co-design had been considered as useful (How do I see, favourites comparison, 3D view, …). As stated by the opticians, the customers missed more variety of frame models, but considering this as a project, the acceptance was quite high (3.41 of average).
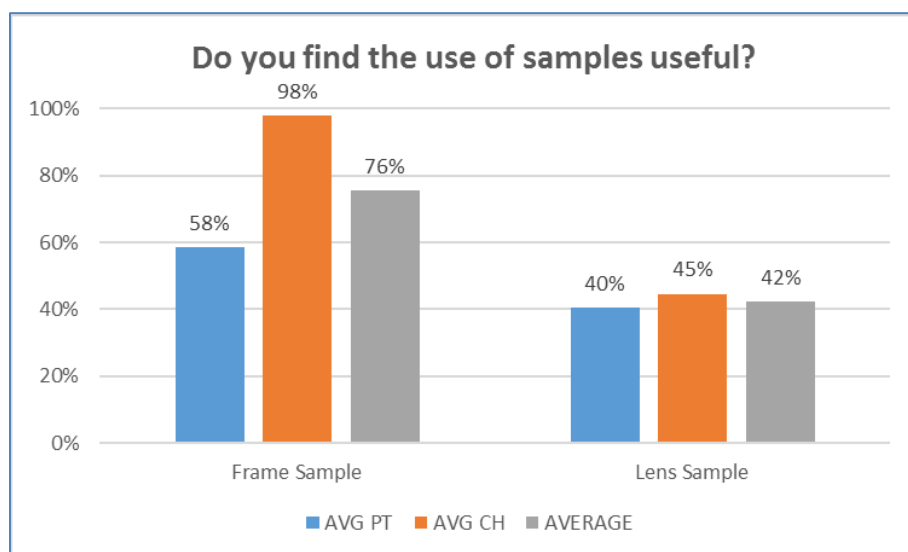
Fig. 25. Real samples

Having real samples of the frames and lenses was highly appreciated (especially by Switzerland customers).

4.2.2.- Customers after delivery

Once the customers received their Optician2020 personalized spectacles, they were asked to fill a questionnaire to check if their expectations had been fulfilled.

4.2.2.1.- Satisfaction
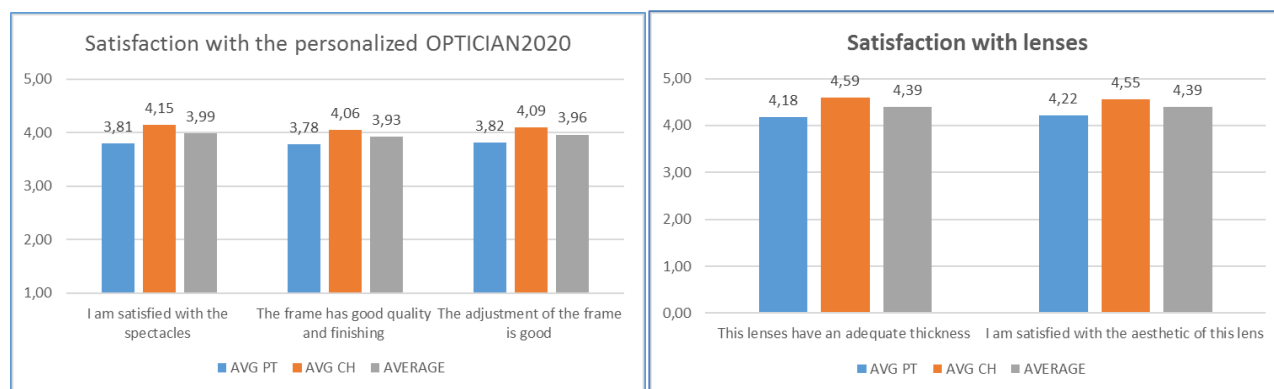
Fig. 26. Frame and lenses satisfaction

The customers satisfaction regarding the spectacles in general and the frame and lenses in particular, are very high, especially the lenses, with an average punctuation higher than 4 over 5.

4.2.2.2.- First impression
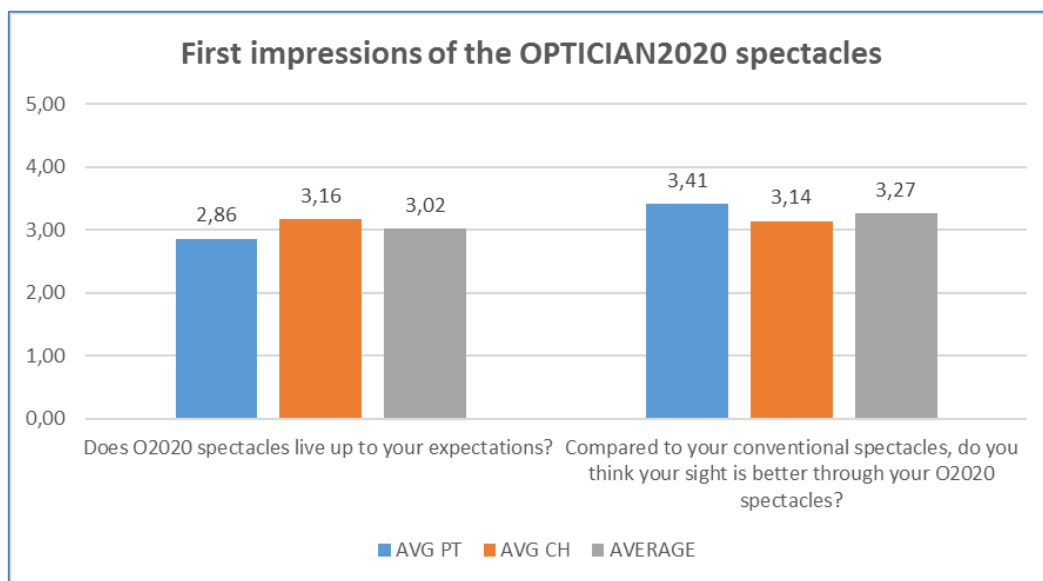
Fig. 27. First impressions

According to the data extracted from the surveys, that expectations had been fulfilled, with an average of 3 over 5. Comparing the sight of the new glasses with the traditional ones, they affirm that with the new ones they have a lightly better sigh.
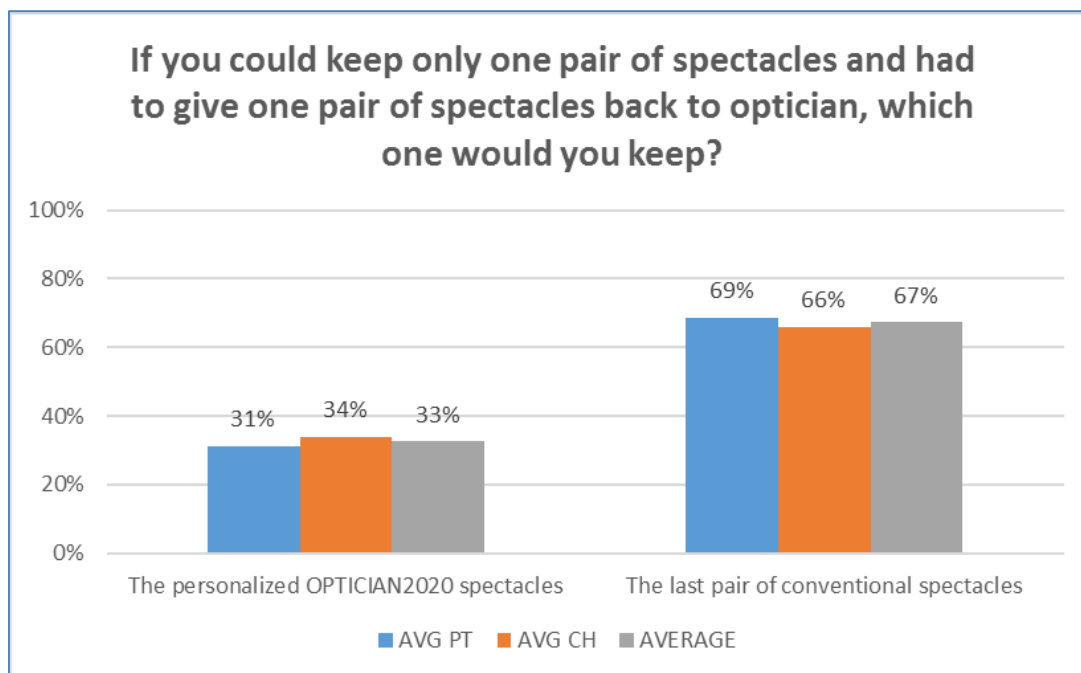

Fig. 28. Give back

Around 1 of every 3 customers will prefer to keep the new Optician2020 glasses, if they have to choose between to return their conventional glasses or the new glasses.
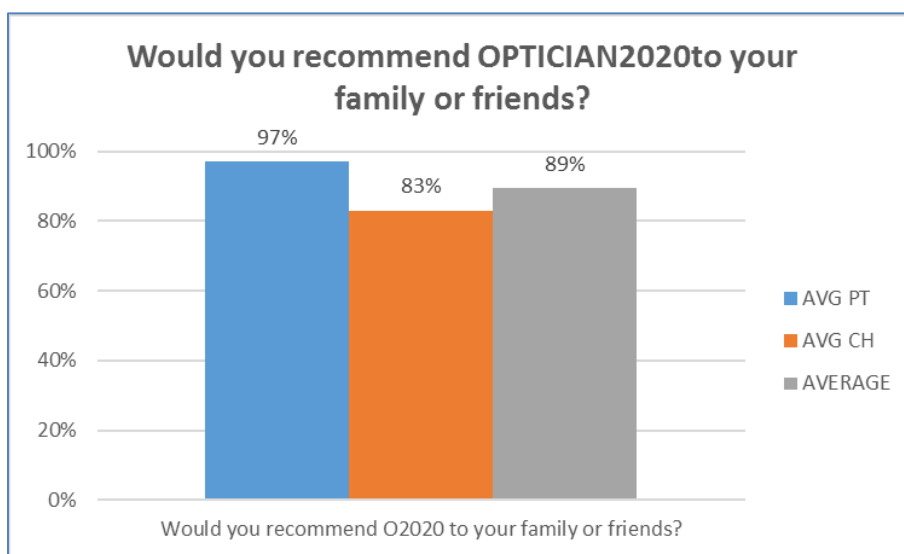
Fig. 29. Recommendation

A high percentage of customers (around 90%) will recommend the Optician2020 spectacles and shopping experience to their family or friends.

4.2.2.3.- Comparison with conventional spectacles
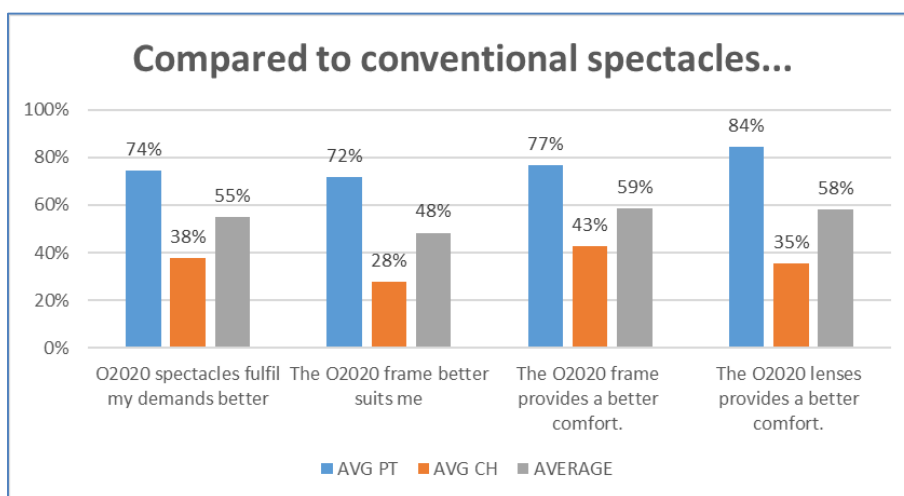
Fig. 30. Characteristics comparison

Portuguese customers find that Optician2020 spectacles had better fulfil their demands on vision and lenses and frames comfort. By the other hand, Switzerland customers don't specially highlight any of these characteristics better than the conventional spectacles.
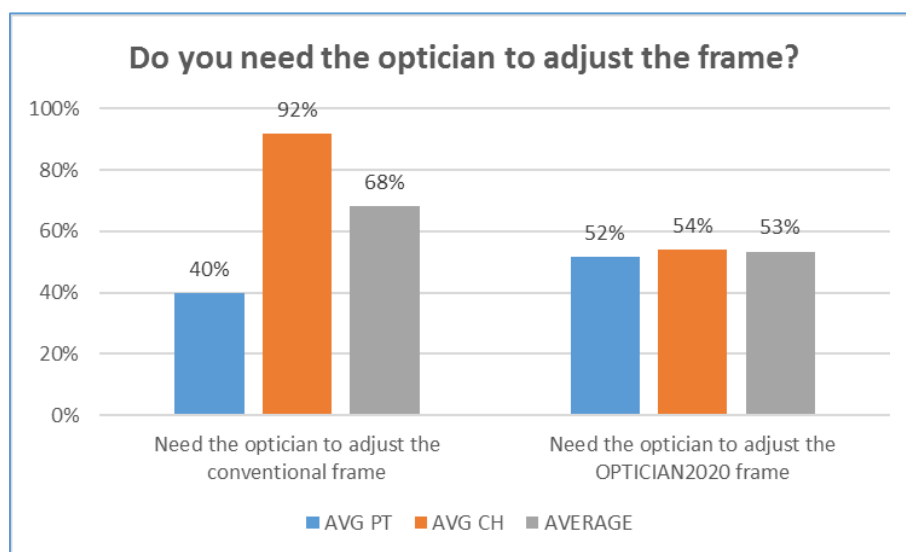
Fig. 31. Frame adjustment

The need of adjustment of the frame by the optician has been reduced for the Switzerland customers, comparing it with the conventional frame. However, the Portuguese customers affirm that, in average, the optician had to adjust the Optician2020 frames slightly more often that in then traditional glasses.
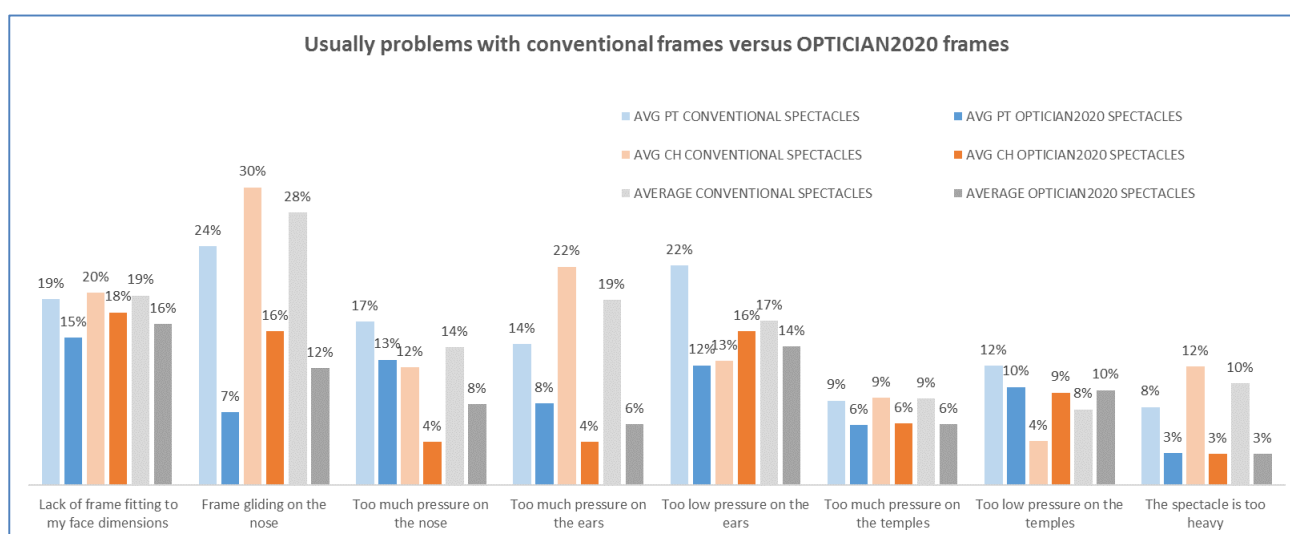

Fig. 32. Common problems

The average of users with comfort problems has been decreased comparing the conventional frame and the Optician2020 frame, specially "gliding on the nose", "much pressure on the ears" and "the spectacle is too heavy" ones. Only "low pressure on the ears" and "low pressure on the temples" problems occur more often for the Switzerland customers with the new glasses.

4.2.3.- Customers after 1 month of use
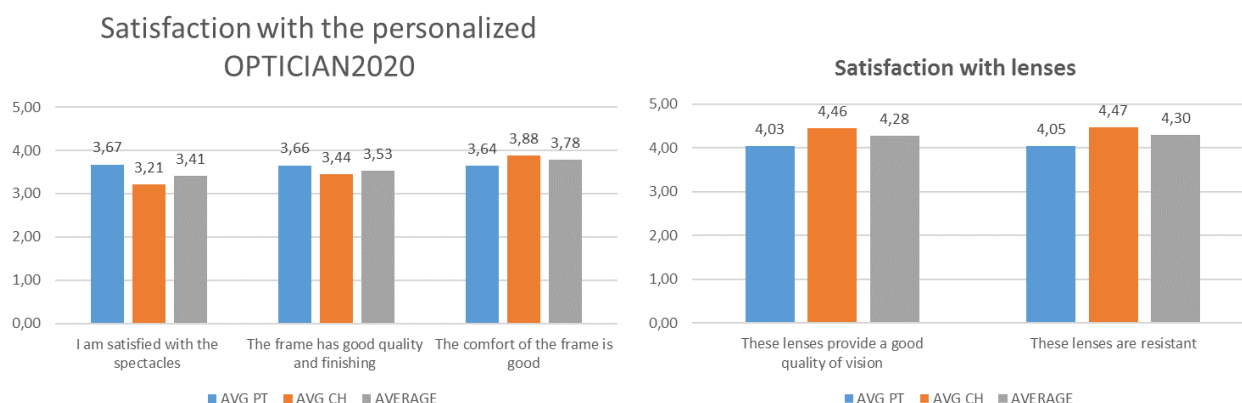
4.2.3.1.- Satisfaction

Fig. 33. Frame and lenses satisfaction

After one month of use, the average satisfaction of the customers keeps high. The lenses satisfaction continues in an average value of 4.3 over 5, while the frames have dropped 0.5 points of satisfaction in average, still in a positive position.
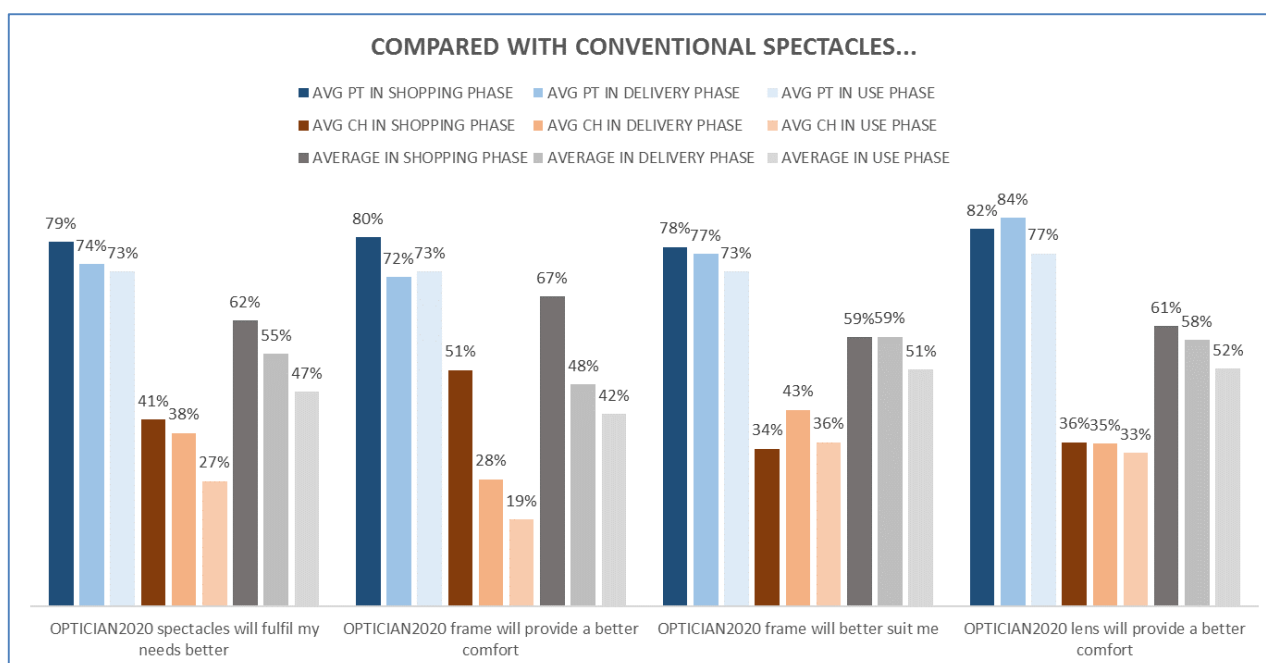
4.2.3.2.- Comparison

Fig. 34. Benefits comparison

Comparing the answers the customers gave on the three surveys during the demonstration phase, we detect a small decrease of the benefits perception the users have about the Optician2020 spectacles against traditional spectacles.
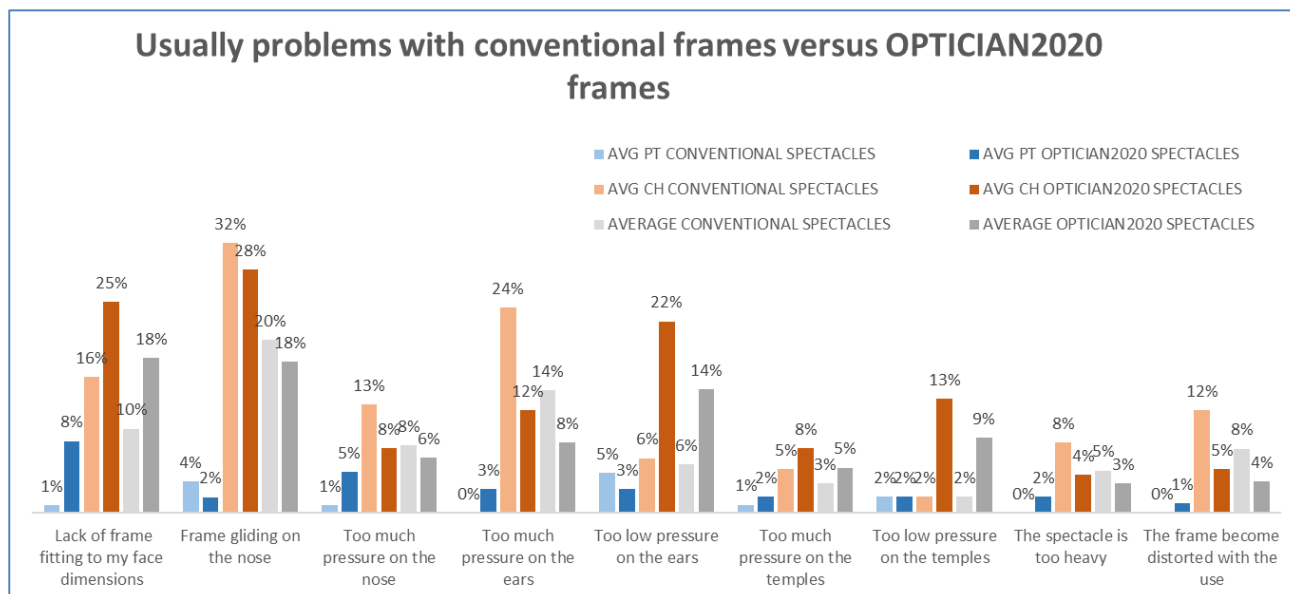
Fig. 35. Problems comparison

After analysing the problems comparison over the three surveys, we can conclude:

- Optician2020 spectacles reduce in general the common problems associated with the conventional spectacles (5 of 9 reduce their frequency).

- Portuguese customers have very low incidences percentages (usually lower than 8%).

- Switzerland customers have more critic answers, as it has been observed during all the analysis.
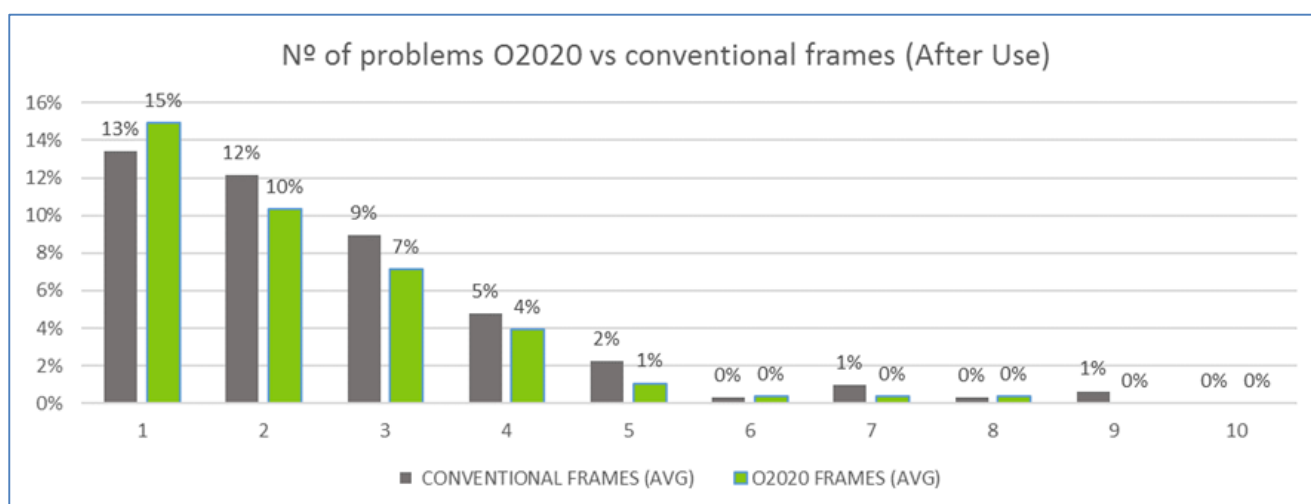

Fig. 36. Number of problems frequency

The number of problems the customers usually had with the new glasses is slightly lower that the number of problems they have with their conventional frames.
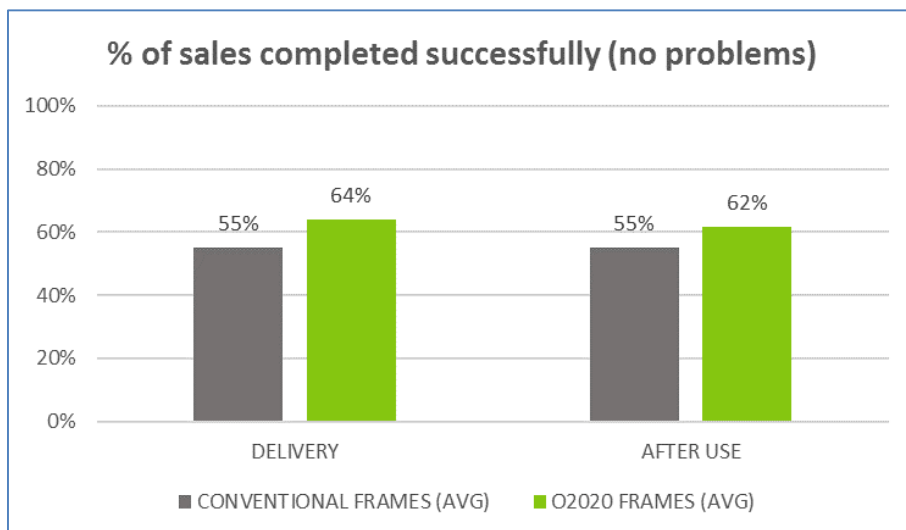
Fig. 37. No problems

On the contrary, the number of customers that did not have any problem about the new Optician2020 spectacles compared with the customers that did not have any problem with their conventional glasses is higher.
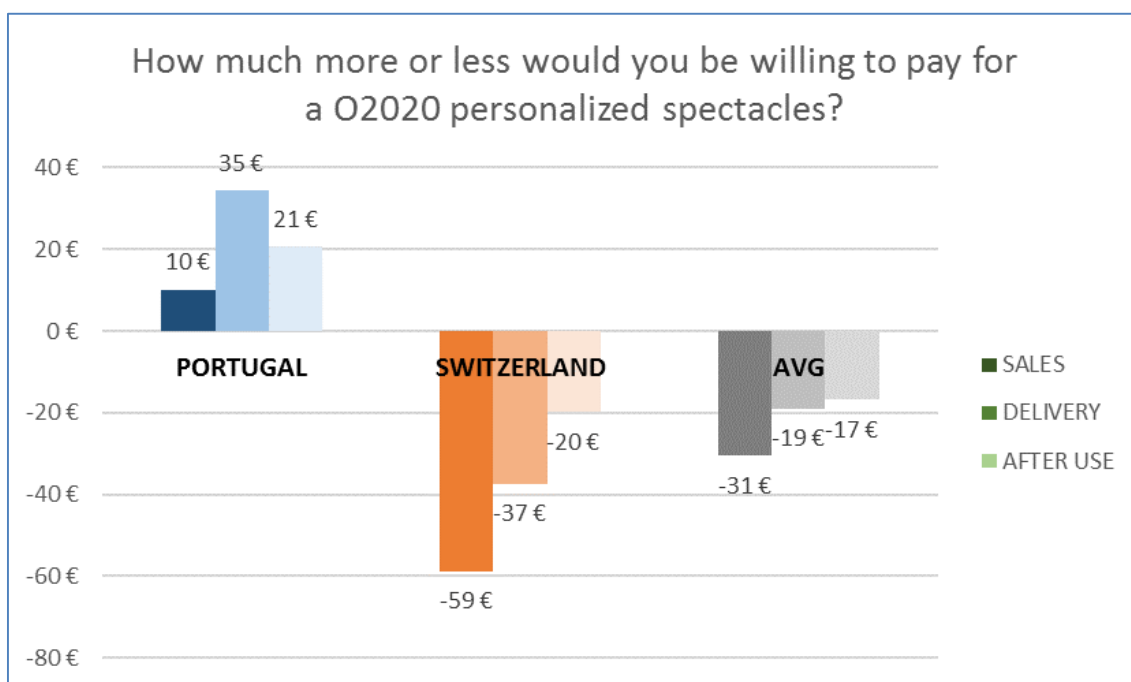
4.2.3.3.- Evolution

Fig. 38. Perceived value evolution

It's noticeable than in both countries, the price the customers would pay increases from the purchase moment to the 1 month usage moment.
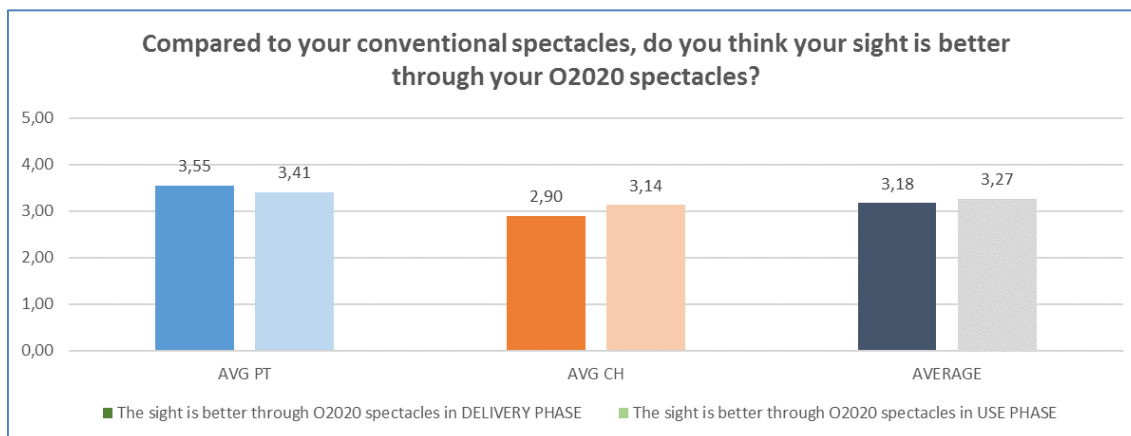
Fig. 39. Sight evolution

After one month using the spectacles, the expectations of the customers are confirmed regarding a good quality vision, proving the high performance of the lenses.
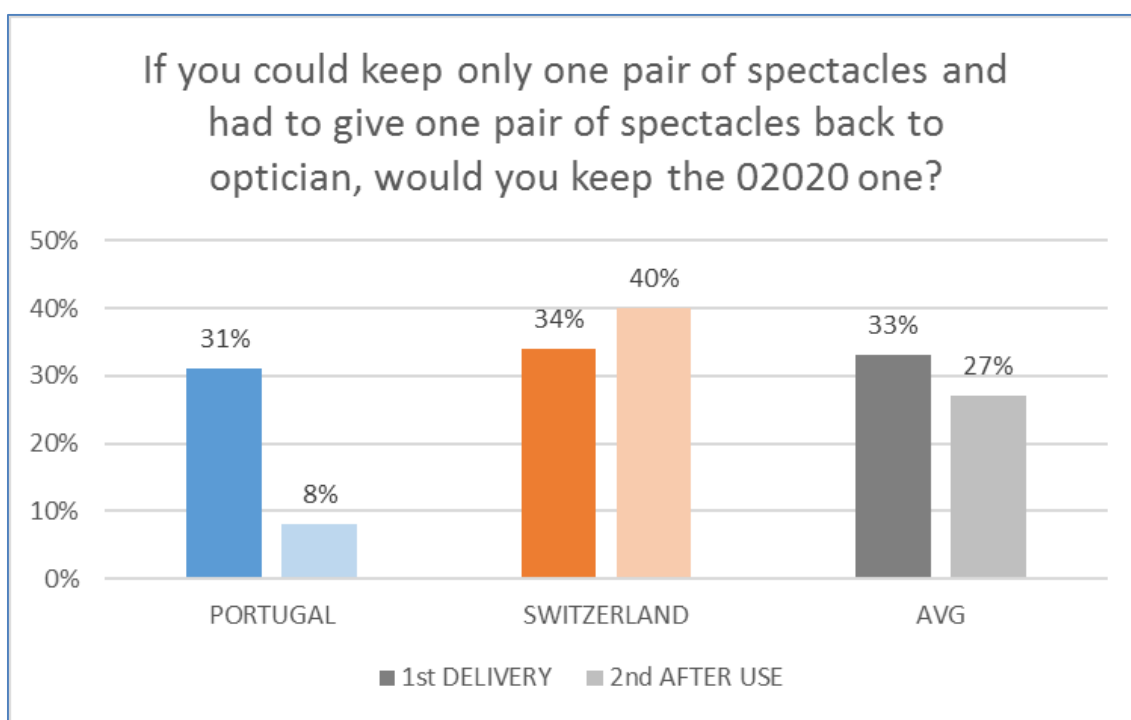

Fig. 40. Give back evolution

The percentage of Portuguese customers that will keep their Optician2020 spectacles instead of their conventional ones decreases, while in Switzerland this percentage increases. This can be because Óptica Pita demonstrator started earlier, so many of the problems (manufacturing, delays, etc.) occurred in the early stages of the demonstrator, probably causing this descent.
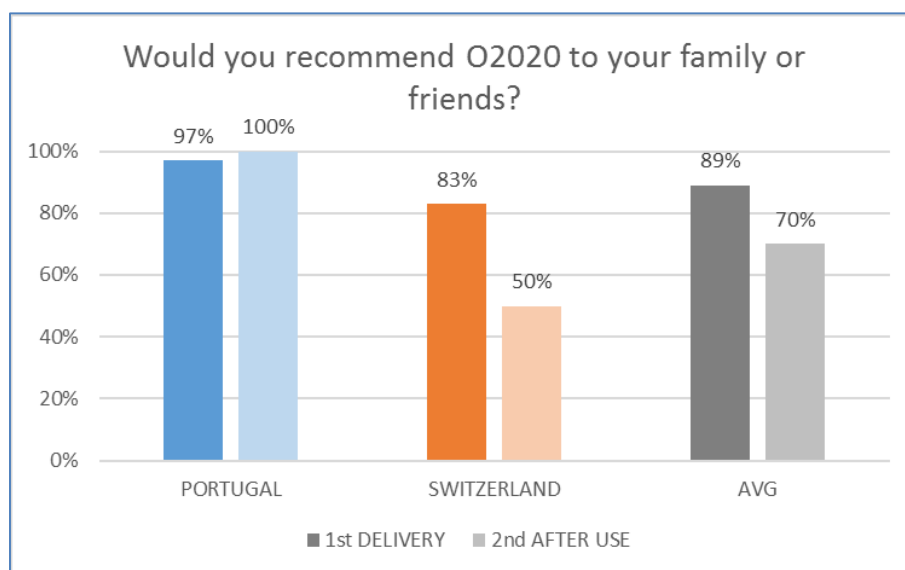
Fig. 41. Recommendation evolution

On the contrary, when asked the customers if they would recommend the Optician2020 experience to their family and friends, all the Portuguese customers would do it, while the Switzerland customers decreased their willingness to recommend the new spectacles after one-month use.

4.3.- Analysis of opticians surveys

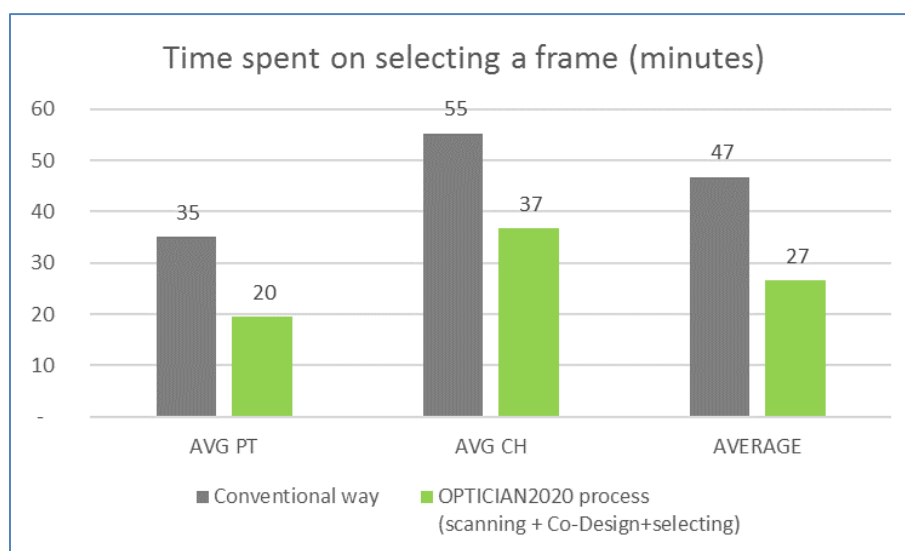### 4.3.1.- Opticians' opinion on the Optician 2020 purchasing process

Fig. 42. Time spent on selecting frame

The opticians were asked to collect information about the time spent selecting a frame with Optician2020 process and with the conventional process. Attending their answers, the time spent in Optician2020 process is 20 minutes in average less than the conventional process.

Regarding the customers preference about the traditional shopping experience vs Optician2020 experience, the Portuguese optics think that clearly their customers would prefer the Optician2020 experience (4.36 over 5), while the Switzerland optics think that this preference would be only slightly higher for Optician2020 proposal.
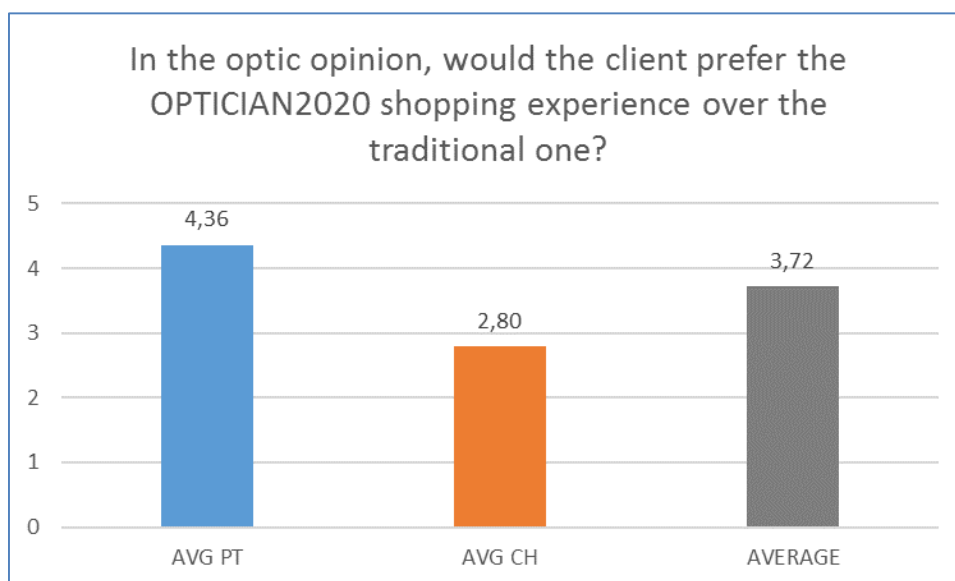
Fig. 43. Shopping experience preference. Optician perception

4.3.2.- Customer satisfaction

The optics perception about the customers satisfaction with the Optician2020 spectacles is high, both as the delivery moment as after one month use. Later on, we will analyse if it coincides with the customers' perception.
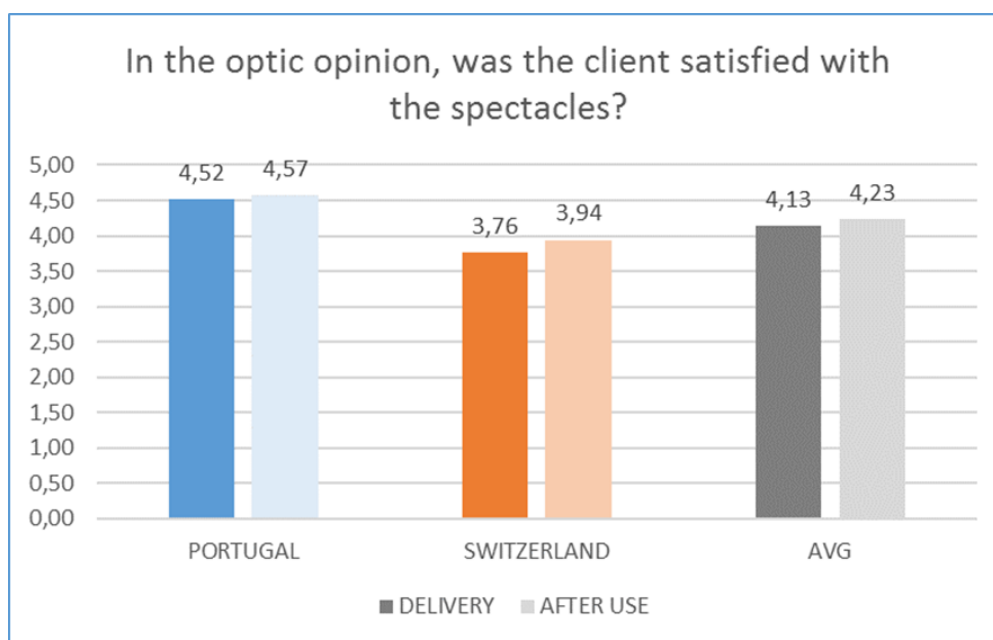

Fig. 44. Client satisfaction. Optician perception

If the customer had to keep the Optician2020 glasses and return their last conventional glasses, according to the opticians' opinion, they though that this willingness decreases after one month use.
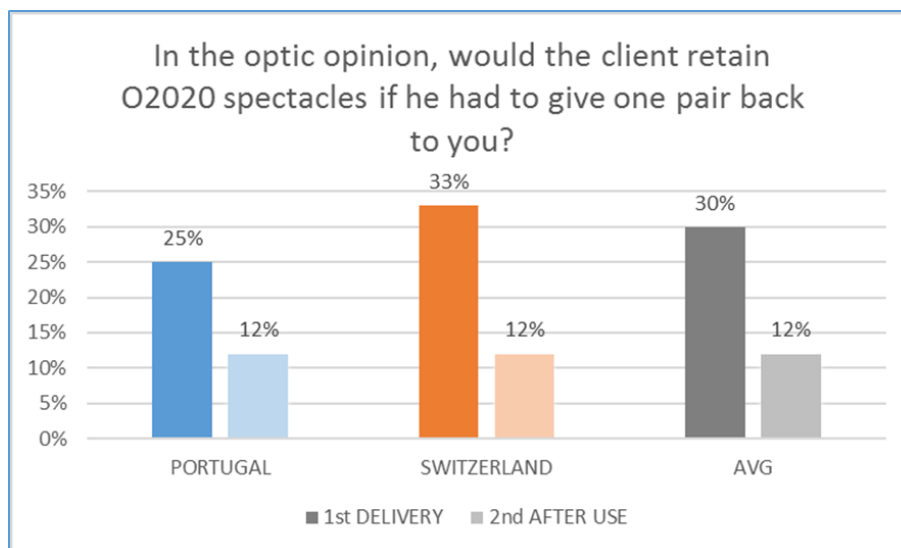
Fig. 45. Give back. Optician perception

4.3.3.- Opticians vs customers opinion

There are some differences between the opticians and customers perceptions, as it should be expected. We have highlighted the most significant.

Asked about how much or less the customer would be willing to pay for an Optician2020 spectacles compared with the last conventional glasses purchase, the perception of the optician tends in the same direction as the customers opinion (only Switzerland opticians reduce this amount after one month use, while the customers declare to be agree to pay more).
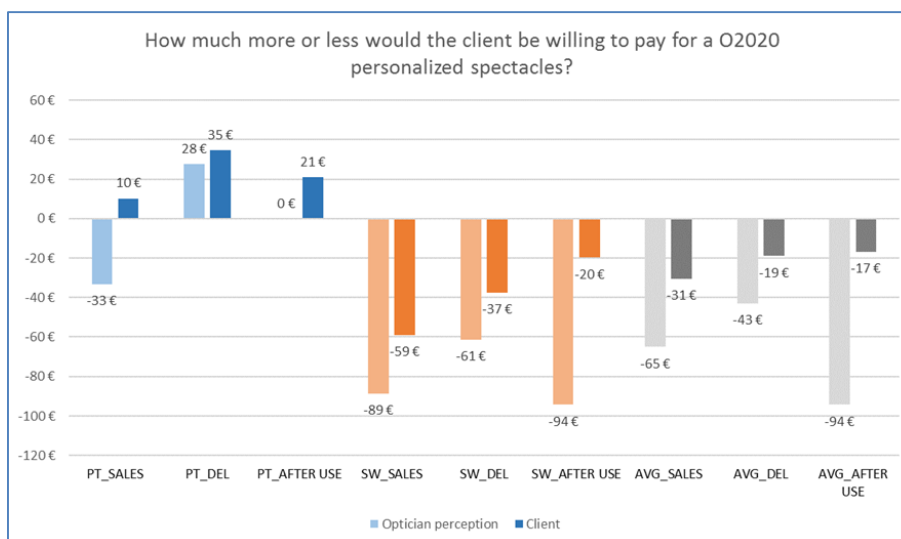

Fig. 46. Perceived value evolution. Optician-Client comparison

There are not significant differences in the perception of the customer satisfaction, neither in phases nor in countries. There is only a small tendency to overvalue the customer's satisfaction by the opticians' side.

Fig. 47. Client satisfaction perception. Optician-Client comparison

While the opticians' perception is higher about the customers' satisfaction, its perception about customers' preference of the Optician2020 spectacles is lower. The customer prefers the Optician2020 spectacles vs conventional ones on more cases than it was perceived by the opticians, especially after one month use in Switzerland.
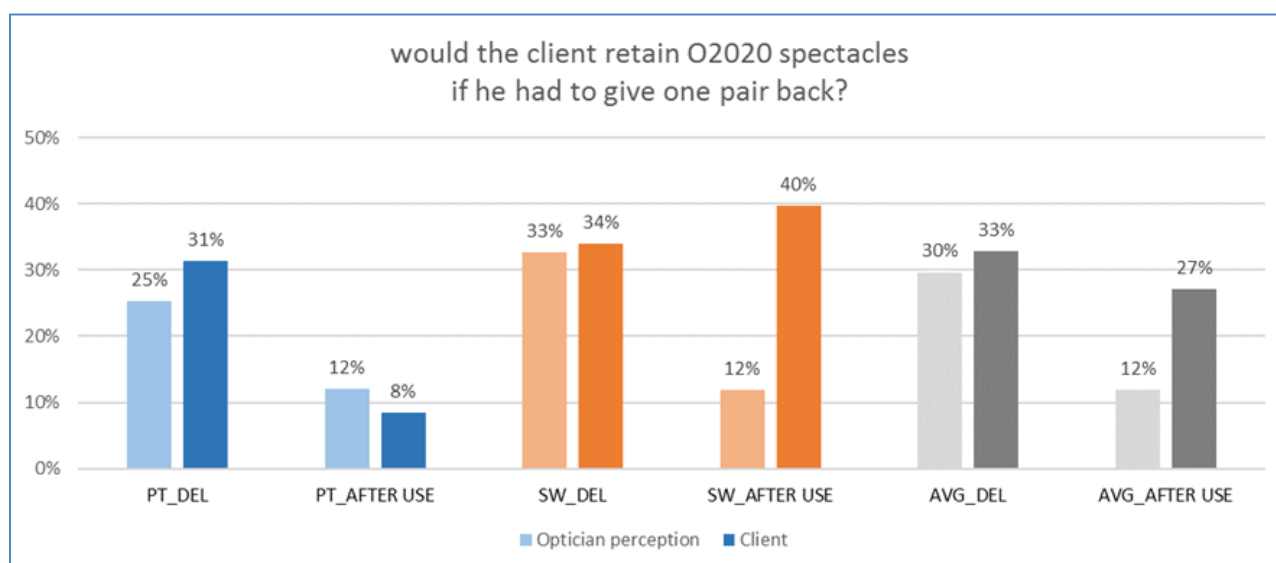

Fig. 48. Give back. Optician's perception vs Client opinion comparison

5.- CONCLUSIONS

This report has analysed the performance of the new proposed Optician 2020 process for the delivery of personalised spectacles from the consumer's point of view based on the opinion collected from all the consumers and opticians involved in the demonstration phase

The overall purchase process has been improved with regard to previous project Made4U, and it is now more appealing for both the consumers and the opticians.

The scanner has been improved causing that the scanning phase is considered comfortable, easy, innovative, accurate, reliable, technological and enjoyable by almost all the customers involved in the demonstrator.

In addition, the co-design system has accomplished one of the objectives of the Optician2020 project, which it was to increase its realism, reducing the gap between testing real glasses and virtual ones. All the stages of the co-design had been considered satisfactory and useful. As stated by the opticians and according to surveys, the customers missed more variety of frame models, but considering this as a project, the acceptance was quite high.

The shopping experience provided by Optician2020 is considered satisfactory. Customers value it in a very positive way (4.72 over 5) and 85% of customers think it improves the current shopping experience.

The time spent in the process is adequate, and is clearly perceived lower than the traditional shopping time, which is crucial given current social trends of immediacy when purchasing goods.

The satisfaction, quality perception and comfort perception about the frames have medium to high levels, with values between 3 and 4 in a 1 to 5 scale. Regarding the lenses, the quality and resistance perception is very high, with average punctuations above 4 over 5. After one month of using the spectacles, customers' expectactions regarding quality vision were confirmed, proving the high performance of the lenses.

Specific benefits that have been highlighted by customers are: "Optician 2020 frame better suits me" and " Optician 2020 lens provide a better comfort".

Finally, it has been demonstrated that Optician2020 spectacles reduce the most common problems observed in the conventional spectacles (5 common problems of a total of 9 reduce their frequency).