SPARK

D5.3 DEMONSTRATION WITH OTHER CREATIVE INDUSTRIES AND WITH CUSTOMERS

Approval Status

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TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

This document reports on the activities carried out within the Task 5.3 of the SPARK project, specifically, the testing of the SPARK Spatial Augmented Reality platform with other creative industries and with customers. The aim of this activity was to gather feedback from companies from outside of the SPARK consortium as to the potential applicability and business value of the SPARK platform within their design activities. Ultimately this feedback will be used to inform the exploitation plan for the SPARK platform, which will be presented in D6.6.
The activities of T5.3 were also designed to provide useful evidence to support the fulfilment of Objective #4 of the project proposal:

Demonstrate the effectiveness of the SPARK platform in wider real cases and show cases

The document presents results from five demonstration sessions completed with companies that represented either packaging design or product design markets. The packaging design sessions featured case studies from a variety of food packaging applications as well as the packaging for a fragrance diffuser product. The product design sessions featured case studies of travel luggage and a handheld electronic device used in industrial applications.

A combination of verbal feedback, written questionnaire responses and system log files were analysed. For the companies representing the packaging design market, the main perceived benefits of the SPARK system were obtaining feedback from customers and improving communication. Prototype cost reduction together with time to market reduction was also rated as important.
However, a number of challenges remain, including the ones related to the manipulation of the platform and its performance. While the platform is still evolving, we felt an important frustration regarding the tablet manipulation. Also, some requirement about the rendering was also presented as limiting the user experience.
Despite the limitations in the feature set and reliability of the current prototype SPARK system, all three of the packaging-focused companies expressed positive statements of interest in implementing a SPARK system within their organisation.

For the companies representing the product design market, the main perceived benefits of the SPARK system were reducing time to market and unnecessary iterations. This is consistent with the objectives of the companies especially the one expressed by Samsonite. Communication issues are perceived as less critical for these companies than for packaging applications as well as idea generation. This tends to consider that the application here is more towards project review and decision making rather than idea generation and customer feedback. However, a number of challenges remain, including the ones related to rendering and latency. Latency is a problem when intensive manipulation is required, and we believe that the perception is made worse by the alignment problems emerging in the real operational environment.

Overall, the demonstrations sessions completed with T5.3 have provided very useful evidence of the effectiveness of the SPARK platform in a variety of applications (SPARK Objective #4) whilst also providing concrete evidence of market interest from both the packaging design and product design

markets. The feedback and suggestions from the participating organisations will be used to further refine the exploitation plans that will be presented in D6.6.

2. INTRODUCTION

This deliverable reports on the activities completed as part of T5.3 that involved a set of demonstration sessions using the SPARK platform with creative industries that are external to the consortium. The aim of the activities was to inform the exploitation strategy for the SPARK platform by gathering feedback from organisations that are representative of potential target markets. The markets targeted were the packaging design market and the product design market.

The activities of T5.3 were also designed to provide useful evidence to support the fulfilment of Objective #4 of the project proposal:

Demonstrate the effectiveness of the SPARK platform in wider real cases and show cases

Throughout the report, the description of the activities and the analysis in organised according to the two target markets. The following section presents the methodology for the demonstration activities. Section 4 presents the results, including qualitative feedback from questionnaires completed with the participants along with quantitative analysis of the session log files. Section 5 presents overall conclusions concerning the effectiveness of the SPARK platform, contributing to the fulfilment of SPARK Objective 4.

3. METHODOLOGY FOR THE DEMONSTRATION ACTIVITIES

In this section we present how the demonstration activities were completed. The organisations and people involved in the demonstration activities are described in Section 3.1. The case studies are grouped into packaging design and product design-focused clusters. Section 3.2 goes on to describe the layout of the SPARK rooms used in the demonstration activities and the general structure of the sessions whilst Section 3.3 describes the data collection activities that were completed.

3.1 Case studies and participants

In keeping with the SPARK exploitation plan, the demonstration activities were targeted at organisations representing product design and packaging design markets. Organisations were recruited to participate in the sessions through the existing networks of the SPARK consortium members and from organisations engaged through earlier dissemination and communication activities of the SPARK project. In total five sessions were organised, including three focused on packaging design and two focused on product design. The sessions were hosted and facilitated by AMS, Artefice and Stimulo at their respective SPARK room installations. Table 1 provides a summary of the sessions organised and the participants that were involved.

Table 1. Summary of the case studies and participants of the demonstration sessions.

Company and product	**Host**	**Objectives**	Client Participants
Colruyt Group Packaging for chocolate pudding, chocolate bar and spirit bottle	AMS	Use the SPARK platform to evaluate new graphical concepts for the packaging of the product	Product Manager Retail Designer 2xGraphic Designer Product Designer
Food Inc. (anonymised for commercial confidentiality) New product packaging	Artefice	Use the SPARK platform to present the rework done after the first creative presentation	CEO Commercial Director Marketing Consultant Brand Manager
Zobele Fragrance packaging	Stimulo	Check feasibility of using miniSPARK for showcasing their products and variants at trade shows	Design Manager Product designer
Wavecontrol - ONIRIS Advanced EMF device	Stimulo	Test user interaction aspects of the large touch screen that appears on the product	Director Chief engineer Creative director Industrial designer
Samsonite NV Cosmolite luggage suitcase Neopulse luggage suitcase	AMS	Check the performance of the SPARK platform for use in design review situations	Design Director Europe Design Manager Hard Side

3.1.1 Packaging design case studies

Colruyt Group is a Belgian, family owned retail corporation with an annual turnover of €9.5 billion. The group manages a number of supermarket chains including Colruyt, Okay and Spar, with significant market presence in the BENELUX region and France.

The objective of the session was to use the SPARK Platform to review new packaging concepts for an existing chocolate pudding product, marketed under the 'Boni' brand see Figure 2.

Figure 2 Chocolate pudding product used in the Colruyt session.

Food Inc. (name anonymised for commercial confidentiality reasons) is a food manufacturer that specialises in high quality, food products and condiments. Food Inc. have an on-going project with Artefice to design packaging for a new product. The main objective of the session was to present the rework done on the packaging following an earlier session (completed without the use of the SPARK Platform).

Zobele Group is a world leader in the business segments of 'Air Care' (see Figure 3 for an example of a Zobele fragrance diffuser) and 'Pest Control' and is also a global player in the 'Health & Personal Care' and 'Fabric & Laundry Care' markets. Zobele primarily sells its products to blue chip, fast-moving consumer goods ("FMCG") companies worldwide.

The purpose of the session was to explore how the SPARK platform could support Zobele as the company introduces more co-creative design activities into the design process. Since Zobele is a worldwide company, exhibiting around the world, they are wondering if a portable version of SPARK could be used as a novel way to present their products at shows, seminars, workshops and related events with end users and potential clients.

Figure 3. Fragrance diffuser packaging used in the Stimulo session.

3.1.2 Product design case studies

Wavecontrol is an engineering company, founded in 1997 and specialising in the industrial products for the measurement of electromagnetic fields. The company headquarters are in Barcelona but also has a sales office in

the USA and serves markets in over 50 countries through a distributor network. Most of their staff have an engineering background and like to interact with innovative technologies and solutions.

The purpose of the session was to create new ideas to go ahead with the project, especially on the screen proposals since it's a completely new range of products for them – see Figure 4.

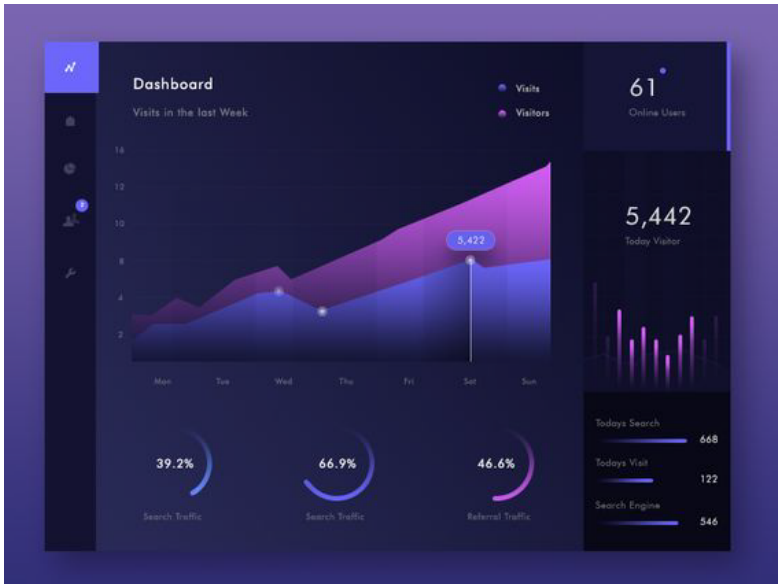

Figure 4. reference interface used in the Stimulo session.

Samsonite is an American luggage manufacturer and retailer, with products ranging from large suitcases to small toiletries bags and briefcases. The head office and design department for Europe is located in Oudenaarde, Belgium.

The puprose of the session was to explore the potential and feasibility to use the SPARK SAR platform technology in monthly internal design review meetings with C-level decision makers. During these meetings multiple design concepts for each Samsonite suitcase are presented on a 1:1 scale foam model and final design decisions are made.

During the case study session, different SAR design representations for the Samsonite Cosmolite and Neopulse hard side luggage suitcases have been tested and evaluated by the participants – see Figure 5.

Figure 5. Samsonite product used in the session at AMS.

3.2 Organization of the demonstrations

The demonstrations were completed using a broadly similar session structure using the SPARK prototype installations at AMS, Artefice and Stimulo. Here we first describe the set-up of each of the SPARK rooms before describing in more detail the typical structure of the sessions.

3.2.1 Set-up of SPARK rooms at AMS, Artefice and Stimulo

All three SPARK rooms at AMS, Artefice and Stimulo made use of the third release of the SPARK platform, which features: infra-red object tracking; two projectors; and a touchscreen controlled graphical user interface. Figures 6, 7 and 8 respectively show the diagrams of the SPARK rooms at Artefice, Stimulo and AMS.

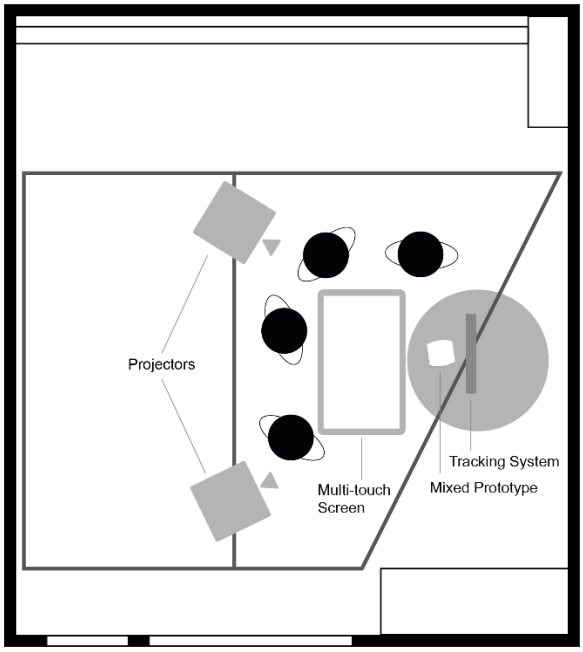

Figure 6: Diagram of the SPARK room at Artefice

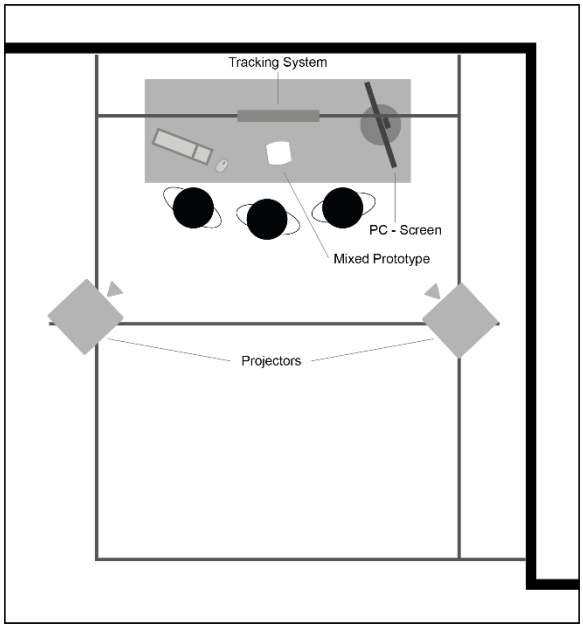

Figure 7: Diagram of the SPARK room at Stimulo

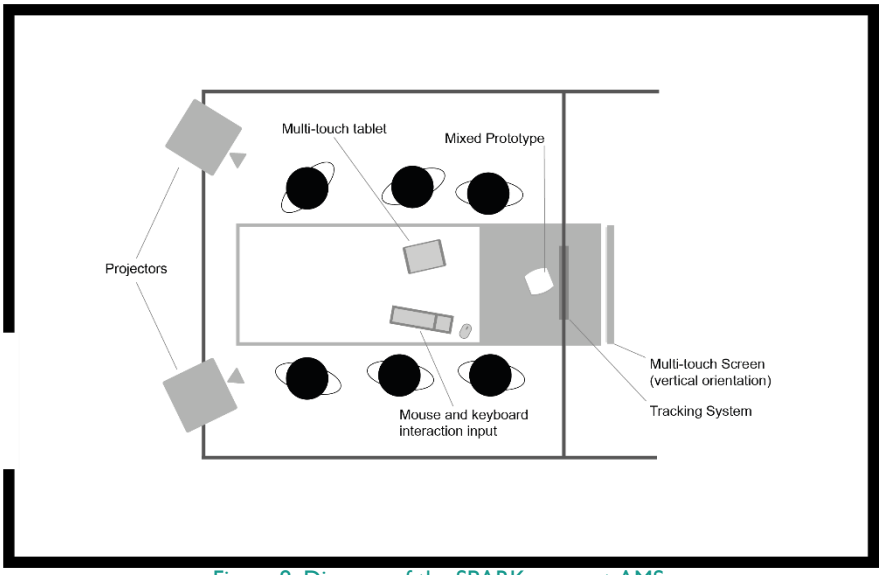

Figure 8: Diagram of the SPARK room at AMS

One significant difference between the set-ups was that the Artefice SPARK room features a 40" multi-touch screen, which allowed multiple designers to interact with the GUI. The SPARK rooms at AMS and Stimulo made use of the standard 10" tablet PC for control of the GUI.

3.2.2 Structure of the demonstration sessions

The structure and duration of each of the demonstration sessions was broadly similar, with a typical session conducted as follows:

- 30 mins – Presentation of the SPARK project and introduction to the SPARK SAR platform by the facilitator;
- 60 mins – Demonstrations using the SPARK platform with the several pre-prepared products/artefacts and assets from the client;
- 30 mins – Interview with the participants and filling in the participant survey to collect feedback from the client.

It is worth noticing that all sessions were set up and carried out by AMS, Artefice and Stimulo staff autonomously, without the direct involvement of researchers from the academic partners, in order to reproduce a real operational environment.

3.3 Method for collection of feedback

Two main forms of data collection were used to gather feedback on the performance of the SPARK platform and the participants' perspective on its potential value within their organisation. First, semi-structured **interviews** were completed with the participants immediately after each session. As part of this interview, the participants were asked to each provide written responses to summarise their viewpoint. This allowed for all participants to register their feedback, even when there was not time to discuss in detail during the interview. A copy of the questionnaire can be found in the appendix.

The second type of **data collection** involved analysis of the log file captured by the SPARK platform during the session. The log file records every function the users carry out with the platform. This includes the changes made to the canvas containing the textual/graphical contents to project (position,

size, orientation, layer level for asset or group of assets), the background colour of the mixed prototype, as well as its spatial characteristics within the user interface. These data provide quantitative information about the outcomes of the session with an objective measurement of the whole process followed by the co-designers.
The data collected in the log files are to be processed to extract the indexes presented in Table 2. They have been defined with reference to the objective 4 "Demonstrate the effectiveness of the SPARK platform in wider real contexts and showcases" and to the expected impact it might trigger in terms of time, human resources, prototyping costs savings etc.

Table 2. Types of data gathered for the log file analysis and their meaning.

Index	**Label**	**Processed Data**	**Quantitative evidence of...**
Number of functions initiated or continued in the log file	#_Funct	Total rows in the log file	Amount of activities within the sessions
Number of effective functions	#_Funct_eff	Switches between different functions and functions repeated after 3 seconds	Amount of changes made to the design – mixed prototypes used for evaluation
Number of assets used within the sessions	#_Asset	Total amount of previously prepared digital contents used within the sessions	Exploration of alternatives for the mixed prototype used for the evaluation
Number of solution variants potentially explored	#_Variant	Total amount of functions involving #_asset and changes to background colour of the prototype	Number of prototypes tested with a single physical prototype and SAR rendered #_Variants.
Duration	#_Time	Difference between start and end time (seconds)	The time required to run co-creative sessions (to be referred to #_variants to check the efficiency of the session)
Session Effectiveness	#_Effectiveness	Ratio #Time / #_Variant	The time required to switch from a variant to a next one.
HCI-GUI efficiency	#_HCI_GUI_eff	Ratio #Funct_eff / #Funct	The efficiency of the SPARK UI in terms of number of changes made to the design with respect to the number of activities requested to the interacting user(s). This helps prioritising for further SPARK developments after the end of the project.

The results are presented and discussed in the next section.

4. RESULT AND DISCUSSION

4.1 Results and feedback from the packaging design sessions

The following sub-sections provide a summary of the product design sessions completed with Colruyt, Food Inc. and Zobele followed by the results of the feedback questionnaire and the log file analysis.

4.1.1 Summary of the packaging design sessions

Packaging design sessions were completed with three companies: Colruyt (with AMS), Food Inc. (with Artefice) and Zobele (with Stimulo). Here we present a brief summary of what happened in each of the sessions.

Colruyt

The focus of the session with Colruyt was on testing the ability of the SPARK platform to support internal design and design review activities. During the session the Colruyt team used the platform to review new proposals for the packaging of the chocolate pudding product. Initially the SPARK platform was used to display the existing packaging design on the SAR prototype. Then a new concept was displayed on the SAR prototype. Some modifications were made to the design of the packaging. After approximately 50 mins, the chocolate pudding product was removed and replaced by a different product, which featured a coloured glass bottle (details of the product are confidential). After discussing this second product for approximately 10 mins it was removed and replaced by a third product, which featured a chocolate bar cardboard packaging (further details of the product are confidential).

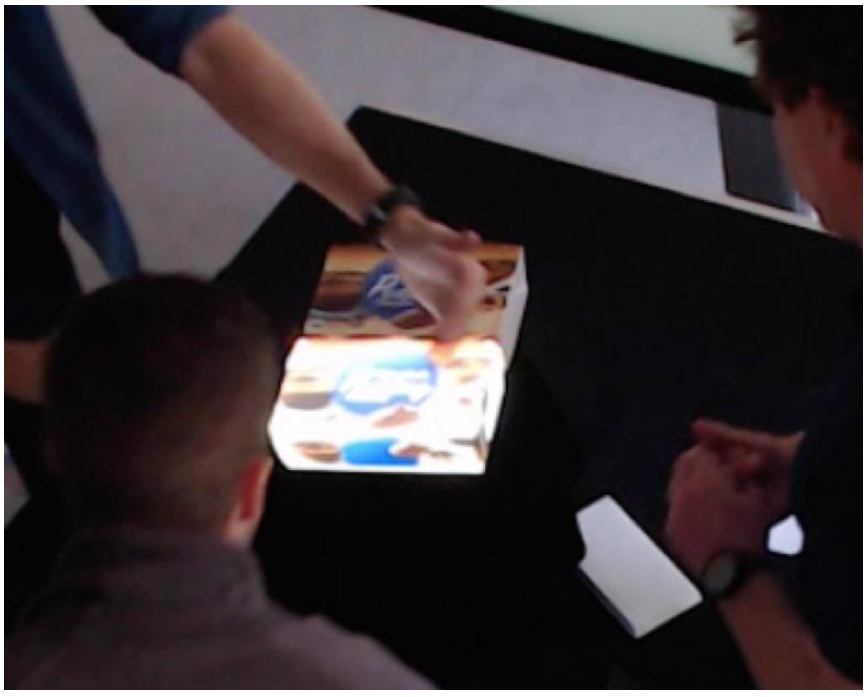

Figure 9. Session recordings screenshot with the printed chocolate pudding packaging and the packaging displayed using the SPARK platform.

At the end of the session the team discussed how they might use the SPARK platform within their work.

What went well?
The Colruyt team were particularly impressed by the speed and ease with which they could switch between different artefacts in one SAR session.

What was challenging?
The SPARK platform suffered some technical problems during the session. This included the tablet-PC GUI crashing, and some 'flickering' in the rendering due to some instability in the tracking system. These issues contributed to an overall impression amongst the Colruyt team that reliability and ease of use of the system are not sufficient. Also, the resolution and latency of the rendering were rated average.

What could be improved?
The Colruyt team stated that it would be very important to improve the integration between the SPARK platform and their existing design software (Adobe Illustrator and Photoshop). All design work is currently completed using these software tools and the final output of projects need to be available in those tools. Hence, the outputs from co-creative sessions completed with the SPARK application would need to be re-created in Illustrator/Photoshop – which was viewed as double work. In their written feedback, one suggestion from the team was that this could be addressed if you could "map the display of your PC directly on the SAR prototype and be able to edit (live) from Illustrator software."

Beyond improvements to the technical aspects mentioned above, the Colruyt team had some feedback on the proposed business model. They stated that they would prefer to buy SPARK as a product to use it in their own premises instead of 'SPARK as a service'. This was because bringing the whole design team from Halle to Kortrijk every two weeks is not an option. It was also suggested that the SPARK platform would need to be portable as the product management meetings for each brand take place in different headquarter locations of the Colruyt Group.

What was the overall verdict of the participants?
They felt that the SPARK platform could be used by the Colruyt Group for fortnightly meetings between design, product & brand management in which the team completes a fast review of different finalized product concepts. In this case, they would only use Adobe Illustrator .png exports from the finalized designs as assets and quickly switch between these assets on the same artefact to easily review and make decisions between different designs for the same product, i.e. they would not be making live modifications to the concepts, just comparing alternative concepts for each product.

Food Inc.
The session with Food Inc. was part of an on-going project in which Food Inc. had commissioned Artefice to help complete the graphic design of the packaging for a new product. A first co-creative session between Artefice and Food Inc. had been completed in September in which four initial concepts had been presented (without SPARK) and two selected for further development. Food Inc. had asked Artefice for the two selected concepts to be reworked, incorporating some of the elements taken from the other concepts.
During the session three revised proposals were presented using the SPARK platform. Each concept was discussed and evaluated. Unfortunately, the bright rendering on the SAR model made it difficult to see the subtle textures that had been incorporated into the concepts. The design team therefore made use of some printed boards, which made it easier to see the background textures.
The final output of the session was a request from Food Inc. to make some further refinements of the concepts presented.

What went well?
The Food Inc. representatives liked the fact that the SPARK system allowed them to make real-time modifications to the concepts presented. The Artefice designers also commented that they felt this ability to support real-time modifications could improve the productivity of co-creative sessions under the right circumstances.
Another point appreciated by Food Inc. was the ability to make a direct comparison between the new product and competitor products by simply placing a competitor product next to the SAR model. Using a similar approach, the designers felt that the SPARK technology could be very useful for conducting 'shelf test' activities, in which the product being designed is placed on a shelf along with a range of competitor products to simulate what the consumer will see when browsing in a supermarket. The aim is to ensure that the new product 'stands out from the crowd'.

What was challenging?
The usability of the tablet user interface was considered less than ideal by the Food Inc. representatives and the designers. Although the written feedback from the clients suggested that they were broadly satisfied by the quality of the rendering, the designers were very disappointed with the resolution, accuracy and latency of the rendering. This seems to reflect the challenges that were encountered in showing the background textures which resulted in the use of the printed boards to complement the SAR projection.

What could be improved?
In the written feedback, the Food Inc. representative suggested that it would be better if the SAR model could be 360 degree rendering (with the current two projector arrangement, the viewing angle is approximately 120 degrees). This is probably due to the higher than normal number of people in the session (four clients plus two designers).
The usability of the tablet user interface was also identified by Food Inc. as an area for improvement. The designers were keen to see improvements in projection resolution and alignment.

What was the overall verdict of the participants?
The designers were frustrated by the rendering difficulties that had been encountered. However, despite these difficulties, Food Inc. subsequently requested that the next co-creative session also be conducted using the SPARK platform. This is good evidence that, despite the problems associated with a prototype technology, the participants see that the SPARK technology can offer benefits packaging design activities.

Zobele
The session with Zobele had the following objectives:

- To test the ability of the SPARK platform to support internal design and design review activities. The current practice for Zobele's design and innovation team is to use email to distribute design proposals and receive feedback. This requires a lot of design iterations and is time consuming. They would like to start doing more co-creative meetings and felt that the SPARK platform could help facilitate such meetings.
- Assess the potential of the SPARK platform for use in commercial presentations, specially for use at the many trade fairs that Zobele attends, such as PLMA INTERNATIONAL in Amsterdam.

During the session, Zobele Design Manager used the SPARK platform to review design proposals for the packaging of the fragrance diffuser packaging. Initially the SPARK platform was used to display the

existing packaging design on the SAR prototype. In the later part of the session, the Stimulo designers introduced some new assets and design concepts to open new discussion with the Design Manager.

What went well?
Cedric Gobber, Zobele Design Manger, is familiar with a range of new design technologies as part of his responsibilities is to identify and adopt new technological solutions to improve the innovation process of Zobele. During the last year Zobele has introduce several new digital tools, specially to improve co-creation sessions. These new technologies are being used for the visualization of the marketing texts/claims during the early stages of design. This stage is for them one of the most important of the packaging process. During the session the team had the opportunity to compare SPARK with two other augmented/virtual reality application (SKETCHFAB and AUGMENT). As a tool for real time product review and modification, SPARK was considered to have good potential for adoption within the Zobele design process because:

- Spatial Augmented Reality can be used in a standard meeting room environment (does not require a VR 'cave').
- Tracking the prototype and being able to move it, improves the co-creation experience from the end user's point of view.
- During the session the packaging had the real product inside, so you can feel the real weight, improving the experience.
- Cost: value ratio would be considered by Zobele if the SPARK platform cost €10-15,000.

It was clear that Zobele was glad to see how easy was to improve idea review and filtering, also for new colour options (see Figure 10).

What was challenging?
During the session the team faced some issues with the resolution of the projected artwork due to the relatively small size of the packaging. For this session, only one projector was used due to calibration problems.
During the session, Zobele was interested to see how the system could cope with switching from one artefact to another (specifically, they wanted to switch between packaging with a window and a standard pack) but the Stimulo team were unable to set this up due to challenges with the Information System and so were unable to demonstrate this ability.
For the Stimulo team, this was the first time that they were required to set-up a SPARK session using 3D and graphic files provided by a client – this took more time. This particular packaging was challenging because of the big window used to display the product.

What could be improved?
Zobele asked if it was possible to output the final concept created in the SPARK platform in a format that was compatible with Adobe Illustrator, which, as yet, is not possible.
Packaging often feature many different graphic assets which the designer would like to align precisely on the package. Zobele therefore requested that the SPARK GUI offer support for quick and easy alignment of assets. The Zobele Design Manager also commented that the colour rendering was not sufficiently accurate in some instances.
Making the design process run faster in the early stage is critical for Zobele. It was suggested that this could be helped by having some basic shapes predefined (round square, rectangular) within the SPARK GUI. It was also suggested that it would be useful if the SPARK platform could import assets from graphic design image and asset repositories', such as Lemanoosh.com.
Other specific suggestions for improvements from Zobele included:

- Would like the ability to connect to a co-creative session remotely as the company has several offices around the world.

- Want to show a looped projection through the SPARK platform to present new concepts during trade fairs.

What was the overall verdict of the participants?
The overall response from the Zobele Design Manager was positive. Zobele view SPARK as a platform to customize its prototypes for each client, instead of having to produce different physical prototypes for each client. SPARK would therefore help to reduce prototyping costs and time by enabling them to work with one prototype and have private sessions with several different potential buyers.
Evidence of this positive response was that they have requested a quotation for renting a SPARK platform for the next fair that Zobele will exhibit at in April. Zobele asked for a day training workshop for their designers and technical assistant for calibration and configuration.
Furthermore, Zobele are interested in renting a 'SPARK room' to host co-creative sessions three to four times per year with Zobele's top clients (big worldwide brands). The Design Manager stated that for top clients these sessions would support client engagement and experience of creativity rather than having a direct impact on the design process. In this direction he remarked that the location/district in which a SPARK room was located would be an important issue. In Barcelona, he suggested some design-focused areas, such as Gràcia or La Barceloneta, or 'high tech' hubs, such 22@. To be considered for the SPARK business model, Zobele would be interested to rent a SPARK room for 5-10 sessions per year.
In addition, a portable version of the SPARK platform would be very interesting for the trade show use case.

Figure 10. Session recordings screenshot with the fragrance packaging with new colours proposals applying the SPARK platform.

4.1.2 Results of the feedback questionnaire from the packaging design sessions

Here we present a summary of the results of the questionnaire from the packaging design sessions.

Question 1 asked how frequently co-creative design sessions are held within the company. At Colruyt these sessions happened once per week, whilst at Food Inc. these sessions only occurred once per quarter.

Question 2 asked 'How important are the following challenges for your organisation?'. The results are presented in Figure 11.

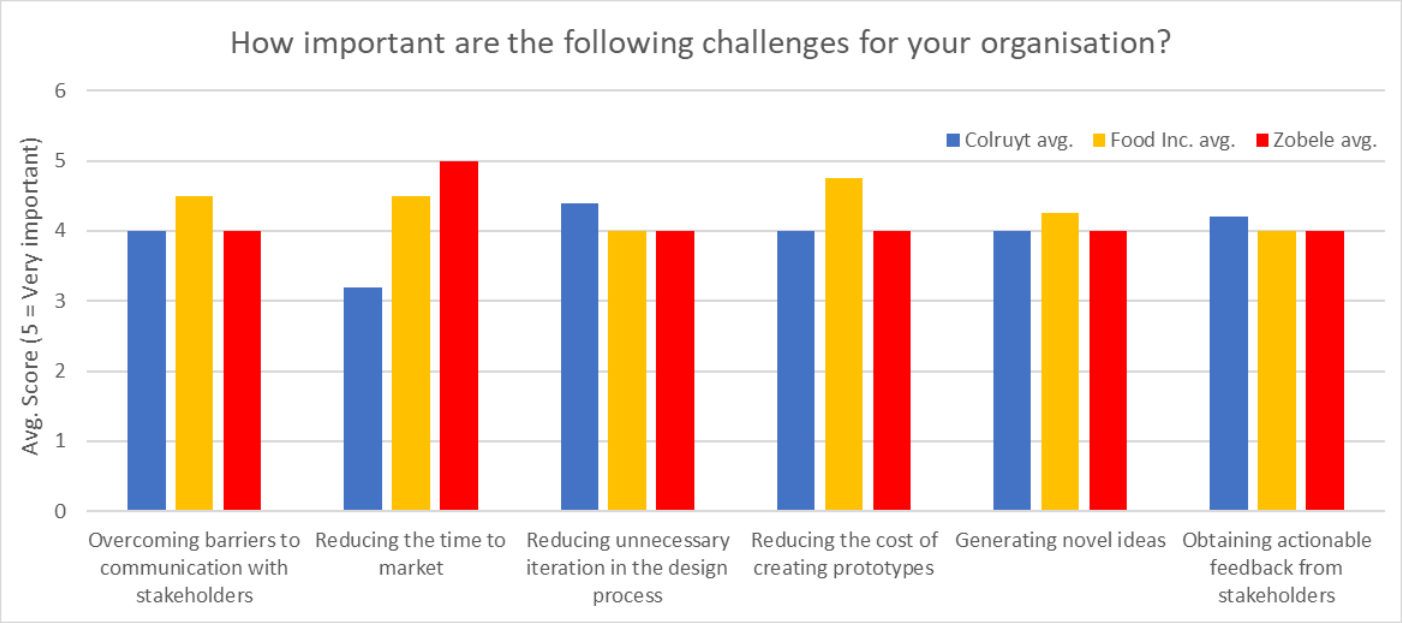

Figure 11. Summary of the average importance scores for question 2.

From Figure 11, it seems that all the challenges identified are significant challenges for all the companies. This is positive in that it confirms the SPARK consortium has a good understanding of the market needs. The most significant variation in responses was for the 'reducing the time to market challenge, which Food Inc. and Zobele rated as very important whilst Colruyt rated as moderate importance.

Question 3 asked "Based on what you have seen today, how would you rate the following features of the SPARK system?" The results are presented in Figure 12.

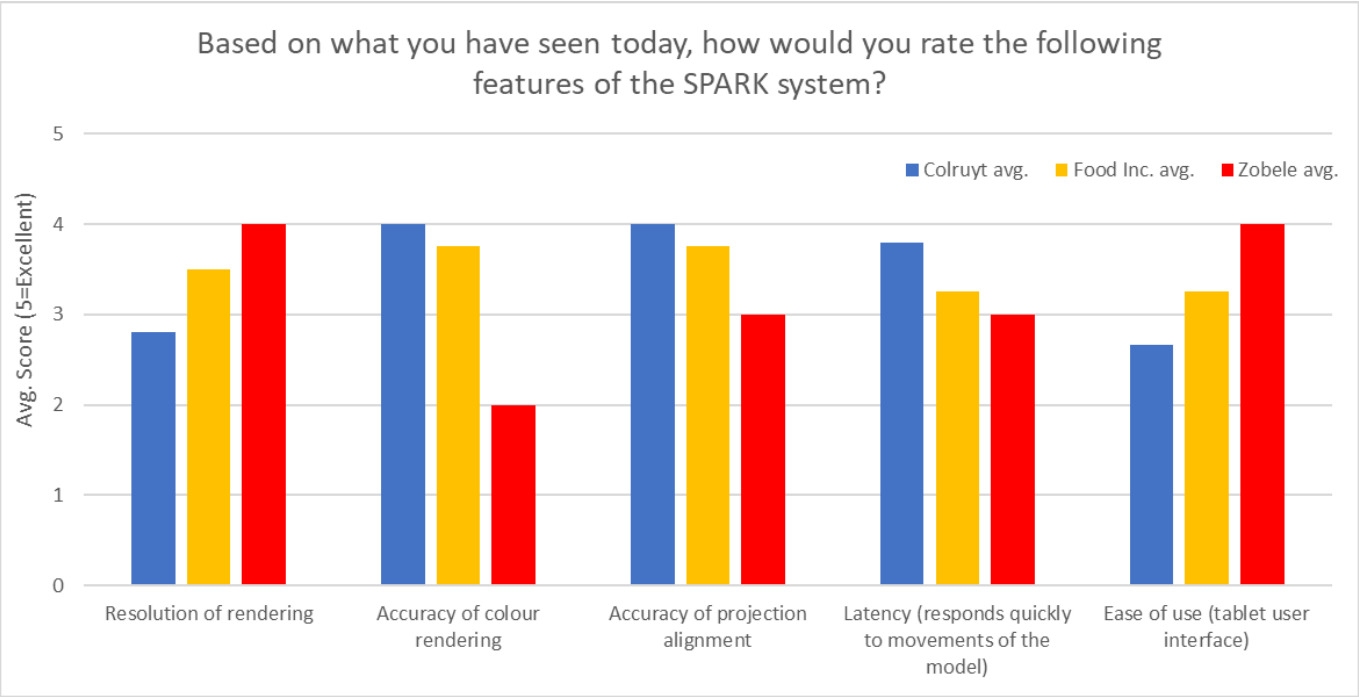

Figure 12. Summary of the average scores for question 3.

Figure 12 shows significant variation in the scores from the three companies. Colruyt and Food Inc. rated the accuracy of colour projection and projection alignment and latency as good. Zobele appreciated the resolution of the rendering and the ease of use of the tablet but were unsatisfied with the accuracy of the colour rendering in particular, as was reflected in their verbal comments. These differences in perceived performance may be due to several factors, such as differences in the hardware used in each of the SPARK rooms, different levels of experience in setting-up sessions amongst the SPARK rooms hosts, or the differences in the size and complexity of the prototypes (the Zobele prototype was particularly challenging as it was small and more complex due to the window cut-out). The implication for the SPARK platform exploitation is that further development is required to ensure a consistent, high-quality SAR experience can be provided whatever the system configuration or prototype. This may require further developments in terms of projector colour calibration, improvements to the tracking calibration process, and improved understanding of how the projector lens choice can be used to provide the best projection resolution for the for the size of the physical prototype to be rendered.

Question 4 asked about the impact of using the SPARK platform for co-creative design sessions at the company. The results are presented in Figure 13.

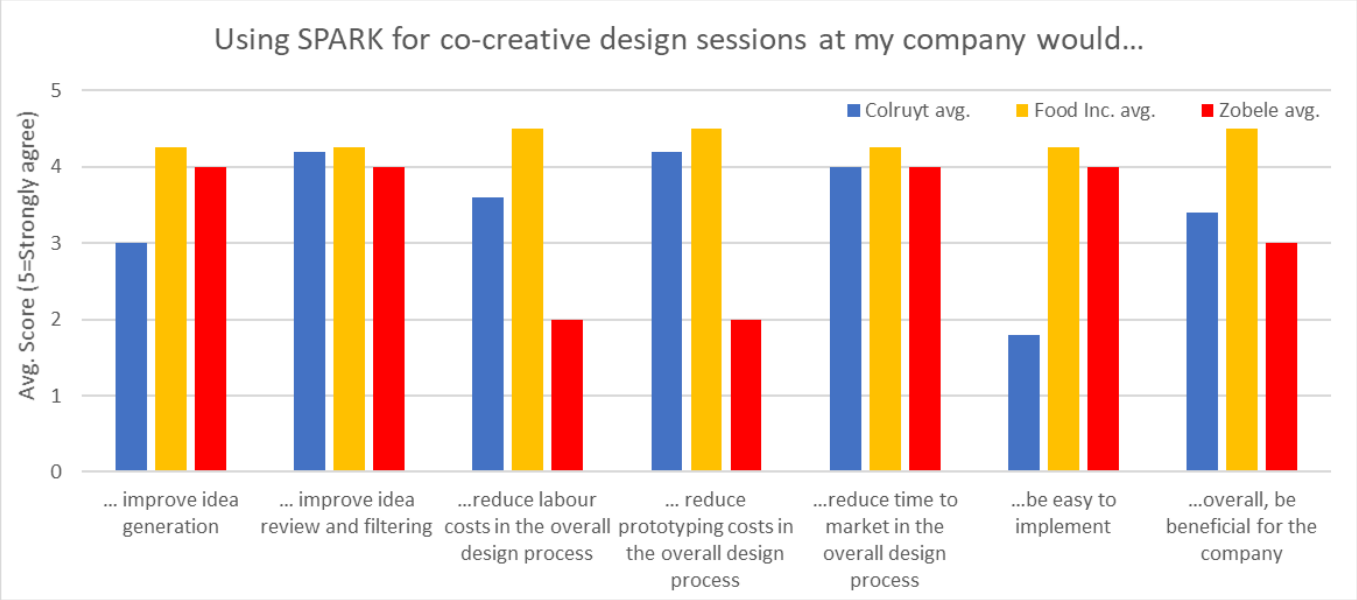

Figure 13. Summary of the average agreement scores for question 4.

From Figure 13 it seems that improving idea review and filtering and reducing time to market are the main benefits that companies expect to gain from implementing the SPARK platform in their design activities. The low average score for ease of system implementation given by the Colruyt participants can be explained by the technical problems that were encountered during that session. For Zobele, it seems that they can envisage the use of SPARK contributing to reducing time to market and improving idea generation and filtering but that it will not reduce labour or prototyping costs. Presumably, this is because their current approach involves distributing design concepts as 2D images via email, which is a very low cost approach but is ultimately less effective due to the increased design iteration and lead time that this can result in to build a consensus amongst stakeholders.

4.1.3 Results of the logfile analysis for the packaging design sessions

The log files of the following sessions have been considered for the analysis, according to the metrics presented in Section 3.3:

- Artefice: 30/10 and 15/11 - Food Inc.
- Stimulo: 16/11 - Zobele

Table 3 presents the values for each index mentioned in Section 3.3.

Table 3. Results of the log file analysis for the packaging design sessions.

	#_Funct	#_Funct_eff	#_Asset	#_Variant	#_Time	#_Effectiveness	#_HCI_GUI
Food Inc. 1	1101	472	37	377	3839 s	10,2 s	42,9 %
Food Inc. 2	741	229	17	140	1828 s	13,1 s	30,9 %
Zobele	2378	482	18	354	2477 s	7 s	20,3 %

The above figures highlight how the SPARK platform has both strengths and weaknesses, according to what happened during the co-creative design sessions. As a starting point, it is worth noticing that the

evidences gathered regards a sufficiently representative set of case studies in terms of duration: from approximately 20/30 minutes to more than 1hour.
It is also worth noticing that the duration (#_Time) is not correlated with the amount of functions used during the sessions, both considering #_Funct and #_Funct_eff. This suggest that also the amount of options selected during the sessions are strongly case study dependent, which is here considered a positive factor in order to demonstrate the effectiveness of the SPARK platform in wider context.
As previously said, the two sessions of the Food Inc. case study should be considered as sessions of the same project. #_Time of session 2, in fact, is approximately one half of session 1, as most of the design was decided and required just final confirmation. The same ratio is confirmed by the #_Assets used in the two sessions and the #_Variants checked. This is a first evidence that the SPARK platform allows co-designer to converge quickly on design concepts and ideas that have been previously developed within the same project, substantially confirming its expected potential for use both in creative design and in creative review session, as well as for more standard design review sessions.
Overall it is worth mentioning the significantly high values of #_Variants checked during the three packaging sessions. This is also an indirect evidence of the extent of creative exploration of design alternatives in co-creative sessions. Such high numbers also provide a first evidence of how the SPARK platform is capable of trigger important savings from prototyping costs, as the testing of hundreds of prototypes, is simply unconceivable.
These values are also confirmed by the ease of application of changes, as witnessed by #_Effectiveness: to switch from a prototype variant to another one, the co-designer had to "wait" from 7 to 15 seconds. These values are also significant with reference to the time required to prepare real-like physical prototypes as the SPARK mixed ones aim at substituting.
#_Effectiveness, as said in section 3.3, represent the average amount of seconds in between the appearance of design modifications to the prototype (#_Time/#_Variant). In these terms, it appears evident that some of the considered changes should occur very quickly (in any case more than 3 seconds to be accounted by the metrics), as sometimes #_Efficiency scores below 10 seconds. This means that just part of the #_Variants have been considered for evaluation and that some intermediate steps just aimed at building a comprehensive design proposal, sufficiently detailed to run a meaningful assessment of its goodness. Nevertheless, this is a strong evidence that the amount of time required to modify the mixed prototype does not represent a bottleneck for the usage of the technology, suggesting that it reaches the expected effectiveness in terms of potentiality.
The results concerning the efficiency of use of the GUI/HCI are also extremely interesting, as they account the amount of functions carried out with a satisfactory result (#_Funct_eff considers, functions ended with, e.g., the proper placements, orientation and size of assets) with reference to the complete set of functions used along the session (#_Funct, thus including those for which the co-designers had to refine what done in a very short time, namely below 3 seconds). The resulting percentages provide interesting results as the setting for the companies involved is slightly different: Food Inc. sessions were carried out at Artefice, whose SPARK room is equipped with a large touch screen for HCI (30-40%), while co-designers in the Zobele session used tablets (20%) as for the SPARK room equipment at Stimulo. These figures suggest that a large interaction surface support a more efficient selection of functions, probably due to an increased precision of placement and command execution.
A detailed analysis of functions carried out at higher or lower degrees of efficiency (number of satisfactory use of the function/overall amount of use of the function) is currently in progress to evaluate potential priorities in case of further SPARK developments beyond the project conclusion.

4.2 RESULTS AND FEEDBACK FROM THE PRODUCT DESIGN SESSIONS

The following sub-sections provide a summary of the product design sessions completed with Samsonite and Wavecontrol followed by the results of the feedback questionnaire and the log file analysis.

4.2.1 Summary of the product design sessions

Product design sessions were completed with two companies: Samsonite (with AMS) and Wavecontrol (with Stimulo). Here we present a brief summary of what happened in each of the sessions.

Samsonite

The focus of this session was on testing the performance of the SPARK platform for use in design review situations. One of the challenges for the SAR system was the size of the suitcases as, beyond a certain size, products that are too large no longer fit within the 'projection volume' of the system (that is the region in which the mixed prototype can be rendered with good accuracy). For this reason, the models were positioned a little bit further from to the projectors, resulting in a bigger projection volume, but lower resolution.

In the first part of the session a range of different colours and material types were displayed on a model representing the existing 'Neopulse' range. There was some discussion about the qualities and benefits of the SAR technology. In the second half of the session, the Neopulse model was removed and replaced by a model representing the 'Cosmolite' range. This model featured more curved surfaces, which, during the preparation of the session, had created problems for the blending of the images from the two projectors. Hence, it was decided to only use one projector for this model. Throughout the session, the focus was on reviewing different colours, textures and materials rather than on modifying any of the detailed features of the suitcase design.

In the last part of the session, the participants requested to map fabric textures on the Cosmolite model Fast changes in size and pattern of two different high-resolution fabric texture images were tested, discussed and reviewed.

What went well?

Samsonite participants appreciated the fact that the SPARK platform would significantly reduce the number of foam models that would need to be made for design review meetings. They also felt that the mixed prototype would support good feedback from review participants, particularly non-designers that might struggle to understand the scale and dimensions of digital models.

What was challenging?

During the session, the participants asked to apply a type of material to the model that had not been pre-loaded within the Information System (IS). To implement this request, it was necessary to exit the SPARK session, find a suitable image on the Internet that provided the desired material look, upload this image to the IS and then start a new session. Hence, whilst it was possible to achieve the desired material effect, the long-winded process highlighted some of the limitations of the existing IS.

There was some discussion during the session about the ease of set-up and use of the SPARK platform. The Design Manager was concerned that it might require significant time from his design team to prepare for sessions and that the system might not always work correctly if it was too complicated to prepare a session. It was suggested that this concern might be addressed by having a 'SPARK champion', who would be given in-depth training in the use of the system and could then help other designers to ensure their sessions went smoothly.

What could be improved?
It was suggested that it would be helpful if the SPARK platform would allow the user to apply a material/texture independently of the colour. Currently, these two aspects are coupled, meaning that the user must upload image files that represent a particular material with a specific colour. It was requested that the resolution of the rendering be improved. This might be achieved with higher resolution projectors, but that implies higher system costs. Still related to rendering quality, it was proposed that shadow rendering would be useful in enhancing the realism of the rendering. Integration of the SPARK platform with existing design software used at the company was identified as a potential source of efficiency improvement.

What was the overall verdict of the participants?
Overall the Samsonite participants felt that the SPARK platform could be useful in saving prototyping costs for the monthly design review meetings with marketing, team leaders and directors. They expressed an interest in building new collaborations with the SPARK consortium in order to further develop the SPARK platform.

Figure 14. Pictures of the blank physical model (left) and SAR-enhanced prototypes from the Samsonite session.

Wavecontrol

The demonstration session with Wavecontrol was used to test user interaction aspects of the large touch screen that appears on the product. The Director and the Chief Engineer from Wavecontrol participated in the session. The technical staff often receive a detailed and highly constrained brief from the marketing department but as this was a completely new type of product for the company there were no pre-defined constraints as to the layout or look of the product. This provided an opportunity to experiment with some different design concepts.

What went well?
Working with a 1:1 scale prototype was appreciated by both the Wavecontrol representatives. In addition, the shape and size of the device being designed was convenient for SAR projection (large size with flat rectangular surfaces), enabling the assets to be projected clearly and at a good size during the session. From the early stages of the session, the users started engaging with the mixed prototype in a natural way: passing the prototype from one person to the other, requesting modifications and reviewing the effects of those modifications in real time. They were able to review different user interface concepts for the display of their product quickly.

They commented that the mixed prototype be very useful when requesting feedback from industry end users. For instance, gloves are often worn when operating the product in the field, so having a physical prototype that they could handle, whilst wearing gloves, would help to get better quality feedback on

the physical ergonomics of the device as well as the visual ergonomics related to the user interface of the display.

During the last part of the session there was some discussion related to colour, material and finishes choices for the product but it was felt that decisions on this topic should be delayed until the next session, when marketing staff will be present.

What was challenging?
The main challenge from Stimulo's perspective was trying to control the initial expectations of the client, given that the SPARK platform is a prototype technology that is still in development. The very high expectations of the Wavecontrol participants led them to requesting several new functionalities, especially for digital interaction.

What could be improved?
Some of the suggestions for improved digital interaction design included the ability to show blinking icons to represent LEDs, and videos or GIFs to represent the display of dynamic graphics and charts. The Wavecontrol participants felt that the use of IR markers in the current tracking system hinders the manipulation of the object (as the projection can become misaligned or unstable if one or more markers are obscured by the users' hands). They suggested a LIDAR laser system might be used in conjunction with an IR or optical tracking system to provide more stable tracking.

What was the overall verdict of the participants?
Overall the Wavecontrol participants felt that the SPARK platform could be useful to enable stakeholders from across the company to provide their feedback and input with the design process. The technical staff remarked that SPARK was an immersive, fast and dynamic tool to modify the design in real time.
The Wavecontrol Director expressed an interest in SPARK as a service since they are more focused in engineering solutions rather than design but that it would be interesting for engineers to get involved with marketing and design team in the early stages of a project. They are interested to keep applying SPARK for future meeting with Stimulo for the ongoing project.

Figure 15. Pictures from Wavecontrol Director and Engineer performing screen assets

4.2.2 Results of the feedback questionnaire from the product design sessions

Here we present a summary of the results of the questionnaire from the product design sessions.

Question 1 asked how frequently co-creative design sessions are held within the company. At Samsonite these sessions happen once per month, whilst at Wavecontrol these sessions only occur once per quarter.

Question 2 asked 'How important are the following challenges for your organisation?'. The results are presented in Figure 16.

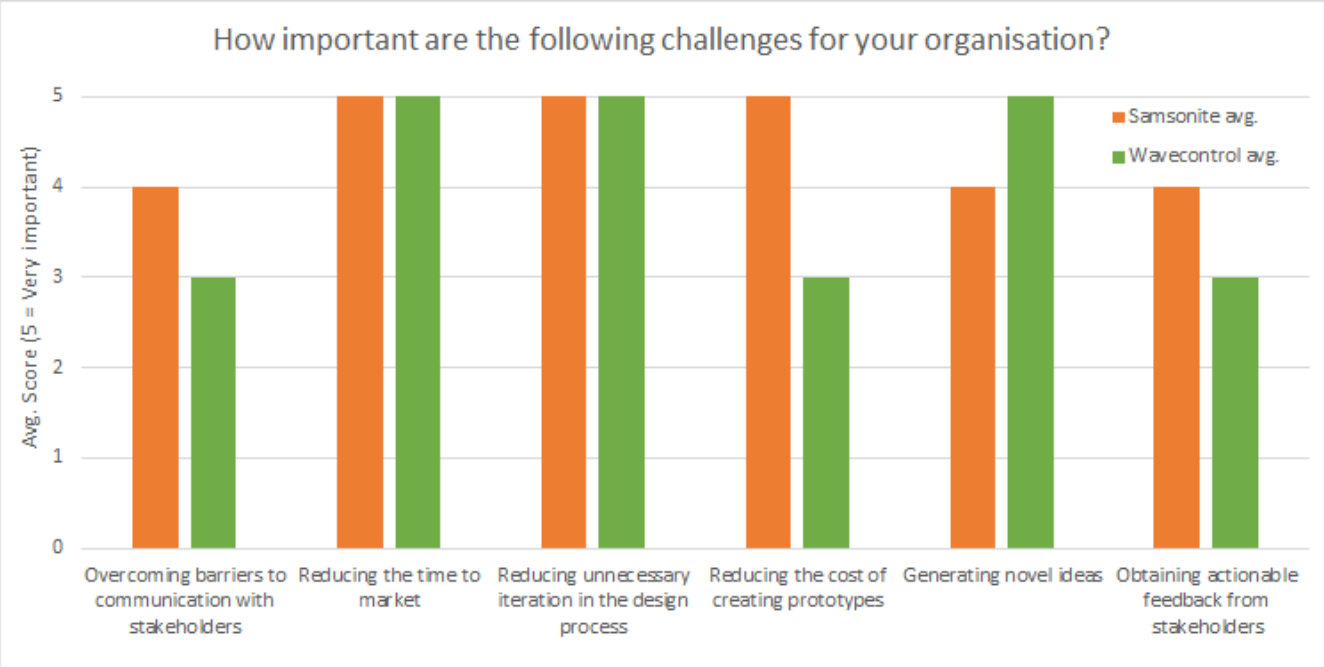

Figure 16. Summary of the average importance scores for question 2.

From Figure 16, reducing the time to market and unnecessary iteration in the design process are considered the most important challenges for the product design-focused companies. Whilst the results from the two companies are generally similar, there is a significant discrepancy in the perceived importance of the cost of creating prototypes. Samsonite placed very high importance on this issue because they currently spend significant amounts of money on producing aesthetic models for their monthly design review, with four or five of these models produced for every meeting. Wavecontrol placed less importance on this issue, which is logical given that they have co-creative design sessions less frequently (once per quarter) and normally only require one model per session.

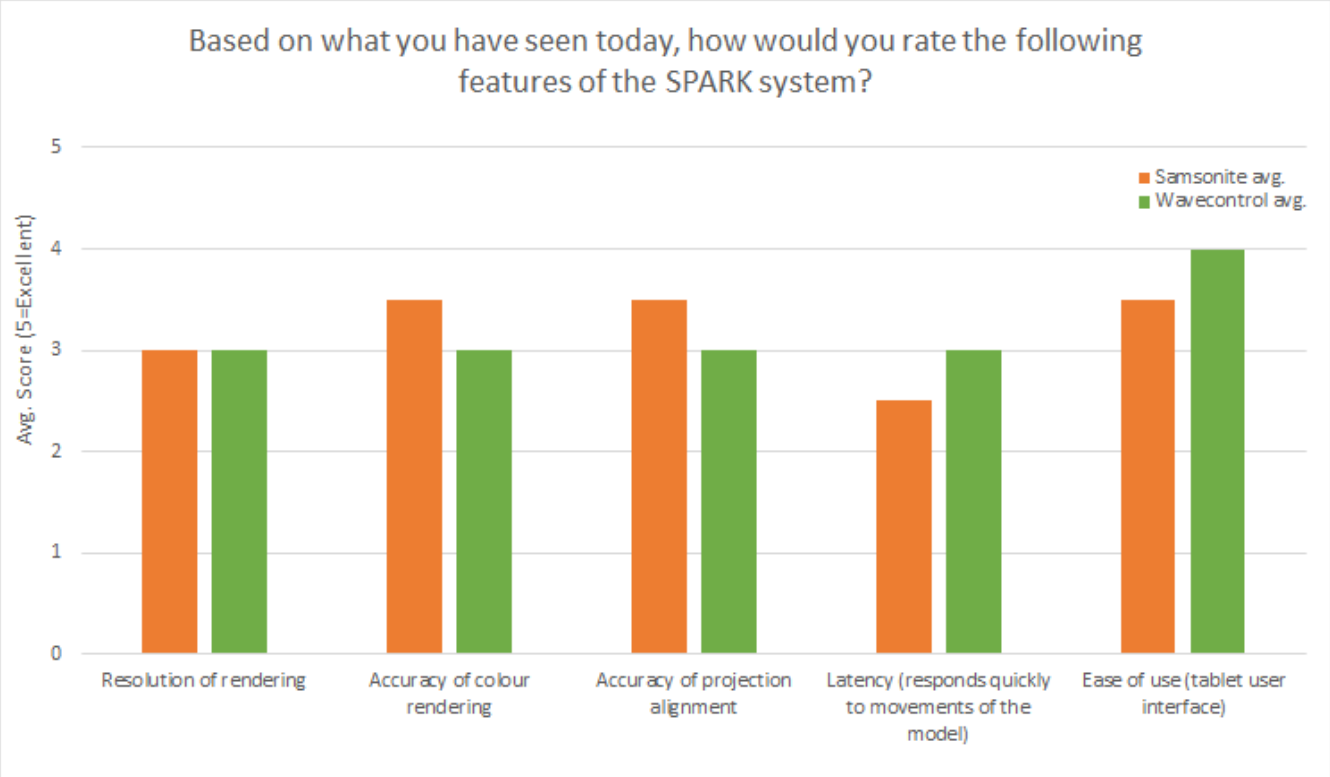

Figure 17. Summary of the average importance scores for question 3.

The ease of use of the tablet PC user interface was appreciated by the product design companies, which is more positive than the more feedback provided by Colruyt and Food Inc. concerning the GUI. The remaining feedback was neutral regarding the performance of the system. In the written feedback participants from both companies suggested a higher resolution of rendering is required whilst Wavecontrol provided a specific suggestion to improve the tracking performance (see session summary). Latency seems to be more a problem for these companies than for the two previous ones.

Question 4 asked about the impact of using the SPARK platform for co-creative design sessions at the company. The results are presented in Figure 18.

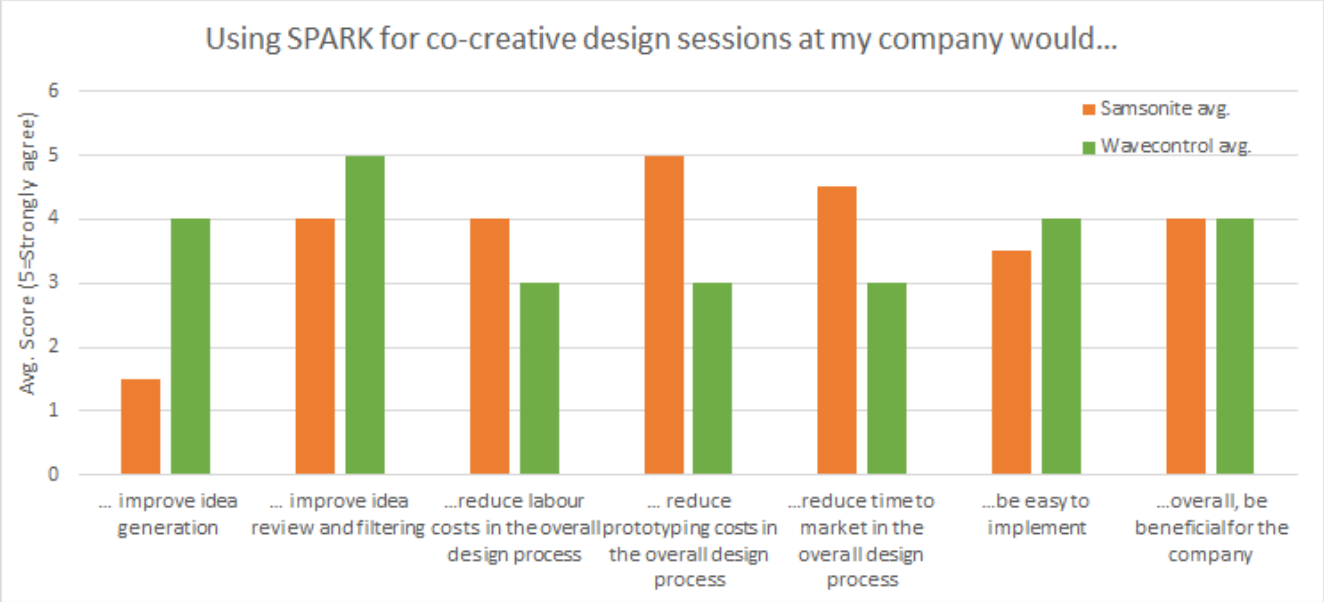

Figure 18. Summary of the average importance scores for question 4.

Concerning the potential benefits of the SPARK system, reducing prototyping costs was the main perceived benefit for Samsonite, which is consistent with the response to question 2. For Wavecontrol, improving idea review and filtering was considered to be the most likely benefit. It is interesting to note that the Samsonite representatives did not feel that SPARK would improve idea generation. However, this is consistent with their planned scenario of use, which was review meetings working with finalised designs.

4.2.3 Results of the logfile analysis for the product design sessions

The log files of the following sessions have been considered for the analysis, according to the metrics presented in Section 3.3:

- AMS: 05/11 - Samsonite
- Stimulo: 07/11 - Wavecontrol

Table 4 presents the values for each index mentioned in Section 3.3.

Table 4. Results of the log file analysis for the product design sessions.

	#_Funct	#_Funct_eff	#_Asset	#_Variant	#_Time	#_Effectiveness	#_HCI_GUI
Samsonite	1777	346	13	186	6074 s	32.7 s	19,5 %
Wavecontrol	3634	602	17	412	8212 s	19,9 s	16,6 %

These two sessions, as the ones mentioned in 4.1.3, are also characterized by a large internal variability. The prototype of the Wavecontrol case study is one of the largest ever tested (in size) with the SPARK platform, and the Samsonite luggage models were even larger. The objectives of these two sessions were also different in purpose (design review for Samsonite and interface design -screen- for Wavecontrol).
These differences are also evident when one compares the #_Assets and the #_Variants. Nevertheless, it is worth mentioning that these two sessions have a more uniform (and quite long) duration (#_Time). Both the product design sessions satisfactorily confirmed that the SPARK platform is capable of supporting the evaluation of hundreds of different alternatives in a very short time: the Wavecontrol

session has the higher #_Variant score among both packaging and product design sessions (412). The #_Effectiveness is also very satisfactory, as the average time interval between an old and a new version of the prototype is still in the range of tenths of seconds. This also suggest that savings on prototyping costs could also be relevant for product design. With reference to the values of #_Effectiveness of the packaging design sessions, it is clear that these durations are longer. This can be explained considering the nature of the expected design: while in packaging design co-designers have to place and orient several assets to reach a sufficiently complete composition to make a meaningful assessment, product design allows for a more "independent" placement of assets, as they typically correspond to specific product functions, which can be explored and discussed singularly, even before a complete product interface description is completed.
The mouse and keyboard interface scores around 15-20% for #HCI_GUI, which is comparable with the scores of the tablet interface (which are consistent with the results obtained with the same interface in packaging design). The analysis of efficiency by functions mentioned in Section 4.1.3. will also take into account the results of the product design sessions.

5. IS THE SPARK PLATFORM AN EFFECTIVE SOLUTION FOR THE PACKAGING AND PRODUCT DESIGN MARKETS?

In the previous sections we have presented the results from a variety of research activities and analysis methods. Here, we present a synthesis of some of the key points that can be drawn from across the results.
For the companies representing the packaging design market, the main perceived benefits of the SPARK system were obtaining feedback from customers and improving communication. Prototype cost reduction together with time to market reduction was also rated as important. This conclusion is also confirmed by the results gathered with log files, as, during the co-design sessions, the participants had the chance to explore a large number (hundreds) of solution variants in a very short time (session duration of 30-150 minutes approximately). This also suggests that the technology is actually enabling a real-like visualization with a mixed prototype (tangible and virtual) what was previously only possible to visualize through digital contents, on digital media.
However, a number of challenges remain, including the ones related to the manipulation of the platform and its performance. While the platform is still evolving, we felt an important frustration regarding the tablet manipulation. As for above, this results is also numerically confirmed via the analysis of the log file: sessions carried out at Artefice (whose SPARK room is equipped with a very large touch screen) showed a more efficient use of the platform (almost 40% of the functions reached the expected target, as the log did not record any prompt need of readjustment). This percentage, despite it is not fully satisfactory, appears to be significantly higher compared to what was measured in the SPARK rooms at AMS and Stimulo, which are equipped with tablet-PCs or desktop PCs. In these two contexts, the number of functions that were carried out satisfactorily with no need of readjustment drops to 15-20%. Also, some requirements about the rendering was also presented as limiting the user experience. Despite the limitations in the feature set and reliability of the current prototype SPARK system, all three of the packaging-focused companies expressed positive statements of interest in implementing a SPARK system within their organisation.

For the companies representing the product design market, the main perceived benefits of the SPARK system were reducing time to market and unnecessary iterations. This is consistent with the objectives of the companies especially the one expressed by Samsonite. Communication issues are perceived as

less critical for these companies than for packaging applications as well as idea generation. This tends to consider that the application here is more towards project review and decision making rather than idea generation and customer feedback. However, a number of challenges remain, including the ones related to rendering and latency. Latency is a problem when intensive manipulation is required, and we believe that the perception is made worse by the alignment problems. In actuality, the alignment and the tracking of the mixed prototype in the real operational environment turned out to perform worse than in the laboratories at the academic premises and this clearly affected the judgement of the testers. As a matter of fact, the SPARK platform needs to be improved in terms of robustness and ease of set-up, so as to allow also less experiences technicians to fully exploit the potential of the SAR technology.

The log file analysis, for product design, confirms that the SPARK platform appears to be extremely suitable to run sessions where multiple options have to be evaluated: the amount of variants checked within these sessions generally exceeds the threshold of a hundred and scores more than 400 in one of the considered sessions.

Overall, the demonstrations sessions completed with T5.3 have provided very useful evidence of the effectiveness of the SPARK platform in a variety of applications (SPARK Objective #4) whilst also providing concrete evidence of market interest from both the packaging design and product design markets. The feedback and suggestions from the participating organisations will be used to further refine the exploitation plans that will be presented in D6.6.

APPENDIX

Survey for demonstration session participants

1. How often does your company currently hold co-creative design sessions (or product development review meetings) with internal stakeholders, customers or end users?

One or more times per week [ ]
Around once per month [ ]
Around once per quarter [ ]
Around once per year [ ]
Never [ ]

2. How important are the following challenges for your organisation?

	Not at all important				Very important
Overcoming barriers to communication with stakeholders	[ ]	[ ]	[ ]	[ ]	[ ]
Reducing the time to market	[ ]	[ ]	[ ]	[ ]	[ ]
Reducing unnecessary iteration in the design process	[ ]	[ ]	[ ]	[ ]	[ ]
Reducing the cost of creating prototypes	[ ]	[ ]	[ ]	[ ]	[ ]
Generating novel ideas	[ ]	[ ]	[ ]	[ ]	[ ]
Obtaining actionable feedback from stakeholders	[ ]	[ ]	[ ]	[ ]	[ ]
Other – please specify below	[ ]	[ ]	[ ]	[ ]	[ ]

Other challenge: _____

3. Based on what you have seen today, how would you rate the following features of the SPARK system?

	Very poor				Excellent
Resolution of rendering	[ ]	[ ]	[ ]	[ ]	[ ]
Accuracy of colour rendering	[ ]	[ ]	[ ]	[ ]	[ ]
Accuracy of projection alignment	[ ]	[ ]	[ ]	[ ]	[ ]
Latency (responds quickly to movements of the model)	[ ]	[ ]	[ ]	[ ]	[ ]
Ease of use (tablet user interface)	[ ]	[ ]	[ ]	[ ]	[ ]

4. To what extent do you agree or disagree with the following statements.

Using SPARK for co-creative design sessions at my company would…	Strongly disagree				Strongly agree
… improve idea generation	[ ]	[ ]	[ ]	[ ]	[ ]
… improve idea review and filtering	[ ]	[ ]	[ ]	[ ]	[ ]
…reduce labour costs in the overall design process	[ ]	[ ]	[ ]	[ ]	[ ]
… reduce prototyping costs in the overall design process	[ ]	[ ]	[ ]	[ ]	[ ]
…reduce time to market in the overall design process	[ ]	[ ]	[ ]	[ ]	[ ]
…be easy to implement	[ ]	[ ]	[ ]	[ ]	[ ]
…overall, be beneficial for the company	[ ]	[ ]	[ ]	[ ]	[ ]

5. In your own words, what are the things that you like most about this new technology?

6. In your own words, what are the things that you would most like to improve in this new technology?

7. Any other comments?

Name:
Company:
Position: