Impact of in-store technology on the consumer shopping process – a field experiment with a smart cart

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Abstract

An in-store experiment in a Finnish supermarket was conducted to measure the impact of a smart cart device on the consumer shopping process. The experiment consisted of research subjects choosing five previously determined products displayed on the smart cart. A control group completed the same shopping process with products described on a traditional shopping list. The length of the shopping process and the time to choose the determined products were measured in real time with Tobii eye tracker glasses for both groups. Also the user experience of the device was investigated after the completion of the shopping process. The results indicate that the smart cart device had a minor impact on the consumer shopping process. However, the participants' positive evaluations of the device indicate that in-store technologies have the potential to impact the shopping process positively and thus shape new types of interactions.

Keywords: Experiment, in-store technology, grocery shopping, retail, consumer behavior

1   INTRODUCTION

A growing domain is the use of information technology to support and interact with the consumer decision journey inside a retail store. The role of physical brick and mortar retail stores is changing due to the growth of mobile devices, social media and in-store technologies (Piotrowicz and Cuthbertson, 2014). The Omnichannel is emerging where customer experiences of physical brick and mortar channels are integrated with online

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channels (Brynjolfsson and Rahman, 2012). New in-store technologies are available such as interactive screens, virtual fittings rooms, intelligent self-service kiosks, vending machines, QR-codes and mobile devices brought to the shop by the customers (Piotrowicz and Cuthbertson, 2014). These types of in-store technologies can affect the consumer shopping process inside a retail store tremendously, thus shaping new types of interactions. In fact, consumers want to look at a product in action and are highly influenced by what they learn, see or do in-store. Up to 40% of consumers change their minds because of these in-store activities (Court et al., 2009). According to the same authors, in-store touch points provide significant opportunities for brands and retailers. Others have also emphasized that consumers make their decisions in-store. In fact according to figures from the retail industry body, Point of Purchase Advertising International (POPAI, 2012), in-store consumer decisions have risen from 70% to 76%. According to Clement and Forsberg (2014), 85% of daily commodities are selected in front of the shelf. Most grocery shoppers (88%) do carry either a physical shopping list or a mental list with them to the supermarket, but at the same time most of them shop or can shop with flexibility (Thomas and Garland, 2004). Hence, it seems obvious that smart in-store technologies can both impact and support the consumer shopping process in an in-store supermarket context. Sigurdsson et al. (2015) have also conducted behavioural analysis research in in-store environments to contribute to the future of retailing. They argue that declining growth of new customers forces retailers to dig deeper into in-store shopping behaviour and to focus more on in-store merchandising and promotions.

Against this background, the objective of this field experiment was to better understand the impact of new in-store technology – a smart cart device – on the consumer shopping process in a real supermarket environment. The research assumption was twofold; (1) a smart cart device impacts the consumers' shopping (i.e. search and choice) process instore, and (2) the smart cart device is perceived helpful by its users. Hence we will here provide the results from an "after only with control group experiment" (Cox and Enis, 1973; Venkatesan and Holloway, 1971) conducted in an in-store grocery environment using a prototype of a smart cart device measured with Tobii eye-tracker glasses and interviews.

2 THE SMART CART DEVICE

The smart cart device is a tablet device integrated into a shopping cart that provides location-based advertising, food recipe features, product brand images, daily offers, and store map, etc. for the shopper at the point of purchase (www.smartcart.fi). The device and the application are provided by a start-up company in Finland, which have so far been implemented in three supermarkets in the Helsinki region. iBeacon technology is used for locating the cart in-store, content is updated online (using the Wi-Fi of the store) and branded ads can be displayed as images, videos and voice. The carts are also charged in an on-site charging station. In this experiment, we used a prototype of the second version of the device. Figure 1 presents a schematic description of the user interface of the prototype when using the recipe feature, which is used in this experiment.
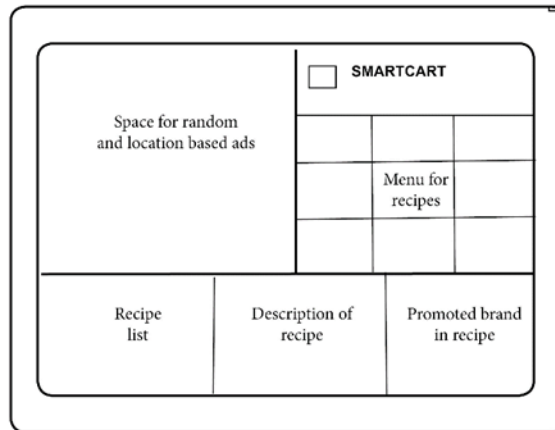
Figure 1. A schematic user interface of the smart cart device for the recipe feature

3 METHODOLOGY

3.1 Procedure

Twenty bachelor students in business, participating in a course "Future of retail" at the authors' business college, were randomly divided into two groups. Ten students in the experimental group used the smart cart device to search and collect a given food recipe containing five different products; meat, milk, cheese, spices and pasta. The other ten students used a sheet of paper as a shopping list containing the same five products as in the recipe – they functioned as a control group in this experiment.

The recipe feature in the smart cart was chosen together with the operator as it contained a shopping list with a "tick off product feature", description of the recipe and images of branded recipe products, i.e. the information provided by the last row in the schematic picture of the smart cart. Hence, our assumption, or preliminary hypothesis, was that this smart cart feature should impact the perceptions and efficiency of the shopping process, the choice of products, and the selection order of products (the in-store route).

A scenario was created in order to control for the influence of external variables. The recipe constituted 9 products, but the participants were told that they needed to buy five of the products, the rest they have at home. The participants were also instructed that they had a maximum of 15 minutes to find the products and bring them to the cashier area. We wanted to avoid a situation where the results were heavily influenced by the time spent to complete the shopping round. The participants could freely decide which products, or brands, to select and in which order, but they were strictly advised not to ask any store personnel for help. We wanted to avoid any human influence and focus on influences by the smart cart and other in-store features (signs, and product placements, etc.). One person from the research team also followed the participants in the store, i.e. checking that everything went as instructed and checking that the eye-tracker glasses were recording properly. All participants were wearing the Tobii eye-tracker

glasses. The experiment was conducted in a K-Supermarket in Helsinki, Finland on December 8th 2015 with the permission of the store owner. See Figure 2.

Figure 2. The smart cart device and eye-tracker glasses in-store

3.2   Data collection and analysis

The experiment was set up with a blend of quantitative and qualitative data collection using the Tobii eye-tracker glasses and by interviewing the participants after they had finished their round of shopping in the store. The interview guide was divided into two parts. The first part was answered by all participants and the second part only by the participants that had used the smart cart device (see Appendix 2 for the guide). The interviews took only a few minutes per respondent, and these were voice recorded and manually transcribed afterwards.

The Tobii eye-tracker was used to record in real time the participants eye fixations and physical movements in the store. We were able to use 18 videos out of 20. For an unknown reason two videos were not recorded properly. Hence, our final sample comprised 9 participants in the experimental group who used the smart cart and 9 in the control group who used a traditional written shopping list. To analyze the video content we used the Tobii glasses analysis software. See Appendix 1 for the coding and results of the video content.

3.3   The participants

Both groups, the experimental group with the smart cart (SC) device and the control group without the smart cart (SC) device, consisted of two male participants and seven female participants. In both groups there was also one participant that knew the store well from the past. The participants were to evaluate their interest for cooking on a scale $1 - 10$ (1 = not at all interested and 10 = very interested). The mean score for the group without the SC device was 8.78 and for the group with the SC device the mean score was 7.23. All participants were in their twenties. Hence, the two experimental

groups were very similar in character regarding age, gender, their past experience of the supermarket and their interest in cooking.

4 RESULTS

4.1 The shopping process in-store

The two experimental groups were asked to evaluate their perceived search process of the five products on a scale 1-10 (1 = hard and 10 = easy). The mean score for the group without the SC device, the control group, was 8.56 and for the group with the SC device, the experimental group, the mean score was 7.00. Both groups were also asked to rate how swiftly they perceived the search process on a scale 1-10 (1= slow and 10 = fast). The mean score for the control group without the SC device was 7.22 and for the experimental group with the SC device it was 7.56.

According to the shopping time measured with the Tobii eye-tracker from the moment they entered the gates of the shopping area until they arrived at the cashier, the control group without the SC device spent on average 6 minutes and 20 seconds in the store from entering the gates, and similarly the experimental group with the SC device spent 6 minutes and 15 seconds.

Figure 3 shows the time that the two groups spent on average in front of the product shelves – meat, milk, spices, pasta and cheese. The times were measured from the moment the participants entered the shelf area (first eye tracker fixations on the shelf) until the participant picked the product. The times follow a similar pattern for both experimental groups, except for spices. The reason was that one participant without the SC device spent an exceptionally long time finding the right spices.

The order for picking the products was overall very widespread (see Appendix 1) but for both groups the most common order was: 1. Meat 2. Milk 3. Cheese 4. Spices and 5. Pasta. None of the participants followed the order of how the products were presented in the recipe. The most commonly chosen brand by the control group without the SC device was: Meat "Pirkka", Milk "Valio Blue", Cheese "Aura", Spices "Santa Maria", pasta "Pirkka" and the most commonly picked brand by the experimental group with the SC device was: Meat "Atria", Milk "Valio Blue", Cheese "Aura", Spices "Pirkka", pasta "Pirkka". Hence, three out of five brands are the same in both groups. Hence, we could not identify a clear difference in the pattern for product choices. Neither could we identify a clear pattern according to the presented brand images on the SC device within the experimental SC group (see Appendix 1).
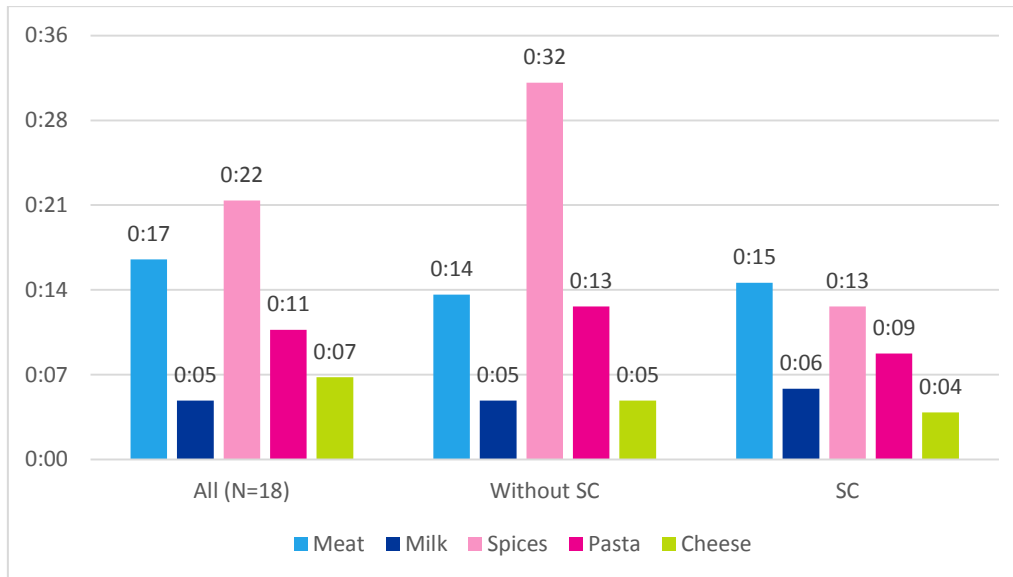
Figure 3. Average shelf time

In the interviews, comments were given regarding the search process for the five recipe products. Here are some reflections that represent the participants' comments well:

"... I thought it would be more difficult than it was, but it was very easy when you read and follow the signs that the K-stores (a supermarket chain in Finland) have."

"All K-markets have roughly the same shelf placement. That you know roughly where the meat is, so then the next needs to be there and there. Logically."

"… cheese and milk are usually in the quite same area and pasta usually quite in the end. The spices were a little harder to find, but the order was quite logical."

"Difficult to look around with the glasses and I did not really know where every-thing was. And it was quite a lot of people."

"It felt like it took forever... Really difficult to think clearly with the glasses."

"Hard to find the cheese and there was too much meat, could not choose."

"The cheese was the only one that was a little harder to find because of that there were two disks, and I was only on the second disk, and then I found it not from there so I went to the second shelf. But everything else was easy."

"Basic commodities, the time limitation set some pressure ..."

"... It felt like I could have been able to go faster and it took longer when I did not know the store from the past."

"This did not take long since I've been here before, and I am familiar with the layout and it has basi-cally not changed in quite some time."

Based on the comments we can see that many aspects influenced the shopping process: in-store signs, the logic of product placements in K-stores, the logic of, e.g. the cheese placement and participants' past experience in this particular store, the number of other customers, time pressure and having to cope with the experimental situation, e.g. eye-tracking glasses. However, the comments did not relate to the SC device, rather the par-

6

ticipants in the experimental group highlighted other aspects in the search and collect process.

4.2   The user experience of the smart cart device

The nine participants in the experimental group who used the SC device regarded its usability quite good. The mean value was 7.11 on a scale $1 - 10$ (1 = Poor and 10 = Excellent), with a variation from 5 to 10. Furthermore, six participants perceived that the SC device helped them in their shopping process, two did not think it helped them but thought it had potential and one participant did not find it helpful at all. Based on Tobii eye-tracker data, we calculated that it took the participants 17 seconds on average to get started with the SC device and find the right recipe. The following comments regarding the SC device were made in the interviews:

"… it gives the recipes and it tries to influence your choices"

"If you do not know what to cook, it helps."

"Very good, because you do not often know what to cook when you go into the store, but with the help of the smart cart you can easily find recipes and use them while shopping”

"By using the list, remember what you have and not have. And that you could tick products."

"… that you could tick those (products) already taken."

"It (the smart cart device) helps if you have a special occasion. But in everyday life no… "

Based on the ratings and comments we see that the smart cart device was perceived quite helpful in the shopping process. Most of the participants also found the device to have potential. We also asked the nine participants if the product brand images shown on the SC device helped them to find the products. All of them responded that they did not look at the product images or they did not see them at all, expect for one that looked at the images at one point. Here are some of their comments:

"… I noticed them (the images) after they told me about them."

"No I did not notice them (the images), I just went by the product names in the recipe."

"I saw them (the images) once, but not at first, they should be placed in the upper left corner instead."

From Figure 4 we can also see that the Tobii eye-tracker fixations were primarily on the list of the recipe and the text descriptions. The product brand image of pasta in the right lower corner was not fixated at all by the nine participants. This is in line with the above results that the SC device had a minor impact on product brand choices. Some minor calibration problems of the Tobii eye-tracker glasses can also be recognized from fixations targeted outside the screen of the SC device.
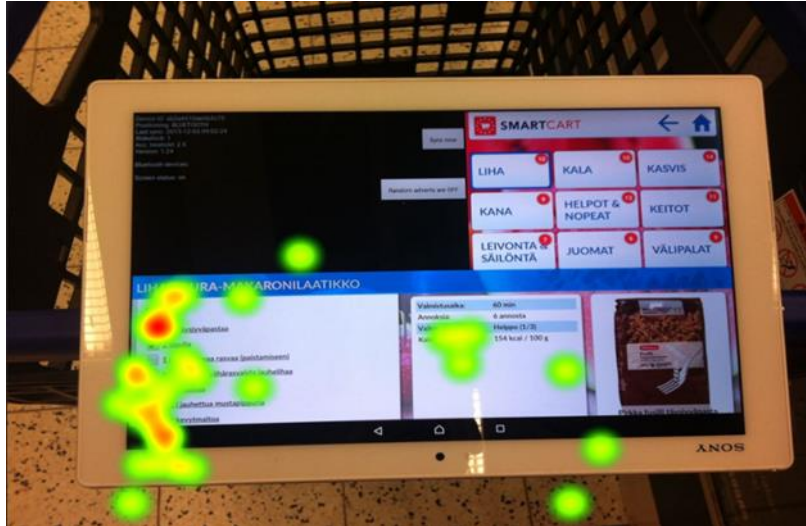
Figure 4. Fixations on the SC device at the pasta shelf

5   DISCUSSION AND CONCLUSIONS

The research assumption of this study was twofold; (1) a smart cart device impacts the consumers' shopping (i.e. search and choice) process in-store, and (2) the use of a smart cart device is perceived helpful.

The results show that the SC device had a relatively small impact on the consumer shopping process in the store. The time spent in the store and at the product shelves was basically the same regardless of whether the participants used the SC device or not. Also the routes taken by the participants, the picked product brands and the participants' self-evaluation of the search and collect process were quite similar between the two groups. Based on the interview comments made by the participants, it seems more likely that their behaviour was influenced by variables such as in-store signs, the logic of product placements in K-stores, the logic of product placement in this particular store and in Finnish supermarkets in general, past experience of this particular store, time pressure and having to cope with the experimental situation, e.g. wearing eye-tracking glasses.

The results, nevertheless, also show that the participants that used the SC device perceived it quite helpful, especially the "product tick feature" in the recipe list. Also the usability of the SC device was ranked positively and the participants could see themselves using the recipe feature when shopping for special occasions and when not knowing what to cook. Hence, their comments indicate very good potential for the SC device. However, the results clearly show that the product images of brands viewed on the SC device were not recognized by the participants. This finding calls for development actions for the operator of the SC device on how to efficiently view product brands and promotions to the users of the device. Effects of digital signage and promotions are indeed an interesting topic also from a scientific perspective. Nevertheless, all in all the participants found the SC device an easy and useful tool with great potential. This is important as in-store technologies should improve the customer experience and not pro-

vide a new barrier to individuals less familiar with technology (Piotrowicz and Cuthbertson, 2014).

To summarize, despite the fact that the SC device seemed to have a minor effect on the consumer shopping process, the positive evaluations of the SC device definitely indicate that in-store technologies can impact the shopping process positively and thus shape new types of interactions. The experiment provided useful information for the operator of the SC device, e.g. on how to further develop the device, how to promote it and what features to consider in the future. For the researchers, this experiment provided a first step in the direction of developing an experimental platform and procedures for understanding the impact of in-store technologies such as the SC device – what variables to measure and what variables to control. This is in line with what Sigurdsson et al. (2015) point out, that in-store experiments should be more systematic (use the same experimental base) in order to increase understanding of industry norms. The experiment has also provided us with useful information of the eye-tracking technology – practical procedures and how to optimize the use of the glasses. In addition, a more in depth analysis of the eye-tracker video content (De Valck et al., 2009) could be conducted to explore other possible behavioural patterns, e.g. product choice. Also a theoretical framework for the impact of digital signage or digital promotions in-store on the consumer shopping process could be developed for further studies of similar character.   This work should therefore be seen as a work in progress and a practical guide on what to consider when setting up similar experiments.

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APPENDIX 1.

Measurements of SC device use, total store time (minutes and seconds), time at the shelves, order of shelves and chosen product brands

	ID	CartS	CartE	ShopS	ShopE	MeatS	MeatE	MilkS	MilkE	SpicesS	SpicesE	PastaS	PastaE	CheeseS	CheeseE	Order of Shelfs	Meat Brand	Milk Brand	Cheese Brand	Spices Brand	Pasta Brand
With SC	2	0:17	0:32	1:29	6:13	2:04	2:19	3:09	3:11	5:15	5:34	4:23	4:39	3:54	3:59	meat-milk-cheese-pasta-spice	Pirkka	Valio Blue	Aura	Santa Maria	Torino
	3	0:09	0:15	2:01	8:45	3:13	3:22	4:59	5:05	8:03	8:09	6:39	6:43	6:07	6:09	meat-milk-cheese-spices-pasta	Green	Valio Blue	Aura	Pirkka Maustepippuri	Pirkka Brown
	6	0:17	0:32	1:30	11:20	8:29	8:56	2:41	2:49	4:06	4:20	10:37	10:57	7:06	7:11	milk-spices-cheese-pasta-meat	Green Seelman	Valio Blue	Aura	Santa Maria	Tumma
	7	0:02	0:23	1:53	6:31	2:27	2:41	3:48	3:59	3:12	3:21	5:56	6:10	-	-	meat-spices-milk-pasta	Pirkka	Valio Plus		Santa Maria bottle	Pirkka
	10	0:17	0:36	3:30	10:52	3:57	4:07	9:41	9:48	8:24	8:34	10:51	11:04	7:40	7:44	meat-cheese-spices-milk-pasta	Black box	Valio Blue	Aura	Santa Maria	Pirkka
	12	0:08	0:25	2:05	8:28	3:04	3:27	5:34	5:45	7:50	8:15	7:04	7:08	4:50	4:56	meat-milk-cheese-pasta-spices	Green	Valio Light Blue	Aura	Santa Maria	Tumma
	14	0:14	0:35	2:31	8:20	3:19	3:25	5:18	5:20	7:38	8:00	6:29	6:38	4:38	4:40	meat-cheese-milk-pasta-spices	HK	Valio Light Blue	Unknown	Santa Maria	Pirkka Brown
	15	0:10	0:31	2:32	6:56	2:56	3:17	4:13	4:16	5:52	6:12	6:42	6:44	4:58	5:00	meat-milk-cheese-spices-pasta	Pirkka	Valio Blue	Aura	Santa Maria	Semper
	17	0:11	0:30	1:51	7:26	6:09	6:21	3:03	3:09	5:17	5:21	6:58	7:10	4:55	4:59	milk-cheese-spices-meat-pasta	Pirkka	Valio Blue	Aura	Santa Maria bottle	Pirkka Brown
Without SC	1			0:58	6:02	1:20	1:22	3:06	3:10	4:35	5:11	3:45	3:48	2:54	2:57	meat-cheese-milk-pasta-spice	K-ruokamestarin	Valio Blue	Alura	Pirkka Maustepippuri	Pirkka Brown
	4			0:41	7:31	1:37	1:55	3:37	3:39	4:56	5:30	6:21	7:07	3:20	3:21	meat-cheese-milk-spices-pasta	Pirkka	Valio Blue	Aura	Pirkka	In a box Tagliatalle
	5			0:20	4:21	0:41	0:46	2:22	2:26	3:07	3:16	3:57	4:00	1:42	1:52	meat-milk-cheese-spices-pasta	K-ruokamestarin	Valio Blue	Aura	Pirkka	Pirkka Brown
	8			1:18	5:36	1:45	1:58	3:08	3:20	4:29	4:41	4:56	5:22	4:04	4:13	meat-milk-cheese-spices-pasta	Pirkka	Valio Blue	Aura	Santa Maria	Tumma
	9			0:58	6:50	1:37	2:01	3:45	3:49	5:16	5:33	6:31	6:39	3:24	3:25	meat-cheese-milk-spices-pasta	Black box	Valio Blue	Aura	Santa Maria	Barilla
	11			0:19	9:00	1:01	1:08	8:40	8:43	6:48	8:40	5:10	5:14	4:36	4:38	meat-cheese-pasta-spices-milk	Atria	Valio Blue	Aura	Pirkka	Another brand
	13			1:15	6:42	1:48	1:58	2:48	2:56	6:03	6:24	5:22	5:29	3:18	4:28	meat-milk-cheese-pasta-spices	Atria	Valio Blue	Castello	Santa Maria	Pirkka Brown
	16			0:50	5:03	1:28	1:45	3:48	3:56	2:27	2:40	4:50	4:56	4:27	4:30	meat-spices-milk-cheese-pasta	Atria	Valio Blue	Aura	Santa Maria	Pirkka Brown
	18			1:59	9:11	2:31	3:50	6:46	6:50	5:26	5:54	8:20	8:36	6:25	6:30	meat-spices-cheese-milk-pasta	Green Seelman	Valio Blue	Aura	Pirkka	Pirkka Brown

CartS = Respondent starts to search for the recipe on the smartcart   ShopS = Respondent enters the store (walks through the gates)   MeatS = Respondent enters the meat shelf area   MilkS = Respondent enters the milk she

CartE = Respondent has found the recipe on the smartcart   ShopE = Respondent comes to the cashiers   MeatE = Respondent has selected teh meat   MilkE = Respondent has selected the m

SpicesS = Respondent enters the spices shelf area   PastaS = Respondent enters the pasta shelf area   CheeseS = Respondent enters the cheese shelf area

SpicesE = Respondent has selected the spices product   PastaE = Respondent has selected the pasta   CheeseE = Respondent has selected the cheese

APPENDIX 2.

Interview guide

Respondent: _____

Date _____ pm_____

Male / Female

Used SmartCart: YES / NO

1. How often do you visit / do you know Mustapekka?

2. Do you usually prepare food according to recipes?

3. How interested are you in cooking? _____
1-10 (1 = not at all interested 10 = very interested)

4. How did you experience the search process?
Scale 1-10 (1 = hard - 10 = very easy): _____ Why?

5. How quickly did the search process go according to you?
1-10 (1 = very slow - 10 = very fast): _____ Why?

For those who used SmartCart

6. How did you perceive the user experience of SmartCart as a whole?
1-10 (1 = poor - 10 = excellent): _____ Why?

7. Did the product images help you?

8. Did SmartCart help you?