Task Performance and Attitudes Towards Supermarket Self-Checkouts

Introduction and Background

Self-checkouts have been a part of supermarkets for over twenty years (Dabholkar et al., 2003). They are increasing in popularity; a 2008 survey found that 63% of supermarkets have self-checkouts in at least one of their stores (Lee and Yang, 2013). According to a study conducted by NCR 90% of the people surveyed described themselves as users of self-service technologies (SST) yet only 7% of those stated that they always use SST (NCR Corporation, 2014).

There have been numerous studies completed regarding user's attitudes and intentions towards SST (e.g.. Dabholkar et al., 2003; Dabholkar and Bagozzi, 2002; Lee and Yang, 2013). Lee and Yang (2013) stated the greater an individual's anxiety with technology is, the less likely they are to use SST. Anxiety has also shown to impact user proficiency and becomes a barrier in using self-checkouts (Lee and Yang, 2013). Another barrier identified is a user's desire for social interaction as an aspect of the task of grocery shopping (Curran et al., 2003). However, for some users this is a motivating factor in choosing to use SST, as it is devoid of interaction (Dabholkar and Bagozzi, 2002). Other motivators for users include shorter waiting times, quicker service, privacy, and ease of use (Demirci Orel and Kara 2014).

The aim of this study is to examine elements of the task of purchasing groceries at the self-checkout and explore possible relationships between task performance and user attitudes. While there have been many studies focusing on interviewing data with respect to user's attitudes, intentions and behaviour, there seems to be very little research involving task analysis of observational data. In order to understand how user's attitude toward SST relates to their experiences using the technology, a deeper understanding of task performance is needed. Through task analysis methods of users completing a transaction, a possible correlation between user experience and attitudes can be determined.

Methods and Results

This research was conducted through observation and interviews of 6 participants at Sainsbury's and Tesco supermarkets. Participants completed consent forms (see Appendix 1) before they were observed. Notes were recorded from each participant's observation and throughout the research process to provide context and an

audit trail (see Appendix 2.1 for an example). Videos were also recorded of the observations for further analysis. Participants were interviewed after they had used the self check-out and their answers were recorded with a portable recording device, as well as field notes taken by the researcher. Observational data was then analysed using the following task analysis methods; hierarchical task analysis and link analysis to show variance between the users. A thematic analysis was completed with the interview data using NVivo. Finally, all of the data was pulled together through triangulation to better understand the task.

Sampling Strategy

Sampling was not randomised, yet created with the planning of the research. While some of the strategy included a convenience sampling, due to time constraints, careful thought was put into finding a purposive sampling of participants that would represent some diversity with age and gender in order to gain rich data. Basic demographic information of the participants was recorded (see Appendix 2.2). Independent samples were used at the two supermarkets.

HTA

Hierarchical task analysis (HTA) provides a framework for other methods of task analysis. It defines the goal of a system and describes that goal by breaking down tasks into their simplest form. A task is redescribed until the operator is able to complete the goal (Wilson and Sharples 2015). A stopping rule for HTA states that if the probability of a failure multiplied by the cost of failure is reasonable, then the analysis may be stopped (Kirwan and Ainsworth, 1992).

The way in which a goal is achieved is determined by different factors such as; the user's proficiency, resources and preference, facilities available, and any possible constraints that exist either with the user or the facilities. It is through these factors that variance is shown within the task. The HTA is best illustrated with both the diagram and the tabular formats, as they supplement each other. The diagram provides a quick easy way to see how a task is completed and the tabular format adds further detail in explaining the task creating clarity (Kirwan and Ainsworth, 1992).

HTA were created by referencing field notes and video recordings collected for each of the six participants, showing how they completed the task (see Appendices 3 to 14 for the diagram and tabular format of each). The stopping rule was in-

dicated on HTA diagrams with a line underneath the plan. The tabular formats include notes, stopping rules and type of operation of a step; input, action or feedback (IAF).

Figure 1 Composite HTA diagram of all users

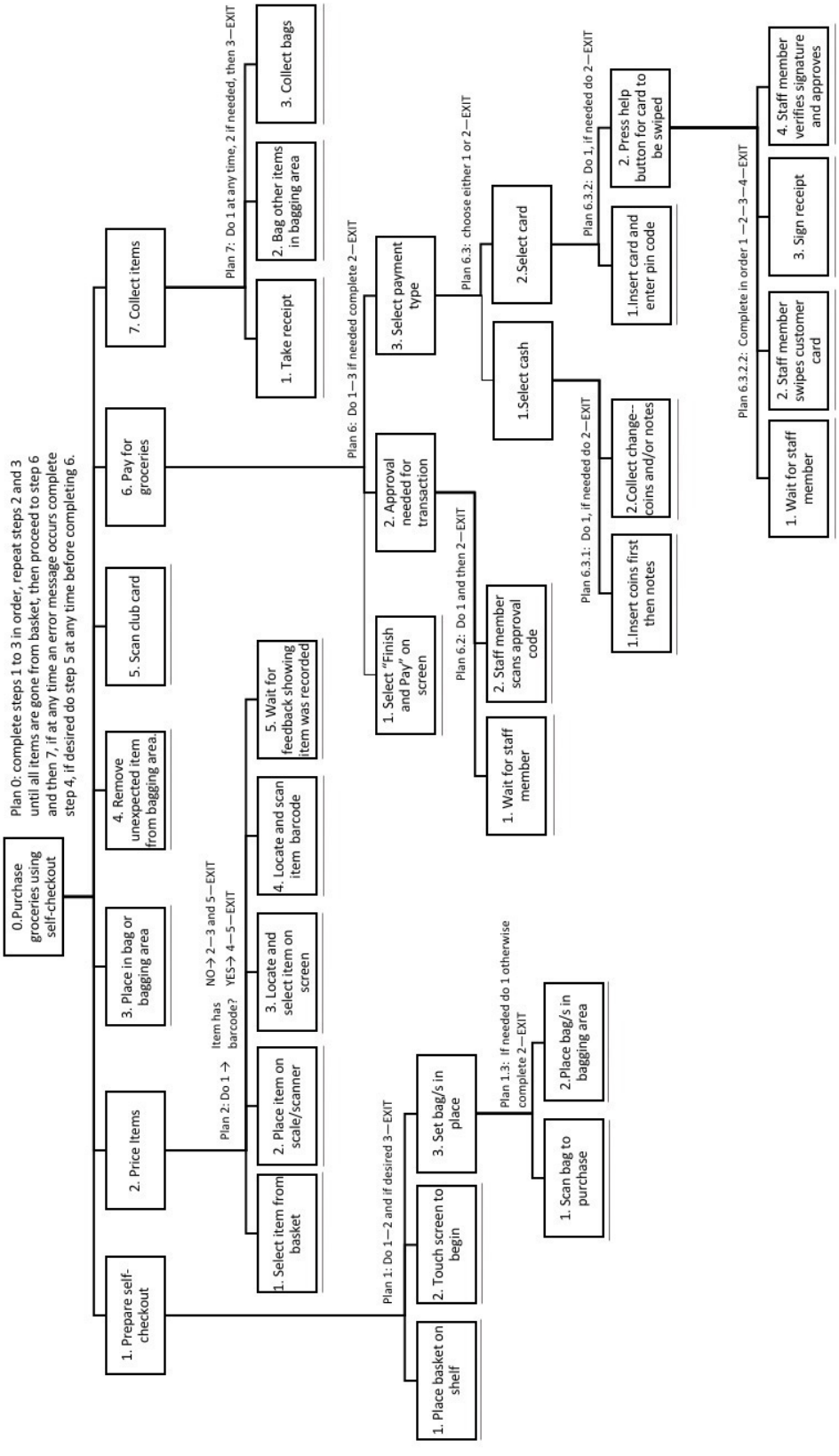


Table 1 Composite HTA tabular of all users

	Task analysis	scribed	I-A-F	Notes
0	Purchase groceries using self-checkout			
	plan 0: *Complete steps 1 to 3 in order, repeat steps 2 and 3 until all items are gone from the basket, then proceed to step 6 and 7, if at any time an error message occurs complete step 4, if desired do step 5 at any time before completing step 6*			
	1 Prepare self-checkout	yes		
	2 Price items	yes		
	3 Place item in bag or bagging area	no	A	
	4 Remove unexpected item from bagging area	no	I	Error shouldn't occur often, if at all, failure to complete this will halt further progress
	5 Scan club card	no		
	6 Pay for groceries	yes		
	7 Collect items	yes		
1	Prepare self-checkout			
	plan 1: *Do 1—2 and if desired 3—EXIT*			
	1 Place basket on shelf	no		
	2 Touch screen to begin	no		
	3 Set bag/s in place	yes		
1	Set bag/s in place			
	plan 1.3: *If needed do 1 otherwise complete 2—EXIT*			
	1 Scan bag to purchase	no		
	2 Place bag/s in bagging area	no		
2	Price items			
	plan 2: *Do 1, if item has no barcode complete 2–3 and then 5 in order, if the item has a barcode complete 4 and 5 in order—EXIT*			
	1 Select item from basket	no		
	2 Place item on scale/scanner	no		This is used most often with produce
	3 Locate and select item on screen	no		
	4 Locate and scan item barcode	no		
	5 Wait for feedback showing item was recorded	no	F	
6	Pay for groceries			

	Task analysis	scribed	I-A-F	Notes
plan 6:	*Do 1—3 if needed complete 2—EXIT*			
	1 Select “Finish and Pay” on screen	no		
	2 Approval needed for transaction	yes	I	occurs most often when purchasing age sensitive items
	3 Select payment type	yes		
6	Approval needed for transaction			
plan 6.2:	*Do 1 and then 2—EXIT*			
	1 Wait for staff member	no	A	
	2 Staff member scans approval code	no	F	
6	Select payment type			
plan 6.3:	*Choose either 1 or 2—EXIT*			
	1 Select cash	yes		
	2 Select card	yes		
6	Select cash			
plan 6.3.1:	*Do 1, if needed do 2—EXIT*			
	1 Insert coins first then notes	no		
	2 Collect change—coins and/or notes	no		
6	Select card			
plan 6.3.2:	*Do 1, if needed do 2—EXIT*			
	1 Insert card and enter pin code	no		
	2 Press help button for card to be swiped	yes	I	Use if card has no chip
6	Press help button for card to be swiped			
plan 6.3.2.2:	*Complete in order 1—2—3—4—EXIT*			
	1 Wait for staff member	no		
	2 Staff member swipes customer card	no		
	3 Sign receipt	no		
	2 Staff member verifies signature and approves	no	F	
7	Collect items			
plan 7:	*Do 1 at any time, 2 if needed, then 3—EXIT*			
	1 Take receipt	no		

	Task analysis	scribed	I-A-F	Notes
2	Bag other items in bagging area	no		
3	Collect bags	no		

Variance was clearly indicated comparing the individual user's HTA as none of the users completed the task in the same way. The individual HTAs were simpler, with fewer plans. However, when complied, the plans became more complex and required more levels of description or a more comprehension organisation of the plans causing the structure to change. The HTA also highlight problems that users experienced during the task.

Link Analysis

This method of task analysis was used to examine the layout of the Tesco and Sainsbury's self-checkout machines, in order to understand task performance and compare differences between the two machines. Link analysis shows where a relationship exists between the system and the user (Kirwan and Ainsworth, 1992). It provides feedback for the layout of a system and shows how a user is interacting with the system. Links with the highest frequency of connections should be placed within close proximity to one another to increase task productivity.

Link analyses of the self-checkout observations were created by reviewing the video recordings of each user completing the task, as well as referencing notes. A link was defined as a movement of the hand from one area of the system to the next. The link analyses were illustrated as diagrams and tables showing the frequency of links. Photos of the self-checkout machines were also added as a point of reference.

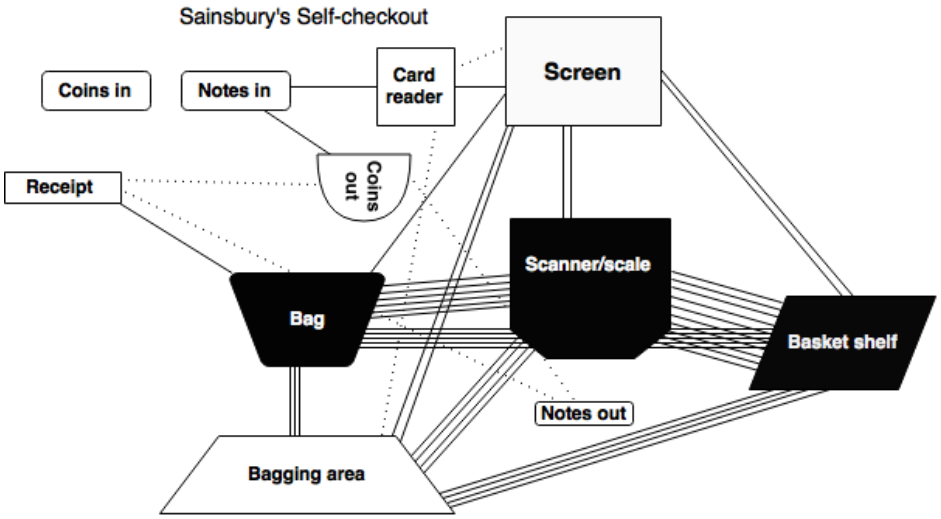
Figure 2 Sainsbury's self-checkout machine

(image from: https://gigaom.com/)

Table 2 Sainsbury's link table

Sainsbury's	1	2	3	4	5	6	7	8	9	10	11
(1) Screen	15										
(2) Scale/scanner	5										
(3) Basket shelf	4	21									
(4) Bagging area	4	9	8								
(5) Bag	2	12	10	7							
(6) Receipt output					3						
(7) Card reader	1			1							
(8) Coin input											
(9) Notes input	2										
(10) Coin output						1			2		
(11) Notes output						1				1	

Figure 3 Sainsbury's link diagram (Solid lines represent 2 links or up to 3 links. Dotted lines show 1 link.)



Sainsbury's most common links were between the basket shelf and the scale/ scanner as well as the bag and the scale/scanner. The layout of the Sainsbury's system is more spread out than Tesco. Users who paid with cash had to take a few steps over to access the notes input feature of the machine. The system also has an input and output for coupons as well as a digital card signing pad, which was not used by any participant during observations.

Figure 4 Tesco self-checkout machine

Figure 5 Tesco link diagram (Solid lines represent 2 links or up to 3 links. Dotted lines show 1 link.)

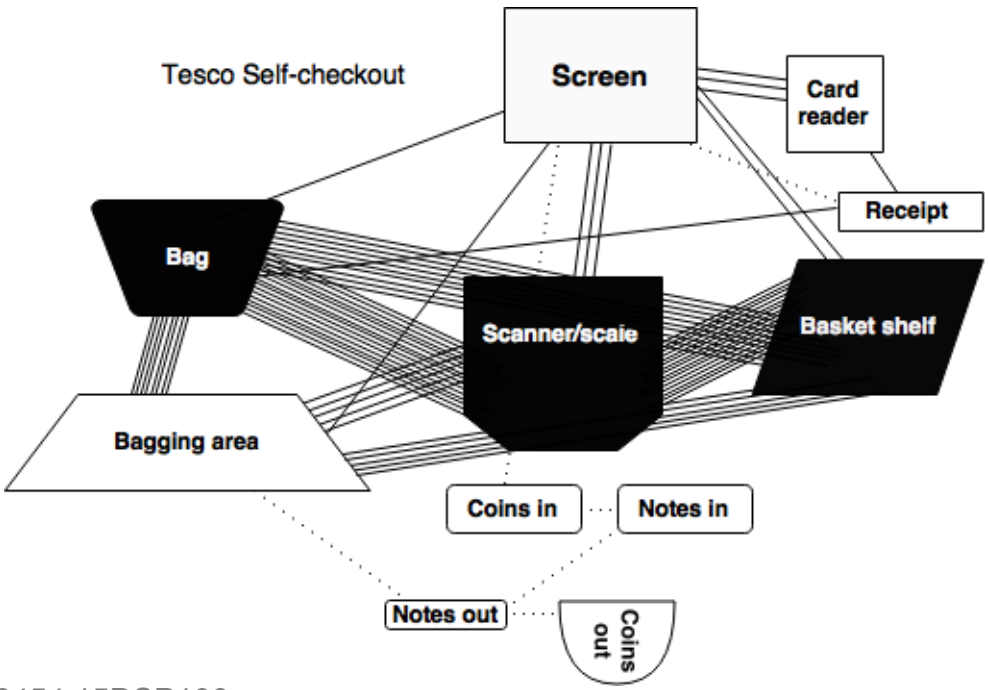


Table 3 Tesco link table

Tesco	1	2	3	4	5	6	7	8	9	10	11
(1) Screen	21										
(2) Scale/scanner	6										
(3) Basket shelf	4	31									
(4) Bagging area	2	10	10								
(5) Bag	3	31	21	17							
(6) Receipt output	1				2						
(7) Card reader	6					2					
(8) Coin input	1										
(9) Notes input								1			
(10) Coin output											
(11) Notes output				1					1	1	

All of the elements of Tesco's self-checkout system are within close proximity to one another, allowing the user to easily reach them with little movement. The most frequently used links were between the basket shelf and the scale/scanner and the bag and the scale/scanner. Tesco's system also had an input for coupons, which no participant used.

Interview

Initially one interview questionnaire was developed for both the Tesco and the Sainsbury's checkout systems. After observation of both systems an addition question was added to the Tesco questionnaire to better understand users attitudes of the separate systems and future intentions to use those systems (see Appendices 15 and 16 for questionnaires). The questionnaires were developed with mostly open-

ended questions using guidelines suggested by Gray (2004). Careful consideration was given in the questionnaire design to ensure validity with attention to word choice, question order, possible probing questions, and importance to the study (Gray, 2004). Probing was used in different ways by the researcher; first as an approach to obtain more in-depth answers about the predetermined questions. Second was to gain a better understanding of the participant's preferences, resources they used and their attitude regarding the overall task.

After interviews were administered in a semi-structured manner they were analysed thematically with a software application called NVivo. Thematic analysis aims to bring comprehension to data, allowing participants to describe their feelings and thoughts regarding their task performance (Wilson and Sharples, 2015). NVivo is designed to manage and analyse qualitative data. The interviews were transcribed from the audio recordings and exported into NVivo, where it was then coded by common themes (see Appendices 17 to 18 for screenshots of this process). A tree diagram was also created with NVivo to show the themes that were coded from the interviews (see Appendix 19).

Themes identified with NVivo included; barriers, motivators, ease of use, independence, speed, SST layout, SST positive comments, SST errors, number of items, attitudes towards SST and privacy. A table was created to explore the main themes of motivators and barriers regarding the check out.

Table 4 Motivator and barrier quotes from interviews

Category name	**Illustrative quotes**	**Interviewee demographics**
Motivators	*Some of the time it's nice not to say hello to a clerk, I don't have to make small talk…when I'm feeling introverted.*	F 40-45
	It's faster…it's more private. I like being able to take care of things myself.	M 30-35
	It's nice to be able to go through quickly….the queue moves faster than a normal checkout.	F 70-75
	Not feeling rushed when I'm bagging my items like someone's waiting for me to get out of the way.	F 30-35
Barriers	*If I was doing a big shop I would go to the normal checkout.*	F 20-25
	When I have to wait for a clear to be able to buy things.	M 30-35
	If you have fresh fruit and vegetables you have to find them on the screen…it's a bit more complicated	F 70-75

Category name	Illustrative quotes	Interviewee demographics
	The uncertainty if you're going to have problems with the checkout or not.	F 30-35

A few users expressed frustration or dislike about the errors that can occur with the self-checkout. However, this negative feeling did not affect their overall opinion of their experience and their future intentions to use SST.

Discussion and Conclusion

Triangulating these three methods together creates validity within the research (Wilson and Sharples 2015). The link analysis and the HTA together show how the user's proficiency, resources and preferences affect the overall productivity of a task. Having a knowledge of the facility's system allows a user to avoid errors while completing their task of purchasing groceries. The user's resources also impact the task, if they are using a card without a chip and pin, the task will take longer and involve more steps. The use of cash can also add to the amount of steps in a task. Preferences and possibly proficiency of a user, impact the task as the user is able to choose the order of some of the steps in the task. That preference directly impacts the length of time of the overall task and can add more steps or actions needed in the task. An example of this is the user's preference of bagging the groceries; if the groceries are placed directly in the bag, instead of the bagging area, after they are recorded by the scanner, this eliminates the extra steps at the end of the transaction of then bagging the groceries from the bagging area to the bag. Lower proficiency with the machines also slows down productivity of the task, possibly causing errors to occur or steps to be repeated until the correct step is found to complete a task.

There is evidence from this study with the users attitudes about their overall experience, regardless of the number of errors that may occur or problems that happen during the task, users will continue to use this technology. Research seems to suggest that despite user's perceived barriers of SST, their overall experience using the technology will be positive.

Comparison of Systems

Sainsbury's self-checkout was further spread out and not as productive for users to easily reach between links. One user stated that the Sainsbury's bagging area seems to be bigger than other stores like Tesco.

Tesco machine required the user to go through more screens at the end of pricing their items to get to the purchase point, adding time to the task. The wording of those screens about purchasing bags also seemed to cause some confusion for the users, resulting in extra time spent trying to understand the screens or the user apathetically clicking through the screen possibly incorrectly costing them more or less money for the bags they used.

Limitations

This research is not free from limitations. Limitations within the interviewing process assumes that the participant will understand the questions in the same way which the researcher meant them and also that they will know how to answer them or be motivated to do so (Gray, 2004). Another limitation regarding interviewing is with the questionnaire design; while attention and thought was put into creating questions that would be easy to understand, gain the most data and explore themes desired, after repeated interviews faults in the questionnaire became evident.

This study would benefit from paired sampled data, allowing for better comparison of the checkout system's differences in task performance. Also to better understand perceptions around SST and user's attitudes, future research could evaluate previous interactions with SST or possibly observing interactions overtime.

word count: 2962

Reference List

Curran, J., Meuter, M. and Surprenant, C., 2003. Intentions to Use Self-Service Technologies: A Confluence of Multiple Attitudes. *Journal of Service Research*, 5 (3), 209-224.

Dabholkar, P. and Bagozzi, R., 2002. An Attitudinal Model of Technology-Based Self-Service: Moderating Effects of Consumer Traits and Situational Factors. *Journal of the Academy of Marketing Science*, 30 (3), 184-201.

Dabholkar, P., Michelle Bobbitt, L. and Lee, E., 2003. Understanding consumer motivation and behavior related to self−scanning in retailing. *International Journal of Service Industry Management*, 14 (1), 59-95.

Demirci Orel, F. and Kara, A., 2014. Supermarket self-checkout service quality, customer satisfaction, and loyalty: Empirical evidence from an emerging market. *Journal of Retailing and Consumer Services*, 21 (2), 118-129.

Gray, D. (2004) *Doing research in the real world*. London: Sage Publications.

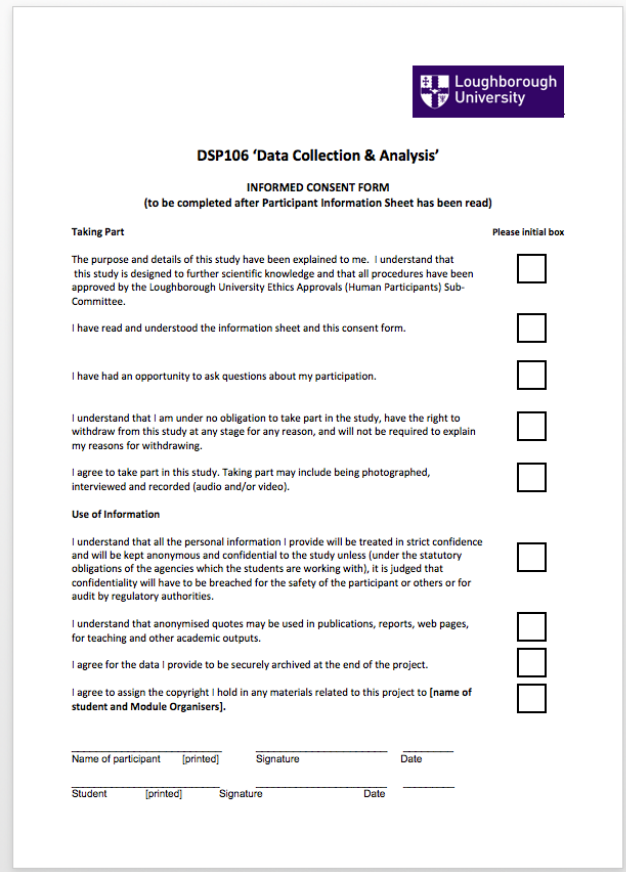
Kirwan, B. and Ainsworth, L., 1992. *A Guide to task analysis*. London: Taylor & Francis.

Lee, H. and Yang, K., 2013. Interpersonal service quality, self-service technology (SST) service quality, and retail patronage. *Journal of Retailing and Consumer Services*, 20 (1), 51-57.

NCR Corporation, 2014. Self-checkout: a global consumer perspective.

Wilson, J. and Sharples, S., 2015. *Evaluation of human work*. 4th ed. Boca Raton: CRC Press.

Appendix 1: Participant Consent forms



Loughborough University

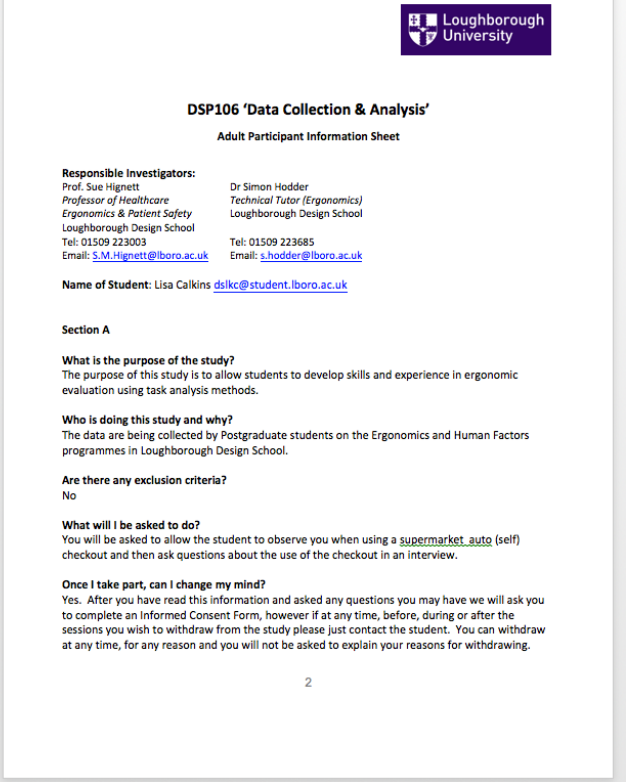
DSP106 'Data Collection & Analysis'

INFORMED CONSENT FORM
(to be completed after Participant Information Sheet has been read)

Taking Part	**Please initial box**
The purpose and details of this study have been explained to me. I understand that this study is designed to further scientific knowledge and that all procedures have been approved by the Loughborough University Ethics Approvals (Human Participants) Sub-Committee.	☐
I have read and understood the information sheet and this consent form.	☐
I have had an opportunity to ask questions about my participation.	☐
I understand that I am under no obligation to take part in the study, have the right to withdraw from this study at any stage for any reason, and will not be required to explain my reasons for withdrawing.	☐
I agree to take part in this study. Taking part may include being photographed, interviewed and recorded (audio and/or video).	☐
Use of Information	
I understand that all the personal information I provide will be treated in strict confidence and will be kept anonymous and confidential to the study unless (under the statutory obligations of the agencies which the students are working with), it is judged that confidentiality will have to be breached for the safety of the participant or others or for audit by regulatory authorities.	☐
I understand that anonymised quotes may be used in publications, reports, web pages, for teaching and other academic outputs.	☐
I agree for the data I provide to be securely archived at the end of the project.	☐
I agree to assign the copyright I hold in any materials related to this project to **[name of student and Module Organisers].**	☐

_____ _____ _____
Name of participant [printed] Signature Date

_____ _____ _____
Student [printed] Signature Date



Loughborough University

DSP106 'Data Collection & Analysis'

Adult Participant Information Sheet

Responsible Investigators:

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Section A

What is the purpose of the study?
The purpose of this study is to allow students to develop skills and experience in ergonomic evaluation using task analysis methods.

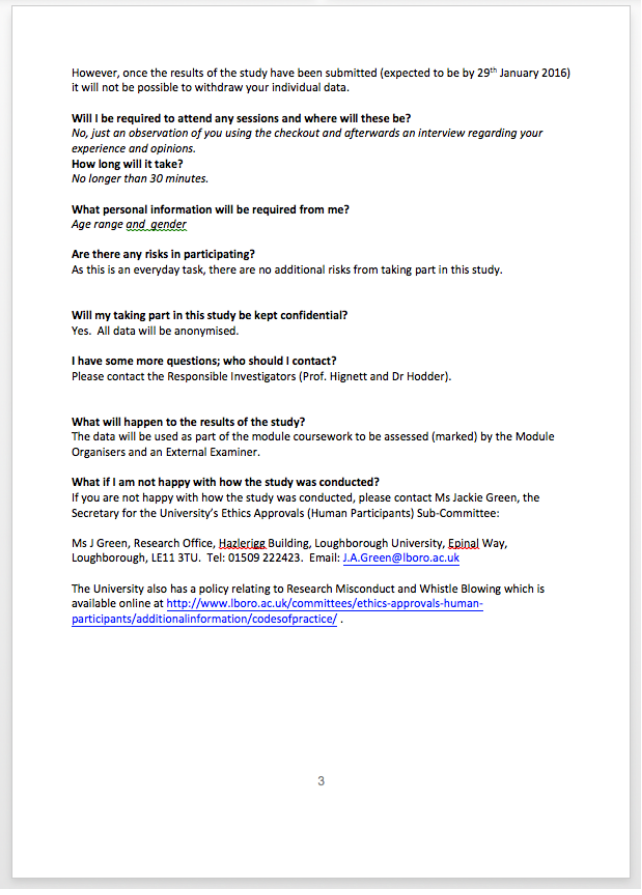
Who is doing this study and why?
The data are being collected by Postgraduate students on the Ergonomics and Human Factors programmes in Loughborough Design School.

Are there any exclusion criteria?
No

What will I be asked to do?
You will be asked to allow the student to observe you when using a supermarket auto (self) checkout and then ask questions about the use of the checkout in an interview.

Once I take part, can I change my mind?
Yes. After you have read this information and asked any questions you may have we will ask you to complete an Informed Consent Form, however if at any time, before, during or after the sessions you wish to withdraw from the study please just contact the student. You can withdraw at any time, for any reason and you will not be asked to explain your reasons for withdrawing.

2



However, once the results of the study have been submitted (expected to be by 29th January 2016) it will not be possible to withdraw your individual data.

Will I be required to attend any sessions and where will these be?
No, just an observation of you using the checkout and afterwards an interview regarding your experience and opinions.
How long will it take?
No longer than 30 minutes.

What personal information will be required from me?
Age range and gender

Are there any risks in participating?
As this is an everyday task, there are no additional risks from taking part in this study.

Will my taking part in this study be kept confidential?
Yes. All data will be anonymised.

I have some more questions; who should I contact?
Please contact the Responsible Investigators (Prof. Hignett and Dr Hodder).

What will happen to the results of the study?
The data will be used as part of the module coursework to be assessed (marked) by the Module Organisers and an External Examiner.

What if I am not happy with how the study was conducted?
If you are not happy with how the study was conducted, please contact Ms Jackie Green, the Secretary for the University's Ethics Approvals (Human Participants) Sub-Committee:

Ms J Green, Research Office, Hazlerigg Building, Loughborough University, Epinal Way, Loughborough, LE11 3TU. Tel: 01509 222423. Email: J.A.Green@lboro.ac.uk

The University also has a policy relating to Research Misconduct and Whistle Blowing which is available online at http://www.lboro.ac.uk/committees/ethics-approvals-human-participants/additionalinformation/codesofpractice/ .

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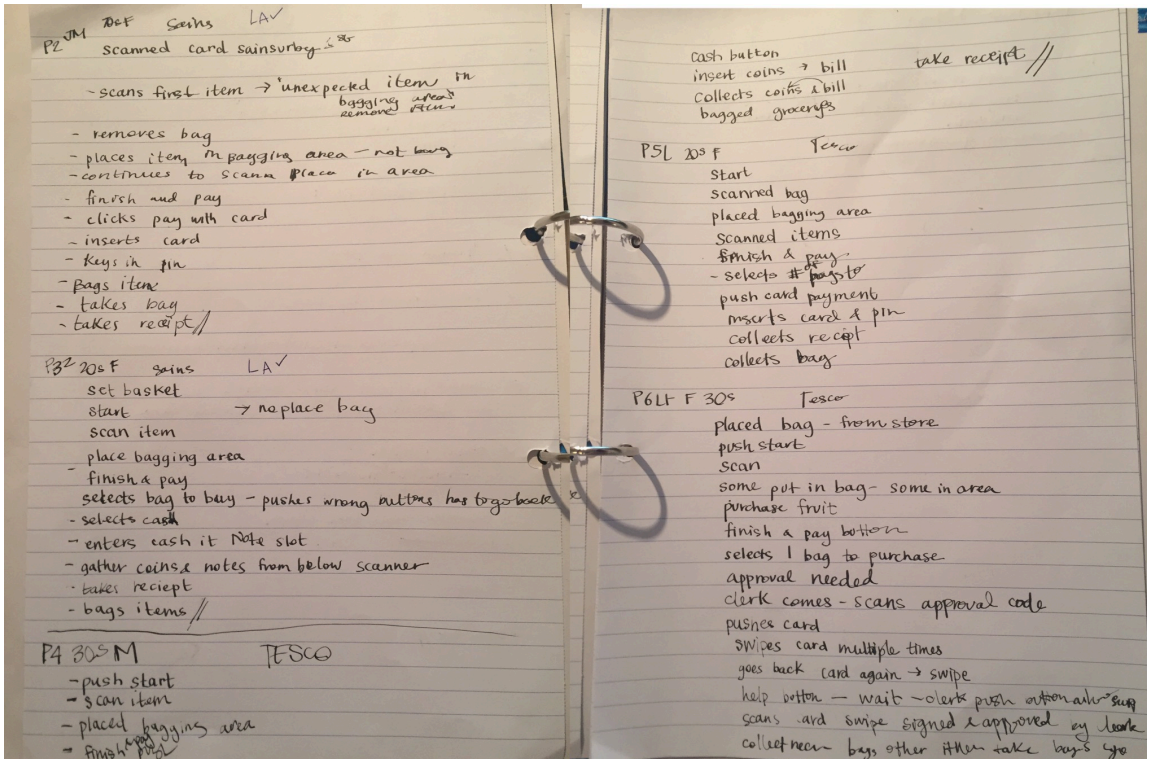
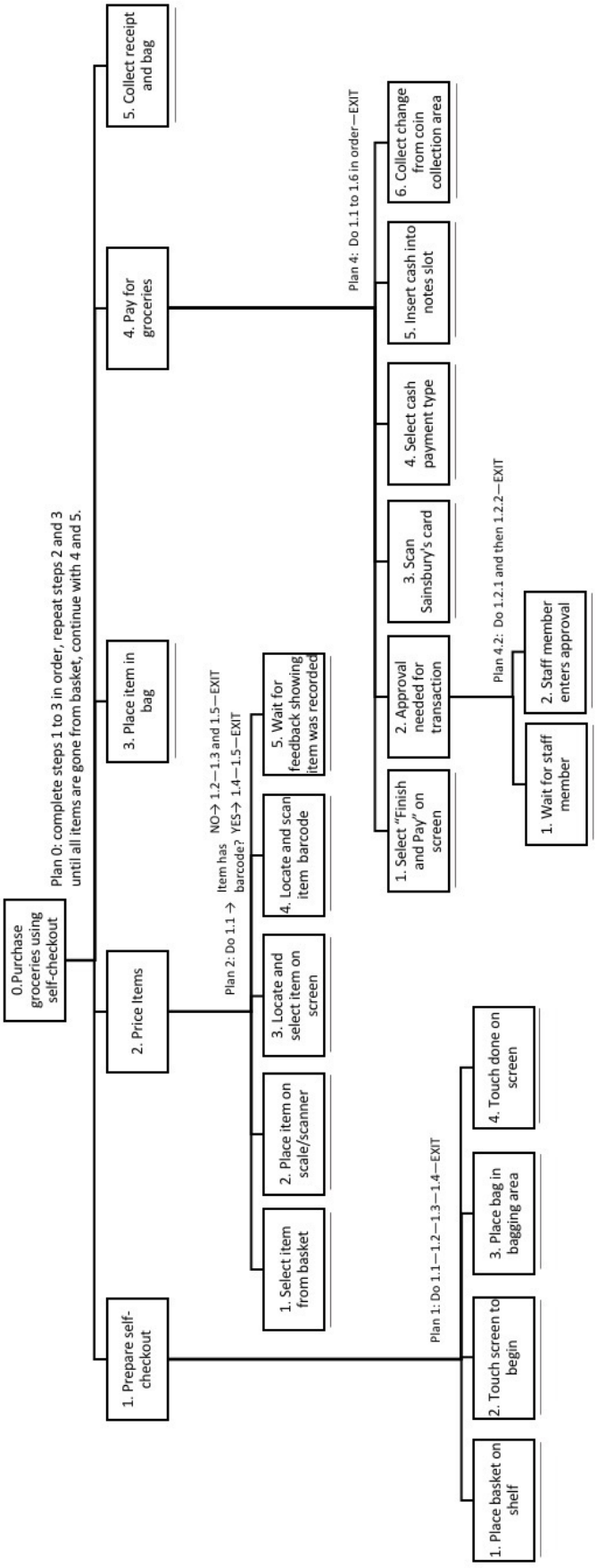
Appendix 2.1: Field Note Journal



Appendix 2.2: User Demographics

User	Gender	Age Range
1	F	40-45
2	F	70-75
3	F	20-25
4	M	30-35
5	F	20-25
6	F	30-35

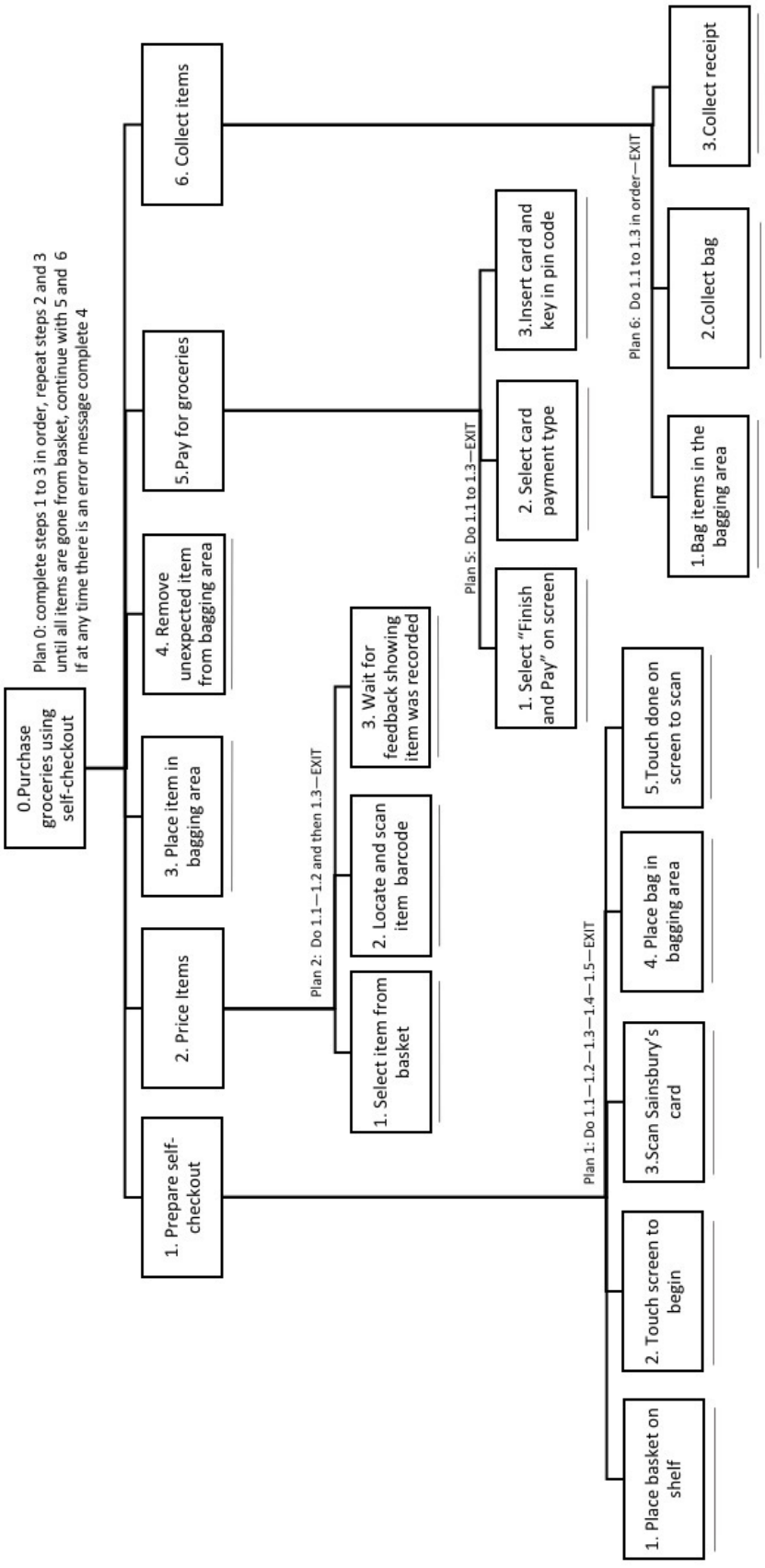
Appendix 3: HTA Diagram User 1—Sainsbury's



Appendix 4: HTA Tabular User 1—Sainsbury's

	Task analysis	scribed	I-A-F	Notes
0	Purchase groceries using self-checkout			
	plan 0: *Complete steps 1 to 3 in order, repeat steps 2 and 3 until all items are gone from the basket, continue with 4 and 5.*			
	1 Prepare self-checkout	yes		
	2 Price items	yes		
	3 Place item in bag	no	A	
	4 Pay for groceries	yes		
	5 Collect receipt and bag	no		
1	Prepare self-checkout			
	plan 1: *Do 1.1—1.2—1.3—1.4—EXIT*			
	1 Place basket on shelf	no		
	2 Touch screen to begin	no		
	3 Place bag in bagging area	no		User brought their own bag
	4 Touch done on screen	no		
2	Price items			
	plan 2: *Do 1.1, if item has no barcode complete 1.2–1.3 then 1.5 in order, if the item has a barcode complete 1.4 and 1.5 in order—EXIT*			
	1 Select item from basket	no		
	2 Place item on scale/scanner	no		User bought fruit
	3 Locate and select item on screen	no		
	4 Locate and scan item barcode	no		
	5 Wait for feedback showing item was recorded	no	F	
4	Pay for groceries			
	plan 4: *Do 1.1 to 1.6 in order—EXIT*			
	1 Select "Finish and Pay" on screen	no		
	2 Approval needed for transaction	yes		
	3 Scan Sainsbury's card	no		
	4 Select cash payment type	no		
	5 Insert cash into notes slot	no		
	6 Collect change from coin collection area	no		
4	Approval needed for transaction			
	plan 4.2: *Do 1.2.1 and then 1.2.2—EXIT*			
	1 Wait for staff member	no		
	2 Staff member enters approval	no		

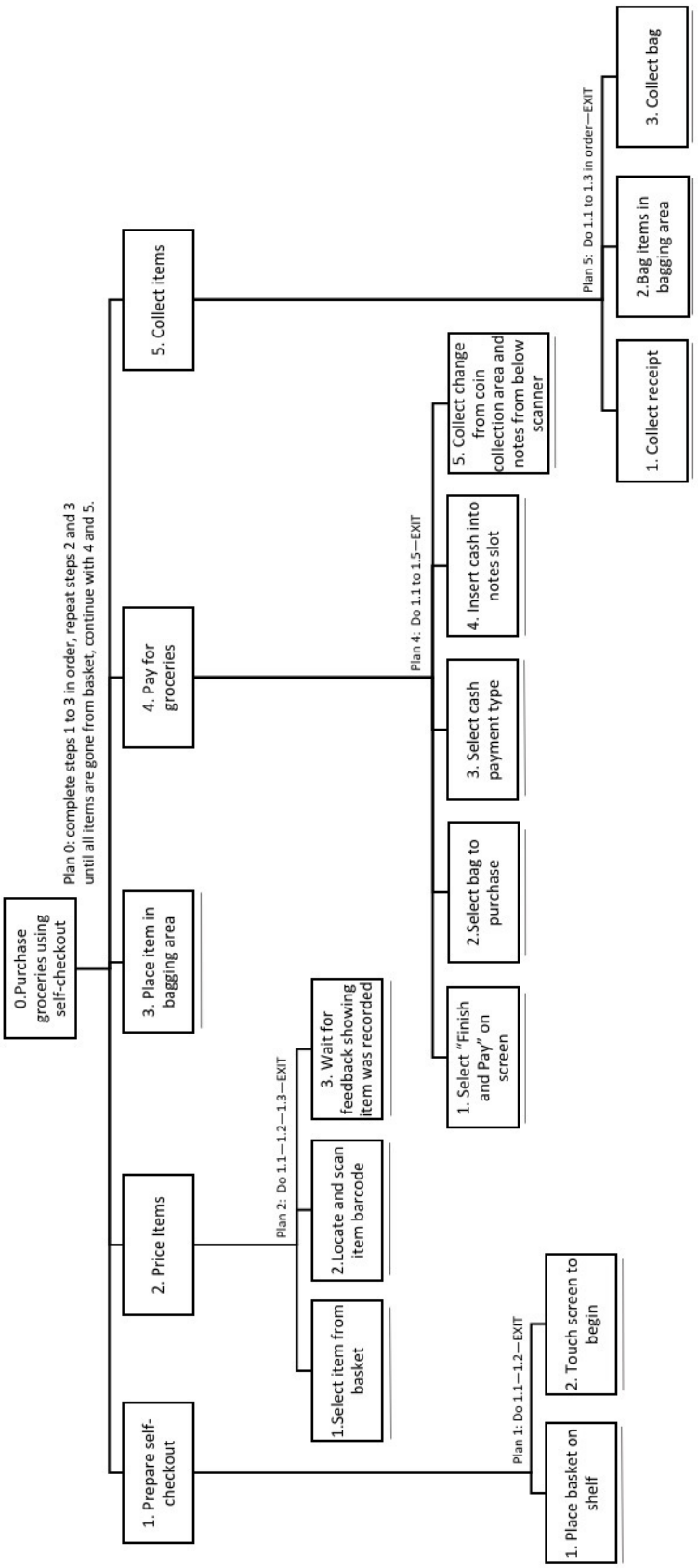
Appendix 5: HTA Diagram User 2—Sainsbury's



Appendix 6: HTA Tabular User 2—Sainsbury's

	Task analysis	scribed	I-A-F	Notes
0	Purchase groceries using self-checkout			
	plan 0: *Complete steps 1 to 3 in order, repeat steps 2 and 3 until all items are gone from the basket, continue with 5 and 6, if at any time there is an error message complete 4.*			
	1 Prepare self-checkout	yes		
	2 Price items	yes		
	3 Place item in bagging area	no	A	
	4 Remove unexpected item from bagging area	no		User removed the entire bag from the bagging area.
	5 Pay for groceries	yes		
	6 Collect items	yes		
1	Prepare self-checkout			
	plan 1: *Do 1.1—1.2—1.3—1.4—1.5—EXIT*			
	1 Place basket on shelf	no		
	2 Touch screen to begin	no		
	3 Scan Sainsbury's card	no		
	4 Place bag in bagging area	no		
	5 Touch done on screen	no		
2	Price items			
	plan 2: *Do 1.1—1.2 and then 1.3—EXIT*			
	1 Select item from basket	no		
	2 Locate and scan item barcode	no		
	3 Wait for feedback showing item was recorded	no	F	
5	Pay for groceries			
	plan 5: *Do 1.1 to 1.3—EXIT*			
	1 Select "Finish and Pay" on screen	no		
	2 Select card payment type	no		
	3 Insert card and key in pin code	no		
6	Collect items			
	plan 6: *Do 1.1 to 1.3 in order—EXIT*			
	1 Bag items in the bagging area	no		
	2 Collect bag	no		
	3 Collect receipt	no		

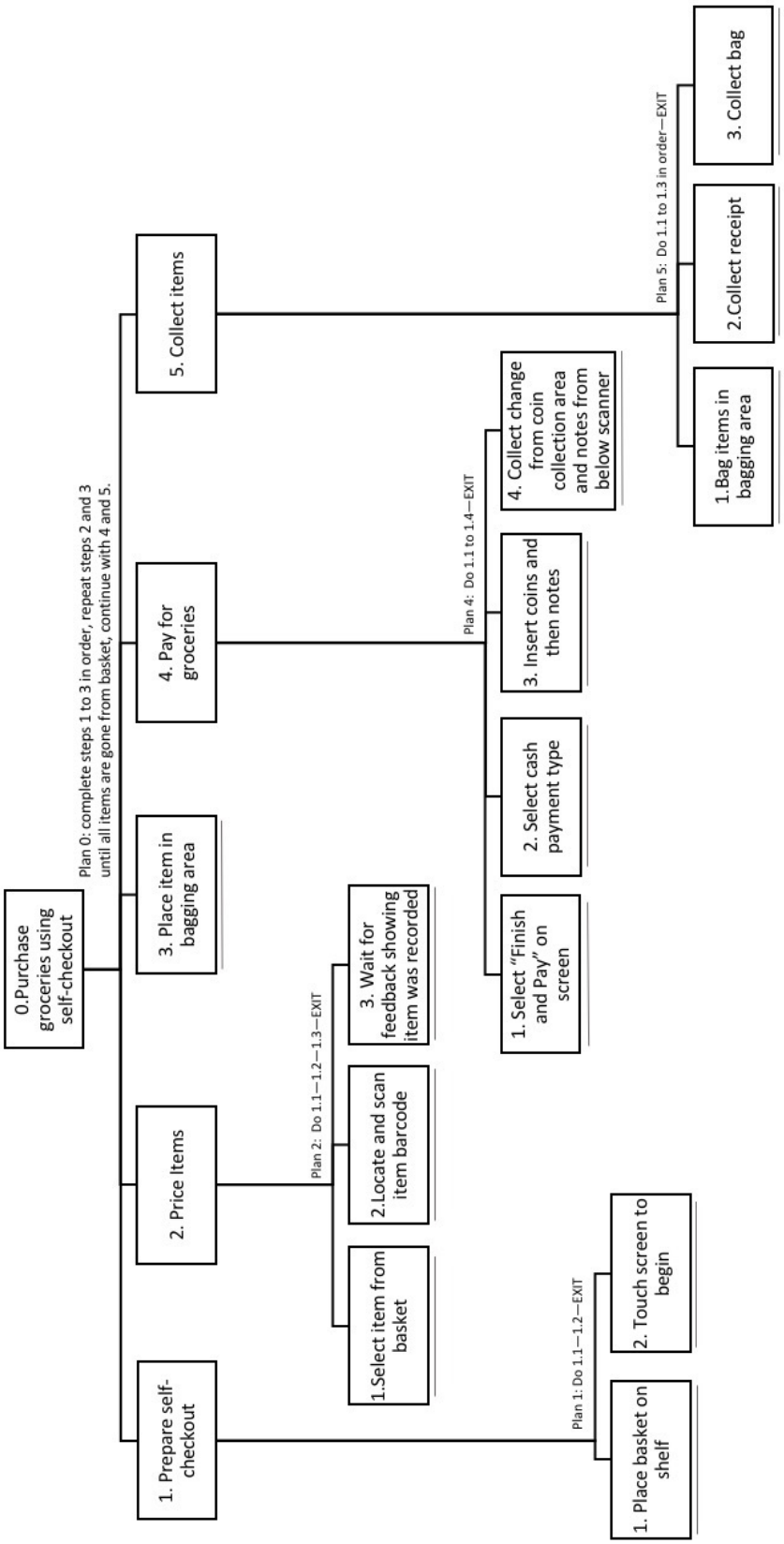
Appendix 7: HTA Diagram User 3—Sainsbury's



Appendix 8: HTA Tabular User 3—Sainsbury's

	Task analysis	scribed	I-A-F	Notes
0	Purchase groceries using self-checkout			
	plan 0: *Complete steps 1 to 3 in order, repeat steps 2 and 3 until all items are gone from the basket, continue with 4 and 5.*			
	1 Prepare self-checkout	yes		
	2 Price items	yes		
	3 Place item in bagging area	no	A	
	4 Pay for groceries	yes		
	5 Collect items	yes		
1	Prepare self-checkout			
	plan 1: *Do 1.1—1.2—EXIT*			
	1 Place basket on shelf	no		
	2 Touch screen to begin	no		
2	Price items			
	plan 2: *Do 1.1–1.2–1.3–EXIT*			
	1 Select item from basket	no		
	2 Locate and scan item barcode	no		
	3 Wait for feedback showing item was recorded	no	F	
4	Pay for groceries			
	plan 4: *Do 1.1 to 1.5—EXIT*			
	1 Select "Finish and Pay" on screen	no		
	2 Select bag to purchase	no		pushes finish and pay before scanning bag after trying to scan a few times goes back to screen before and scans bag.
	3 Select cash payment type	no		
	4 Insert cash into notes slot	no		
	5 Collect change from coin collection area and notes from below scanner	no		
5	Collect items			
	plan 5: *Do 1.1 to 1.3 in order—EXIT*			
	1 Collect receipt	no		
	2 Bag items in bagging area	no		User waited to the end to bag groceries- causing longer task completion
	3 Collect bag	no		

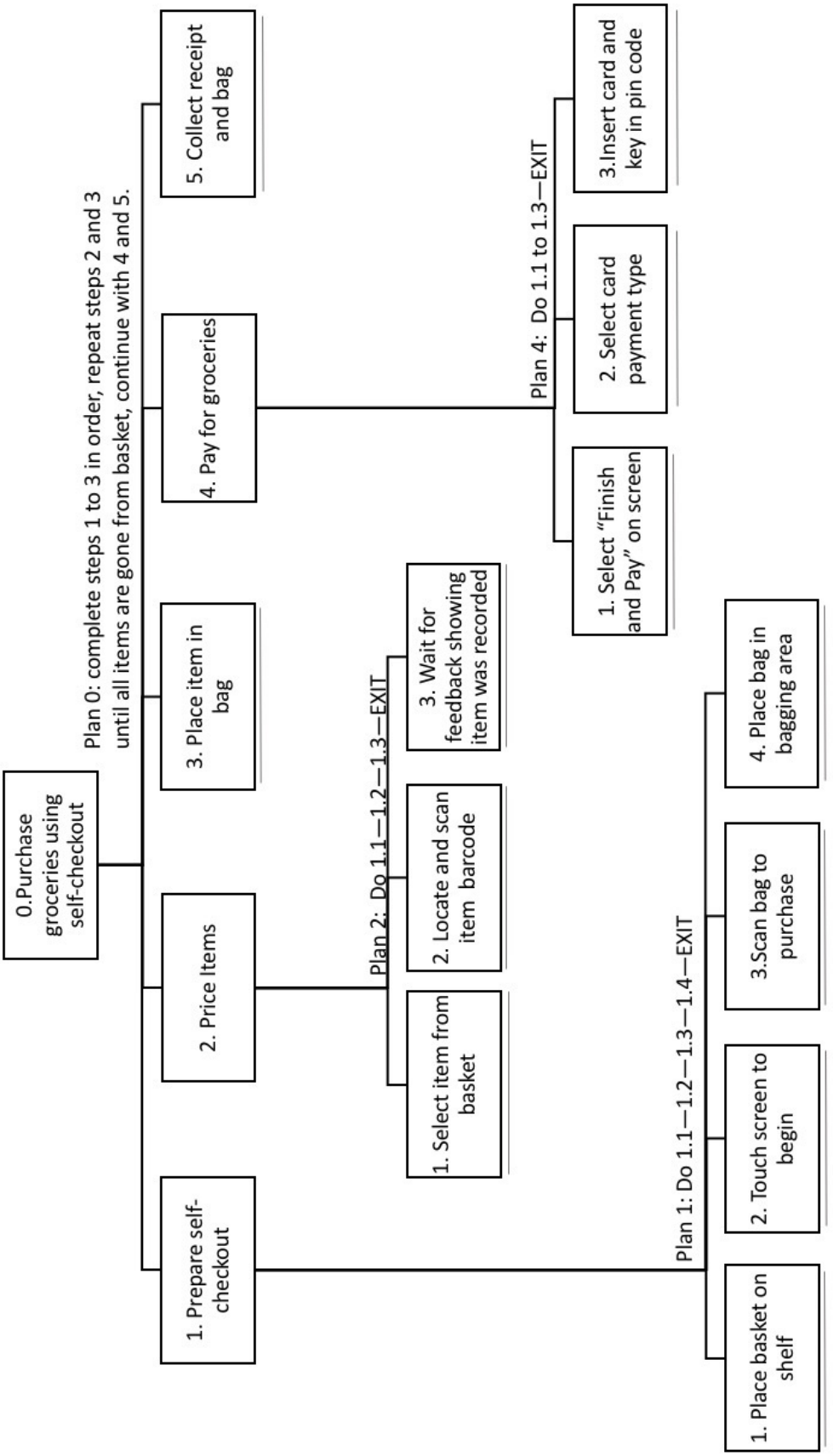
Appendix 9: HTA Diagram User 4—Tesco



Appendix 10: HTA Tabular User 4—Tesco

	Task analysis	scribed	I-A-F	Notes
0	Purchase groceries using self-checkout			
	plan 0: *Complete steps 1 to 3 in order, repeat steps 2 and 3 until all items are gone from the basket, continue with 4 and 5.*			
	1 Prepare self-checkout	yes		
	2 Price items	yes		
	3 Place item in bagging area	no	A	
	4 Pay for groceries	yes		
	5 Collect items	yes		
1	Prepare self-checkout			
	plan 1: *Do 1.1—1.2—EXIT*			
	1 Place basket on shelf	no		
	2 Touch screen to begin	no		
2	Price items			
	plan 2: *Do 1.1–1.2–1.3–EXIT*			
	1 Select item from basket	no		
	2 Locate and scan item barcode	no		
	3 Wait for feedback showing item was recorded	no	F	
4	Pay for groceries			
	plan 4: *Do 1.1 to 1.4—EXIT*			
	1 Select “Finish and Pay” on screen	no		
	2 Select cash payment type	no		
	3 Insert coins and then notes	no		
	4 Collect change from coin collection area and notes from below scanner	no		
5	Collect items			
	plan 5: *Do 1.1 to 1.3 in order—EXIT*			
	1 Bag items in bagging area	no		Didn’t bag while scanning items, used his backpack to carry items
	2 Collect receipt	no		
	3 Collect bag	no		

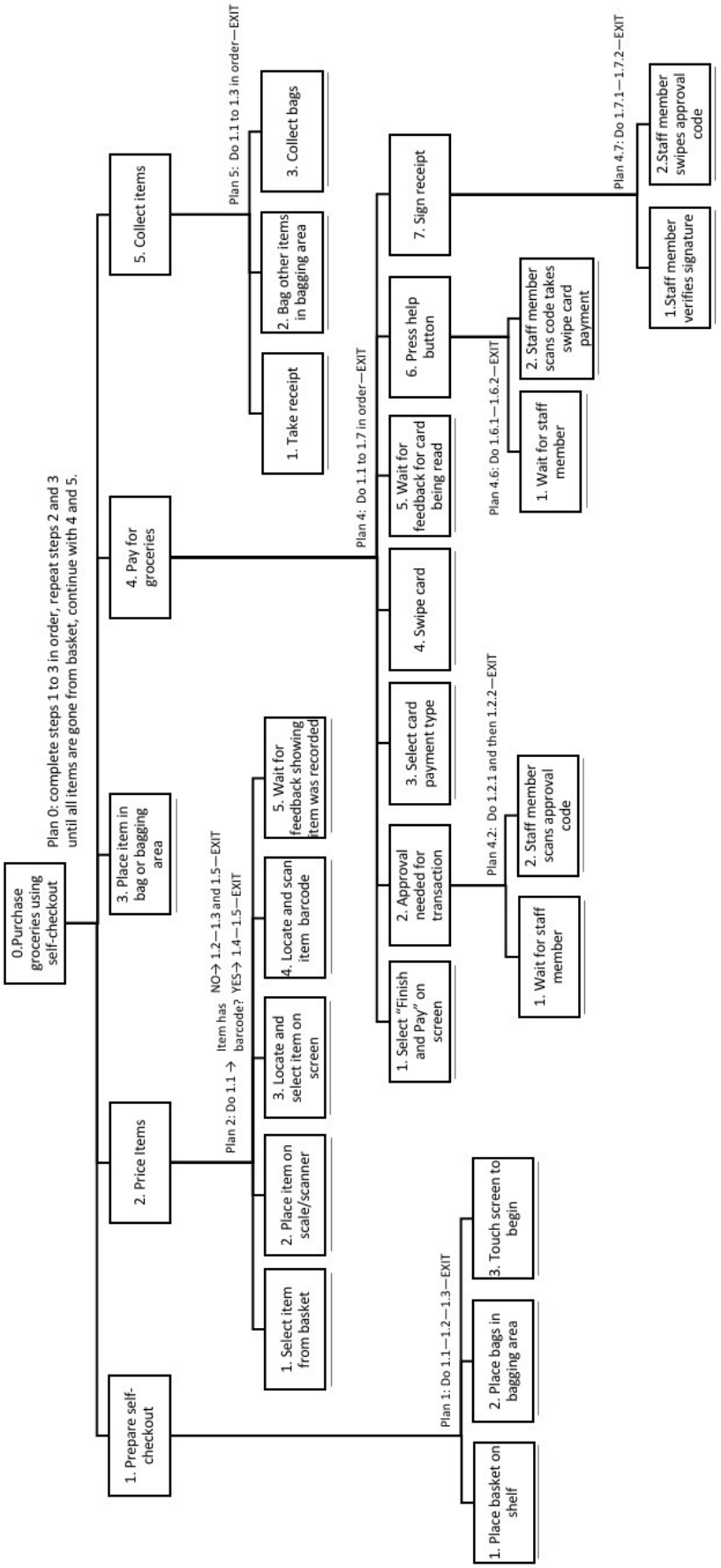
Appendix 11: HTA Diagram User 5—Tesco



Appendix 12: HTA Tabular User 5—Tesco

	Task analysis	scribed	I-A-F	Notes
0	Purchase groceries using self-checkout			
	plan 0: *Complete steps 1 to 3 in order, repeat steps 2 and 3 until all items are gone from the basket, continue with 4 and 5.*			
	1 Prepare self-checkout	yes		
	2 Price items	yes		
	3 Place item in bag	no	A	
	4 Pay for groceries	yes		
	5 Collect receipt and bag	no		
1	Prepare self-checkout			
	plan 1: *Do 1.1—1.2—1.3—1.4—EXIT*			
	1 Place basket on shelf	no		
	2 Touch screen to begin	no		
	3 Scan bag to purchase	no		
	4 Place bag in bagging area	no		
2	Price items			
	plan 2: *Do 1.1–1.2–1.3–EXIT*			
	1 Select item from basket	no		
	2 Locate and scan item barcode	no		
	3 Wait for feedback showing item was recorded	no	F	
4	Pay for groceries			
	plan 4: *Do 1.1 to 1.3—EXIT*			
	1 Select “Finish and Pay” on screen	no		
	2 Select card payment type	no		
	3 Insert card and key in pin code	no		

Appendix 13: HTA Diagram User 6—Tesco



Appendix 14: HTA Tabular User 6—Tesco

Task analysis	scribed	I-A-F	Notes
0 Purchase groceries using self-checkout			
plan 0: *Complete steps 1 to 3 in order, repeat steps 2 and 3 until all items are gone from the basket, continue with 4 and 5.*			
1 Prepare self-checkout	yes		
2 Price items	yes		
3 Place item in bag or bagging area	no	A	
4 Pay for groceries	yes		
5 Collect items	yes		
1 Prepare self-checkout			
plan 1: *Do 1.1—1.2—1.3—EXIT*			
1 Place basket on shelf	no		
2 Place bags in bagging area	no		
3 Touch screen to begin	no		
2 Price items			
plan 2: *Do 1.1, if item has no barcode complete 1.2–1.3 and then 1.5 in order, if the item has a barcode complete 1.4 and 1.5 in order—EXIT*			
1 Select item from basket	no		
2 Place item on scale/scanner	no		
3 Locate and select item on screen	no		
4 Locate and scan item barcode	no		
5 Wait for feedback showing item was recorded	no	F	
4 Pay for groceries			
plan 4: *Do 1.1 to 1.7 in order—EXIT*			
1 Select “Finish and Pay” on screen	no		
2 Approval needed for transaction	yes		needed approval for age sensitive item
3 Select card payment type	no		
4 Swipe card	no		user swiped cared more than one time and when nothing happened continued to swipe until she pushed the help button
5 Wait for feedback for card being read	no	F	
6 Press help button	yes		
7 Sign receipt	yes		

	Task analysis	scribed	I-A-F	Notes
4	Approval needed for transaction			
	plan 4.2: *Do 1.2.1 and then 1.2.2—EXIT*			
	1 Wait for staff member	no		
	2 Staff member scans approval code	no		
4	Press help button			
	plan 4.6: *Do 1.6.1—1.6.2—EXIT*			
	1 Wait for staff member			
	2 Staff member scans code takes swipe card payment			
4	Sign receipt			
	plan 4.7: *Do 1.7.1—1.7.2—EXIT*			
	1 Staff member verifies signature	no		
	2 Staff member swipes approval code	no		
5	Collect items			
	plan 5: *Do 1.1 to 1.3 in order—EXIT*			
	1 Take receipt	no		
	2 Bag other items in bagging area	no		
	3 Collect bags	no		

Appendix 15: Questionnaire Tesco

Questionnaire Tesco

1. How did you feel about using the self-checkout?

    1.1. Could you describe the emotions you feel about it?

2. Is there a time or circumstance when you prefer to use the self-checkout?

    2.1. What about a time or circumstance when you would prefer not to use it?

3. What factors motivate you to use a self-checkout?

    3.1 Is there anything satisfying about using the self-checkout?

4. Do you feel the self-checkout is easy to use?

    4.1 Have you ever had an problems with it? Describe them.

5. What factors, if any, do you feel are a barrier regarding the self-checkout?

    5.1. Is there anything frustrating or difficult about using it?

6. What do you think about the layout of the self-check machine's elements, such as the scanner, basket shelf, bagging area, card reader, notes and coin input and output etc.?

    6.1. Are all the elements located in a convenient, easily accessible area?

    6.2. Do you feel the layout has an impact on how you completed the task?

7. Did you understand the screens after "finish and pay" about the number of bags used?

    7.1. How did you continue past those screens?

Extra probing questions from the observation of user completing the task:

Appendix 16: Questionnaire Sainsbury's

Questionnaire

1. How did you feel about using the self-checkout?

    1.1. Could you describe the emotions you feel about it?

2. Is there a time or circumstance when you prefer to use the self-checkout?

    2.1. What about a time or circumstance when you would prefer not to use it?

3. What factors motivate you to use a self-checkout?

    3.1 Is there anything satisfying about using the self-checkout?

4. Do you feel the self-checkout is easy to use?

    4.1 Have you ever had an problems with it? Describe them.

5. What factors, if any, do you feel are a barrier regarding the self-checkout?

    5.1. Is there anything frustrating or difficult about using it?

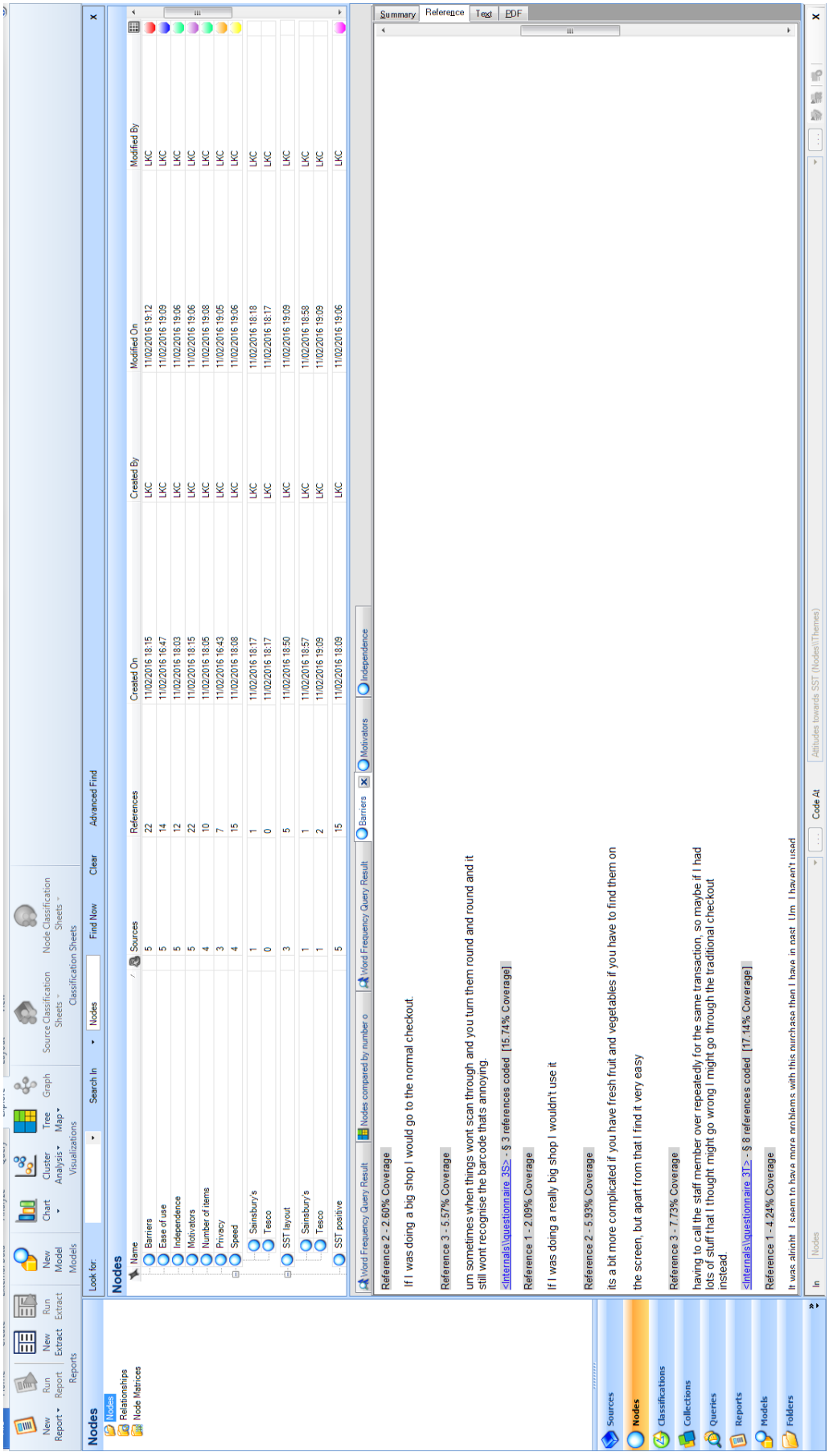
6. What do you think about the layout of the self-check machine's elements, such as the scanner, basket shelf, bagging area, card reader, notes and coin input and output etc.?

    6.1. Are all the elements located in a convenient, easily accessible area?

    6.2. Do you feel the layout has an impact on how you completed the task?

Extra probing questions from the observation of user completing the task:

Appendix 17: NVivo Screenshot 1—Barriers



Appendix 18: NVivo Screenshot 2—Motivators

Appendix 19: Nodes Compared by Number of Items Coded