University of Technology Eindhoven
Design <> Research

Faculty of Industrial Design

2017

Minimize Caffeine Intake with Design

P. Smit
University of Technology Eindhoven

L.J. Stuyfzand
University of Technology Eindhoven

F.R.A. van Tilburg
University of Technology Eindhoven

E.M de Vries
University of Technology Eindhoven

Index

Minimize caffeine intake with design

Ellen de Vries
Industrial Design
Eindhoven, NL
e.m.d.vries@student.tue.nl

Flavia van Tilburg
Industrial Design
Eindhoven, NL
f.r.a.v.tilburg@student.tue.nl

Lucy Stuyfzand
Industrial Design
Eindhoven, NL
l.j.stuyfzand@student.tue.nl

Pim Smit
Industrial Design
Eindhoven, NL
p.smit@student.tue.nl

ABSTRACT

Caffeine has lots of negative effects on the human body, which caught the interest to conduct this research to try to find out how to minimize the caffeine intake. A qualitative research has been conducted to find answers to the question: "What effects does the designed feedback system have on people's attitude towards coffee drinking?". Participants were asked to keep track of their coffee drinking in order to create awareness of the amount of coffee they drink. Afterwards, they were interviewed to find out what thoughts were triggered during the test. It was found that there is a lack of knowledge amongst the test group when it comes to the maximum amount of caffeine intake on a daily basis. Also, most participants claimed the influence of the feedback was minimal. Lastly, this study shows that the feedback system should not bother the user too much.

Author Keywords
Caffeine Consumption, Behavior Change, Awareness, Feedback System.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous

INTRODUCTION

According to the most recent Dutch National Food Consumption Survey (2007-2010) 33% of the total fluid intake of Dutch people consists of coffee and tea [6]. Many studies on the effect of caffeine to the human body have been executed. Although those studies show several health benefits of caffeine, like decreasing the chance to develop Parkinson's disease [2] or treating asthma [3], they also mention a great variety of unpleasant health issues. Heavy daily caffeine use, between 500 to 600 mg, can cause side effects of [8] insomnia, nervousness, restlessness, upset stomach, fast heartbeat and muscle tremors

The negative effects of the intake of caffeine are the reason there is interest in trying to minimize the intake of caffeine. One needs to change the habits of people regarding caffeine. This comes down to influencing human behavior.

In previous research, it is shown that design can be used for behavioral changes by giving feedback under certain conditions [1] which are specified in a study conducted afterwards in Sweden. This Swedish study is about the consumption of energy showed that a designed product can give such feedback. The design was a new kind of energy display that used a time metaphor to visualize a home's energy consumption (as a clock). In this Swedish study, the conditions for effective feedback have been found to be: real time feedback, visible feedback and easy understandable feedback [5]. At the School of Health Sciences in Melbourne, a research about whether nutrition knowledge influences the food one consumes has been conducted. The most important result of this study is that the 'nutrition knowledge' is a necessary but not sufficient factor for changes in consumers' food behaviors. This Australian research does not mention what would be a factor that changes consumers' food behaviors [11]. If one compares the Swedish study and the Australian study, continuous feedback is more effective than knowledge.

In the field of changing behavior of caffeine intake, the products that are on the market are mostly smartphone applications with which the user can keep track of their intake. Besides, there is a smart mug, called the Vessyl, that is developed by the company Mark One. This mug can examine the content of a drink and sends this information to a number of applications [10]. However, these products have not been tested with regard to the influence on the intake of caffeine or other substances. They do want to make people aware of their drinking behavior but not with a specific focus on caffeine.

A design opportunity arises in the field of caffeine intake: could the intake of caffeine also be altered through design? Design could provide feedback about the intake of caffeine under the conditions aforementioned, just as with the energy feedback in households [5]. If these conditions are strictly followed, this might also change the caffeine intake behavior. The original idea of the researchers was a coffee machine that communicates with a coffee mug about the

amount of caffeine that was poured into this coffee mug during a day. For this specific research, the focus was put on the feedback system of the coffee mug. Therefore, the research question is: What effects does the designed feedback system have on people's attitude towards coffee drinking?

To answer the research question and explore the effect of feedback on behavior changes, a qualitative approach is chosen for the first insights. The paper discusses a design for a feedback system on coffee consumption. By this, the paper aims to contribute to knowledge on the way of giving feedback to change individual behaviors like coffee consumption.

RELATED WORK

For this particular design research multiple papers were studied in order to create a broad understanding on the topic. The related work focuses on creating awareness via feedback. Additionally, papers on coffee related topics were found to be interesting as the research is based on caffeine consumption. Furthermore, research about knowledge influencing the behavior of people is related to the research on caffeine too.

Research has been done about the effect of design on behavioral change by giving feedback. At the university of Groningen, the effectiveness of interventions aiming to encourage households to reduce energy consumption, is been reviewed and evaluated. This research shows that providing people with feedback on their energy behavior can lead to a reduction in energy use, if been given under appropriate conditions [1].

A study, done in 2010 in Sweden showed that a designed product can give such a feedback by tracking attention to energy consumption, and specified the conditions mentioned in the Swedish study to make the feedback effective and change energy consumption behavior [5]. In this research a clock is used as design to track the attention of households. By showing the level of energy consumption and providing the households with feedback, the energy consumption habits could be changed. However, little is known about the effect of feedback on behavior change of caffeine intake.

At the School of Health Sciences in Melbourne, a research about whether nutrition knowledge influences the food one consumes has been conducted. The paper reviewed literature, and found that the evidence for the influence of nutrition knowledge on food behaviors is mixed. The main argument is that the 'nutrition knowledge' is a necessary but not sufficient factor for changes in consumers' food behaviors. The paper suggests multiple ways to improve the nutrition knowledge, for example via parents or education. The relevance of this paper to the research is that this paper checks whether knowledge about a subject, changes the behavior towards a subject. Thus, the Australian paper shows there are opportunities to change behavior by means of knowledge. When it comes to caffeine, the same might be possible [11].

In research conducted by Goldstein and Kaizer information was gathered about the psychotropic effect of caffeine. Through a questionnaire, information was gathered about coffee drinking and the effects. This research was held with 239 young housewives. All participants were asked questions such as why they drink coffee in the morning, the behavioral changes it produces and what they believed the effects would be if morning coffee were omitted. The results indicate substantial differences in the responses correlated with the extent of coffee use. Participants drinking a lot of coffee reported less wakefulness caused by coffee at night and less nervousness caused by coffee in the morning compared to light users. Furthermore, heavy users said they dealt with more desirable stimulant than light users. Some of the other characteristic symptoms heavy users reported when their morning coffee was omitted were irritability, inability to work effectively, nervousness, restlessness, lethargy and headache [7]. This paper shows the relevance to our research since the maximum amount of caffeine consumed is taken into account. The evidence of the possible negative health effects show why it is so necessary to take into account how much caffeine you drink.

iTunes has multiple applications for the smartphones that monitor the user's coffee drinking. For example the application Up Coffee by Jawbone, that helps the user monitor caffeine intake and tells when one has had enough. The end goal is to help the user to get a better night of sleep. The method used in this application is a meter that fills as the user fills in that he/she drank a cup of coffee [9]. However, the goal of these smartphone applications is to optimize the caffeine intake by giving feedback on when to drink coffee, and not to create awareness to self-change the behavior of drinking coffee by giving feedback.

Beside those applications, there is a product in development that measures the composition of a drink itself. This smart mug, called Vessyl, is developed by the company Mark One. The Vessyl knows and aggregates the makeup of everything that is in the the cup. It automatically sends the data to a smartphone application, with which the user is able to set goals for specific 'lenses' [10]. However, the mug itself does not give feedback about the intake, and the user has to look in the application for feedback.

Research has been done about the effect of design on behavioral change by giving feedback. This Swiss' research shows that providing people with feedback on their energy behavior can lead to a reduction in energy use, if been given under appropriate conditions [1]. A study done in 2010 in Sweden showed that a designed product can give such a feedback by tracking attention to energy consumption, and specified the conditions mentioned in the Swiss' study to make the feedback effective and change energy consumption behavior [4]. In this research a clock is used as design to track the attention of households. By showing the level of energy

consumption and providing the households with feedback, the energy consumption habits could be changed. However, little is known about the effect of feedback on behavior change of caffeine intake.
When searching in iTunes for smartphone applications that monitor the user's coffee drinking, there can be found several (search request "Coffee" in iTunes). The application Up Coffee by Jawbone helps the user monitor caffeine intake and tells when one has had enough, with the end goal of helping the user to get a better night of sleep [8]. However, the goal of these applications is the optimize the caffeine intake by giving feedback on when to drink coffee, and not to create awareness to self-change the behavior of drinking coffee by giving feedback.

Beside those applications, there is a product in development that measures the composition of a drink itself. This smart mug, called Vessyl, is developed by the company Mark One. The Vessyl knows and aggregates the makeup of everything that is in the cup. It automatically sends the data to a smartphone application, with which the user is able to set goals for specific 'lenses' [10]. However, without the application, the mug does not give any feedback to the user.

METHOD

Approach

For executing the user test eight people were asked to count the amount of coffee consumed during a day from 9:00 until 14:00. In order to conduct this research a pilot was conducted first. In this pilot one person was asked to count the amount of cups with coffee consumed during one day. This was done by writing it down on a post-it which was put on the coffee mug. The intention was to create fully working prototypes. However, since the initial technological prototype that was designed would not be the actual design, neither technologically nor aesthetically, it would not have added value to use this prototype over post-its. After the tallying the pilot participant was asked four different questions (see Appendix A). The following questions were used during the actual user test as well:

- Did you expect you would drink this amount of coffee during this time slot?
- Do you have the feeling that during this test your coffee drinking behavior was influenced?
- Would you expect yourself to change your coffee drinking behavior on a long term if you would be constantly reminded of the amount of coffee you drink?
- Are there any other questions or remarks?

Participants

In the study eight students from the Technische Universiteit Eindhoven, faculty of Industrial Design were asked to keep track of the coffee they consumed. The decision ask students as participants was merely made due to the limited availability of other participants. There is no intention to only focus on students. However, it only fastened and simplified the research.

Procedure

All the participants got a post-it to put on their coffee mug. Furthermore, all students started their day at 9:00 o'clock and ended at 14:00 o'clock. In between these five hours they were asked to tally their coffee mugs. They had no limit to the amount of coffee they could consume and the researchers did nothing to neither encourage nor dissuade the participants in their usage of coffee.

Next to the tallying of the consumed coffee all of the participants were asked to fill in a questionnaire with open questions after they finished the tallying (see Appendix A). These questions were asked via Google Forms. It was asked how they experienced the day and what they felt like during the five hours of keeping track.

In order to exclude biased participants the idea behind the research was not explained initially. They were merely asked to count the amount of coffee consumed during five hours.

Data Analysis

The data collected from all the users was organized and during this process the initial thoughts and ideas were noted down. The data was then read and re-read several times by the researchers. This "repeated reading" and reading the data in an active way makes sure the researchers are familiar with the data before analyzing further [4]. Following from this the coding phase started. After coding the data for the first time, the researchers searched for themes in this coding and the data. These themes explained larger sections of the data, all initial codes which were crucial to the research questions became a theme. When interrelating the themes, some themes did not have enough data to support them or were too diverse. After this redefining of the themes, the researchers named them and gave them a description.

RESULTS

In this section, the obtained results are defined and explained. The pilot, the main research and the questions asked during the tests will be elaborated further on in the discussion.

Pilot

After the pilot test, the emerging issues were sketched. The main learning experience from the pilot is that it is not necessary to use a technological prototype since the pilot showed it does not have any extra value. As mentioned in the method, the first, technological prototype build, did not have any comparison to the envisioned design. Therefore, it has been decided to use a coffee mug with a post-it on it, on which participants can keep track of the amount of coffee they drink. Furthermore, the researchers realized the interest lies specifically in the answers to the questions rather than the amount of coffee the participants actually drink. The time

slot in which participants were asked to keep track of their coffee drinking behavior has also been altered as a result of practicalities, namely to a time slot from nine o'clock in the morning until two o'clock in the afternoon.

Analysis of research

The answers to the question mentioned in the method can be found in Appendix C. To analyze the data of the user test, thematic analysis was performed. These themes were viewed as essential in determining the effect of the test on the participants. The categories were labelled as "Time Limit", "Self-consciousness", "Awareness to reduce", "Effort of tallying" and "Daily schedule". There were aspects of the effect of the test that overlap across these themes.

Time Limit

The time limit part is defined by the remarks of the restricted time the participants had to consume coffee. It was mentioned twice that people did not have enough 'time' to get their coffee and they expected themselves to drink more. It was mentioned once that the participant had an "off day", in which the urge to drink coffee was less than other days.

Self-consciousness

The important aspect of awareness in this research it described in this theme. It was important to notify whether the participants were aware of their own coffee drinking behavior. Two participants mentioned they were aware that they drink too much coffee.

Aware to reduce

This theme is the result of combining three previous codings: actively reducing intake, effect of feedback, and right amount of caffeine. Since all those codings involve being aware about the fact that they should, could or how to reduce the intake of caffeine.

One of the participants who claimed to be self-conscious about his/her coffee drinking behavior mentioned he/she was already actively trying to reduce the intake of caffeine. A response to the question whether the design influenced the drinking behavior was that "it was just an extra reminder". However, this person mentioned to the third question about the effect of long term feedback, it would "especially help when I have my weak moments".

'Aware to reduce' is also about the comments on reducing the amount of consumptions when getting feedback. The third question was about whether the participants would change their behavior towards caffeine on the long term if they would constantly be reminded about their behavior. Some of the participants figured this would help them to think about the amount of coffee they drink. These participants did not claim they would drink less if they were reminded of the amount of coffee, but they would get the opportunity to think about it.

One participant responded it would be nice to know what the right amount of caffeine would be for each specific person, because he/she drinks three cups a day without knowing if that is the maximum amount for him/her specifically.

Effort of tallying

When setting up the user test, the researchers searched for the easiest way to let the participants keep track of their cups of coffee. However, after the pilot study it was decided tallying would be best suitable for this research. In this part all remarks about the tallying during the test are discussed. All participants answered the questions as if it was a research to improve a design, which was indeed its intention. None of them saw this as a social research or a health research.

Two participants responded the method to keep track of the amount of coffee cups was inconvenient. It bothered them too much they had to find a pencil, and the post-its did not stick to the cups long enough. The design should be easy to use and cannot take too much effort. However, on question two, whether the participant felt the tallying influenced their coffee drinking behavior, two of the participants answered they felt they should drink less coffee because they had to tally the amount of coffee they drink. On the other hand, they did not mention what the specific reason was, and why they felt this way.

Daily Schedule

When aiming to make people aware of behavior, habits are an important factor. One of the participants mentioned he/she usually drinks the same amount of coffee every day. A regular schedule is developed, and followed every day.

DISCUSSION

During the research conducted and the questionnaire afterwards, feedback about the availability of the coffee was received. Some of the participants said that they would have probably drank more coffee, had they been closer to the place where free coffee was available. Therefore, it is debatable how valid some of the answers were to the question on how many cups the participant drank. It can be seen that even though most participants drank quite some coffee, a threshold still exists for people in order to actually get the coffee. It is clear that this threshold influenced our findings. It is questionable whether the participants drink more coffee on average, or if they have a wrong picture of their coffee-drinking behavior. Furthermore, it would be interesting to see if participants would give the same answers if the time slot would be longer.

Two participants claimed to be aware of the fact that they drink too much coffee. One can consider this to be a confirmation of the research mentioned in the introduction section which claims people drink too much caffeine. On the other hand, none of the participants mentioned anything about the right amount of caffeine per day. Thus, it is

interesting to find out where people get the 'gut feeling' from that they drink too much caffeine.

With regard to what influence the tallying had on the coffee drinking behavior some mixed results were received. Initially the aim was to know whether keeping track of the coffee consumed, would make you more aware of the amount you drink. On top of that, some participants felt like they should drink less coffee due to the tallying. Influencing the caffeine drinking behavior is not the main aim of this research and it would require a new study to explore how to change the caffeine drinking behavior.

As aforementioned, some participants felt as if they should drink less coffee due to the tallying. This might have influenced the results. Nonetheless, the purpose of the research was not explained on beforehand. The participants could only guess what the research was for, thus there is no evidence that this did influence the participants. Therefore, it could be assumed that the results obtained did not decrease the validation of the research.

Furthermore, all of the participants, while answering the questionnaire, might have slightly been biased due to their study direction. All of the participants were design students which results in them having a certain attitude during the research. Of course they already knew it was about a design and where it could be improved. Moreover, all participants responded to the questions as if it was an actual design. The fact that the participants all have a specific point of view, might have influenced the research. One could execute a research where participants are 'fooled'. If this research would be executed in a company, participants would have a different attitude towards the research. It should be checked to what extent these points of view influence the research.

CONCLUSION

In conclusion, the obtained results in the research test are very diverse. First of all, when looking at the actual awareness of participants during and after the test, one can confirm that most participants drink too much caffeine and that 75 percent of the participants is aware of their behavior. Additionally, one might conclude that there is a lack of knowledge amongst the test group when it comes to the maximum or right amount of caffeine intake on a daily basis.

During the test, most of the participants did not feel influenced by the designed feedback system. However, half of the attendees thought the design would influence their behavior on the longer term because it would change their habits.

When looking at the actual design one can conclude that it has future improvement opportunities. Starting with the practical insert of data by means of tallying on the coffee mug. This could be improved to decrease the effort of the user and increase the motivation to use the design.

For this particular research it can be concluded that there are opportunities for design to be the solution to the unhealthy amount of caffeine consumed. Also, most participants in this research claimed the prototype would influence their coffee drinking behavior on the long-term. However, since this is the first exploration within the field of 'awareness towards caffeine', further research needs to be done to explore the specific solution and conditions of design.

REFERENCES

[1] Abrahamse, W, Steg, L, Vlek, C, and Rothengatter, T. A review of intervention studies aimed at household energy conservation. Journal of Environmental Psychology (Jan 1, 2009), 1-19.

[2] Arendash, G.W.. et al. Caffeine Protects Alzheimer's Mice Against Cognitive Impairment and Reduces Brain Beta-Amyloid Production. Neuroscience, Vol. 142(4). 941-52.

[3]Brain, M., Bryant, C., & Cunningham, M. (2000, April 01). How caffeine works. Retrieved December 3, 2016, from http://science.howstuffworks.com/caffeine1.htm

[4] Braun V., Clarke V. Using thematic analysis in psychology. Qualitative Research in Psychology (2006) 3(2). 77–101.

[5] Broms, L., Katzeff, C., Bång,M., Nyblom, Å., Ilstedt Hjelm, S., Ehrnberger, K. (2010). Coffee maker patterns and the design of energy feedback artefacts. In Proceedings of the 8th ACM Conference on Designing Interactive Systems (DIS '10). ACM, New York, NY, USA, 93-102.

[6]FWS. Drankenconsumptie in Nederland. Dutch Associaton for Soft Drinks, Waters and Juices (FWS), The Hague, 2013.

[7] Goldstein, A, Kaizer, S. Psychotropic effects of caffeine in a man. III. A questionnaire survey of coffee drinking and its effects in a group of housewives. American Society for Clinical Pharmacology & Therapeutics (Jul, 1969)

[8]Harms, R. W. (n.d.). Caffeine: How much is too much? Nutrition and Healthy eating. Retrieved December 3, 2016, from http://www.mayoclinic.com/health/caffeine/NU00600

[9] Up Coffee by Jawbone (n.d.). iTunes Preview. Retrieved December 14, 2016, from https://itunes.apple.com/us/app/up-coffee/id828031130?mt=8

[10] Mark One (n.d.). Vessyl. Retrieved December 17, 2016, from https://www.myvessyl.com/vessyl/

[11] Worsley, A. Nutrition knowledge and food consumption: can nutrition knowledge change food behaviour? Asia Pacific J Clin Nutr (2002) 11(3): S579–S585.

APPENDIX A

This questionnaire is created to be used and filled in after the tallying of the amount of coffee consumed during a school day (from 9:00 till 14:00) for students.

1. *Did you expect you would drink this amount of coffee in a day?*
2. *Do you have the feeling that during this test your coffee drinking behavior was influenced?*
3. *Would you expect yourself to change your coffee drinking behavior on a long term if you would be constantly reminded of the amount of coffee you drink?*
4. *Are there any other questions or remarks?*

APPENDIX B

The participants answers to the questions in the pilot study were:

1. How much did you drink?

   6 - 8 cups of coffee a day on a very regular basis.

2. Did you expect you would drink this amount of coffee in a day?

   Yes, I expected that. I have a very regular schedule every day and therefore I know at what time I take a break and drink coffee. I normally do not drink any other Caffeine containing drinks.

3. Do you have the feeling that during this test influenced your coffee drinking behavior?

   Yes, I suddenly realized that I indeed drink too much coffee and this stopped me from drinking one or two more cups.

4. Would you expect yourself to change your coffee drinking behavior on a long term if you would be constantly reminded of the amount of coffee you drink?

   On a long term I think I will forget about it as I am so used to my schedule.

5. Any further questions or remarks?

   When the concept design was explained the participant said that it would help the participant to drink less coffee because of the constant reminder of the caffeine intake limit. That is the case for long term effects as well.

APPENDIX C

Participant	**Amount of cups consumed**	**Question 1: Did you think you would drink this amount of coffee in a day?**	
		Yes/No	*Why yes/no*
1	5	Yes	I know I drink a lot of coffee during a day.
2	4	Yes	I actually expected to drink more coffee. Due to the limited amount of time I was not able to get more.
3	5	Yes	I drank a lot of coffee before. However, I am trying to minimize the amount of coffee I drink since I know it is not too good for my health.
4	2	No	I had an off day. Usually I drink more coffee than I did today.
5	3	Yes	I usually drink the same amount of coffee every day. I sort of developed a regular schedule.
6	4	No	-
7	5	Yes	-
8	3	Yes	-

Participant	**Question 2: Do you have the feeling that during this test your coffee drinking behavior was influenced?**	
	Yes/No	*Why yes/no*
1	No	I am already aware of my coffee drinking behavior when I drink a lot of coffee.
2	Yes/No	I did not know what the research was for and just took coffee when I felt like it. It did not feel like I should drink more or less just for the research. However, if you look at it differently, it did. When I was thinking about getting a new cup I thought "Oh, I've already had two, maybe I should wait a little while".
3	No	I am already trying to drink less so it did not influence me more.
4	Yes	I was more aware of the fact that I got a cup of coffee. However, it didn't hold be back to get another cup of coffee.
5	No	In my case not really, since I always sort of plan my coffee use over the day.
6	No	-
7	No	Because I was doing it in my peripheral. During the test I was not constantly aware of that I was involved in a test, I was just focusing on my regular tasks that I had to perform.
8	No	I found it quite a hassle to tally. I had to find pencil every single time. Therefore, I did not do the tallying separately but put more stripes on at once.

Participant	**Question 3: Would you expect yourself to change your coffee drinking behavior on a long term if you would be constantly reminded of the amount of coffee you drink?**	
	Yes/No	*Why yes/no*
1	No	I will always keep drinking coffee when I want to.

2	Yes	During the test I realized already how many cups I drank and I was constantly reminded. Already then I sometimes felt like I should drink a little less coffee.
3	Yes	Especially on my weaker moments when I'm not aware of it, then it will help me not to take the extra cup.
4	Yes	I think so. When I drink a lot and I am aware of that, it may help me stop to drink even more. At this moment I am not really good at estimating how much I drink.
5	No	I will probably start ignoring the reminder at some point.
6	No	-
7	Yes	Right now I am not consciously drinking coffee, it just became a habit. I would probably drink less if I had to do this every day and I figured it would help me increase my health. However, I am not sure whether I would pay for something that will teach me a lesson.
8	No	I am very conscious about my coffee drinking behavior. I take three cups a day and try to prevent myself from drinking more. Also, I don't feel the urge to drink more than that. It became a habit and rule to myself.

Participant	**Other remarks?**
1	-
2	I like the initial idea. It already made me aware of the coffee usage and made me think I should maybe drink some less. I don't know whether you could actually say that someone is only allowed to drink and certain amount of cups in one day.
3	I am already trying to drink less coffee.
4	The post-it's did not stick on the mugs completely which made it more of a hassle to tally.
5	-
6	-
7	I really liked tearing the paper each time I drank coffee. It was better than finding a pencil somewhere and mark it on the post-it.
8	It would be interesting to know what the right amount is for me. The amount of caffeine depends on the length and weight of a person. I would like to know how much I could drink without getting negative results.

PERSONAL REFLECTION P. SMIT

In this reflection I cover the learning activities of the Design < > Research (DDB100) course. In the first three weeks of the course we went through a Reflective Transformative Design Process, which we had to document with the use of a small videos. Additionally, we started on the introduction of our research report. Afterwards we went through a design research process. Furthermore, I will portray my expectations, insights, learning moments for the first three weeks and goals for the future.

Expectations

After interviewing a friend who passed Design < > Research in B1, I expected the course to be focusing on research and analysis. Additionally, I imagined the course to be jumping back and forth between design and research data. The interview was mostly focused on the latter weeks of the course and therefore I think these expectations will be evaluated later on. Furthermore, in this reflection I will be discussing the design process apart from the research process.

Learning activities and Insights

Initial design process

During the first week of the process we did a few brainstorm sessions resulting in a video explaining our direction for the course. Although we thought that this was one way to go, we did not completely agree with our direction. Therefore sitting together and discussing about the design was the right decision at that moment. In the second week we all got a better idea of what the assignment really was about and constructed the basis of our design. Additionally, we worked on a research question which was still in its first phase by then. After the first iteration I read the paper Designing Disruptive Innovative Systems, Products and Services: RTD process by C. Hummels and J. Frens to further understand the design research process during this course and the relation it has to this faculty.

In this second week I made a video using flat images as the main style. This video made our concept and direction for the research clear. In these first phases we worked with the Reflective Transformative Design Process. Initially, I started with an envisioning approach, standing in the kitchen envisioning communication between various objects. Other team members started with thinking about what the possible combination could be. This was concluded quite fast in the first week as we all had affinity with coffee drinking and were interested in the communication between the coffee machine and the coffee cup. Other colleagues made a coffee mug with LED's and a push button to count the amount of coffee consumed as a possible technological design for the research.

For the continuation of our research we went with the qualitative design research method. This because we thought it would provide us with a more honest and valid view on our research being about becoming aware of one's behavior.

Research process

In the third week we created a hypothesis and the introduction draft of our project report. With this hypothesis we could validate the design research question and formulate it differently to achieve what we were really looking for in this research. We abstracted our purpose in this design to validate the relevance of the technological design that we made. According to our newly made purpose we learned that to get the answer on our research question, we do not have to use this technological design.

When conducting the pilot for our research I focused on the amount of coffee the person drank on a daily basis. I wasn't able to see the person's drinking behavior throughout the whole day, however I could observe some faulty aspects to the pilot. We noticed that by explaining our research purpose on beforehand, it would provide the participant with a biased view on the test, which would influence our results. Therefore we did not implement this in the final test.

After reading the paper Journal of Environmental Psychology by W. Abrahamse, L. Steg, C. Vlek and T. Rothengatter, we noticed that a feedback system could change people's behavior towards a certain situation. This inspired us to go on with our research and to look for changes in behavior during and after the test.

For our research we recruited the participants. We chose students of the faculty of Industrial Design on the Technical University of Eindhoven because these participants have the availability to free coffee during the day. I would have found it very interesting to test it with more user groups in order to compare and contrast. Additionally, our research being of limited time, it would have been interesting to see what effects a feedback system would have on the participants over a longer term.

After the test we analyzed the data and used data visualization to create a clear overview of the results. The results were not that surprising, we saw that they were mixed. However, some of the participants said the design would definitely change their coffee drinking behavior in the future. We learned that people will indeed create more awareness by means of using a direct feedback system.

Furthermore, we reached out to the audience by means of a design research report. I improved on my academic writing by writing and correcting parts of the report. Using different papers to validate our research we aimed at writing a coherent piece. Finally, we concluded the course by giving a presentation about our final design research.

To conclude, I learned how to do qualitative research with a selected user group. I am now able to create research methods and work on designs that can contribute to the research. Additionally, I learned to abstract the purpose of a research or design and that this abstraction can lead to a clarification of the process.

PERSONAL REFLECTION L.J. STUYFZAND

Design < > Research is a course about the connection between research and design. My expectations from this course were that I would learn how to validate designs and how to test certain aspects from a design. The purpose of the course, as stated in the study guide, is to learn how to generate useful input for design, or be more on the design outcome.

During the first weeks, we were asked to start with the design process and to deliver movies to show the progress made within a week. It took me quite some effort to understand the 'design research cycle' provided during the first lecture. As far as I was concerned, doing research was a linear process. The first lecture taught me how this is not true, since one 'jumps' between different phases of the design process real quickly and especially not linear.

I found it hard to find a balance between the time and effort to put in the process and/or the movie. As a designer, I like to put lots of time and effort in communicating what I have done and why, which is why I tended to focus on the movie only. Nevertheless, the movies were only supposed to be used to communicate the process, so the process is just as important as the movie itself.

The first weeks were especially to think and analyze the kitchen and the 'connection' of the objects. I have experienced this to be my strongest phase, since I can be creative and I see opportunities for design very quickly. Yet it was difficult to communicate my thoughts to my team members, since the vision I have is not always easy to communicate verbally for me. Also, I have noticed I think differently from my team members, particularly in the way I approach problems. This course helped me to learn how to communicate the way I think and to express myself clearly when it comes to verbal communication.

As soon as the method was set and well stated for each team member, the process went much faster than before. Conducting a research goes easy once the method is written down with lots of detail. There cannot be any confusion if the method is precise and accurate. Defining the research process took lots of time and effort, since it is so easy to become inaccurate and have flaws in your research. Next time, I wish to take more time to write a more accurate method and to plan the conduction of the research more carefully.

The execution of the research went quite smoothly, and especially during the analyzing I noticed I was very critical to myself when it came to making assumptions. Qualitative analysis (as we have done) asks for the researchers to be very critical and to question their own knowledge as well. I found myself enjoying this phase pretty much, I think due to the fact that I am very interested in philosophy as well. Philosophy questions everything assumed in daily life, and my background knowledge in this field was very helpful during the qualitative analysis.

Also, the participants have been quite talkative, much more than I initially expected. I am aware of the fact that all participants were designers and they approach user tests like this one much different from other people, but they were quite critical and they noticed lots of things I had not thought of before. Nevertheless, it is important to stay critical and know that designers have a very specific view on things; I am very interested what the same research would result in if the participants were not designers. It is also something I wish to do differently next time: choose the group of participants. Choosing participants and a research environment is crucial for an accurate research, and influences results to a high extent. I have learnt this during Design < > Research and I will take this into account during the next research I will conduct.

As a designer, I am an observer. I like to observe people in daily life and to look closely at how they behave. I often question myself why people behave the way they do and how everything designed in their environment influences this behaviour. Executing the research for this course has opened doors for me, because I know how to find out what influences a certain design can have. Making a design is important, but only one aspect of the entire design process. A designer makes decisions based on too little information, but once a product is designed, designers should, in my opinion, check their assumptions by doing research and user tests. The course gave me clear guidelines about how to do design research, which will be helpful in my upcoming projects.

PERSONAL REFLECTION F.R.A. VAN TILBURG

For this course we needed a very fast start since the first deliverable was due within a week. Therefore, it was of essence of that our group needed to corporate efficiently and so we set out tasks for all of us to fill out. However, during the brainstorm for the initial idea it already became clear that no one of us completely understood the assignment. This did not completely surprise me since during the lecture it was mentioned multiple times that one of the goals of this course was also to learn with too little knowledge.

After receiving the feedback on the first deliverable it was concluded that we did indeed not understand the assignment properly and so we came together to adjust our mind set on the assignment and alter what had been done already. By doing this we validated what we had come up with so far and work onwards with a better understanding. I believe our ability to discuss everything properly and without holding back is a good feature of the group. This ensured that, in the end, we all agreed upon our initial design.

It is to my believe that in the first week we used the Reflective Transformative Design process too little and just went with our gut. All of us are already well aware of a design process however, none of us ever reflected upon what and how we actually did it. We started off by directly designing and envisioning our concept which let to difficulties later on. Since we had not thought about the feasibility of our ideas it later turned out unachievable. However, in our second week we altered this course and first analyzed and concretized our idea properly before creating it. This resulted in a better concept of our idea which in the end also gave us a better start for the research process.

My contribution to the group work was mostly directed towards the creation of the first video and the visuals of the second video. This was since my own goal during the start of this course was mostly directed towards the ability to properly depict what I meant with my ideas. I believe I succeeded in doing this however not completely in the right manner for this assignment. Had we understood the assignment better, I feel confident I would have been able to accomplish it then too.

When starting the research phase of this course I had little knowledge on how such a process went. Due to the fact that I had never experienced a process like this before, I felt lost in where to start. However, with some help of my teammates I managed to gain sufficient understanding in order to finish and comprehend the course within the time available. Along with the help, the guidelines and lectures continuously pushed me in the right direction.

Our brainstorm brought us to a conflict which was quite appealing to myself since I am big fan of coffee drinking too. However, formulation the research question properly was a more challenging experience. During our first try we did not fully grasp the essence of the proper formulation yet. This resulted in a poorly built up phrase that did not clearly portray what we wanted to research. It was too broad and had too little relevance to our specific research. We changed this into an open-ended question which expressed exactly what we wanted to learn from our research.

For our research we first attempted to create the tangible concept ourselves. However, through the pilot we realized that the essence of a finished prototype was relatively small since we were not researching the prototype but were focusing on the feedback system and the impact of this. The decision to go with the research we did was also made on the lectures that were provided. We would have liked to perform a bigger pilot version of the research but lacked the participants. Doing the pilot with only one person already gave us a lot of good feedback for the real test. Had we done it with more people, I believe we might have gotten more out of the final version of the test.

For the recruitment of the participants we decided only to ask students. This decision was partly based on shortage of time and partly on handiness. We, wrongly, assumed that all the students would have access to the free coffee machine in the Laplace building. This would be an extra detail to our research since, it being free, it would not retain the participants from getting coffee. However, we did not take into account that the students might decide to go somewhere else and not have the free coffee to their availability. While searching for participants we asked them if they would be on university the whole day but not specifically asked if they would in inside the Laplace building. The lesson that I drew from this is to be very specific and cautious when searching for participants so that you really find the ones that fit to your profile.

While analyzing our results I realized that it might sometimes be difficult to see the relations between answers from different participants. The method we used for this, the repeated reading and reading in an active way, learned me how to deal with chunks of data that could perplexed and bewildered. It was a method I had never used before but quickly taught me the basics of coding and finding the overlapping themes. I had tried to create a pie chart in order visualize some of our results, however, we received feedback that this only caused vagueness. After redoing the pie chart but still receiving feedback about the lack of clarity we decided to leave it out. Next time, I would like to try and see if I could have found another way of depicting what I was trying to do in the pie chart.

After the finalized research, analysis and data visualization, we spend a lot of time on the formulation of everything. We came together multiple times and went over the entire paper multiple times. It was fascination to see how we found something new

every single time. While going through all of this, we became more and more confident about our own paper. After receiving the final feedback from fellow students and our tutor we could still improve but also felt that our paper was very well academically written already compared to other groups. In the end we went through it and adjusted were we felt necessary, however, we constantly kept true to ourselves with regard to what we wanted to say and how we wanted to convey the message.

My own contribution to the research part of this course is very much alike to the contribution of the other group members. All of us were in charge of finding two suitable participants for the course. Along with this, we had to keep in contact with them about the questionnaire which was held afterwards. Furthermore, other examples of my contributing were putting all the data in spreadsheets, writing the basic frame for the discussion and continuously rereading others pieces and providing feedback on those parts. All in all I feel that I gained enough knowledge to start my research project next semester, one of the main goals I had for this course. This brings me a satisfying and relaxing feeling which I will benefit from when starting next semester.

PERSONAL REFLECTION E.M. DE VRIES

Reflection Part 1: Design Process

The first two weeks of this course were about designing for a "Talkative Kitchen" by making use of the Reflective Transformative Design process. I was already familiar with the process, however in an unconscious way. Therefore, it was interesting to see how to work with the RTD process.

In the first week we had to make a quick start, since the deadline was already soon. Due to this time pressured we follow our intuition in what to do, this caused us to lose track of the RTD process. Nevertheless, before writing this reflection, I saw that our action taken in this week, were somehow similar to steps in the process and that we unconsciously did follow the process.

We had to make a concept, prototype and video, however the exact purpose of those things were not clear for us. This was my first learning point: making decisions based on too little information. Personally I like to do some research before making decisions, however there was no time for that now. An interesting thing for me was that the fast decisions we made in the first week, were validated by insights that came up later in the RTD process. This is a very helpful insight since this actually showed me that it is possible to start with complete freedom when coming up with ideas since there is the opportunity to validate them later.

During the second lecture, feedback was given about the videos, and the assignment was explained in more detail. We knew we did not interpret the assignment in the right way, and the goal for the video was not to only show the product, but especially to show the process. By looking at some other videos, I learned different ways of showing a product or process, and got inspired to make a second video in a completely different way.

In the second week we focused on the RTD process, and especially on reflecting after each step. By reflecting on all decisions we made in the first week, we changed some important aspects of the design to come to a more solid and clear concept. I found it always difficult to know what were right moments to reflect, however the RTD process gives the opportunity to reflect after each step. This really helped me in getting a clear overview of the decisions we made. Since in the first week we were not conscious about the RTD process, and in the second week we were, it is interesting to see that we took a different order of steps, and that this resulted in a different end result.

During the second feedback session it was interesting to see where other groups started and how that influenced their further process. In the future I will keep in mind that it can be very helpful to start at different point since this will give other insights in a situation.

For this reflection I wanted to mark our steps in the RTD process, especially since we didn't were aware of them during the first week. I translated our actions in this week into steps, and added the steps taken in the second week, which showed me how much different activities we had done (shown in figure 1).

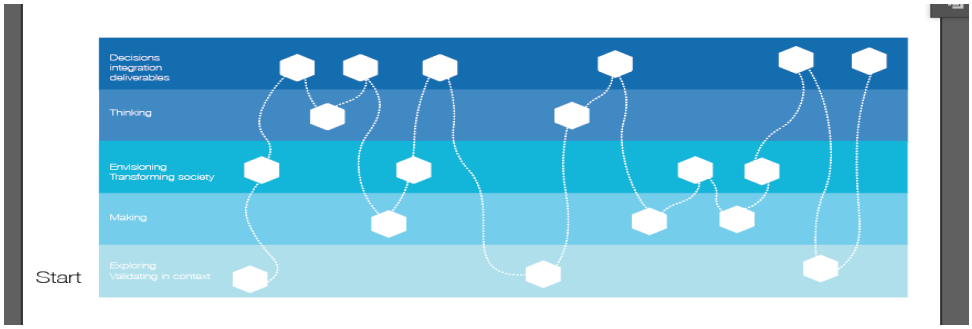

Figure 1: Visual of the RTD process during the first two weeks of the course, the five steps are, from below: exploring, making, envisioning, thinking and decisions.

Reflection Part 2: Learning Goals

In the first reflection I already some learning point during the first two weeks. After that, the focus of the course changed from the RTD process to doing a research and writing a research paper. For me, this was not the first time I did a research, however I had never done a research in combination with design. This coursed really showed me different ways of doing this: design for research, or research for design. Doing this research, and writing the paper showed me how to include design in the usual aspects of a research (paper).

Starting already when we had to choose if wanted to do a qualitative, quantitative or mixed methods research. Since we wanted to research behavioural change on a short notice, doing a qualitative research seemed the best option. However, this was a decision we made, and as I experienced when explaining decision to our tutor, all decisions can be made with different views, methods and questions. Therefore reflecting on previous decisions is very important during the whole research. Before this course I always thought a research question was composed at the begin of a research and never changed. However, I learned that every decision we made influenced the research questions, which therefore has been adapted several times, since every time new insights changed the vision of the research.

When thinking about how to conduct the research in such a way the research question would be answered, we needed to consider several aspects. Since we wanted to find something out about a perceiving of feedback, and were doing a qualitative research, we needed to make sure we would understand our users very clearly. In order to accomplish this, we needed to ask the right questions, and analyze the data in the correct way. Doing the pilot research with one person showed me our initial plan had to be slightly adapted, questions had to be asked slightly different, and the prototype had to be changed to get the right interaction with it. This pilot made it easier to think about the actual method for the research and how to analyze the data.

I am used to look at quantitative data and make graphs and tables out of numbers, but qualitative data ask for a completely different method. We used the method of thematic analysis to make sure we interpreted our data in the correct way. It was very interesting to follow the steps form this method, starting with getting familiar with the data by organizing and reading it several times, and after that searcher for themes, give code names to that, and reflect and change the themes until they are as compact as possible. For me this was a new way of looking to data, I am used to look at quantitative data and make graphs and tables out of numbers, however qualitative data ask for a completely different method. This knowledge about the content of a qualitative research will help me in the future with choosing between the qualitative, quantitative or mixed method research.

Since we used themes to interpret our results, it was easy to link this information to our own design. However, by thinking about why this information would be useful to answer the research question, in the conclusion and discussion, helped me to see how this information could inform more general designs. Also by searching for related work to our research, I learned to search for researches that have a specific similar aspect, instead of a completely the same research. Those researches can have a completely different main theme, but the similar aspects can bring helpful insights in my own research. In the discussion it was very important to have a critical view on what we had done, and on the results. To make sure we interpreted the results in the correct way, we needed to be aware of the different factors that may have influenced the findings.

By writing those two reflections about the course, I really had to think deeper about what we have done during this course. This course was very helpful, as for me it felt like doing a research project only in one quartile, instead of a semester. All new insights mentioned in those reflections I will take with me next project, and I am sure they will help me to prevent certain mistakes.