

ICOS: Interactive Clothing System



Figure 1. ICOS

Hans Brombacher

Eindhoven University of Technology
Eindhoven, the Netherlands
j.g.brombacher@student.tue.nl

Selim Haase

Eindhoven University of Technology
Helmond, the Netherlands
s.haase@student.tue.nl

Abstract

New techniques are being developed and are influencing our daily life and environment. These influences take place in several interaction-attention fields. The challenge for designers is to develop new products that use these new techniques, that improve the experience of the user. We designed ICOS; a Smart, Interactive and Adaptive clothing rack, which presents the advantages of machine learning when implemented in our daily lives. The machine learning was developed and implemented within a clothing rack

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that uses weather data (type of weather and temperature) and frequency of the previous selected clothes to advise the user. This is to improve and enrich the daily routine of picking clothes of users.

Author Keywords

Machine learning; implicit interaction; peripheral interaction; home environment; clothing selection; weather data.

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous; See <http://acm.org/about/class/1998> for the full list of ACM classifiers. This section is required.

Introduction and Background

Interaction design is becoming a more important topic in our daily lives. The way interaction design influences our life can mostly be divided into two forms of interaction: First, Center of attention interaction, the user is fully aware and focused on the interaction. Examples of this are setting a reminder in your agenda or following the GPS on your smart watch. Secondly, the Outside the attentional field of the user attention (Figure 2). Example of this is how certain cars automatically activate the windshield wipers when it is raining. Interestingly is the scope of Calm technology where user act rather in the periphery of attention than constantly at the center of attention. This form of

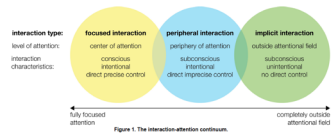


Figure 1. Interaction attention continuum [2]

attention informs the user but does not demand all the attention of the user and because of this, shifts between the two scopes [6]. But how could you design a product that shifts between these scopes? Research shows that: *"in order to fit interactions with computing technology more seamlessly into our everyday routines, interactions with interactive systems should be available at various levels of attention [1].* These forms of attention are explained with the help of the interaction-attention continuum (Figure 2). Research also indicates that: *it is essential to design interactive systems that are to become part of our everyday life routines such that they can be operated at various levels of attention"* and *"interactive systems can blend enable shifts between these interaction types, requiring designers and researchers to consider various levels of* Machine learning could be used to design an implicit interaction within a product. Machine learning is now a fairly established technology, and user experience designers appear regularly to integrate machine learning services in new apps, devices, and systems [4]. The question is how we could implement this more in our everyday routines and by doing this, help with the shifting throughout our attention fields. However, this technology has not experienced a wealth of design innovation that other technologies have and this might be because it is a new and difficult design material [4].

The home environment plays an important role within our everyday routine. New and developing technologies are playing a more important role in our daily life. The challenge for designers is to develop products/systems that use these new, developing techniques to improve the daily life of the user.

The goal of this project is to design a product that shifts along the interaction attention continuum (with a focus on the shift between peripheral-implicit interaction) and fits within the home environment. The shift between these interactions should be enriched through machine learning, by combining this with tangible interaction we want to enhance the routine of selecting clothes while being in the periphery.

Approach

User study

Our goal was to design within the existing home environment. Clothing is not a topic often chosen, while looking at Machine learning. We believe that we can enhance the daily routine of selecting clothes by implementing this. A cultural probe study was held about people's current patterns and habits towards clothing selection to generate mostly qualitative data. Within this study, a research was held about the current selection of clothes people were wearing to understand how they made their decision and what factors do influence their selection. To gain more elaborate insights from the data we conducted semi constructed interviews. The user study consisted of 18 participants (7 male – 11 female). Underneath is overview of the data on what influences people while selecting clothes:

Factor that play role in selecting clothes:

- 16/18 weather (type and/or temperature)
- 11/18 personal preferences
- 11/18 agenda

When clothes are selected:

- 10/18 choice made in the morning

- 7/18 choice made in the evening
- 1/18 different

We used several ideation techniques based on Thinkertoys [5], to generate and select concepts. From there, a storyboard was developed with the integrated concept (Figure 3).

Design

ICOS creates a highly-personalized ICOS is an interactive clothing rack that helps users by presenting suggestions on their daily clothing selection. By implementing machine learning with real-time data (weather type, temperature, agenda and frequency of selection), ICOS creates a highly-personalized experience. There are multiple factors that affect the suggestions that ICOS makes. By constantly measuring the clothes selection of the user and qualities of the clothes, ICOS can analyze and interpret the user's everyday choices. This way the system learns what clothes the user prefers during different circumstances. By combining this information with user's daily selection, the system analyses the user preference for each weather type and temperature. The system analyzes the current circumstances and uses previous data to generate a new suggestion. The suggestions are presented to the user by a subtle light pattern, which creates a peripheral and elegant interaction. If the suggested clothing piece is not selected, the system will recognize and analyse this and take this into account for future suggestions. During the initial period of use, ICOS will not make suggestions. This is the learning phase of the machine learning program. During this phase, the system will be collecting data that can be rendered useful through analysis. Through this process, the quality of ICOS's recommendations will only become better with time.

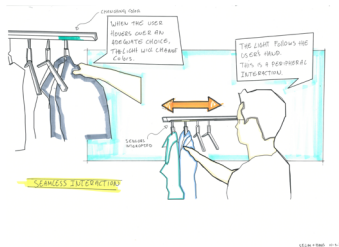


Figure 3. Storyboard on design direction



Figure 4. First iteration of ICOS

During the developments of the prototypes, we mostly focused on functionality. The prototype uses IR sensors to measure whenever a clothing piece is used. By using distance sensors, it is able to follow the users' movement and mimic this movement with light, and will change colors whenever the user is close to a suggested piece (Figure 4 and 6). The system uses machine learning to learn which clothes are selected during the different weather types and analyze the frequency they are selected. The system shows the top 2 of clothes (displayed with the help of a light pattern) that fit the weather forecast predicted for that day. The system keeps gathering data throughout this process and will improve and become more accurate (Figure 5).

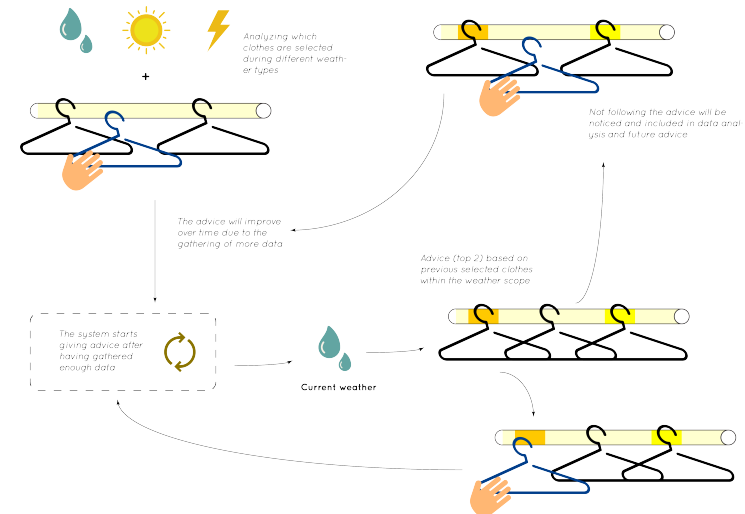


Figure 5. System overview of the machine learning of ICOS [3]



Figure 6. User interaction with ICOS

Conclusion

The following goal was set at the beginning of the project:

The goal of this project is to design a product that shifts along the interaction attention continuum (with a focus on the shift between peripheral-implicit interaction) and fits within the home environment. The shift between these interactions should be enriched through machine learning, by combining this with tangible interaction we want to enhance the routine of selecting clothes while being in the periphery.

By looking at the development of our project, it becomes apparent that it fits the design scope well. From a machine learning perspective, we were able to create an algorithm that is flexible and adaptable to the user's input. Next to that we were able to integrate the required technological hardware and software into a clothing rack. This will enhance an existing interaction, rather than creating a new one. This subtle approach on peripheral interaction will result in a more seamless fit into the everyday life, mostly because it facilitates the shift between peripheral and implicit interaction. Through this design, we are able to combine machine learning with tangible interaction to enrich a part of our daily lives.

Discussion

Future concept

For future development, we are looking at how our design fits the everyday life. We are creating a higher quality prototype. Through this prototype will be able to create a fluid and elegant interaction. Another step will be to test the machine learning program on a longer term in its natural context, user's home. This will give

insights on how users are affected by our design and how big the adaptability of the system will be towards the user.

Next to that, we are exploring new functions that could be added, such as a random function that will suggest random clothing pieces to create a versatile experience. But also, the option to add new clothes and that the system easily recognizes this piece as new.

Limitations

At the moment, the user needs to place his clothes at the same clothing hanger, every time. The system is not able to recognize which pieces of clothing is hanging on the clothing hanger. This should however be possible in the near future. Amazon has developed their Smart Supermarket where user can just walk in, grab something and walk out and pay, without having to interact with anyone [1]. This way of sensing which product is chosen and present at which location is a technique that should solve the limitation stated above.

ACKNOWLEDGMENTS

We want to thank dr.ir. S. Bakker, prof.dr.ir. J.H. Eggen, dr.ir. B.J. Hengeveld and Koen Beljaars for their guidance and feedback during the coach session. We also want to thank all the participants that participated in our user study. At last, we want to thank De Meeuw as our client.

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