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Interactive Sensory Wheel

A Descriptor Management Tool

Martijn Swenne · Jeannette Shijie Ma

Supervised by:
Jae Perris · Donna Schipper · Fons Verbeek

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Abstract Descriptive sensorial communication is ubiquitous but overlooked. As a part of the Human Computer Interaction course, this project aimed to improve the efficiency of descriptive communication by developing an interactive sensory wheel website to store, define and retrieve vocabularies for different products. Usability analysis was done with some public surveys, expert evaluations and a user test. Based on the evaluation outcome of this project, the website will have a chance to be polished into an open tool for the public.

Keywords descriptor management · sensory · interactive

1 Introduction

1.1 Background - *Descriptive analysis and sensory wheel*

Expressing and communicating feelings has been a very important activity of human beings. With the desire for communication we developed rich cultural societies. For a long time communication of our senses was mostly valued in the humanities disciplines. There were many approaches that ambiguously express our perception and feelings. For example: poems, metaphors, paintings, music. With the development of society, philosophers like Kant started to discuss about the importance of understanding our own perception in natural science studies [1]. A bridge between natural science and humanity has since then been developing. Sensory science is a discipline studying human perception as objective nature, aiming to better understand the things we perceive (from the environment). There are many types of sensory analysis with descriptive

Authors
LIACS, Leiden University, Niels Bohrweg 1, Leiden, The Netherlands
E-mail: swennemartijn@gmail.com, j.shijiem@gmail.com

Supervisors
E-mail: jae.perris@gmail.com, d.schipper@liacs.leidenuniv.nl, f.j.verbeek@liacs.leidenuniv.nl

analysis being one of them. Descriptive analysis is mostly used to make a profile of certain product types with related attributes [2]. It can also create a map for different products in certain categories to show their features. In scientific research, descriptive panels are commonly used for descriptive analysis. A descriptive panel is usually a group of 8-15 well-screened and well-trained people plus a panel leader. The panel leader is responsible for the screening, training, conducting and maintaining of the panel. During the first few panel sessions for a product, the panelists are facilitated by the panel leader to come up with a set of descriptors for this product. Then, these descriptors will be organized into a sensory vocabulary wheel. Sensory wheel is a powerful tool to manage sensorial descriptors [3]. It acts as a small dictionary and assists the panelists to evaluate the samples more efficiently. Usually the creation of a research-grade sensory wheel needs inputs from the panel, panel leader, product experts and language experts. A well-developed sensory wheel will do a good job assisting rest of the training and profiling sessions in descriptive analyses for the same type of products.

1.2 Problem statement - *Ubiquitous descriptive communications need assistance*

Descriptive sensorial analysis is usually organized in big companies or research institutes where there are sensory scientists, sensory technician and facilities available. If a smaller company would like to make a profiling of their products, they usually have to hire the help from a sensory analysis institute or a quality management institute. It is hardly possible for amateur groups like cooking clubs to access well-assisted descriptive analysis. However, descriptive communication is not limited in sensory research labs. It is ubiquitous. When tasting or experiencing certain products, people have a hard time coming up with descriptive words for their perception. Sometimes due to lack of communication, it is difficult to feature certain products in a product category (e.g. think about the feature of Port wine except sweeter). Keeping track of descriptors in sensorial experiences could help with building an aligned communication both within and outside an interest group. However, there are no specific tools available for sensorial descriptor management. Seeing through the history of sensory science, humanity has been an important foundation of inspiration. Not only scientists and trained specialists have the desire to communicate and align their perceptions. Anyone in any specific group is willing to communicate with the group about their core topic (e.g. wine could be regarded as the topic in a wine club). Thus, we think it is important to make sensorial descriptor management more efficient and approachable for everyone.

1.3 User analysis - *a tool for public and amateurs*

Potential user tasks and user groups were analyzed based on the problem statement. There are generally four tasks in descriptor management. They are vocabulary creation, vocabulary editing, calibration specification (vocabulary

definition) and profiling specification (vocabulary usage). For small companies like bakeries and home breweries, it is important to get sensory characteristics about their products for categorizing, advertisement and quality management. With a new digital management aid, they will be able to generate and collect descriptive vocabularies about their products. They will also be able to make a rough profile mapping of new samples. People in interest clubs also need (or sometimes they naturally have) a vocabulary for their interest. It could be difficult for new members to learn those vocabularies. With a digital vocabulary management tool, they can collect and define their terms. If they like it, they might also try profiling tests to feature certain items with their own vocabulary. Researchers with creative ideas might also utilize a digital descriptor manager to do social studies. The tool will make it simpler to keep and organize descriptors while doing any type of research.

1.4 Objectives and Research question

To conclude the introduction, this project objected to develop an interactive descriptor manager in the form of a sensory wheel. Based on the objectives we formulated a research question: *Are amateurs able to use an interactive sensory wheel to manage the descriptors for ubiquitous descriptive communication?*

2 Methodology - *Design a descriptor manager: interactive sensory wheel*

This project consists of 3 major activities: design, development and usability tests. These three activities refer and react to each other during the whole project process. This section describes how these activities were implemented. Part of the methods described here has been modified from our initial proposal based on intermediate results.

2.1 Design

Functions: Since we were given limited time (about 3 months), we decided to use our own server and localhost our website for the project prototype. The major functions of this website were designed based on the user task analysis. An instruction page shows the main functions of this website. An interactive wheel will allow the users to view, store and edit their descriptors. Editable templates of common products were also provided. The diagram in Figure 1 gives an overview of the functions (organized by assumed usage steps). Some of the functions were assumed to be more repeatedly used than the others. For example, users might spend more time in wheel editing than wheel creation. Based on these assumptions, we decided to make three interactive main pages and two static information pages for this website. Table 1 summarizes the pages and their functions.

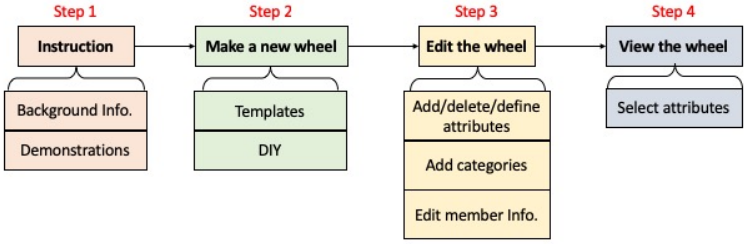

Fig. 1 Function design of the website

Table 1 Website pages and functions

Interactive main pages	Static information pages
1. Login - make a new wheel (templates and DIY) 2. Editing add/delete/define attributes 3. Finished wheel view and select attributes	1. Demonstrations and background Info. 2. Contact information

HCI elements: The website details (colors, shapes and small utilities) were designed based on both HCI principles and feasibility (our programming skill etc.). The colors of each arc in the wheel is different than their neighbors color. In this way the user can easier recognize each attribute and relate color to their memory. Attributes and their categories and their sub-attributes should be in similar colors. Definition and references of attributes have the same color code as their arc color in the wheel. The color for calibration and profiling specification is neutral. The current page is highlighted in the menu to keep the users on track of what they are doing. The general shape of a finished wheel is a circle (to give the users a clear closure signal). However, Outer layers of wheel can be remained as arcs since not all the attributes have sub-attributes. Title and subtitles will be bold and centered. The editing buttons will be smaller and more transparent to give the whole wheel a clearer view. Elements in or around the wheel will react to the users action. For example, the pointed attribute will become larger than others; the editing buttons will be more solid when pointed at. Figures 2-4 display some featured elements which were realized in the final prototype. Due to time limitation, some elements were decided to be only demonstrated but not implemented.

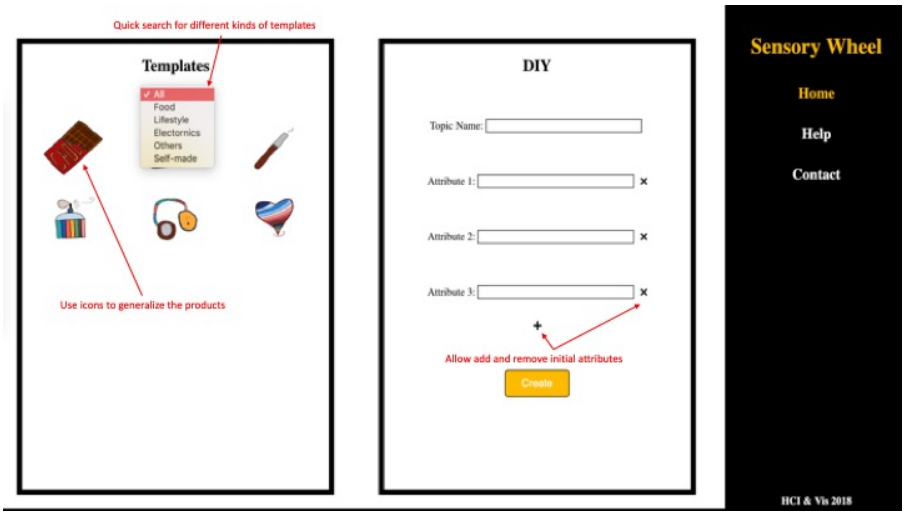

Fig. 2 Final prototype marked with features - Login page

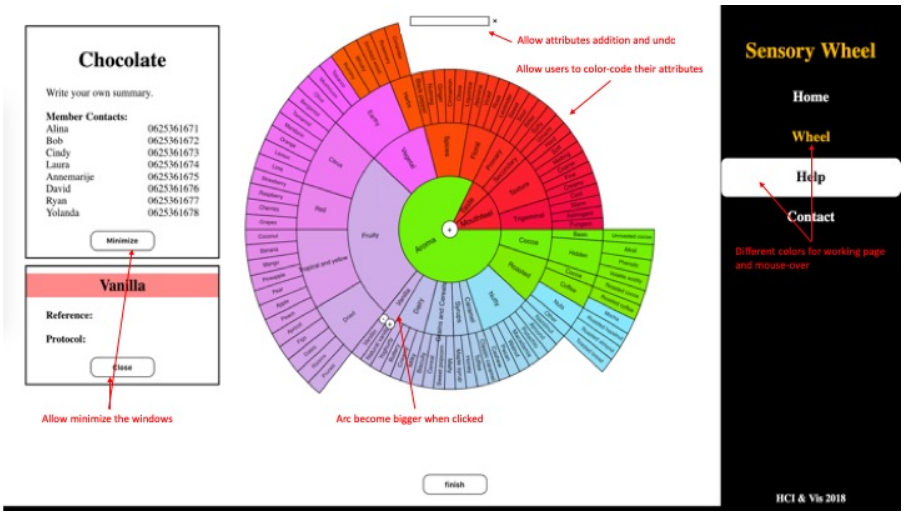

Fig. 3 Final prototype marked with features - Wheel editing page

2.2 Development

Prototypes: The development of this website started with a low fidelity draft. Based on the draft, the first prototype realized the login page (DIY) and editing page. This prototype was presented to the project pitch presentation. The second prototype realized the background page and improved the editing page. In addition, six full templates from different product categories were added to the login page. This prototype was used for user evaluations. Based

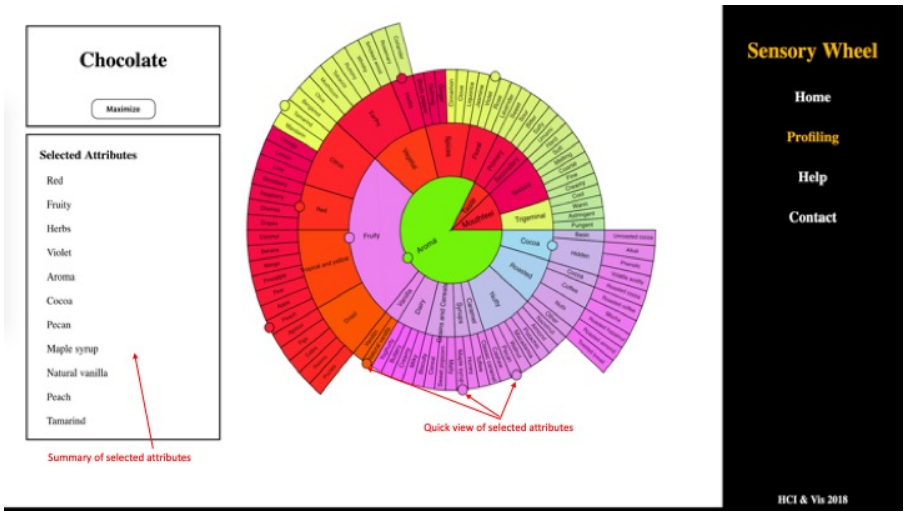

Fig. 4 Final prototype marked with features - Finished wheel page

on the evaluation result, the final prototype improved some detailed elements and implemented the attribute selection, demonstration and contact pages.

Technical information: In order to learn limitations and possibilities from sketch to product, we decided to not use website-building tools. The website framework was built in HTML and CSS from sketch. The wheel functions were mainly based on arc manipulations. It was the most challenging part and was realized in p5.js, jQuery and JavaScript. The wheel templates function was enabled by adding pre-edited XML files. The icons and instructions were designed with Autodesk Sketchbook and Microsoft PowerPoint.

2.3 Usability tests

The prototype's usability was evaluated in multiple ways throughout the whole development process. The main evaluations were: a public survey, a pitch presentation, two expert evaluation sessions and one user evaluation session.

Public survey: After the first low-fidelity draft, an online public survey was done to evaluate our problem statement and assist the page and function design. This survey consists of 4 multiple choice questions about descriptive communication behaviors and 1 open question about descriptor generation. The survey was composed in both English and Chinese and distributed online via social media. Appendix **??** presents the English version of the survey questions. The survey result was interpreted to evaluate the interest weight distribution of each function. For example, less creativity-driven population

would be less likely to use the DIY function while prefer the templates function. Please see the result section for the detailed interpretation of the survey result.

Designer session 1 and Pitch presentation: The first prototype was evaluated in a designers meeting session. Subtle modification was made based on the result of the meeting. The modified prototype was then presented to part of the course admin and classmates via a 10-minutes presentation. The audiences provided useful feedback about the design and prototype.

Expert session 2 and user evaluation: The second prototype was evaluated by both expert role-playing and user tests. The designers were asked to walk-through the website and try all possible tasks. After that, they were asked to evaluate the task difficulties and leave comments with computer science and sensory science insights. Five potential users were asked to complete four tasks on the sensory wheel. They were presented with four types of chocolate samples to assist the tasks. After each task, the users were asked to rank difficulties and leave comments. Both experts and users were asked to fill in a system usability survey after the tasks. Appendix **??** shows the tasks of the tests. The amount of needed modification depended on the difficulty and usability scores. The comments inspired the direction of improvements in the final prototype.

3 Results - *Evaluation from public, experts and potential users*

The whole process of this project took around 3 months. The initial design and first prototype were finished in the first month and realized the basic framework and functions. In the second month we re-designed and built the second prototype which was more detailed and complete in terms of both functions and representations. In the third month we conducted user evaluation tests and made improvements to build the final prototype. The final prototype only implemented part of the initial design, but we managed to make it into a complete and functioning product. Figure 2-4 display some features of the final prototype. The sub-sections below will explain the results from user evaluations and how they were reflected to the followed processes.

3.1 Public survey

The public survey received 80 responses. The results of the first 4 questions were shown in Figure 5. Question 1 evaluated the attitude of communication motivation. Most(56%) participants showed high motivation of initiating a communication while only 5% tend to avoid communications. The answer of question 2 revealed the existing of common communication problems like misunderstanding, strange terms and descriptor shortage. The result of question 3

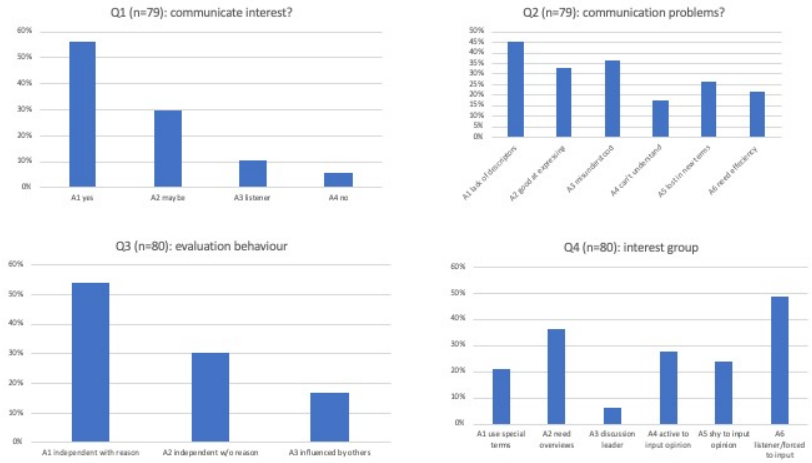

Fig. 5 Public survey results (x:answers; y:percentage)

indicated that most people are independent thinkers during evaluation. Question 4 showed that most people play a listener role in their interest group. The open questions received many skipped responses and misunderstood responses. The result shows that people are less able/patient to generate descriptors even for their interested topics. To reflect these results, we switched our focus from the DIY function to the template function since most people tend to only need a reference vocabulary wheel with editing possibilities. Background and instruction pages were also needed since most potential users tend to seek guidance. Small functions like group information box were added to design since most users might use our product in an interest group.

3.2 Designer meeting and pitch presentation

The first prototype was discussed in a designer meeting. From the sensory insight, the colors, wheel layer numbers and possible attribute distribution were discussed. From the computer science view, the data storage and retrieving, user action and response were discussed. After the discussion, we decided to implement 4 layers of attributes and demonstrate the color coding by automatic color assignment for each arc. The font size of the attributes was proposed to be smaller in outer layers. XML files and finishing function were added to the design for data management and better user experience. The audience from the pitch presentation remarked on the color and shape of the wheel. We finally decided to make the arcs smaller and close the wheel as a circle only when the users click the finish button since it will provide a closure experience.

3.3 Expert and user evaluations

The average system usability score for all participants was 73.93 (73.5 excluding the experts). In terms of task difficulty, most participants found the instruction too abstract and the attribute editing function was a bit confusing. Once they got familiar with the operation, they felt the tasks were very easy to complete. However, all of them ignored some obvious problems (exceeded fonts etc.). Since we asked classmates and friends for the usability test, they might have acted differently from the real user population. The experts provided extra feedback on the inconsistency of menu bar and undo functions. Based on the comments, we decided to improve the font size; add undo function and improve the instruction page for the final prototype.

3.4 Reflect on research question

The result from usability test indicated that amateurs are able to use an interactive sensory wheel to manage descriptors for communication. However, since in reality people are more diverse in terms of education background and language skill, the difference of the usability test and reality could be large. In order to further answer the research question, this product needs to be lunched facing a larger audience group and get feedback from it.

4 Conclusion - *Discussion, limitation and possibilities*

This project has been challenging but motivating. As co-designers we learned from each other about different specialization insights and practiced together on the HCI theories we learned in the course. There are some limitations of the final prototype: The data storage function was not yet implemented thus the users own creation could not be saved. Some elements should look catchier or even force-reading (instructions etc.). Also, the final prototype is not as interactive as initially designed due to time and skill limitations (no fish eye display etc.). However, there are also some possibilities revealed from the project results: We conclude that if this prototype was published and accepted by the public, there will be multiple phases with dynamic user acceptance through time. We assume: first the wheel templates function will be the most popular function since it provides rich information. After the user number gets larger and larger, certain society pattern could be developed and it might trigger the contribution motivation of users towards the society. Thus, the DIY function might start to gain popularity.

5 Future Work

The project calls an end, but the product could be further improved into a fully functioning tool for the public. For future work we need to implement

the database and user registration functions. More detailed elements in our initial design need to be taken care of. More user evaluation tests are required with more random potential users in various topics and backgrounds. Since we thought the development of new technologies could rapidly influence communication behavior, we decided to keep the public online survey open for future uses (repeat or update). If the product is completed, it will have change to be applied as a small widget for social media and chat applications.
Language develop with time and culture. Differentiation helped us to survive, while description encouraged us to communicate. Descriptors, like all the other precious cultural art, need a place to live with us.

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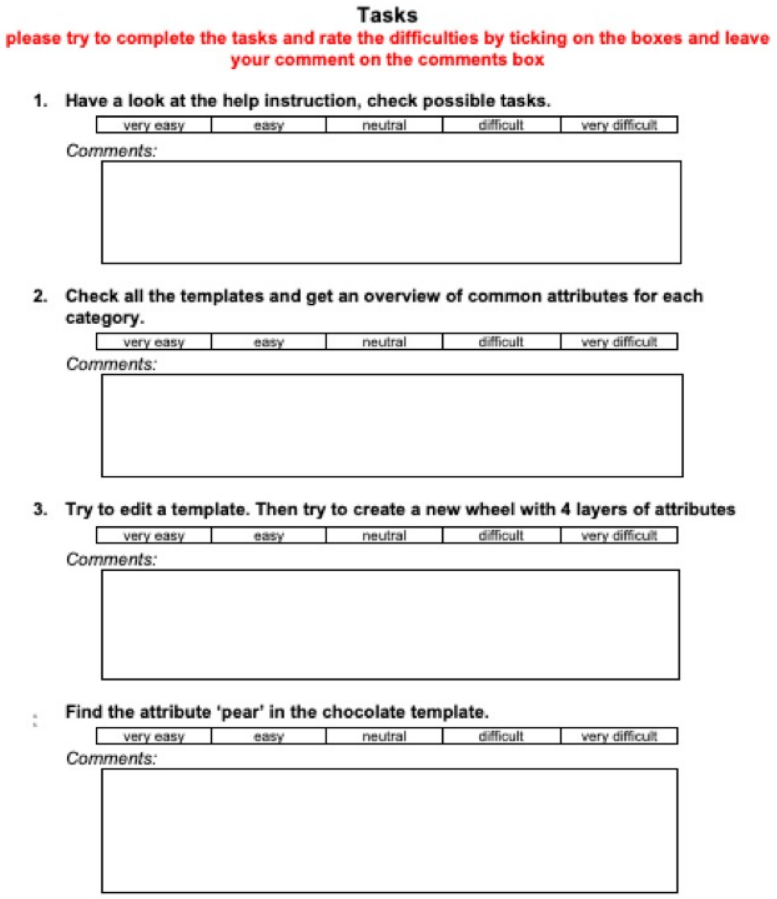
Fig. 6 Appendix 1 - Public survey in English



Tasks

please try to complete the tasks and rate the difficulties by ticking on the boxes and leave your comment on the comments box

1. **Have a look at the help instruction, check possible tasks.**

very easy	easy	neutral	difficult	very difficult

Comments:

2. **Check all the templates and get an overview of common attributes for each category.**

very easy	easy	neutral	difficult	very difficult

Comments:

3. **Try to edit a template. Then try to create a new wheel with 4 layers of attributes**

very easy	easy	neutral	difficult	very difficult

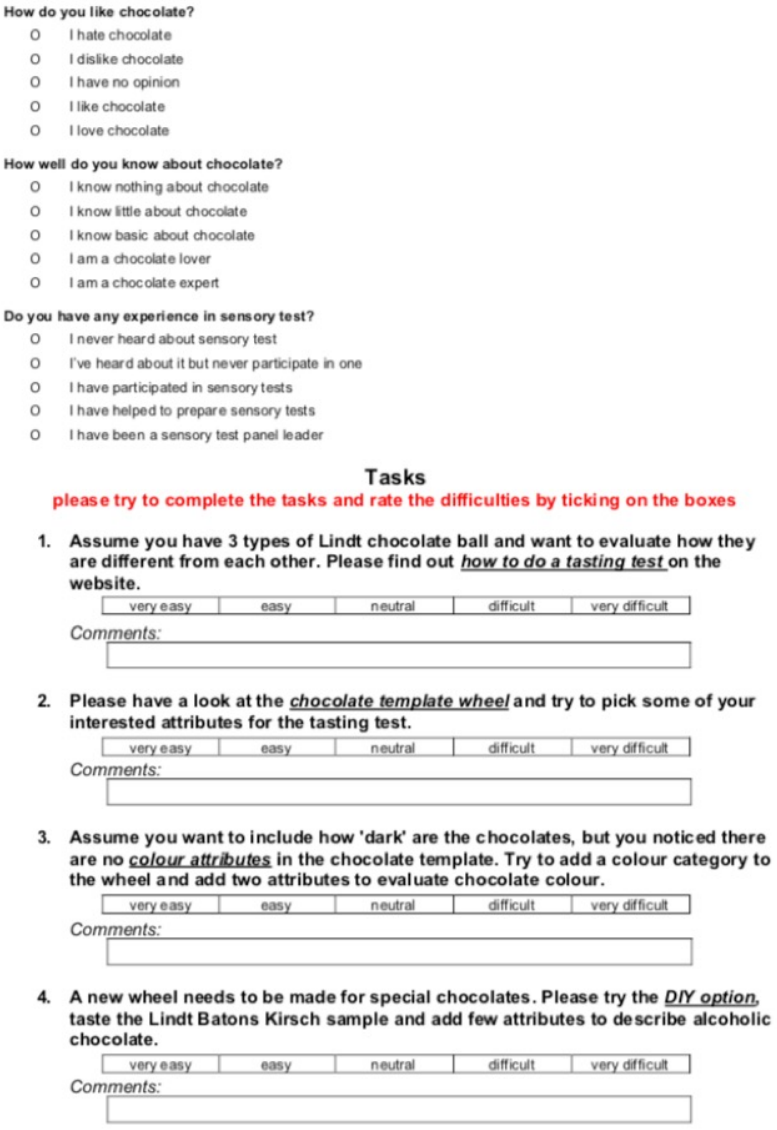
Comments:

Find the attribute 'pear' in the chocolate template.

very easy	easy	neutral	difficult	very difficult

Comments:

Fig. 7 Appendix 2.1 - Usability test tasks for experts



How do you like chocolate?

- O I hate chocolate
- O I dislike chocolate
- O I have no opinion
- O I like chocolate
- O I love chocolate

How well do you know about chocolate?

- O I know nothing about chocolate
- O I know little about chocolate
- O I know basic about chocolate
- O I am a chocolate lover
- O I am a chocolate expert

Do you have any experience in sensory test?

- O I never heard about sensory test
- O I've heard about it but never participate in one
- O I have participated in sensory tests
- O I have helped to prepare sensory tests
- O I have been a sensory test panel leader

Tasks

please try to complete the tasks and rate the difficulties by ticking on the boxes

1. **Assume you have 3 types of Lindt chocolate ball and want to evaluate how they are different from each other. Please find out *how to do a tasting test* on the website.**

very easy	easy	neutral	difficult	very difficult

Comments:

2. **Please have a look at the *chocolate template wheel* and try to pick some of your interested attributes for the tasting test.**

very easy	easy	neutral	difficult	very difficult

Comments:

3. **Assume you want to include how 'dark' are the chocolates, but you noticed there are no *colour attributes* in the chocolate template. Try to add a colour category to the wheel and add two attributes to evaluate chocolate colour.**

very easy	easy	neutral	difficult	very difficult

Comments:

4. **A new wheel needs to be made for special chocolates. Please try the *DIY option*, taste the Lindt Batons Kirsch sample and add few attributes to describe alcoholic chocolate.**

very easy	easy	neutral	difficult	very difficult

Comments:

Fig. 8 Appendix 2.2 - Usability test tasks for users