UNIVERSITY OF TWENTE.

Faculty of Behavioural, Management and Social Sciences

Adjusting the navigation structure of a faculty intranet to the average user with Card Sort and Q-sort

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M.Sc. Thesis
February 2018

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Abstract

The purpose of this study was to propose an alternative navigation structure for the intranet of the faculty Behavioural, Management and Social Sciences of the University of Twente. A good navigation structure is crucial for the usability of a website (Bernard, 2000a). When adjusting this structure to the way users categorize the website content, the user's mental model, the website will be more intuitive and easier to use (Schmettow & Sommer, 2016). A multilevel open card sorting test was done to gain insight into the mental model of the average intranet user as well as gaining insight into the way users label categories. Heatmaps were created to visualize the mental model of the users. A Q-sort task was used to prioritize items on the intranet. The average user categorized content representative for the intranet in three categories: education, organization and services. Anecdotal evidence that was gained during the Q-sort indicates that participants often did not see the need for the intranet in the first place. In contrary to the expectation of this research, the basic underlying structure of the current intranet did not deviate a lot from the proposed structure. Other impact factors of the intranet being hard to navigate are clutter because of outdated content, lack of location feedback and bad internal search engine findability. Advised is to evaluate the need for a BMS intranet in the first place. When it is decided to re-design the intranet the advice would be to critically measure the content to criteria as determined in this study, to adjust the categorization to the proposed structure and to appoint a content manager.

Keywords: card sort, q-sort, usability, navigation structure, mental model

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1. Introduction

1.1. Summary and motivation

In the beginning of 2015 a fusion between the faculties Management & Organisation and Behavioural Sciences of the University of Twente took place, leading to a new faculty: Behavioural, Management & Social sciences (BMS). Both faculties had their own intranet which were merged to create one central place with information about the current situation within the faculty. Since this merge, the faculty of Behavioural, Management & Social sciences has indicated that employees experience difficulties with finding their way on the faculty intranet, causing a decrease in productivity. Therefore the faculty has asked to redesign the intranet in such a way that it will be easier to use, in other words: improving the usability of the website.

An important aspect for the usability of a website is the navigation structure (Martin & Kidwell, 2001). For the (re-)design of a navigation structure of a website general guidelines are available (see Bevan (2005) for an overview of guidelines and standards for web usability). However, for the specific categorization of items within a navigation structure of a website there are little to no specific guidelines because the categorization is dependent on the content of the website. The organization of information in a person's mind can be seen as a mental model. When the navigation structure of a website is adjusted to the mental model of its users it will be more intuitive and therefore more usable (Schmettow & Sommer, 2016). A user-centered method to approach the user's mental model of items on a website is card sorting (Dong, Martin, & Waldo, 2001). With the card sorting method insight can be gained into the mental model of users (Spencer & Warfel, 2004). To prioritize the items of the website, the Q-sort method is used.

1.1.1. Present study

In the present study an alternative navigation structure will be proposed for the BMS intranet. This will be based on the mental model of the users of the intranet. An open multilevel hierarchical card sorting study will be utilized to approximate the mental model of users of the faculty intranet. With this mental model, insight can be gained in the categorization of the intranet content of the average user. This method will be combined with a Q-sort to prioritize the items that are used for the card sorting test. The combination of these methods is unique. A

proposal for an alternative navigation structure for the BMS intranet that is adapted to the approximated mental model combined with the prioritizations will be given. The main research question of this study is as follows: 'What is an alternative navigation structure for the intranet website from the faculty Behavioural, Management and Social sciences based on the average mental model of faculty employees as approached by an open multilevel card sorting test combined with the Q-sort method for the prioritization of the website items?'

1.2. Context

The faculty of Behavioural, Management & Social sciences (BMS) is a faculty that consist of multiple departments (see appendix A for an overview of the organizational structure of BMS). The faculty strives to 'play a pivotal role in understanding, co-engineering and evaluating innovation in society'. It is an overarching institution of multiple studies which consist of departments with knowledge in psychology, business administration, public administration, communication sciences, philosophy and education sciences. All departments share a focus on solving societal challenges. There are supportive services that are not related to a specific study programme that fulfil a supportive function for the faculty, such as 'Marketing and Communication', 'Educational Affairs' and 'Human Resources'.

1.2.1. Current intranet

The faculty intranet is a website that is accessible for everyone that has an internet connection via the university of Twente or that has an account at the university of Twente. It is meant to serve as a place where employees can find up-to-date information about the BMS faculty and it also serves as a reference work. A restriction for redesigning the intranet is that every website of the university of Twente has the same layout, it is not possible to deviate from this.

The faculty intranet is available in two languages: English and Dutch. Although the intranet suggests there is also a German version, there is not. There are similarities between the content and navigation structure of the English and Dutch intranet but there are also big differences. Therefore from now on the Dutch and English intranet will be considered separately from each other. The basic structure of both can be found in appendix B. In figure 1, the main page and part of the local navigation structure of the intranet can be seen. The current intranet has a lot of overlap with the general BMS website. The general BMS website is

different from the intranet in that it can be accessed by everyone, there is no login required as is with the intranet.

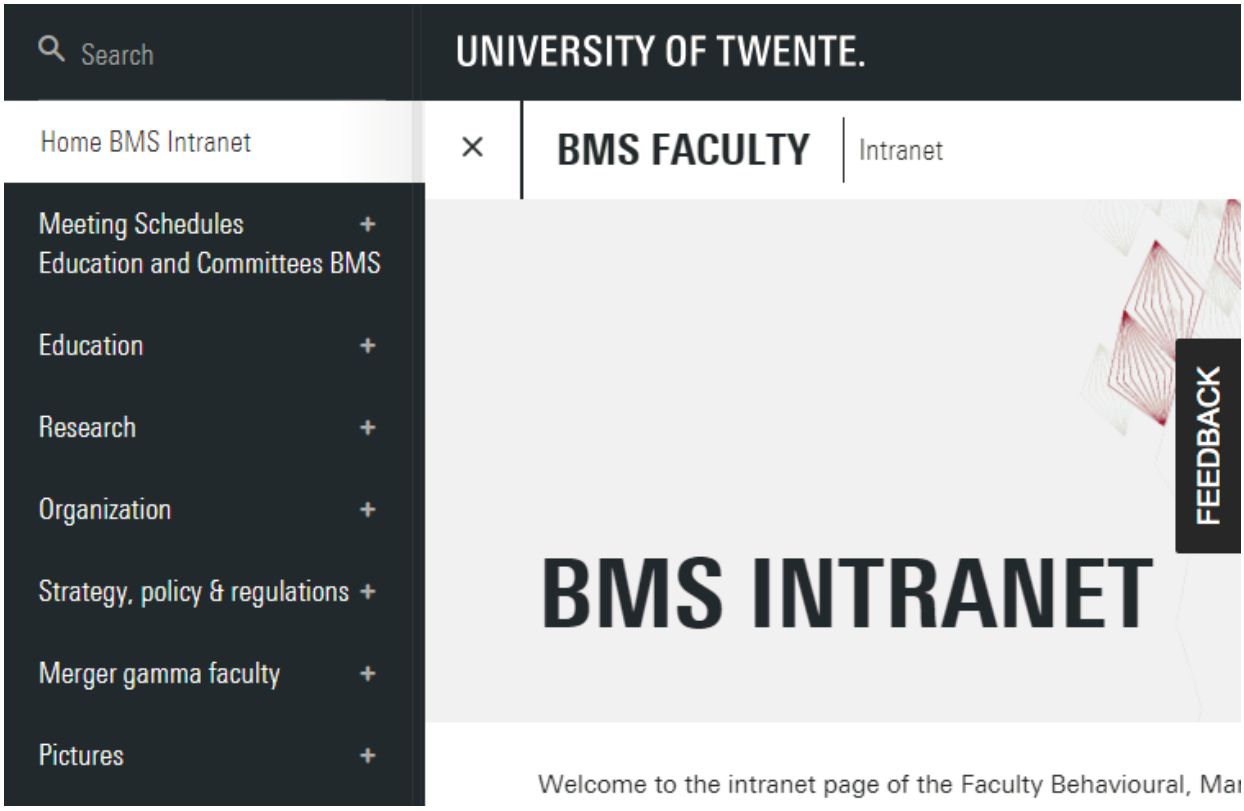

Figure 1. A screenshot of the BMS intranet homepage, retrieved from https://www.utwente.nl/en/bms/intranet/

1.2.2. Purpose and target group of the BMS intranet

The target group of the intranet are employees of the BMS faculty. The information on the intranet should be relevant and aimed at BMS employees. The purpose of the intranet is to inform them about faculty specific matters that are slightly confidential. Slightly confidential information refers to information that does not have to be shared with the entire internet, such as education quality information, but that is appropriate to be accessed by university affiliated persons. Because the information on the intranet is slightly confidential, access to the BMS intranet is restricted: only students and employees affiliated to the university can login to reach the intranet. Faculty related matters that are not confidential can be found on the general BMS intranet.

1.3. Theoretical background

1.3.1. Website usability

While browsing on a website a user must carry out multiple cognitive tasks at the same time. Kim & Hirtle (1995) divide these cognitive tasks in three categories: (1) navigational tasks: the planning and execution of routes through the structure of the website; (2) informational tasks: reading and understanding the content that is presented and (3) task management: coordinating information and navigational tasks. The performance of these tasks at the same times requires cognitive overhead (Kim & Hirtle, 1995). When a user's cognitive resources are overwhelmed by these cognitive tasks, thus when the overhead is high, degraded performance occurs. This high cognitive overhead can cause 'user disorientation' (Boechler, 2001). User disorientation is described by Hardman & Edwards (1989) as "the user not having a clear conception of the relationships within the system, or knowing his present location in the system relative to the display structure, or finding it difficult to decide where to look next within the system". This disorientation can express itself in three ways: (1) the user does not know where to go next; (2) the user does not know how to achieve their goal and (3) the user does not know where he is in relation to the overall structure (Hardman & Edwards, 1989). User disorientation can cause cognitive overload and getting lost on a website, this can lead to the user failing into achieving a goal, the user getting frustrated and it can induce the user to leave the website (Gwizdka & Spence, 2007; Otter & Johnson, 2000). User disorientation is a major (usability) problem causing users experiencing problems with (coordinating) navigational tasks (Foss, 1989; Gwizdka & Spence, 2007). To support the user with performing cognitive tasks without causing a cognitive overload, a website has to be user-friendly, in other words it has to have a high usability.

The usability of a website is an aspect that is often overlooked, however it is an important aspect for a user's success in finding information (Gullikson et al., 1999). Usability is defined as 'the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use' (International Organization for Standardization, 1998). Effectiveness is an aspect of usability which measures the degree to which a user can achieve goals. Efficiency measures the effort that is needed to achieve a goal and satisfaction refers to how content users are with a website (Schmettow & Sommer, 2016). Examples of a good website usability are that a website should be easy to

figure out and learn, the layout should be as intuitive as possible and there should be as few steps as possible required to retrieve the desired information (Bernard, 2000a).

According to Fang & Holsapple (2006) there are five classes which are identified as joint contributors to the usability of a website: (1) task features; (2) user features; (3) provider features; (4) system features and (5) environment features. Of these five features, system features are the most controllable. Because an organized, well-designed and intuitive navigation system is critical for user success (Chevalier & Kicka, 2006) and can help reducing user disorientation (Head, Archer, & Yuan, 2000) a choice has been made to focus on the adjustment of the system feature 'navigation structure' to increase the usability of the BMS faculty intranet.

1.3.2. Navigation structure

The navigation structure of an intranet is a very important aspect for its ease of use (Martin & Kidwell, 2001), it is vital for a website's usability (Bernard, 2000a). A website that provides low or substandard levels of navigability impairs the consumption of information (Wojdynski & Kalyanaraman, 2016). A good navigation structure allows users to acquire more of the information they seek and it makes the information easier to find (Fang & Holsapple, 2006). Users of a website must be able to navigate freely and with confidence through a website in order to make efficient use of the content (Dong, Martin, & Waldo, 2001). Many users prefer browsing the navigation structure over the search function when trying to find information (Katz & Byrne, 2003). Furthermore many users have poor search skills and will therefore not succeed with only using the search function (Nielsen, 2014). This makes a good navigation structure a key feature for the usability of a website. Organizing information in such a way that users can intuitively find particular information is a challenge (Schmettow & Sommer, 2016).

1.3.3. User centered design

If a navigation structure matches users' needs, expectations and cognitive processes, users can navigate effectively through a website (Boechler, 2001; Martin & Kidwell, 2001). By assessing the expectations and preferences of the users for the intranet, a sense of ownership, contribution and community is encouraged, which is vital to an effective intranet (Martin & Kidwell, 2001). Adjusting the navigation structure to the cognitive processes of the average user is a user-centered design process. This is a broad term which described a process of designing were potential end-users influence the design (Abras, Maloney-Krichmar, & Preece, 2004). User-

centered design methods aim to optimize the usability of a website rather than forcing users to change their ways of acting to use the system (Hjalmarsson, 2015). Hahsler and Simon (2000) give three reasons to use a user-centred approach when creating a navigation structure to organize objects: the structure gets (1) an increased usability; (2) a reduced subjectivity and (3) a higher level of acceptance, because users have actively participated in the (re)design process. For these reasons the choice has been made to work with user centered design methods in the current study.

1.3.4. Guidelines for the design of a navigation structure

For the design of a navigation structure with a good usability a few general guidelines are available. First of all, the depth and breadth of a menu navigation structure have an important influence on the usability of a website. Increasing the depth of a navigation structure decreases its search efficiency (Kiger, 1982). Snowberry et al. (1983) found that error rates increase from 4.0% to 34.0% as depth increased from a single level to six levels. Therefore a broader navigational menu structure is preferred. However, the shape of a hypertext structure is also important. Bernard (2002) found that navigational structures with broad middle levels and navigational structures with a constant shape produced the poorest performance with participants whereas concave shapes (i.e. (6 x 2 x 2 x 12)) of the same depth were navigationally more efficient. The concave structure shape is an optimal design structure according to Norman and Chin (1988) because when there is a larger percentage (and thus more defined) of descriptive category items at the beginning of a structure the user can form a more exact match between the category and the actual target item. At the final (terminal) level, a broad menu reduces the overall information uncertainty because at this level the target items are more explicitly defined.

Another guideline for the design of a navigation structure is that the website must provide feedback on the users location in the navigation structure in order to let the user know where he is at a website (Bevan, 2005). Feedback can be provided by providing path and hierarchy information with for example the use of breadcrumb navigation (Rogers & Chaparro, 2003).

Regarding the actual content of a navigation structure there are only very general guidelines available such as the need to label and categorize in a clear manner (Bevan, 2005).

Several guidelines that should be taken into consideration when (re)designing the actual content of a navigation structure will be extracted from literature in the following paragraphs.

To gain more insight into how to structure the actual content of a navigation structure, it is important to clarify how users decide on what information to select. According to the 'information foraging theory' users searching for information on a website can be compared to animals foraging for food. An animal has to choose where to look for food in the same way a person has to choose where to look for certain information. Metaphorically the user is an information predator whose aim it is to select information with a maximum gain rate of information relevant to their task (Pirolli & Card, 1999). The information foraging theory assumes that people follow an 'information scent' path when deciding what item to click on. Information scent describes the amount of information that users can obtain from proximal cues (for example item labels) regarding the location of the information that the user is looking for (Pirolli, 1997). The proximal perception of information scent is used to assess the gain and prevalence of the information source behind the item: it informs the user about which item to select to maximize the information that can be gained. The more explicit the association is between the initial descriptive item and the targeted item, the greater the scent is (Bernard, 2002). If the scent is sufficiently strong, the user (forager) will be able to make a correct choice at each decision point which supports successful category selection by the user (Snowberry et al., 1983). A high information scent for category or item labels is particularly helpful at the highest levels of an information hierarchy, because when a user selects the correct category there is a higher chance on reaching their goal without click backtracks (Czerwinski & Larson, 1998).

User judgement on information scent is based on spreading activation (Pirolli & Fu, 2003). The information goal of a user activates a set of chunks in a user's memory. This activation spreads in a spreading activation network through memory associations to words and images that the user sees on a website page. The amount of activation matching for the goal- and display chunks is an indicator of their mutual relevance. If the chunks that are activated for a descriptive item on a website match the chunks activated by the goal of a user, the user will judge the descriptive item as being highly relevant to the pursued goal and the information scent can be described as being high (Pirolli & Fu, 2003). By letting users themselves indicate what descriptive items (labels) are logically connected for them to a certain goal, insight is gained in

the connection between items and labels. A high information scent is pursued when adjusting a website to these insights (Otter & Johnson, 2000).

Another important aspect for the design of a good navigation structure is the categorization of information (Nawaz, Clemmensen, & Hertzum, 2011). Categorization, also referred to as 'classification' in some literature, is the clustering of information that shares a common property (Nawaz, Clemmensen, & Hertzum, 2011). Coxon (1999) states that a basic principle for category formation is that the categories provide maximum information with the least cognitive effort needed to understand the information. Also, categories must be distinct and mutually exclusive (Gullikson et al., 1999). Often once developed, categories form a hierarchical cognitive taxonomy (Porac & Thomas, 1990).

1.3.5. Mental model

Cognitive categories are based on perceived similarities and differences in the attributes of the objects or events that are being classified by someone (Rosch, Barbara, & Lloyd, 1978). The categorization of information in the mind of a person can be seen as a mental model. A mental model is the internal representation of a concept that corresponds to the external structure that it represents (Chi, 2008). It is so to speak a map of the perceived world structure as it is in the mind of a person (Yuviler-gavish & Parush, 2008). In the case of a website the mental model of a user is specifically about the perceived structure of the website domain. Mental models in a person are formed through experience, training and instruction (Yuviler-gavish & Parush, 2008) and are based on beliefs not on facts (Nielsen, 2010).

A common usability problem with websites is that there is a gap between the designers' mental model and the users' mental model (Nielsen, 2010). For a user to navigate successfully through a website, at least a rough idea of how the website is organized is required (Bernard, 2000b). If the information on a website is categorized in a manner that fits well with the user's perception of the information topics as it is in their mental model, then information retrieval on the website is efficient and sometimes even satisfying (Bernard, 2000a). According to Rosch et al., (1978) "maximum information with least cognitive effort is achieved if categories map the perceived world structure as closely as possible" as can be visualized in a mental model (Rosch et al., 1978). Therefore, if information on a website is structured similarly to the average mental model of a user of the website domain, the website will have a higher usability and the search for items should be more efficient and successful (Yuviler-gavish & Parush, 2008). Organizing

a website according to the users average mental model also reduces the problem of user disorientation (Bernard, 2000a).

1.3.6. Card sorting

A mental model cannot be observed directly, therefore it has to be inferred indirectly (Yuviler-gavish & Parush, 2008). A user-centered method to approach the mental model of a user is card sorting (Spencer & Warfel, 2004). The card-sorting technique assumes that people make sense of the world by categorizing it and that people can describe their own categorisation with reasonable validity and reliability (Rugg & McGeorge, 1997). With card sorting insight can be gained into the participant's categorization of the assessed items: how users group, sort and label information and objects (Spencer & Warfel, 2004). A card sorting exercise allows participants to express their internal perceptions of the relatedness of items within a set, the strength of the perceived semantic proximity within a set of items is assessed (Dong et al., 2001; Schmettow & Sommer, 2016). A card sort can help understand the knowledge structure of a domain of concepts users have, thereby showing a glimpse of their internal mental model (Petrie, Power, Cairns & Seneler, 2011). It can help designers of a website understand the expectations of users regarding the content organization (Dong et al., 2001). After a card sort a grouping structure can be created which pulls semantically associated items together (Schmettow & Sommer, 2016).

Card sorting is a knowledge-elicitation activity involving the user grouping objects or concepts. In a card sorting test a user is provided with a set of cards. On the cards are items that represent subjects that are (going to be) on the website. The user has to organize and categorize these items in way that they perceive as being logical. The objects or concepts can be presented as online or physical cards, both seem to wield the same results (Bussolon, Russi & Missier, 2006). There are single-level card sorts and multilevel card sorts. With single-level card sorts participants can only sort cards into a single level of groups. With multilevel card sorts, sometimes referred to as hierarchical card sorts, participants have the possibility to partition groups they made in a previous step, which results in nested groups of cards (Schmettow & Sommer, 2016). In this way subjects can express any concepts that cover hierarchical levels (Harloff, 2005). A challenge with multilevel card sorting is the increase in the number of items to be sorted (Wood & Wood, 2008). Card sorts in which participants define and label the groups themselves are termed open card sorts. As mentioned before, it is very valuable to gain insight

into what labels are logically connected to a certain goal for users in order to pursue a high information scent. With an open card sort it is possible to gain this insight because users are labelling the categories themselves. Card sorts where the groups are provided in advance are termed closed card sorts. A closed card sort can be useful when adding new content to an existing structure (Spencer & Warfel, 2004).

1.3.7. Q-sort

For the navigation structure of a website, an order of importance must be created. The most significant information is placed on higher levels or even on the homepage, the less significant information is placed lower down the tree structure. This is an issue of prioritization, for which classic card sorting does not apply. Therefore the Q-sort method can be used as an addition to the card sorting test (Schmettow & Sommer, 2016). The Q-sort method is an inverted technique of factor analysis. It is an alternative measurement technique which can be used in any situation where subjectivity is at issue (Ten Klooster, Visser & de Jong, 2008). With the Q-sort method several qualitative aspects can be measured in a quantitative manner, the strengths of both research types are combined (Amin, 2000).

In the Q-sort method, the participant is given a set of items. This would be the same set of items as used with the card sorting test. The items must be placed on a scale according to importance (Block & Eagle, 1963). It is a forced-choice research approach and therefore all items must be ranked by the participant (Ten Klooster et al., 2008). However, the user is limited in the amount of items that can be placed at a certain ranking. This results in having the items sorted into a given normal distribution in the end (Rugg & McGeorge, 1997). With a Q-sort, distinct groups with a different opinion about prioritization can be detected. Also which items were scored roughly in the same level (consensus items) and which items were scored at a different level by different participants (contention items) can be detected (Donner, 2001). Based on the results of the Q-sort decisions can be made about the hierarchy and prioritization of items on the faculty intranet.

2. Method

This study combines two methods: the card sorting method and the Q-sort method. Card sorting is an explorative technique for eliciting mental models in a qualitative manner (Schmettow &

Sommer, 2016). In order to enable the participants to organize the items in a hierarchical structure and to label the groups themselves, a multilevel open card sort was conducted. In order to establish a hierarchy of relevance of the website items a Q-sort was conducted. The Q-sort method measures qualitative aspects in a quantitative manner (Ten Klooster et al., 2008). Both methods are participatory and user-centered.

2.1. Participants

In total twenty-four participants volunteered to participate in the study. Of these participants, twelve had an academic function and twelve had a supportive function within the BMS faculty. Twelve of the participants were more or less familiar with the intranet and twelve were not at all familiar with it. Two of the participants who were familiar with the intranet, administered parts of the intranet by adding information to it regularly. For the Q-sort task, data of one participant is missing because the participant did not have enough time after the card sort to conduct the Q-sort. The participants were sampled via email and by convenience sampling within the employees of the BMS faculty. All participants had a good command of either the Dutch or English language.

2.2. Item selection

A card sorting test was conducted to approach the mental model of the average user. For the execution of this test items had to be selected that represent the BMS faculty intranet. It is important that the amount of items that will be used for the card sort is sufficient. Research suggests that there should be no less than thirty items and no more than a hundred (Spencer & Warfel, 2004; Tullis, 2003). The content of the card sort items should be representative for the site and have to have enough similarity to allow groups to be formed. If the items that are chosen are too varied, participants will not be able to create natural groupings. Furthermore it is best that the granularity (level of detail) of the items is more or less similar because participants find it difficult to group items that have different levels of granularity (Spencer & Warfel, 2004).

To make a representative item selection for the card sort, three inclusion and some exclusion criteria were defined based on the target group and purpose of the intranet. Based on these criteria, items were selected that are most representative for the faculty intranet, an overview of the thirty three selected items can be found in appendix G. A BMS marketing and

communication employee that manages the BMS intranet was consulted to discuss if the item selection made by the researcher was sufficient.

The first inclusion criteria was that items should be relevant for employees of the BMS faculty. An example of an item that is relevant for BMS employees is ‘Career and professional development’ because this is specifically about the development of BMS employees. ‘Student services’ is excluded because this service is meant for students and not for employees.

Items on the BMS intranet should be moderately confidential. An example of moderate confidential information is an overview of the members of the company medics team or the actions of improvement that will be made for study programmes. An example of an item that was excluded is ‘Repetitive strain injury’. An exception was made for items that refer to a specific BMS facility or service. This is because it can be convenient for employees to know where information about these facilities, departments and services can be found. For example a reference item that refers to the BMS faculty council intranet.

Finally, items have to be specifically relevant for BMS. The items on the current intranet often refer to general university facilities, policies or regulations that are not specifically linked to the BMS faculty. ‘BMS employees for Marketing and Communication’ is BMS specific and therefore included. ‘ICT service centre’ is general for the university and excluded.

A few (mainly exclusion) criteria have been determined that are practical for the card sorting task itself. First of all, items should not be too specific. Those that are very specific are often only important for certain employees and do not give a good representation of the general content of the intranet. Specific documents or information that clearly belong to a group are put together in an overarching item. All the OFI-numbers for example are grouped together. Furthermore, the content of the items must be up-to-date. Many items on the current BMS intranet are outdated and are generally no longer relevant for employees. An example of this are two categories and its content that are completely left out in the item selection: ‘Tech4People’ and ‘Merger gamma faculty’. Content about the former MB and GW faculties is left out because the faculties do not exist anymore. Some content is not up-to-date but still useful as reference, content like this is not included in the item selection because it does not have a place in the basic framework of the navigation structure. There is a good chance that for example ‘Older student opinions about PSY master courses’ will be in the same place within the mental model as ‘Student opinions PSY master courses’. Therefore this reference content can be categorized the same as similar up-to-date content on the reorganized intranet. Some

content is repetitive for different study programmes. Information about actions for improvement for example is available for five different study programmes. To avoid too much repetition in the card sort, only two study programmes are chosen to select items from (Communication Science and Psychology). In this way participants can group the content differently but do not have to repeat the sorting for the same items multiple times. Items can categorized per study programme but can also be organized based on content.

For the Q-sort the same items were used as with the card sort except for six study specific items (three for Psychology and three for Communication Science) being interchanged for three items with the same content but not study specific (for example 'Student opinions BMS bachelors/masters' instead of 'Student opinions bachelor Communication Science') . This was done in order to prevent participants who affiliated to another BMS study than Psychology or Communication Science sorting the cards at a low level of relevance purely because of the study programme and not because of the actual subject on the card. This means that for the Q-sort thirty items were used.

2.3. Test materials

This study was conducted using physical cards for both sorting tasks. The cards were made digitally with Microsoft Word, printed out on paper, cut out and laminated. The cards had the item names on it and in the low right corner a number. This numbering was relevant for the researcher to document the data after the test and was randomized to prevent influencing the participant. On the back of every card was a short description of the concerning item. Post-its were used by the participants to label the groups. For the Q-sort five cards which indicated the level of relevance (with -- for 'not relevant at all', - for 'not quite relevant', +/- for 'neutral, 1 for 'quite relevant' and 2 for 'very relevant') were printed. They were used to divide the table into five parts for participants to sort the cards. For the input of the data, both R-studio and SPSS were used. The card sort data was analyzed with R-studio and the and Q-sort data with SPSS.

2.4. Procedure

The card sorting tests took place at either the office of the participant or in a project room. The room only needed a table to sort the cards on and preferably no other distractions. At the beginning of the session the participant had to read part one of the instruction about card sorting

(see appendix C). Then the employee was asked if familiar with the BMS intranet. An additional explanation was given about the procedure of the card sorting and the researcher asked if the participant was familiar with the current intranet. After the instruction the participant had to sign an informed consent (see appendix D). The participant executed the card sorting test by grouping the cards on the table in an intuitive manner. To keep the card sort intuitive and to prevent the participant from thinking too much about the groups made a time frame of half an hour was given for the card sort. When it was unclear for a participant what an item meant the researcher referred to the explanatory text on the item card. On the Post-its the participant wrote names for the created groups. During the execution of the card sort participants were instructed to think out loud so the researcher could get insight into their approach and make notes. After finishing the card sorting test the researcher wrote down the created groups and sub-groups with help of the numbers on the cards. The researcher also made a picture of the sorted cards to document the grouping and labelling of the participant. Hereafter the Q-sort took place. The participant read the second part of the instruction and the researcher gave a short additional explanation. The participant had to assign each card to one of the five levels of relevance. Subsequently the researcher placed five cards on the table to make clear which levels of relevance there were and to create separate rows to divide the cards in. The participant divided the cards over the levels based on how relevant the concerning item was for him or her. The researcher made sure the participant did not exceed the limit of cards per relevance level in order to achieve the given normal distribution of 10% - 20% - 40% - 20% -10%. To document the distribution, the researcher wrote down which cards were placed in every level and a picture was made of the sorted cards.

2.5. Data analysis

To analyze card sort results, an interim step is needed where similarity measures between any two items are created. With these measures a similarity matrix can be made. In an open single level card sort similarity measures are dichotomous: items are grouped together or not (Hudson, 2005). However, with an open multi-level card sort the measures for similarity between items is more complex because they are divided in multi-level groups which makes the co-occurrence of items gradual (Schmettow & Sommer, 2016). A frequently used similarity measure for hierarchical card sorts is the Jaccard coefficient (Capra, 2005; Rorissa & Hastings, 2004). The Jaccard coefficient is constructed for any two items. It is calculated by counting the number of

groups both items are a member of divided by the number of groups at least one item is member of. When there are more group levels, as can be the case for a multi-level card sort, the granularity of the set of possible values increases for the Jaccard score for any two items compared (Schmettow & Sommer, 2016).

A similarity matrix represents the mutual semantic proximity between any two items. To structure a similarity matrix in a way that clusters of items with a large similarity become clear, agglomerative hierarchical cluster analysis (HCA) can be executed. With HCA an iterative algorithm operates on the similarity matrix that merges items or groups closest to each other at every step (Schmettow & Sommer, 2016). Based on the agglomerative clustering algorithm, a visualization of the similarity matrix itself can be made in the form of an ordered heatmap. A heatmap is diagonally mirrored and is a graphical representation of a similarity matrix, for which applies that the stronger the similarity between items the warmer the colour is (Wilkinson & Friendly, 2009). If the order of items on a heatmap is adjusted to the order of iterative aggregation steps during HCA, clusters with strong similarity will appear on the diagonal of the heatmap (Schmettow & Sommer, 2016). It is possible that an item fits multiple clusters, a HCA will then put the item into the cluster which it fits best (Capra, 2005). A heatmap will visualize the cluster(s) where the item can also fit: the colour of the item will be different from the surrounding items. An item like this is termed as an 'ambiguity' (Schmettow & Sommer, 2016). Ambiguities have to be judged manually by a researcher. This can be time-consuming and possibly inaccurate.

The card sorting data was analyzed in R-studio, see appendix E for the syntax. First the data was manually inserted, see appendix F for the data entry syntax of one participant. Hereafter the Jaccard score was calculated and based on this score a similarity matrix was created. The similarity matrix was reordered into a heatmap with help of an agglomerative cluster analysis. Based on the clusters and ambiguities, the average mental model of users was described based on which an alternative navigation structure was created.

For analyzing the Q-sort results, the mean prioritization per item was calculated. This score indicates which items are seen as important on average. Based on these scores there can be decided which items should receive more prioritization in the proposed navigation structure. The data was first manually inserted into the statistical programme SPSS. The first row contained all the participant numbers and the first column the item numbers. For every participant the rating that was given was filled in per item. Every level of relevance

corresponded with a score: not relevant at all corresponded with -2, not quite relevant with -1, neutral with 0, quite relevant with 1 and very relevant with 2. With SPSS the mean prioritization and standard deviation for every item was calculated.

3. Results

In this result section the results of the card sort and Q-sort task will be presented. Hereafter additional observations about the website will be given and described.

3.1. Card sorting

Based on the card sorting data of all participants a heat map has been constructed (see figure 2), which approaches the average mental model of all participants.

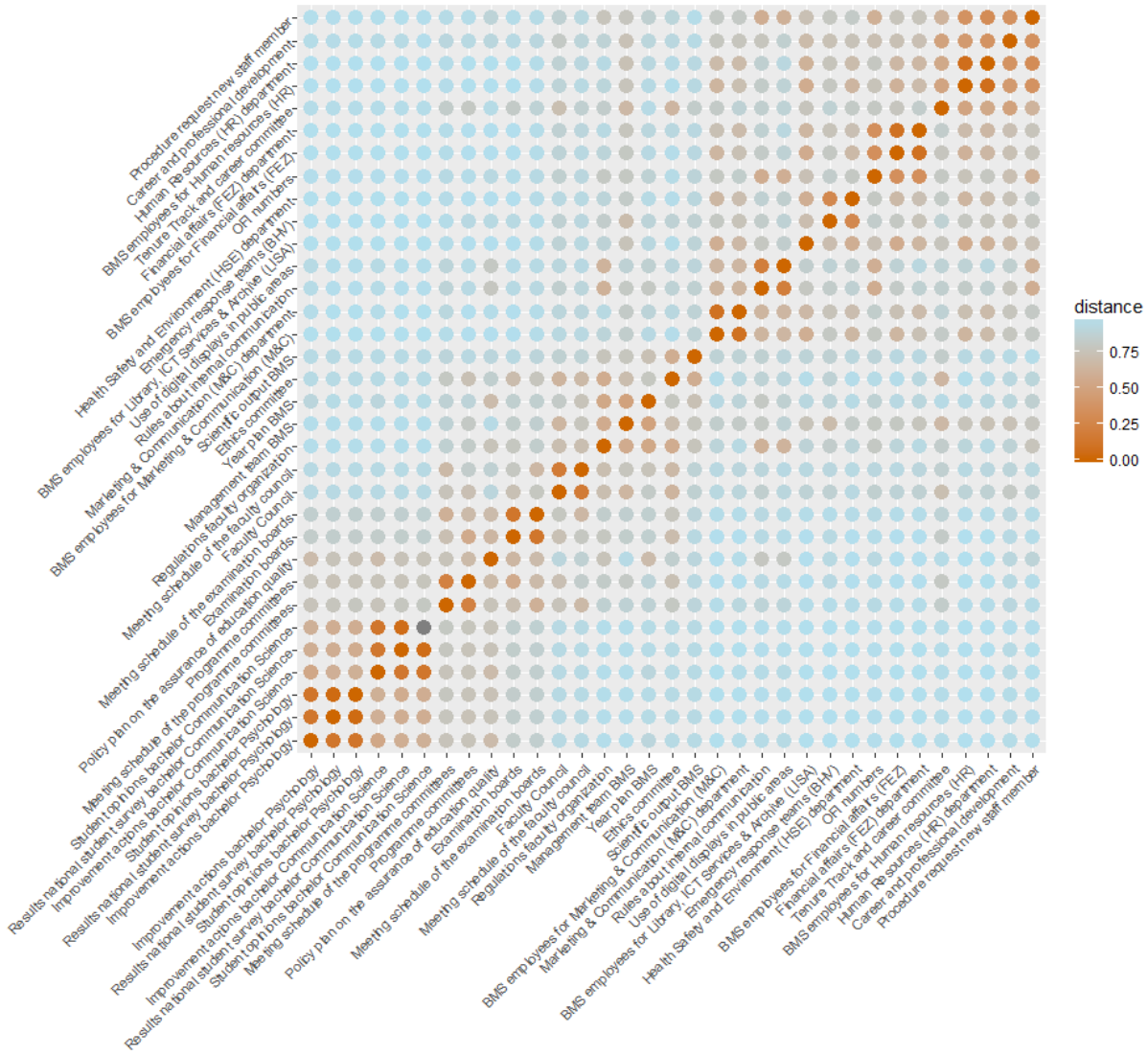

Figure 2. Heatmap of all users. The card sort items can be found vertically and horizontally, the stronger the perceived similarity between items the warmer the colour.

The participant pool can be divided in two main user groups: Scientific staff and supportive staff. To analyze if these user groups have different mental models, separate heatmaps were created for both groups in figure 3 and 4.

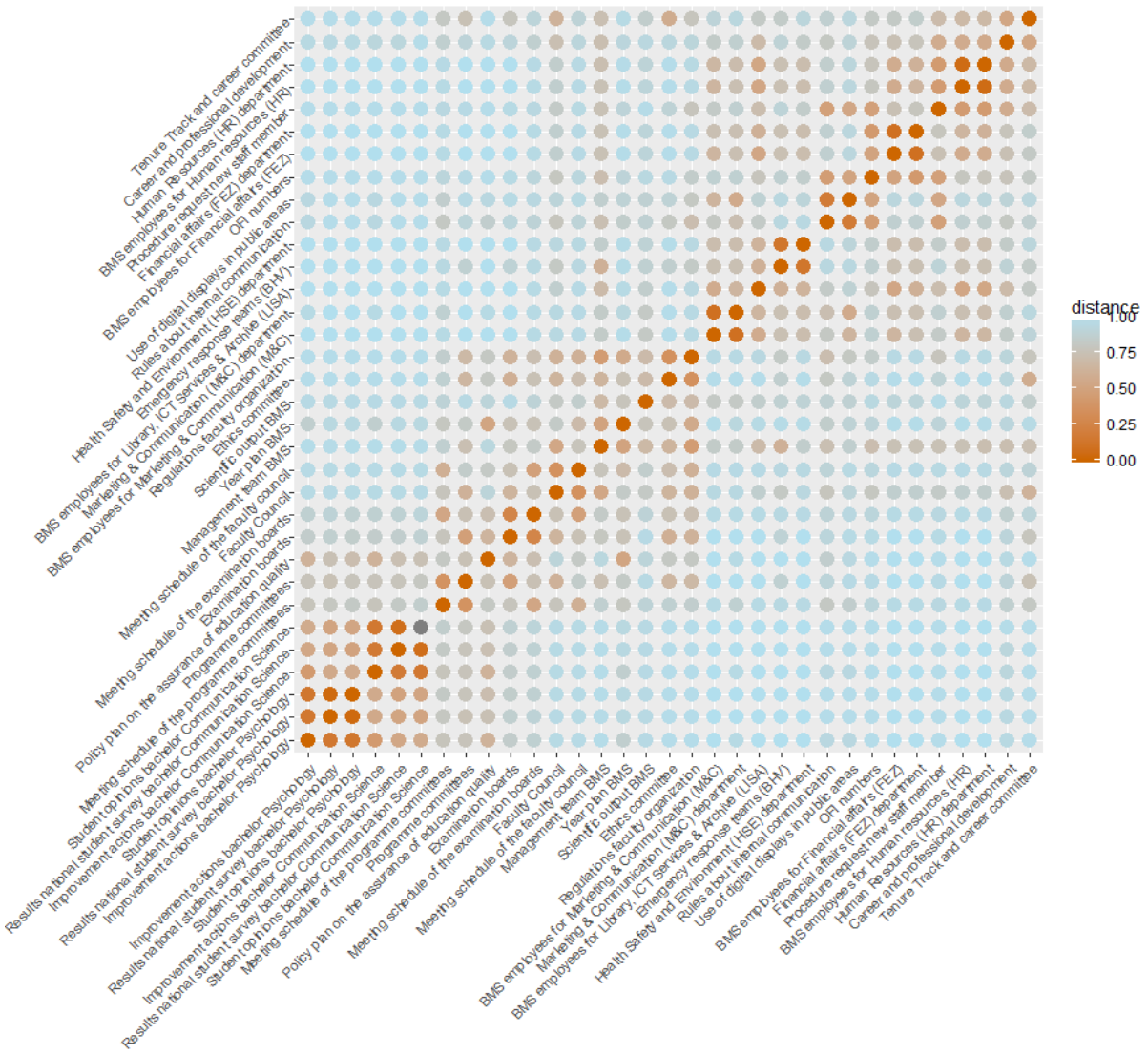

Figure 3. Heatmap of scientific staff. For additional explanation see figure 2.

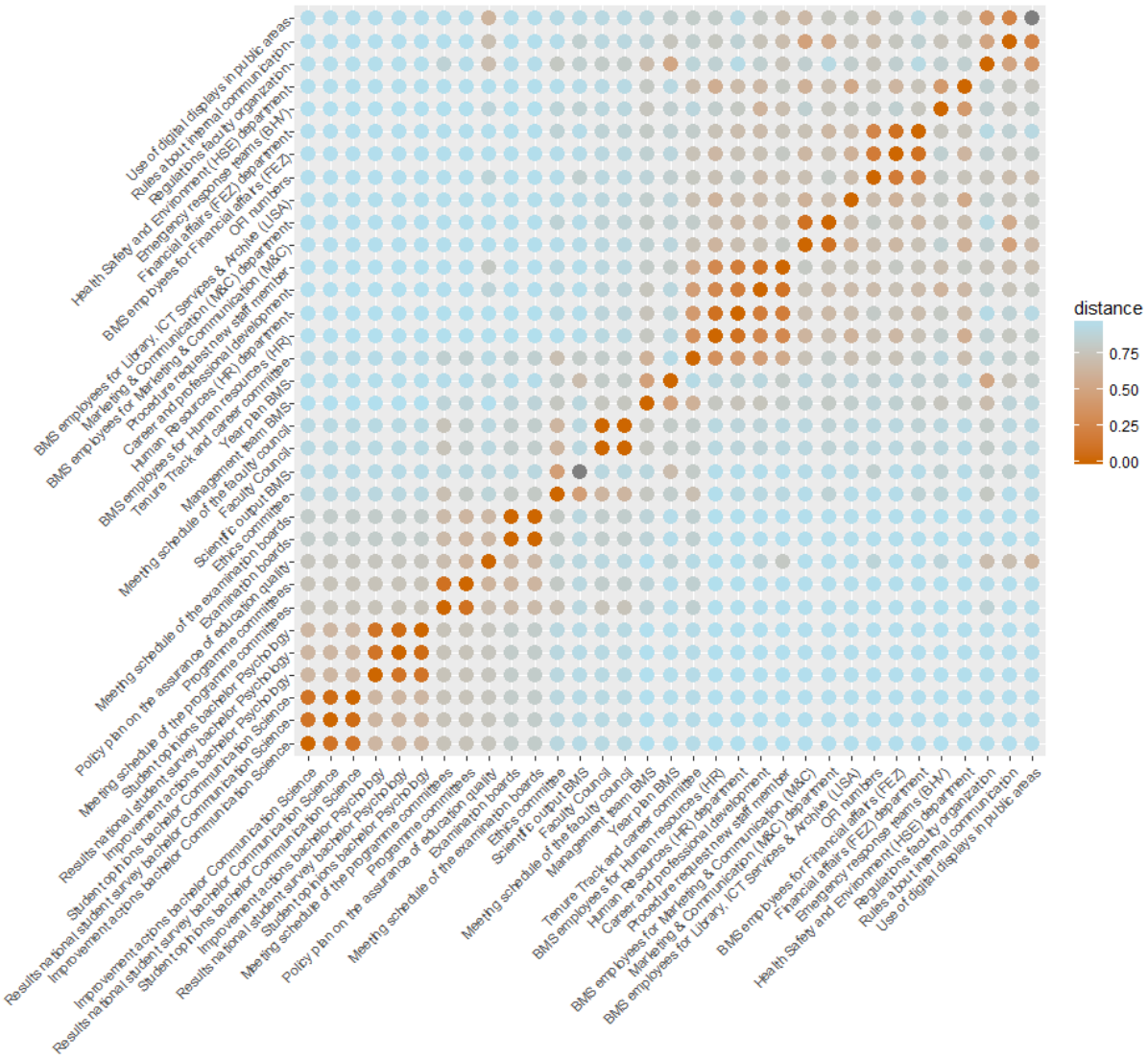

Figure 4. Heatmap of supportive staff. For additional explanation see figure 2.

Off-diagonal warm bleeding spots can be seen on the heatmaps, these indicate ambiguities. When items are truly ambiguous they truly match with more than one item. Because it is impossible to create a heatmap that matches the mental model of everyone, warm bleeding spots can also indicate differences between mental models of users. This means that multiple participants (but not the greater part) link the concerning item to a different item. The nature of the ambiguities can be discovered by comparing those of the user groups with one another.

Table 1

Category labels as proposed by participants

Nr.	Labels		
1	Departments and employees	BMS organization	Services
	Services for employees	Organization	Faculty matters/affairs
	Organization of BMS	Supportive facilities	Administration
	Overview faculty organization	Faculty BMS	Institutions
	Faculty and functional division	Organizational structure	Management Structure
		Who is who BMS	BMS departments
2	Rules and administration	Rules and regulations	Regulations
	Administration	How to do something	Regulation Procedures
	Issuing of rules	Practical information	Career
	Frequently Asked Questions	Functional information	Public Relations
	BMS Facilities and procedures		
3	Research and development	Science	Research
4	Interne overlegstructuren	Governance bodies	Overarching for BMS
	Committees and departments	Committees and boards	BMS Gremia
	General BMS information	Boards and committees	Committees
	BMS programme organization	Education organization	
5	Data faculty	BMS Policy	Faculty regulations
	BMS vision, goals and management	Vision 2017	
6	Student experiences	Analysis	Kwaliteitszorg
	Improvement actions	Results	Opinions
	Information programmes	Kwaliteitsborging	Education
	Evaluation Bachelor programmes	Information programmes	Data

Note. Labels participants gave to groups during the card sort can be found here. Every group in the table contains labels that are (roughly) linked to each other or to the same subject. The columns do not indicate any separation within the group but are merely created to keep the size of the table manageable.

In table 1 an overview can be seen of the labels that were given by participants during the card sort. Labels were often similar to each other. Often participants chose to use the name of an existing item as label, which happened mostly for sub-level categories. These labels are not included in the table. Some labels are in Dutch because participants could not properly translate them.

3.2. Q-sort

For the Q-sort a mean prioritization and a standard deviation has been calculated for every item based on the scores given by all participants, see table 2.

Table 2

Overview mean prioritization and standard deviation all items for Q-sort score

Item	Mean prioritization	Standard deviation
Career and professional development	0,78	-0,78
Ethics committee	0,74	1,07
Examination boards	0,3	1,08
OFI numbers	0,3	1,3
Use of digital displays in public areas	0,43	1,17
Faculty Council	-0,21	0,59
Emergency response teams (BHV)	-0,35	0,81
Programme committees	0,17	1,01
Rules about internal communication	-0,22	1,02
Meeting schedule of the faculty council	-0,7	0,8
Meeting schedule of the examination boards	-0,17	1,01
Procedure request new staff member	-0,91	1,02
Financial affairs (FEZ) department	0,04	1
Year plan BMS	0,39	1,13
Tenure Track and career committee	-0,57	1,17
Meeting schedule of the programme committees	-0,65	1,09
Management team BMS	0,22	0,93
BMS employees for Marketing & Communication (M&C)	0,04	0,7
BMS employees for Financial affairs (FEZ)	0,22	0,98
Marketing & Communication (M&C) department	0,13	0,61
BMS employees for Library, ICT Services & Archive (LISA)	0,52	0,71
Scientific output BMS	0,04	1,37
Policy plan on the assurance of education quality	0,17	0,92
Human Resources (HR) department	0,22	0,98
BMS employees for Human resources (HR)	0,22	0,59
Regulations faculty organization	0,09	1,06
Health, safety and environment (HSE) department	-0,7	1,04
Student opinions BMS bachelors/masters	0,13	1,42
Results national student survey BMS bachelors/masters	-0,04	1,23
Improvement actions BMS bachelors/masters	0,35	1,34

Note. Participants could score items from -2 to 2. With -2 indicating the item was perceived as being not relevant at all, -1 as not quite relevant, 0 as neutral, 1 as quite relevant and 2 as very relevant.

Noticeable during the Q-sort was that the participants often were very divided in opinions about what was relevant and what was not. This can be seen by the fact that the standard deviations exceed the mean scores in all cases. Because interpreting all items would be too extensive for the study, the three most prioritized and the three least prioritized will be interpreted in the next chapter (see table 3).

Table 3

Top three highest and lowest mean prioritization and standard deviation of items

Items	Mean prioritization	Standard deviation
Career and professional development	0,78	0,78
Ethics committee	0,74	1,07
BMS Employees for Library, ICT Services & Archive (LISA)	0,52	0,71
Meeting schedule of the faculty council	-0,70	0,80
Health, Safety and Environment (HSE) department	-0,70	1,04
Procedure request new staff member	-0,91	1,02

Note. See table 2 for an explanation about the scoring.

3.3. Observations navigation structure current intranet

Additional (mainly factual) observations have been made by the researcher regarding flaws in the current intranet navigation structure. These observations were made while exploring the BMS intranet in order to extract representative items. The observations could decrease the usability of the intranet and are summed up below.

1. **Unnecessary and unclear repetition of items** Every item that a user clicks on is shown again as top item in the level below. For example: if one clicks on ‘Education’, the first item in the level below will be again ‘Education’. If a user clicks on this multiple options can happen: (1) the user is redirected to a web page where the menu items appear once again (2) the user will be redirected to a page with a short introduction about the

category (3) the user is redirected to an empty page This is inconsistent and the user can not know up front what to expect when clicking on a repeated item.

2. **Too much items in a row without clear categorization** Several levels contain up to thirty items without further categorization. When this is the case, the user has to read every item separately to find what he is looking for. An example being ‘Archive’ items on the intranet, for example with ‘Older opinions’ underneath ‘Student opinions’. This contains up to twenty-four items without further categorization.
3. **Being redirected without warning** Quite often the user is being redirected to another university or external website without a warning when clicking on an item. The website where the user is being redirected to appears in the same tab as the user is currently being on, this can cause the user to get lost. Because the design of all university websites is identical a user sometimes does not notice that redirection is taking place. A solution could be that the website the user is being directed to, opens automatically on a different tab.
4. **Back button goes to home page** When clicking on the ‘back button’ in the browser, the user is redirected to the intranet homepage instead of to the page the user was visiting previously. There are up to seven levels in the current navigation structure. It can lead to frustration when the user clicks on an item which doesn’t give the expected information, because when trying to get back the user has to start navigating all over again from the home page. Furthermore, the back button referring to the homepage poses a problem when the user is redirected to the general BMS website in the same tab (as described above). If this happens there is no possibility of going back to the intranet with the back button.
5. **Visibility home button** The ‘Home BMS intranet’ button at the top of the local navigation structure can only be seen when the user is already on the BMS intranet homepage. It is not necessary for a user to be able to click on the home button when already on the homepage. However when the user is somewhere else on the intranet, it is convenient to have the possibility to go back to the home page by clicking on the home button. This is not possible in the current BMS intranet.
6. **Inconsistency between the Dutch and English intranet** As mentioned before, the Dutch and English version are not compatible. It is to be expected that the content is the

same but in a different language, this is not the case. This inconsistency can cause users to miss certain information when being on either the Dutch or English version.

7. **Inconsistent item order** Sometimes there is no consistency in the order of items. For example for content below 'Quality Assurance' the order of the information is different per study.
8. **Outdated information** A great part of the intranet content is outdated and incomplete. For example only the BMS year plan of 2013 can be found.
9. **Dead links and empty items** There are a lot of dead links on the intranet. Quite often a user is referred to an empty page or one that does not exist anymore.
10. **Label does not match content** Labels do not always match their content. For example 'Student associations' contains information about study associations, which are totally different from student associations. This can cause confusion with the user.
11. **Too specific labels** Sometimes labels of items are too long and detailed. This makes it hard for a user to scan the label and to know quickly what to expect. An example is 'Information for promovendi (cursussen, verlenging dienstverband, beoordelingsformulier e.d.)'.
12. **Inconsistent item labels** Documents with similar content are often labelled differently per study, this can be seen for example in the documents beneath 'Course evaluation'.
13. **Inconsistent label content** In general, labels on a website give information about the content that can be found when clicking on the item. However, on the current intranet sometimes an announcement is done within a label as occurs with 'I.v.m. de fusie per 1 mei a.s. zijn de verkiezingen voor de faculteitsraad GW geannuleerd. Nader bericht volgt'. This is inconsistent and it can cause confusion with the user. The label is not only used as an announcement but sometimes it is not even possible to click on it.
14. **Double item labels** Sometimes item labels are redundant but contain different information. This is very confusing as the user has no clue as to the difference between the items. For example 'Organisatie-coördinatie-stage afronding buitenland' is repeated five times beneath the subcategory 'Stages'. Every one of these contain different items beneath. Some of them again have identical names but contain different information.
15. **Dutch labels at the English intranet and vice versa** Labels on the English intranet are sometimes in Dutch. This makes it hard to understand the content of items for users who only speak English.

16. **Internal search bar only gives external information** When using the internal search bar on the intranet, the results can lead to anywhere on the internet except for the BMS intranet itself. This can be confusing to users.
17. **Multiple levels for single items** Sometimes a separate level is made for only one item, this causes an unnecessary greater path length. 'Further reading and background information' for example has only one final item below. It is more transparent to put the final item directly at the place of the category item instead of making the user click on it. Sometimes the items on different levels are even named the same, for example 'Oriëntatie buitenlandse opleidingstrajecten' contains only one final item below with exactly the same name.
18. **Separate items for similar information** Separate items are made for information that can be put on one page. For example there are three items within the 'Financial Affairs' category that all give contact information. This can be easily put underneath one item with a slightly more general name.
19. **Inconsistent referring** 'Naar de Nederlandse website/To Dutch website' is given (beneath 'Financial Affairs'). This is inconsistent with the language buttons present in the standard layout.

4. Redesign recommendations

For this study the main research problem is to find a navigation structure that suits the average user. To answer this question, the proximity structure in the heatmap, the group labels and the Q-sort ratings were used.

4.1. Visual interpretation general heatmap

A visual interpretation of the heatmap of all participants was done, the blue boxes point out the main- and sub clusters, ambiguities were indicated with yellow boxes (see figure 5). In table 4 an overview of the items per main cluster in the visually interpreted heatmap can be found. Three main categories of the mental model can be distinguished: (1) education (2) organization and (3) services. Every category and characterization of the approached users mental model will be discussed below.

The heatmap gives inconclusive information about the mental model regarding the overlapping part between ‘Education’ and ‘Organization’. When including this with ‘Education’, this category consists of information about the quality of education, educational committees and a policy plan about the assurance of educational quality. The information about the education quality is categorized per study programme and not by content. This specific information can be clustered in a subgroup because of the strong similarity scores. The committees in the category (the programme and the examination committee) are relevant for education. Users divided the committees by content instead of sorting them purely on function.

‘Organization’ consists of committee, faculty overarching and scientific output items. When including the overlapping part here, committees are categorized together in the mental model, regardless of the content of the committee. The committee specific content can be divided in subgroups based on their proximity. Overarching faculty items such as information about the year plan, management team and faculty regulations are categorized together in the mental model. These items are sorted by their content and not by their function. The year plan for example has concerning the content no strong connection with the quality assurance policy plan, but concerning the functions they are in the same category. ‘Ethics committee and ‘BMS scientific output’ can be put together in a subgroup. Both are about research and seem to be categorized according to content in the mental model.

As for ‘Services’ most items are about general university services and items that users categorize to belong with these services. Every subcategory that can be created contains one department, its employees and sometimes specific content that was matched with the services. Regarding the services the actual organizational structure matches with the mental model of the average user. The services are categorized by content and not by function. Categorization by function would be the case if all the departments or all the employees would be categorized together.

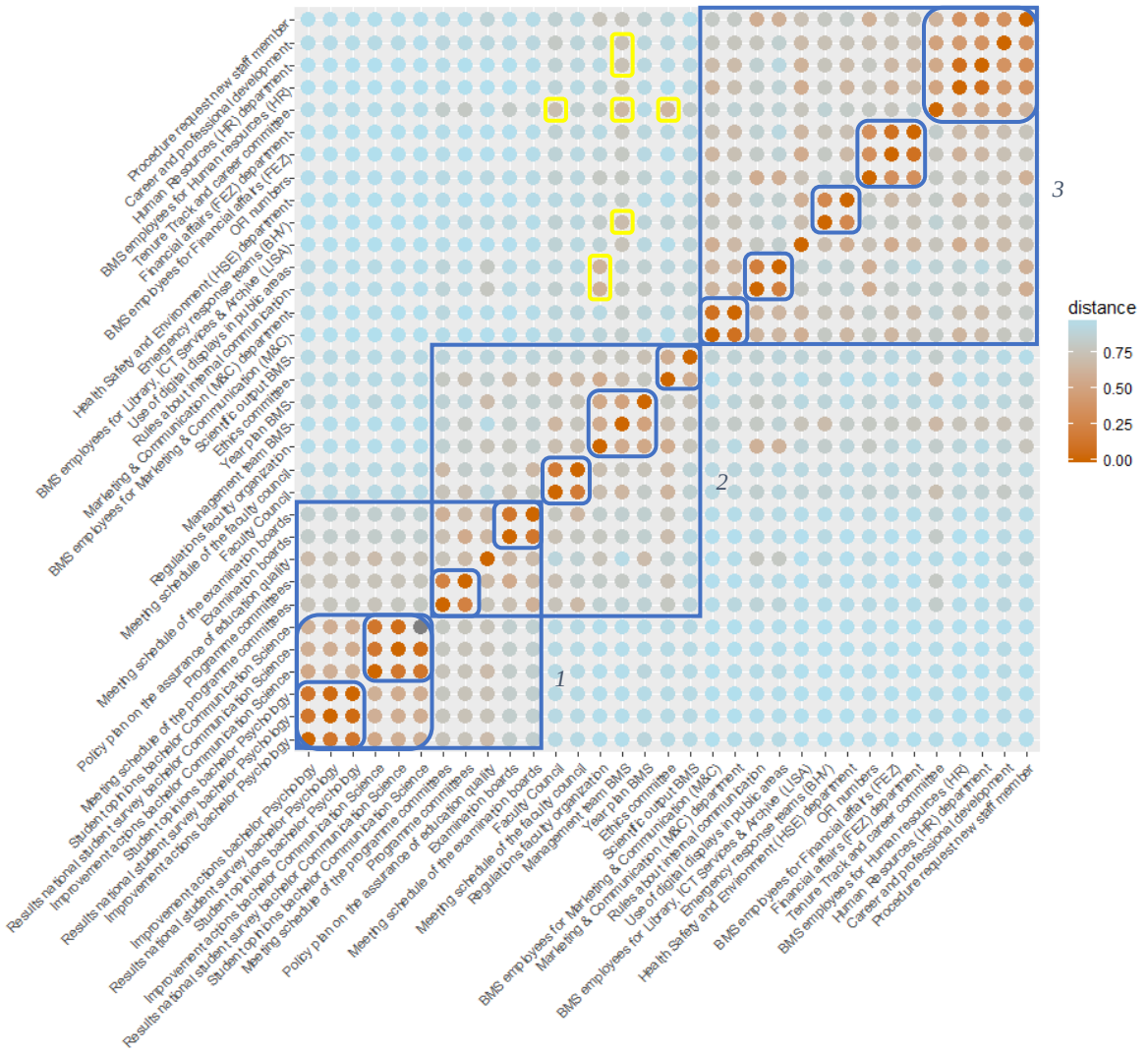

Figure 5. Visually interpreted heatmap of all the participants. Main- and sub clusters are pointed out with blue boxes, ambiguities with yellow boxes. For additional explanation see figure 2.

Table 4

Items per main cluster in the visually interpreted heatmap of all participants

Cluster	Items
1	Meeting schedule of the examinations boards
	Examination boards
	Policy plan of the assurance of education quality
	Programme committees
	Meeting schedule of the programme committees
	Student opinions bachelor Communication Science
	Results national student survey bachelor Communication Science
	Improvement actions bachelor Communication Science

	Student opinions bachelor Psychology
	Results national student survey bachelor Psychology
	Improvement actions bachelor Psychology
2	Scientific output BMS
	Ethics committee
	Year plan BMS
	Management team BMS
	Regulations faculty organization
	Meeting schedule of the Faculty Council
	Faculty Council
	Meeting schedule of the examination boards
	Examination boards
	Policy plan of the assurance of education quality
3	Procedure request new staff member
	Career and professional developments
	Human Resources (HR) department
	BMS employees for Human Resources
	Tenure Track an career committee
	Financial affairs (FEZ) department
	BMS employees for Financial affairs (FEZ)
	OFI numbers
	Health Safety and Environment (HSE) departments
	Emergency response teams (BHV)
	BMS employees for Library, ICT Services & Archive (LISA)
	Use of digital displays in public areas
	Rules about internal communication
	Marketing & Communication department (M&C)
	BMS employees for Marketing & Communication (M&C)

Note. The clusters as interpreted visually in the heatmap of all participants. The first and second clusters have three overlapping items.

4.2. Visual interpretation user group heatmaps

To discover if the mental model for the two user groups have differences, the heatmaps of the separate user groups were visually interpreted, see figure 6 and 7.

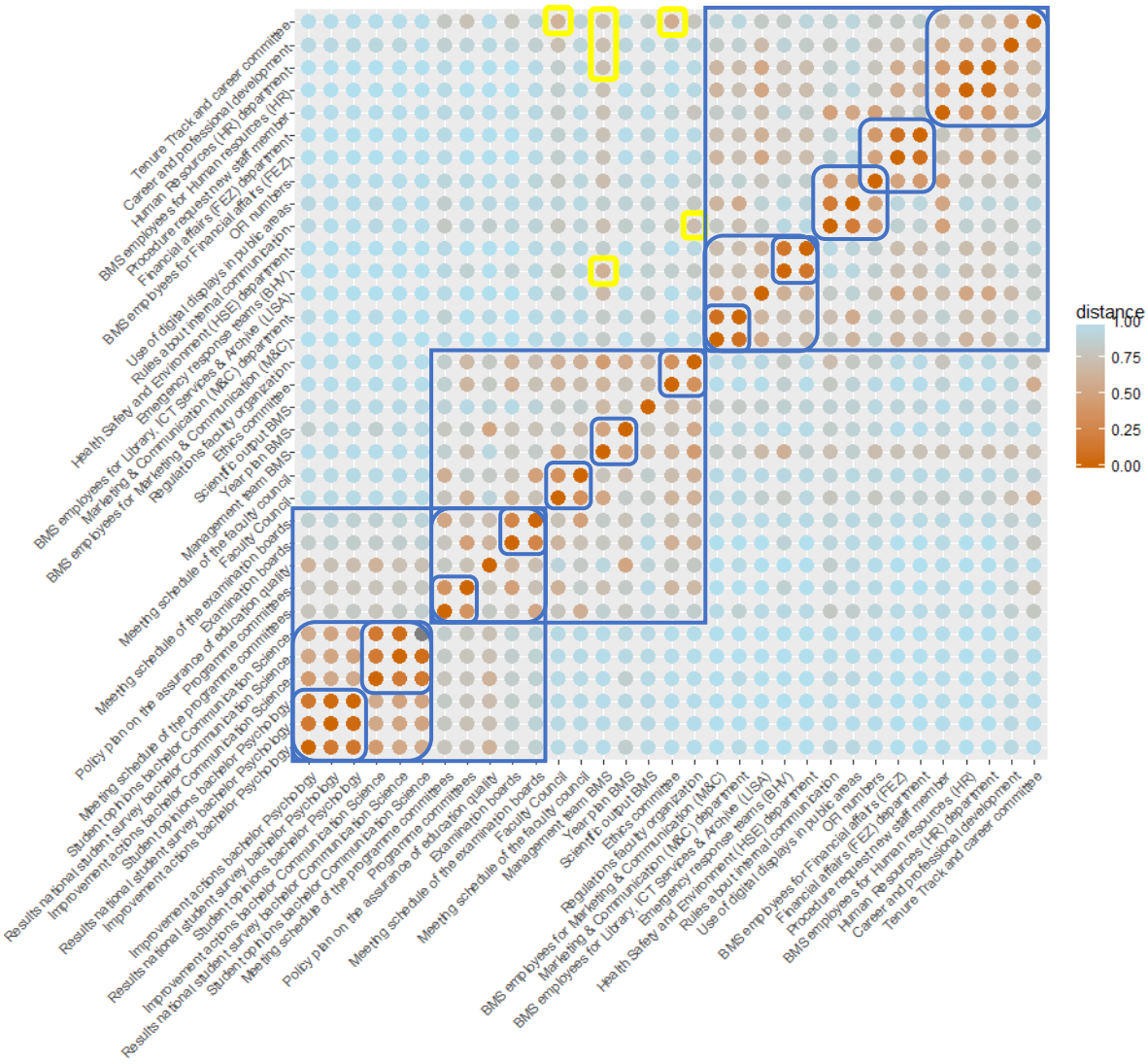

Figure 6. Visually interpreted heatmap of the scientific staff user group. Main- and sub clusters are pointed out with blue boxes, ambiguities with yellow boxes. For additional explanation see figure 2.

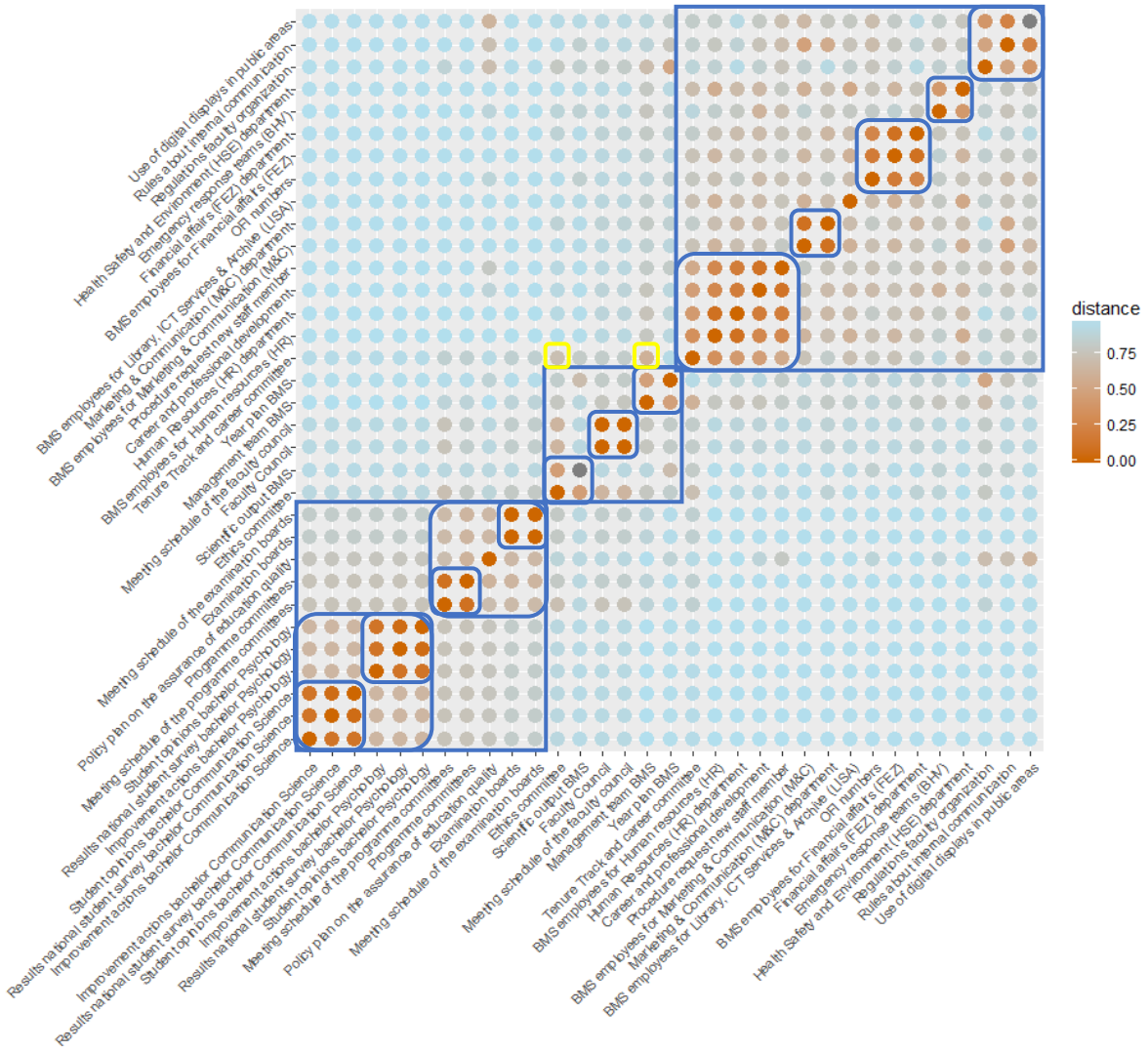

Figure 7. Visually interpreted heatmap of the supportive staff user group**.** Main- and sub clusters are pointed out with blue boxes, ambiguities with yellow boxes. For additional explanation see figure 2.

Large parts of the clusters in both groups are similar, even though the items are ordered differently sometimes. However, there are three notable differences. First, 'Regulations faculty organization' is clustered together with the ethics committee in the scientific staff heatmap. The link between these items is not immediately clear. It could be because the ethics committee decides about certain regulations regarding ethics and 'Regulations faculty organization' is also about regulations, although about more overarching ones for the faculty itself. In the supportive staff group 'Regulations faculty organization' was linked to 'Use of digital displays in digital

areas' and 'Rules about internal communication'. These have in common that they entail information about rules and regulation, even though on a different level. Second, the item 'OFI numbers' is clustered together with the financial affairs department (FEZ) and its employees in both heatmaps. In the supportive staff heatmap 'OFI numbers' can also be clustered with 'Use of digital displays in digital areas' and 'Rules about internal communication'. The items have in common that they entail information about some form of internal communication within the faculty. Lastly, in the heatmap of the scientific staff an overlapping part of clusters is present similar to the heatmap of all users. In the heatmap of the supportive staff this 'inconclusive' cluster matches stronger with the items about the quality of education.

The mental models of the two user groups do not differ enough from each other to create separate intranet versions. The proposed navigation structure can possibly be adjusted to the differences between the mental models with cross links.

4.3. Ambiguities

Three warm bleeding spots are present in the heatmap of all users, which can indicate ambiguities. To discover their nature, a comparison was made between the ambiguities in the heatmap of all users than those that can be found in the separate user group heatmaps (see table 5).

Table 5

Comparison of ambiguities of general heatmap with the ambiguities of specific user groups

Heatmap all user groups		SC	SP	Truly ambiguous?
1. Tenure track and career committee	Ethics committee	Yes	Yes	Yes
	Faculty council	Yes	No	No
2. Regulations faculty organization	Rules about internal communication	Yes	Yes	Yes
	Use of digital displays in public areas	No	Yes	No
3. Management team	Career and professional development	Yes	No	No
	Human Resources (HR) department	Yes	No	No
	Tenure Track and career committee	Yes	Yes	Yes
	Emergency response teams (BHV)	Yes	No	No

Note. SC is short for scientific staff, SP is short for supportive staff. If an ambiguity is present for both supportive and scientific staff it is seen as truly ambiguous.

The ambiguities with the Tenure Track and Career committee can be explained because all of these items are committees or can be considered as one. The ambiguities with 'Regulations faculty organization' can be explained because all items entail information about internal communication within BMS. The ambiguities with 'Management team' are more complex. Considering the content or the actual organization structure there is no immediate connection between the items. However, when considering the function, these items connect because they are all part of the general organizational structure of BMS. 'Career and professional development' is an exception. Possibly participants linked the management team to this item because of the influence the management team has on career and professional development opportunities. Only scientific staff members connect the management team to the items mentioned in table 3, except for the tenure track and career committee. A possible reason for this could be that supportive staff is often more involved with the different services than the scientific staff. Therefore supportive staff possibly has a more specific mental model regarding the organizational structure, that matches the actual organization structure of BMS more closely. Scientific staff possibly categorizes more in general terms when it comes to the organization structure without having much knowledge of the actual structure.

4.4. Proposed structure

Based on the described mental model an alternative navigation structure was proposed as can be seen in table 6. The categorization aspects that deviate from the mental model will be justified with content based arguments. The assignment of labels proposed by participants to create a high information scent will be discussed as will be the order of the items in the proposed structure.

Table 6

Alternative navigation structure for the BMS intranet

First level	Second level	Third level
Committees, boards and faculty regulation	Ethics Committee Faculty Council	Faculty Council Meeting schedules of the faculty council

	Examination Boards	Examination boards Meeting schedules of the Examination boards
	Programme committees	Programme committees Meeting schedules of the programme committees
	Regulation of the faculty	Year Plan BMS Management team BMS Regulations faculty organization
	Policy plan on the assurance of education quality	
	Tenure Track and career committee[1]	
Services and information	Library, ICT Services and Archive (LISA)	BMS employees for Library, ICT Services and Archive (LISA)
	Human Resources (HR)	Career and Professional development Human Resources (HR) department BMS employees for Human Resources Tenure Track and career committee Procedure request new staff members
	Financial Affairs (FA)	Financial Affairs (FEZ) department BMS employees for Financial Affairs (FEZ) OFI numbers
	Marketing and Communication (M&C)	Use of digital displays in public areas Rules about internal communication Marketing and Communication (M&C) department BMS employees for Marketing and Communication (M&C)
	Management team BMS[1]	
	Emergency response teams (BHV)	
Evaluation study programmes	Bachelor Communication Science	Student opinions bachelor Communication Science Results national student survey bachelor Communication Science Improvement actions bachelor Communication Science
	Bachelor Psychology	Student opinions bachelor Psychology Results national student survey bachelor Psychology Improvement actions Bachelor Psychology
	Programme committees	Programme committees Meeting schedules of the programme committees

	Examination boards Policy plan on the assurance of education quality	Examination boards Meeting schedules of the Examination boards
Scientific output BMS		

Note: [1] Cross link. This (three level) proposal for the BMS intranet is based on the mental model of the average user as approached in figure 5 with the exception of some deviations from the mental model made based on arguments concerning content. Labels are given based on proposed labels by participants as can be found in table 1.

4.4.1. Categorization and labels

When analysing the content, it seems best to keep the overlapping part as described in the mental model because the items fit regarding the content and function well in both categories. This means the items present in the overlapping part will be present in two categories.

The first proposed main category matches for the greater part with the mental model category ‘Organization’ as described. However ‘Scientific output’ is put in a separate category as described later on. In agreement with the ambiguities in the mental model, a cross-link was added towards the tenure track and career committee. For the item ‘Regulations faculty organization’ no cross link was made, even though there was an ambiguity. This is because the item regarding to the content is significantly different than the items it has an ambiguity with. ‘Regulations faculty organization’ is about the structure of the faculty itself and what regulations there are for forming the structure of the faculty, it is an overarching item. The two items it has an ambiguity with are about rules or guidelines for very specific cases. Putting a link between these could be confusing.

The label ‘BMS committees and boards’, as proposed by participants, seems transparent as a label for the main category except for the year plan and faculty regulations not being addressed. Both items can be seen as faculty regulations (as was also proposed by participants), therefore the label ‘Committees, boards and faculty regulations’ would give transparency about the content of the main category. For the sublevel categories within the main category participants often used already existing cards as labels, they did not come up with a name themselves. Therefore the sublevel categories for committee items are all named after the

committee they represent. The label ‘Regulation of the Faculty’ is proposed for the category containing the items ‘Year plan BMS’, ‘Management team BMS’ and ‘Regulations faculty organization’. This label is not mentioned by participants. However since all the items are related to the regulation of the faculty itself, the proposed label seems more appropriate than any of the other labels which are too specific to cover both the management team and the regulations.

The second proposed category matches almost entirely with the category ‘Organization’ of the mental model. A cross link is added to the item ‘Management team’ because of the ambiguity, with this cross link users can find it more easily. During the card sorts it came forward that some participants expected study related departments instead of general university services when reading the word ‘department’ on a card, therefore ‘department’ in item labels will be replaced by ‘service’. The label ‘Services and information’ is proposed as label for this main category to indicate that information about the content of the services will that be given. Every service category was named after the specific service it represents, as participants often suggested by putting existing cards referring to general services above categories instead of creating own labels. As can be seen in the proposed structure some labels that were proposed are very specific and would suit categories dividing up the items below the services. In a later phase when the BMS intranet will be filled up with information these proposed labels can be used to name categories underneath the general services.

The third proposed category is the same as the mental model category ‘Education’. Although the content in the third main category were often labelled with ‘Education’ by participants, this seems to be too general. Because all are linked to the evaluation of content of educational study programmes, ‘Evaluation study programmes’ is proposed as label. Almost every participant named the study specific categories ‘Bachelor Communication Science’ and ‘Bachelor Psychology’.

For the actual intranet, student opinions, NSS results and improvement actions for BMS master programmes will be present. These were removed from the item selection to prevent repetitiveness during the card sort. Furthermore, student opinions will be available for different courses per study programme on the actual intranet. Therefore, for the actual intranet structure it is recommended to follow the structure as proposed in table 7. Note that this table only gives

an example structure for one study programme and that this should be extended with other programmes. The labels that can be seen in the table are as proposed by participants.

Table 7

Proposed extended navigation structure for category 'Evaluation study programmes'

First level	Second level	Third level	Fourth level	Fifth level	Sixth level
Evaluation study programmes	Communication Science	Bachelor	Student Experiences	Student opinions Results national student survey	Course 1 Course 2
			Improvement actions	Improvement actions	

Finally a fourth category is added. This category consists of only one item: Scientific output. In the mental model this item is connected with the ethics committee, probably because both have a link to research. However, concerning the content it does not fit with the other items in the 'Committees, boards and faculty regulation' category or any of the other. Therefore this item has its own category so that users can find it easily/ Because there is only one card sort item in the committee the category will be named after it. Other items that are research related could be added to the category later on, a fitting label proposed by participants could be 'Research'.

4.4.2. Prioritization with Q-sort

'Career and professional development' was on average rated as most relevant. An explanation for this could be that this is an item that is very general and applicable for almost every employee that can still grow in their job function. Another high ranked item was 'Ethics committee BMS'. This could be because a large part of the BMS employees has to do with this committee, namely teachers, researchers and some supportive staff. Furthermore, the BMS employees of LISA were often seen as important because of the ICT aspect of LISA. Every employee can go there when having ICT related problems, and since they all use digital devices this can happen to everyone. These three items with the highest score were put on top within their categories in the proposal so that they can be found more easily.

The item found least relevant is ‘Procedure request new staff member’. After input of the participants this item is seen as too specific. The participants for who it was relevant pointed out that they always go to the HR employees to get more information about this and don’t look it up online. The HSE department item was not only given a low priority but could also be not placed in the card sort by a couple of participants. The information on the current intranet that falls under the HSE department is not BMS specific except for the emergency response team information. To prevent unnecessary depth in the information structure the choice has been made to remove the Health, Safety and Environment item completely out of the proposal and to show only the emergency response team on the intranet. The meeting schedule of the faculty council was also seen as irrelevant, probably because it is only relevant for a specific group of people. ‘Procedure request new staff member’ and ‘Meeting schedule Faculty Council’ were given the lowest position within their category in the proposed structure. In this way users who do not specifically search for the items don’t have to scan through them.

Often there was no consensus about which content was relevant and which was not. This is logical because there was a lot of variety in job-related activities. For every job function different information is needed and therefore different information is relevant.

The order of prioritization of the categories in the proposal is based on the average Q-sort score of all the items within the category, see table 8.

Table 8

Average Q-sort score for proposed categories

Proposed category	Average Q-sort score
Committees, boards and faculty regulations	1,0
Services and information	0,94
Evaluation study programmes	0,44

Note. Average Q-sort score is based on given scores between -2 and 2. See table 2 for further explanation about the scoring.

5. Discussion

5.1. Comparison with the current intranet

In order to determine if the current website structure matches with the mental model of the

average user, a comparison was made. This can be executed only partially because (1) not all the card sorting items match with the current intranet items and (2) the card sorting items were retrieved from the English as well as the Dutch intranet. Therefore some card sorting items were not present in both versions. The comparison made is primarily focussed on the main categories and their structure.

If all the items of the current website are removed, leaving only the comparable items, the mental model of the proposed navigational structure and the current intranet do not differ very much. The three main categories distinguished in the mental model (education, organization and services) are similar to the categories of the current intranet. The fourth group, referred to as the research category, is also similar to one on the current intranet. There are some differences between the design of the current website and the mental model as was approached in this study. These will be described and items that are predicted to have a low findability will be identified.

The main difference is that the category where committees can be found belongs to the educational one on the current intranet. In the proposed structure there is a separate group with committees and there is no main educational category but a more specific one about the evaluation of study programmes. However, when looking at the overlapping part in the heat map of all users, there can be seen that two committees fall together with educational items, so partially the current website and the approached mental model are similar in this way.

In the current website the faculty council is not seen as a committee since it is not placed with the other ones, whilst in the approached mental model it is. The faculty council can be found in the current intranet within the category ‘Strategy, policy and regulations’ in the sub-level category ‘Consultation forum’. This is identical for the item ‘Management team’. The label for this category seems to have a low information scent, since neither the management team or faculty council fall within any of the terms mentioned in the label. Both items mentioned above are actually boards that overarch the terms mentioned in the label. However, it is not indicated in the label that information about such boards can be found here. It is therefore to be expected that users will not find these items easily.

Finally, in the current intranet the meeting schedules of the committees are placed together in one category, without informative items about the committees themselves. In the approached mental model these are linked. Also in the proposal, these items are not on the first level on the highest menu position as is the case on the current intranet. Because of the low

ratings the items received in the Q-sort, the prioritization they have on the current website seem misplaced.

The differences between the mental model of the current navigation structure and that of the proposed one are relatively small and not fundamental for the intranet being difficult to use. This raises the question: What else can be a reason for the low findability of items on the current intranet?

5.2. Alternative impact factors

A lot of the content on the current intranet is outdated or no longer relevant, for example documentation about the merging of the former faculties and documents that are not valid anymore. This outdated content is not relevant for the average user and it causes a lot of clutter in the navigation structure menus. Users have to scan through all of these outdated items because the relevant items are hidden between the outdated ones. The processing of all this irrelevant information uses cognitive resources that otherwise could be used for reading and understanding useful content (Kim & Hirtle, 1995). Furthermore, visual clutter in a navigation scheme has a negative effect on a user's experience of a webpage and of a website in general (Weideman & Ngindana, 2004). There are also a lot of items on the current intranet that do not belong there. A lot of them can be also found on the general BMS website, there is no need for these items to be put on the intranet as well. These 'double' items also cause clutter.

Within the current intranet it is expected that it is sometimes difficult for users to have a sense of their place within the organization of information because there are little to none location references. With the exception of looking at the URL, a user cannot gain any information about their current location on the intranet, there is a lack of navigation support. This can cause user disorientation (Webster & Ahuja, 2006). In combination with a user sometimes being directed to another (university) website without any warning, it is expected that the user can get lost easily. The implementation of location-based breadcrumbs to support the user's location orientation could make it easier to navigate on the website (Nielsen, 2007). Preventing users from being directed to a different website without a warning in the first place, could also give contextual clarity.

The goal of a user on a website can be to find specific information (Boechler, 2001). When looking for this, users often employ the search function of a website (Spool, 2001). However, because the intranet is restricted, its content cannot be found via any search function.

There is a low engine findability for the intranet items via the search engine. Therefore when a user employs the search function to find an intranet items, relevant results will not appear and the user will have not be successful in trying to find the item. This could result in users getting frustrated and being dissatisfied with the website.

5.3. Anecdotal evidence

During the card sorting, participants often made remarks about the intranet and its content. A selection of these remarks are described in this paragraph and possible implications were drawn from them. First of all, a remark heard quite often was that participants did not perceive the BMS intranet as being useful. Often participants thought that the sorting items were unnecessary and irrelevant, seeing no added value for the intranet. Some did see the relevance of the quality assurance items but did not understand why an entire intranet is needed for only these items. Furthermore, remarks were made about some items being that were also present in other sites. For example the meeting schedules of the committees can also be found on the general intranet. When looking critically at all the intranet items there is a logical location for almost every item other university websites, except for content about quality assurance. Some items are relatively confidential but can be placed on other intranets, such as OFI-numbers which can be placed on the financial affairs intranet.

During the Q-sort many participants had difficulties with placing items on the higher ranked levels, which they were obliged to do because of the forced choice nature of the Q-sort method. Often comments were made about finding items irrelevant. When an item was perceived as relevant, the comment was that this information did not have to be searched for on the intranet because it was already familiar. Also remarks were made about the content being important in general but not relevant to them personally. The year plan is an example of this. A note should be made that the last year plan uploaded on the intranet was in 2013, so there is a chance that these are not published publicly anymore. In conclusion, this raises the question if a BMS intranet is necessary in the first place. It might be an alternative to replace it with a specific intranet for only quality assurance items. When considering that this is the only content that does is perceived as relevant and does not have a logical alternative. This statement however is merely based on anecdotal evidence and should be investigated further, by conducting interviews or a survey about the usefulness of the intranet among participants.

Some specific items were commented on more frequently. First of all, employees of BMS are not allowed to approach the BMS LISA employees directly anymore. Recently a new policy was applied demanding that the LISA department should be approached via a centralized system. Therefore there is no added value in having information about specific BMS employees for LISA. Recommended is to not include this item in the revised intranet. Since recently, the scientific output of BMS can be found at another platform: the PURE platform. There are no reports published anymore about the scientific output, recommended is to remove it. Lastly, 'Health, Safety and Environment' was often seen as completely irrelevant. Participants sometimes could not place it among the other items and felt that there was no information linked to this service that could be useful for them. This anecdotal evidence supports the decision to remove this item all together out of the proposal.

5.4. Limitations

A weakness of the use of a card sort test is that perceptions of participants about the organization of the items may be influenced by a preexisting organization. After a website structure is presented it can become fixed in the user's mind, this influences a user's mental model of an information landscape (Faiks & Hyland, 2000). If grouped items are seen together on the current intranet they may be considered to be similarly related when performing the card sorting. To prevent this influence, the card sorting test should have been done before creating the intranet in the first place (Faiks & Hyland, 2000). Although only half of the participants in this study was familiar with the intranet, there is a good chance that every participant is familiar with other university websites, where similar items are sometimes present. To discover if familiarity with the preexisting organization of the intranet influenced the mental model of the participants, a comparison could be made between the average mental model of participants who were familiar with the intranet and participants who were not.

For the card sorting test it was necessary to select a representative item set from the intranet. It is relatively easy to work with a small item set but in doing so there is a risk of missing content items that would belong to an additional category (Miller, 2011). Another risk of working with an item set is that certain information users expect to be present on the website could be missing entirely. A possibility is to extract on forehand user information needs in order to cover all the expected information in the item set. Information needs can be elicited with for example focus group interviews or brainstorms (Umber, Naweed, Bashir, & Sarwar, 2012). For

this study thirty-three items were selected for the card sort, whether this is sufficient to approach a valid mental model is a crucial question. Spencer and Warfel (2004) recommend using between the thirty and hundred cards, although it has been acknowledged that there is no 'magic number'. Miller (2011) states that with an informed item selection a sample of about thirty items will fully represent a taxonomy of eight categories more than 80% of the time and one of six categories almost 100% percent of the time. On the current intranet there are (depending on the language) six or seven main categories. Due to some content not sufficing to the item selection criteria, items selected out of five main categories were used for the card sort. Therefore the expectation was that the categorization, as present in the mental model, of users would not exceed eight categories. The fact that only three main categories emerged out of the card sorting test supports this expectation. While being a bit meager, the use of thirty-three items should be sufficient to elicit a valid mental model. For studies where little is known about the expected or desired taxonomy of categories, pilot card sorts are recommended (Miller, 2011).

Another limitation of the card sorting method is grouping of the cards could have been influenced by the wording of the items on the cards (Faiks & Hyland, 2000). If the same words are present on multiple cards, for example the words 'department' or 'meeting schedule' it is possible that the cards are sorted merely on similarity of the wording and not per se by their content. Similarity can be measured in various ways, for the grouping of the cards it can be measured by concept-based or semantic-based similarity (Goldstone, 1994; Resnik, 1995). Because grouping the cards by concept-based similarity is the essence of card sorting, Faiks and Hyland (2000) recommend to instruct users to think of the concepts behind the words rather than the words themselves. In the current study this was not explicitly instructed. For a future study it is recommended to give this explicit instruction to participants in order to limit the influence of the wording of items on the grouping.

During the card sort tests, some participants expressed the desire of wanting to put items in multiple categories, because they felt that the concept belonged into more than one category. Because of the singular nature of card sorting this was not possible. An advantage of this singular nature is that the static nature of the cards forced the participants to select what they considered to be the strongest relationship (Faiks & Hyland, 2000). Some card sorting guides suggest to give the participants the option of placing an item into more than one category in

order to improve the chance of a sample representing the entire taxonomy (Spencer & Warfel, 2004).

Participants of a card sorting study should be representative of the actual users of the website (Nielsen, 2004). The participant pool of this study is not fully representative, there are many job functions within BMS and not all of them were represented in the participant pool. However, the main distinction can be made between supportive staff and scientific staff, for both of these groups participants were found. The distribution of the actual user groups is not fifty-fifty as was the case in the participant pool but seems to be closer to a distribution of twenty to eighty. However, since the mental models of the user groups did not differ greatly from each other, it is to be expected this has a limited influence on the results.

A high information scent (Pirolli & Fu, 2003) was pursued by taking labels proposed by users into account when labeling the categories in the proposal. When labels have a strong similarity to the verbally encoded information goal in the user's mind, it requires least effort for users to find information (Schmettow & Sommer, 2016). Therefore a high information scent is important for the perceived ease of use of the intranet (Saward, Hall, & Barker, 2004). This research did not directly measure information scent but merely aimed at increasing it. To measure if the information scent has indeed improved, in future research the perceived information scent of the current labels and the proposed labels could be measured as described by Saward, Hall and Barker (2004).

5.5. Executive summary

The aim of this study was to propose an alternative navigation structure for the BMS intranet based on the mental model of faculty employees and prioritized with Q-sort results. This structure is proposed and when compared to the current structure the underlying mental models do not differ significantly. Furthermore, the mental models of the user groups also are not very different. In contrast to the expectations described earlier in this research, the intranet not being adjusted to the mental model of users seems to not be the primary cause of users having difficulties with finding information. However there were several other usability problems found in the intranet, such as the content being outdated, lack of location feedback and low search engine findability. Before trying to solve these usability problems within the revised intranet, it is very important to investigate if the intranet is relevant in the first place, since anecdotal evidence indicates that this might not be the case.

If the conclusion can be drawn that the intranet is relevant, it is advisable to update it thoroughly in order to remove non-relevant or outdated items. It is recommended to take the proposal for an alternative navigational structure as a framework and to add the similar items that were left out of the card sort to the proposed categories. It is likely that extra content will be added, two steps should be taken to pursue this. First, to avoid content being irrelevant or being not in place on the intranet, the advice is given to measure every item against the three inclusion criteria as described in paragraph 4.1. These criteria are that the content must be (1) specifically relevant for BMS (2) moderately confidential and (3) relevant for employees of the BMS faculty. If the content to be added suffices with the criteria, the second step is to execute a closed card sorting test in order to keep the website modified to the mental model of the average user. Executing a closed card sorting test can be useful when adding content to an existing structure (Spencer, 2009; Spencer & Warfel, 2004). During such a sort participants are asked to place cards into pre-established primary categories. Because the categories emerging from this research are already justified by the open card sort performed, it is sufficient to execute a closed card sort (Wood & Wood, 2008). If expanding the BMS intranet is considered carefully with above steps clutter will be avoided and the mental model of the average user will be taken into concern. When items are outdated but are still relevant, for example course reviews of past years, it is advised to create an 'Archive' sub-level category for the specific category where these items can be found. In this way users can still find them but they are not mixed up with up-to-date items. Lastly, highly recommend is to assign a content manager for the intranet to keep its content up to date.

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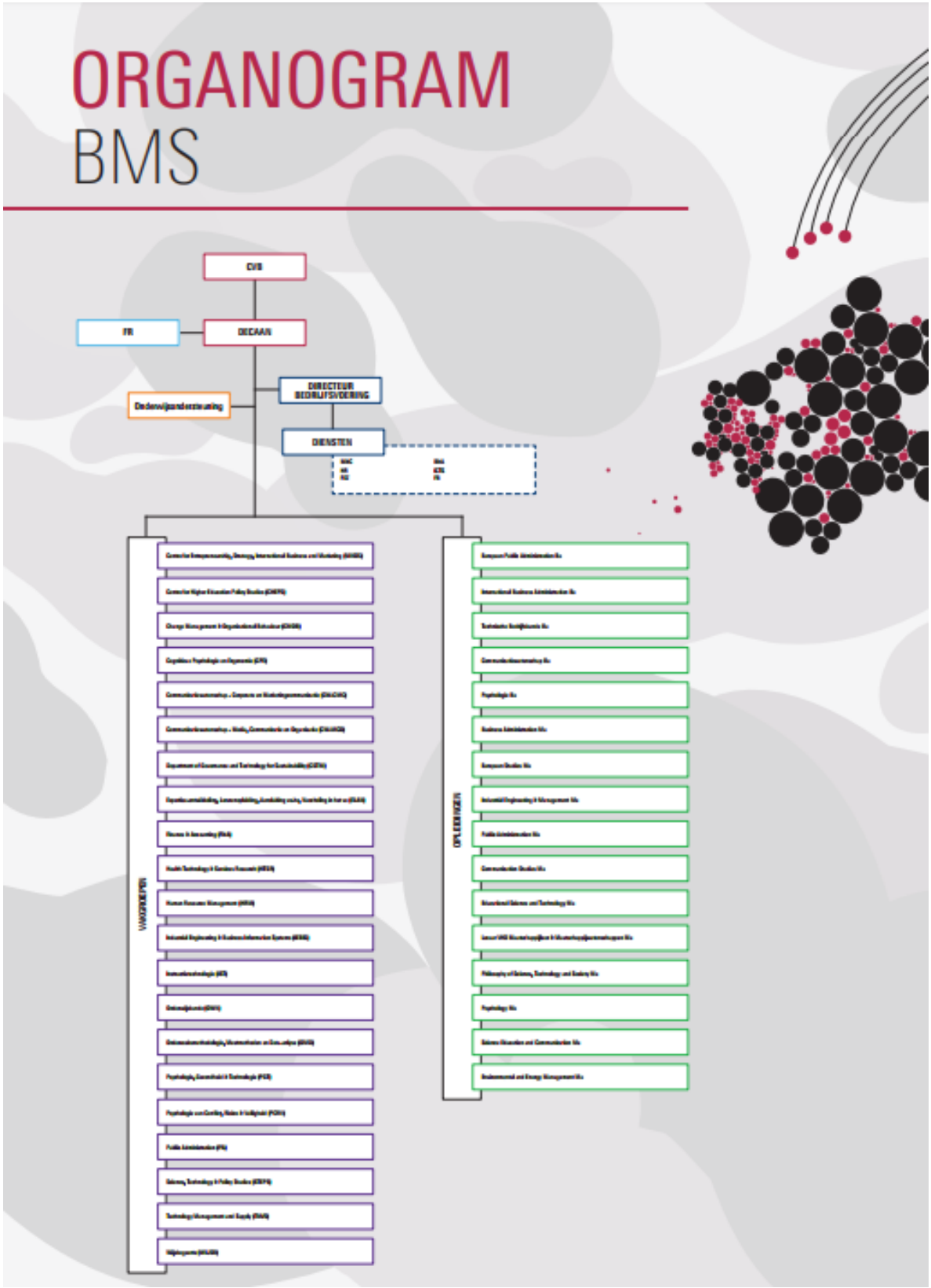
7. Appendices

7.1. Appendix A – Organizational structure BMS



7.2. Appendix B – Current navigation structures English and Dutch intranet

Table 9

Item overview English version BMS intranet

First level	Second level	Third level
Meeting Schedules Education and Committees BMS	Meeting schedule examination board	
	Meeting schedule faculty council	
Education	Committees BMS	Examination boards
		Programme committee
		Ethics committee
	Manuals, guidelines and processes +	
	Quality assurance	Quality assurance
		Results National Student Survey 2017
		What are these Quality assurance pages about?
		Quality assurance in the Faculty BMS (internet)
		Quality Assurance Bachelor programmes +
		Quality Assurance Master programmes +
		Framework Quality Assurance Archive
	Student Association +	
Organization	Services	
	Health Safety and Environment	Health Safety and Environment
		Emergency responses +
		General information +
		Repetitive strain injury (RSI) +
	Human Resources	Human Resources
		General +
		Forms +
	ICT Service Centre (ICTS)	
	Library and Archive	
	Financial affairs BMS	Financial affairs BMS
		Who is who
		Who should I ask for
		Forms +
		Manuals +
		OFI-numbers +
		Procedures +

Strategy, policy & regulations	Organisatie & beleid	
	Consultation Forum	Faculty Council BMS Managementteam + Advies faculteitsraad t.a.v. fusie + Verkiezingen FR 2014 + Faculteitsraad +
	Policy documents	Beleidsdocumenten + Archief
Merger gamma faculty	Welcome!	
	News + Merger Process + Organisation + Agenda Documentation + Contact	
Pictures	X-mas 2016	

Table 10

Item overview Dutch version BMS intranet

First level	Second level	Third level	Fourth level
Onderwijs	Centre for Educational Support (CES)	Bureau Onderwijszaken (BOZ) International office Onderwijs systemen Onderwijskundige dienst Student Services Studenten begeleiding Study & Career Taal coördinatiepunt	
	Committees BMS	Examination Boards Programme committee Ethics committee	
	Handleidingen, richtlijnen en verwijzingen	Handleidingen, richtlijnen en verwijzingen	
		Handleidingen en onderwijsprocessen	Bachelor- en masteropdrachten + Begeleiding studenten + Functies + In- en uitschrijving +

			Instrumenten + Onderwijsprocessen Onderzoek evaluaties + Personeel + Richtlijnen bij afstuderen + Screenen + Stages + Tentamens +
		Verwijzingen + Studieverenigingen + Kwaliteitszorg	
Onderzoek	M-winkel/Test-o-theek Facultaire Ethiekcommissie Wetenschappelijke integriteit		
	PhD +	General information + By Department + Further reading and background information +	
Organisatie	Onderwijs Service Centrum	Startpagina Onderwijs Service Centrum Opleidingen Telefoonlijsten + Medewerkers OSC/BMS Voorzieningen Bachelor Onderwijs- en examenregelement BMS (OER) Master Onderwijs- en examenregelement BMS (OER) Study Abroad Kwaliteitszorg+ Examencommissie BMS	
	Arbo en Milieu	Algemeen + Arbo informatie faculteit BMS + Gebouw arbo + Informatie in het kader van het vastgestelde RSI preventiebeleid +	

		Bedrijfshulpverlening (BHV)
	Bibliotheek Universiteit Twente	
	Communicatie	BMS Nieuws +
Strategie, beleid & regelingen	Strategie, Beleid & Organisatie	
	Strategienota MB 2011-2015	
	Faculteitsregelement MB	
	Hoogleraren- en UHD-plan MB 2007-2014	
	Herorientatie financiële situatie +	
	Overlegorganen +	
	Beleid +	
Fusie Gammafaculteit	Intensieve samenwerking over de grenzen van disciplines heen	
	Nieuws +	
	Organisatie +	
	Documentatie +	
	Fusieproces +	
	Agenda	
	Contact	
	Archief	
	reorganisatie ‘route 14’-2011 +	
Tech4People	About Tech4People +	
	Previous Calls +	
	Workshops +	
	Data Infrastructure +	
	Q&A	
	Opening lab	
	News +	

7.3. Appendix C – Participant instruction (English and Dutch)

Participant instruction

Thank you for participating in this study! The aim of this study is to get insight into how BMS employees think the content of the intranet is sorted logically. It consists out of **two parts**.

Part 1

For this part you have approximately 30 minutes. The researcher will give you a stack of cards. Each card has a name on it which is an item at the intranet of the faculty BMS. Please sort the cards into categories that **you** think are logical. You can make **sub-categories** inside categories if you think that this is logical, this is not required however. After (or during) the sorting, you can **name the categories** you created by writing a category name on a post-it card and placing this above the category. You can move the cards as much as you like until you are done.

An important note is that the task is intuitive. You can't do it wrong and you don't have to overthink your categorization. A few remarks:

- Please **think aloud**, in this way the researcher gets more insight in what you do
- On the back of each card is a little more information about the regarding item if needed.
- There are numbers on back of the cards but you don't have to do anything with them.
- If you think the same item is logical in multiple groups please tell the researcher
- Category names you want to create can match with the name of existing items
- It is possible that you think a card does not fit anywhere, in this case you can place it in a separate category

Part 2

For this part of the study you get to sort the same stack of cards again. The researcher will place five cards on the table ranging from 'least relevant' to 'most relevant'. You have to sort the stack of cards according to relevance based on what you find relevant or interesting **for yourself.** You may only sort the cards in a given distribution of 3, 7, 12, 7, 3. In the end there should be five vertical rows in the given distribution. You can move the cards as much as you like until you are done. Some remarks:

- Some cards are repetitive, you can sort them by their specific content instead of by the group you might have formed in your head

Deelnemers instructie

Bedankt voor het deelnemen aan dit onderzoek! Het doel van het onderzoek is om inzicht te krijgen in hoe medewerkers van de faculteit BMS de inhoud van het BMS intranet logisch gestructureerd vinden. Het bestaat uit twee onderdelen.

Deel 1

Voor dit deel staan ongeveer 30 minuten. Je zal een stapel kaarten krijgen met op elke kaart de naam van een onderwerp op het intranet. De bedoeling is om de kaarten te verdelen in groepen op een manier die **jij** logisch vind**.** Je kan **sub groepen** maken mocht je dat logisch vinden, dit is echter niet verplicht. Na (of tijdens) het sorteren van de kaarten is het de bedoeling om de gemaakte groepen een **naam** te geven. De naam kan je op een post-it schrijven en boven de groep plakken. De kaarten kunnen zoveel verschoven worden als je wil totdat de groepering klaar is. Een belangrijke opmerking is dat deze taak intuïtief is, er kan niks verkeerd worden gegroepeerd en je hoeft niet teveel na te denken over de groepering. Een paar aantekeningen nog:

- Het is de bedoeling om **hardop te denken** zodat de onderzoeker inzicht krijgt in het proces.
- Op de achterkant van iedere kaart staat meer informatie over het betreffende item.
- Er staan nummers achterop de kaart, daar hoeft niks mee gedaan te worden.
- Als je vind dat hetzelfde item in meerdere groepen past merk dat dan op.
- De namen van de categorieën die je maakt mogen matchen met bestaande items.
- Het is mogelijk dat bepaalde kaarten nergens lijken te passen, plaats deze dan in een aparte groep.

Deel 2

Voor dit onderdeel krijg je dezelfde stapel kaarten. De onderzoeker plaatst vijf kaarten bovenaan de tafel die van ‘**minst relevant’** naar ‘**meest relevant**’ gaan. De bedoeling is om de stapel kaarten te verdelen groepen op basis van wat **relevant** of **interessant** is voor jezelf. De kaarten moeten worden gesorteerd in een verdeling van 3 – 6 – 12 – 6 - 3. Het is de bedoeling dat er aan het eind vijf verticale rijen zijn in de opgegeven verdeling. Er kan zoveel als nodig is worden geschoven met de kaarten.

- Sommige kaarten lijken repetitief, verdeel ze op de specifieke inhoud in plaats van op de groep die je mogelijk in je hoofd hebt gevormd.

7.4. Appendix D – Informed consent

Informed consent card sort and Q-sort for the BMS intranet study

'I hereby declare that I have been informed in a manner which is clear to me about the nature and method of the research as described by the researcher. My questions have been answered to my satisfaction. I agree of my own free will to participate in this research. I reserve the right to withdraw this consent without the need to give any reason and I am aware that I may withdraw from the experiment at any time. If my research results are to be used in scientific publications or made public in any other manner, then they will be made completely anonymous. My personal data will not be disclosed to third parties without my express permission. If I request further information about the research, now or in the future, I may contact Jessica Stroes via j.d.stroes@student.utwente.nl. If you have any complaints about this research, please direct them to the secretary of the Ethics Committee of the Faculty of Behavioural Sciences at the University of Twente, Drs. L. Kamphuis-Blikman P.O. Box 217, 7500 AE Enschede (NL), telephone: +31 (0)53 489 3399; email: l.j.m.blikman@utwente.nl).

Signed in duplicate:

....

Name participant Signature

I have provided explanatory notes about the research. I declare myself willing to answer to the best of my ability any questions which may still arise about the research.

....

Name researcher Signature

7.5. Appendix E – Data analysis syntax

Loading data

```
source(file = "Data card sorting v02.R")
Labels <- readxl::read_excel("Labels.xlsx") %>%
  mutate(ID = as.character(ID))
Labels
```

```
## # A tibble: 33 × 2
##       ID                                                        Label
##    <chr>                                                        <chr>
## 1      1                                  Career and professional development
## 2      2                                               Ethics committee
## 3      3                                            Examination boards
## 4      4                                                  OFI numbers
## 5      5                                  Use of digital displays in public areas
## 6      6                                               Faculty Council
## 7      7                                  Emergency response teams (BHV)
## 8      8                                            Programme committees
## 9      9                                  Rules about internal communication
## 10    10       Results national student survey bachelor Communication Science
## # ... with 23 more rows
```

Checking integrity

```
for(i in 1:length(cardsort))
{
  cat("CARDSORT ", as.character(i), "\n")
  read_lol(cardsort[i])}
## CARDSORT  1
## CARDSORT  2
## CARDSORT  3
## CARDSORT  4
## CARDSORT  5
## CARDSORT  6
## CARDSORT  7

## Warning in .local(from, to, graph): edges replaced:
## 'ResearchAndDevelopment|18'
```

```
## CARDSORT  8
## CARDSORT  9
## CARDSORT  10
## CARDSORT  11
## CARDSORT  12
## CARDSORT  13
## CARDSORT  14
## CARDSORT  15
## CARDSORT  16
## CARDSORT  17
## CARDSORT  18
## CARDSORT  19
## CARDSORT  20
## CARDSORT  21
## CARDSORT  22
## CARDSORT  23
## CARDSORT  24
```

Getting graphs

```
graphs <- llply(cardsort, cardsortR::read_lol)
```

```
## Warning in .local(from, to, graph): edges replaced:
## 'ResearchAndDevelopment|18'
```

```
cardsorts <- gather_dist(graphs, Labels)
DM  <- distima(cardsorts)
DM %>%
  cluster() %>%
  heatmap() +
  scale_color_gradient(low = "darkorange3", high = "lightblue2")
```

Scale for 'colour' is already present. Adding another scale for 'colour', which will replace the existing scale.

```
DM %>%
  square() %>%
  cluster() %>%
  openxlsx::write.xlsx(file = "Heattab.xlsx")
```

7.6. Appendix F – Data entry syntax

```
cardsort <- list(
 P01  =  list(
    Group_1 = list(26, 23, 20, 3, 2),
    Group_2 = list(
      Subgroup_2.1 = list(6),
      Subgroup_2.2  = list(28,18)),
    Group_3 = list(32,31),
    Group_4 = list(33,17,10,29),
    Group_5  = list(19,4 ,8),
    Group_6  = list(30,27,25,24,21,1,12,11,7,5,13,16),
    Group_7 = list(22,15,14,9))
```

7.7. Appendix G – Item selection with explanation per item

1	Ethics committee
	Facilitates and monitors the ethical conduct of all research involving human beings in the faculty of BMS.
2	Examination boards
	Independent authorities regarding anything that has to do with examinations.
3	Programme committees
	The Programme Committees have an advising position for all matters directly related to the design and quality of education.

4	Faculty Council
	The Faculty Council can give advice to the dean on all matters which BMS, its personnel or students become.
5	Career and professional development
	Overview of possibilities to develop yourself as employee.
6	Emergency response teams (BHV)
	Information about the emergency response teams of BMS, for example who is in the team per building.
7	Rules about internal communication
	For example rules about mailings to all BMS employees.
8	Use of digital displays in public areas
	Information about using the digital display screens in public areas, for example to announce an event.
9	OFI numbers
	An overview of OFI-numbers. An OFI-number is an internal bank account number of the UT.
10	Procedure request new staff member
	Information about the request of a new staff member (when needed) for BMS.
11	Tenure Track and career committee
	A Tenure Track is a track that enables an employee to get a promotion if the employee fulfils certain requirements within a time period. This committee evaluates the work of the employee and decided if promotion is granted or not.
12	Meeting schedule of the examination boards
	Shows the monthly meeting schedules of the examination boards of BMS.
13	Meeting schedule of the programme committees
	Shows the meeting schedules of the programme committees of BMS.
14	Meeting schedule of the faculty council
	Shows the meeting schedules of the faculty council of BMS.
15	Results national student survey bachelor Communication Science
	The NSS is an annual survey that invites nearly all higher education students in the Netherlands to give their views about their study.

16	Results national student survey bachelor Psychology
	The NSS is an annual survey that invites nearly all higher education students in the Netherlands to give their views about their study.
17	Improvement actions bachelor Psychology
	An overview of concrete improvement actions for the bachelor Psychology.
18	Improvement actions bachelor Communication Science
	An overview of concrete improvement actions for the bachelor Communication Science.
19	Student opinions bachelor Psychology
	An overview with results of surveys conducted among students about the quality of courses they follow within the bachelor Psychology.
20	Student opinions bachelor Communication Science
	An overview with results of surveys conducted among students about the quality of courses they follow within the bachelor Communication Science.
21	Policy plan on the assurance of education quality
	A plan about how to maintain and improve the quality of education within BMS.
22	Faculty structure regulations
	Regulations about the organizational structure of BMS (for example the establishment of committees).
23	Scientific output BMS
	Yearly report with research output per BMS department (how many dissertations, journal articles, conference proceeding etc.).
24	Management team BMS
	Information about the composition of the BMS management team.
25	Year plan BMS
	Yearly plan where the faculty goals/objectives for the coming year are described.
26	Financial affairs (FEZ) department
	An UT-broad department regarding financial affairs, only BMS specific information is given at this item.
27	Marketing & Communication (M&C) department
	An UT-broad department regarding marketing and communication, only BMS specific information is given at this item.

28	Human Resources (HR) department
	An UT-broad department regarding everything regarding staff, only BMS specific information is given at this item.
29	Health, safety and environment (HSE) department
	An UT-broad department regarding everything regarding health, safety and environment. Only BMS specific information is given at this item.
30	BMS employees for Financial affairs (FEZ)
	An overview of the BMS employees that work for the Financial affairs (FEZ) department.
31	BMS employees for Human resources (HR)
	An overview of the BMS employees that work for the Human Resources (HR) department.
32	BMS employees for Marketing & Communication (M&C)
	An overview of the BMS employees that work for the Marketing & Communication (M&C) department.
33	BMS employees for Library, ICT Services & Archive (LISA)
	An overview of the BMS employees that work for Library, ICT Services & Archive (LISA).