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DESIGN FACTORS INFLUENCING THE GRAPHICAL USER INTERFACES OF HEALTHCARE PORTALS

PhD thesis

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List of Abbreviations

afgis – Action Forum of Health Information Systems

BDSG – German Federal Data Protection Act

BDSG – German Federal Data Protection Act

BlnDSG – Berlin Data Protection Act

BVerfGE – German Federal Constitutional Court

CTCRI – Canadian Tobacco Control Research Initiative

DIN EN – Deutsches Institut für Normung Europäische Norm (German Institute for Standardization—European standard)

DSRM – Design science research methodology

E-Health – Electronic health

FAQ – Frequently Asked Questions

FPOGX – Fixation Point of Gaze x-coordinates

FPOGY – Fixation Point of Gaze y-coordinates

GP – Gazepoint (eye tracking software and hardware)

GUI – Graphical User Interface

HDSG – Hesse Data Protection Act

HON – Health On the Net Foundation

Hz – Hertz (unit of measure for frequency)

ID – Identity document

ISO – International Organization for Standardization

NGO – Nongovernmental organisation

ppi – Pixels per inch (unit of measure of screen resolution of different output devices)

PrävG – German Law to strengthen health promotion and prevention

pt – Point (Desktop Publishing points); unit for font size, 1 pt = 0.3528 mm

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RWTH Aachen University – Technical University of Aachen, North Rhine-Westfalia

Segoe Ul Light – Font style Ultra Light of the Segoe font

SEM – Structural Equation Modeling

STAR – Spiral Technology Action Research

Swiss721LtBt – Font style Light Booktext of the Swiss font family

WCAG – Web Content Accessibility Guidelines

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1 Introduction

The development of the age of technology has created the Internet as a communication platform serving us for all areas of our everyday lives. Parts of the Internet focus on stabilization of health, illness prevention achieved by healthy lifestyles and information on symptoms and diseases. Interested Internet users may select among different Healthcare portals dealing with disease patterns and symptoms. These portals provide both prophylactic tips for the well-being and care of the body and mind and the latest findings about how to treat diseases—important information that may be interesting and important for everybody interested. In the view of this, it might surprise that the relevant Healthcare portals are little used and not widely known. What are the reasons for their lack of acceptance? May the findings on the gestalt theory increase the use of such platforms?

In this research project both the design and structural factors aiming at increasing acceptance will be investigated and their weighting will be analyzed. The target is to answer the following questions:

May aspects of gestalt psychology as well as design-oriented placement of objects and contents improve the acceptance of Healthcare portals? May the achieved results provide for developing a set of rules for a design-oriented construct of Healthcare portals?

Before answering these questions in more detail, basic conditions and terms are to be explained.

1.1 Modern health service—E-Health

Since the year 2000, the term e-health has been spread around even in medicine, and health care specialist publications and its communication opportunities via the Internet have been considered to play a decisive role. [1]

E-health declares the providing of information on both stationary and mobile devices in the areas of medicine and health. Among others, they refer to the electronic supervision, care, support/company of people requiring aid and support. The focus is on offering, transmitting and collecting data with the objective of stabilizing health, reducing diseases,

attenuating the course of a disease as well as accessing patient files in case of an emergency. Explaining to the population the influence of a healthy lifestyle on the positive general state of the organism contributes considerably to the happy and healthy well-being of people. This is exactly the point where the Internet comes into play.

One possibility represents the information portal (so called Healthcare portal [2]). Here doctors or medical experts provide interested users or patients with information on symptoms, courses of a disease and new therapies. [3]

Other applications may be the direct information exchange among patient and doctor or doctor and doctor. However, a direct reaction of the communication partner may be required but may not be absolutely necessary (for example in the case of telemedical examinations, diagnoses or monitoring via the Internet). [4] So additionally, patient data collected by individual specialists may be gathered and evaluated over a longer period of time and may serve as the ideal basis for individually defined treatment measures. In this respect the privacy of personalized data is to be guaranteed.

There are no limits to the opportunities resulting from using the Internet for the advantage of the patients when aiming at improving individual treatment and the quality of therapies.

1.2 General comments on Healthcare portals

Healthcare portals are increasing their importance more and more. They offer completely different information addressing different relevant target groups. Some provide comprehensive databases together with medical experts and specialists, information and explanations on symptoms and disease patterns as well as self-tests, others offer tips for sustainable nutrition and a healthy life including personal fitness plans and respective advice. In each case, they offer important and up-to-date findings that, currently, are being accessed and used far too little. Some possible causes of why Healthcare portals are still suffering from lacking acceptance will be investigated in detail in this research paper.

From a technical point of view Healthcare portals are mostly Content Management Systems, as their contents are to be updated and amended regularly. Usually, the programmer creates a mask in the backend providing an equal division of individual fields. In the frontend, each field shows the introduction of a particular topic (with/without images, headlines, brief introductions using a predetermined number of characters). The online

editor or other employees may fill in the mask with information without any programming knowledge. This allows for the information to be permanently updated. This fact may be decisive for Healthcare portals to be successful or not, as those people eager to learn and know more always hope for the latest information to get when searching the Internet.

1.2.1 Opportunities and benefits of Healthcare portals

E-health platforms may offer different information. Users may receive explanations of medical or health-oriented terms, symptoms and disease patterns, the combination of different symptoms and disease patterns resulting from them, tips for sustainable nutrition and a healthy life, advice on sports activities, tips regarding fitness and body care. Some portals have focused on specific areas, such as the use of medicinal herbs and alternative care and treatments, whereas others offer additional services such as addresses of medical experts or communication with experts.

Included herein are communication platforms for medical specialists and doctors providing and offering a fast exchange of experience. Up-to-date information on closely located rescue facilities that can be accessed rapidly may be extremely important in the case of emergency. Telemedicine offers here high value for both doctors and patients especially when the supervision of patients with chronic diseases or the immediate treatment of injured people is required.

Communication platforms are not only supposed to keep communication among doctors, moreover, they provide the opportunity for exchange between the patient and the medical expert. However, information given on treatment methods and therapies may be basically generalized and abstract. Recommendations are not permitted to be given to unknown patients (German ban on telemedicine). [5]

Many platforms broach the issues of the stress and burn-out syndromes and which symptoms may help to detect them at an early stage. Self-tests and also games provided as apps are not only entertaining, they may even help you to become aware of your own health problems and symptoms.

Problems resulting from our attitudes toward recreational and illicit drugs should not be forgotten. Users can mostly find this topic on e-Healthcare portals. The new German Prevention Act, whose draft was published on 11 March 2015, grasps the findings that

some disease patterns are at least supported and forced by unhealthy lifestyles. Conscious, healthy nutrition can eliminate and/or reduce certain risk factors. [6] By offering information, ideas, tips and more, Healthcare portals contribute to the clear and sustainable awareness and responsibility for one's own health.

High value for users and providers of Healthcare portals requires permanent data maintenance of each Internet page and the whole content. Each article should be under editorial control regarding its up-to-dateness and accuracy, it should offer new trends and health-oriented information as well as show important new findings.

The acceptance of Healthcare portals and, as a result, the benefits for the platform provider may be limited if the user is only allowed to retrieve the information desired by personal registration. Many users do not want to do this or are uneasy about the registration procedure or the possible further use of their personal data.

Registration functions are important if the exchange of internal, specialized or personal data or individual offers is required.

1.2.2 Determinants of Healthcare portals

Healthcare portals are Internet portals providing comprehensive explanations regarding topics such as health, nutrition, exercise tips, symptoms, causes and treatment of specific diseases as well as much more information about medical questions. Contents differ widely and are complex. Besides the contents shown so far, on the basis of user-oriented logins, they may additionally offer links or databases containing contact details of medical specialists (search for doctors), self-tests, self-aid groups, addresses of pharmacists' shops, user forums and communication platforms with medical experts and even up-to-date findings made by specialists.

Healthcare portals are to provide information on health or medical problems. Doctors are not meant to be substituted. But users may be put into a position at an early stage to assess whether a doctor is required and what appropriate measures they may take themselves to recover. A survey conducted states that 61% of American adults and 54% of European adults search for medical information online before consulting a doctor personally. [7]

What all Healthcare portals have in common is the exclusive thematic reference to health

or medical topics which may be amended by links. [8] The scope of the topics treated is very different as well as the scope and content-related quality of the respective accomplishment.

In 1995, the Swiss foundation **"Health On the Net Foundation" (HON)** was established with the objective of establishing a uniform standard of quality of comprehensibility, transparency and other aspects. In 2002, HON acquired the status of a nongovernmental organisation (NGO status) of the United Nations for the free certification of Healthcare portals (until 2014). Since 2015, this NGO has now offered certification subject to a charge. From its foundation until 2010, HON was able to confirm more than 6500 websites in 118 countries offering medical information to be "reliable." [9] [10] The HON foundation has developed the HONcode to be able to check transparency and quality of health Internet websites (Healthcare portals) objectively. This code is supposed to serve as a code of honor and ethical standards for webmasters of Healthcare portals. [11] The following aspects of the Internet websites are considered: [11]

"1 Author's qualifications (The qualifications of authors of health information)

2 Complementarity (To complement and not to replace the doctor–patient relationship)

3 Privacy policy (The privacy policy for personal information submitted by site visitors)

4 The sources (The source(s) of the health information provided and the dates of publication/last update on the pages with health information)

5 Demonstrability (Claims about the benefits and efficiency have to be proved)

6 Transparency (The accessibility of information, identification of the webmaster, the availability of at least one contact address)

7 Funding of the site (Sources of the funding of the site)

8 Advertising policy (The clear separation between the advertising and editorial content)." [11]

In Germany, in addition, there is the quality label initiative of **Aktionsforum Gesundheitsinformationssysteme (afgis) e. V. (Action Forum of Health Information Systems).** Top-quality health information systems are allowed to bear this significant certification mark. [12] For receipt of the afgis quality label the following transparency criteria of the Healthcare portal are considered:

"1 The service providers

2 Target and target group(s) of the information offered

3 The authors and information sources

4 The first version, up-to-dateness and planned maintenance of contents and data

5 Opportunities for users' feedback

6 Internal self-assessment quality assurance procedures

7 Separation between advertising and editorial contents

8 Funding and sponsoring

9 Cooperations and cross-linkings

10 Privacy protection, data transfer and data use." [13]

The current certification fee is €690.00. This quality label available for German Healthcare portals needs to be applied for each year. The same applies to the international HONcode.

Neither certification provider verifies the correctness of contents.

At present, the Healthcare portal www.onmeda.de holds both certifications. Its competitor, www.netdoktor.de, as well as 34 other medical information portals in Germany, holds the afgis certificate. [13]

The possibility of specific certification of Healthcare portals grasps the idea already present in other areas of social life, namely, to create independent determinants for health-oriented and medical information with the highest quality requirements. Certifications of this kind have grown significantly in importance within the last few years.

They may help consumers or users to trust adequately in services and products according to recognized quality criteria and standards.

What Healthcare portals differentiate from other portals of common life is the exclusive medical, health-oriented or pharmacological content. This content may be amended by forums/communication platforms, self-tests, games, apps, online articles and address databases of exactly this content. How is the present acceptance of Healthcare portals to be classified?

1.2.3 State-of-the-Art of "Healthcare portals"

So already in the middle of the 1990s, some institutions recognized the chances of Healthcare portals for being used by either medical experts and laymen and patients as well.

The acceptance of Healthcare portals is not nearly as high as they deserve. The big service player Google, for example, ran their own Healthcare portal **Google Health** until 1 January 2012. [14] Then, after a 12-month run-off period, Google decided permanently to cease operating Google Health by 2 January 2013. [15] The reasons are sure to be complex. On the one hand, running and administrating a Healthcare portal is very expensive and time-consuming. Databases and all the information need to be kept up to date. If sufficient users are to find the portal, it needs to be found on the very first pages offered by search engines under varied search terms.

Eventually, this upper position after the browser search appears to be interesting for advertising companies. But what companies should be allowed to place their adverts there? Do users want to find products of their everyday lives on Healthcare portals or rather personal recommendation systems? What positions and sizes should be provided for them? The certification procedures explained above check the websites regarding the clear separation between the advertising and editorial content. Will this be sufficient? Certifications of Healthcare portals establish trust in the quality of information among users. But they are expensive and frequently need to be repeated every year. Even this aspect has to be taken into account.

1.2.3.1 Analyzing Healthcare portals

The German consumers' magazine "Stiftung Warentest" investigated the usability of 12 Healthcare portals between January 2009 and April 2009 [16] and published the results in the issue of "Stiftung Warentest" in June 2009 [16]. The following Healthcare portals in the German language for nonmedics with more than 5000 visitors a day (September 2009) were presented, analyzed and compared with each other: Gesundheit Pro.de, net-doktor.de, vitanet.de, onmeda.de, netdoktor.at, dr-gumpert.de, Medizin online, gesund-heit.de, qualimedic.de., MedizInfo.de, sprechzimmer.ch, paradisi.de and others. [16] These 12 health platforms are visited by almost six million users monthly, as reported by Google-Trends. [16] As an orientation, they called on the checklist of the consumer ad-vice center of North Rhine-Westphalia, which was published under www.vz-nrw.de/link7818A.html. [16]

The evaluation of the different portals focused on content quality (60%), the handling of the website (30%) and the dealing with requests (10%). "Stiftung Warentest" investigated the following aspects [16]:

- Navigation
  Uniqueness of the navigation elements
- Orientation of position
  Transparency for users where they are situated (also for users who have used search terms and directly reached a subpage of the Healthcare portal)
- Assignment of information and results
  Reduction of search results by number and scale
- Clarity of terms
  Consistent and unambiguous designation for identical functions (forums, forums for laymen, waiting rooms are used for the same functions)
- Freedom from barriers
  Information access without technical or design deficits (using red/green colors may cause problems with users with red-green color blindness and others)
- Multimedia contents
  Videos and clips should be mainly used only for professional comments on the information (weighting regarding the use of advertisements)

- Advertising
  Clear separation between the advertising and editorial content (wrong conclusions should be excluded)
- Impartiality and objectivity of the information
  Medical knowledge presented needs to be responsible, complete, correct and comprehensible
- Comprehensibility of text
  Usage of technical terms that are not explained, Usage of comprehensible language, long sentences and subordinate clauses
- Sources of information (information more than two years old should be labeled regarding their actuality). [16]

This analysis was based on five clinical states that are of high prevalence in the population: cystitis, high blood pressure, type 2 diabetes, shingles and measles. [16]

Medical and legal experts checked the portals on behalf of the magazine "Stiftung Warentest" [16]. They queried for medical issues, did research work, asked questions and evaluated answers. [16] The list of criteria used resembled the EN ISO 13407, EN ISO 9241-151 [16] and other Internet guidelines for usability.

With the implementation of the standard Industry 4.0 [17], starting the fourth industrial revolution and influencing all areas of our social and economic lives, digital communication undergoes a powerful, increased significance. Cyber-physical systems, besides the Internet of Things, will provide for a change in everybody's life and of the medical health system and care. In addition to telemedical services, this also includes the electronic health record, the Clinic Decision Support System, Internet medicine (monitoring, diagnostics, advice) as well as the monitoring of vital signs with medical wearables, devices for health prevention and stabilizing health. [18]

1.2.3.2 Comparison of two Healthcare portals

Basically, two established Healthcare portals were analyzed by the executor of the research project (Ph.D. student Manuela Krauß) to find similarities and different design-related problems. Different design aspects and structural faults were determined and subsequently presented.

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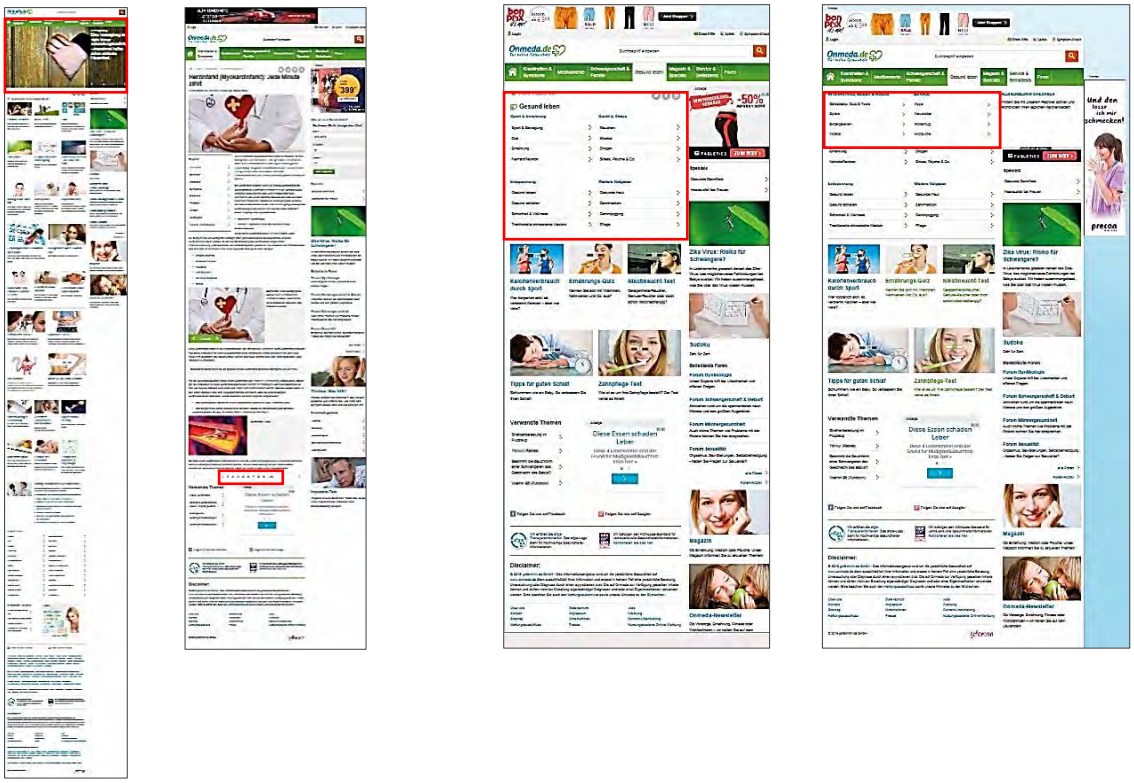
The information provided on the "Onmeda" portal was partially considered to be too technical and poorly comprehensible for the layman. This resulted in the rating "sufficient" [16] for this particular field. In addition to the technical formulations understandable only to experts, the assessment rated comprehensibility of text, long sentences, complicated sentences as well as terms that had not been translated nor explained. This analysis was executed by means of special software. [16]



Portal Onmeda Home page | **Explanations "Heart attack" with 15 subpages** | **Subpage with the main menu collapsed** | **Subpage with the main menu expanded**

Figure 01
Healthcare portal Onmeda

The readability of the text is not the focus of Figure 01, but rather the layout, quantity of text and the amount of the different content and information.

Since then comprehensibility of the medical information on the "Onmeda" portal has been thoroughly revised by the gofeminin.de GmbH company. They have made sure the information given at present is mostly clearly understandable for patients and those interested without any medical background. The situation is different if the number of explanations regarding a clinical pattern is considered. In fact, topic-based information frequently

extends to over 10 additional individual subpages. The text length of the information given is highly recommended to be revised now taking into account its presentation suited for the Internet. [16]

The home page of the Healthcare portal "Onmeda" shows an unclear structure and disorder regarding the topics offered (the menu functions framed in red are partially unstructured and can only be found after lengthy scrolling). Completely different topics are placed in a disordered manner and without any identifiable hierarchy right on the home page together with pictorial representations. On the other hand, right under the main navigation (left picture framed in red), users find games such as "brain trainer" next to "Sudoku," self-tests ("migraines test" and "How old is my child") and some advice on disease prevention next to disease symptoms. [19]

Picture quality is partially moderate, additionally, image details are unsuitable or only slightly meaningful. The green shades of the significant trademark differ from one another when shown on different occurrences.

The texts are not suitable for the Internet (they should be short, precise and to the point). When doing interactions, the texts that are already colored change their colors again. Colors here have not been used as a leading function but as a means of the colorful design of this website. The font sizes are too large and predominantly address older age groups, who are usually inexperienced in using the Internet. Only when using the Onmeda information frequently do users get accustomed to the design deficiencies.

Proof of the lack of a clear structure is that identical contents can be found on diverse subpages and different navigation points. Identical contents are repeatedly displayed (self-test "How old is my child" on the home page under the section self-tests and under the section "My child") [19], which bloats the whole application significantly.

Other Healthcare portals, such as www.paradisi.de, clearly limit the amount of their information up to a maximum of four Internet pages and show a better structure and design of their thematic areas.

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Portal Paradisi Home page | **Explanations "Heart attack" with four subpages** | **Subpage with the main menu collapsed** | **Subpage with the main menu expanded**

Figure 02
Healthcare portal Paradisi on Heart attack
Paradisi home page (centered) and home page with the main menu expanded (right) [20]

The readability of the text is not the focus of Figure 02, but rather the layout, quantity of text and the amount of the different contents and information.

Healthcare portals like Paradisi.de and others show user-friendly usability partly better than Onmeda.de. Figure 02 shows a clear presentation of several navigation units. However, they are frequently not found among the first pages of the results given by many search engines when typing in the question "What is a heart attack?" Paradisi was not listed until the seventh page of results whereas Netdoktor.de appeared on page 1. Onmeda.de was listed on page 3. [21] However, users tend to click on the first hits they can get, even though in this case it would take a certain time to get used to the particular structure.

The portal operators of "Onmeda" accord less value to the design-related and structural presentation of the information. The permanent update and optimization (Search Engine Optimizing = SEO), on the other hand, is in the foreground of the portal. The result is that this Healthcare portal will be found right on the first search pages after the users having typed in the respective search terms.

If users are to receive their information queried for on the different Healthcare portals faster, a universal standard is required regarding design, size and positioning of the design elements. This raises the question:

Would nonmedics use Healthcare portals if they were clear, transparent and informative?

1.2.4 Analysis of the research environment

For the implementation of the research project, the determinants and environmental variables are important and must first be determined and analyzed in detail. This includes, in addition to the target group analysis, the analysis of the necessity of this research project, the analysis of possible effects and the influence of the expected result on the acceptance of Healthcare portals. These are described in detail below.

1.2.4.1 The users as participants

In the first place, the cluster of users of this service needs to be analyzed.

The information here is acquired by user interviews [22] submitted as analog input and digitally and being available for search and analysis. Those persons are selected who preferably appear to be impartial and unbiased and are suited to be potential users of Healthcare portals. According to Bogner [23], users are defined on the basis of the relevant action area "… within a clearly limitable problem area …" [22]. Their subjective perceptions and behaviors represent the object of research. [24]

Healthcare portals attract users who frequently have no or only little medical knowledge. They are patients who, before or after having gone to see a doctor, want to find out more about symptoms, about diagnoses made by doctors or just want to learn practical tips for healthy everyday living. They show a simple up to excellent level of knowledge with computers and use the Internet for searching for information on Healthcare portals. This

work is mainly done in their leisure time, so one can start from the assumption that they own either mobile devices (such as a smartphones, tablets) or personal computers at home.

They do research work mostly starting from the age of 19. The upper age limit of the target group is dependent upon the routines shown when using personal computers or mobile devices.

1.2.4.2 Identifying the need for this research project

First, the actual needs have to be investigated. For this purpose, a qualitative empirical survey was developed using a one-page questionnaire [Appendix 01] investigating previous and future use on the condition of user-friendly design. Eleven test persons aged between 22 and 67 were involved in this project. All test persons showed different technical and medical knowledge.

64% (seven participants) had not visited Healthcare portals before. 55% of (six participants) were male and 9% (one participant) was female. A close look at this group of seven participants reveals that all had used computers and the Internet for 10 years or even longer. With regard to the use of the Internet 18% (two participants) reported a period of having used the computer for more than 10 or 11 years and 46% (five participants) for 20 years and more.

Taking exclusively into account only the group of the new users, 86% (six participants) out of the 100% of the test persons who had never used Healthcare portals so far would use Healthcare portals if they were structured and designed in a transparent, clear and informative way. [25]

The group of test persons who had already used Healthcare portals before consists of 50% females and 50% males. Whereas female test persons had already visited several Healthcare portals, male test persons had only looked into several portals if they had a medical or therapeutic training (25%). When suffering from chronic diseases themselves (25%), they searched for appropriate information only on one Healthcare portal. This percentage of female research is due to the cautious behavior and sense of responsibility for themselves and for other family members.

All test persons having already used Healthcare portals referred to web applications run by health insurance companies and certain health institutions (such as the Association of Statutory Health Insurance Physicians, the health insurance companies BKK-VBU, Techniker Krankenkasse and AOK). None of them had come across free and independent Healthcare portals like Netdoktor.de or Onmeda.de. [26]

If the search term "Heart attack" is typed into a browser, just on the first page there will appear independent Healthcare portals like Onmeda.de and Netdoktor.de. [27] Why do users not visit those portals? The cause may be in the previously described usability or the level of awareness.

In total, out of all test persons, 91% opted for a possible future use of Healthcare portals. The decision against using Healthcare portals was exclusively made by men. Is it possible, as a conclusion, to put forward the hypothesis that women would be more open to Healthcare portals and men would not show any interest in Healthcare portals as long as they do not suffer from any chronic disease themselves or are not medically qualified? Based on this qualitative survey by way of a first needs analysis, this statement cannot be regarded as having sound standing. Further quantitative surveys would be required to prove that.

All of the test persons in general often surf the Internet to gather information according to their private interests. None of them claims to use the Internet sporadically or never. When asked what information was requested on Healthcare portals, 100% of the female test persons prioritized "Healthy nutrition." Only 43% of the male test persons wanted information on "Healthy nutrition."

33% of the female participants consider information on "disease prevention" important, with men this number reaches 71%. "New healing methods and diagnostics" are interesting for 33% of the female participants and 57% of the male participants.

One can recognize that female participants show more interest in information on health stabilization and prevention whereas the male participants are more interested in information on recovery and healing.

The needs analysis is to be confirmed additionally by the statistics published on the portal www.statista.de. According to the latest information in 2014, 4.6% of all German-speaking online users visited the Healthcare portal "Onmeda," representing the fourth place for that period. Www.Jameda.de reaching 5.5% heads the ranking list. [28]

In 2015 in Germany 9,717 users of larger Healthcare portals were asked whether they were willing to pay for health apps and web Healthcare portals: 80% completely rejected their willingness to pay, 12% of the persons surveyed stated their readiness to pay a one-off fee of 5 to 20 euros for apps and applications that are reliable and can be proven to be effective. [29] This statistic demonstrates the large demand for information.

The results displayed here are the reason to investigate the design factors influencing the design of Healthcare portals in more detail and to create a set of rules as a guideline for a clear and user-friendly design.

1.2.4.3 Research plan

Problem statement and relevance of the research work

Healthcare portals provide much important and up-to-date information on the various topics of healthy eating, stabilizing health, different disease patterns and symptoms and much more. They represent a real medium of information. Nevertheless, a low acceptance by users is to be found. Improving acceptance can promote the long-term stabilization of the health of the population. Thus, expenses for consultations in medical practices can be reduced. A conscious healthy lifestyle can reduce the incidence of certain diseases such as adiposis and cardiovascular diseases. To this end, Healthcare portals make a significant contribution to health education. However, most web designers of these portals do not adhere to the design rules for good and user-friendly Graphical User Interfaces. Sometimes, the typography is too large and unclear, often the entire color palette available is used (without taking into account the guiding function of the color), different and nonrelated contents are integrated into one navigation unit, graphics and photos are partly missing the concrete reference to the content and information is subordinated with advertisements and much more. Texts on a topic (symptoms or disease patterns) are often too long (over far more than 15 subpages), important contents can only be found after very long scrolling on the homepage and there are many more problems.

What are the reasons for the low acceptance of Healthcare portals? Are they to be found in the user-unfriendly design, menu guidance and structure of the user interfaces? The hypothesis derived from this analysis is: “Design factors do influence the Graphical User Interfaces of Healthcare portals.”

To obtain evidence of the need for the improvement of the acceptance of Healthcare portals, an empirical survey is developed in the form of a questionnaire and afterward evaluated. The evaluation of the results is to show whether more users would use Healthcare portals if usability were more user-friendly. This statement has been confirmed.

Objectives of the research work

The purpose of this research work is to find out what design aspects (including structure and menu management) are particularly important to users. This list of priorities is an important framework for web designers.

Would users prefer Healthcare portals if web developers observed the design rules for user-friendly interface design? Are these design rules for user-friendly interfaces elaborated at the end of the 80s and the beginning of the 90s still relevant? The answers to these questions are to be investigated and analyzed.

Methodical approach and research design

First, the theoretical foundations are presented. These are the rules and standards for the user-friendly design of Graphical User Interfaces. These have been compiled by various experts from the fields of psychology, media psychology, perception psychology, computer science, graphic design and media design and they are published in textbooks and special literature for design training and various design or media informatics study courses. The sources used are listed in the source list.

The qualitative research approach is chosen. A Healthcare portal is being sought to represent the typical errors and problems of user-unfriendly usability—www.onmeda.de. Onmeda is an established Healthcare portal run by the gofeminin.de company with the latter, furthermore, being a subsidiary of Axel Springer SE. Only Healthcare portals of the German-speaking areas are reflected upon.

A new portal is being developed (www.phd.manuelakrauss.de) providing exactly the same information as the original Healthcare portal, but considering unexceptionally the design rules for good user interfaces of portals. In addition to the design elements, this also includes the menu navigation, the navigation concept as well as the content structure, which is to be completely changed for the sake of a user-friendly information presentation.

The prognosis is that in the comparison between both Healthcare portals Onmeda (Portal A = www.onmeda.de and Portal B = www.phd.manuelakrauss.de), most test persons prefer Portal B.

For the empirical survey, a comprehensive questionnaire was created, starting with a question set on the personal sociodemographic information of the test person. The next set requests a comparison of both portals, with the test persons each having to decide for one of the two portals. Following is a question set asking for the basic design elements that are most important to the test persons. This should be a framework for web designers. The results are evaluated and visualized using the statistical model Structural Equation Modeling (SEM).

The last question set exemplarily deals with open questions about the desired image motifs and content of the advertising.

The comparison of the two portals by the test persons is recorded by the eye-tracking software Gazepoint especially bought for this purpose. In this way, additional behavioral patterns and determinants of the test persons can be recorded, analyzed and evaluated.

The evaluation of the empirical survey is carried out with the research method of induction, the results are evaluated by bottom-up procedures.

Results of the research project to be expected

On the one hand, the confirmation of the hypothesis and prognosis is expected. If the prognosis is confirmed, it speaks in favor of the validity of the set of design rules elaborated last century. If it is not confirmed, the causes need to be analyzed and investigated whether patterns of the cluster of people are recognizable from the sociodemographic information. If the results show that the design rules are antiquated, new recommendations have to be developed here on the basis of the research results.

On the other hand, the ranking list of the design elements is to serve the portal developers as an aid with the objective of improving usability.

Furthermore, behavior patterns are expected in the cognition of the information from the Gazepoint videos, which either confirm the findings of the perception psychology so far or bring new insights. In particular, the analysis of sociodemographic information is of special importance and the possible combination with certain behaviors.

The expectations of the results are complemented by the answers to the open questions of the questionnaire. What further new findings this research work may bring up cannot be currently estimated.

1.2.4.4 Motivation of this research work

In addition to the certifications mentioned above, design and structural aspects influence the acceptance of Healthcare portals. The expectation of an 86% increase in the number of people using Healthcare portals (six out of seven test persons would use Healthcare portals in future) as shown in the scientific survey on the acceptance of Healthcare portals is impressive. The conviction that Healthcare portals constitute an important and not easily substitutable possibility of providing information and advice on medical and health-related questions has been proved by this evaluation and the previous statistic surveys.

Healthcare portals may have a large share in the preventive education of people. It is important to recognize new priorities in the prevention and promotion of health as done by the German Federal Government by passing the Prevention Bill (PrävG) [30] on 18 June 2015.

In today's digitized world Healthcare portals should and can play an important—perhaps decisive—role for the sake of the prevention and the healing of diseases.

The objective of Healthcare portals is not to replace the necessary visit to the doctor, but they can indicate in the run-up the urgency/necessity of consulting a doctor personally. Advice and tips given here may provide a reasonable preparation of the visit to the doctor.

The large importance of prevention, the possibilities offered by Healthcare portals and the fact of the user-unfriendly design of several portals prove the motivation of investigating the design factors influencing the acceptance and use of Health platforms and, as a result, of developing a basic set of rules in this respect.

1.2.4.5 Selection of the object of research—the Healthcare portal "Onmeda"

Several tests have shown that the Healthcare portal "Onmeda" places among the top German-language Healthcare portals. [16] [31] Users may find here tips for healthy nutrition, detailed explanations of symptoms and diseases, the importance of doing sports activities, alternative options for treatment, causes and effects of stress, information on insemination and first aid, prevention and advice on stabilizing one's state of health, databases containing details of medical experts as well as pharmacy emergency service, forums, games, self-tests, magazines and much more.

"Onmeda" complies with the afgis transparency criteria. In addition, their contents were declared reliable according to the HONcode standard.

The investigations and certifications so far conducted have not considered aspects of design, positioning of text, pictures and navigation elements. Only those features have been exclusively examined carefully that are technically measurable, such as the correct use of technical terms, the length of sentences or the correctness of the information provided. [16] [32]

This research work examines design aspects such as font size, number of characters in one line, media-friendly length of text, size, positioning of photos and graphics, picture details, positioning of navigation elements, the number of elements in one navigation unit, structural distribution and allocation of contents, the positioning of contents. These very aspects have largely impeded the user-friendly information intake.

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The lead picture with text

When entering the Onmeda portal the user is welcomed by a slide show played in almost the full screen with five lead pictures referring to several topics positioned directly below the navigation unit and inserted in alternate arrangements from the sides. On the right of the particular image, there are short explanations referring to the topic. However, each image pauses only for a short time. The thematic introduction to the topic in that short period of time cannot be read fully and properly.

Figure 03
Lead picture with text [19]

Problem: The images are too large and move too fast. As a result, reading the complete text (on the right in the lead picture of Figure 03) is often not possible.

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Navigation

The navigation unit is positioned above the lead picture. The font size is too large and competes with the significant brand name "Onmeda" placed above it. In addition, all the topics are accommodated in this sole navigation unit. If one of the offered topics is opened, on the one hand, part of the picture is covered and, on the other hand, an overview with different subheadings is displayed again.

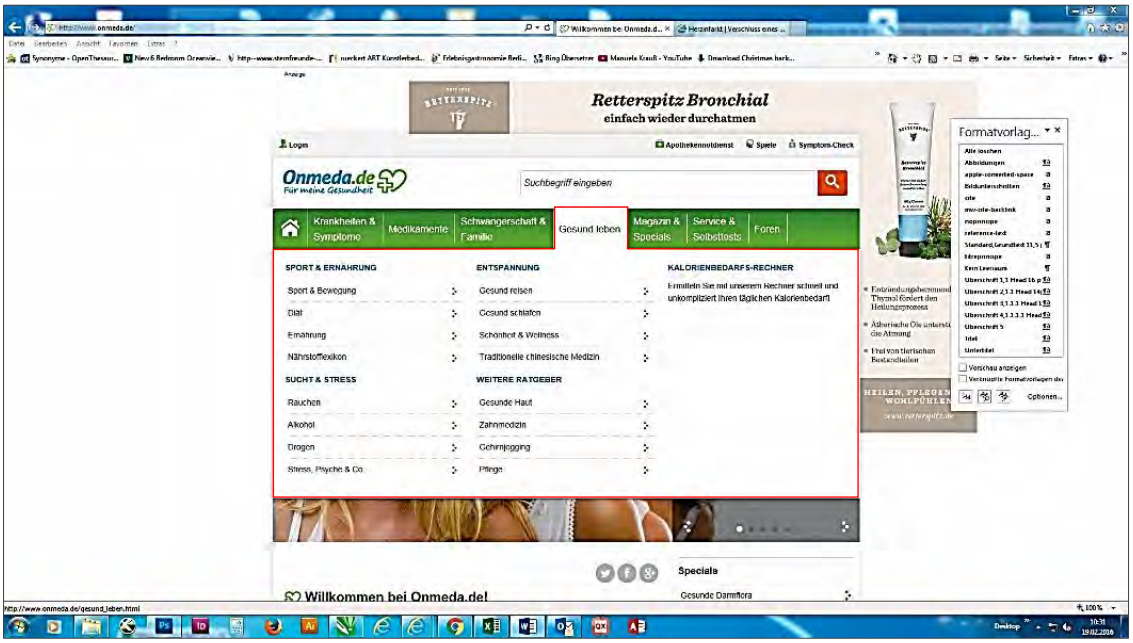

Figure 04
Subheadings of the navigation element Healthy living [19]

Too many topics are offered here. Figure 04 shows the number of buttons existing exclusively for one navigation point.

The Home button on the home page is redundant as we are already there (the button has no function). It can be seen on the left in the navigation bar.

Problem: Bad, confusing structure of the topics and navigation elements and images that are far too large. It is lacking a consistent and clear topical orientation and design as well as a neat relation to the topics. Navigation elements should be subordinated to the name of the Healthcare portal.

Results output of the search function

If typing in a search term like "heart attack" above the navigation unit, users will not receive the proper information itself but will be forwarded to a subpage listing 10 articles

per Internet page, in total 392 Internet pages exclusively dealing with this topic. So, users now have to decide which one of the 3911 articles [19] on “Heart attack” they should access. When having decided on one article to be accessed, the patient will find then again information with a volume of mostly more than 10 Internet pages. This is not very helpful for nonmedics.

The number of articles dealing with one single topic only—even if more specified—unsettles the user. The amount of information on one specific topic should be limited. This maximum number might be reached with 10 articles referring to one specific search term. The platform’s editors should focus on up-to-dateness and condensed descriptions and integrate the 10 most important, complementary articles. In addition, editorial supervision should be exercised and guarantee to replace articles with common medical explanations every three years. Only the number of results displayed is important. In this case, 3911 extensive presentations on the topic “Heart attack” unsettle the user.

If limiting the specific search, for example, to articles on the topic “Heart attacks with women,” there are still 766 articles [33] dealing with this specific topic. Furthermore, each article provides extensive explanations (frequently covering more than one Internet page).

The main criticism here applies to the confusing number of articles displayed by the search function.

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Figure 05
First subpage of the topic Heart attack [19] *and header navigation above*

Problem: The unclear amount of information has to be structured more reasonably and must be condensed/reduced to suit the needs of the Internet. On this Portal 3911 articles are offered dealing only with this topic (see Figure 05).

Header navigation menu

Completely different contents in the header navigation menu are similarly happily mixed together: “Pharmacy emergency service,” “Games,” and “Symptom check” as well as Social Media-Links. Many providers of Internet portals use this navigation for company-related information or much-needed data such as “Imprint” “Contact,” “About us,” “Company,” “Sitemap,” “Press releases,” “Jobs,” “Privacy protection” or other items. “Onmeda” provides this information in the footer. Because this homepage requires lengthy scrolling, users may reach this area rather seldom.

Problem: Header navigation should display information not directly related to the proper content of the Healthcare portal—for example information on the company or other important information—within one uniform subject area. These contents should be considered to be immediately visible and, therefore, should contain extremely important information.

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Further navigation units

When continuing scrolling down in the lower section of this application to the footer, further navigation units appear suddenly, offering contents in a different structure that might have been partially reached as well by using the main navigation channels.

The penultimate navigation unit eventually provides the important information on the company itself and a short direct speech delivered by the Managing Director, Marc Schmitz.

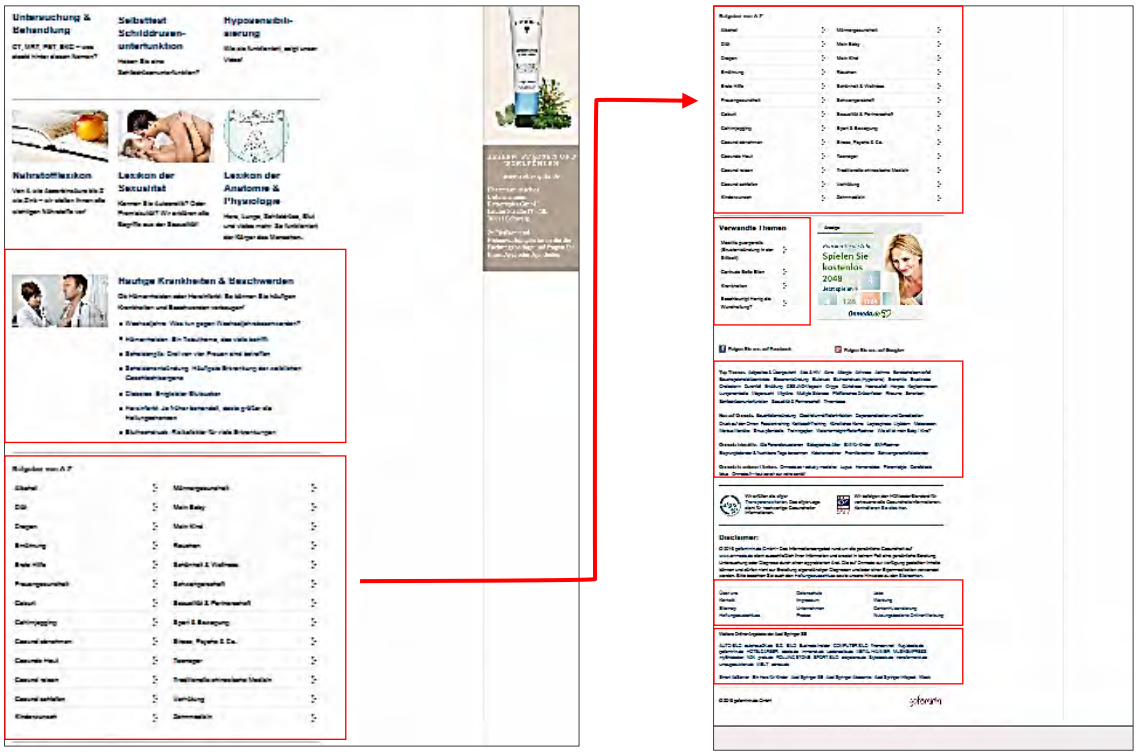

Figure 06
Additional navigations and links above the footer [19]

The readability of the text is not the focus of Figure 06, but rather the large amount of additional information and navigation units causing confusion.

The positioning of this information unit is severely inappropriate because company details should be available fast as a welcome address. Navigation units containing the same content but structured differently are redundant. In this way, this application is unnecessarily bloated. In the middle of the opening page, users already find medical explanations and health-oriented tips. Nobody expects navigation units and link collections below.

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As seen in Figure 06, this subpage presents a great number of additional buttons and text links (framed in red).

Headlines

Below the opening image, the different topics are briefly outlined. The size and font of the basic text are easily legible. In contrast, the headline is greatly enlarged and swamps the basic text by its excessive contrasting dimensions. In addition, the headline is even more strongly focused by its cyan coloring.

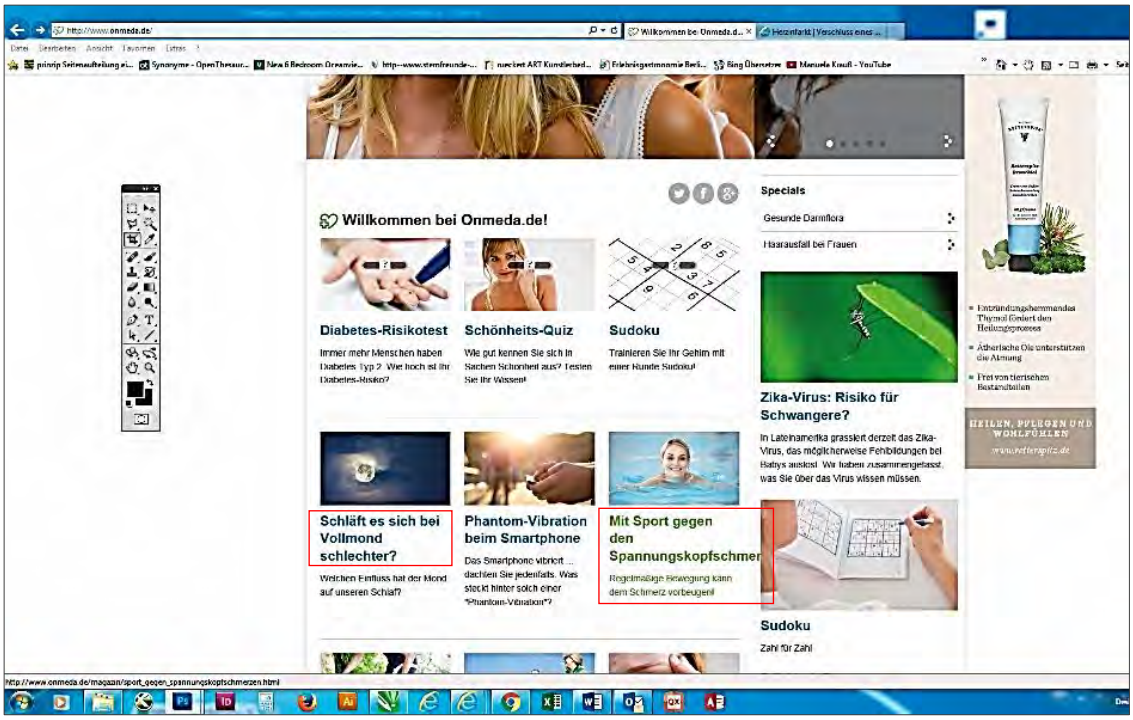

Figure 07
Section headlines in cyan and green coloring of the text during the MouseOver event [19]

Figure 07 also shows, apart from the colorful photos and graphics, colored text links (framed in red). The overall presentation of all information seems to be too colorful.

Here, color loses its guiding function.

Apart from the technical inaccuracy of the continuing headline, it remains unclear what role the additional color cyan of the headline performs. A harmonic text design would be supported by the font set in bold and by enlarging the font size by ca 3 pt compared with the basic text. Instead of this, the headline is about 6 or 7 pt larger than the basic text.

The color change when using the MouseOver function is comprehensible. However the different color shades to highlight the text should not have been selected. Practicality and user guidance may be achieved by setting the whole text in bold or in italics in a black text color. Even other options to highlight are conceivable.

Problem: The unprofessional use of font sizes and colors causes the homepage to seem cheap and multicolored. This contradicts the high quality standards claimed by this Healthcare portal. Because the images appear quite colorful, the content has to stimulate smooth reading by clear, steady, topic-related design. Such design aspects interfere with the acceptance of the portal.

Arrangement of the topics

The topics arranged next to each other should be sorted according to content too. At present, there are tips next to self-tests, symptoms, games and a beauty quiz. The contents of this Content Management System lack completely of thematic order on the home page. This leads to a loss of orientation.

The situation on the subpages is similar. Moreover, medical information is even interrupted by adverts positioned right in the middle of the content area. Figure 08 presents adverts in the middle of the text. This can result in losing the advertising effect.

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Figure 08
Adverts separate medical information in the content area

The readability of the text is not the focus of Figure 08, but rather the presentation of the advertising material between the medical and health-oriented information.

Problem: The disorganization of the topics offered in the content area of this home-page eventually does provide an inside view of the variety of information, but if a targeted search is intended, the main navigation will have to be used. However the main navigation is far too packed. Many contents listed here can be found several times, bloating this portal further.

This Healthcare portal shows exemplarily what mistakes are made when designing Content Management Systems. The acceptance of Healthcare portals may be adversely affected by user-unfriendly surface design.

Subsequently, the management of this Healthcare portal was asked for permission to indicate their basic errors by means of this example and to allow research work on the influence of the design elements.

After consent was given by the Managing Director, Herr Marc Schmitz of gofeminin.de, the research topic “onmeda.de” was set. The reason is that the thorough analysis of perception psychology aspects of the user-friendly usability has proved the clear potential for improvement.

Who is behind “Onmeda.de”? It is a platform run by the gofeminin.de GmbH. In 1997 scientists at the Berlin Charité Hospital and at the Max Planck Institute founded the Healthcare portal “Medicine-worldwide.” In 2004, that portal was taken over by the OnVista Group of Cologne. In 2005 there was a relaunch and the commercial launch of “Onmeda”. In 2008, eventually, On Vista sold its platform to gofeminin.de. Today, “Onmeda” is a subsidiary of the French corporation aufeminin.com, in which the Axel Springer AG holds a majority stake. [34] Onmeda is financed on the one hand by advertisements and on the other hand by licensing contents to third-party providers.

The website is cared for by six specialist editors and medical journalists as well as further experts of different specializations. More than 30 doctors and experts of other specializations are available for advice to be given in the online forums.

1.3 Standards and rules for designing Graphical User Interfaces

Graphical User Interfaces are processed today differently than 20 years ago. One decisive factor constitutes the variety of information provided online. In this respect, many people of completely different sociodemographic, geographic and psychographic structures and cultures as well as of different esthetic perceptions are addressed.

Healthcare portals reduce those user groups by selecting their national languages. Even though some platforms offer translations of their sites, there is no basic modification of the layout. So, standards have to be developed that consider the different user groups mentioned above.

User-friendly standards need to be integrated representing universally valid insights gained from perception and the gestalt psychology [35]. The aspects for the design and perception of Graphical User Interfaces will particularly be taken into account.

1.3.1 Problem statement

Graphical User Interfaces of Healthcare portals need to be manageable, clearly arranged and easy to handle. [36] Nevertheless, the differences between the user structures must be considered too. All users shall be able to get a quick orientation to continue being a visitor of the platform in question.

This is particularly important with Healthcare portals as user structures here could not be more diverse. However, the explanations, tips and the contents of the databases offered are by all means important for patients and health professionals. Thus, a very high proportion of the population of a specific country or region is addressed.

All Healthcare portals show completely different structures. They are partly incomprehensible, inconsistent and little matched with the needs and routines of the target group. Users will decide within a very short period of time if they continue searching for the information desired on the current portal or if they leave the Portal and try a different communication platform. The acceptance of high-quality Healthcare portals may vanish or be not strengthened at all.

There are many platforms providing medical and health-oriented information. They do not need to be certified. If the content is not reviewed by external experts—i.e., a recognized certification is missing—users may have trouble evaluating the quality of the information given. If, on the other hand, a Healthcare portal undergoes the permanent control and supervision by neutral, external specialists and obtains the confirmation of their high quality standards by certification, this important statement should be displayed in the upper position of the homepage when the user enters the website, so the user can find the important information quickly.

Certified Healthcare portals should exhibit a unified construct implementing manageable and clear user guidance for the group of its users.

1.3.2 Basic gestalt principles of perception and design

The user friendliness of interactive interfaces is reflected in successful user behavior and the positively experienced quality of use. [37] The scientific definition frequently identifies “user friendliness” as “serviceability,” which represents the original meaning of “usability”—in contrast to “user-friendly.” [38] However, the term “user friendliness”

emphasizes intuitive and emotional aspects of the usage experience. So, the term “User Experience” includes more likely the perceived user experience best. [39]

Attention should now be focused on important aspects of perception.

1.3.2.1 Perception

When speaking about the perception of information, it does not exclusively refer to visual perception but to the interpretation of the data available by interacting with attitudes, notifications and experience of the other sensory organs. Thus, the human perceptions are not objectively true but always constitute synergy effects of different, individual data evaluations. [40] [41]

However, the effect of memorizing and retaining information is higher if several perception channels are addressed. On average, information is memorized as follows:

Information that has been exclusively read	10%
Information that has been exclusively heard	20%
Information that has been exclusively seen	30%
Information that has been heard and seen	70%
Information that has been said by oneself	80%
Information that has been said and done by oneself	90% [42]

These values deliver a rough orientation and do not take into consideration the specific perception situation and the quality of the information given. Basically, perception based on input from several channels is more sustainable than perception based on only one. [42]

Just the visual perception of text together with pictorial/photographic amendments, the integration of videos as well as graphical expositions reinforce the memorability of information considerably. In this case, several channels are enabled.

1.3.2.2 Modes of perception

The reception of environmental information is allowed for by seven modes of perception

[41] which influence differently the memory of the information. They are as follows:

- Visual perception: Seeing (eyes)
- Audible perception: Hearing (ears)
- Tactile perception: Touching, feeling (skin, hand, mouth)
- Olfactory perception: Smelling (nose)
- Gustatory perception: Tasting (mouth, palate, tongue)
- Kinesthetic perception: Equilibrium regulation (vestibular system) [41]

On the one hand, information perception considers the specific advertising medium and the media-oriented information processing. On the other hand, findings, which helped to develop rules for gestalt psychology, facilitate information perception. Such rules constitute the gestalt laws for the visual information reception.

Quickly selecting important and unimportant information governs the human everyday life. The targeted search for the products wanted represents the selective perception. [43]

However, if new information is offered, the topical grouping of individual information is helpful. If the eye is not trained in this advertising medium and has not learned how to perceive selectively, the gestalt laws guide the eyes to summarized information units that are clearly separated from other topics. These gestalt laws apply to the design of all media—and particularly to Healthcare platforms.

1.3.2.3 The gestalt laws of perception

The human visual perception is facilitated by the figural and holistic reception of the information. These are research findings of gestalt psychology [44] based on research work on gestalt psychology by Christian von Ehrenfels in 1890. [45]

The subject of gestalt psychology was established at the beginning of the 20th century and was based on the observations made by Ehrenfels at the end of 19th century. Max Wertheimer, Wolfgang Köhler and Kurt Koffka contributed substantially to the results of gestalt psychology. At the beginning of the 20th century, they devoted themselves to experimental research in the field of perception. [46]

When considering visual perception more closely, the following definition for the gestalt laws applies accordingly:

“The laws of gestalt are regularities that may govern, influence or even deceive human perception (positively as well as negatively).” [41]

How do the gestalt laws now facilitate the reading and user friendliness of Healthcare portals? They increase and improve user friendliness by continuity, system and rhythmic composition of data. [41] Individual elements are grouped, whereas affiliation is characterized by common properties or systems of order. Some of the gestalt laws important for Healthcare portals will be explained by means of examples below:

Gestalt law of proximity

Content and elements belonging together should be designed close together. They are presented in a system of order (sequence, grouping, stacking, scaling and others) [47]. In contrast, elements and content not belonging to one topical or hierarchical unit should be separated from the other group by free space. [41]

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Figure 09
Application of the gestalt law of proximity to the newly designed Healthcare portal

The readability of the text is not the focus of Figure 09, but rather the clear presentation of content-oriented navigation units as a screenshot of the newly designed portal.

Figure 09 shows a clear structure of the text links and buttons and a clean, content-related assignment to different topics (red frame).

The Healthcare portal “Onmeda” (called Portal A) shows many deviations from the rules of design for user-friendly interactive user interfaces. As a result, a new design for the portal “Onmeda” (Portal B) was developed on the basis of the established design rules, taking up all the design standards and rules and implementing them in a completely new layout with a new content structure.

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Whereas the information on Portal B is grouped as units, the content-based classification of the topics and the grouping of the thematic areas on the original Onmeda portal (Portal A) are completely lacking.

The framed topics form a joint hierarchy level and are, therefore, in closer proximity to one another. At the same time, they show the distance to other information units by being placed farther away.

The use of dividing lines creates the clear content-related distance to other information units.

They are perceived as one picture, figure or group. This common feature is additionally supported by integrating the gestalt law of similarity.

The picture is different when it comes to the platform www.onmeda.de. There is no topical assignment of the contents and of the visual grouping to one information unit. Topical information is placed in a disorderly manner next to each other.

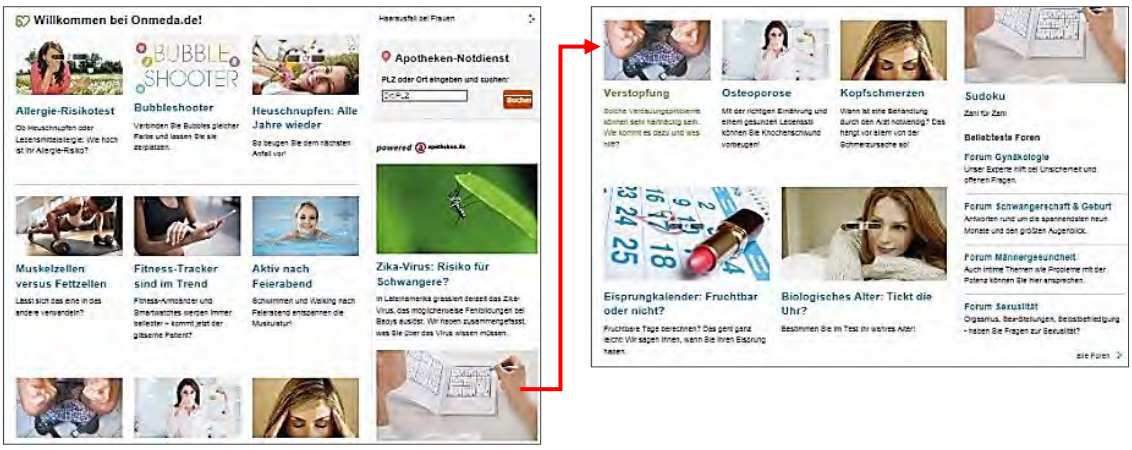

Figure 10
Gestalt law of proximity on www.onmeda.de

The readability of the text is not the focus of Figure 10, but rather the allocation of information to an information unit and the arbitrary and partially unnecessary assignment of photos—basic illustration of the gestalt law of proximity (related information).

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The whole of the colorful photos and graphics as well as additionally the colorful text causes the loss of a clear arrangement, and the objects belonging together do not undergo cognition as a group, which is illustrated in Figure 10.

Although consistent text formats have been selected, they do not receive gestalt-psychological perception as an overall picture.

Gestalt law of similarity

Associated content or navigation elements show their consistent hierarchy or their topical reference by means of a similar design of color, size, same attributes of graphical characters and the design elements. This gestalt law is frequently also called the gestalt law of similarity. [48]

Figure 11
Application of the gestalt law of similarity to the newly designed Healthcare portal

The readability of the text is not the focus of Figure 11, but rather the illustration of the gestalt law of similarity.

Figure 11 shows a clear structural presentation of the contents belonging together, taking into account the gestalt laws.

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The design of the framed information units is very similar. Typographic information units are characterized by identical font size, typeface, style, line spacing, font color and—if available—by a similar background color. They show the same distinguishing features regarding their surroundings. [48]

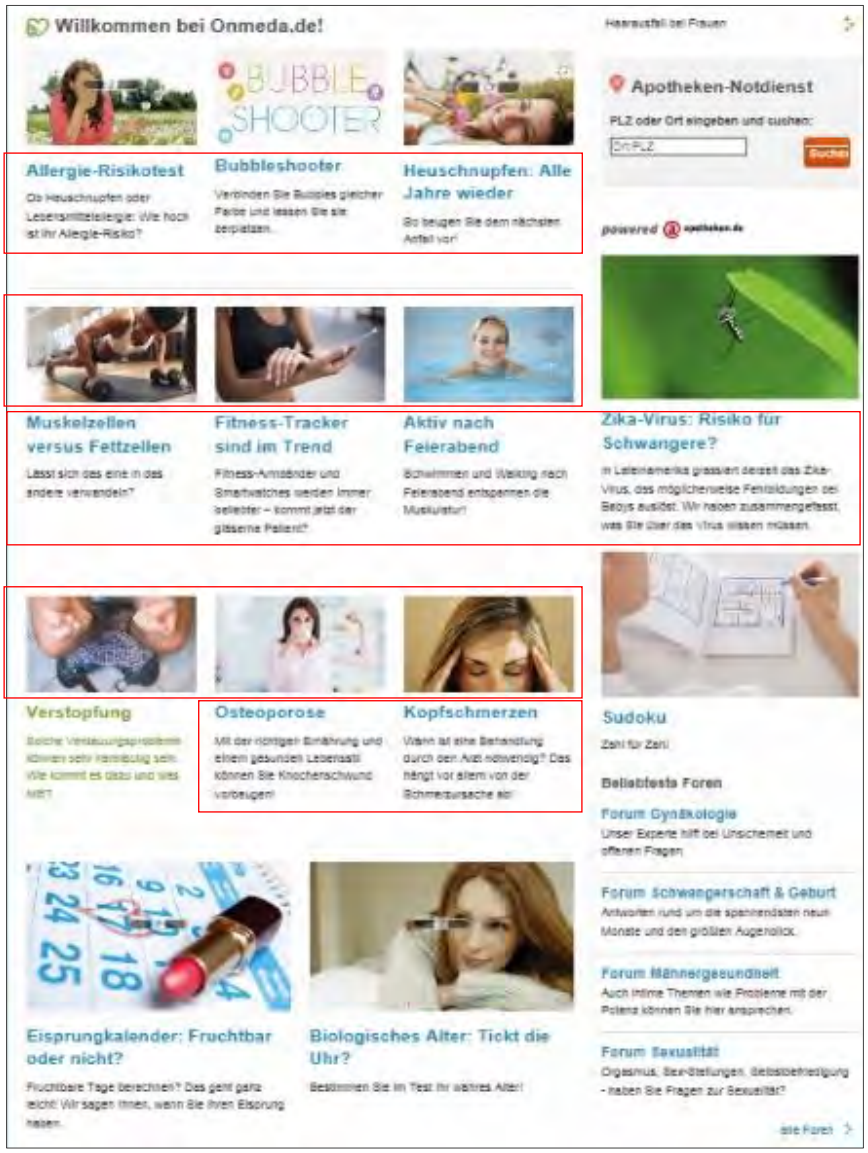

Figure 12
Gestalt law of similarity on www.onmeda.de

The readability of the text is not the focus of Figure 12, but rather the similarity of the body text of the same hierarchy, of the headlines of the same hierarchy and the composition of images of the same hierarchy.

Figure 12 shows the missing possibility to allocate contents belonging together. The text links are arranged randomly and do not take into account the gestalt laws or experiences resulting from gestalt psychology.

Similar visualization causes the specific information unit to be perceived as a closed body, as a unit, as a group, and is automatically regarded as being differently designed compared with the units lying close to it. [48]

Again, the design on www.onmeda.de (Portal A) is different. Although one can find the assignment of similar design elements, they again present different contents. As regards content, allergy risk evaluation tests are mixed with information on the Zika virus, ovulation calendar, headache, Sudoku games, constipation, osteoporosis and others. Content is presented without showing any kind of structure and topics are randomly positioned.

Gestalt law of closure

Related elements and objects within closed outlines, frames or fields on colored backgrounds are perceived as one information unit and form a closed group. [49]

The mechanism of gestalt psychologic closure also works even if the frames or fields are not completely delimited on all sides. The human brain falls back on visual experiences and parallels and complements missing pieces that the brain is able to assemble to a well-known form. [49] These findings contribute to further gestalt laws such as the gestalt law of past experience, the gestalt law of common fate or the law of continuity. Other laws of gestalt psychology will not be further discussed at this point as they do not play any or only a tangential role when specifically designing Healthcare portals.

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Figure 13
Application of the gestalt law of closure to the newly designed Healthcare portal

The readability of the text is not the focus of Figure 13, but rather the delimitation of similar contents in the navigation units.

Figure 13 shows the assignment of topics belonging together to a closed unit visually separated from the next topic by space.

Considering the currently active Healthcare portal Onmeda the absence of closure is evident.

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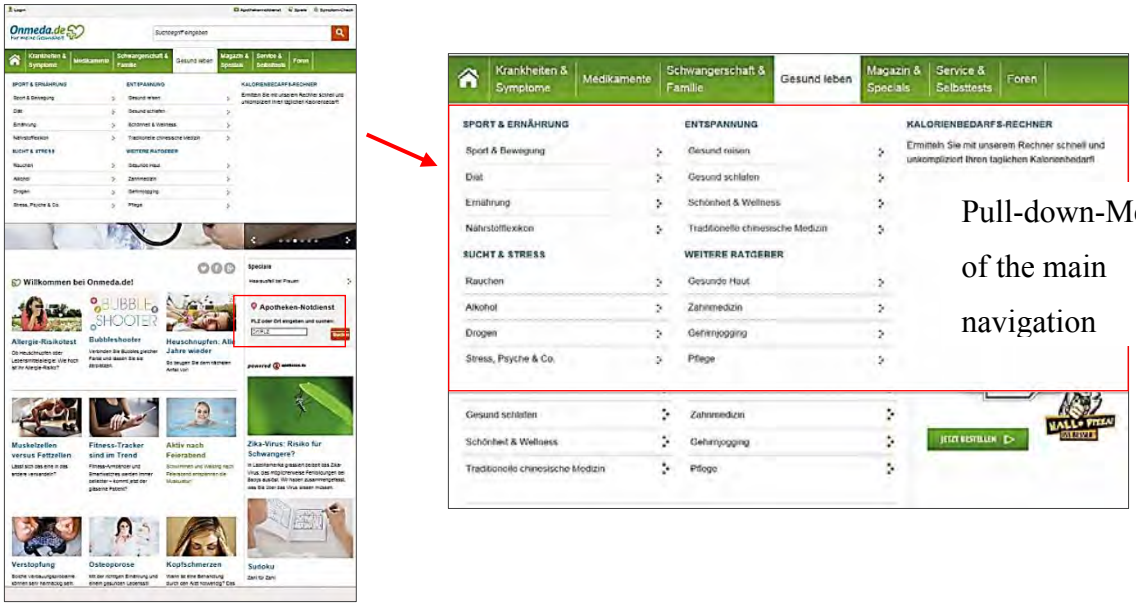

Figure 14
Gestalt law of closure on www.onmeda.de

The readability of the text is not the focus of Figure 14, but rather the delimitation of unstructured contents and of the navigation units displayed here twice for the original portal Onmeda.

Figure 14 shows the missing unity of topics belonging together as an information unit. The red frames identify the arbitrary amount of text and positioning of buttons and database queries.

Only the pharmacists' emergency service is separated from other information. Postal code search on gray font may provide the specific pharmacist offering emergency service at a particular time. This highlighting serves the sole purpose of increasing attention. However, it does not form an independent group.

When performing MouseOver operations, the main navigation inverts its color, which interrupts the unity of the navigation bar. In addition, the Pull-down Menu covers a large percentage of the lead picture, which appears to be rather annoying.

The enlargement on the right side of Figure 14 shows the Pull-down Menu of the main navigation unit. There is no topical separation here either; no aspects of the gestalt law of closure can be recognized. Each button within the navigation unit, as well as the entire navigation unit, should show the associated contents of the other buttons or navigation units by means of a clear demarcation. This is missing in Portal A (Figure 14).

Each button instead shows limitations to the top and bottom.

As soon as several gestalt laws are taken into account within an information unit, a mechanism will gain the upper hand. This mechanism will predominantly provide for perceiving the elements as a group. [49]

These aspects are to be considered when developing the conceptual structure of Internet platforms—this is also the case with Healthcare portals.

1.4 Screen design of Healthcare portals

ISO 9241 (English version: DIN EN ISO 9241-210:2011-01, Beuth Publishing House, "Ergonomics of human–system interaction" —Part 210: "Human-centred design for interactive systems," ISO 9241-210:2010) regulates the application of different standards to guarantee the ergonomics of interactive systems. Part 9241–110 "Dialogue principles" is especially intended for ensuring the serviceability of websites. There are seven basic principles laid down, which will now be introduced in parts taking the requirements relative to Healthcare portals into account. [50] The objective is to accompany the user with "... a little time, patience, memory and transfer services to the target." [51]

1. Suitability for the task
   Clarity of the product and information, communication with the website owners

2. Self-descriptiveness
   Giving orientation with the help of reference points provided and immediate transparency with the help of page hierarchy ("Where am I coming from?," "Where am I?," "Where can I go to from here?"), and predictability implements the purposeful controllability of navigation by clear localization of position as well as distance to the target [52]

3. Conformance to expectations
   Human perception is based on cognitive, psychological-behavioral and psychological-learning factors; fast registration of information might be supported by incorporating uniform patterns of content presentation and functions/navigation; inexperienced users adapt faster to new patterns of the web application, experienced users make much higher claims against conformity and have higher expectations when
   visiting websites for the first time [53]
4. Fault tolerance
   Different faults caused by the users or those they might come across [54]
5. Controllability
   Owners should give confidence and security to their users on how to handle the probably new website. This can be reached by clear topical assignments, possible use of different media, permanent accessibility of the start page and more [55]
6. Individualization
   The possibility to adapt the system to the "...requirements of the work task...," the users' individual preferences, as well as usability, are paramount [56]
7. Promotion of learning
   Inexperienced/untrained users should be offered assistance with complex websites helping successfully to complete the users' interactions (even if performed slowly): page layout needs to be logical, logical processes need to facilitate user guidance, help pages, FAQ, guided tours, visual guiding [57]

All these factors are supported and strengthened by design aspects. The layout of each page alone of the Healthcare portal needs to be clearly structured and separated according to the different contents of the topics.

1.4.1 Layout design

The topic fields are self-contained (by applying the gestalt laws) and form a clear pattern. This pattern helps users to find orientation and to abstract from the homepage their learned behaviors and apply them to the other subpages. [58]

The expectation to be able to transfer the behavioral patterns and structures learned to other subpages influences the successful use and the user's well-being while using the website. [59]

A clear orientation of the information is part and parcel of the user-friendly design of online platforms, i.e., vertical axes should be used that result from buttons, information in textual form or the arrangement of photos/graphics. Order-based alignment of the presentation media to the axes facilitates reading guidance. The user gets the feeling of being guided, which may create the user's well-being. [60]

When speaking about the layout of Healthcare portals, primarily the concordance of the basic layout of all pages has to be taken into account. Even if there is a large variety of templates (preprogrammed and premodeled) already offered for Content Management Systems—which are virtually predestined for Healthcare portals—the question arises whether a template can be found that may be exactly appropriate for the planned or adequately adaptable content.

In the late 1980s and early 1990s, experts from the fields of perception psychology, media psychology, psychology, design, ergonomics, media design, computer sciences and programming developed a set of rules for printed advertising media as well as the development of user-friendly user interfaces on the Internet. This set of rules is the standard for all related fields of study and training in design, media and programming. Here, recommendations and standards are specifically declared for printed and interactive advertising media to ensure fast, unconscious perception of the information and cognition by the customer or user. Examples of this are given in the list of sources as specialist literature for study and teaching, such as "Kompendium Mediengestaltung—Konzeption und Gestaltung für Digital- und Printmedien," "Farben—Natur, Technik, Kunst," "Kompendium Mediengestaltung" and others.

The most important aspects for a user-friendly user interface are explained below.

1.4.2 Color concept

The corporate design color of the portal is of primary importance as the dominant color. This color should be found again as a leading function on the buttons or possibly with the headlines. Because color on online platforms is supposed to guide the users' eyes onto

information belonging together or the important one, color has the particular responsibility to guide as a color-coding system. [61] If there are many colors used, they may lose their guiding function and the users' eyes may wander around between different color information with no orientation. If, apart from the corporate color, achromatic colors (tones between black and white-gray tones) are applied to text, buttons and graphical elements, the application will obtain a clear and well-arranged contents presentation. This is very important for targeted information search. [61]

Should different sections on the Healthcare portal receive different colors as specific color code systems, it is recommended to select differing tonal values—based on the corporate color. The dominant green tonal value on the Healthcare portal "Onmeda" may be brightened up by using white or darkened by using black. The result would be different color shades that will integrate into the portal's overall color concept seamlessly. The selection of the color concept influences how the website is sensed—a process running unconsciously to a large extent. [61] Therefore, color harmonies and harmonic color tones are to be selected carefully even with the design of Internet portals.

1.4.3 Typography

The selection of typefaces and font sizes is particularly important. The text conveys the main information. Because Healthcare portals are exclusively visited online, the monitor takes over the function of the output device.

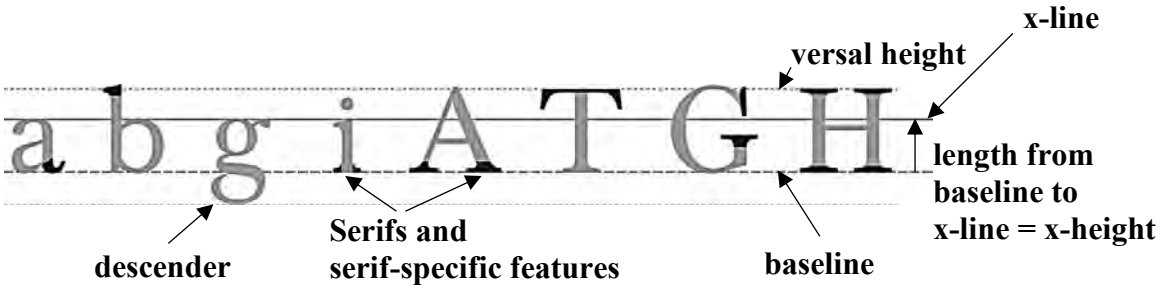

Figure 15
Ductus of the characters

The "...typical computer-to-plate resolution..." for print media is 2540 dpi (dots per inch) [61]—sometimes a little more. Monitors are capable of displaying between 72 and 96 ppi (pixels per inch) [61]. Because of the low resolution of the screen, the serifs of some serif fonts break off, curves are displayed as jaggies from aliasing, fine details of the individual

writing characteristics get lost, letter spacing may look inconsistent/unbalanced.

Overall, the typeface runs very filthily, restlessly and unevenly. [61] This is the reason why websites should exclusively use sans-serif fonts.

Figure 15 shows what characteristic features have to be watched out for (characteristic style) when selecting the appropriate font for the Healthcare portal.

The extension of the *x*-height in proportion to the total height of the capital letter influences the size effect of the font. If the body text shows a high *x*-height, the user's cognition of the information in textual form will be made easier. The objective is to optimize readability by selecting the font appropriately and esthetically.

The body text on websites should never be displayed smaller than 10 pt (1 pt = 0.3528 mm). [61] 11 or 12 pt [61] are more readable—dependent on the font selected and the corresponding x-height. Is the x-height smaller in proportion to the size of the versal letters (e.g. only half as long), the font size is to be increased accordingly.

Headlines should be completely different from the body text, but should not be too "eye-catching." The font color should be clear and achromatic (and not colorful) to strengthen objectivity and integrity of the information given.

Apart from the selection of suitable fonts and font sizes, the color contrast to the text backgrounds, the text length per line, as well as the amount of text, play important roles. The monitor's light emission may cause black text on a white background to appear radiant. Moderately colored/achromatic backgrounds (up to 10% tonal value) are to be used to counteract.

Body text should be placed on colorless or achromatic (or slightly colorful) backgrounds. [61] The contrast between font and background needs to be sharp, so, pictorial backgrounds or color gradients should be completely avoided.

Short line lengths support readability. There should not be more than 50 characters per text line. [61] If longer texts cannot be avoided, they should be introduced by "lead headlines" (teasers). [61] Summaries may be amended by "Please, read more ..." This enables the user to go deeper into the topic. [61] Text modules are to be arranged in small manageable units and blocks. [61]

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1.4.4 Embedding graphics and photos

Embedding photos and graphics requires attention to the use of consistent sizes, orientations and axis alignment toward texts and buttons. The picture motifes should be meaningful and should be selected according to the target group and topic.

The output on smartphones and other mobile output devices should be based on the development of an application in responsive design.

1.4.5 Tonality

Healthcare portals have to consider the assumed knowledge of the target group. If the visitors of Healthcare platforms do not show any previous medical knowledge, the formulations, lengths of sentences and use of technical terms have to be adapted accordingly.

This applies to both the information in textual form and the offered apps, self-tests, games and more.

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2 Objectives

On the basis of one Healthcare portal, the design factors influencing the usability are to be examined and derived, i.e., which design factor takes which weighting. It is the objective to derive recommendations for the new set of rules and to determine a priority list of the importance of design aspects by observing user behavior. The question arises:

"Could design-oriented placement of objects and content improve the acceptance of Healthcare portals?"

The following aspects will be studied: typography, volume, font size, font color, selection of images, image size, image positioning, image section, picture arrangements, extent, structure, content of navigation, compliance with corporate design, content, size, placement of adverts. By integrating the knowledge of screen design and the development of user-friendly interfaces, the sphere of influence will be investigated with the objective of deriving from the research results a basic set of rules.

2.1 Project description

The online Healthcare portal "Onmeda" represents Portal A. As a comparison object a new Healthcare portal "Onmeda" was designed and programmed showing a different layout and a modified structure. Because of the massive size of the current platform described above, 73 Internet pages were completely remodeled and programmed and shown to the test persons for comparison. This application (Portal B) may be accessed online under the domain www.phd.manuelakrauss.de.

On the basis of these two portals of the same content, an empirical survey within the group of users was carried out that evaluates the influence and usability separately. Both platforms provide identical contents, however, they show different layouts, different attributes of the presentation media and are, as far as their topics are concerned, clearly and verifiably assigned.

To record the behaviors shown by the test persons, the eye-tracking hardware and software "Gazepoint" was purchased. The eye-tracking device is equipped with a camera and is able to record eye movements. The hardware is placed below the monitor so that it is immediately directed onto the eyes of the test persons. The hardware "Gazepoint 3" transmits infrared light to the retina. Reflection is caused (glitter).

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The previous calibration enables the 60 Hz camera [62] to recognize eyes' and pupils' movements and the glittering is used to calculate the look (X and Y values). These are displayed as points on the monitor. A layer of the eyes' points is placed onto the visible picture of the monitor. In addition, the coordinates, times, resting times as well as the video sequence and the display output are stored in a csv file.

Each participant requires individual hardware calibration for their eye positions and possible eye movements. After having completed the calibration successfully, the specific behavior of the test person in question can be subsequently recorded.

Figure 16
Eye-tracking hardware below the monitor for recording eye movements

Figure 16 shows the structure of the research workstation with the installation of the Gazepoint hardware.

The Gazepoint software now records the participants' eye activities. After a first introduction of the research project, the participants' have three minutes time to get familiar with Healthcare portal A and to gain a quick impression of its usability. This is followed by two tasks where medical information is to be found. So, the participant gets used to the structure of the application. After having solved the two tasks, the test person gets an impression of Healthcare Portal B. Here another three minutes may be used to navigate and learn something about this portal. Afterward, the participant is asked again to solve two tasks, i.e., searching for medical information on this new portal "Onmeda" Portal B.

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Figure 17
Exemplary recording using Gazepoint

Figure 17 shows the sequence of gazes and eye movements of the test persons as video recording in Gazepoint.

Subsequently, the Gazepoint recording is stopped and the test person answers the questionnaires where their personal weighting of the design aspects of both portals compared are asked for.

The time scheduled for one participant is circa 35 minutes.

After the empirical survey of all the participants' recordings, data and executions, the export functions of Gazepoint are used. Then, the eye movements of each participant are evaluated. The program analyzes actions within the first 10 seconds, after one minute and after three minutes, namely scroll behavior, eye positions and movements and much more for both portals.

The research director generates *.prj files and *.csv files in Gazepoint for further processing in MS Excel. The specifications given in the columns FPOGX (fixation point-of-gaze [63] x-axis) and FPOGY (fixation point-of-gaze [63] y-axis) show the viewing positions directed to the Internet page at time t. This enables statistical evaluation.

The generated project file is supposed to hold together all data recorded (user data and recorded data). The recorded data include the respective current screen as well as the eye positions.

The research documentation is to support or refute one's hypothesis. Furthermore, there can be expected a hierarchy of the design elements influencing the usability of Healthcare portals. Personal data on the participant's gender, favorite color, particular lifestyle etc. might help to classify basic reading behaviors.

2.1.1 Objectives of this research project

The objective of this research project is to find out if different clusters of test persons show different viewing behaviors when visiting Healthcare portals. Is it conceivable to derive from them design aspects aiming at different target groups? Is it possible to work out a set of rules representing a layout basis and implementing font attributes, the number of colors to be used, image sizes and image placements?

May similar structures, user guidance and similar layouts facilitate information search on Healthcare portals? Will users be helped if they find familiar usability on different medical platforms?

What influencing design factors may support or hinder information reception? Are there any positive or negative effects caused by using design objects?

Can the service provider, therefore, expect certain effects—such as an increasing use of the portal? What benefits are derived for the service provider if acceptance is increased? What contents, positions and kinds of product placements and companies' advertising are accepted by users or even desired? Does the number of advertising companies influence the image of the owner or operator of the specific portal?

What services are requested by users? May a too extensive range of products and services negatively influence the acceptance and use of the platform?

At this point, attention shall be drawn to the health insurance companies. There lies a large potential for giving information on disease patterns, on how food can influence the course of a disease and on healthy lifestyles. Publishing recent research advances may help to overcome the outdated understanding of the effects of specific foods on the human

body. Healthcare portals may contribute a lot to healthy lifestyles. This also includes the specific use of exercises to heal initial physical ailments or preventively to stabilize one's health. Healthcare portals already perform all these works and save the health insurance companies considerable high cost and time investment. Nevertheless, the new set of rules for the design of Healthcare portals may bring much more acceptance, may save more cost and strengthen the health of the people. Research results prove [64] that healthy people live happier lives, like going to work and actively make the most of their free time.

2.1.2 Research gap

None of the research projects mentioned above and researched on an international scale investigates the design factors influencing the acceptance of Healthcare portals and aimed at developing a fundamental set of rules for the design of medical platforms. This set of rules is to list the influencing design objects, i.e., what design aspects have to be considered, particularly by operators of Healthcare portals.

2.1.3 Hypothesis

The structure and design of Graphical User Interfaces substantially influence the acceptance and use of the products and services offered. Modifying the properties of the design objects will increase the use and improve the acceptance of the research object "Onmeda." The currently valid design standards for websites are applied and serve as a basis for the newly developed design and structural as well as content-related topic assignments of the Healthcare portal "Onmeda" (Portal B).

Broadly spoken, the design concept, tonality to the group of participants as well as clear user guidance and comprehensible structures are decisive factors for reducing or improving the acceptance of Healthcare portals.

By elaborating a single set of rules dealing with the design of Healthcare portals, the handling of different Healthcare portals may seem familiar to the user. Ergo, users will prefer various portals featuring similar structures and design.

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2.1.4 Prognosis

It is expected that test persons, by comparing the two "Onmeda" Healthcare portals (Portal A and B), will consider Portal B to be the more user-friendly portal. Thereby, they will assess font attributes, coloring concepts, image attributes and the contents structure.

Likewise, it is being predicted that the test persons, solving the tasks on Portal A, will have considerable problems, and that the desire for clear structures will be awakened.

The diversity of different information offered, such as medical information, health tips, self-tests, games, databases with pharmacists' addresses and emergency services, databases with doctors, magazines, different forums and communication platforms and much more will make participants insecure and awaken the desire for less information. These research results are to be expected and therefore help to create the corresponding set of rules.

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3 Methods

3.1 Methods and approach

This research project pursues the qualitative research approach and applies different methods. The two research methods, induction and deduction, appear to be extremely interesting.

Scientific findings will be gained by induction for one part of this research work and by deduction for the other part. The actual implementations will be described in Sections 3.2.1 to 3.2.4. [73]

Overall, Structural Equation Modeling appears highly suitable for the visualization of the priority list of the individual design elements. SEM is a very precise statistical model in which several values can be compared by either deduction or induction.

3.1.1 Induction

Induction represents a bottom-up method where the findings of one particular participant are kept hold of and combined with each other. It is possible to combine several data and individual decisions. [73]

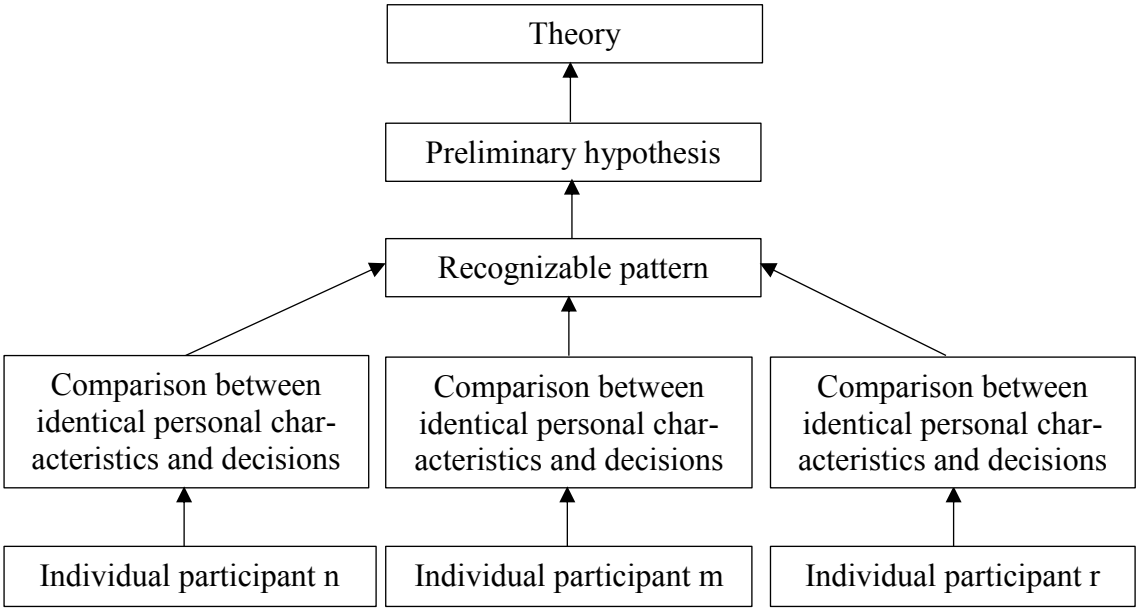

Figure 18
Method of induction (Bottom Up) [73]

This model (Figure 18) is based on the expositions stated by Balzert, Schröder and Schäfer and was adapted by the author. [73] It shows a possible presentation of the results.

This approach is likewise considered for all the other test persons in each possible combination. Are there any specific patterns revealing similar decisions, for example, with test persons of the same gender and the selection of the better coloring concept of the reference portal?

At this time, there is no prognosis on the result to be expected as possible results are absolutely open and a hypothesis cannot be proposed.

3.1.2 Deduction

Deduction is a theoretically oriented research approach that requires conditions that have to be specified and have to be determined as directly designed influencing factors. [74] Several "IF components" are specified from which the effective quality components "THEN components" develop.

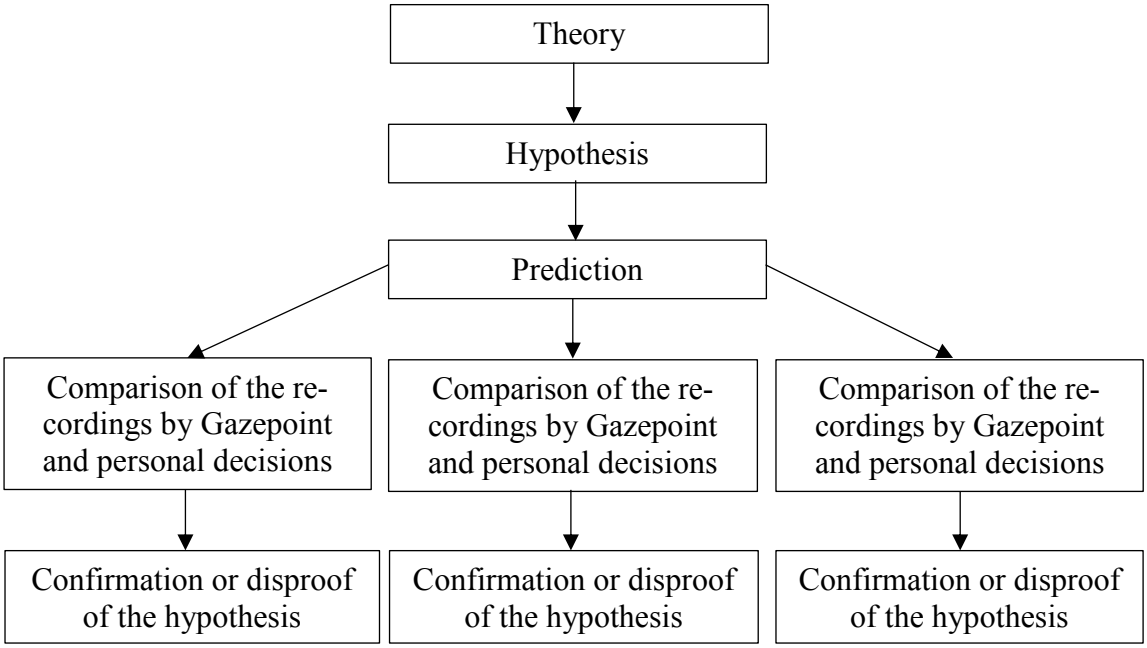

Figure 19
Method of deduction (Top down) [73]

Figure 19 shows a different possible presentation of the results for the evaluation and development of a new set of rules. Both methods will be incorporated and used for the evaluation and assessment of the results.

This method is excellently qualified for scientific research with the presentation of hypothesis, prognosis. The objective may be to confirm theories. [74]

In the center there are the relations of the discoveries as an explorative demonstration of the cause–effect relations that, in the course of this theory development, lead to the hypothesis. [74]

The examination setup applied here [74] is to lead to knowledge production of the hypothesis:

The participants find the usability of Portal B more user-friendly and more structured than Portal A.

This hypothesis may be confirmed or disproved. It is possible too that some individual results will support or contradict the results found in some areas of the hypothesis. This will be incorporated as a top-down method.

3.1.3 Structural Equation Modeling (SEM) [75]

The results to be assessed and measured have to be presented in a construct of theoretical and intellectual nature. This is the way to enable the results of the research work to be measured. This process is called operationalization.

To visualize the construct for operationalization a model needs to be developed. In this research project, the presentation is based on the Structural Equation Model.

Therefore, it is necessary to define the following elements as parts of the Structural Equation Model [76]:

- Indicator (Item)
  The variables concerned are single observed ones that blend into the factor. The measurable results are incorporated and condensed. These are a part of the latent variable. [76] (δ_1–δ_7)
- Latent variable (Factor)
  The factors blend into the observed variables. They are gained from the indicators. The individual factors blend into the measurement model as variables. These factors may be either independently latent (exogenous) or dependently latent (endogenous). Frequently, there is no measurement procedure that implements an objective factor analysis. [78] (ξ_1–ξ_3)

- Measurement model

  In this model the results from the latent variables blend in. Connections are modeled between the indicators and the latent variables. [77] At this stage a vague statement is made as an interpretation of the covariance (which random variables go together with which other random variables). [79] (η_1)

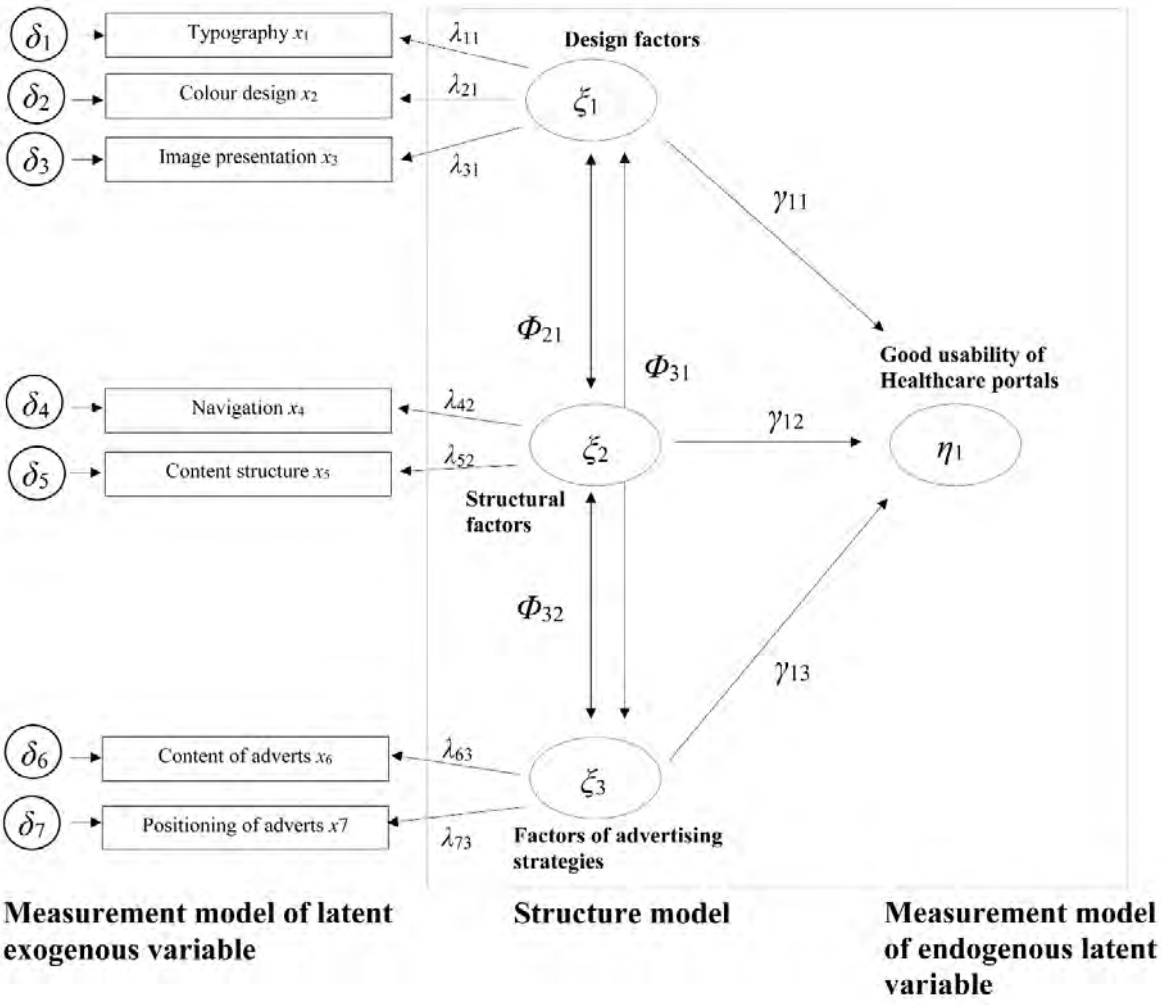

Figure 20
Path diagram for SEM [80]

Figure 20 shows the presentation of the results in the SEM.

The latent variables of the design factors, structural factors as well as advertising-related factors constitute a nonstandardized measure of association. Stochastics call the latter covariance [78] and describes the monotonic link of two random variables with a joint probability distribution. [79]

λ_n designates the relations and the influence of the latent exogenous variables on the respective factor. Within the factors, the variables obtain a distinction of significance for the user.

γ_n shows the influence of the respective factor onto the usability quality of Healthcare portals.

Because of the calculations, the weighting of the indicators may represent a comparable measure. The assessment of the results may be used for the hypothesis-based research work.

3.1.4 Alternative statistical data analyses

The analysis and evaluation of the data obtained need to be based on an appropriate statistical procedure. In the process, it must be observed that bivariate or multivariate analysis methods are employed. Because both the inductive and deductive research methods are applied, the dependencies between the participants and the chosen variables or the interdependencies (mutual dependencies) need to be investigated. [81]

3.1.4.1 Causal–analytical and descriptive research design

The causal–analytical and descriptive research design is suitable for the hypothesis-oriented research methods. In this case, in advance, there is already a model-like idea existing about the confirmation or refutation of the hypothesis. It is necessary to work out the assumed dependencies between the indicators (variables) and the factors and to predict them. The descriptive method must be added to the descriptive statistics. [81]

3.1.4.2 Explorative research design

The research part of the combination of assumed dependencies as well as personal data of the test persons may be characterized by the explorative research design. Dependent and independent variables cannot be differentiated and there is no way to make a statement on the possible analysis result in advance. Despite the problematic statement of a prognosis, the direction for analysis should be specified. This procedure is counted as belonging to the evaluating statistics. [81]

The analysis methods described are used in each of the evaluation areas. In doing so, the dependencies as well as the interdependencies, are analyzed and possible patterns of the cluster of people are determined. These represent the basis for new findings to be derived.

3.2 Data protection and data security

The protection and security of the data collected are important aspects during and after the empirical survey. This research project is based on the voluntary and exclusively anonymized participation of the participants. So, there are only a few rules applicable.

3.2.1 Protection of personal data

At first, the term should be explained: Personal data are "…individual information about personal or factual circumstances of specific persons or identifiable persons …" according to the German Federal Data Protection Act (BDSG) §3 Abs. 1. [82] The protection of the informational self-determination additionally refers to "… individualized or individually adaptable data referring to an entity entitled to the fundamental right under discussion (German Federal Constitutional Court BVerfGE 67, 100 [69]) …." This is information that allows clear conclusions on the identity of a specific person. [82]

The data collected within the research work do not allow any conclusions on or assignments to the concrete identity of a particular person. They were obtained on a purely anonymous basis. No damage is caused to the vulnerable interests of the people concerned.

As at the end of this research a set of rules for Healthcare portals is to be developed declaring the fundamental layout, the design elements and their properties, public interest in the realization of this research project is the focus here.

3.2.1.1 Earmarking by explaining the research project

The explanation of this research project precedes the data survey in this work. The participants' voluntary participation in this research project shall be deemed as their consent. Each participant has the freedom of choice to take part, their consent is put down by the participant in the questionnaire in writing. [83] According to article 30 sec. 3 of the Berlin Data Protection Act (BlnDSG) and/or article 33 sec. 3 of the Hesse Data Protection Act (HDSG) the submitted data are strictly earmarked. By virtue of the contents of the data surveyed, any other type of usage is prohibited as stipulated by the BlnDSG and HDSG.

3.2.2 Protection of data collected

The data collected digitally are available as a Gazepoint project. That only the research director may access. Because the generated file can only be opened with this software, the surveyed data are placed as the entire project on this computer too.

The data collected analogically during the empirical survey are also stored separately in special areas, which are exclusively accessible to the members of the research group. This guarantees the "clean" and "classic" forms of data access. [84]

3.2.3 Data processing

The processing of the digital and analog information occurs exclusively in special areas and at computers that are exclusively accessible to the researchers. Articles 5a and 6 of the Berlin Data Protection Act allow the processing of personal data on the basis of the consent given by the person concerned.

The processing of data follows the statistical or stochastic methods described in 3.2. Methods and approach.

3.2.4 Protection of the evaluated data

The evaluation results are stored in a locked facility and only researchers have access. As a matter of course, for the presentation of the research results of Semmelweis University Budapest will receive the research documents and data.

3.2.5 Data storing and erasing

The access to and storing of the research documentations and research data will occur in close consultation with Semmelweis University Budapest. [85]

When the purpose of the data surveyed terminates or data processing is completed or further data storing is no longer necessary, all data will be erased (according to the German Federal Data Protection Act (BDSG) sec. 35 part 2).

3.3 Structure of the questionnaire

The preparation of the empirical survey includes several phases. After designing the new Healthcare portal "Onmeda," the participants' questionnaire needs to be developed. The latter is meant to hold the participants' evaluations after the direct interactive comparison of the initial portal with the new one. Afterward, the research workplace needs to be set up.

The questionnaire [Appendix 02] is filled in by the test person during the survey. As the participants should be aware of the contents and objectives of this research project, they are briefed before starting. They also receive privacy information on the exploitation or destruction of their stored personal data.

As the results need to be evaluable afterward and a definite statement can be made, the analysis criteria need to be defined in advance. Only after this procedure, the questions and the evaluations of the participants' answers can be declared.

3.3.1 Personal details of the participant

Analyzes and assignments according to individual personality characteristics shall be possible, such as:

- Gender
- Age
- First work contact with computers
- First Internet search work
- Favorite color
- Life philosophy/ /leisure activities:
  people of nature, technology enthusiasts, sports people, others

- Vocational training
- Kind and volume of usage of the Healthcare portal

Using these criteria, the assignment of the participant's behavior while searching Healthcare portals shall be possible.

These personal details facilitate the recognition of patterns. The intensity of the IT practical knowledge shall be combined with the answers to determine possible concordances. The answers or other personal details are combined with their life philosophy or attitude toward life likewise. To reduce different categorizations to a minimum, the classification into "people of nature," "technology enthusiasts," "sports people" and "others" has been chosen.

3.3.2 Development of the criteria catalog

The participants are asked two questions regarding each of the Healthcare portals. The clarity of the information given and the search for solutions should help the participants to experience an individual impression of the user friendliness.

Then the questionnaire [Appendix 02] is filled in where the participant's personal impressions are probed, such as:

- Comparison of the structures, clarity, transparency of both portals
- Comparison of textual perception of both portals (font size, amount of text, text length, hierarchical clarity)
- Comparison of coloring of both portals (texts and backgrounds, buttons, number of colors)
- Comparison of photos and graphics of both portals (sizes, position, picture motifs and choice of image sections)
- Comparison of navigation and linking of both portals (transparency of buttons and links, arrangement and user friendliness)

Using these comparison criteria, the participants are expected to make a decision for just one of these portals.

It is different with the following queries. The identical design aspects—but much more in detail—are queried.

3.3.2.1 Answer variants

Results as compared with the two Onmeda portals

Basically, the questionnaire allows different possible responses, however, they are standardized per set of questions and are evaluable.

On the other hand, it is important for the research project to obtain a decision on the better usability of one of the two portals. This is a completely subjective and spontaneous declaration because the participants are the users of the Healthcare portals. On the other hand, it is important to compare these decisions with the already known rules for screen design of Internet platforms and to identify current findings, which represent the basis for the new set of rules.

The decision for the more user-friendly design of a portal is expressed in percent (%). This number can be associated with the personal details of the participants to find concordances.

Results for the priority list

Furthermore, there is a range of questions with the valuation system usually used at schools. Here grade "1 = very good" means "1 = very important," whereas grade "6 = insufficient" means "6 = absolutely unimportant." The number of grading is multiplied with the grade itself. Thus, results showing small grades represent high importance for the user. Only these answers are included in the production of the priority list of the design aspects and are displayed in the SEM with the unit of the points figured out. The output in percent is not useful.

Additional requests made by the participants

There are some questions where additional responses are possible. These cannot be incorporated in the two categories above. In this case, it is important to find the concordances which may enter the new set of rules for the design of Healthcare portals.

3.3.3 Evaluation scale for determining the priority list

This additional detail is supposed to determine a hierarchical weighting by the participants for the different design criteria. The aim is, as a result of the evaluation, to obtain a list displaying the design aspects and their influences on the acceptance of Healthcare portals.

Furthermore, evaluations are included considering aspects of advertising strategies. The test persons are to decide what product and company adverts they would allow or want on Healthcare portals and what position of the adverts they would prefer, within or outside the portal.

For the later confirmative factor analysis with the help of the SEM, the latent exogenous variables are to be adapted to the weighting of the queries and marking in the questionnaire.

3.3.4 Setting up the workstation for the empirical survey

A computer running the operating system Windows 8.1 and two monitors were set up for the empirical survey. The left monitor is reserved for the browser display to be used by the participants, whereas the right monitor is reserved as control monitor for the recording of the participants' behaviors and the control of the Gazepoint software.

The use of the software requires the careful and exact individual calibration of the fixation points (recorded points) at the eye positions of the participants.

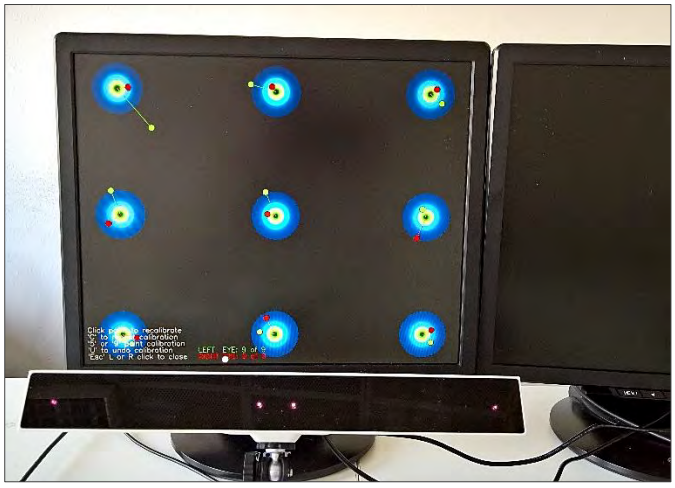

Figure 21
Calibration of the participant's eyes

Figure 21 shows exemplarily the calibration of a participant's pair of eyes. The research director has to pay attention so that the green points (left eye) and the red points (right eye) are preferably captured in the blue circle or even better in the white one. If there are several green and red points far away from the respective calibration point, the measurement needs to be repeated.

The example below in Figure 21 shows a good recording of the fixation points. Afterward, the recording of the participant's behavior can start.

3.3.5 Recording procedure

Before calibration, the participant reads the introduction, the purpose of this research project, and fills in the required information on the questionnaire. Then, the Gazepoint camera adopts the nine recording points to the participant's eyes. After successful calibration, the camera starts the recording of the visual behavior.

Now the participant is free to have a look at the first Healthcare portal (Portal A = the original Onmeda portal) for three minutes. They are expected to get a feeling regarding the usability of the portal. After the expiration of this time, they receive two tasks for targeted search.

After this, the test person uses the newly designed portal (Portal B) and, as a start, proves the usability for the identical period of three minutes. This time again they receive two tasks for targeted search for specific content. After having completed the task, the recording is stopped. The data recorded are saved in the research.prj file, which was created before. Any further recording complements the *.prj file by one new dataset. These data are the basis for the specific export.

At the end, the participant fills in the following pages of the questionnaire.

3.3.6 Users as participants

The nonmedical users represent the largest group of users of Healthcare portals. Attention was paid that the test persons showed different IT knowledge, different medical knowledge, different ages, education structures and occupational particularities. Sixty participants should be surveyed within this research project.

The participants are students, employees and teachers of further education measures and intensive training courses offered at the "Fachinstitut für Informatik und Grafikdesign."

The venue of the research is the "Fachinstitut für Informatik und Grafikdesign" in Storkower Street 158, 10407 Berlin. This institution, as an accredited educational institution with its technical equipment and administrative support, is well suited to carry out such a project.

The recruitment of participants is effected by notices and personal presentations of the research project by the project director.

3.3.7 Scheduled research period

The period from 1 October 2015 till 30 November 2015 is available for the practical qualitative research. The evaluation of the results should be done in December.

3.4 Organization

The sequence of the specific partial steps of the empirical survey needs to be specified. The participant has to be accompanied over the whole period if questions or technical anomalies arise.

3.4.1 Tasks for the participants

The participants receive two tasks per portal they should solve within two minutes.

The tasks for the original Healthcare portal Onmeda (Portal A) are as follows:

a) You are planning a journey to South Africa on your next holiday. You would like to get information about health risks and protection from sunburn. Please consult the Onmeda Healthcare portal on this subject.
b) When talking to a friend a few days ago, you learned that there were interesting tips for healthy food on the Onmeda portal ("10 rules for healthy nutrition"). You would like to know more about it and you are looking for this subject at this portal.

The tasks for the newly developed Healthcare portal (Portal B) are as follows:

a) When consulting your doctor today, he found out that you suffered from achalasia. You have never heard anything about this disease. You would like to know more about it. Please look for further explanations.
b) Your doctor recommended the medical check J1 for your son (aged 12). As you have never heard anything about it, search for suitable information about this check.

In total, 35 minutes should be scheduled for each participant.

3.5 Execution of the empirical survey

On 9 October 2015, the project was presented and explained personally in all training groups. Thereby, circa 75 potential participants and teachers were recruited for this project.

On the same day, the first participant appeared.

Because only one participant was able to use the research workstation at a specific time, time coordination for the use of the workstation had to be implemented. Because up to 30 November 2015 not all the interested participants could take part in this project, the period was extended up to 30 December 2015.

By then, further training groups, including teachers, had been involved. As a result, 157 potential participants had been addressed. Thirty-one interested persons decided to participate in the research project.

3.5.1 Collection of data

The data were recorded both as analog input and digitally. The analog information is the questionnaire filled in by the participant. Here, the results of the comparison between the two portals are retained. The participants were asked to evaluate them purely intuitively.

While directly comparing the portals and solving the given tasks, the hard- and software Gazepoint recorded the participants' behaviors digitally. The eye-tracking recordings of the participants were saved as a research.prj file. During the saving process the file was updated. The software numbered the participants automatically at the beginning of the digital recording.

As a result each participant received a unique ID. When the recording starts, three separate files are created:

1. the file containing the recording of the eye movements as (user ID)-face.avi,
2. the file capturing the screen content of the selected monitor as (user ID)-scrn.avi,
3. a compressed file as (user ID)-user.yml.gz [86] with the vector and time data (the unpacked file shows the (user ID)-user.yml).

3.5.1.1 Vector data

The user ID is defined as a counter by the program. From the start of the recording, the fixation points (separately by eye and additionally pupil) are allocated to the counter as FPOGY (Fixation Point of Gaze y-coordinates) and FPOGX (Fixation Point of Gaze x-coordinates). These points define the correct gaze detection/eye positions on the screen detailing the x and y positions.

The pupils' positions in the camera image are recorded separately as LPCX and LPCY data/RPCX and RPCY data (left/right pupil camera x-coordinates and y-coordinates)—separately for each eye. These x and y values are taken from the *face.avi and written into the *.yml file. Furthermore, the *face.avi analyzes the eye and pupil positions which appear framed as the output of the *.face.avi.

3.5.1.2 Time data

The length of the recording per participant as well as the residence time of the gaze within a limited area are being captured during recording and laid as a layer over the screen in the *.prj file. In this way, reading behaviors and interactions are analyzable.

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3.5.1.3 Visualization in a diagram

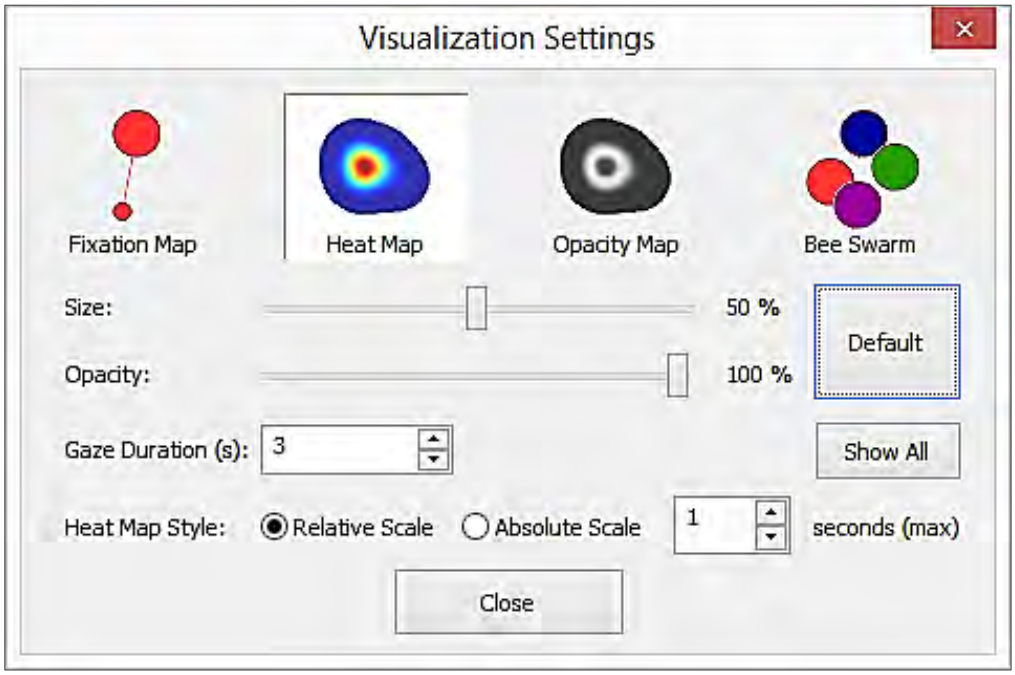

Figure 22
Settings for the representation of the participant's eyes

After the recording, the eye movements can be displayed in different representation variants, as can be seen in Figure 22.

The probands' recordings are visualized with the help of the four visualization options provided by Gazepoint to determine which option should ultimately be selected to deliver evaluable results.

3.5.1.4 Exporting the Gazepoint data

With the research.prj file open, the *.csv file can be created via the export function. There are the data from the video of the gaze movements, the respective screen image and the captured vector and time data. In this case, the FPOX and FPOY files are particularly interesting.

The *.csv file lists all data of the selected user and outputs them into Excel. The columns required—in this case, the columns with the FPOX and FPOY data—are highlighted, copied and pasted into a new Excel file. This file now provides the particular data of each user on eye steering on the two portals. The data can now be output in the form desired (diagram or similar) for the evaluation of the results.

3.5.1.5 Input and combination of the data collected

The data collected from the questionnaires are saved in an Excel file. They include personal details of the participants that can be traced to their gender, their IT knowledge, their favorite colors and cluster of people.

The data are laid down as separate tables and combination tables making it possible to put two values in relationship to one another. An additional diagram visualizes the result.

Another part of the questionnaire compares Portals A and B. The participant had to decide if Portal A or B was more user-friendly, better structured, more clearly arranged and easier to read. These statements were fed to the Excel file too, making it possible to explore the connections between the participants' personal traits and knowledge and the choice of their preferred Portal.

The last part is about the influencing design factors of the usability and their effects on the acceptance of the two Healthcare portals. The number of points rewarded was included in the Excel file. Connections between individual clusters of people and the respective results are to be expected.

The digitalization of the information from the questionnaires was scheduled to take three weeks. This period started immediately after having completed the empirical survey on 2 January 2016. After the complete data input, an error was detected caused by rounding made by the Excel program. The error was caused by the percentage value that served as the calculation basis for the proportional percentage of a participant out of the group of 31 people surveyed:

$$\frac{100}{31} = 3.225806451612903225806451612903 2\%$$

Thus, one participant has the value of 3.225806451612903225806451612903 2%. This value proved to be difficult as the base value for further calculations, particularly as Excel when summing up an asset showed incorrect statements. Therefore, the value presented is rounded:

$$100/31 = 3.225806451612903225806451612903 2\% \approx 3.226\%$$

and declared the initial value for the participant. This value enabled Excel to perform correct calculations.

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To allow comparisons and to show connections of several information fields, combination tables needed to be developed. It was necessary to detect connections between genders and favorite colors or favorite colors and clusters of people.

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4 Results

Section "3.2. Methods and approach" already indicated different methods of research. Data may be combined with each other, as described for the method of induction (see 3.2.1) without the result being predictable beforehand. This applies to the combination of the personal details of the participants with the results of the comparisons of the portals.

Within the framework of the research, different results were found. The participants had to state in the questionnaires which Portal they preferred and they, finally, opted for better usability. The output of the results and the comparison with other statements made by the participants is in percent (in %). This is optimal for recognizing concordances of different evaluations.

Another range of questions requires marking from "1 = very important" to "6 = absolutely unimportant." The number of participants per grade is summed up and multiplied by the grade (the value of the grade):

$$\textbf{Weighting value} = \textbf{number of participants with grade}_n \times \textbf{Value of grade}_n$$

As a result, low values indicate a high weighting of the design aspects.

The method of deduction, however (see 3.2.2), produces clear possible results, namely the better usability of either Portal A or Portal B. Hence, both methods are used.

4.1 Evaluation of the participants' personal details

In total 31 participants, 16 female and 15 male test persons, took part in the research project. The distribution is 51.61% female and 48.39% male participants.

As a first step, the participants read the questionnaire [Appendix 02] up to page four and filled in their personal details. The first pages of the questionnaire deal with the presentation of the research project and its objectives. After a short introduction given by the research project director, the participants themselves read the explanations, including the data protection regulations.

After this, the participants are accompanied into the next phase. The software Gazepoint 3 is calibrated onto their gaze positions and pupils ensuring the recording of a result that can be evaluated. Then, the recording starts. The participant now looks at Portal A for

three minutes to gain an overall view of the arrangement of the information, structure and the like. Afterward, the participants receive two tasks and they are required to obtain the respective information within three minutes on Portal A. Next, the participant also surfs Portal B for three minutes and tries to receive an overall view of the new portal (Portal B). They again receive two new tasks and have to search for the information required within three minutes. That is followed by filling in the questionnaire [Appendix 02] up to page 16.

4.1.1 Information about the participant groups

The questionnaire [Appendix 02] on page 4 serves the association of personality traits to the design-oriented decisions in comparison of the two portals. Based on the information taken from the questionnaire [Appendix 02], nine association groups were developed with the respective subdivisions:

Gender: male, female

Age: up to 25 years, 26–35 years, 36–45 years, 46–55 years, older than 55 years

(Experience with) **Computers**: up to 5 years, 6–10 years, 11–15 years, more than 15 years

Internet (use): up to 5 years, 6–10 years, 11–15 years, more than 15 years

Favorite color: blue, red, green, yellow, black, none

Cluster of people: people of nature, technology enthusiasts, sports people, other allocations

(health) **Portals** already used: yes, no, perhaps unconsciously

Education: training, study, no qualification

Occupational group: craft, office, pedagogy, health

4.1.1.1 Age structure of the participants

For the survey, many more users were chosen. The age of the respondents covers a range from 22 to 63 years old. Participation was 51.61% women and 48.39% men [Appendix 03].

In total, 35.48% of the participants (22.58% female and 12.90% male respondents) were under 36 years old [Appendix 04]. 64.52% of the respondents (29.03% female and 35.49% male participants) were aged 36 and more [Appendix 04].

4.1.1.2 IT knowledge and Internet use

The participants were required to state their computer usage experience from the date of the empirical survey backward (November/December 2015).

This knowledge is brought into relation to the evaluations made by the participants. Participants showing vast IT know-how and based on their experiences are expected to find the design of Portal B more attractive.

70.97% of the respondents in all age groups have used computers for more than 15 years [Appendix 05]. When considering this percentage separately according to gender, the male percentage obviously predominates contributing 45.16% whereas women only contribute the remaining 25.81%.

When bringing the clusters of people in relation to their practical computer knowledge, it must be concluded that office employees with 0 up to 15 years of practical computer experience are almost evenly distributed. Respondents usually working in media-related jobs usually show experience of at least 11 up to 15 years (3.226%). Participants working in the media with over 15 years of computer usage amount to 35.48%. No participant of media jobs showed less than 11 years of active computer experience.

The statements on the use of the Internet made by the participants are an important indication about the target group of the visitors of Healthcare portals as well as about the number of years of having already used computers. This number of years is the focus.

Considering the use of the Internet by the participants depending on gender, it becomes obvious with women that there is no connection between the use of computers for a long time and intensive Internet research. Women too showing IT basic knowledge surf the Internet to the same extent as users who have used computers for a rather long time.

They use the Internet continuously even if they only have little program knowledge [Appendix 06]. The picture is different with men. The better the computer knowledge the more frequently the Internet is used.

4.1.1.3 Favorite color

The personal details about favorite colors are meant to show relationships between the IT practical usage, age and further individual details.

The participants are to select colors and tones that can be allocated to the basic colors blue, red, green, yellow and black.

The following associations are connected to colors

Blue: confidence, distance, coldness, infinity, relaxing, sportiness, sky, sea, water … [87]

Red: love, passion, anger, energy, fire, heat, danger, heart, communism, wine, cherries, roses … [88]

Green: nature, health, poison, forest, grass, recreation, hope, liveliness, summer, freshness, apple, garden, spring … [89]

Yellow: sun, summer, moon, sunflowers, gold, post, wheat, broom … [90]

Black: outer space, night, coal, coffee, social code for festivities and elegance … [91]

The color favored by the participant may be a decisive aspect when evaluating the color concept for the Healthcare portal. Using the inductive research method, different combinations with the favorite colors chosen may lead to results that cannot be predicted at the moment.

In total, 45.16% of the participants opted for the color blue. This color was chosen as favorite color of men and women equally and both genders contribute 22.58% each [Appendix 07]. This shows that the color blue speaks to each age group and that it should be integrated into the color concepts of Healthcare portals (as corporate color).

This is followed by, in equal proportions, the colors red (9.67% women, 12.90% men) and green (12.90% women and 9.67% men). The participants showed only slight interest in the colors yellow and black.

4.1.1.4 Cluster of people

Favorite colors are present in all clusters of people. Mainly women aged between 26 and 45 (29.03%) called themselves people of nature. Men of the same age group obviously

showed little enthusiasm (up to 9.68%). No participant belonging to the age group of under 25 regarded themselves as people of nature. The percentage of men in the cluster of people aged between 46 and 55 and more increases: 9.67% men and 6.45% women [Appendix 15]. The inductive research method helps us to recognize here an increasing affinity to nature—more particularly expressed by men when growing older. In contrast, young people up to the age of 25 do not regard themselves yet as people of nature. This should also be taken into account by advertising services. Products and services directed to male best-agers should be borne by natural motifs (natural subjects).

Even here, the color blue is present with all clusters of people in similar parts (16.13% people of nature, 9.67% technology enthusiasts, 9.67% sports people, 9.67% other allocations [Appendix 08]).

In addition, a similar percentage of the people of nature chose to opt for the colors red (12.90%) and green (12.90%). These people did not choose yellow at all. This should be taken into account when doing advertising directed to people of nature.

Technology enthusiasts, on the other hand, apart from blue, additionally chose red and green to the same extent (9.67% each). Apparently people of nature and technology enthusiasts do not differ basically in their positive color perception.

It is different with the sportspeople. They exclusively prefer the color blue. Product placements for sportspeople should be done only with the help of blue tonal values.

4.1.1.5 Previous use of Healthcare portals

Healthcare portals have been used consciously so far by technology enthusiasts (19.35%). The figure for the people of nature was only 12.90%. 35.48% of the people of nature have admitted that they had never looked for information on Healthcare portals before or that they had not been aware of this. In contrast, only 12.90% of the technology enthusiasts had no experience with these portals [Appendix 09]. This shows that users with competent computer knowledge call up Healthcare portals specifically, whereas people of nature frequently decide unconsciously for different sources for health-related recommendations. This should have effects on advertising for Healthcare portals on the Internet (on the Internet as banner ads on other websites or in any other manner).

This is less important for adverts placed by other organizations or the products on the website of Healthcare portals.

4.1.1.6 Professional qualifications of the test persons

The participants showed the following professional qualifications: completed apprenticeship 54.84% (35.49% female, 19.35% male), a university or college degree 41.94% (16.13% female, 25.81% male). 3.23% (one participant) showed no completed training.

38.71% of the participants belonging to the professional group Office have accredited vocational certificates and 6.45% a university or college degree. 25.80% of the participants belonging to the media professionals have university or college degrees and 12.90% accredited vocational certificates. These two professional groups account for the largest share.

22.58% belonging to the cluster of people of nature have completed apprenticeships and 25.80% university degrees. Among the technology enthusiasts, there are 22.58% with completed apprenticeships and 9.67% with university or college degrees.

Considering the professional qualifications in connection with favorite colors, blue is present with all professional careers. This means that the color blue does not show any connections to the different experiences of a university study or apprenticeship, but rather experiences made within a cultural field.

4.1.1.7 Summary of the participants' groups

There were 51.61% women and 48.39% men all aged between 22 and 63 involved in this research project.

Blue was chosen as the favorite color (45.16%) by members of all clusters of people, age groups, people with different professional qualifications and participants of both genders. It is followed immediately by red and green in equal shares.

Among the participants who have already used Healthcare portals, the technology enthusiasts account for the largest part.

Among the respondents, there are many more people of nature having a university diploma/Bachelor/Master than the technology enthusiasts. In general terms, it can be

noted that technology enthusiasts spend more time at the computer and that they can translate their frequent usage into knowledge enhancement, whereas many academics focus on recreation and nature.

4.2 Comparing Portals A and B according to the first impression

In Section 3.1, the participants were asked eight questions dealing with their first overall impressions. It is about the comparison of Portals A and B as well as the decision which portal they would prefer. The survey participants were to state their first impressions regarding design aspects, structure and navigation.

4.2.1 Evaluation of both portals at first sight (question 3.1.1 [Appendix 02])

Portals A and B are compared directly. Portal A is the original Healthcare portal Onmeda which still can be found on the Internet. This Portal breaks several rules of usability. Seventy-three new web pages were designed and programmed taking into account their user-friendly design.

It is now essential to analyze the acceptance of both Onmeda Healthcare portals.

Basically, 54.84% opted for Portal A and its better transparency, whereas 45.16% preferred Portal B [Appendix 10].

4.2.1.1 Gender comparison between Portal A and Portal B

It is notable that far more female users opted for Portal A (32.26%), whereas the percentage of men amounted only to 22.58%. There is no essential gap between women and men who rated Portal B to be more transparent (19.35% women, 25.80% men). Here the gender ratio is almost balanced [Appendix 10].

When considering the participants' ages Portal B again shows balanced results as opposed to Portal A [Appendix 11]. Thus, these similar values of Portal B can be regarded as similarity or approximate opinion of all age groups. Opinions on the transparency of Portal A made by the different age groups differed.

4.2.1.2 Comparison of the participants' IT knowledge

A significant difference can be observed when it comes to participants showing long-lived computer experiences—more than 15 years of using computers. These participants felt Portal B to be much more clearly structured (41.93%) than Portal A (29.03%) [Appendix 12].

A particularly conspicuous aspect is that Portal B was almost exclusively chosen as the better Portal by those users who had been using computers for a long time. Portal A, on the other hand, shows a distribution among all users.

It is similar when it comes to using the Internet. Whereas Portal A was equally favored by all user groups, Portal B was mainly preferred by long-term users [Appendix 13]. The focus of attention with Portal B lay clearly on the professional knowledge of user guidance and the experiences already made by the users when accessing Internet portals. That is an important statement referring to the target group. When offering services or products to professional computer users, the Internet portal should observe the rules for user-friendly clarity. When considering the choice made by conscious users accessing Internet portals in more detail, the analysis shows a distribution in equal parts (22.58% each) for Portal A and Portal B [Appendix 14].

Although Portal A has reached a broader cluster of people, it has been proven that this group essentially consists of users who do not use computers daily (not the cluster of people technology enthusiasts and occupational group media experts).

4.2.1.3 Portals A and B in comparison with the clusters of people

When comparing the portals on the basis of the clusters of people, the difference between the decisions by the people of nature (35.48% for Portal A) and the technology enthusiasts (22.58% for Portal B) is striking [Appendix 15]. Even these values support the hypothesis that Portal B is preferred by professional users (technology enthusiasts), which is accounted for by the deductive research approach.

4.2.1.4 Portals A and B compared according to the educational levels

The better clarity of Portal A was stated at first sight by the office employees at 29.03%, Portal B was considered better by 16.13% of the office clerks. An equally high number of media specialists, in contrast, voted for either Portal A or Portal B (19.35%).

Craftsmen felt that Portal B had been more transparent (6.45%). 0% voted for Portal A. The clusters of people education and health showed similar distributions for both portals. What matters is the experience made so far with Healthcare portals.

4.2.2 Comparing the design-related overall impression of both portals

The design-related overall impression (question 3.1.2 [Appendix 02]) was clear with Portal A (67.75%). It is interesting to note that that group of computer users (up to 15 years) voted similarly equally for Portal A and B [Appendix 16]. A clear difference can only be noted when considering the very experienced users of more than 15 years of computer experience [Appendix 16]. These users voted for Portal A reaching a percentage of 48.39% and for Portal B reaching 22.58%. Because, in total, a majority preferred Portal A, a majority regarding the design-related overall impression was expected. However, this twice the number of people was not foreseeable.

The explanation, in this case, is the high number of people of nature [Appendix 17], who favor the design-related overall impression of Portal A. This may indicate emotional and subjective aspects. This hypothesis is confirmed by the slightly higher percentage of women who found the design aspects of Portal A to be more responsive [Appendix 18].

In contrast, from the total of 45.16% of the participants considering Portal B clearer and more informative 25.80% were men, 19.36% women. The remaining 54.84% voted for Portal A. Even this may be an indication of the emotional perception of the information input. What design aspects in particular address to the participants?

4.2.2.1 Summary evaluation of the first impression when comparing both portals (evaluation of 3.1)

When summarizing the first impressions with the use of the two Onmeda Healthcare portals Portal A (original Portal) and B (newly designed/programmed Portal) it is stated that

- 51.62% found the arrangement of text and the amount of information of Portal B clearer/more user-friendlier (question 3.2.1);
- 54.84% found Portal A more clearly arranged at the first sight (question 3.1.8) and would rather prefer it when searching for information (question 3.1.1);
- 35.48% of the people of nature (men and women) voted for Portal A (question 3.1.1 regarding the better clarity at first sight) whereas 22.58% of the technology enthusiasts voted for Portal B [Appendix 41].

A balanced relationship between Portals A and B can be found when considering the active users of Healthcare portals (22.58% each). Whereas Internet users preferring Portal A showed a similar distribution of usage time (between 0 and more than 15 years representing each between 9.67% and 16.13%), the more experienced Internet users (more than 15 years of using computers) had a share of 29.03% for Portal B. This picture is even clearer when considering the really experienced computer users. The participants having used computers for more than 15 years preferred Portal B (41.93%), but only 29.03% Portal A.

When focusing on clusters of people, it can be seen that media specialists showed a balanced proportion of favoring either Portal A or B (19.35% each). The majority of office clerks, in contrast, voted clearly for Portal A (29.03% for Portal A, 16.13% for Portal B).

Basically, the majority of people of nature when dealing with several questions of their first impressions voted for Portal A, whereas the majority of technology enthusiasts voted for Portal B.

4.2.2.2 Interim conclusion

So, it is crucial what target group the Healthcare portal is intended for. If the Internet users are not very experienced over many years and do not use computers daily for professional activities, rules of the professional design of Graphical User Interfaces may be partially ignored. On the other hand, the standards of perception psychology for optimal cognition by professional computer users having been taught in training courses and studies so far serve as a measure for the design of websites.

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4.3 Priorities of design aspects

For the sake of the development of a ranking list of the design factors influencing the acceptance of Healthcare portals, a particular evaluation system was submitted to the participants.

The comparison of both portals was no longer the focus, but the evaluation of design aspects from the very personal perspective.

The participants' task was to evaluate in detail the most important design elements such as

Typography

Color scheme

Image presentation

Navigation

Content structure

Content of the adverts

Positioning of the adverts

They were allowed to give marks between mark 1 (very important) up to 6 (absolutely unimportant). From these sets of questions, the appropriate questions were selected to create a priority list.

The evaluations made by the participants are summed up for each set of rules and displayed as a sum. The sum of the questions per set was divided by the number of questions to obtain a comparable mean value.

$$\frac{\text{Sum of all the points of the set of questions}}{\text{Number of questions}}$$

As a result, values are produced that provide for the basis values of the priority list. In this case, the lowest value shows the highest importance for the design of Healthcare portals. This may be responsible for improving the acceptance of Healthcare portals.

At this point, it was deliberately not intended to determine percentage rates as their conversion into relative data would require roundings. In the context of the qualitative research method, the comparison of the average evaluation points of the variables is ideally suited.

4.3.1 Typography on Healthcare portals

When considering the decisions of the group of people of nature compared with the technology enthusiasts on the typographical implementation of the information, this trend is continuing: Whereas the majority of the people of nature voted for Portal A, the majority of technology enthusiasts voted for Portal B. There are two specific characteristics that should be noted: Evaluating the appropriate font size both people of nature and technology enthusiasts equally showed preferences for Portal A [Appendix 19], which is to be incorporated into the new set of rules to be developed.

61.29% of the participants primarily preferred Portal B when evaluating user guidance by professional use of typography and uniform font formats (question 3.2.7). This clear decision can be found both with people of nature and technology enthusiasts [Appendix 20].

4.3.1.1 Participants' evaluations of text properties

Starting from point 4.1 in the questionnaire, the participants had to assign personal importance to the design elements. It was not the comparison between Portals A and B that was the focus, but the personal evaluation of the influence of design objects onto the acceptance of Healthcare portals. Mark "1" means "very important" and mark "6" means "unimportant."

The following four subjects related to typography (font size, text length, position of the main information, same text formats for identical sorts of test) were included.

The majority of the participants considered the handling of text on Healthcare portals to be very important/important on a marking scale of 1 to 6 [Appendix 21 and Appendix 22]. This was selected uniformly by the majority of the two large clusters of people of the people of nature and technology enthusiasts.

As the right placement of the most important information on the webpage, 41.93% preferred the upper and upper central position as well as the upper left position. This corres-ponds to the findings in the design theory so far acquired, but it contradicts the current information offered on the current Onmeda Internet portal (Portal A) and the evaluation of the video recordings made in Gazepoint.

4.3.2 Color scheme on Healthcare portals

The participants were asked to compare the color schemes between Portals A and B and to decide which one they preferred. This decision was clearly made in favor of Portal A with the age clusters of people between 46 up to 55 favoring Portal A significantly [Appendix 26].

When compared by clusters of people, the decision is interesting regarding the question of the optimal color scheme. If only people of nature are taken into account, the majority of them voted for Portal A [Appendix 27].

4.3.2.1 Participants' evaluations of the color scheme

The participants were required to draw conclusions relating to the basic influence of the color scheme on the acceptance of Healthcare portals. In this respect, they had a huge regard for harmonious color schemes and/or the reduced use of colors.

4.3.3 Image presentation on Healthcare portals

Picture sizes were considered better on Portal A (question 3.4.1 reaching 61.29%). People of nature showed a relatively greater weight with the picture presentation (just 38.71%), whereas the other clusters of people favored both portals proportionally or even Portal B [Appendix 30]. Differently, large picture presentations as well the superimposition of menu bars did not disturb the participants.

Furthermore, the participants were expected to comment their preferences regarding the picture motifs. They could select between images of nature, talk with patients, medical devices/technology and other motifs [Appendix 32]. 45.16% of the respondents would prefer images of nature, 25.81% talks with patients, 16.13% medical devices/technology and only 12.90% had even different ideas such as food and disease patterns and descriptions.

As can be seen in Appendix 32, the desire for images of nature can be found in every age group—important information for the choice of pictorial motifs on Healthcare portals. There is no connection noticeable between the selection of nature pictures and the favorite color green [Appendix 33].

4.3.4 Content structure on Healthcare portals

Navigation and content structure (question 3.5.2) were considered slightly better on Portal A [Appendix 31]. The decision in favor of Portal A eventually was caused by one respondent only (3.226% difference). There is a relatively similar distribution. People of nature spoke in favor of a better navigation on Portal A, whereas the other clusters of people preferred here Portal B. It was similar with the professional group of office management employees. This group made a clear decision in favor of Portal A, whereas the other professional groups rather preferred Portal B or voted evenly.

What main information do users expect on Healthcare portals? Disease patterns/symptoms were selected here apart from nutrition/care/prevention as well as doctors' and specialists' contact details in the form of a doctors' database [Appendix 36]. In this respect, the assignments to the respective professional groups are interesting, whereas [Appendix 37] shows distribution according to gender. Media specialists, as well as a large number of the office employees, predominantly expect information on disease patterns and symptoms [Appendix 36]. Identical information is mostly expected by the female participants.

4.3.5 Advertising on Healthcare portals

Detailed questions about advertising are asked in the fifth set of questions. 93.55% favor the omission of adverts [Appendix 34]. If this cannot be done, 67.75% could imagine specific products to be banned [Appendix 35]. In the main, medical, pharmaceutical or natural products should be advertised.

4.4 Statistical determination of the priority list of the design aspects by means of the Structural Equation Model

To support the comparison of the influencing factors for the acceptance of Healthcare portals, Structural Equation Modeling is used. This is a measuring model in which the latent variables flow in. The latent variables are generated from the specific influence

areas of the "design factors," the "structural factors" and the "factors of advertising strategies." The latent variables (factors) are referred to as ξ_1–ξ_3.

To visualize the relationship between the indicators and the latent variables, the endogenous factors are named λ_n. This value exclusively indicates the dependencies and influences of the indicators onto the latent variables. When considering the factors compared with one another, the dependency on the item in question does not play any role. That is why the latent variables are given the value ξ_n. "n" denotes the number of the respective objects needed for the calculation.

The term "latent" is used, as the results do not represent exact values but roundings for the statistical comparison.

Any latent variable absorbs the respective indicators x_1–x_7 as follows:

Design factors λ_1	Typography x_1	λ_{11}
	Coloring scheme x_2	λ_{12}
	Picture presentation x_3	λ_{13}
Structural factors λ_2	Navigation x_4	λ_{21}
	Content structure x_5	λ_{22}
Factors of advertising strategies λ_3	Content of advert x_6	λ_{31}
	Positioning of advert x_7	λ_{32}

These individual factors may be generally exogenous (independently latent) or endogenous (dependently latent). In this research project, the individual factors exclusively show exogenous relationships to each other—so they are independently latent.

To be able to compare the items, the mean values for each item need to be elaborated. Each item (x_1–x_7) has a different number of questions. Depending on the number of questions the item's structure is extended:

$x_n = x_{n+1} + \delta$

$\delta_n = x_n$ Hierarchy of the mean values

These are only comparable if there is a mean value of each item. Each item has total

points for all the questions of this indicator.

The items x_1–x_7 represent the following types of questions

Typography x_1	question 4.2.1–4.2.4 x_{11}–x_{14}	four questions with a total 305 points
Coloring scheme x_2	question 4.3.1–4.3.2 x_{21}–x_{22}	two questions with a total 107 points
Picture presentation x_3	question 4.3.3–4.3.10 x_{31}–x_{38}	eight questions with a total 823 points
Navigation x_4	question 4.1.1–4.1.4 x_{41}–x_{44}	four questions with a total 389 points
Content structure x_5	question 4.1.5–4.1.12 x_{51}–x_{58}	eight questions with a total 843 points
Content of advert x_6	question 4.4.1, 4.4.5 – 4.4.6 4.4.8 – 4.4.10	six questions with a total 774 points x_{61}–x_{66}
Positioning of advert x_7	question 4.4.2–4.4.4, x_{71}–x_{74} 4.4.7	four questions with a total 403 points

Each value x_n is the result of the total points of

x_{n1-n}: number of questions

The mean value determined for each influence area provides the priority of the design aspects for Graphical User Interfaces of Healthcare portals. The hierarchy of the seven items is given as δ_n.

Basically, the decision was made to output the results in points. The possible comparison given in percent was consciously rejected. The great advantage is the direct comparison of the weightings chosen by the participants. The conversion into percent would result in

rounded values and additional deviations. It was important to take up the respondents' declarations as precisely as possible and set them in relation to each other. This was the reason that only the total points of the evaluation had to be divided by the number of questions from the specific range of questions. This determined value represents a meaningful comparative value.

The altered weighting of the factors influencing the design will be an important component of the new set of rules.

4.4.1 Design factors

The latent variables are dependent on the items flowing in—hence endogenous—and are expressed as ξ_n. To enable the direct comparison of the items, comparable values need to be found from the questionnaires. The participants received a different number of questions dealing with each set of questions. The questions relevant to enable a decision flow into the items. If a comparable value for elaborating a ranking list of the design aspects influencing the acceptance of Healthcare portals needs to be determined, the points gained from all participants regarding each question have to be calculated cumulatively. Then, the questions of one set of questions (e.g., "typography") are summed and divided by the number of questions. So, a mean value of the influence area (item) is calculated.

Here, only those sets of questions are used that required a grading of "1" to "6."

4.4.1.1 Indicator typography

The statistical comparison is enabled by the calculation of the values of the individual indicators (items):

Typography x_1 four questions with a total 305 points x_{11}–x_{14}

$$x_1 = \frac{x_{11} + x_{12} + x_{13} + x_{14}}{4}$$

$$= \frac{80+93+72+60}{4}$$

$$= \frac{305}{4}$$

$$x_1 = 76.25 \text{ points}$$

were on average allotted for the influencing area typography. This is an important comparable value for further design objects. These values are compared with one another. The priority list arises from the lowest ("very important") to the highest number of points ("unimportant"), as these seemed to be important to the participants (assessment "1" for "very important").

4.4.1.2 Indicator coloring scheme

The participants were asked to answer two questions dealing with the coloring scheme with the required assessment of 1 = "very important" to 6 = "completely unimportant":

Coloring scheme x_2 two questions with a total 107 points x_{21}–x_{22}

$$x_2 = \frac{x_{21} + x_{22}}{2}$$

$$= \frac{57+50}{2}$$

$$= \frac{107}{2}$$

$$x_2 = 53.5 \text{ points}$$

calculated as a comparable value for the coloring scheme. Because the coloring scheme shows a lower number of points than typography, the participants have considered the coloring scheme to be more important than typeface design (typography). Consequently, the coloring scheme gains the highest priority with the design objects.

4.4.1.3 Indicator picture presentation

In this influencing area eight questions were asked and assessment required.

Picture presentation x_3 eight questions with a total 823 points x_{31}–x_{38}

$$x_3 = \frac{x_{31}+x_{32}+x_{33}+x_{34}+x_{35}+x_{36}+x_{37}+x_{38}}{8}$$

$$= \frac{82+119+107+64+125+107+98+121}{8}$$

$$= \frac{823}{8}$$

$$x_3 = 102.875 \text{ points}$$

The latter is incorporated as the mean value for x_3. The participants showed a certain indifference toward the picture presentation. This design aspect appears to influence the acceptance of Healthcare portals only a little.

4.4.1.4 The latent endogenous variable of the design factors

The ranking list of the influencing areas is specified using δ_n:

Typography x_1	76.25	δ_2	2nd highest priority so far
Coloring scheme x_2	53.5	δ_1	highest priority so far
Picture presentation x_3	102.875	δ_3	3rd highest priority so far

Now here too, a comparable value needs to be calculated for the structural factors ξ_2 and the factors of advertising strategies ξ_3.

$$\xi_1 = \frac{x_1 + x_2 + x_3}{3}$$

$$= \frac{76.250 + 53.500 + 102.875}{3}$$

$$= \frac{232.625}{3}$$

$$= 77.541666 \text{ points}$$

$$\xi_1 = 77.541666 \approx 77.54167 \text{ points}$$

This value determined is the average priority basis value of the design factors. Higher points mean for the participants a very high importance of the design element (higher than the average value).

The design factors ξ_1 were rated by the 31 participants with an average of 77.5417 points. Comparing the individual indicators with the calculated total average, the participants show that they consider the design aspects of the typography more important. The

respondents even attached much more importance to the coloring scheme than to the text properties.

4.4.2 Structural factors

The sets of questions regarding navigation and structure flow in the latent variable of the structural aspects:

Navigation x_4	four question with a total 389 points	x_{41}–x_{44}
Content structure x_5	eight questions with a total 843 points	x_{51}–x_{58}

Only those questions were included that required assessment of 1 to 6.

4.4.2.1 Indicator navigation

To enable the comparison with the other indicators, the average weighting made by the participants need to be determined:

$$x_4 = \frac{x_{41}+x_{42}+x_{43}+x_{44}}{4}$$

$$= \frac{65+120+128+76}{4}$$

$$= \frac{389}{4}$$

$$x_4 = 97.25 \text{ points}$$

This value shows that when using Healthcare portals, the users assign a minor role to navigation. The user-friendly navigation was rated by the participants to be more important than the picture presentation.

4.4.2.2 Indicator of the content structure

The respondents were asked eight questions to assess the content structure and to rate them:

$$x_5 = \frac{x_{51}+x_{52}+x_{53}+x_{54}+x_{55}+x_{56}+x_{57}+x_{58}}{8}$$

$$= \frac{80+116+175+101+116+80+79+96}{8}$$

$$= \frac{843}{8}$$

$$x_5 = 105.375 \text{ points.}$$

Users of Healthcare portals obviously approve the given structure and do not need any kind of special content-related user guidance. How else could it be explained that the importance of the structure played only a minor role for the participants when assessing the portals? A clear content structure is even less important for the participants than picture presentation.

4.4.2.3 The latent endogenous variable of the structural factors

After having compared the individual indicators, now the endogenous variable "structural factors" is to be compared with the also endogenous variable "design factors." So, it is necessary to calculate the average evaluations made by the participants: The indicators of this influencing area show the following ranking presentation:

Navigation x_4 97.25

Content structure x_5 105.375

$$\xi_2 = \frac{x4+x5}{2}$$

$$= \frac{97.25+105.375}{2}$$

$$= \frac{202.625}{2}$$

$$\xi_2 = 101.3125 \text{ points.}$$

The dependence of the two latent exogenous items shows that the structural aspect among the users surveyed is of minor importance compared with the design aspects of text and color. The basic average value for structure, navigation and menu guidance amounts to 101.3125 points. The individual indicators navigation and structure will be measured based on it.

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4.4.3 Factors of advertising strategies

The latent endogenous variable includes two sets of questions referring to advertising strategies, which were expected to be answered similarly to the grading system at schools:

Content of adverts x_6 six questions with a total 774 points x_{61}–x_{66}

Positioning of adverts x_7 four questions with a total 403 points x_{71}–x_{74}

4.4.3.1 Indicator content of the adverts

The mean value calculation requires the following procedure:

$$x_6 = \frac{x_{61} + x_{62} + x_{63} + x_{64} + x_{65} + x_{66}}{6}$$

$$= \frac{173+102+173+128+108+90}{6}$$

$$= \frac{774}{6}$$

$$x_6 = 129 \text{ points.}$$

The high number of points of the exogenous indicator proves the rather low importance assigned by the participants for the use of Healthcare portals.

4.4.3.2 Indicator positioning of the adverts

Subsequently, the weighting of the adverts' positions is considered.

$$x_7 = \frac{x_{71} + x_{72} + x_{73} + x_{74}}{4}$$

$$= \frac{100+83+155+65}{4}$$

$$= \frac{403}{4}$$

$$x_7 = 100.75 \text{ points}$$

This value also proves that the proper position of the advert is only of minor importance. It is different when asking: "How important would the omission of advertising be?" There was a sum of all participants' assessments reaching 66 points. This aspect is not included in the calculation shown above. However, this aspect shows that advertising is generally

perceived to be disturbing and hindering while doing information research. Because many portals are partly financed by advertising, the omission of advertising may only be encouraged. Moreover, the importance of personalized advertising on the basis of the evaluation of Big Data is increasing permanently.

4.4.3.3 The latent endogenous variable of the factor of advertising strategies

To obtain a comparable value of the three latent endogenous factors, an average is calculated based on the contents and the importance of the positions:

Content of adverts x_6 129

Positioning of adverts x_7 100.75

$$\xi_3 = \frac{x_6 + x_7}{2}$$

$$= \frac{129 + 100.75}{2}$$

$$= \frac{229.75}{2}$$

$$\xi_3 = 114.875 \text{ points}$$

Generally speaking, the aspects of advertising strategies are only of minor importance for the acceptance of Healthcare portals.

4.4.3.4 Influence of the design aspects to a good usability of Healthcare portals

The value to be calculated η_1 is the basis for the design factors influencing the proper usability of Healthcare portals. This produces the following calculation:

$$\eta_1 = \frac{\xi_1 + \xi_2 + \xi_3}{3}$$

$$= \frac{77.54167 + 101.3125 + 114.875}{3}$$

$$= \frac{293.7291}{3}$$

$$\eta_1 = 97.909723 \text{ points.}$$

This value helps to determine the relationship to the latent endogenous relations as well as the relationship between the factors and indicators.

4.5 Current presentation in form of the SEM

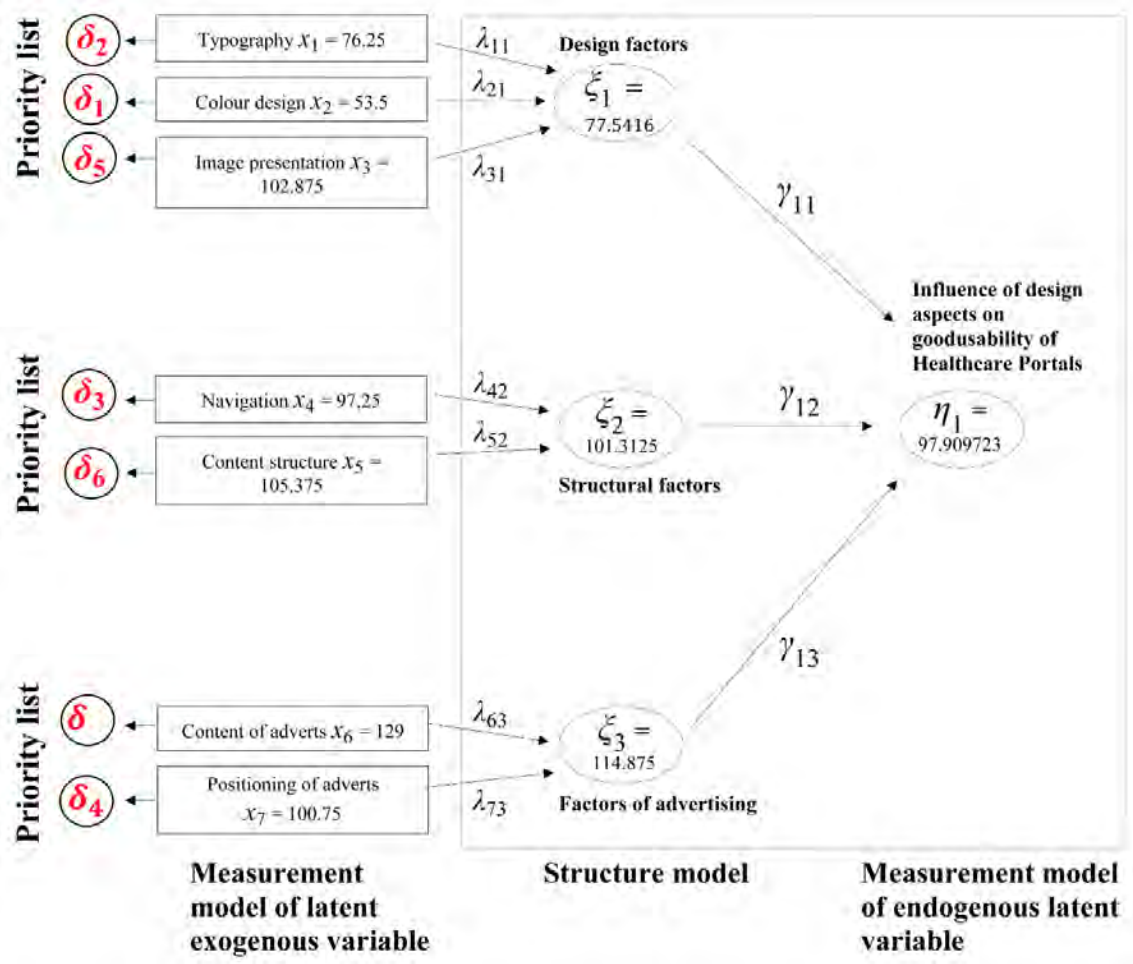

Figure 23
Presentation of the influencing factors in the SEM

Figure 23 visualizes the evaluation results with the ranking order of design objects after the research evaluation.

The values obtained are combined with the measurement unit “points” and presented in the resulting Structural Equation Model.

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4.5.1 Connections within the Structural Equation Model

Subsequently, it is possible to examine in more detail the latent exogenous and latent endogenous relations and the monotonic correlation of the data series. The measurement model η is here the core of the Structural Equation Model.

4.5.1.1 Acceptance influence of the design aspects

The correlations shown in the Structural Equation Model—covariance—illustrate the particularly strong influence of the design aspects on the acceptance of Healthcare portals. As seen by the users, the elements have a positive effect on the use and acceptance of Healthcare portals:

1. δ_1 Coloring scheme x_2 = 53.5 points
2. δ_2 Typography x_1 = 76.25 points
3. δ_3 Pictorial presentation x_3 = 102.875 points

} 77.5416 points Ø

Covariance λ_{21} is to be rated higher than average—the importance of the professional coloring scheme within the design factors. This can be clearly recognized in the SEM. It represents the greatest possible influence on the acceptance.

The influence of typography within the design elements surveyed λ_{11} corresponds nearly to the value of the design aspects onto the acceptance of usability.

The pictorial presentations and picture positions have a rather negative effect within the design aspects—they are, more explicitly said, unimportant. The covariance λ_{31}between x_3 (102.875 points) and ξ_1 (77.5416 points) is controlled by the high value of x_3. The influence of this value levels down the importance of design factors in general. This way, the design aspects in comparison with the structural and advertising strategy factors lose importance.

The importance of pictorial representations toward the acceptance of medical online platforms is similar to the importance of the content structure x_5 (105.375 points).

4.5.1.2 Acceptance influence of the structural aspects

The acceptance of Healthcare platforms is not dependent on navigation or content structures. These aspects only play—as seen by the respondents—a tangential role. These values can be clearly taken from the SEM.

4.5.1.3 Acceptance influence of the aspects of advertising strategies

However, the advertising strategy factors play a secondary role. Even within this set of questions, the participants pointed out that the categorical omission of advertising would be very important for them (66 points). Many participants exclusively wished advertising for health and medical/pharmaceutical products. Nevertheless, they would actually not avoid Healthcare portals offering advertising for products from every sphere of life. But at the same time, they stated that content, businesses, products, services advertised would not influence the acceptance of health-oriented platforms at all.

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5 Discussion

Because of the participants' opinions, the design aspects influence the acceptance of medical portals prior to the structural and advertising strategy factors. Within the design factors, there was the following priority:

1. Coloring scheme
2. Typography
3. Pictorial presentation

Navigation and structure of a website play a tangential role. This decision is based on the user behavior on portals: The users adapt themselves to the structure offered and, moreover, adapt their information research.

Most users do not wish advertising. This statement was important for the participants. But if there is the need to incorporate advertising, the users are generally indifferent to the contents of the adverts shown. Therefore, there may be adverts for food and clothing but for pharmaceutical products, too. The omission of pop-up windows is more important than the omission of advertising at all. This is a significant result for the programming of Healthcare portals.

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Weighting of the influencing factors			
Column 1 **Categories of the different influencing factors**	**Column 2** **Total points (absolute)**	**Column 3** **Number of questions per category**	**Column 4** **Ø Value of the questions**
Navigation (4.1.1 – 4.1.4)	389	4	97.250
Content structure (4.1.5 – 4.1.12)	843	8	105.375
Typography (4.2.1 – 4.2.4)	305	4	76.250
Color design (4.3.1 – 4.3.2)	107	2	53.500
Image presentation (4.3.3 – 4.3.10)	823	8	102.875
Content of the adverts (4.4.1, 4.4.5, 4.4.6, 4.4.8 – 4.4.10)	774	6	129.000
Positioning of the adverts (4.4.2 – 4.4.4, 4.4.7)	403	4	100.750

Column 1: The questionnaire can be divided into 7 different categories with regard to the influencing factors

Column 2:
Addition of the evaluations from 1 to 6
(1 = very important; 6 = completely unimportant) of all the questions of the categories/influencing factors 4.1 to 4.4

Column 3:
Number of questions according to category/influencing factor

Column 4:
Average value of questions according to category

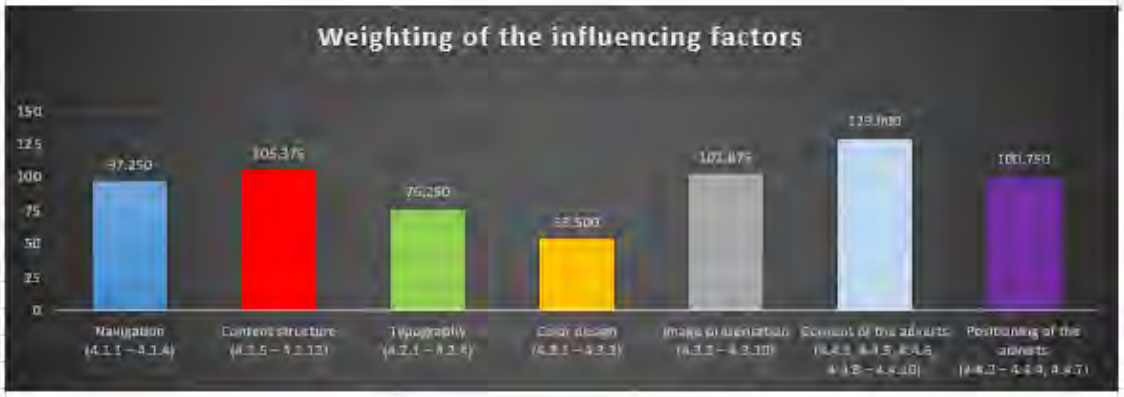

Figure 24
Graphical presentation of the values of the Structural Equation Model

Figure 24 shows the partial results having led to the point results of the items in tabular form.

5.1 Results of this research work for the design of Healthcare portals

The SEM displays the priority in the design of Graphical User Interfaces of Healthcare portals. The results were determined by means of the notes given by the participants and they are included in the new set of rules only indirectly.

The other responses from the questionnaire enabled the comparison of the two portals. These findings (shown by comparison in percent), on the other hand, are included directly in the new recommendations.

5.1.1 Coloring scheme

The questions affecting the importance of coloring schemes on Healthcare portals were replied by the participants with high priority. Here, the participants were asked if they preferred a calm coloring scheme for texts, backgrounds and other design objects and how important the harmonious color matching of the individual elements would be.

Here the respondents reached 57 and 50 points. As shown in [Appendix 23] the majority of women considered a calm color scheme to be very important. On the other hand, this aspect was not that important for men.

There are even differences when looking at different professional groups [Appendix 24]. Whereas office employees did not find calm or harmonious color schemes to be very important, media specialists insisted on professional color schemes as highest or high priority. This aspect is included in the new set of rules focusing on the target group of the users of those platforms.

When comparing the participants' formal education, it is striking that those having completed vocational training at a regional chamber appreciate the importance of a harmonious coloring scheme differently. Although most of them attach high priority to this scheme, the grading reaches from "1" to "4" [Appendix 25]. University graduates, on the other hand, opted clearly for a high or very high importance of a harmonious coloring scheme.

Attention should be drawn to a high color contrast between text and background color.

5.1.2 Typography

The deeper every single question of the set of questions is immerged into, a number of peculiarities become obvious. Question “4.2.4 How important is a uniform font and font size for the same types of text?” was prominently rated with only 60 points. If here the covariance is called into the total value of typography (76.25 points), the high importance becomes clear users attach to the observance of textual style sheets.

Question “4.2.3 Do you wish the most important contents of the Internet portal—the primary objective—to be found centrally at eye level? How important is that position for you?” was as well opted for as exceptionally important and reached 72 points.

[Appendix 22] shows that this position was especially important for the cluster of people of technology enthusiasts (rating of “1” and “2”), whereas the people of nature selected the whole rating scale from “very important” (“1”) to “unimportant” (“6”).

The font size of the continuous text on Portal A is 15 pt. In contrast, Portal B observes the standards of screen design with a font size of 12 pt for the continuous text. Specialist books on screen and web design propose the font size of 10—12 pt for continuous text [61]. This rule could not be confirmed as almost all participants found that the size of 12 pt on Portal B was too small. This change in the reading behavior might be a result of the increasing monitor sizes.

On both portals, the background was white and the font color black. The previous statement that this contrast between the white background and black typography would be too strong [61] could not be proven. If a sans-serif font with a thin line width (light font) is chosen, the text can be read optimally. The thicker the line width of the font selected (never choose a font style thicker than the Regular font, the Light font style is better), the more the designer should reduce the 100% black shade. This represents an urgent recommendation that will be included in the set of rules additionally—an important finding of this research work. Reducing the shade by only a few percent will already make an important difference.

These aspects will be incorporated into the new set of rules.

5.1.3 Pictorial presentation

In general the representation and quality of photos and graphics were rated fairly differently. Whereas some media specialists considered picture quality to be very important, other media specialists found that it was rather unimportant. These assessments can be found with all professional groups [Appendix 28].

The assessments of the sliders produced a similar result. The ratings here were from "very important = 1" to "unimportant = 6." The respondents' answers to the question if animations or explanatory videos should be included were completely varying likewise. This proves that, in the new set of rules, no recommendations can be given on this design aspect.

5.1.4 Results of the research work for navigation and structure

The answers to the questions about the fundamental navigation and the desired structure on Healthcare portals produced a similar distribution ranging between "very important" and "absolutely unimportant." Therefore, no recommendations can be included in the new set of rules. No concordance could be determined even from the personal characteristics of the different age groups and clusters of people or other allocations (such as favorite colors).

The participants evaluated the wish for additional forums and games very differently. Because of the spread of the answers, it is not possible to produce a pattern of the allocations of the evaluations to the personal details.

However, almost all participants found self-tests to be unimportant. The representation according to the participants' professional qualifications appears to be interesting [Appendix 29]. The university graduates and the participants with vocational training qualifications rated this aspect with "6" = "unimportant."

Navigation plays an important role, because users of Healthcare portals specifically search for information. Viewing the pictures is not in the foreground, as shown by the eye movements in Gazepoint, but the text. The rule that there should not be more than five navigation elements to the navigation [92] was disproved here. This rule had been derived from viewing behavior when watching television. However, using Healthcare portals is not picture-oriented (as in the case of television), but text-oriented.

This is the reason that—with the objective of clear orientation—a navigation unit should provide clear and thematic contents and, by all means, may consist of more than seven subitems (buttons, text links …).

5.1.5 Results of the research work for aspects of advertising strategies

Healthcare portals should not contain any kind of advertising. It is recommended to subsidize medical portals as they provide information for the people's education and prevention measures. Apart from medical information, users expect advice and tips concerning healthy nutrition, care and prevention. As this, in the long run, may prevent medical therapies, alleviate existing diseases or reduce the intensity of a disease, this purpose should be emphasized.

5.1.6 Evaluation of the video recordings made within the software Gazepoint

The video recording is started immediately before the user gets familiar with Portal A. It ends after the tasks for the information research on the Portals A and B have been completed.

The user behavior on Portals A and B just before the participants started their research is especially interesting for the evaluation of the recordings. There may turn out conclusions concerning the reading behavior and interaction activities when comparing analytically the clusters of people, gender, professional qualifications, ... The most striking outcomes are presented here.

5.1.6.1 Reading behavior

There are different behaviors regarding the information perception during first-time use of both portals. The focus is on the dwelling on an information unit/extensive reading or, conversely, the experienced cross-reading and rapid recognition of topics that are personally not relevant.

There is a clear difference between the clusters of people. The large majority of people of nature take considerably more time for the cognition of the topics provided and usually do not decide if the topic is important for them or not until they have started to read the text right from the beginning. Then they "migrate" to the next interesting text module.

It is different with the technology enthusiasts. Half of this group speeds quickly through the topics and looks rapidly and specifically for the information they find personally interesting, dwells for a while for reading and continues searching fast and efficiently at other places.

This behavior can be found on both portals likewise.

5.1.6.2 Gaze position

It was previously assumed that the main gaze position is directed to the optical center (slightly above the center of the page). This is an important statement for the positioning of the main information (in the virtual "main frame"). This research project could not confirm that.

The gaze positions of each participant were captured at the end of research on Portal A and overall at the end of using Portal B (including Portal A).

45.16% of the participants were looking for the information in the center in the summary of both portals (at the end of solving of all exercises on both portals), as shown in Figure 25 [Appendix 38]. You can recognize it at the time point on the bottom of the screen shot.

All the other users mainly dwelled on other places of the screen: leftmost from the center, rightmost from the center, on the top margin or right at the bottom at the page boundary, as seen in Figure 26.

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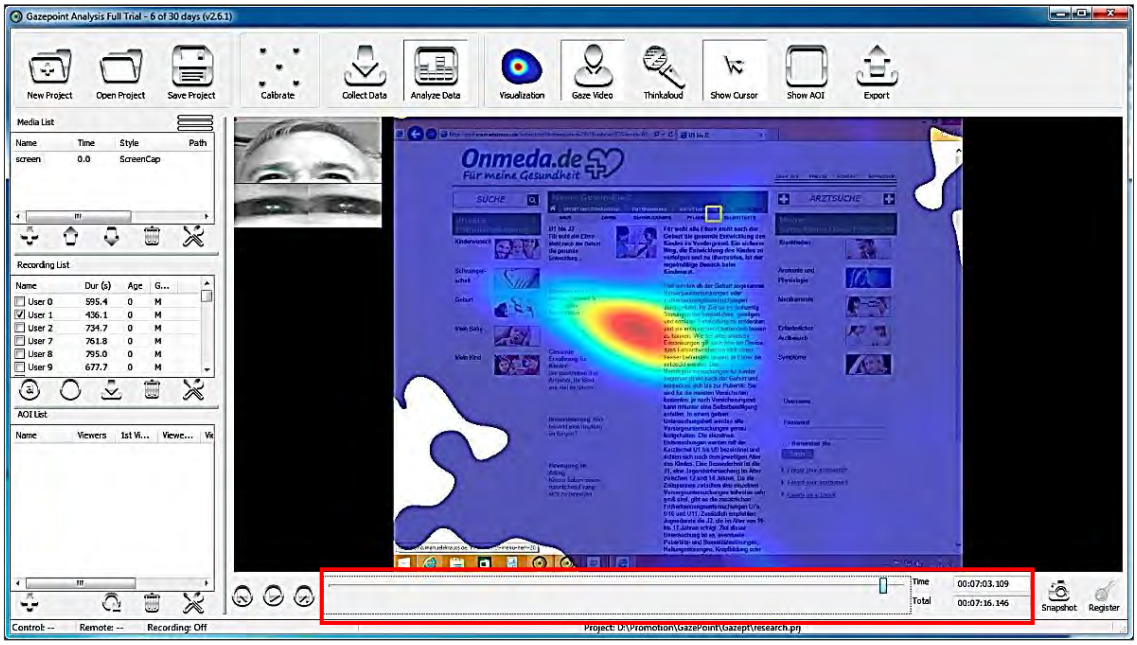

Figure 25
Main central eyes' position on Portal B

Figure 26
Main participants' eyes position bottom left

If gaze positions are analyzed cumulatively at the end of Portal B [Appendix 39], this result is confirmed. It states that main gaze positions in all the recordings of Portal A and B further diverge from the center.

There were no attributions to personal characteristics or decisions evident.

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5.1.6.3 The participant's behavior after starting using the portal

Now the participants' behaviors on the Portals A and B are analyzed. The focus is to figure out if the participant first scrolls and dwells on that page in order to see further information displayed here or if they use the navigation to get an idea of the other contents provided.

In this case, Portal A is looked at. On this portal there are many text modules on each page requiring intensive and lengthy scrolling. In contrast, the homepage of Portal B offers the contents without any need of scrolling.

67.75% of the participants, after having opened Portal A, first used the browser navigation [Appendix 40]. This is not surprising because after accessing this Healthcare portal only a large photo can be seen (see Figure 27) and users may suggest that only navigation might lead to other contents.

Figure 27
Opening the "Onmeda" Healthcare portal (Portal A)

The readability of the text is not the focus of Figure 27, but rather the presentation of the first and second screens of the homepage under www.onmeda.de.

In case there were important contents on the first page right below the photo, they would be discovered by 67.75% of the users—if at all—only after further information search.

So, the users prove that navigation on the first page is of high importance. If portal operators offer contents on their homepages requiring scroll activities, this should be obvious immediately when having accessed the Portal and with the page unscrolled.

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If the initial screen shows a self-contained representation, no further information about the possible need for scrolling has to be given.

These results of the user behaviors too will be included in the new set of rules.

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6 Conclusions

The results are now matched with the current standards and rules of screen design and checked for plausibility. So, the evaluated results are compared with the current existing standards and design recommendations and validated and discussed with respect to the logic of the new findings. A result has been expected that attaches more importance to the handling of typography on Healthcare portals as well as to their structures and navigation.

6.1 Comparison between hypothesis and result and the research result

The hypothesis put forward under point 3.1.5 has been confirmed. It has been possible to elaborate a priority list with the help of the Structural Equation Model proving the influence of the different design factors on the acceptance of Healthcare portals.

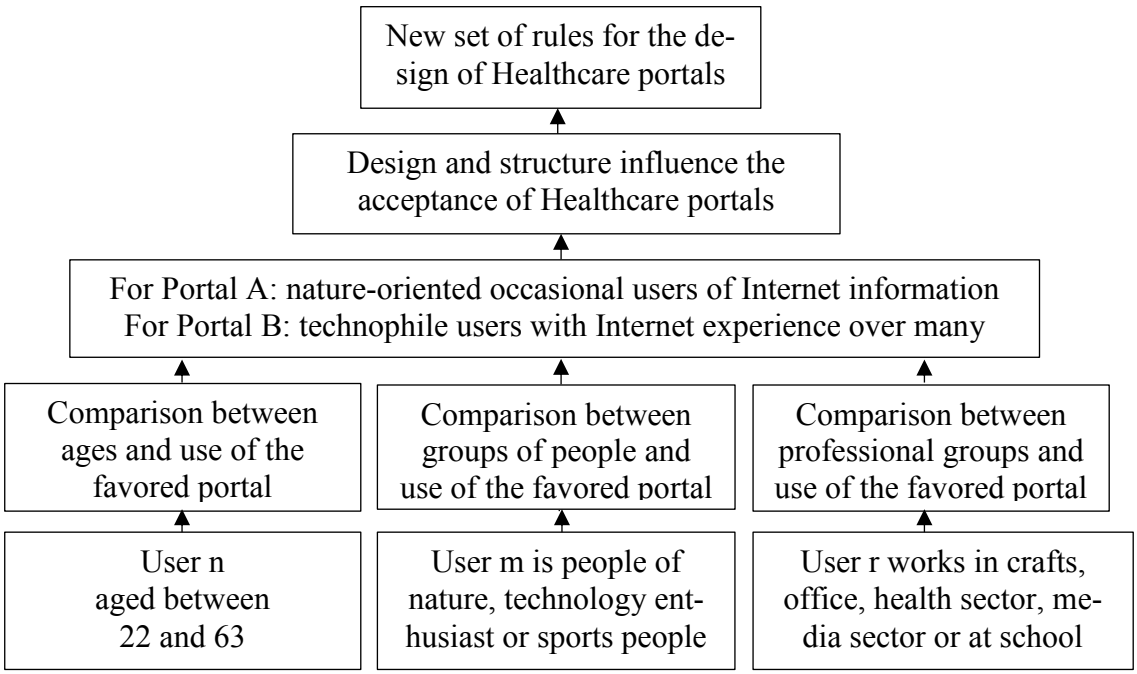

Figure 28
Presentation of the research results according to the induction method (Bottom Up)

6.1.1 Comparison between hypothesis and result

The hypothesis under point 3.1.5 contained the improvement of the acceptance of the Healthcare portal "Onmeda" by modified design as well as user-friendly content allocations and structures. The currently valid design standards for websites have been used and

implemented. This research work proves that the present rules are no longer current and need to be updated. The hypothesis has only partially been confirmed by the participants' evaluations (modified basic layout, structure, content-related topic assignments). New rules have to be deduced concerning font sizes and the typography concept, because the hypothesis has not been confirmed in this subfield.

The results detected prove the different weighting made by the different clusters of people, genders, professional qualifications, professional fields, ages as well as the length of time computers have been used. The sequence of the design aspects and their weighting selected by the participants is surprising.

The screen design of Internet portals provides stringent rules concerning the structure, content arrangement, typography and professional image editing. These rules have been able to be confirmed in this research project only partially.

6.1.2 Comparison between prognosis and result

It was forecast that the 73 pages of the newly created and programmed Healthcare portal "Onmeda" would gain the majority of participants and that the new design altogether would be preferred. This has not been confirmed. A slight majority opted for the original Portal A currently in use and operated by **gofeminin.de GmbH** on the Internet.

The cause is the modified user behavior and user perception of text as bulk text and, similarly, of the text-based navigation elements.

The findings from this research project may enable new rules of the current user behavior to be stated and to be incorporated as recommendations in the new set of rules.

6.1.2.1 Causes of the results obtained

First, the causes were the old-fashioned rules of the Internet design. They need to be updated. Second, the rules currently existing do not take into account the behaviors of inexperienced users. This is clearly stated in the result that technology enthusiasts, media specialists and participants proving computer experience of more than 15 years predominantly opted for the newly designed and programmed Portal B.

These findings implicitly require the development of a new set of rules for the design of

Healthcare portals. The findings on the user behavior of inexperienced users are especially taken into account.

6.2 Analysis of the empirical survey

This research project serves as a basis for developing a new set of rules for optimal usability of Healthcare portals. It is to redefine obsolete standards and rules that are still in use daily in the professional training of design and media professionals (media designers, bachelors of arts, communications and graphic designers).

As a result, it can be stated that when accessing Healthcare portals, users approve the designs and structures. Important rules of how to design Graphical User Interfaces completely lose significance, others receive higher weighting. So far, buttons of a navigation unit have been supposed to consist of one word only. This has only partially been confirmed by this research project. Less than half of the participants in the survey put emphasis on this aspect. However, in practice, participants are not disturbed by buttons of Portal A such as “diseases and symptoms,” “pregnancy & family,” “stomach problems on holiday” and many others.

Clear structures and content allocations of similar topics, in practice (Portal A), are not perceived as quality criteria of the Healthcare portal.

6.2.1 Benefits of the research result

The empirical survey provided much potential to be included in the set of rules. This does not refer only to the priority of the design aspects but also findings from the survey relating to the newly developed portal. Necessary modifications will be included in the recommendations. Healthcare portals provide optimal opportunities for new medical and health-oriented services. If the target group is expected to be reached, acceptance should be increased. This objective can be reached if the set of rules attracts the approval of the portal operators and medical experts.

6.2.1.1 Benefits for the medical field

These findings provide an important basis for the digitalization of medical services and products. Specific offers concerning health-preserving measures, the presentation of and information on symptoms and their causes can specifically increase the acceptance of Healthcare portals.

Information research is alleviated by simple design, results are output by delimited thematic areas more rapidly and even the inexperienced user obtains the contents required fast.

Doctors may place articles on current research finding and treatment experiences specifically on Healthcare portals dealing with those thematic areas.

Information and responsibility for maintaining one's own health and for recovering may promisingly support the specific therapy accompanied by the doctor.

By the information provided, health insurance companies may save consulting fees caused by medically qualified personnel or specialists, so that they only need to be gone to in case of severe symptoms and diseases. The health insurance companies save possible expenditures for medical consultations by just appealing to customers to show responsibility for a healthy lifestyle and, thus, for the prevention of diseases.

The database containing medical specialists and asked for by the participants represents a good signpost for patients and facilitates the specific contact to the specialist. Doctors appear there introducing their treatment specialties and contact details.

The new set of rules does not only serve as a guide for Healthcare portals but for all institutions present in the Internet offering medical, nursing and health-oriented services.

6.2.1.2 Benefits for programmers and portal operators

The new set of rules can enable programmers and operators of Healthcare portals to develop their usability and to place advertisements specifically according to the content and target group. This promises to gain new users as well as to increase advertising income. More users of Healthcare portals open up new aspects for their operators reflecting a larger variety of collecting user data/inquiries (for Big Data).

This set of rules will provide a programmer's guideline for designing Graphical User

Interfaces of future Healthcare portals and will enable the programmers to focus more on the programming requirements.

6.2.1.3 Benefits for patients

People interested in diseases and symptoms can already acquire information from the Internet and decide whether a visit to the doctor is necessary. This saves time and travel expenses. Especially in regions situated far away from urban centers, users of Healthcare portals may benefit greatly.

People looking for advice may find new findings and research results via Healthcare portals without visiting a doctor personally. They may receive in the Internet nutritional suggestions and implement them. Here, large benefits for prevention and health stabilization may be seen. Advice for healthy lifestyles and nutrition allows the users to create their own foundations for healthy and happy lifestyles. This includes current findings about the effects of specific products on the human body and of specific foods in the body.

New medical and health-oriented services and products may be offered without the user facing any time or financial expenditures.

6.3 The course of and peculiarities during the research

There were no peculiarities during the whole period of the research project. However, the results of the survey and the evaluation of the recordings were surprising. When comparing some results taken from the questionnaires with the evaluation of the recordings, it has to be noted that some aspects did not correspond to the practical user behaviors on the portals. Whereas, for example, the respondents in the questionnaires attached high importance to the design aspect of labeling buttons with only one word, violations of this on Portal A in practice were not considered to be negative, although it was frequently the case there. Many participants favored the center as the correct position of the main information. Nevertheless, they moved their eyes predominantly to the top or even to the bottom margin of the application.

As a whole, the result has been surprising because many aspects were stated to be unimportant that formerly had been classified as quality criteria of good Internet design. This

refers, for example, to the position of the main information on a page. There was no uniform response in the questionnaire, which was confirmed by the Gazepoint evaluation of the gaze positions.

The research itself proceeded as planned. Initially, the participants' survey had been scheduled to be completed by the end of November 2015. This time was extended until 31 December 2015, because not all the participants had been able to take part in the research project before December.

6.4 Recommendations for the set of rules

As a result of this research project, the following set of rules will be developed. Here new findings obtained by the empirical survey as well as the evaluation of recognizable patterns will be incorporated. It represents a set of rules for the designing and programming of current Healthcare portals based on the latest findings.

On the one hand, this work shows the possibilities of how to develop the layout structure and, on the other hand, sets clear frameworks for the better acceptance of Healthcare portals.

6.4.1 New findings for the layout of Graphical User Interfaces

The set of rules refers to the desktop representation of Healthcare portals. There may be different alternatives. The basic layout should take into account the different range of topics and should be able to be perceived rapidly. It must be considered that most participants immediately used the navigation and only as a second option the scroll bars for finding the then still invisible information.

While analyzing the recordings, it became clear that the participants mainly focused on text—and less on the pictures. The text is full of information content, whereas pictures have a loosening and additionally explanatory function. They support memorability of text and have a strengthening effect. So, integrating too few pictures should be avoided. Finally, the information given in the form of text plays the main role.

6.4.1.1 New guidelines for screen partitioning and layout

A Content Management System is suited for Healthcare portals. This can be maintained

by editorial assistants and continuously updated. The proportional division of the page is advantageous as it reinforces the harmonious perception of the application.

Advertising should be integrated into the application as it is hard to realize outside the portal or it is perceived as disturbing there. Advertising on pop-up windows is perceived as disturbing as well.

Navigations in the right margin should be avoided completely because when reducing the size of the browser window, frequently the layout changes and navigation becomes invisible.

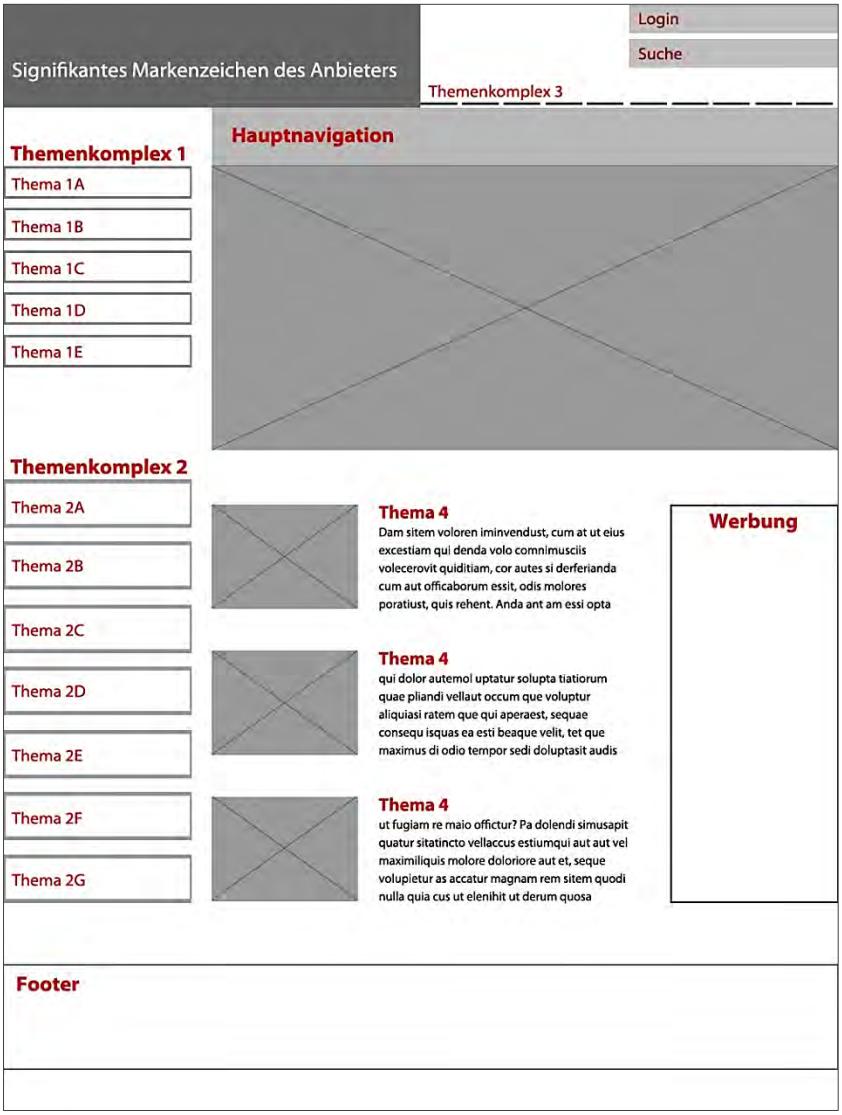

Figure 29
Exemplary layout structure of a Healthcare portal

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Clear space should be planned between the individual topics to illustrate different contents. Alternatively, tiny gray lines may be used to separate different thematic areas. Topic area 1 might provide information about the topic “Children and family,” topic area 2 “Symptoms and complaints,” topic area 3 company details and corporate philosophy (“About us,” “Press,” “Legal notice,” “Contact” …) and topic area 4 extensive current announcements.

The application layout shown in Figure 29 sees a width of 1000 pixels and divides them into four grid blocks of the same width. Height is unimportant as it depends on the amount of information. Here, there are no instructions or recommendations. The topic ranges may be amended vertically as desired.

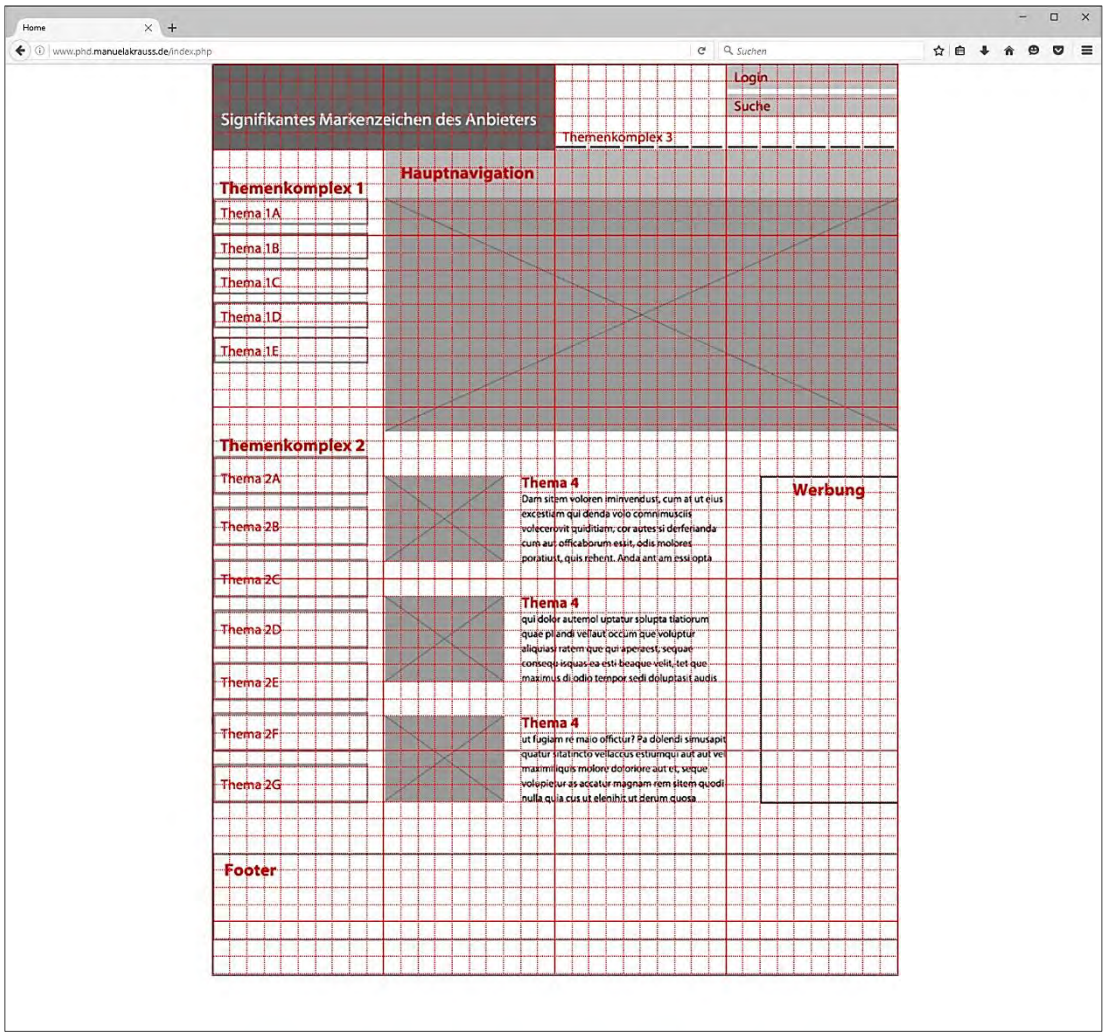

Figure 30
Basic layout structure with construction grid

Figure 30 shows an illustration of the construction grid. The division into four horizontal blocks represents an example. Even the division into five or six grid blocks is possible, as seen in Figure 31. This basic layout may be helpful if the left column does not provide enough space for the content intended, probably, because some additional pictures or larger text modules have been placed here.

Starting from the assumption of a basic layout comprising six horizontal blocks, each block is $166.6\overline{6}$ pixels wide. In this case, the two blocks on the left may be used as subordinate text modules and the four grid blocks on the right provide space for the main information with main navigation.

Here too, sufficient space has to be provided between the individual topics, whereas the information within one topic should be directly next to each other (gestalt law of proximity [48]).

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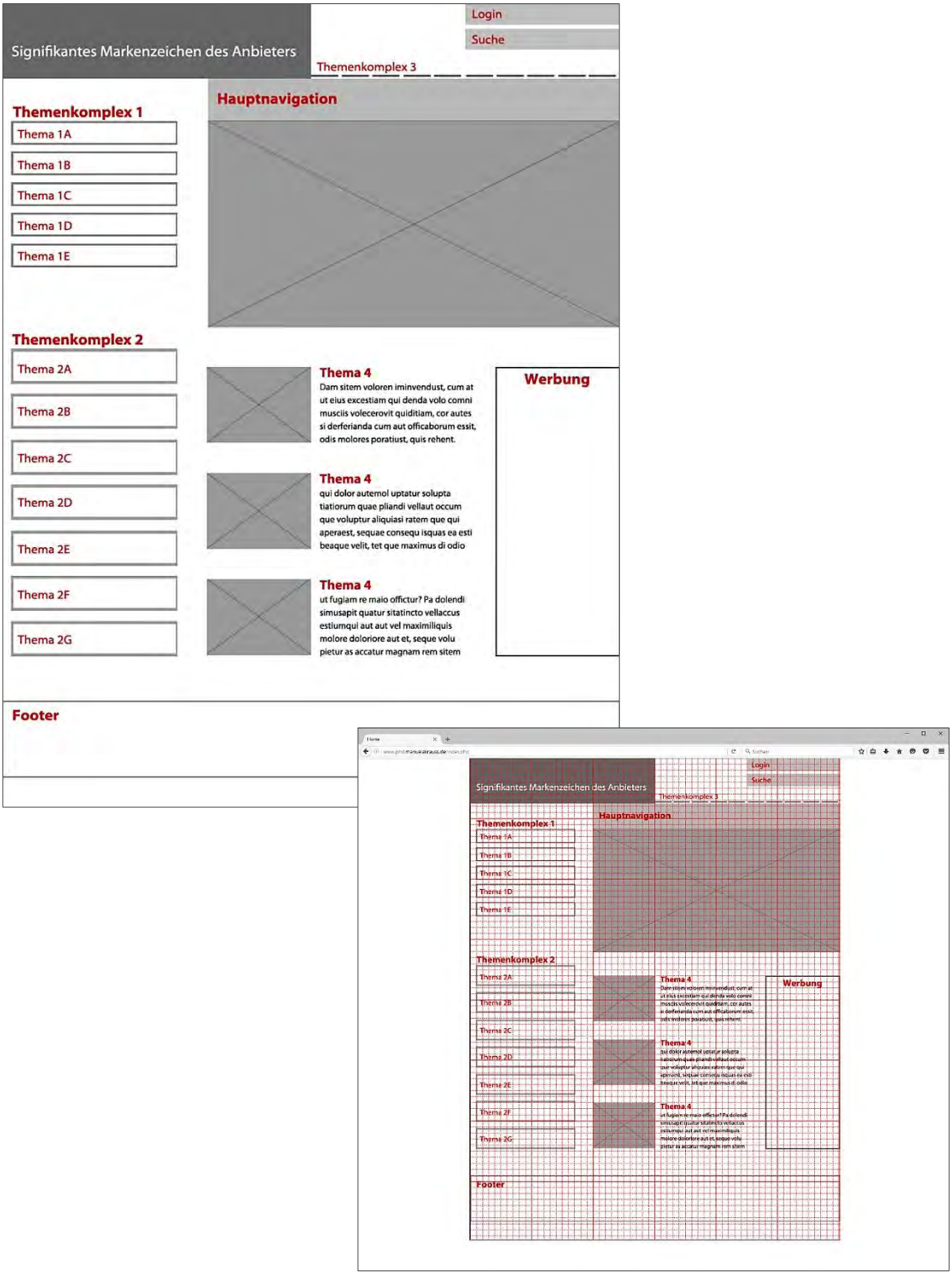

Figure 31
Basic layout with six horizontal blocks

6.4.2 New findings referring to design objects on Healthcare portals

On the basis of the evaluation of all the participants' questionnaires and video recordings, new standards and recommendations for the handling of design objects are to be set up.

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6.4.3 New guidelines for the handling of design objects

For the handling of design elements such as color, text, contrast, pictures and graphics the following recommendations are given.

6.4.3.1 New guidelines for the coloring scheme

The coloring scheme of Healthcare portals should focus on the colors blue and green in addition to the achromatic colors between white and black. Not just because blue was determined as the favorite color of most participants, but also because this color is associated with sky, freshness, sea, recreation, confidence, sportsmanship, cleanliness, harmony, relaxation, and flowers like the forget-me-not [93]. The possible color scheme ranges from bright to dark shades of blue, as seen exemplarily in Figure 32.

This tonal value should be defined as a component of the corporate color.

A harmonious combination of the corporate color might consist of an additional shade of green or a darkened shade of red. In this case, green would stand for healthy nutrition and lifestyle, for recreation and hope, fresh fruit and healthy nature and environment [94].

Figure 32
Exemplary color combinations blue-green

Red could be chosen as the secondary color if the Healthcare portal predominantly provides medical information. This tonal value might be associated with healthy blood, potential injuries, heat and dangers.

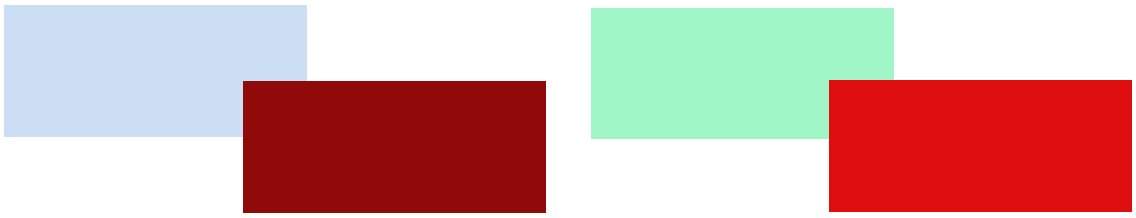

Figure 33
Exemplary color combinations blue and green with red

The color combinations applied in Figures 32 and 33 are recommendations for corporate colors with primary and secondary colors. The Corporate design of the Healthcare portal may have a primary color or be amended with a secondary color. The choice of color should be given careful consideration. The two colors may work together to produce a harmonious color concept. If a dissonant color with a different saturation value is chosen as the secondary color, the leading function of the saturated color needs to be reconsidered.

Therefore, the background should be white, if possible, or should have another soft pastel tone. The focus is on the "moderation" of the colored background. The background is not to distract attention from the information (in the foreground).

Black or a dark gray tone with a higher proportion of black should be selected for text. Further explanations about text color follow in the next chapter. It is essential to pay attention to a high brightness contrast between the text and background.

To indicate links, the (text-) link may have a color of the already stated coloring concept. Further possibilities to highlight text links to other subpages or anchored text modules are outlined below at "New guidelines for the handling of typography."

Likewise, the colors of the buttons should correspond to the overall coloring scheme.

In principle, color gradients should be avoided.

6.4.3.2 New guidelines for the handling of typography

Continuous text

The font size should be 14 pt as a minimum (better is 15 pt). A sans-serif Light or Regular font style should be chosen (as outlined in Figure 34). Line spacing may be 150% of the font size depending on line lengths.

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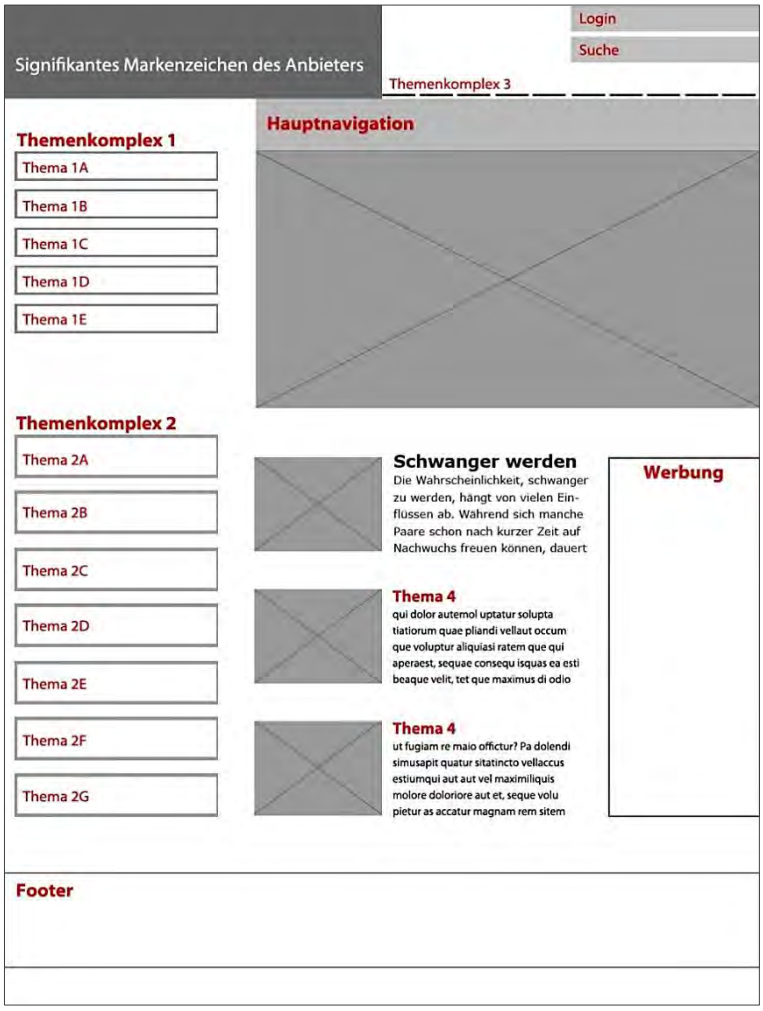

Figure 34
Continuous text with 15 pt Verdana and 22.5 pt line spacing with 33 characters/line

One line should contain at least 30 up to 55/60 characters approximately (including space characters). Expert literature recommends a standard of maximally 50 characters per line [61] or 55 characters per line [95]. This information should be used only as a rough guide, as they support reading guidance and legibility. Good legibility is provided at a line length of about 50 characters and a space to the next line of 150% of the font size.

Text should be black or show a slight reduction of tonal value.

The amount of bulk text should be limited. This limitation may be 15,000 characters per article. This corresponds to the explanations on www.onmeda.de dealing with the topic “Heart attack” ranging over four Internet pages. Therefore, scientists and specialists need to limit themselves to a manageable amount of text.

Headlines

They should stand out from continuous text clearly—probably by using bold formatting—but they should belong to the same font family. The font size should be proportional to the continuous text. Figure 34 shows the font size of the headline as 1.5-fold scaling (continuous text = 15 pt, headline = 22.5 pt). To maintain the objectivity of the information, the achromatic integration of the font is recommended (if possible even black).

Text links

Text with link functions should not be underlined. Another color from the defined coloring scheme instead may indicate the link. This color change may already occur during a MouseOver event.

Navigation elements

They should not be smaller than 14 pt, but may even be displayed slightly larger. The distinction between navigation or information units may be achieved by displaying all names of a navigation unit in uppercase letters or differently colored. However, consistency and coherence need to be recognizable (gestalt law of similarity [48]).

Care must be taken to ensure that the same text types have identical formats and that they clearly distinguish from each other. Hierarchies need to be clearly visualized.

Recommended fonts to be used for an easily legible text are Calibri Light, Frutiger Light, Gothic720 Light, Segoe Ul Light, Swiss721Lt BT, Yu Gothic Light and others.

6.4.3.3 New guidelines for incorporating pictures and graphics

Pictures on Healthcare portals are considered subordinate. Users look for specific information as text—explanations about symptoms and diseases, causes, possible therapies, influences of nutrition and fitness, prevention. That is why pictures should have a complementary function and their number should be limited.

All photos should demonstrate the direct contextual reference to the topic of the page.

On the homepage, as the entrance to the application, there may be incorporated a large

lead picture or slide show. Further photos represent just text supplements. Photos without any reference to the proper information should be avoided.

Pictures of nature should be placed in the foreground. Tips and advice should be accompanied by motifs showing talks between doctors and patients. If the technical equipment takes a fundamental part of the diagnosis and therapy, photos with the respective motifs should be amended to complement the text.

Photos belonging to the specific topics should be placed below or left of the text, thus directing the reading guidance. Text should be positioned close to the picture.

6.5 New findings for structure, contents and navigation on Healthcare portals

The analysis of the participants' user behaviors disproves some of the rules so far recommended when designing Healthcare portals. The new guidelines predominantly apply to Healthcare portals because the analysis results represent the behaviors of the group of test persons (participants).

6.5.1 New guidelines for structure and contents

There must be a clear content structure in the center of the conceptual development of Healthcare portals. Similar topics need to be pooled in one section.

Thematic fields belonging together should be combined and integrated into one complete navigation unit, such as "Our family," "My symptoms/complaints," "My health," and others.

Search functions and databases should be recognizable at first sight and visualize the service. Breadcrumbs (logical path directing to the current page hierarchy as text) may be incorporated as sitemap function on the subpages.

6.5.2 New guidelines for menu guidance and navigations

The menu guidance should follow the clear content assignments of the topics to specific sections and navigation units. The menu guidance should be based on spacious buttons with larger fonts.

If interaction is possible, it must be clearly indicated and it should respond to the Mouse-Over effect.

If possible, buttons should not have color gradients. If they are indispensable, they should be used exclusively in a reduced form—for example as a light effect.

The number of navigation units is not limited. However, the important ones should already be in the area of the initial screen without forcing the user to scroll down. The number of navigation units should be selected in a way that they do not impede clear transparency and orientation for the user.

The same applies to the subitems of the navigation unit. Button labeling should be short and clearly formulated, but does not necessarily need to be limited to one word only.

Icons and known pictograms are wanted by the users and should be used.

6.6 New findings for contents concerning advertising strategies

In the center of the findings, there is not only the commercial aspect interesting for advertising businesses but also the effect on the users and the efficiency of advertising for users and the advertiser. Therefore, the new results of advertising on Healthcare portals are incorporated in the guidelines.

6.6.1 New guidelines for incorporating advertising

Additional pop-ups for adverts should be avoided completely. It is ideal to find a fixed position or fixed positions on the Healthcare portals. If there are adverts outside the page, it may be perceived as disturbing or even completely ignored.

Check your target group. The majority of the participants when assessing the Onmeda portal exclusively opted for adverts dealing with medical, health-oriented or pharmaceutical products. Adverts for external products or businesses should be excluded.

6.6.2 Further technical requirements

Additional technical aspects of usability to be considered when programming portals should be briefly mentioned.

6.6.2.1 Accessibility

The texts should be simple and legible. For people with sight impairments, good color contrasts and additionally a screen magnifier (belonging to the operating system) or the zoom function of the browser are recommended. Furthermore, the standards of the WCAG 2.0 (Web Content Accessibility Guidelines) for accessibility are to be observed. [96] [97]

In addition to considerations of how to meet physical and psychological limitations of users of Healthcare portals, attention should be paid to the different mobile output devices and the information transfer to smartphones (responsive design) and other devices.

6.6.2.2 Multilingual Healthcare portals

If addressing users worldwide or just in Europe, the portal operators need to offer the translation of all the information displayed. Users should be able to recognize this immediately when accessing the portal. Different languages might be symbolized by the respective national flags placed in the header of the site. Generous space might separate the languages from the information of the operator.

6.6.3 Summary of the new standard

The new set of rules for the design of Healthcare portals diverges considerably from the present standards taught in the professional training for design studies at vocational schools and universities. The rules so far applied in screen design are often 20 years old or even older.

6.6.3.1 Changed user behaviors

The user behavior, however, changes with the use of the output devices. Today, the screen sizes are much larger than in the 90s, wide screens are common, large-format screens are the order of the day. Much more information is visible on the screens, so the texts should be written in a larger font size and should be structured more clearly.

6.6.3.2 The experts

This research project involved participants with completely different IT knowledge and different ages. They reflect the average user of Healthcare portals. Users who surf the

Internet only a little and do not use computers regularly prefer larger font sizes.

6.6.3.3 Changed tonality

The tonality of the descriptions should be up to date and personal. Users shall feel concerned immediately and get the desired object on searching for their specific information right away. Because of the participant group, the language needs to be simple and comprehensible. Medical knowledge, as well as medical terms, cannot be assumed.

The Internet has become a permanent companion of most people in the search for descriptions, explanations and the latest information. So, a familiar and factual tonality should be chosen.

6.7 Concluding remarks

The objectives of this research work were to examine the current user behavior, and the gaze behavior on Healthcare portals. Is it possible to recognize certain patterns with participants who show individually different preconditions? Can design aspects be derived for different target groups? The analysis proves that common perception psychology aspects have been detected and that the design rules considered valid for such a long time are obsolete. The perception psychology in the information reception on Internet pages is changing as a result of the progress of digitalization. In the same way, trends are developed in the way of life and daily work routine, the cognition of digital media as well is subject to changes. It may additionally have characteristics of the target group, seasonal influences or event-driven priorities and peculiarities that have to be especially considered by the design.

The result shows that similar structures for user guidance are not necessary to facilitate the user's search on Healthcare portals. Users do not require familiar usability. That is to say, that the corporate design of each portal operator may be maintained.

This research project shows ultimately the influencing design factors and how they may promote or hinder information reception. The participants' focus was on color contrast and the user-oriented choice of fonts.

Furthermore, there are clear statements by the participants regarding the services to be provided by Healthcare portals. Databases for doctors, pharmacist's shops and other

medical facilities are important for the users. Self-tests are in general accepted, but very seldom considered important.

As a whole, the result has been surprising. At the beginning, it was not expected that the participants would have very diverse opinions. On the other hand, the patterns of the participants' decisions illustrate that it was overdue to reexamine the standards for the design of Healthcare portals.

Derived from these results chances and opportunities for users, Healthcare portal operators and medical institutions are shown. The importance of the acceptance of Healthcare portals for prevention and information transfer to people and as a communication platform used by medical specialists needs to be recognized and understood today in the era of digitalization and standard Industry 4.0.

6.8 Course of the research

As a whole, the requirements emerging from the research have been met as planned. But the survey with the participants, the digitalization of the research results, their evaluation and the completion of the doctoral thesis have taken longer than originally planned.

6.9 Risks

There is a risk with the complete or adapted transmission of this set of rules onto other websites. When adapting this set of rules, the different user behaviors and user expectations have to be focused.

If, for example, media agencies or designers present their services and products, some of the new guidelines are not applicable without adjustments.

6.10 Transfer of the research results to mobile output devices

The focus of this research is the information search on the desktop computer. However, many new results can be transferred to the responsive version of Healthcare portals that are to be newly eveloped. The user-friendly display on mobile output devices is already today of high priority. The trend of information research on mobile devices will stabilize and intensify in the coming years.

Therefore, the important aspects of the new set of rules are shown subsequently with regard to the importance for the responsive design, whereby the responsive design enables the layout to be adapted to mobile devices.

6.10.1 Typography

Basically, the amount of text needs to be reduced to the most important information, because it can be assumed that the display size of the mobile screen is smaller than that of a usual monitor. The content needs to be formulated briefly and concisely for presentation on smartphones.

The font size for the different types of text should correspond to the recommendations published in the new rule book. Because of the current hardware resolution of common mobile devices of 360 ppi to 410 ppi, the texts displayed are clearly legible.

6.10.2 Color concept

The corporate design of the company also forms the basis of color design, with identical rules for the psychological effect of the products in the dominant colors of light blue and green. Particularly noteworthy are the different brightness effects on mobile devices used outdoors, in enclosed areas, but also in darkened/dark areas. Therefore, a clear brightness contrast between the dominant color and the other colors should be considered. To ensure that the colors used do not lose their guiding function, the color values need to be clearly distinguishable.

6.10.3 Image design

Because of the minimized display capability on mobile devices, the number of photos, images and graphics should be greatly reduced. This also affects the loading time of the individual pages. If these should nevertheless show important additional information, they should be integrated accordingly at a reduced size.

6.10.4 Content structure and navigation

The structure of the responsive version has to show related information. There may not be too many navigation elements belonging to one navigation unit. A manageable number of different buttons within a navigation unit causes the user to show a reasonable scrolling

behavior. Too much different information requires the user to scroll multiple times.

The names of the buttons need to be short and concise so that the user is immediately able to recognize the associated contents and statements.

The content structure, the names of the navigation elements and navigation units of the mobile version should match the desktop version.

6.10.5 Layout structure

The structure of the various layouts for mobile output devices has to be adapted to the desired width. The content structure and navigation concept should in principle be maintained. However, the design of the menu navigation and the navigation elements changes. These must be integrated clearly and manageably and reduced in the design. Here, a block division should be avoided, because this can no longer be represented on smartphones. Programmers should use a one-column design for smartphones.

6.11 Remarks

User behaviors and user expectations are changing and are adapting to the technical requirements (larger monitors, mobile devices) and habits by regular use. This is the reason that there cannot be created a generalistic construct for all Internet applications, but only a set of rules particularly created for one field—in this case for Healthcare portals. This set may apply as a basis for basic Internet portals and should be adapted for other websites in each particular case.

To enable Healthcare portals to provide important information free of advertising, some of them should be subsidized. They offer advice for healthy nutrition, explain the influence of healthy lifestyles in the case of complaints and explain behavior patterns which might ease suffering from diseases. It should be a task run by the State to inform its citizens nationally or even on an international scale. This helps to save expenses spent on complex examinations and treatments.

6.12 Prospects

Healthcare portals are an important companion in our daily lives. They are going to gain

more importance, and the possibilities of their use by patients and medical experts/specialists are going to increase. The information exchange of new findings and research results can be achieved fast and efficiently via secure lines among the doctors. Doctors may take part online in operations as observers or supporters. All this is already a reality today. All these opportunities may be integrated into Healthcare portals. Just a few Healthcare portals should develop to branch leaders providing a particularly user-friendly information reception together with reliable content. This harbors a great opportunity for "Onmeda."

In future waiting rooms of doctor's offices, emergency rooms and other medical institutions may be able to indicate online the waiting times, so that the patients may decide if they want, at a specific time, to go to that hospital or practice or to another one, just to avoid longer waiting times (frequently four and more hours in Berlin's emergency departments). Even this information might be retrievable from Healthcare portals.

The further use of telemedicine via the Healthcare portals is another interesting idea. It is to say that Healthcare portals should be sponsored by the Federal Ministry of Health.

Healthcare portals may provide much information, which is why the acceptance needs to be increased considerably now. The development of a set of rules for the optimal usability of Healthcare portals is to provide an essential contribution to this.

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7 Summary

After detailed analysis of different Health portals, user-friendly design and structure are considered to be a cause of low acceptance. The comparison between a typical faulty Health portal Onmeda (www.onmeda.de) and a completely newly designed one (observing all established design rules for GUIs) with a total of 73 subpages enabled new research results to be obtained.

The hypothesis is "Design factors and content structure (according to established rules of design) do influence the acceptance of Healthcare portals." After having compared the original Onmeda portal with the newly designed portal, it is predicted that most test persons will prefer the newly designed portal.

The research project was carried out with 31 test persons, who had to answer a comprehensive questionnaire. In addition, the Eye tracking tool recorded their behaviors while doing research work on the original Onmeda portal and on the newly designed at ww.phd.manuelakrauss.de.

The objectives of the research project are: 1 To find out whether the design rules for the interfaces of portals dating back to the 80s and 90s of the previous century are still relevant. 2 To research the perception of user behavior and to gain new insights for the design of Healthcare portals that improve their acceptance. 3 To ascertain if it is necessary to develop a new set of rules that takes up all the results of this research. Has the user behavior changed so that there must be a revised or even completely new set of rules—particularly for the development of Healthcare portals? 4 To trace a list of priorities of the importance of the design elements for the users. This serves as a guide for web designers to design new Healthcare portals. 5 To evaluate patterns between the decisions made by the test persons and their sociodemographic information. Are correlations recognizable (e.g., between age, gender, computer experience and preferred portal)? These give the web designers important information about the target group to be addressed. 6 To gain new insights into image presentation as well as the products to be advertised.

The results were digitized and visualized in Excel combination tables to obtain correlations of the behavior of the test persons and their sociodemographic data. The results were evaluated by means of induction, whereby the list of priorities of the design elements was visualized using Structural Equation Modeling (SEM).

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7 Összefoglalás

Különböző egészségügyi portálok részletes elemzése után megállapítható, hogy a felhasználóbarát kivitelezés és struktúra hiánya felelős ezen oldalak alacsony elfogadottságáért. Egy tipikusan hibákkal teli portál, az Onmeda (www.onmeda.de) és annak teljesen új tervezésű változatának (a GUI összes elfogadott tervezési szabályának figyelembe vételével) összevetésében, összesen 73 aloldal használatával új kutatási eredményeket sikerült megállapítani. *Hipotézis:* az eredeti és az újonnan tervezett Onmeda portálok összevetésében prognosztizálható, hogy a legtöbb tesztszemély az új kialakítású oldalt részesíti előnyben. A kutatási projekt 31 tesztszeméllyel került elvégzésre, akiknek egy átfogó kérdéskatalógust kellett kitölteniük. Ezenfelül a szemmozgásukat követő szoftver (GazePoint Eye tracking tool) feljegyezte viselkedésüket az eredeti és a www.phd.manuelakrauss.de alatt elérhető, új tervezésű Onmeda portálon folytatott kutatások során.

A disszertációban kitűzött megvalósítandó célok:

1. Annak megállapítása, hogy a jelenlegi portáloknak, az 1980 - 90-es évekből származó kialakítási szabályai még mindig aktuálisak-e.

2. Felhasználói viselkedések kutatása és új felismerések nyerése az egészségügyi portálok kialakításának területén, amelyek növelnék ezek elfogadottságát.

3. Vannak-e változások a felhasználói viselkedésben, vagy teljesen új protokollt (irányelvek együttesét) kellene létrehozni – különös tekintettel az egészségügyi portálokra - , vagy elégséges-e, a meglévő szabályok átdolgozása.

4. Felhasználói prioritás lista kialakítása, amely az új igényeket tartalmazza. Ezek a szempontok a webdizájnereknek szolgálna irányelvként az egészségügyi portálok tervezéséhez.

5. Minta adatbázis analízise: a tesztalanyok viselkedése és azok szociodemográfiai adatai közötti minták felismerése (korrelációk például kor, nem, számítógépes tapasztalat és előnyben részesített portálok között). A kialakítási elemek prioritási listája Strukturális egyenletek modelljének (SEM) használatával történő kidolgozása/szemléltetése. Új felismerések szerzése a képi ábrázolások, valamint a reklámozott termékek tekintetében.

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11 Appendices

11.1 Questionnaires

Appendix 01 | Survey on general user behavior

Semmelweis University Budapest
M. Sc. Manuela Krauß

Evaluierung
Research project:
Factors Influencing the Acceptance of Healthcare Portals

Questionnaire

on user behaviours when using graphical user interfaces

The Fachinstitut für Informatik und Grafikdesign carries out an evaluation relating to the comprehensibility and perception of information and services provided on Healthcare portals. The results improve the acceptance of already existing or future health-oriented and medical services.

Naturally, your participation is voluntary, but we would be very pleased if you take 15 minutes time for it. We thank you very much in advance for doing so.

Information about the user

Sex male ☐ female ☐ **Age** _____ years old

How long have you been using computers? for _____ years

Your apprenticed profession /current profession is _____

Information about computer use

How often do you use the Internet for research? never ☐ sometimes ☐ often ☐

Do you know any Healthcare portals? non ☐ yes ☐

which ones? _____

_____

Would you use Health portals, if they were clearly arranged, transparent and informative?
yes ☐ no ☐

Which information are you particularly interested in??
Disease prevention ☐ New healing methods ☐

Healthy nutrition ☐ Seasonal/profession specific nutrition ☐

Addresses of doctors and hospitals ☐

Date: Juni 2012 Signature _____

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Appendix 02 | 16 page questionnaire, page 1

Semmelweis University Budapest
M. Sc. Manuela Krauss

Empirical survey

Research project:
Factors influencing the acceptance of Healthcare Portals

1 Description of the research project

1.1 Subject

The acceptance and frequency of using Healthcare portals for patients in Germany have not been developed decisively in Germany. The magazine "test" in issue 6/2009 already introduced an evaluation on 12 different Healthcare portals and assessed their usability and content structures.

Although we each are potential patients and are interested in our health concerns, Healthcare portals have not reached the acceptance they deserve. They frequently provide very important explanations and nutritionally oriented tips that far too few citizen access. Why is that?

This research project (using eye tracking methods) is to analyse reading behaviours, reading guidance and the factors influencing the Healthcare portals' acceptance. So, the key questions are:

"What influencing factors have effects on the acceptance of Healthcare portals? (How can this acceptance be increased?)"

1.2 Content

In a moment two similar Healthcare portals will be presented that provide the same information but in different design. Before starting you will receive fixed tasks/questions which are to be solved by consulting the respective Healthcare portal. The time slot will be 5 minutes. All actions and the entire reading guidance will be recorded with the help of the eye tracking technique.

All tasks/questions apply to both portals. All movements and interactions will be captured at all times.

Finally you will be given a questionnaire explicitly asking for the effects caused by structural and design aspects:

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Structural aspects
Structure and transparency of navigation
Amount of buttons within a navigation area
Amount and placement of navigation areas
Clear content structure

Design aspects
Sensations regarding the layout
Text (font size, font colour, font amount, font alignment...), wordings
Images and graphics (size, position, image motif, animation ...)
Colouring (number of colours, choice of colours, coloured objects ...)
Placing of logo, brand recognition

Aspects of advertising strategies
Content of adverts
Positioning of adverts
Animation and banner ads
Design of adverts
Information provided within the advert

1.3 Objective

This research project is to research aspects of perception psychology for Healthcare portals that may increase their acceptance considerably. All data obtained by eye tracking and empiricism will help to develop a ranking order of the influencing factors and, finally, provide indices for final assessment.

Different test persons of different ages, sexes, education levels ... showing different medical and information technology backgrounds will be included in the test group.

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1.4 Data usage

Data collection within this research project is anonymised. Only some socio-demographic and psychographic data for assessing reading behaviour will be collected without including any personalised data.

The results obtained within this research project will be used for evaluating and analysing the research results or, hereinafter, for the declaration of a set of rules resulting directly from this research project.

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2. Personal details of the test person (before)

2.1 First name _____

2.2 Sex Female ☐ Male ☐

2.3 Age _____ years old or year of birth _____

2.4 Started working with computers in the year _____

2.5 Started doing web search in the year _____

2.6 Personal favourite colour _____

2.7 Which group of person do you feel to belong to:
Man of nature ☐ Technology freak ☐ Sportsman ☐

Others _____

2.8 Apprenticeship trade _____

2.9 Last occupation _____

2.10 Have you ever used a Healthcare portal?

No ☐ Perhaps unconsciously ☐ Yes ☐

If yes, which one(s) _____

_____

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Tasks to be performed at the Onmeda version, Portal A

Please have a very close look at portal A and try to understand what information you may get there. You should take about 3 minutes.

Hereafter, please solve the 2 tasks on the following page

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1. You are planning to travel to South Africa on your next holiday. You would like to get informed about health risks and protection from sunburn. For this purpose, please consult now the Onmeda Healtcare portal.

2. When talking to friends some days ago, you learnt that the Onmeda portal offers useful tips for healthy nutrition ("10 Healthy dietary rules"). You would like to know more about it and look for this topic on this portal.

Thank you. Now go on looking into the second version of the Healthcare portal – portal B – likewise for about 3 minutes.

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Now please solve the following tasks using portal B
(Search and login functions are not available in this version)

1. When consulting your doctor today you have been diagnosed with achalasia. You have never heard anything about this disease. You want to learn now further particulars about it. Look for appropriate information on this portal.

2. Your doctor has recommended the preventative check-up called J1 for your son (12 years old). As you have not been aware of such a check, look for some advice and further information in this respect.

Thank you. Now please fill in the following questionnaires.

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3 Analysis of Acceptance (afterwards)

3.1 Please decide which version of the Healthcare portals you would consider more comprehensible and user-friendly. Herein focus is especially on the following aspect:
Structure of information

	Portal A		Portal B
3.1.1 Which portal was more clearly arranged at first glance?	☐	or	☐
3.1.2 Where did you like best the artistic overall impression?	☐	or	☐
3.1.3 Which Healthcare portal showed better/clearer arrangement?	☐	or	☐
3.1.4 Where could you recognize faster what the portal was about and what information you could get?	☐	or	☐
3.1.5 Where could you allocate the subpages of the application and their contents better?	☐	or	☐
3.1.6 Where was content structured in a better or more comprehensible way?	☐	or	☐
3.1.7 Which portal offered clear functionality?	☐	or	☐
3.1.8 Which portal would you more likely to use?	☐	or	☐

3.2 Now, please, compare both portals considering the following aspect:
Text design

3.2.1 Where was the arrangement of text and amount of information more comprehensible/more user-friendly?	☐	or	☐

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	Portal A		Portal B
3.2.2 Where was the text more clearly arranged?	☐	or	☐
3.2.3 Where was the amount and length of text per paragraph/chapter more user-friendly? (Does it bother you if you have to scroll down much?)	☐	or	☐
3.2.4 Where was font size better?	☐	or	☐
3.2.5 Where was font colour (headlines, links, mouse actions ...) better chosen?	☐	or	☐
3.2.6 Where did you like best text alignment (left-justified /right-justified /justification)?	☐	or	☐
3.2.7 Which portal, considering headlines, subheadings, image captions and contents, led you to the results desired in a better way?	☐	or	☐

3.3 Now consider the following aspect:
Choice of colours

3.3.1 Which portal shows a more attractive choice of colours?	☐	or	☐
3.3.2 Where was the number of colours chosen optimally?	☐	or	☐
3.3.3 Where did you like the background colours best?	☐	or	☐
3.3.4 Where was the choice of colours for the buttons better?	☐	or	☐

3.4 Now consider the following aspect:
Integration of images and graphics **Portal A | Portal B**

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3.4.1 Where did you like the image sizes best? ☐ **or** ☐

3.4.2 Where did you like the image motives best? ☐ **or** ☐

3.4.3 Which portal showed more carefully chosen image details? ☐ **or** ☐

3.4.4 Which portal showed a better position of the images? ☐ **or** ☐

3.4.5 Where did you find the graphical symbols/icons more comprehensible and fully transparent with regard to content? ☐ **or** ☐

3.5 Now consider the following aspect:
Navigation and links

3.5.1Where was navigation and buttons more clearly arranged? ☐ **or** ☐

3.5.2 Where were the number and the positions of the navigation elements more easily recognisable? ☐ **or** ☐

3.5.3 Where were the navigation elements more transparent regarding content?

☐ **or** ☐

3.5.4 Where were mouse actions labelled in a better or more user-friendly way?

☐ **or** ☐

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4 Rating the influencing factors

(Please rate the following aspects concerning information search on web portals and use the school grades) on a scale

from 1 to 6; stating
1 = very important
6 = completely unimportant)

4.1 Please rate the importance of the following aspects:
Structure and navigation

4.1.1 How important is user navigation with the help of known icons and pictograms? ☐

4.1.2 How important is a maximum of 5 subcategories as division within the navigation unit? If you could think of even more subcategories you may rate here "6" (**unimportant**). ☐

4.1.3 How important is a limit of maximally 5 different navigation units on one internet page? If you could think of even more units you may rate here "6" (**unimportant**). ☐

4.1.4 How important is the description of the buttons with only one single meaningful word? If you could think of even more words you may rate here "6" (very bad/**unimportant**). ☐

4.1.5 How important is an additional reference on each subpage to know exactly where you currently are? ☐

4.1.6 How important are additional forums on this Healthcare portal? ☐

4.1.7 How important are additional games on this Healthcare portal? ☐

4.1.8 How important are additional self-tests on this Healthcare portal? ☐

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4.1.9 How important is **a limited scope** of offers on a Healthcare portal? Would you additionally expect databases with doctors' address lists, addiction prevention advices, galleries with images and videos, beauty recommendations, fitness exercises and more apart from only disease symptoms, nutrition tips and further tips for care and treatment? If you consider it important to find more areas there, please state that the limitation to only few areas is **unimportant** (rate "6"). ☐

4.1.10 How important is a limited length of information on one page, so that lengthy scrolling would not be necessary? ☐

4.1.11 How important is the detailed description of a particular disease symptom, so that you would be able to start medical treatment without consulting a doctor? ☐

4.1.12 How important is the possibility of online communication with a medical specialist? ☐

4.1.13 What important main information would you expect on a Healthcare portal?

_____

4.1.14 What additional service offers on Healthcare portals would make you especially glad?

_____

_____

_____

_____

_____

_____

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4.2 Please evaluate now the importance of design aspects:
Text properties

4.2.1 How important is a (extraordinarily) big font size (as seen on Portal A or even bigger)? ☐

4.2.2 How important is short and precise information on the topic looked for? If you do not mind the amount of text and you prefer reading even more detailed descriptions over several pages (even 10 pages or more)about the topic chosen, rate here grade "6" (**unimportant**). ☐

4.2.3 Would you prefer finding the most important contents – the main concern – offered by the Internet portal placed centrally at eye level? How important is this position? ☐

4.2.4 How important is the consistent use of one font style and font size for the same type of text? ☐

4.2.5 Could you imagine a better placement of the main information on this page? Which one? I would prefer the main information to be placed _____.

4.3 Please evaluate now the importance of further design aspects:
Choice of colours and image composition

4.3.1 How important is a smooth colour scheme (few colours) for the text, the background ...? ☐

4.3.2 How important is a harmonious colour balance of all objects (text, background, buttons, bars and other elements)? ☐

4.3.3 How important is a horizontal and vertical arrangement and orientation of the photos? ☐

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4.3.4 Are large photos on each page representing different topics important? ☐

4.3.5 Is it important to see several topics represented by smaller images as introductions on one single page (instead of fewer but larger images)? ☐

4.3.6 Are top-quality photos important (fine contrast, good definition, without colour faults? ☐

4.3.7 Are sliders (changing photos) important? ☐

4.3.8 Is it important to only use sliders with the main topic? ☐

4.3.9 Is it important to embed animations or videos for a better illustration? ☐

4.3.10 Is it important that photos stand clearly out from the background and should be framed (as seen on Portal B) or should be positioned on colour fields? ☐

4.4 Please evaluate now the importance of advertising on Healthcare portals:
Strategic advertising aspects

4.4.1 How important for you is advertising or advertising banners on Healthcare portals principally? ☐

4.4.2 How important is where the adverts are positioned? ☐

4.4.3 Is it important that adverts are on the outer edge of the website? ☐

4.4.4 Is it important that adverts are placed within the web application? ☐

4.4.5 Is it important to only show particular medical, pharmacological or health-oriented adverts on Healthcare portals? ☐

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4.4.6 Is it more important to even advertise completely atypical services and products on Healthcare portals? ☐

4.4.7 Is it important that adverts are not displayed in pop-up windows? ☐

4.4.8 Is it important to be informed about seasonal or other special offers? ☐

4.4.9 Is it important that advertising should show a more consultative or recommendatory nature? ☐

4.4.10 Would it be important to be informed about new findings or advancements in the battle against widespread diseases with the help of adverts? ☐

4.4.11 How important would the ban of advertising be? ☐

5 Suggestions for improving acceptance

Please comment now the following aspects for improving acceptance of Healthcare portals listed below. Please tick your favourites:

5.1 Choice of different image motives Better: Images of nature ☐

Patient interviews ☐

Medical equipment /technology ☐

Other image motives _____

5.2 Do you wish adverts on the portal? No ☐ Yes ☐

If yes, what products should be advertised? Don't mind, all ☐

Only medical and pharmaceutical products ☐ Natural products ☐

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Other products _____

5.3 Should advertising for certain products be banned?

No ☐ Yes ☐

Other products _____

5.4 Finally we would like to ask again for the comparison of the two portals presented here: Should this specific portal show more animations?

Portal A

No ☐ Yes ☐

Portal B

No ☐ Yes ☐

5.5 Should this Portal be designed more statically?

Portal A

No ☐ Yes ☐

Portal B

No ☐ Yes ☐

Thank you very much. We appreciate your time and attention you invested in order to answer these questions.

Yours

Manuela Krauß

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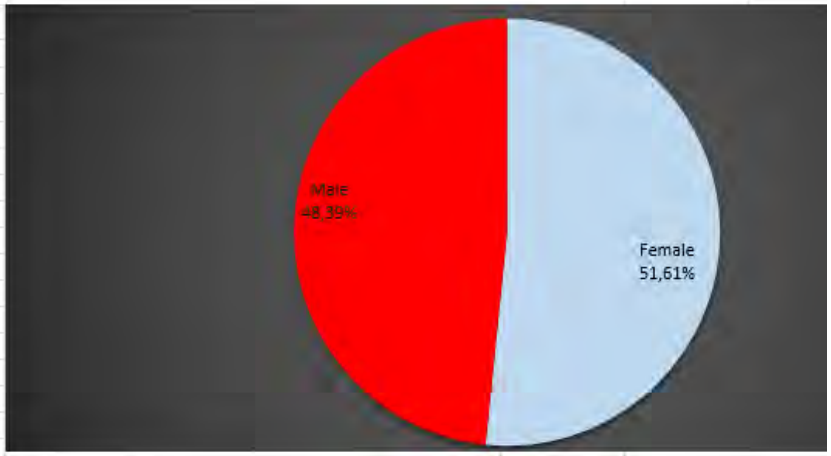
11.2 List of tables

Appendix 03 | Gender distribution

Gender		
Female	**Male**	**Total**
16	15	**31**
51.616%	48.390%	**100%**



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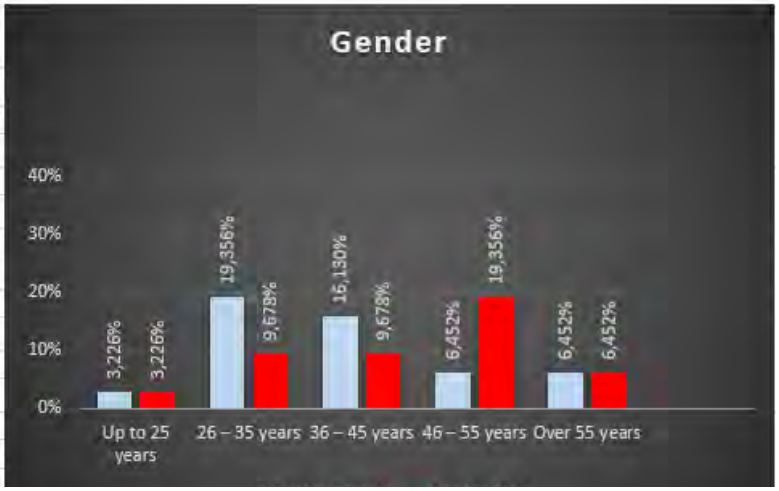
Appendix 04 | Age distribution

Age of participants	Gender		
	Female	Male	Total
Up to 25 years	1	1	2
	3.226%	3.226%	6.45%
26 – 35 years	6	3	9
	19.356%	9.678%	29.03%
36 – 45 years	5	3	8
	16.130%	9.678%	25.81%
46 – 55 years	2	6	8
	6.452%	19.356%	25.81%
Over 55 years	2	2	4
	6.452%	6.452%	12.90%
			0
			0.00%
			31



Appendix 05 | Gender distribution due to computer knowledge

Gender	Experiences in working with computers				
	Up to 5 years	6 – 10 years	11 – 15 years	More than 15 years	Total
Female	4	2	2	8	16
	12.904%	6.452%	6.452%	25.808%	51.62%
Male	0	0	1	14	15
	0.000%	0.000%	3.226%	45.164%	48.39%
					0
					0.00%
					0
					0.00%
					0
					0.00%
					0
					0.00%
Total	12.90%	6.45%	9.68%	70.97%	31
					100%

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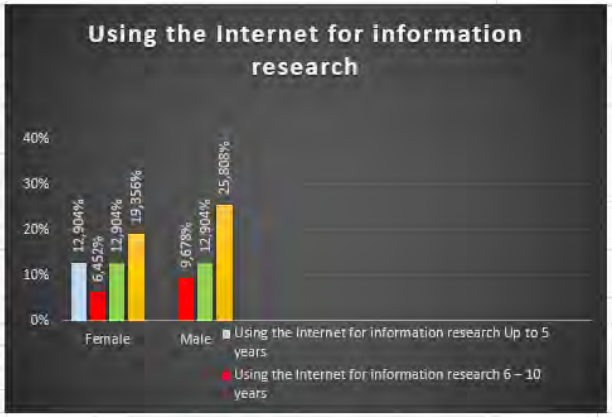
Appendix 06 | Participants distribution due to gender and Internet use

Gender	Using the Internet for information research				
	Up to 5 years	6 – 10 years	11 – 15 years	More than 15 years	Total
Female	4	2	4	6	16
	12.904%	6.452%	12.904%	19.356%	51.62%
Male	0	3	4	8	15
	0.000%	9.678%	12.904%	25.808%	48.39%
					0
					0.00%
					0
					0.00%
					0
					0.00%
					0
					0.00%
					31
Total	12.90%	16.13%	25.81%	45.16%	100%



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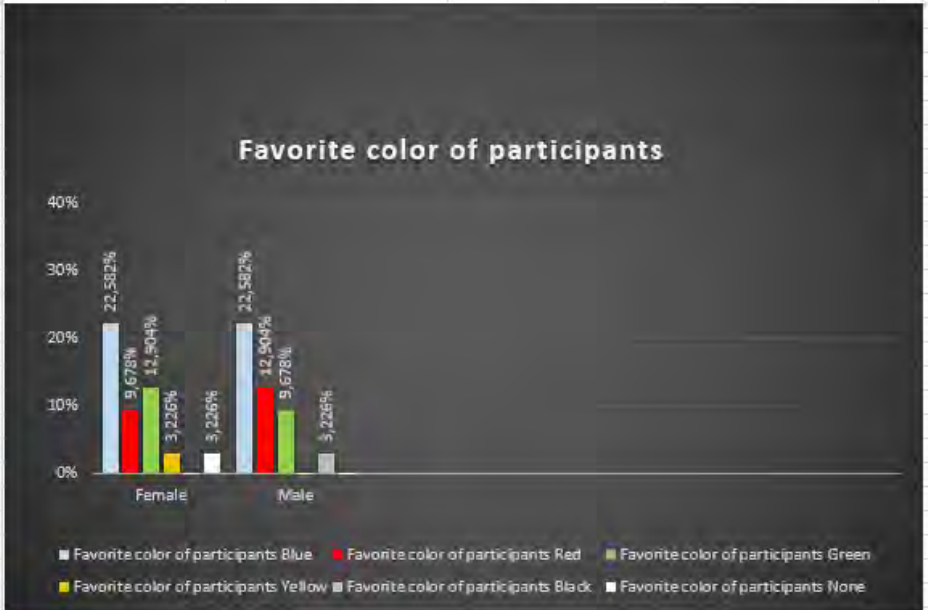
Appendix 07 | Relationship between favorite color and gender

Gender	Favorite color of participants						
	Blue	Red	Green	Yellow	Black	None	Total
Female	7	3	4	1	0	1	16
	22.582%	9.678%	12.904%	3.226%	0.000%	3.226%	51.62%
Male	7	4	3	0	1	0	15
	22.582%	12.904%	9.678%	0.000%	3.226%	0.000%	48.39%
							0
							0.00%
							0
							0.00%
							0
							0.00%
							0
							0.00%
							31
Total	45.16%	22.58%	22.58%	3.23%	3.23%	3.23%	100%



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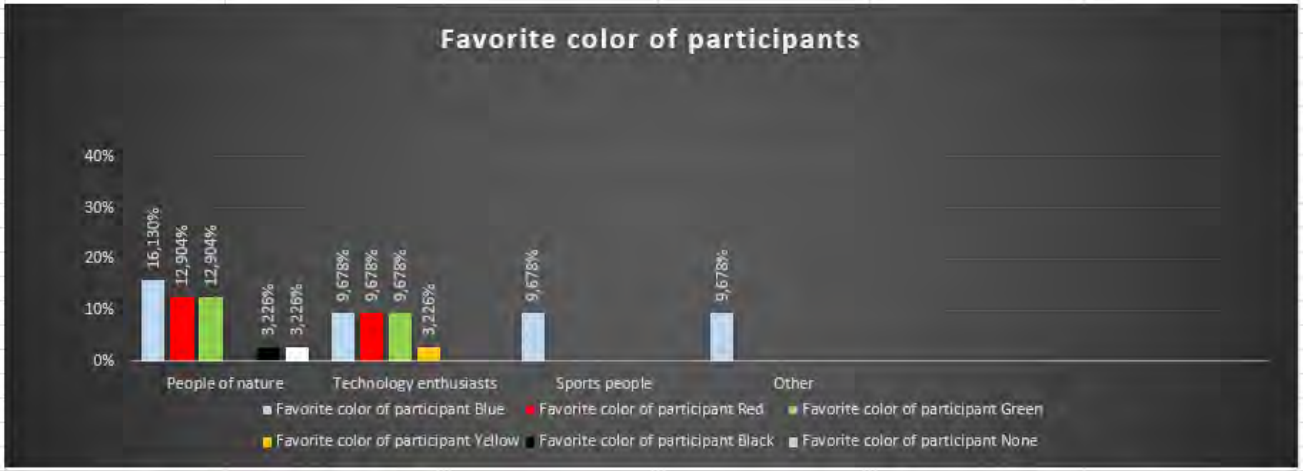
Appendix 08 | Relationship between cluster of people and favorite color

Cluster of people	Favorite color of participants						
	Blue	Red	Green	Yellow	Black	None	Total
People of nature	5	4	4	0	1	1	15
	16.130%	12.904%	12.904%	0.000%	3.226%	3.226%	48.39%
Technology enthusiasts	3	3	3	1	0	0	10
	9.678%	9.678%	9.678%	3.226%	0.000%	0.000%	32.26%
Sports people	3	0	0	0	0	0	3
	9.678%	0.000%	0.000%	0.000%	0.000%	0.000%	9.68%
Other	3	0	0	0	0	0	3
	9.678%	0.000%	0.000%	0.000%	0.000%	0.000%	9.68%
							0
							0.00%
							0
							0.00%
							31
Total	45.16%	22.58%	22.58%	3.23%	3.23%	3.23%	**100%**



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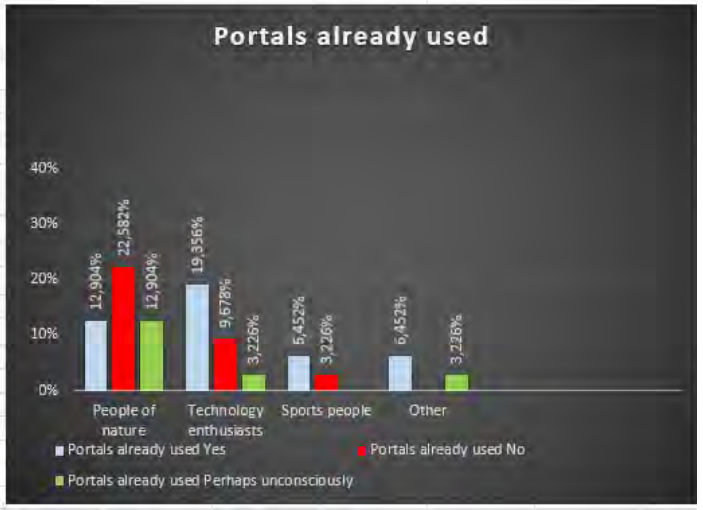
Appendix 09 | Comparison between cluster of people and use of Healthcare portals

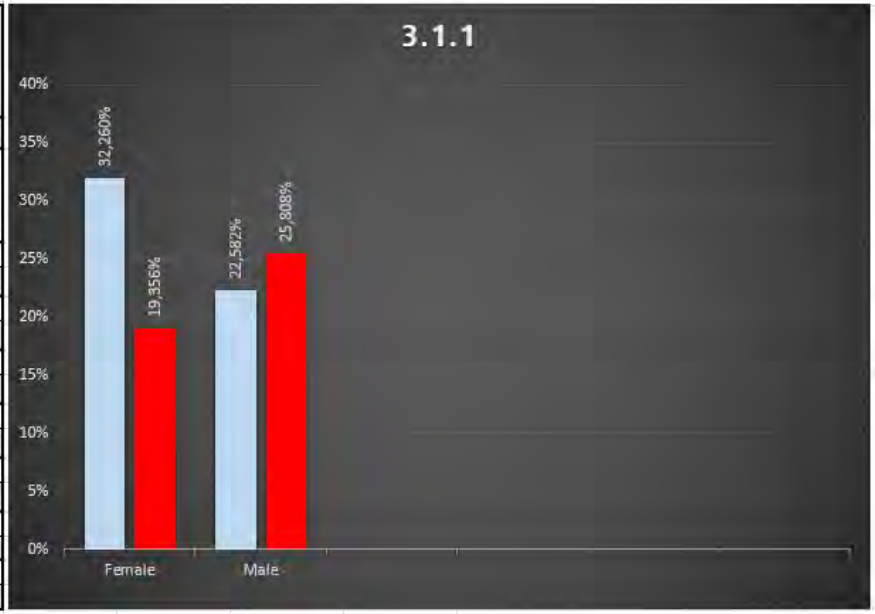
Cluster of people	Portals already used			
	Yes	No	Perhaps unconsciously	Total
People of nature	4	7	4	15
	12.904%	22.582%	12.904%	48.39%
Technology enthusiasts	6	3	1	10
	19.356%	9.678%	3.226%	32.26%
Sports people	2	1	0	3
	6.452%	3.226%	0.000%	9.68%
Other	2	0	1	3
	6.452%	0.000%	3.226%	9.68%
				0
				0.00%
				0
				0.00%
				31
Total	45.16%	35.49%	19.36%	100%



DOI:10.14753/SE.2018.2068

Appendix 10 | Comparison of Portals A and B with gender distribution

	Which portal was more clearly arranged at first glance?		
	3.1.1		
Gender	**Portal A**	**Portal B**	**Total**
Female	10	6	16
	32.260%	19.356%	51.62%
Male	7	8	15
	22.582%	25.808%	48.39%
			0
			0.00%
			0
			0.00%
			0
			0.00%
			0
			0.00%
			31
Total	54.842%	45.164%	**100%**



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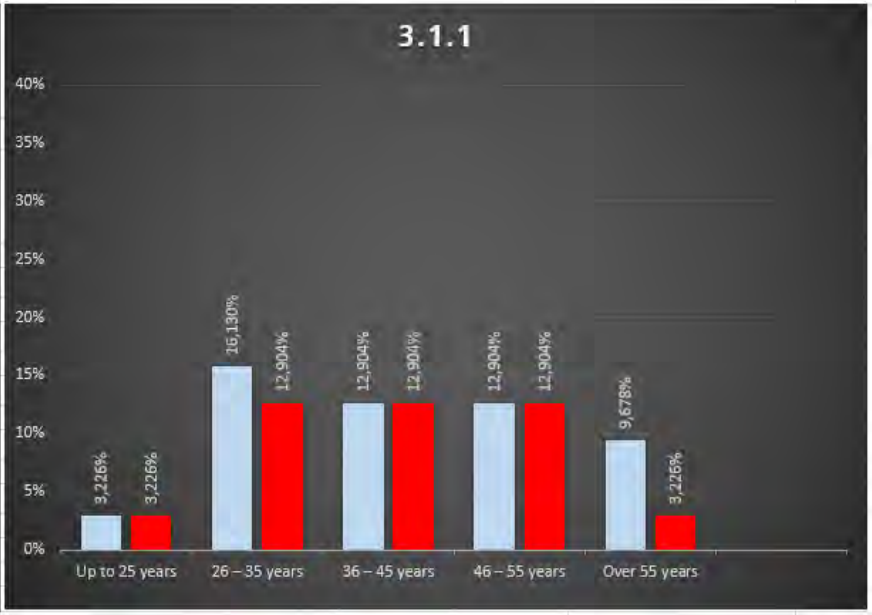
Appendix 11 | Comparison of Portals A and B with age distribution

	Which portal was more clearly arranged at first glance?		
	3.1.1		
Age of participant	**Portal A**	**Portal B**	**Total**
Up to 25 years	1	1	2
	3.226%	3.226%	6.45%
26 – 35 years	5	4	9
	16.130%	12.904%	29.03%
36 – 45 years	4	4	8
	12.904%	12.904%	25.81%
46 – 55 years	4	4	8
	12.904%	12.904%	25.81%
Over 55 years	3	1	4
	9.678%	3.226%	12.90%
			0
			0.00%
			31
Total	54.842%	45.164%	**100%**



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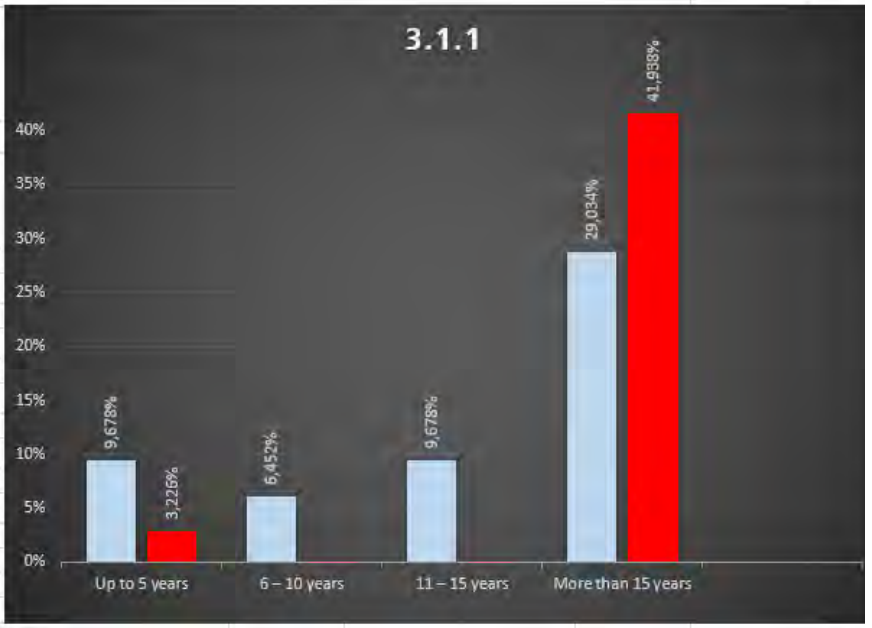
Appendix 12 | Comparison of Portals A and B with presentation of computer knowledge

	Which portal was more clearly arranged at first glance?		
	3.1.1		
Experiences in working with computers	**Portal A**	**Portal B**	**Total**
Up to 5 years	3	1	4
	9.678%	3.226%	12.90%
6 – 10 years	2	0	2
	6.452%	0.000%	6.45%
11 – 15 years	3	0	3
	9.678%	0.000%	9.68%
More than 15 years	9	13	22
	29.034%	41.938%	70.97%
			0
			0.00%
			0
			0.00%
			31
Total	54.842%	45.164%	**100%**



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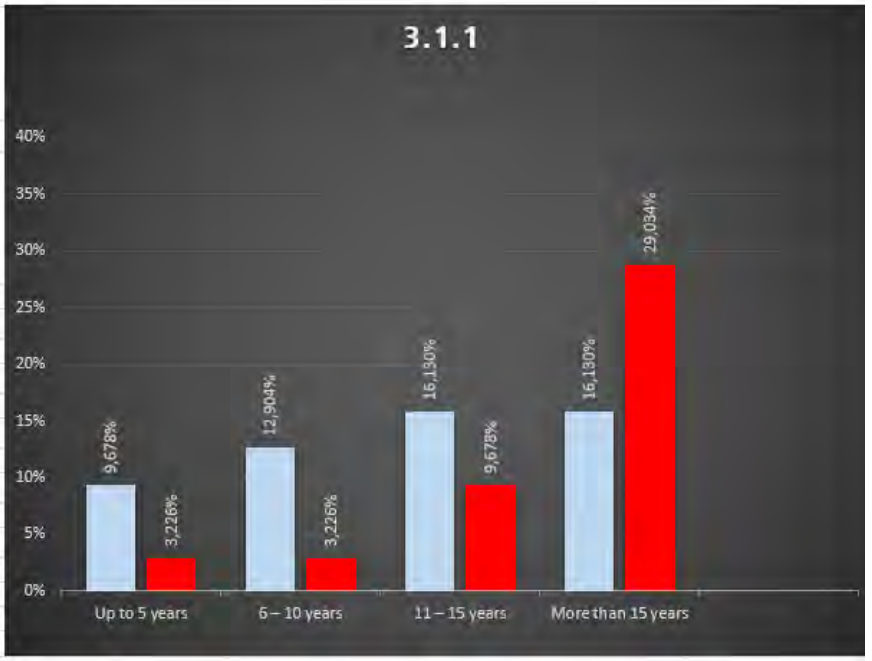
Appendix 13 | Comparison of Portals A and B with period of having used the Internet

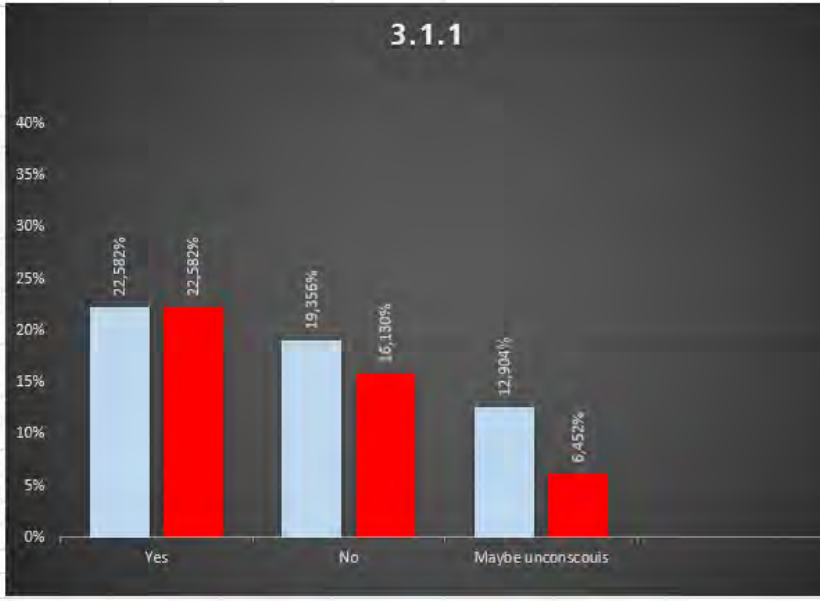
	Which portal was more clearly arranged at first glance?		
	3.1.1		
Using the Internet for information research	**Portal A**	**Portal B**	**Total**
Up to 5 years	3	1	4
	9.678%	3.226%	12.90%
6 – 10 years	4	1	5
	12.904%	3.226%	16.13%
11 – 15 years	5	3	8
	16.130%	9.678%	25.81%
More than 15 years	5	9	14
	16.130%	29.034%	45.16%
			0
			0.00%
			0
			0.00%
			31
Total	54.842%	45.164%	**100%**



DOI:10.14753/SE.2018.2068

Appendix 14 | Comparison of Portals A and B with presentation of the conscious use of Healthcare portals

	Which portal was more clearly arranged at first glance?		
	3.1.1		
Healthcare portals already used	Portal A	Portal B	Total
Yes	7	7	14
	22.582%	22.582%	45.16%
No	6	5	11
	19.356%	16.130%	35.49%
Perhaps unconsciously	4	2	6
	12.904%	6.452%	19.36%
			0
			0.00%
			0
			0.00%
			0
			0.00%
			31
Total	54.842%	45.164%	100%



Appendix 15 | Portals A and B comparing the cluster of people

Cluster of people broken down by gender and age	Up to 25 years			26 – 35 years			36 – 45 years			46 – 55 years			Over 55 years			
	Total	Female	Male	Total	Female	Male	Total	Female	Male	Total	Female	Male	Total	Female	Male	
People of nature	0	0	0	6	5	1	4	4	0	4	2	2	1	0	1	
	0.000%	0.000%	0.000%	19.356%	16.130%	3.226%	12.904%	12.904%	0.000%	12.904%	6.452%	6.452%	3.226%	0.000%	3.226%	
Technology enthusiasts	1	1	0	2	0	2	3	1	2	3	0	3	1	1	0	
	3.226%	3.226%	0.000%	6.452%	0.000%	6.452%	9.678%	3.226%	6.452%	9.678%	0.000%	9.678%	3.226%	3.226%	0.000%	
Sports people	0	0	0	1	1	0	1	0	1	0	0	0	1	1	0	
	0.000%	0.000%	0.000%	3.226%	3.226%	0.000%	3.226%	0.000%	3.226%	0.000%	0.000%	0.000%	3.226%	3.226%	0.000%	
Other	1	0	1	0	0	0	0	0	0	1	0	1	1	0	1	
	3.226%	0.000%	3.226%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	3.226%	0.000%	3.226%	3.226%	0.000%	3.226%	
Total	2	1	1	9	6	3	8	5	3	8	2	6	4	2	2	31
	6.45%	3.23%	3.23%	29.03%	19.36%	9.68%	25.81%	16.13%	9.68%	25.81%	6.45%	19.36%	12.90%	6.45%	6.45%	100%

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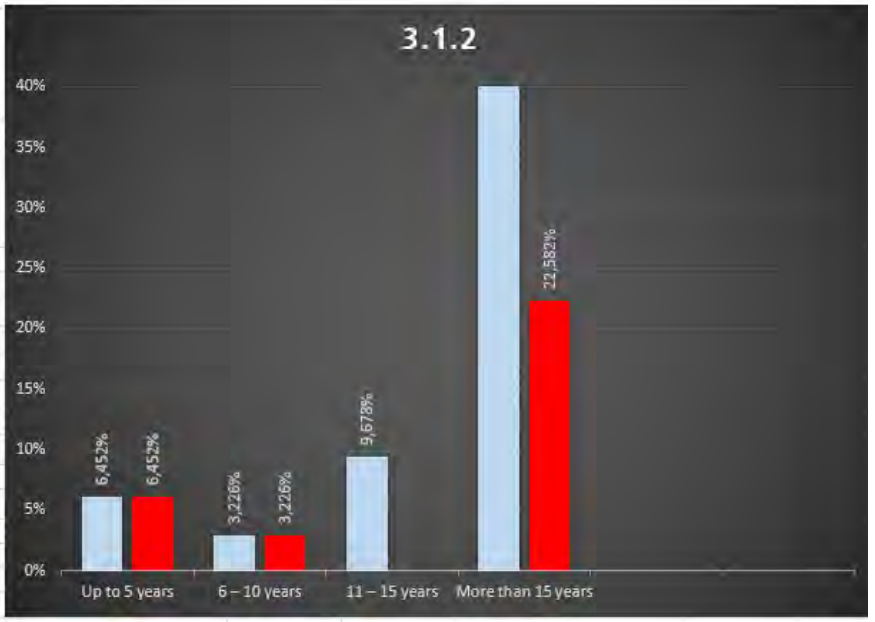
Appendix 16 | Overall design impression of both portals compared

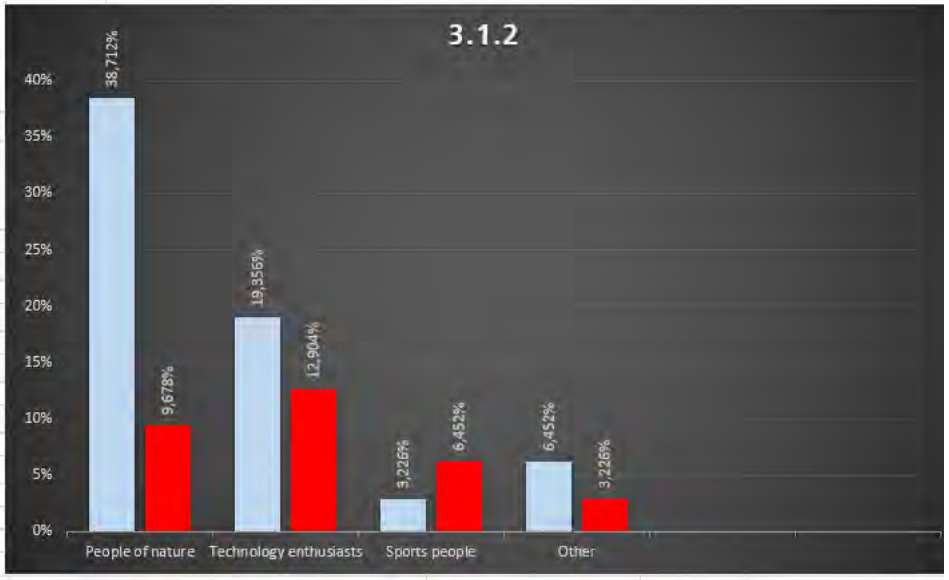
	Where did you like best the artistic overall impression?		
	3.1.2		
Experiences in working with computers	**Portal A**	**Portal B**	**Total**
Up to 5 years	2	2	4
	6.452%	6.452%	12.90%
6 – 10 years	1	1	2
	3.226%	3.226%	6.45%
11 – 15 years	3	0	3
	9.678%	0.000%	9.68%
More than 15 years	15	7	22
	48.390%	22.582%	70.97%
			0
			0.00%
			0
			0.00%
			31
Total	67.75%	32.26%	**100%**



DOI:10.14753/SE.2018.2068

Appendix 17 | Differences in the overall design impression expressed by different clusters of people

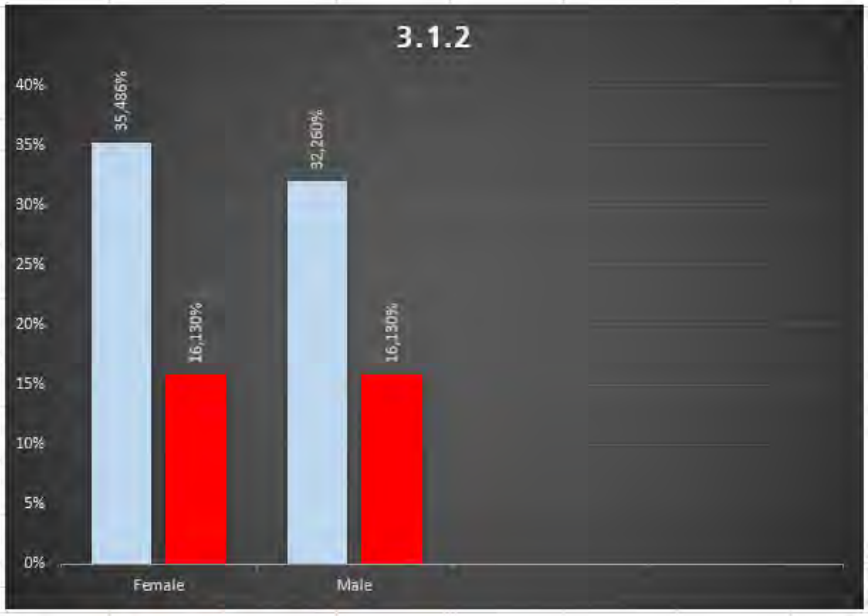
	Where did you like best the artistic overall impression?		
	3.1.2		
Cluster of people	**Portal A**	**Portal B**	**Total**
People of nature	12	3	15
	38.712%	9.678%	48.39%
Technology enthusiasts	6	4	10
	19.356%	12.904%	32.26%
Sports people	1	2	3
	3.226%	6.452%	9.68%
Other	2	1	3
	6.452%	3.226%	9.68%
			0
			0.00%
			0
			0.00%
			31
Total	67.75%	32.26%	**100%**



DOI:10.14753/SE.2018.2068

Appendix 18 | Overall design impression separated by gender

	Where did you like best the artistic overall impression?		
	3.1.2		
Gender	**Portal A**	**Portal B**	**Total**
Female	11	5	16
	35.486%	16.130%	51.62%
Male	10	5	15
	32.260%	16.130%	48.39%
			0
			0.00%
			0
			0.00%
			0
			0.00%
			0
			0.00%
			31
Total	67.75%	32.26%	**100%**



DOI:10.14753/SE.2018.2068

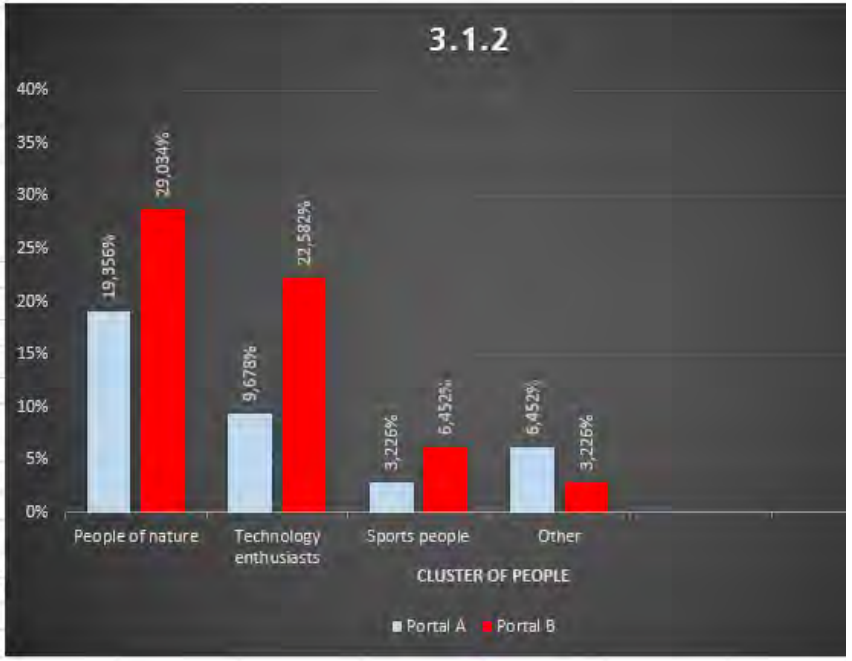
Appendix 19 | Comparison of font sizes of both portals

	Where was font size better?		
	3.2.4		
Cluster of people	**Portal A**	**Portal B**	**Total**
People of nature	13	2	15
	41.938%	6.452%	48.39%
Technology enthusiasts	7	3	10
	22.582%	9.678%	32.26%
Sports people	1	2	3
	3.226%	6.452%	9.68%
Other	3	0	3
	9.678%	0.000%	9.68%
			0
			0.00%
			0
			0.00%
			31
Total	77.42%	22.58%	**100%**

DOI:10.14753/SE.2018.2068

Appendix 20 | Comparison of user guidance using the different font hierarchies

	Which portal, considering headlines, subheadings, image captions and contents, led you to the results desired in a better way?		
	3.2.7		
Cluster of people	**Portal A**	**Portal B**	**Total**
People of nature	6	9	15
	19.356%	29.034%	48.39%
Technology enthusiasts	3	7	10
	9.678%	22.582%	32.26%
Sports people	1	2	3
	3.226%	6.452%	9.68%
Other	2	1	3
	6.452%	3.226%	9.68%
			0
			0.00%
			0
			0.00%
			31
Total	38.71%	61.29%	**100%**



DOI:10.14753/SE.2018.2068

Appendix 21 | Weighting of typography questions 4.2.1 and 4.2.2 for the SEM

4.2.1							
Cluster of people	**1**	**2**	**3**	**4**	**5**	**6**	**Total**
People of nature	4	6	3	1	0	1	15
	12.904%	19.356%	9.678%	3.226%	0.000%	3.226%	48.39%
Technology enthusiasts	0	4	1	2	2	1	10
	0.000%	12.904%	3.226%	6.452%	6.452%	3.226%	32.26%
Sports people	2	0	1	0	0	0	3
	6.452%	0.000%	3.226%	0.000%	0.000%	0.000%	9.68%
Other	2	0	1	0	0	0	3
	6.452%	0.000%	3.226%	0.000%	0.000%	0.000%	9.68%
Total	8	10	6	3	2	2	**31**
	25.81%	32.26%	19.36%	9.68%	6.45%	6.45%	**100%**
Weighting result	8	20	18	12	10	12	80

4.2.1 How important is a (extraordinarily) big font size (as seen on Portal A or even bigger)?

4.2.2							
Cluster of people	**1**	**2**	**3**	**4**	**5**	**6**	**Total**
People of nature	2	6	2	2	0	3	15
	6.452%	19.356%	6.452%	6.452%	0.000%	9.678%	48.39%
Technology enthusiasts	1	5	1	1	1	1	10
	3.226%	16.130%	3.226%	3.226%	3.226%	3.226%	32.26%
Sports people	1	0	1	0	1	0	3
	3.226%	0.000%	3.226%	0.000%	3.226%	0.000%	9.68%
Other	0	2	0	0	1	0	3
	0.000%	6.452%	0.000%	0.000%	3.226%	0.000%	9.68%
Total	4	13	4	3	3	4	**31**
	12.90%	41.94%	12.90%	9.68%	9.68%	12.90%	**100%**
Weighting result	4	26	12	12	15	24	93

4.2.2 How important is short and precise information on the topic looked for? If you do not mind the amount of text and you prefer reading even more detailed descriptions over several pages (even 10 pages or more)about the topic chosen, rate here grade "6" (unimportant).

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Appendix 22 | Weighting of typography questions 4.2.3 and 4.2.4 for the SEM

4.2.3							
Cluster of people	**1**	**2**	**3**	**4**	**5**	**6**	**Total**
People of nature	4	3	4	1	2	1	15
	12.904%	9.678%	12.904%	3.226%	6.452%	3.226%	48.39%
Technology enthusiasts	3	6	1	0	0	0	10
	9.678%	19.356%	3.226%	0.000%	0.000%	0.000%	32.26%
Sports people	1	1	1	0	0	0	3
	3.226%	3.226%	3.226%	0.000%	0.000%	0.000%	9.68%
Other	1	1	1	0	0	0	3
	3.226%	3.226%	3.226%	0.000%	0.000%	0.000%	9.68%
Total	9	11	7	1	2	1	**31**
	29.03%	35.49%	22.58%	3.23%	6.45%	3.23%	**100**
Weighting result	9	22	21	4	10	6	72

4.2.3 Would you prefer finding the most important contents – the main concern – offered by the Internet portal placed centrally at eye level? How important is this position?

4.2.4							
Cluster of people	**1**	**2**	**3**	**4**	**5**	**6**	**Total**
People of nature	4	7	2	1	0	1	15
	12.904%	22.582%	6.452%	3.226%	0.000%	3.226%	48.39%
Technology enthusiasts	7	1	1	1	0	0	10
	22.582%	3.226%	3.226%	3.226%	0.000%	0.000%	32.26%
Sports people	2	1	0	0	0	0	3
	6.452%	3.226%	0.000%	0.000%	0.000%	0.000%	9.68%
Other	0	3	0	0	0	0	3
	0.000%	9.678%	0.000%	0.000%	0.000%	0.000%	9.68%
Total	13	12	3	2	0	1	**31**
	41.94%	38.71%	9.68%	6.45%	0.00%	3.23%	**100%**
Weighting result	13	24	9	8	0	6	60

4.2.4 How important is the consistent use of one font style and font size for the same type of text?

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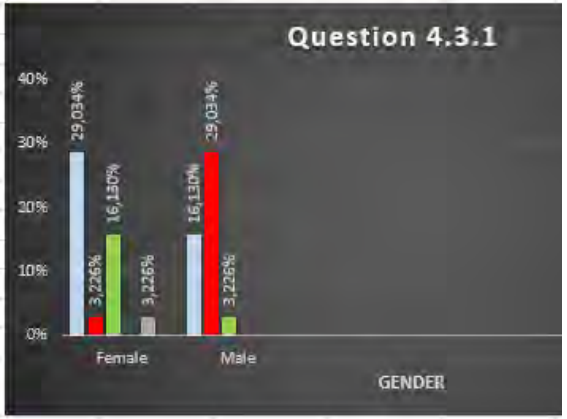
Appendix 23 | Weighting of color questions 4.3.1 and 4.3.2

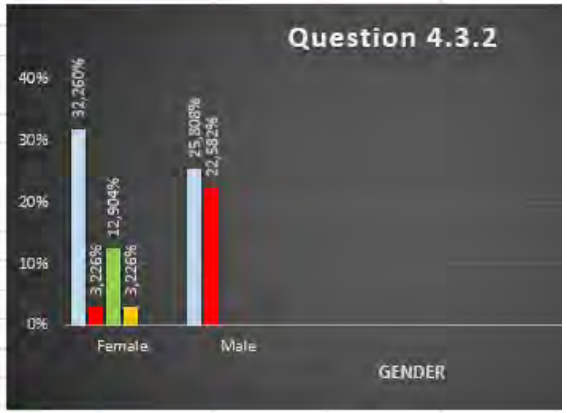
4.3.1							
Gender	**1**	**2**	**3**	**4**	**5**	**6**	**Total**
Female	9	1	5	0	1	0	16
	29.034%	3.226%	16.130%	0.000%	3.226%	0.000%	51.62%
Male	5	9	1	0	0	0	15
	16.130%	29.034%	3.226%	0.000%	0.000%	0.000%	48.39%
Total	14	10	6	0	1	0	**31**
	45.16%	32.26%	19.36%	0.00%	3.23%	0.00%	**100%**
Weighting result	14	20	18	0	5	0	57

4.3.1 How important is a smooth color scheme (few colors) for the text, the background ...?



4.3.2							
Gender	**1**	**2**	**3**	**4**	**5**	**6**	**Total**
Female	10	1	4	1	0	0	16
	32.260%	3.226%	12.904%	3.226%	0.000%	0.000%	51.62%
Male	8	7	0	0	0	0	15
	25.808%	22.582%	0.000%	0.000%	0.000%	0.000%	48.39%
Total	18	8	4	1	0	0	**31**
	58.07%	25.81%	12.90%	3.23%	0.00%	0.00%	**100%**
Weighting result	18	16	12	4	0	0	50

4.3.2 How important is a harmonious color balance of all objects (text, background, buttons, bars and other elements)?

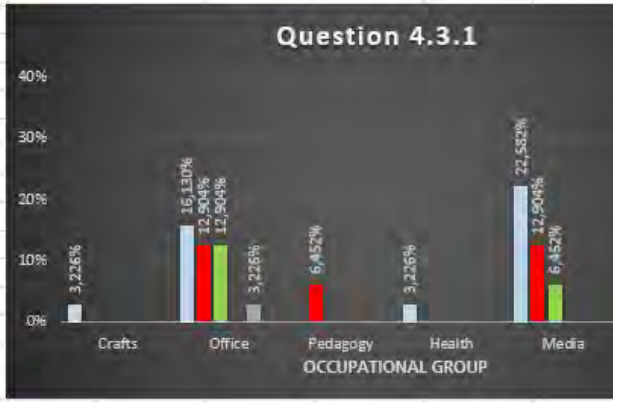


DOI:10.14753/SE.2018.2068

Appendix 24 | Weighting of color design for the different clusters of people

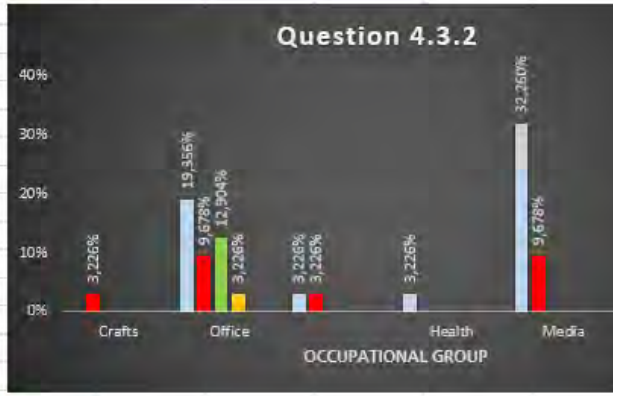
4.3.1							
Occupational group	**1**	**2**	**3**	**4**	**5**	**6**	**Total**
Crafts	1	0	0	0	0	0	1
	3.226%	0.000%	0.000%	0.000%	0.000%	0.000%	3.23%
Office	5	4	4	0	1	0	14
	16.130%	12.904%	12.904%	0.000%	3.226%	0.000%	45.16%
Pedagogy	0	2	0	0	0	0	2
	0.000%	6.452%	0.000%	0.000%	0.000%	0.000%	6.45%
Health	1	0	0	0	0	0	1
	3.226%	0.000%	0.000%	0.000%	0.000%	0.000%	3.23%
Media	7	4	2	0	0	0	13
	22.582%	12.904%	6.452%	0.000%	0.000%	0.000%	41.94%
Total	14	10	6	0	1	0	**31**
	45.16%	32.26%	19.36%	0.00%	3.23%	0.00%	**100%**
Weighting result	14	20	18	0	5	0	57

4.3.1 How important is a smooth color scheme (few colors) for the text, the background ...?



4.3.2							
Occupational group	**1**	**2**	**3**	**4**	**5**	**6**	**Total**
Crafts	0	1	0	0	0	0	1
	0.000%	3.226%	0.000%	0.000%	0.000%	0.000%	3.23%
Office	6	3	4	1	0	0	14
	19.356%	9.678%	12.904%	3.226%	0.000%	0.000%	45.16%
Pedagogy	1	1	0	0	0	0	2
	3.226%	3.226%	0.000%	0.000%	0.000%	0.000%	6.45%
Health	1	0	0	0	0	0	1
	3.226%	0.000%	0.000%	0.000%	0.000%	0.000%	3.23%
Media	10	3	0	0	0	0	13
	32.260%	9.678%	0.000%	0.000%	0.000%	0.000%	41.94%
Total	18	8	4	1	0	0	**31**
	58.07%	25.81%	12.90%	3.23%	0.00%	0.00%	**100%**
Weighting result	18	16	12	4	0	0	50

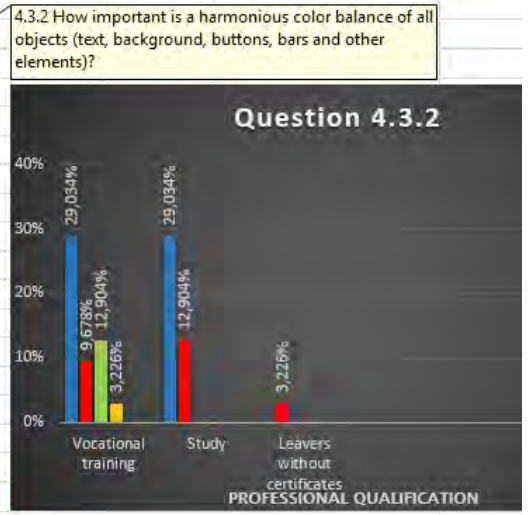
4.3.2 How important is a harmonious color balance of all objects (text, background, buttons, bars and other elements)?



DOI:10.14753/SE.2018.2068

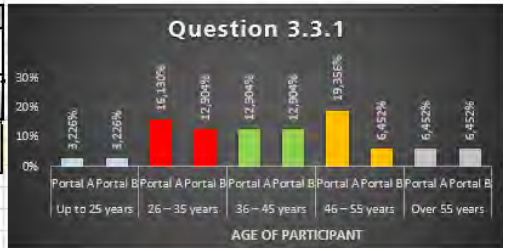
Appendix 25 | Desire for harmonious color concept according to different professional qualifications

4.3.2							
Professional qualification	**1**	**2**	**3**	**4**	**5**	**6**	**Total**
Vocational training	9	3	4	1	0	0	17
	29.034%	9.678%	12.904%	3.226%	0.000%	0.000%	54.84%
Study	9	4	0	0	0	0	13
	29.034%	12.904%	0.000%	0.000%	0.000%	0.000%	41.94%
Leavers without certificates	0	1	0	0	0	0	1
	0.000%	3.226%	0.000%	0.000%	0.000%	0.000%	3.23%
Total	18	8	4	1	0	0	**31**
	58.07%	25.81%	12.90%	3.23%	0.00%	0.00%	**100%**
Weighting result	18	16	12	4	0	0	50



Appendix 26 | Evaluation of the color concept compared by ages

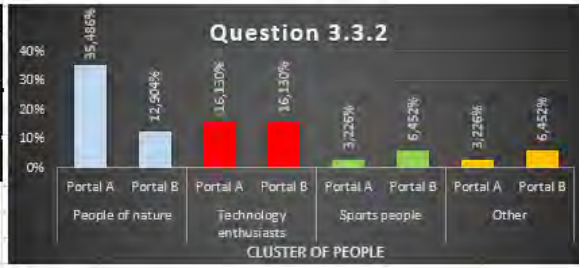
Age of participant												
Total		Up to 25 years		26 – 35 years		36 – 45 years		46 – 55 years		Over 55 years		Question
Portal A	Portal B	Portal A	Portal B	Portal A	Portal B	Portal A	Portal B	Portal A	Portal B	Portal A	Portal B	
18	13	1	1	5	4	4	4	6	2	2	2	3.3.1
58.07%	41.94%	3.226%	3.226%	16.130%	12.904%	12.904%	12.904%	19.356%	6.452%	6.452%	6.452%	
31												3.3.1 Which portal shows a more attractive choice of colors?
100%												



DOI:10.14753/SE.2018.2068

Appendix 27 | Cluster of people selecting optimal color concept compared for both portals

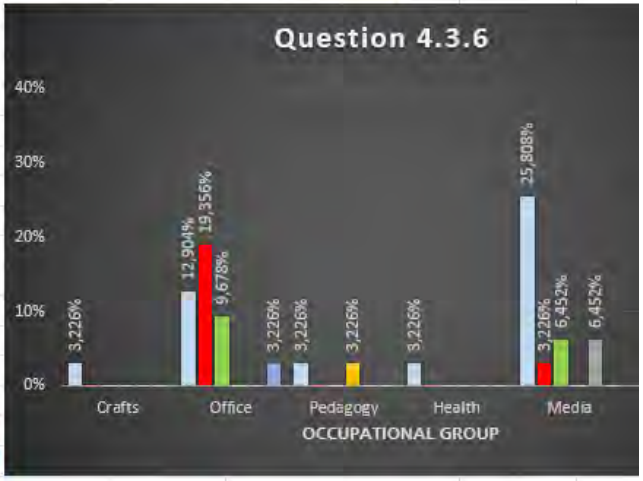
Cluster of people										
Total		People of nature		Technology enthusiasts		Sports people		Other		Question
Portal A	Portal B	Portal A	Portal B	Portal A	Portal B	Portal A	Portal B	Portal A	Portal B	
18	13	11	4	5	5	1	2	1	2	3.3.2
58.07%	41.94%	35.486%	12.904%	16.130%	16.130%	3.226%	6.452%	3.226%	6.452%	
31										3.3.2 Where was the number of colors chosen optimally?
100%										



Appendix 28 | Evaluation of picture quality represented according to clusters of people

4.3.6							
Occupational group	1	2	3	4	5	6	Total
Crafts	1	0	0	0	0	0	1
	3.226%	0.000%	0.000%	0.000%	0.000%	0.000%	3.23%
Office	4	6	3	0	0	1	14
	12.904%	19.356%	9.678%	0.000%	0.000%	3.226%	45.16%
Pedagogy	1	0	0	1	0	0	2
	3.226%	0.000%	0.000%	3.226%	0.000%	0.000%	6.45%
Health	1	0	0	0	0	0	1
	3.226%	0.000%	0.000%	0.000%	0.000%	0.000%	3.23%
Media	8	1	2	0	2	0	13
	25.808%	3.226%	6.452%	0.000%	6.452%	0.000%	41.94%
Total	15	7	5	1	2	1	31
	48.39%	22.58%	16.13%	3.23%	6.45%	3.23%	100%

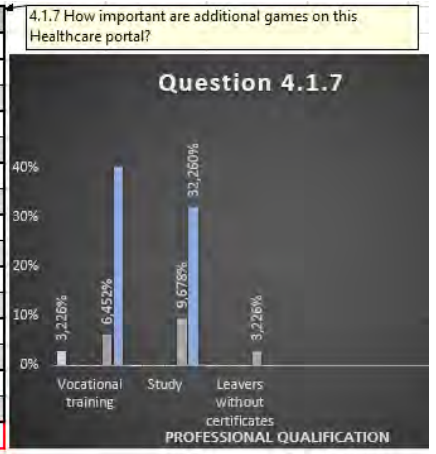
4.3.6 Are top-quality photos important (fine contrast, good definition, without color faults?



DOI:10.14753/SE.2018.2068

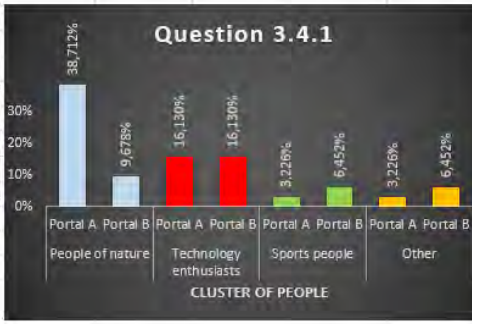
Appendix 29 | Evaluation of the necessity of self-tests on Healthcare portals

4.1.7							
Professional qualification	**1**	**2**	**3**	**4**	**5**	**6**	**Total**
Vocational training	1	0	0	0	2	14	17
	3.226%	0.000%	0.000%	0.000%	6.452%	45.164%	54.84%
Study	0	0	0	0	3	10	13
	0.000%	0.000%	0.000%	0.000%	9.678%	32.260%	41.94%
Leavers without certificates	0	0	0	0	1	0	1
	0.000%	0.000%	0.000%	0.000%	3.226%	0.000%	3.23%
Total	1	0	0	0	6	24	**31**
	3.23%	0.00%	0.00%	0.00%	19.36%	77.42%	**100%**



Appendix 30 | The better favorite image size of both portals compared by clusters of people

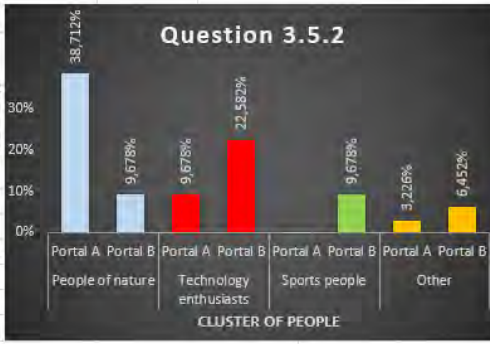
Cluster of people										
Total		People of nature		Technology enthusiasts		Sports people		Other		Question
Portal A	Portal B	Portal A	Portal B	Portal A	Portal B	Portal A	Portal B	Portal A	Portal B	
19	12	12	3	5	5	1	2	1	2	3.4.1
61.29%	38.71%	38.712%	9.678%	16.130%	16.130%	3.226%	6.452%	3.226%	6.452%	
31										
100%										



DOI:10.14753/SE.2018.2068

Appendix 31 | Clusters of people compare navigation of both portals

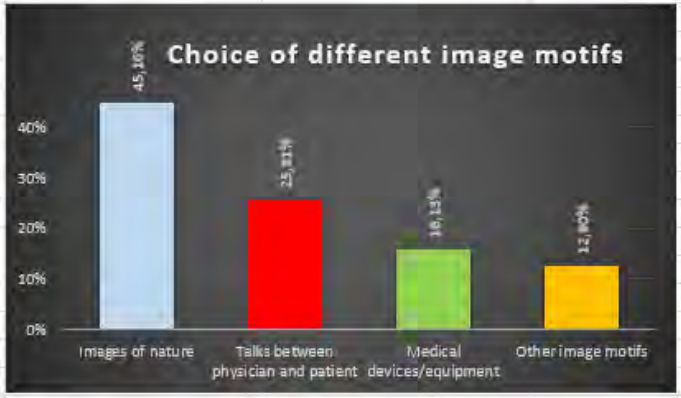
Cluster of people										Question
Total		People of nature		Technology enthusiasts		Sports people		Other		
Portal A	Portal B	Portal A	Portal B	Portal A	Portal B	Portal A	Portal B	Portal A	Portal B	
16	15	12	3	3	7	0	3	1	2	3.5.2
51.62%	48.39%	38.712%	9.678%	9.678%	22.582%	0.000%	9.678%	3.226%	6.452%	
31										3.5.2 Where were the number and the positions of the navigation elements more easily recognizable?
100%										

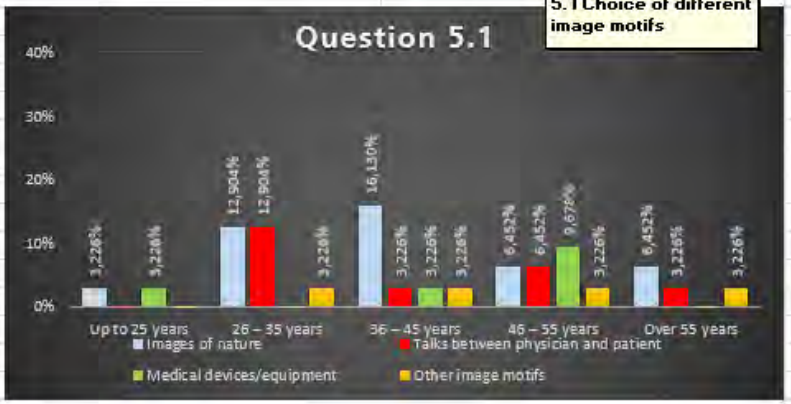


DOI:10.14753/SE.2018.2068

Appendix 32 | Desire for picture motifs on Healthcare portals

5.1 Choice of different image motifs					
Total	**Images of nature**	**Talks between physician and patient**	**Medical devices/equipment**	**Other image motifs**	
31	14	8	5	4	**5.1**
100%	45.16%	25.81%	16.13%	12.90%	





5.1					
Age	**Images of nature**	**Talks between physician and patient**	**Medical devices/equipment**	**Other image motifs**	**Total**
Up to 25 years	1	0	1	0	2
	3.226%	0.000%	3.226%	0.000%	6.45%
26 – 35 years	4	4	0	1	9
	12.904%	12.904%	0.000%	3.226%	29.03%
36 – 45 years	5	1	1	1	8
	16.130%	3.226%	3.226%	3.226%	25.81%
46 – 55 years	2	2	3	1	8
	6.452%	6.452%	9.678%	3.226%	25.81%
Over 55 years	2	1	0	1	4
	6.452%	3.226%	0.000%	3.226%	12.90%
Total	14	8	5	4	**31**
	45.16%	25.81%	16.13%	12.90%	**100%**

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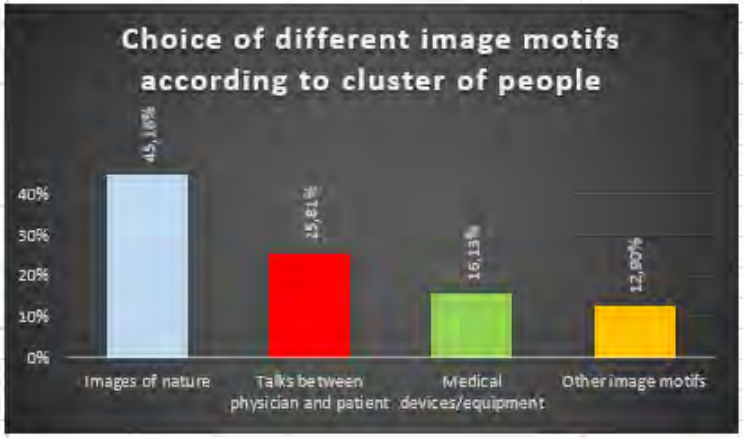
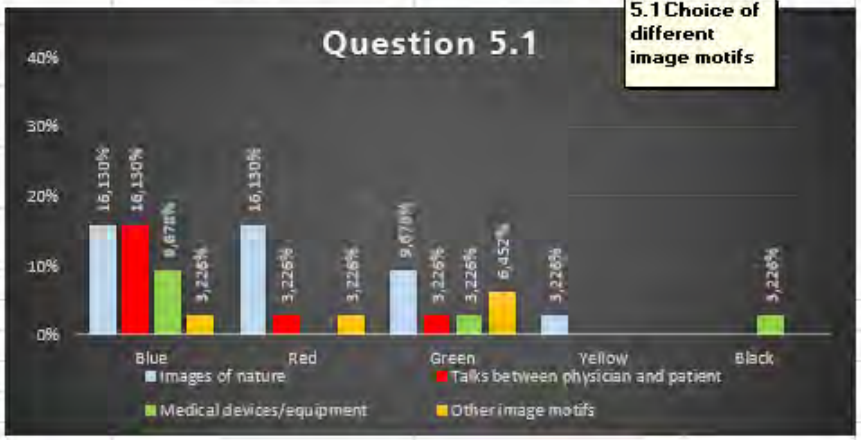
Appendix 33 | Missing concordance between the choice of nature pictures and favorite color green

5.1 Choice of different image motifs

Total	Images of nature	Talks between physician and patient	Medical devices/equipment	Other image motifs	
31	14	8	5	4	5.1
100%	45.16%	25.81%	16.13%	12.90%	





5.1					
Favorite color	**Images of nature**	**Talks between physician and**	**Medical**	**Other image motifs**	**Total**
Blue	5	5	3	1	14
	16.130%	16.130%	9.678%	3.226%	45.16%
Red	5	1	0	1	7
	16.130%	3.226%	0.000%	3.226%	22.58%
Green	3	1	1	2	7
	9.678%	3.226%	3.226%	6.452%	22.58%
Yellow	1	0	0	0	1
	3.226%	0.000%	0.000%	0.000%	3.23%
Black	0	0	1	0	1
	0.000%	0.000%	3.226%	0.000%	3.23%
None	0	1	0	0	1
	0.000%	3.226%	0.000%	0.000%	3.23%
Total	14	8	5	4	**31**
	45.16%	25.81%	16.13%	12.90%	**100%**

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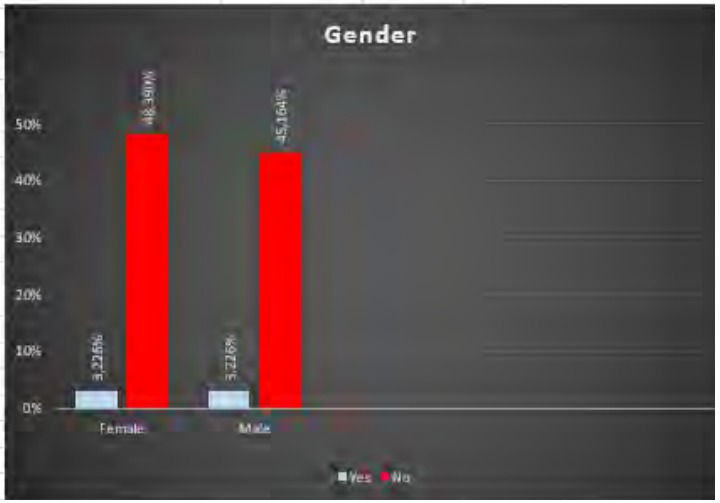
Appendix 34 | Desire for adverts—presented according to gender

5.2 Do you wish adverts on the portal?

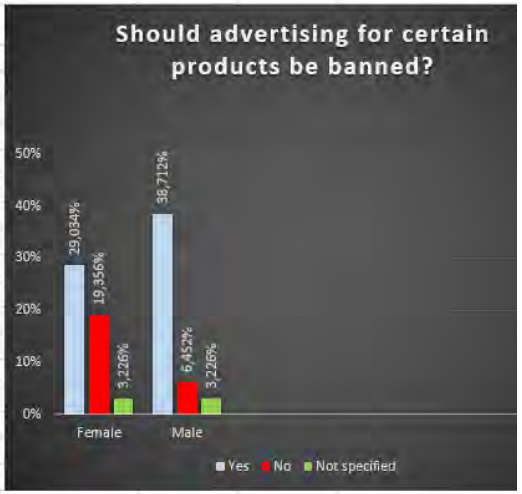
Gender	Yes	No	Total
Female	1	15	16
	3.226%	48.390%	51.62%
Male	1	14	15
	3.226%	45.164%	48.39%
			0
			0.00%
			0
			0.00%
			0
			0.00%
			0
			0.00%
			31
Total	6.45%	93.55%	100%



Appendix 35 | Desire for omission of specific products separated by gender

5.3 Should advertising for certain products be banned?

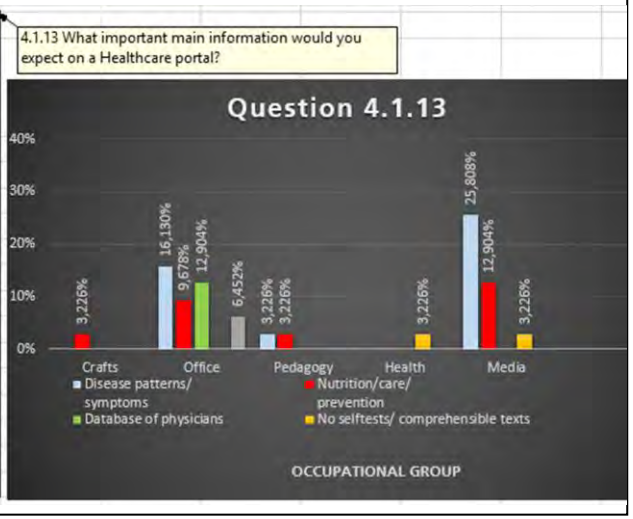
Gender	Yes	No	Not specified	Total
Female	9	6	1	16
	29.034%	19.356%	3.226%	51.62%
Male	12	2	1	15
	38.712%	6.452%	3.226%	48.39%
				0
				0.00%
				0
				0.00%
				0
				0.00%
				0
				0.00%
				31
Total	67.75%	25.81%	6.45%	100%



DOI:10.14753/SE.2018.2068

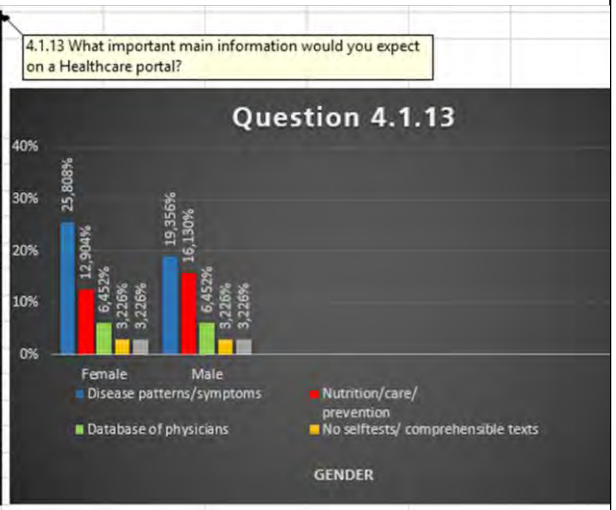
Appendix 36 | Content-related requirements of Healthcare portals

4.1.13						
Occupational group	**Disease patterns/ symptoms**	**Nutrition/care/ prevention**	**Database of physicians**	**No selftests/ comprehensible texts**	**Not specified**	**Total**
Crafts	0	1	0	0	0	1
	0.000%	3.226%	0.000%	0.000%	0.000%	3.23%
Office	5	3	4	0	2	14
	16.130%	9.678%	12.904%	0.000%	6.452%	45.16%
Pedagogy	1	1	0	0	0	2
	3.226%	3.226%	0.000%	0.000%	0.000%	6.45%
Health	0	0	0	1	0	1
	0.000%	0.000%	0.000%	3.226%	0.000%	3.23%
Media	8	4	0	1	0	13
	25.808%	12.904%	0.000%	3.226%	0.000%	41.94%
Total	14	9	4	2	2	**31**
	45.16%	29.03%	12.90%	6.45%	6.45%	**100%**



Appendix 37 | Content-related requirements to medical platforms separated by gender

4.1.13						
Gender	**Disease patterns/symptoms**	**Nutrition/care/ prevention**	**Database of physicians**	**No selftests/ comprehensible texts**	**Not specified**	**Total**
Female	8	4	2	1	1	16
	25.808%	12.904%	6.452%	3.226%	3.226%	51.62%
Male	6	5	2	1	1	15
	19.356%	16.130%	6.452%	3.226%	3.226%	48.39%
Total	14	9	4	2	2	**31**
	45.16%	29.03%	12.90%	6.45%	6.45%	**100%**



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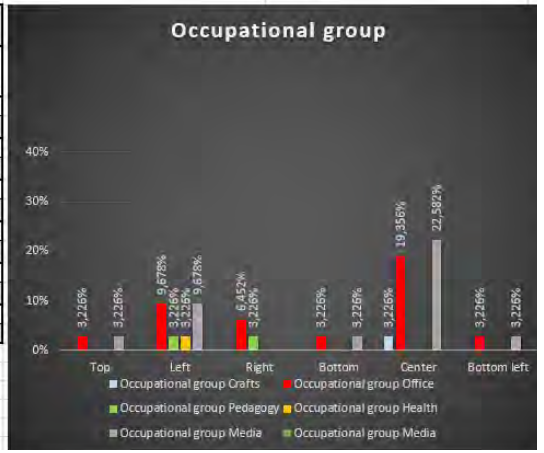
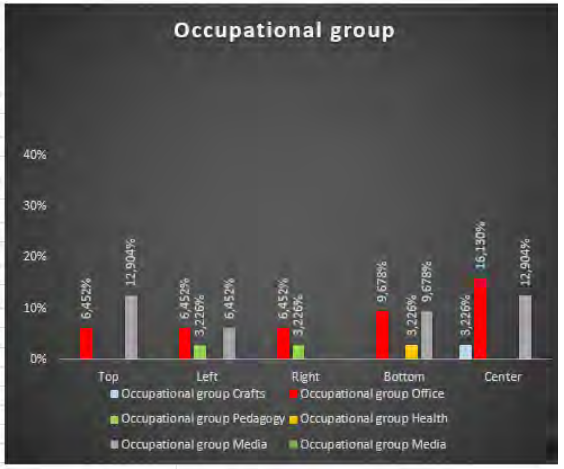
Appendix 38 | Gaze position at the end of looking at Portal A

Main gaze position Portal A (GazePoint video)	Occupational group					
	Crafts	Office	Pedagogy	Health	Media	Total
Top	0	1	0	0	1	2
	0.000%	3.226%	0.000%	0.000%	3.226%	6.45%
Left	0	3	1	1	3	8
	0.000%	9.678%	3.226%	3.226%	9.678%	25.81%
Right	0	2	1	0	0	3
	0.000%	6.452%	3.226%	0.000%	0.000%	9.68%
Bottom	0	2	0	0	2	4
	0.000%	6.452%	0.000%	0.000%	6.452%	12.90%
Center	1	6	0	0	7	14
	3.226%	19.356%	0.000%	0.000%	22.582%	45.16%
						31
Total	3.23%	41.94%	6.45%	3.23%	38.71%	100%



Appendix 39 | Cumulative gaze positions at the end of using B (incl. Portal A)

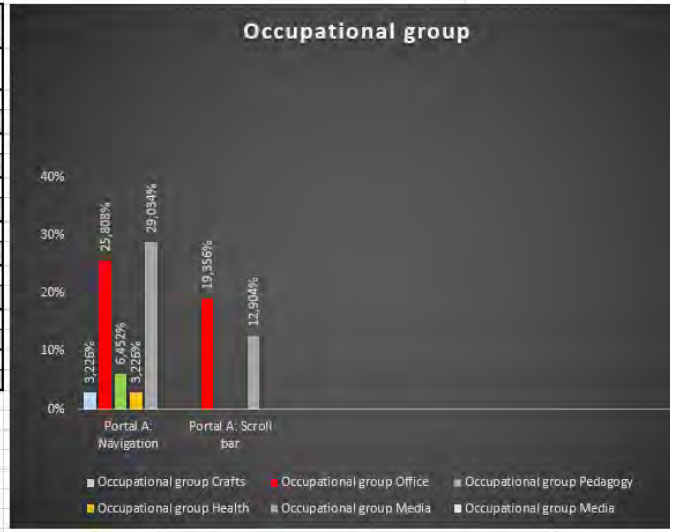
Main gaze position Portal B (GazePoint video)	Occupational group					
	Crafts	Office	Pedagogy	Health	Media	Total
Top	0	2	0	0	4	6
	0.000%	6.452%	0.000%	0.000%	12.904%	19.36%
Left	0	2	1	0	2	5
	0.000%	6.452%	3.226%	0.000%	6.452%	16.13%
Right	0	2	1	0	0	3
	0.000%	6.452%	3.226%	0.000%	0.000%	9.68%
Bottom	0	3	0	1	3	7
	0.000%	9.678%	0.000%	3.226%	9.678%	22.58%
Center	1	5	0	0	4	10
	3.226%	16.130%	0.000%	0.000%	12.904%	32.26%
						31
Total	3.23%	41.94%	6.45%	3.23%	38.71%	100%



DOI:10.14753/SE.2018.2068

Appendix 40 | User behavior on Portal A—comparison between interaction and scrolling

First action on Portal A (GazePoint video)	Occupational group					
	Crafts	Office	Pedagogy	Health	Media	Total
Portal A: Navigation	1	8	2	1	9	21
	3.226%	25.808%	6.452%	3.226%	29.034%	67.75%
Portal A: Scroll bar	0	6	0	0	4	10
	0.000%	19.356%	0.000%	0.000%	12.904%	32.26%
						0
						0.00%
						0
						0.00%
						0
						0.00%
						0
						0.00%
						31
Total	3.23%	45.16%	6.45%	3.23%	41.94%	100%



Appendix 41 | Comparison of user friendliness according to clusters of people

Question 3.1.1					
Cluster of people	Portal A		Portal B		
	Female	Male	Female	Male	
People of nature	7	4	4	0	
	22.582%	12.904%	12.904%	0.000%	
Technology enthusiasts	1	2	2	5	
	3.226%	6.452%	6.452%	16.130%	
Sports people	2	0	0	1	
	6.452%	0.000%	0.000%	3.226%	
Other	0	1	0	2	
	0.000%	3.226%	0.000%	6.452%	
Total	10	7	6	8	31
	32.26%	22.58%	19.36%	25.81%	100%

3.1.1 Which portal was more clearly arranged at first glance?