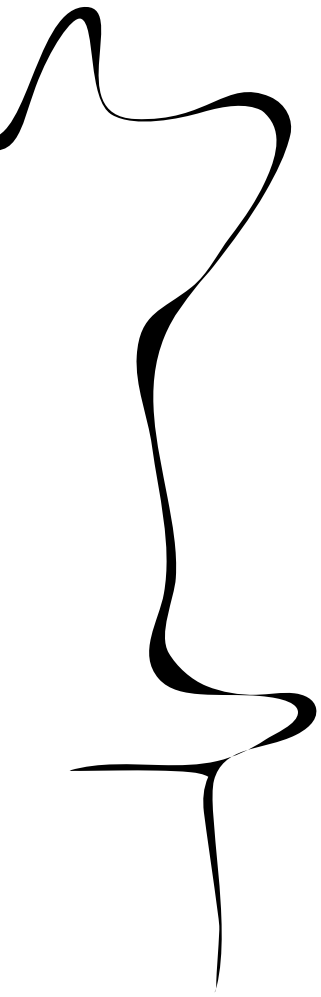# UNIVERSITY OF TWENTE.

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Eye-Tracking in the Usability Testing of the One Health Hub - A Website for the General Public its Questions about Zoonoses

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Abstract

The One Health Hub, a question and answer website that provides both the general public and healthcare professionals with information on the topic of zoonoses, was usability tested by the general public. In the usability tests two different cued retrospective think-aloud protocols in combination with a User Experience Questionnaire were employed to identify points of improvement for the One Health Hub as well as to evaluate the appropriateness of an eye-tracking cue in usability testing.

37 random members of the general public were personally invited to participate in the One Health Hub usability tests which were carried out in the Experivan, a mobile test environment that was placed on a public square. The participants were asked to perform six scenario based tasks with the One Health Hub, to subsequently fill out a User Experience Questionnaire, and to retrospectively verbalise their thoughts of their task execution whilst being supported by either a *video-* or a *gaze video* cue. The cued playback videos and transcripts of the participants' verbalisations were used to analyse the (1) identified usability problems, (2) effective user interaction, and (3) added value of a gaze cue in usability testing.

The One Health Hub's user experience was positively evaluated by the participants who identified 149 usability problems whilst interacting with the One Health Hub with a success rate of 61.3%. The gaze video cue evoked participants to identify more layout- and total number of usability problems with a higher severity level whilst verbalising more words and expressing more manipulative and cognitive operational comments, as compared to video cued participants.

A prototype was developed with implemented recommendations to enhance the One Health Hub's usability. The overall *consistency* and *navigational elements* of the One Health Hub should be improved to ensure faster and more successful goal achievement by users.

Contents

List of Acronyms

OHH	One Health Hub
Q&A	Question and Answer
UX	User Experience
UEQ	User Experience Questionnaire
CTA	Concurrent Think Aloud
RTA	Retrospective Think Aloud
cRTA	cued Retrospective Think Aloud
GVC	Gaze Video Cue
VC	Video Cue
DAT	Data Analysis Tool
KPI	Key Performance Indicator
ANOVA	Analysis of Variance

Chapter 1

Introduction

1.1 Zoonoses

A *zoonosis* is an infection that is transmittable from animals to humans [1–3]. This transmission can go *direct* (e.g. by contact with an animal), but is more likely to go *indirect* (e.g. by ingestion of contaminated food) [4, 5]. Research of Taylor et al. [5] has shown that 61% of all pathogens infecting humans are zoonotic of nature. Because of this wide variety in pathogens, a 'one-size fits all' solution (i.e. one treatment to cure all zoonotic diseases in the same way) is not applicable for zoonotic infections [6]. Zoonoses can have a serious impact on society since they largely affect humans health and well-being [7], which in turn impacts social economics and can eventually provoke policy challenges [1, 4, 6–8]. Zoonoses' severity is often underestimated by the general public, as a result from little knowledge on the matter [1, 4, 8–11]. As an example, a study of Beerlage-de Jong et al. [11] showed that almost one third of the general public did not know that zoonoses can spread via human animal contact. Underestimation of zoonoses is critical while they impact not only public health, but also the medical field and veterinary field [1, 8]. The multiple fields of professions involve many stakeholders (i.e. general public, healthcare professionals, veterinarians, farmers, policy makers) who do not necessarily have the same view and opinion on the matter or its solution [1, 6]. Additionally, underestimations of the impact of zoonoses can result in the development of zoonotic epidemics or pandemics lasting over large periods of time and crossing geographical borders [8]. Since zoonotic infections (1) consist of varied infection types that do not have a clear one-size fits all solution, (2) impact the societal and economical level of society, and (3) affect several groups of stakeholders, zoonoses require for a *One Health approach* [6, 12–14]. In a One Health approach both humans and animals are well-coordinated by a multidisciplinary cooperation, to attain the best possible outcomes for all parties involved (i.e. public-, animal-, and environmental health) [15].

Human behaviour and the spread of zoonoses are closely related. Integration and interdependence of animals and humans, both as source of nutrients and companionship, has resulted in an increase in the number of infection cases [4, 10, 12, 16]. Additionally, proliferation of travelling to unvisited places where new animal habitats are entered, has resulted in the incurrence of new zoonotic diseases [1]. Humans are thus the critical factor for the

dissemination of zoonoses. Hence, it is vital that the general public has adequate knowledge on what zoonoses and their effects are. Lack of knowledge leads to unawareness of the earnest of zoonoses, which can result in poor risk assessments of the matter [6, 13]. So, in order to prevent and retain zoonotic disease dissemination, the general public should be made aware of, and educated on, the subject of zoonotic diseases [11, 16, 17].

1.2   One Health Hub

As described above, it is important that humans treat zoonoses adequately. In a One Health approach both humans and animals are well-coordinated by a multidisciplinary cooperation, to attain the best possible outcomes for all parties involved (i.e. public-, animal-, and environmental health) [15]. eHealth technology is well suited to support a One Health approach since it connects the medical-, public-, and business field. eHealth enables the fields to get access to the care information at any time, thereby supporting health and well-being by use of technology, without requiring all fields' members to physically be together in the same time and location [18]. The Centre for eHealth and Wellbeing Research at the University of Twente is working on projects where a One Health approach is applied to prevent and retain zoonotic epidemics [11, 13, 19]. The Centre for eHealth and Wellbeing Research develops technology that supports health and wellbeing in a meaningful, effective and human way [20].

One of the projects is the One Health Hub (OHH)[1] which comprises a question and answer (Q&A) website that provides information and education to the the general public as well as to healthcare professionals [19]. The OHH provides for each zoonotic disease answers to general questions, question with respect to contamination, diagnosis & treatment, and lifestyle with respect to the disease. A chatbot and searchbar allow for manual input of users' questions. The OHH is designed using persuasive technology elements to help and guide the users in achieving their goals (attaining information and education on zoonoses), in the way as it was intended by the developers, without coercion [21].

The OHH is still under development, but a beta version is already available. This beta version is tested with the general public to determine its usability and user experience (UX) [22]. Usability is defined as the ease of use with which users effectively interact with a product [18, 23, 24]. Evaluation of the OHH's usability and UX determines the elements of the OHH that do and do not work for its users [25]. Improvement of the elements of the design that need revision, increases the UX and usability, which is vital for a good and sustainable interaction with the OHH by its users.

This study aims to evaluate the data of a usability test and User Experience Questionnaire (UEQ), to make recommendations and improvements to the One Health Hub. The research question drawn up for this is:

What improvements can be made, according to the general public,
to increase the usability of the One Health Hub?

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[1] https://onehealthhub.nl/nl/

1.3 Cued Retrospective Think-Aloud Usability Testing

Think-aloud research methods are commonly used in usability testing to identify interaction problems emerging from the tested design [26]. In a think-aloud protocol, participants are asked to verbalise their thoughts on the actions performed when fulfilling tasks [27]. This gives researchers insight into what parts of the design work and where participants have difficulties [28–31]. Thinking aloud can either be done whilst performing the tasks, which is the *Concurrent Think-Aloud* (CTA) method, or after the tasks are performed, which is the *Retrospective Think-Aloud* (RTA) method [26–30, 32]. Several studies advocated for the use of RTAs over CTAs in usability testing, while a CTA method can influence the participants' reactivity, thereby negatively influencing the participants' task performance [26–29, 32, 33]. Therefore, the OHH usability tests employed a RTA method which evoked the participants verbalising their thoughts and actions of when they performed the tasks. The analysis of these participants' verbalisations is used to answer the following sub research question:

1. What elements of the One Health Hub Q&A website cause user interaction problems?

1.3.1 Cues in Retrospective Think-Aloud Sessions

Participants that have to retrospectively think-aloud can be supported by cues, which are aids for the participant to better recall their actions [26, 32]. During the OHH RTA sessions two types of cues were used, *video* and *gaze video* cues. The former only holds a screen recording of the participant performing the tasks, the latter encompasses again the screen recording but with an overlay of the participant's gaze-path [26, 31, 32]. A gaze-path is the visualisation of an eye-tracking recording, which is the captured eye movement of the participant while (s)he is looking at an object [26, 29, 31].

The screen and gaze-path recordings of the participants served as a cues for the participants when retrospectively thinking aloud. Next to serving as cues, these recordings allow for the evaluation of the participants' task performance to answer the following sub research question:

2. To what extent are participants able to effectively interact with the One Health Hub?

1.3.2 Eye-Tracking in Usability Testing

The use of a gaze cue in usability testing is a relatively new but promising research method [26, 28, 29, 31, 32, 34]. Because of its novelty, it is not yet well-known whether a gaze cue is a valuable addition to usability testing with respect to the amount of participant verbalisations, and identification of different or more usability problems [26, 29, 32, 33].

In the OHH usability tests both video cued RTA and gaze video cued RTA protocols were employed, which were evaluated against the already validated UEQ [35]. In this way the usability tests can be used for the identification of usability problems, as well as the evaluation of the appropriateness of eye-tracking as extra cue in usability testing. The former is done

whilst answering sub research question 1 and 2, the latter is researched using the following sub research question:

3. What is the added value of an additional eye-tracking cue in usability testing?

   (a) Does an extra gaze cue cause detection of more usability problems than with a video cue?

   (b) Does an extra gaze cue cause identification of usability problems with a higher severity level than with a video cue?

   (c) Does an extra gaze cue cause more verbalisations than with a video cue?

   (d) Does an extra gaze cue cause different types of operational comments than with a video cue?

Chapter 2

Methods

2.1   Study Design

A mixed-methods approach was used for the usability evaluation of the OHH, for which a between-subjects design was employed. Two cued RTA (cRTA) protocols (*video* and *gaze video*) were employed to support participants in retrospectively thinking aloud. The gaze video cRTA protocol utilised eye-tracking, which is still a rather new topic in the field of usability testing [26]. Therefore, quantitative UEQ-inventories were added to function as a support for the data of the qualitative cRTA usability tests, since UEQs are already widely used and validated [36]. An assessment of the usability testing methods (cRTA and UEQ) was conducted to evaluate the added value of both research methods in usability testing.

2.2   Participants

Convenience sampling was conducted by parking the Experivan [37] on a public square and personally inviting random members of the general Dutch public to participate in the usability test. To be eligible to the study, participants had to be at least 18 years old, speak fluent Dutch, and the following obstructive elements had to be absent: bifocal glasses; permanently dilated pupils; glaucoma; cataract; and excessive mascara usage. Eventually, 41 members of the general public participated in the usability testing, from which four were excluded due to not meeting the inclusion criteria, resulting in eighteen participants in the gaze video cue (GVC) group ($N_{GVC} = 18$), and nineteen participants in the video cue (VC) group ($N_{VC} = 19$). An evaluation of the participants' demographics (i.e. *gender*, *age*, *education*, *urbanity*, *web usage*, *OHH website known*) showed no difference between the two groups at baseline.

2.3 Materials

2.3.1 Scenario and Tasks

The participants were asked to perform six scenario based tasks, as part of the usability test. The scenario entailed a small story about a friend who had surgery but has to stay longer in the hospital because he got infected with the zoonosis MRSA. Six tasks were drawn up, based on possible questions of the general public resulting from the scenario (Appendix A.1). The tasks included several topics that required accessing various sections of the website. The six tasks the participants had to perform were on the topics of: (1) the infection type of MRSA, (2) MRSA spread, (3) intravenous antibiotics administration, (4) contamination via pigs, (5) healthcare professionals living on a farm, and (6) length of a carrier treatment.

2.3.2 Usability Test Environment

The usability tests were carried out in the Experivan [37], a novel mobile test environment of the University of Twente. The Experivan is a large van that enables to bring the social science test environment (e.g. eye-tracking, VR-lab, behaviour observations) to the target audience in its naturalistic setting [38].

Participants were provided with an A4 sheet comprising the scenario and tasks (Appendix A.1). Task execution was done on a computer running a Windows 10 operating system accompanied by a monitor where the OHH website was displayed on. The participants' eye movements were recorded using the eye-tracking setup available in the Experivan, comprising the Tobii X3-120 eye tracker and the Tobii ProLab software. After the task execution, the UEQ and survey were provided on an A4 paperwork for the participants to fill out (Appendix A.3).

2.3.3 Video and Gaze Recording

During the participants' task executions, screen and eye-tracking recordings were made. These recordings were put into playback videos using ProLab software and Open Broadcast Software. The playback videos either encompassed only a video cue, which contained the screen and mouse movements recorded during the task execution, or a gaze video cue, which contained the screen and mouse movement recording with an overlay of the eye-tracked gaze-path, depicted in Figure 2.1. Both types of playback videos showed the participant what (s)he did while carrying out the tasks. Where the gaze cue had the potential to assist the participant better in recalling what (s)he did and why [26, 29, 32, 33].
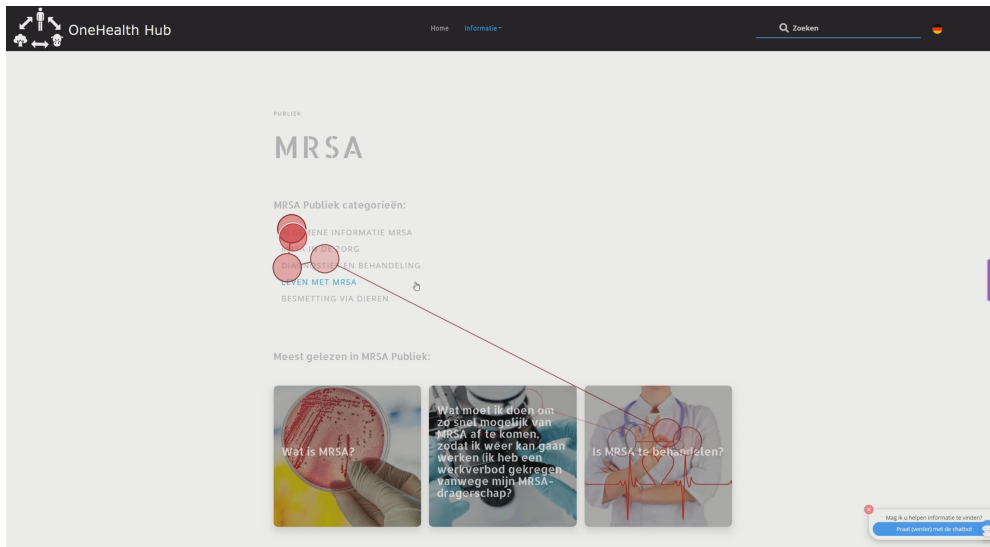
Figure 2.1: Playback video with gaze-path overlay

Participants were randomly assigned to either the *video* or the *gaze video* cue group. 19 participants received a playback video with only a video cue and 18 participants received a playback video with a video and gaze cue. The participants were divided into two groups to enable the comparison of the outcomes of both groups, to evaluate the appropriateness of eye-tracking in usability testing, as was also done in several other studies [26, 28, 29, 32, 33].

2.3.4 User Experience Questionnaire

A User Experience Questionnaire (UEQ) [39] was employed to quantitatively evaluate the OHH's user experience. The UEQ aims to capture the user experience (UX) of a participant who just interacted with the OHH website, in a quick and comprehensive manner [35, 36]. This is done by providing the participant with 26 semantic differential items with a seven-stage scale [40]. Each of the 26 items belong to one of the six scales that the UEQ comprises: *Attractiveness*, *Perspicuity*, *Efficiency*, *Dependability*, *Stimulation*, and *Novelty* [35, 36]. Each scale covers a specific quality of the OHH's UX [41]. All together, the scales envision the OHH's pure valence (the OHH's overall appearance appreciation), pragmatic quality aspects (the practical, reliable, and comprehensible OHH interaction), and hedonic quality aspects (the innovativeness and defiance of the OHH) [35, 36, 39]. The UEQ-inventories were analysed using the *UEQ data analysis tool* (DAT) [42]. Since the use of eye-tracking is still a novel method in usability testing [26], the already widely employed UEQ [35] was added to the OHH usability test as an additional research method.

2.4 Procedure

Prior to the research, screening questions about the for eye-tracking obstructive elements, were posed to the participant. When the participant was eligible to the study, the researcher explained the research and eye-tracking thoroughly, and the participant was asked to fill out and sign an informed consent form.

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After the introduction, the eye-tracking system was calibrated to the visual sight of the participant, and any questions from the participant were answered by the researcher. The OHH website was opened by the researcher and the scenario, accompanied with six tasks (Appendix A.1), was presented to the participant. The participant was asked to perform the tasks, using the OHH website. The participant was instructed to do this in the way (s)he would normally interact with any website, when searching for information. To stimulate a life-like situation, the researcher did not offer any help in doing so.

When all tasks were completed to the participant's satisfaction, the participant was asked to fill out the survey. The survey encompassed a UEQ with key performance indicator (KPI) extension, open questions on the participant's experience of the website, and a form for demographics (Appendix A.3). While the participant filled out the survey, the researcher prepared the playback video for cRTA with either video or gaze video cues.

For the cRTA session the participant was instructed to verbalise his/her thoughts and actions of when completing the tasks. The playback video was played, functioning as cue for the participant. The screen and audio were recorded during the cRTA session.

2.5   Data Analysis

2.5.1   Retrospective Think-Aloud

Transcripts double-checking

In preceding research, all audio recordings of the cRTA sessions were transcribed using AmberScript. In current research, the transcripts were double-checked by the native Dutch speaking researcher. The transcripts were read, whilst listening to the audio recordings. Textual adjustments were made when the transcripts did not correspond with the audio.

Coding

In the preceding research, a codebook was drawn up containing the code groups: *Usability problems*, *Severity ratings*, and *Operational comments*. These code groups were drawn up based on the code groups used in previous studies that also explored the influence of cue types on the number and types of usability problems found during cRTA [27, 29, 32]. One study of Olsen et al. [32] showed that gaze cues provoked more *visual* and *cognitive* comments whereas video cues resulted in slightly more *manipulative* comments. This was backed up by Elbabour et al. [29] who added that an additional gaze cue results in detection of more *navigation* and *comprehension* usability problems, and detection of usability problems that have lower *severity levels*.

In the process of the double-checking of the transcripts, it became apparent that some participants already gave recommendations for the usability problems they encountered. Therefore, an additional code group, *Participant remarks*, was drawn up based on the usability problems code group.

The transcripts were read and the participants' comments were categorised as either manipulative, visual, or cognitive comments, see Table 2.1. Comments that indicated usability

problems were coded according to the six categories depicted in Table 2.2. Additionally, the identified usability problems were labelled with one of the five severity levels defined in Table 2.3. If participants gave recommendations for the problem they encountered, the recommendation was labelled with one of the three categories depicted in Table 2.4.

Table 2.1: Code group operational comments

Category	Definition
Manipulative	Comments that express an action, e.g. *'I enter my password in this box'*
Visual	Comments that depict what the participant sees/wants to see, e.g. *'I am looking for the link'*
Cognitive	Comments that reveal the participant's interpretations, assessments and expectations, e.g. *'Now I understand why the link was not clickable'*

Table 2.2: Code group usability problems

Category	Definition
Layout	Participant is unable to detect something on the screen that (s)he needs to find; Aesthetic problems; Unnecessary information
Terminology	Participant is unable to understand the terminology
Feedback	Participant does not receive relevant feedback, or it is inconsistent with what (s)he expects
Comprehension	Participant is unable to understand the instructions given to him/her on the website
Data Entry	Participant has problems with entering information
Navigation	Participant has problems with finding his/her way around the site

Table 2.3: Code group severity ratings

Severity scale	Definition
S0 = 0	I do not agree that this is an usability problem at all
S1 = 1	Cosmetic problem only: need not to be fixed until extra time is available for the project
S2 = 2	Minor usability problem: fixing this should be given low priority
S3 = 3	Major usability problem: important to fix, so should be given high priority
S4 = 4	Usability catastrophe: important to fix this problem before release

Table 2.4: Code group participant remarks

Category	Definition
RD = Design	Remarks on aesthetics or design, e.g. font size, colours used
RT = Text	Remarks on text or terminology
RI = Input	Remarks on manual input of the participant, e.g. chatbot, searchbar

OHH user interaction problems

All usability problems identified in the transcripts were put together into one file. If a usability problem was a task specific problem, it was labelled with the task, and where possible, the usability problems were labelled per subject (e.g. chatbot, navigationbar). The usability problems were checked on duplicates, when doubles were present, these usability problems were merged and counted as a single usability problem. The final dataset contained the variables *problem type*, *severity rating*, *task*, *subject problem*, *UXHP* (participants that identified the problem), *count UXHP* (number of times one participant mentioned the same problem), *count total* (number of participants that identified the same problem), and *usability problem*.

A Pivot Table was used to analyse the usability problems per type, task, and subject, to evaluate what elements of the OHH caused interaction problems. The 5-whys root cause analysis was employed to identify the root causes of the usability problems [43]. Root causes that fell within the scope of the research (e.g. altering navigation buttons), were solved by implementing the solution in the prototype with the renewed design of the OHH website. In case of a root cause solution that fell outside of the scope of the project (e.g. altering the algorithm of the searchbar), a recommendation was posed to find a solution for the problem (Appendix D). In the process of solving the usability problems, the participant remarks (Appendix C.2) were used as advice to improve the OHH website.

Quantification of the qualitative cRTA elements

The qualitative cRTA data was used to create quantitative data to evaluate the OHH its usability, as well as the appropriateness of eye-tracking in cRTA usability testing. Quantification has been used in multiple researches in the field of cRTA [28, 29, 32], and has been proven effective by Olsen et al. [32], who found that counting the number of words verbalised, among others, allowed for making a significant distinction between the gaze and video cue group of participants.

The transcripts and *cRTA playback video*, the playback video shown to the participants which was altered by the researcher in playback speed to encourage participants' verbalisations, were used to determine the cRTA times (start, success, and end). When the audio of the cRTA playback video coincided with the task its first and last sentence in the transcript, the cRTA playback video its timestamp functioned as cRTA start and end times. Task success was labelled as *yes*, *no*, *almost*, *wrong*, or *skip*, depending on what the participant identified as the correct page to answer the task. *Yes* represented the task being fulfilled according to the usability test protocol (Appendix A.2), and *no* indicated that the participant was unable to find an answer to the task. *Almost* and *wrong* implied that the participant indicated to have found the answer to the task in either a similar article (*almost*), or an incorrect article (*wrong*), as described in Appendix B. The success was labelled as *skip* when the participant had not conducted the task.

During the cRTA, the researcher was able to pause, and de- or increase the playback speed, when needed to encourage the participant's verbalisations. Thereby creating the *cRTA playback video* which was different in length to the actual *playback video*. Therefore,

the task performance durations were not equal to the cRTA durations. The task performance (task- and total task duration) was determined for the gaze video cued participants, using the cRTA times. The tasks' start and end times were determined using the stills of the cRTA playback video at the moments of the cRTA start and success. When the stills of the cRTA playback video coincided with the stills of the playback video, the playback video its time stamps functioned as start and end times for the tasks.

Finally, the coded transcripts were quantified and added to the quantification dataset. Quantification of the transcripts implied the counting of (a.) the amount of usability problems and their types found, (b.) severity levels of the usability problems identified, (c.) number of words verbalised, and (d.) number of operational comments verbalised. The quantified dataset contained a total of 26 variables, explained and depicted in Appendix E.

OHH user interaction effectivity

The OHH's usability, which was defined as the ease of use with which users effectively interact with the OHH [18, 23, 24], was determined using the quantification dataset. A descriptive statistics analysis of the task performance was conducted to evaluate the extent to which participants were able to effectively interact with the OHH. The descriptive statistics were combined with a crosstab analysis to evaluate the success rate per task.

Added value of eye-tracking in usability testing

All participants were assigned to either the video cue or the gaze video cue group to evaluate the added value of the additional gaze cue, as was done in several other studies [26, 28, 29, 32, 33]. The difference in cRTA results of the two cue groups was analysed using one-way analysis of variance (ANOVA) tests. One independent variable (cRTA protocol) with two levels (*video* and *gaze video* cue) was used in each of the one-way ANOVA tests. The dependent variables varied per test, being (a) the number of usability problems found, comprising six levels (*layout*, *terminology*, *feedback*, *comprehension*, *data entry*, and *navigation*), (b) the number of severity ratings of the usability problems found, comprising five levels (*S0 - S4*), (c) the number of words verbalised, and (d) the number of operational comments verbalised, comprising three levels (*manipulative*, *visual*, *cognitive*). A significance level of $p < .05$ was employed to identify significant differences in means for the two cue groups.

2.5.2 User Experience Questionnaire

The UEQ data analysis tool (DAT) enabled quick evaluation of UEQ-inventories. The data was entered in the DAT, which automatically calculated the descriptive statistics of the 26 items and six scales, scale consistency, answer consistency, KPI, and benchmarked the results with 452 other product evaluations [40].

Participants that answered the UEQ critically inconsistent, meaning three or more scales that seem to reveal inconsistency in the answers shown in the consistency report, were excluded from the UEQ data analysis. This resulted in a UEQ sample size of 32 participants: sixteen participants in the gaze video cue group ($N_{GVC\text{-}UEQ} = 16$), and sixteen participants in the video cue group ($N_{VC\text{-}UEQ} = 16$).

A UEQ does not reveal what should be altered to increase the product's UX, however it can provide substantiation for an educated guess of what should be changed to enhance the UX of a product [40]. UEQs and usability testing can compliment each other since a UEQ gives an impression of the user's attitude towards the product, and the usability tests give insight into what elements of the product cause problems [44]. The UEQ and cRTA results of the OHH were therefore exploratively evaluated to compare the appropriateness of both research methods in usability testing.

Chapter 3

Results

3.1 OHH User Interaction Problems

A total of 149 usability problems were identified, where the largest usability problem subject was the *chatbot* (Appendix C.1). The root cause analysis identified 76 unique root causes, where the root cause that generated the largest amount of usability problems (N=17) was the chatbot not being designed/programmed for participants to be able to manually enter a question/search term.

Solutions for the root causes were created by the researcher, from which there were 20 unique implementable prototype solutions, 19 unique recommendations for solutions, and 16 root causes that were not worth solving (e.g. an internet problem caused a brief website-freeze during the usability test). All root causes and their accompanying solutions are depicted in Appendix D.

3.2 OHH User Interaction Effectivity

The average total task duration of the OHH usability test was eight minutes and twenty-three seconds. The average task duration was one minute and twenty-four seconds, from which participants performed task 1 the fastest with an average task duration of thirty-six seconds, and task 5 the slowest, with two minutes and twenty-seven seconds (Table 3.1).

Table 3.1: Descriptive statistics task duration

Task Number	Mean	Std. Deviation	% of Total Sum	Minimum	Maximum
1	00:36	00:24	7.1%	00:10	01:31
2	01:42	01:19	20.2%	00:26	06:10
3	01:19	00:51	15.7%	00:14	03:40
4	01:17	00:40	15.3%	00:15	02:38
5	02:17	01:42	27.3%	00:06	06:52
6	01:12	01:07	14.4%	00:07	04:57
Total	01:24	01:11	100.0%	00:06	06:52

Tasks with a high mean task duration simultaneously had a low task success rate. Task 5 had the highest amount of participants that indicated to not be able to find the answer to the task, and the lowest number of participants that were be able to find the answer. Again, task 2 was the second lowest performing task, together with task 5 it had the highest number of participants identifying the wrong article as answer to the task (Table 3.2).

Table 3.2: Success rate per task

		Almost	No	Skip	Wrong	Yes
				Success		
Task Number	1	0	0	0	0	37
	2	5	8	0	8	16
	3	0	10	1	7	19
	4	0	1	0	6	30
	5	0	15	2	8	12
	6	3	7	0	5	22
Total		8	41	3	34	136

So, when solely taking the task success rate into account, the effective interaction rate of the OHH website was 61.3%, meaning that 38.7% of the interaction with the OHH was not successful (i.e. task success rate $\neq yes$). When adding the task duration to the success rate, it was revealed that the longer the average task duration, the smaller the number of participants that successfully fulfilled the task (i.e. task success rate $= yes$), except for task 4.

3.3 Added Value of Eye-Tracking in Usability Testing

3.3.1 Usability Problems

First of all, the effect of the cue type during cRTA sessions on the total number of identified usability problems as well as the number of identified usability problems per type of usability problem were evaluated.

Table 3.3: Usability problems

		Comprehension	Data Entry	Feedback	Layout	Navigation	Terminology	Total
GVC	$\bar{x}$	0.07	0.11	0.36	0.33	0.39	0.06	1.31
	σ	0.26	0.34	0.66	0.66	0.75	0.23	1.54
VC	$\bar{x}$	0.07	0.11	0.25	0.12	0.25	0.07	0.87
	σ	0.26	0.34	0.63	0.36	0.49	0.32	1.18
F		.012	.016	1.768	8.971	2.529	.152	5.925
p		.911	.898	.185	.003	.113	.697	.016

Participants who received the gaze video cue identified on average 1.31 usability problems, which was significantly more [$F(1, 220) = 5.952$, $p = 0.016$] than the 0.87 usability problems averagely identified by the video cue participants. Among the usability problems, the *layout*

problems were averagely more often identified by the participants receiving the additional eye-tracking cue than by the video cue participants [F(1, 220) = 8.971, p = 0.003].

The average number of identified *feedback* and *navigation* usability problems appeared to be some what higher for the gaze video cue group as compared to the video cue group, however no significant difference was found between the two cue groups [F(1, 220) = 1.768, p = 0.185] and [F(1, 220) = 2.592, p = 0.113] respectively.

Between the two cue groups there was no significant difference found for the number of identified *comprehension* usability problems [F(1, 220) = 0.12, p = 0.911], *data entry* usability problems [F(1, 220) = 0.16, p = 0.898], and *terminology* usability problems [F(1, 220) = 0.152, p = 0.697].

3.3.2 Severity Levels

Corresponding to the usability problems, the effect of the cue type during cRTA sessions on the severity levels of the identified usability problems was evaluated.

Table 3.4: Severity levels

		S0	S1	S2	S3	S4
GVC	$\bar{x}$	0.14	0.06	0.57	0.53	0.03
	σ	0.37	0.27	0.92	0.90	0.17
VC	$\bar{x}$	0.06	0.04	0.47	0.27	0.00
	σ	0.28	0.21	0.71	0.66	0.00
F		3.119	.134	.837	5.895	3.228
p		.079	.715	.361	.016	.074

Usability problems with severity level 3, *major usability problem: important to fix, so should be given high priority*, were more often identified by the gaze video cue group than the by the video cue group [F(1, 220) = 3.630, p = 0.016].

It also appeared that the gaze cue resulted in the participants verbalising problems which were not actual usability problems of the OHH (S = S0, Table 3.4). However, no significance was found to substantiate this statement [F(1, 220) = 3.119, p = 0.079].

Between the two cue groups there was no significant difference for the number of identified usability problems with severity level *S1* [F(1, 220) = 0.134, p = 0.715], *S2* [F(1, 220) = 0.837, p = 0.361], and *S4* [F(1, 220) = 3.228, p = 0.074].

3.3.3 Words Verbalised

The effect of the cue type during cRTA sessions on the amount of words participants verbalised during the cRTA per task and in total was evaluated.

Table 3.5: Verbalised words

		Task word count	Total word count
GVC	$\bar{x}$	216.12	1296.72
	σ	147.40	552.19
VC	$\bar{x}$	153.63	921.79
	σ	107.54	359.49
F		13.119	36.316
p		.000	.000

Participants who were retrospectively supported by their eye-tracking data verbalised on average 62.49 words more per task, and 374.93 words more during their cRTA sessions, than the video cue participants (Table 3.5).

This difference in means was significant [F(1, 220) = 13.119, p = 0.000] (task) and [F(1, 220) = 36.316, p = 0.000] (total). H_1 was therefore accepted: employing an additional gaze cue results in more words verbalised during cRTA sessions as compared to only employing a video cue.

3.3.4 Operational Comments

Lastly, the effect of the cue type during cRTA sessions on the total number of operational comments as well as the number of operational comments per type of operational comment were evaluated.

Table 3.6: Operational comments

		Manipulative	Cognitive	Visual	Total
GVC	$\bar{x}$	5.12	6.99	3.41	15.523
	σ	4.18	5.01	2.83	10.26
VC	$\bar{x}$	3.52	5.67	2.81	11.99
	σ	2.98	3.68	2.56	8.30
F		10.930	5.083	2.763	7.973
p		.001	.025	.098	.005

As a possible result from the larger amount of words verbalised by gaze video cued participants, the average total number of operational comments has also shown to be significantly larger for the gaze video cue group [F(1, 220) = 7.973, p = 0.005].

Manipulative and *cognitive* comments were expressed significantly more by the participants supported by the gaze cue, [F(1, 220) = 10.930, p = 0.001] and [F(1, 220) = 5.083, p = 0.025] respectively.

Visual comments also appeared to be used more by the gaze video cue group as by the video cue group, however no significance was found in the data to substantiate this statement

$[F(1, 220) = 2.763, p = 0.098]$.

The addition of a gaze cue in cRTA usability testing is thus of significant added value. It results in more usability problems identified in general, and specifically more *layout* usability problems identified, the usability problems with major severity were identified more often by gaze video cued participants who verbalised more words and in doing so expressed more *manipulative* and *cognitive* comments, as compared to participants who only received video as a cue during their cRTA session.

3.4   OHH User Experience Evaluation

All OHH UEQ item means were above zero (Appendix F), meaning that all items were averagely evaluated more positive than negative. The average value of all the OHH UEQ items was 1.1, implying an overall positive user experience evaluation of the OHH [40]. The benchmark showed an *Above average* evaluation for all scales except the *Dependability* and *Perspicuity* scales. The latter two were part of the pragmatic quality of the OHH [44]. These scales scoring below average thus implied that the interaction with the OHH was not as practical, logical, or efficient as the other products in the benchmark.

Chapter 4

Discussion

4.1   OHH User Interaction Problems

The usability of the OHH was evaluated to identify which elements of the OHH cause user interaction problems. 149 unique usability problems were identified during the cRTA sessions of the OHH usability tests, with the chatbot causing the largest amount of usability problems. According to the participants, the chatbot contained too much text and lacked the ability to let the participant manually enter a search term or follow up question. Therefore it is recommended to fit the chatbot with a function where users can manually enter search terms (recommendation 6). Furthermore, the chatbot asked the participant whether (s)he was a healthcare professional, which the participant had already disclosed by selecting the public profile on the first page of the website. According to guideline 13.6 of the Web Design & Usability Guidelines [45] a user should not have to enter its information more than once. Therefore it is recommended that the chatbot knows the user's profile (recommendation 7).

The 149 usability problems were brought back to 76 unique root causes, for which 20 unique in prototype implementable solutions and 18 unique recommendations were established. To solve the root causes of 21 usability problems, it is recommended to re-examine the categories, chapters, and public/professional distribution of the articles (recommendation 8), which has the potential to largely improve the usability of the OHH [usability guidelines 16.4, 16.5 in [45]]. Another strongly recommended alteration is to adapt the text content to the B1 level (recommendation 2) [usability guidelines 15.2, 15.3, 16.8 in [45]], since the OHH public profile is meant for the general public but its content is now too difficult, as identified by the participants.

Many (N=36) different usability problems' origins were brought back to the root cause that the navigational elements were not intuitive for the participants. For this root cause many implementable solutions and recommendations were drawn up. Such as assigning the green accent colour to the public profile and the purple colour to the professional profile, to make it visually apparent for the user when (s)he enters the other profile page [usability guideline 16.9 in [45]], since several participants unintentionally searched at the wrong profile, resulting in elongated or unsuccessful searches. In continuation on the colours, the use of the colour light grey should be avoided since light grey is often used in graphical user interfaces

to indicate that something is not clickable, which is also called *greyed out* [46, 47] (solution 6). A logical solution to enhance the navigational elements, is to improve the navigationbar. The *Home* button should lead to the profile choice menu [usability guideline 5.1 in [45]]. The *Information* button should be replaced with the zoonosis' name (e.g. MRSA), revealing a drop down menu with the MRSA categories, when clicked on. An additional button named *Zoonoses* should be added, leading to the profile home page which contains the database with all zoonotic diseases on the OHH website. An *About* button that leads to a page with extensive information about the OHH website is recommended to be added (solution 3) [usability guidelines 7.2, 9.1 in [45]]. And lastly, the searchbar should be made more apparent by putting it in a white box, contrasting with the dark green navigationbar (solution 17).

It is important to have visual consistency on a website to decrease interaction problems [usability guidelines 11.2, 11.4 in [45]] [48, 49]. The most often reoccurring elements are the page design and the tiles. In the beta version the public profile home page, MRSA main page, and category page all had different page designs as well as different tile designs. The same type of page design and tile design should therefore be used to ensure overall consistency of the website [48, 49].

More implementable solutions and recommendations were drawn up for the identified root causes (Appendix F). The implementable solutions were included in the new OHH prototype. This prototype is elaborately explained in Appendix G, and accessible here.

4.2   OHH User Interaction Effectivity

It was researched to what extent the participants were able to effectively interact with the OHH (research question 2). This study showed that the participants of the OHH usability test were able to successfully fulfil just above 60% of the tasks, which took eight minutes and twenty three seconds on average. This seemed reasonably effective with an average task duration of one minute and twenty four seconds to find the information for a task. However, when keeping in mind that the OHH is developed for people to easily find information, a success rate of less than two out of three (i.e. 61.3%) can be seen as mildly effective. Success is nevertheless a highly subjective topic for which no strict cut-off values are available [50].

Since the task success rate showed to be negatively correlated with the task duration, the task duration should be reduced to improve the extent to which users can effectively interact with the OHH. This means that the time between entering the website, and finding what the user needs, should be shortened [51]. One way to achieve this is by minimising the number of clicks the user has to make to achieve its goal [usability guideline 16.5 in [45]]. This could be accomplished by switching from a deep website hierarchy, to a more flat website hierarchy [52, 53]. Changing the website hierarchy is closely related to the reorganisation of the articles per chapter and category. Since the current article, chapter, and category distribution was established using a card sorting method, there is advised to revise the results of the card sorting with a UX developer specialised in flat and deep hierarchy designs of databases.

4.3   Added Value of Eye-Tracking in Usability Testing

In answer to research question three, *What is the added value of an additional eye-tracking cue in usability testing?*, it was concluded that an additional gaze cue is of added value in usability testing since it provoked the participants to identify more usability problems, with a higher severity level, while verbalising more words and thereby expressing more manipulative and cognitive comments.

The ability of the gaze video cue to identify more usability problems than video cue is in agreement with the studies of Elbabour et al. [29], Olsen et al. [32] and Eger et al. [33]. The OHH gaze video cued participants identified more layout usability problems, which was not yet found in other studies exploring the added value of eye-tracking in usability testing. The study of Elbabour et al. [29] did show that the gaze video cue provoked identification of more navigation usability problems, which the OHH data also hinted towards but could not significantly support.

Usability problems with a major severity level were more often identified by gaze video cued participant than by the video cued participants. Assigning severity level is not yet often done in other studies, only the study of Elababour et al. [29] revealed the contradicting result that the gaze video cue provoked identification of more usability problems with low severity levels. However, in this study the severity levels were assigned by the researcher according to a rather subjective codebook (Table 2.3), and should therefore be interpreted with caution.

The gaze video cued participants of the OHH verbalised significant more words than the video cued participants. Which is in line with the studies of Elababour et al. [29] and Olsen et al. [32]. Verbalisation of more words can be caused by the gaze video cued playback videos were played slower than the video cued playback videos [29], or because the participants attention was guided over the screen by the gaze cues, thereby better supporting the participant in recalling his/her own behaviour.

The results in operational comments of the OHH did not correspond with the results of the other studies [26, 29, 32]. These studies identified that the gaze video cue provoked the verbalisation of more visual comments, where the OHH gaze video cued participants rather expressed more manipulative and cognitive comments as compared to the video cued participants. This could be because the operational comments were not compensated for the difference in number of words verbalised by the two cue groups. Additionally, since the three studies [26, 29, 32] all had the same outcome which was contrary to the OHH results, different interpretation of the code definitions could have caused the differences in results between the OHH study and other studies. This could have been prevented by letting two individual researchers both code the transcripts and subsequently merge the two versions of the coded transcripts.

Future research exploring the extent to which a gaze cue is of added value in usability testing, should focus on the objective identification of the usability problems' severity levels, to explore whether the gaze cue also has the ability to provoke identification of usability problems with contrasting severity levels as opposed to a video cue.

4.4 UEQ and cRTA

A UEQ provides insight into the users attitude towards the product [44]. The UEQ-inventories revealed that the OHH lacked in its dependability and perspicuity, meaning that the pragmatic quality of the website was not as highly evaluated as the attractiveness and hedonic quality of the OHH website. To improve the dependability of the OHH, the interaction with the website should be more intuitive and give the user the feeling that (s)he is in control [36]. The perspicuity of the OHH website can be increased by making the website more clear and understandable so that it is easy to learn how to interact with it [35, 36]. Reflecting back on the results of the cRTA sessions, this means that the navigation should be enhanced and consistency has to be retained throughout the whole website in order to make the interaction clear and intuitive.

Improving the OHH design solely using the UEQ results would lead to solutions based purely on the UX developer's interpretation of what would be the problem causing the low dependability and perspicuity scales evaluation. The UX developer does not need to make educated guesses when additionally using the cRTA sessions' results, since than (s)he can solve the identified usability problems that lie within the scope of the dependability and perspicuity scales.

Solely using the cRTA results to improve the product's design is possible since the exact problems users encounter were identified. However, for the OHH this would mean solving 149 unique usability problems. Therefore, using a UEQ as an additional guide of what participants experienced as good and poor scales of the OHH, assists the UX developer into focussing on the most important solutions.

The combination of UEQ and cRTA as research methods in usability testing is thus the best option, which is in line with the study of Schrepp et al. [44]. However, in case of little research time and budget, solely using a UEQ as research method could be sufficient enough to give insight into which scales cause usability problems. The execution and analysis of the UEQ require little time and allow for calculation of figures representing the product's UX. Nevertheless, the UEQ only provides an indication of where the problems lie, and does not reveal the actual usability problems. Improving a product solely based on UEQ results thus remains restricted to educated guessing. Using only a cRTA as research method gives more qualitative insight than the UEQ, and is thus better when the aim of the usability test is to identify actual usability problems for adaption of the product. Drawbacks of cRTA are that it takes longer to execute and analyse, and participants often do not completely understand the aim of the cRTA sessions, seen in the usability testing of the OHH as well as the study of Elling et al. [28].

Chapter 5

Conclusion

In this study the usability of the One Health Hub was evaluated using the data from the by the general public carried out usability tests employing two different cue protocols in combination with a User Experience Questionnaire. It was concluded that the *consistency* and *navigational elements* of the One Health Hub have to be improved to ensure faster and more successful goal achievement by users. The comparison of the two cue protocols established that an additional gaze cue provokes identification of more usability problems and verbalisation of more words, and has the potential to identify more layout usability problems as compared to only using a video cue. The User Experience Questionnaire was identified as a suitable research methodology for quick identification of a product's performance as indicator for potential future research, however when product improvement is the goal, detailed information about the product's performance should be gathered using a cued retrospective think-aloud research method.

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Appendix A

Usability Test Setup

In the preceding research, the usability test was developed and carried out for the One Health Hub. This appendix holds the scenario and tasks used during the the usability test, the protocol according to which these tasks should be performed, and the survey given to the participants after task performance, developed by Simon Langener.

The One Health Hub usability tests have been carried out in Dutch, and the website only has a Dutch and German version. However, for the accessibility of this appendix, the scenario and tasks, and the protocol have been translated to English.

A.1   Scenario and Tasks

<u>Scenarios for participants re OneHealth Hub:</u>

You are told that your friend, who has had a small operation, has to stay in the hospital. He got infected during his hospitalisation. Someone who was present tells you it is about a so called MRSA-contamination, which is hard to treat. You have never heard about this infection. When you are at home you immediately start up your computer to google it. The first website that google shows you is the so called OneHealth Hub (www.onehealthhub.nl). You click on it, and the site opens:

[Website is opened by the researcher]

<u>Task 1:</u>   Like described above, you have never heard of MRSA. What kind of infection is it?

<u>Task 2:</u>   You are worried and want to visit your friend. However, you are also worried about whether you yourself can be infected during the hospital visit, and how this happens. How does MRSA spread?

<u>Task 3:</u>   During your visit you see the intravenous drip and your friend tells you it is for the antibiotics. You have never seen this before. You only know antibiotics in pill form. Why is it sometimes also administered intravenously?

<u>Task 4:</u>   Your friend has a farm and he thinks that the contamination went via a pig. How is this possible? Try to use the Chatbot.

<u>Task 5:</u>   The partner of your friend works in healthcare. Is that allowed when they live together on a farm?

<u>Task 6:</u>   You hope that your friend can return home soon. How long does a carrier treatment tak?

A.2 Protocol

Table A.1: Usability test task protocol

Task	Task goal	Tasks	UI path	Website
1.1	BROWSE / FIND GEN. INFO.	You have, as described above, never heard about MRSA. What type of infection is it?	Public > MRSA > General Information > What is MRSA	`https://onehealthhub.nl/nl/informatie-publiek/mrsa/algemene-informatie-mrsa/wat-is-mrsa`
1.2	BROWSE / FIND INFO. SPREAD	How does MRSA spread?	Public > MRSA > General Information > Risks and Spread	`https://onehealthhub.nl/nl/informatie-publiek/mrsa/algemene-informatie-mrsa/hoe-kan-mrsa-zich-verspreiden`
1.3	BROWSE / FIND INTRA-VENOUS INFUSION	Why is the antibiotics administered intravenous?	Public > MRSA > Diagnostic and treatment > Treatment > Why intravenous infusion	`https://onehealthhub.nl/nl/informatie-publiek/mrsa/diagnostiek-en-behandeling/waarom-worden-sommige-antibiotica-via-een-infuus-en-andere-in-pilvorm-verstrekt`
1.4	BROWSE / FIND CONTAM-INATION PIG	Can a MRSA-contamination be transmitted via a pig?	Public > MRSA > Contamination via animals > Farm > MRSA via pigs	`https://onehealthhub.nl/nl/informatie-publiek/mrsa/besmetting-via-dieren/hoe-krijg-ik-mrsa-via-varkens`
1.5	BROWSE / FIND WORKING HEALTH-CARE FARM	The partner of your friend works in the healthcare. Is that allowed if they life together on a farm?	Public > MRSA > MRSA in healthcare > Working in the healthcare sector > Married or living together with a pig farmer?	`https://onehealthhub.nl/nl/informatie-publiek/mrsa/mrsa-in-de-zorg/mag-ik-in-de-zorg-werken-als-ik-getrouwd-ben-of-samenwoon-met-een-varkenshouder`
1.6	BROWSE / FIND CARRIER TREAT-MENT	How long does a carrier treatment take?	Public > MRSA > Diagnostic and treatment > Treatment > MRSA-carrier treatment	`https://onehealthhub.nl/nl/informatie-publiek/mrsa/diagnostiek-en-behandeling/hoe-lang-duurt-een-gemiddelde-behandeling-van-mrsa-dragerschap`

A.3 Survey

Maak dan nu uw evaluatie:

Voor de beoordeling van de website, vragen we u de onderstaande vragenlijst in te vullen. De vragenlijst bestaat uit twee tegengestelde eigenschappen die van toepassing zijn op de website. De rondjes staan voor verschillende gradaties. U kunt uw beoordeling geven door het rondje, die het meest uw indruk weerspiegelt, aan te vinken.

Voorbeeld:

aantrekkelijk	○ ○ ○ ○ ○ ○ ○	onaantrekkelijk

Dit antwoord zou betekenen dat u de website beoordeelt als meer aantrekkelijk dan onaantrekkelijk.

Graag uw eerst ingeving invullen. Wacht niet te lang met invullen om te voorkomen dat u gaat twijfelen over uw eerste ingeving.

Soms bent u misschien niet helemaal zeker van uw antwoord of u vindt de eigenschap niet volledig van toepassing, kruis dan toch een rondje aan.

Het is uw mening die telt. Let op: er is geen goed of fout antwoord!

Gelieve beoordeel de Onehealth Hub website nu door het aanvinken van een cirkel per regel:

	1	2	3	4	5	6	7		
onplezierig	O	O	O	O	O	O	O	plezierig	1
onbegrijpelijk	O	O	O	O	O	O	O	begrijpelijk	2
creatief	O	O	O	O	O	O	O	saai	3
makkelijk te leren	O	O	O	O	O	O	O	moeilijk te leren	4
waardevol	O	O	O	O	O	O	O	inferieur	5
vervelend	O	O	O	O	O	O	O	spannend	6
oninteressant	O	O	O	O	O	O	O	interessant	7
onvoorspelbaar	O	O	O	O	O	O	O	voorspelbaar	8
snel	O	O	O	O	O	O	O	langzaam	9
origineel	O	O	O	O	O	O	O	conventioneel	10
belemmerend	O	O	O	O	O	O	O	ondersteunend	11
goed	O	O	O	O	O	O	O	slecht	12
complex	O	O	O	O	O	O	O	eenvoudig	13
afstotend	O	O	O	O	O	O	O	aantrekkelijk	14
gebruikelijk	O	O	O	O	O	O	O	nieuw	15
onaangenaam	O	O	O	O	O	O	O	aangenaam	16
vertrouwd	O	O	O	O	O	O	O	niet vertrouwd	17
motiverend	O	O	O	O	O	O	O	demotiverend	18
volgens verwachtingen	O	O	O	O	O	O	O	niet volgens verwachtingen	19
inefficiënt	O	O	O	O	O	O	O	efficiënt	20
overzichtelijk	O	O	O	O	O	O	O	verwarrend	21
onpraktisch	O	O	O	O	O	O	O	praktisch	22
ordelijk	O	O	O	O	O	O	O	rommelig	23
aantrekkelijk	O	O	O	O	O	O	O	onaantrekkelijk	24
aardig	O	O	O	O	O	O	O	onaardig	25
conservatief	O	O	O	O	O	O	O	innovatief	26

$\longrightarrow$

volgende pagina

Gelieve beoordeel de <u>volgende statements</u> door het aanvinken van een rondje per regel:

          1   2   3   4   5   6   7

De website moet er aantrekkelijk, plezierig, vriendelijk en aangenaam uitzien.   27

helemaal niet belangrijk   ○ ○ ○ ○ ○ ○ ○   uitermate belangrijk

Ik zou mijn taken met de website snel, efficiënt en op een pragmatische manier moeten kunnen uitvoeren.   28

helemaal niet belangrijk   ○ ○ ○ ○ ○ ○ ○   uitermate belangrijk

De website moet begrijpelijk, duidelijk, eenvoudig en gemakkelijk te leren zijn.   29

helemaal niet belangrijk   ○ ○ ○ ○ ○ ○ ○   uitermate belangrijk

De interactie met de website moet voorspelbaar en veilig zijn en aan mijn verwachtingen voldoen.   30

helemaal niet belangrijk   ○ ○ ○ ○ ○ ○ ○   uitermate belangrijk

Het gebruik van de website moet interessant, spannend en motiverend zijn.   31

helemaal niet belangrijk   ○ ○ ○ ○ ○ ○ ○   uitermate belangrijk

De website moet innovatief, inventief en creatief ontworpen zijn.   32

helemaal niet belangrijk   ○ ○ ○ ○ ○ ○ ○   uitermate belangrijk

Beantwoord alstublieft nog een paar vragen:

Hoe hebt u de navigatie van de website ervaren?

Wat vindt u van de structuur van de website?

Hebt u moeilijkheden ondervonden toen u de website gebruikte? Welke?

Wat vond u positief toen u de website gebruikte? Waarom?

Welke apparatuur (computer, smartphone, tablet etc.) gebruikt u gewoonlijk bij het bezoeken van een dergelijke website? Waarom?

Zijn er nog dingen die ik niet heb gevraagd maar die u belangrijk of opvallend vindt?

Persoonlijke informatie:

Proefpersoon nummer: _____	
(In te vullen door onderzoeker)	

Wat is uw geslacht?	☐ Man	☐ Vrouw	☐ Anders/Zeg ik liever niet

Wat is uw leeftijd? ☐ 18 – 25 jaar ☐ 26 – 35 jaar

☐ 36 – 45 jaar ☐ 46 – 55 jaar

☐ 56 – 65 jaar ☐ Ouder dan 65 jaar

Wat is uw hoogste
opleiding? ☐ Basisonderwijs ☐ Vmbo, havo, -vwo-onderbouw, mbo 1

☐ Havo, vwo, Mbo 2-4 ☐ Hbo en wo bachelor

☐ Hbo en wo master, doctor

Wat is uw beroep? _____

Hoe stedelijk is uw
leefomgeving? ☐ Niet stedelijk ☐ Weinig stedelijk

☐ Matig stedelijk ☐ Sterk stedelijk

☐ Zeer sterk stedelijk

Wat is uw woonplaats? _____

Hoe vaak gebruik u
het internet? ☐ (Bijna) nooit ☐ Minder vaak

☐ Ongeveer 1 dag per week ☐ Meerdere dagen per week

☐ (Bijna) elke dag

Was de geteste
website bekend? ☐ Ja ☐ Nee

Geachte heer/mevrouw,

Graag willen we u uitnodigen om deel te nemen aan ons vervolgonderzoek. Om dit te kunnen doen, hebben wij deelnemers van verschillende leeftijden, beroepen en opleidingen nodig. Wilt u dus ook in de toekomst bijdragen aan onze onderzoek? Vul dan uw e-mail adres in:

Uw e-mail: _____

(deze informatie wordt alleen voor het huidige onderzoek en vervolgonderzoek gebruikt)

In te vullen door onderzoeker:

Opmerkingen: _____

_____

_____

Appendix B

Success Rate

The success rate of the tasks performed by the participants have been labelled according to definitions in Table B.1. This Appendix holds, next to these definitions, the *'Almost'* success rate prerequisites and the there on based articles per task.

Table B.1: Success rate definitions

Success Rate	Definition
Yes	Participant finds the article as described in the protocol and identifies the article as correct
No	Participant cannot find an answer to the task
Almost	Participant indicates to have found the answer to the task on a page that is equivalent to the correct article according to the protocol
Wrong	Participant indicates to have found the answer to the task on a page that is not equivalent to the correct article according to the protocol
Skip	Participant skips the task

Prerequisites for the almost articles
- The article should be in the public part of the website

- The article should contain the answer to the task

Task 1: Wat is MRSA? - *What is MRSA?*
Answer: MRSA is a bacterium. In vernacular, MRSA is also called the hospitalbacterium because the bacterium is often incurred in hospitals.
All participants have successfully accomplished task 1, therefore there are no almost articles.

Task 2: Hoe kan MRSA zich verspreiden? - *How does MRSA spread?*
Answer: MRSA mainly spreads via hand contact with a person who is already contaminated with MRSA (MRSA host). Additionally, MRSA can be spread via the air (dust and dander), object and surfaces (e.g. a bed trapeze bar).

Hoe vaak kan iemand MRSA krijgen? (publiek) - *How often can somebody get MRSA (public)*

Extra information: MRSA can be incurred anywhere. Contamination with MRSA especially occurs via direct physical contact, especially via the hands.

Waar en hoe kun je MRSA oplopen? - *Where and how can someone be incurred with MRSA?*

Answer: MRSA can mainly be incurred in hospital, but outside of the hospital MRSA can also be incurred. MRSA is mostly incurred via direct physical contact with someone who is contaminated with MRSA.

Is MRSA ook seksueel overdraagbaar? - *Is MRSA sexually transmittable?*

Answer: MRSA is not a sexually transmittable disease (STD). However, MRSA can be transmitted via physical contact, so during intercourse it is possible that MRSA is transmitted from one body to the other.

Task 3: Waarom worden sommige antibiotica via een infuus en andere in pilvorm verstrekt? - *Why are some antibiotics administered intravenously and others in pill form*

Answer: Certain antibiotics are not absorbed in the gastrointestinal tract; they leave the body in the defecation and thus have barely any impact on the body. These antibiotics are therefore administered intravenously.

No other articles answer task 3

Task 4: Hoe krijg ik MRSA via varkens? - *How do I get contaminated with MRSA via pigs*

Answer: Possible contamination of MRSA from pigs to humans occurs via direct contact, via the skin.

No other articles answer task 4

Task 5: Mag ik in de zorg werken als ik getrouwd ben of samenwoon met een varkenshouder? - *Am I allowed to work in healthcare if I am married to or live together with a pig farmer?*

Answer: Currently there are no rules that forbid this.

No other articles answer task 5

Task 6: Hoe lang duurt een gemiddelde behandeling van MRSA-dragerschap? - *How long does an average treatment of a MRSA carrier take?*

Answer: An average treatment of MRSA with special nasal ointment and shampoo (so called 'decontamination') including control culture will take a couple weeks. Which agents will be used is dependent on the place on the body where the MRSA is present.

Waarom duurt MRSA-dragerschap soms zo lang? - *Why does carrying MRSA sometimes take so long?*

Answer: When certain risk factors are present, such as catheters, wounds and antibiotic usage, MRSA carrying can sometimes take long. Additionally it turns out that some healthy MRSA carriers can carry the bacterium for a long time, reasons for this are not yet known. Extra information: Due to the presence of the mentioned risk factors, the MRSA bacterium can permanently locate itself in skin flora and mingle itself with other bacteria on the skin. Therefore, in presence of the risk factors, it can take weeks to months before the treatment catches on.

Appendix C

Usability Problems and Participant Remarks

The cRTA sessions of the One Health Hub website usability tests, carried out with members of the general public, have identified many usability problems and participant remarks. This appendix holds the usability problems, categorised by their type: *Terminology*, *Layout*, *Feedback*, *Comprehension*, *Data Entry*, and *Navigation*. The second part of this appendix holds the participant remarks, categorised by their type: *Recommendations*, *Quotes*, and *Plus points of the website*.

C.1   Usability Problems

Table C.1: Identified terminology usability problems

Problem type	Severity rating	Task	Subject problem	Count total	Usability problem
T	S2	T1		4	Names of bacteria in the *'Wat is MRSA?'*-article are difficult words from which the participant does not know the meaning
T	S3		Chatbot	1	The chatbot asks difficult questions
T	S0	T1		1	Participant mentions the scientific terms in the 'Wat is MRSA?'-article, but also indicates that those are not a problem
T	S2	T5	Searchbar	1	Participant does not know what terms to use in the searchbar
T	S3		Public/professional profile choice menu	1	Participant is confused by the term *'zoönose'* on the public-tile because he does not know what a zoonosis is
T	S2	T4		1	Participant is unsure about the term *'direct contact'*, she expects that it means the petting of animal, but is not sure
T	S2			1	Participant thinks that *'long'* is a vague term with respect to the length of carrier status, she would like a minimum and a maximum duration, one concrete answer
T	S2		Public/professional profile choice menu	1	Participant finds the explanation on the public-tile too difficult
T	S2			1	There is not explained what MRSA and Q-koorts is on their tiles (participant does not know what both of the zoonoses are)
T	S2			1	Participant does not understand the text in the *'Is MRSA te behandelen?'*-article

Problem type	Severity rating	Task	Subject problem	Count total	Usability problem
L	S3		Chapter link buttons	1	Chapter link buttons are too small
L	S2		Amount of text	1	Too much text in the 'Welke maatregelen moeten in het verpleeghuis genomen worden, als een MRSA-patiënt na ontslag uit het ziekenhuis naar het verpleeghuis gaat?'-article
L	S2	T2	Search problem	1	Participant can only find contamination via animals, but not spead of MRSA
L	S3		Chapter link buttons	1	Because the chapter link buttons are white, they do not stand out
L	S0		Amount of text	1	Too much text in the article 'Ik ben zelf MRSA-positief en mag daarom niet werken. Mag ik thuis gewoon visite ontvangen?'
L	S3		Chatbot	6	Too much text in the chatbot
L	S3		Amount of text	4	A lot of text on the tiles (therefore reading and searching takes long)
L	S2		Amount of text	1	A lot of text and various categories on the MRSA mainpage
L	S2		Images	1	The images accompanied with the questions are sometimes quite random
L	S3		Amount of text	1	Some chapters have a lot of tiles with a lot of text as questions, it takes a long time to read through all of it
L	S2		Tags	1	Too much tags at the 'MRSA Public tags:' on the MRSA mainpage
L	S1		Images	1	Too much questions (articles) have the same image, makes it unclear
L	S2		Chapter link buttons	1	Participant only sees the Chapter link buttons at the end of the usability test
L	S3		Chatbot	1	Participant is unable to find the chatbot because it appears delayed with the loading of a new page
L	S2		Tags	1	Participant reveals during the cRTA that she did not see the tags at the bottom of an article
L	S3		Images	1	The 'Wat moet ik doen om zo snel mogelijk van MRSA af te komen zodat ik weer kan gaan werken (ik heb een werkverbod gekregen vanwege mijn MRSA-dragerschap?'-article underneath the 'Most read in MRSA:' has an image with blue colours and the title becomes blue when you hover over it, which makes the text hard to read
L	S2		Searchbar	1	Participant did not see the searchbar during task execution
L	S2	T1		1	Participant misses subparagraphs in the extra information of the 'Wat is MRSA?'-article
L	S2	T2		1	Participant misses subparagraphs in the extra information of the 'Hoe kan MRSA zich verspreiden?'-article
L	S2		Chatbot	2	Participant could not find the chatbot at first
L	S3		Chapter link buttons	1	Participant thought that the chapter link buttons were tags and not clickable
L	S3		Chapter link buttons	1	Because the chapter link buttons were so light of colour, the participant did not know what to do with them
L	S1			1	Participant thinks it is confusing that the layout of the website and the articles is exactly the same
L	S2		Scroll problem	1	Participant sees only after a while that there is a division between 'Diagnostiek' and 'Behandeling'
L	S3		Images	1	The images on the tiles do not support the question (article) properly
L	S1		Tags	1	The tags underneath an article are not clear enough
L	S1			1	The 'Lees verder' buttons of the articles are not on one straight line on the tiles
L	S1			1	The 'Lees verder' buttons on the tiles do not really stand out
L	S2		Public/professional profile choice menu	1	On the public/professional profile choice menu page you cannot instantly see what it is about
L	S1			1	Participant skips the answer and looks straight at 'Extra information' paragraph, because she always automatically looks at the paragraph with the largest amount of text
L	S2		Images	1	The same images are used for two different articles, which forces the participant to extensively read the text on the tiles before picking one
L	S2			1	Participant states that for a layperson there might be too much choice possibilities (participant worked in healthcare)
L	S2			1	Participant uses the chatbot to go to the 'Boerderij'-chapter but still clicks the tag 'Varkenshouder' underneath the farm-articles
L	S3		Amount of text	1	The 'Wat moet ik doen om zo snel mogelijk van MRSA af te komen, zodat ik weer kan gaan werken (ik heb een werkverbod gekregen vanwege mijn MRSA-dragerschap?'-tile contains too much and unclear text
L	S2		Tags	1	Participant noticed the tags only after a while
L	S1		Chatbot	1	Participant thinks the chatbot animations are slow

Problem type	Severity rating	Task	Subject problem	Count total	Usability problem
FB	S2			1	There are multiple ways to access the same answer (article), this is vague for the participant
FB	S0	T3		1	Participant thinks the task is too far-fetched and would not search the answer on the OHH website
FB	S2	T5		1	Participant expected to be able to find the information about living together on a farm in the category *'MRSA in healthcare'*
FB	S2			1	There is no information in the professional part of the website about people who work in healthcare (as a practitioner that treats MRSA)
FB	S0			1	The *'Diagnostiek'*-articles do not contain a time indication of the length of the treatment
FB	S3		Chatbot	2	You have to start over with reading every time the text in the chatbot shift upwards (undesirable)
FB	S4		Tags	1	Due to the blue tiles underneath the chapter tiles, it looks like the end of the page, resulting in that you do not scroll further
FB	S2		Tags	1	The tags underneath the tiles of the *'Wat is MRSA?'*-chapter on the *'Algemene informatie MRSA'*-category page, are too much and too varied
FB	S2		Chatbot	1	The chatbot asks the same questions as the navigation
FB	S0			1	Participant keeps on clicking on the text of the tiles, rather than on the *'Lees verder'* button (text is also clickable)
FB	S3		Chatbot	4	In the chatbot the previous conversation has to be closed, and all questions have to be answered again for a new search, this takes a lot of time
FB	S3		Chapter link buttons	1	Participant thinks it is inconvenient that you need the chapter link buttons to find the answer
FB	S2		Chatbot	1	Participant tries to close the chatbot with a browser refresh, but gets a notification that the questions will be removed, if that is the notification to ask whether the questions of the chatbot can be removed, it is an unclear message
FB	S3		Chatbot	1	The shifting of the chatbot poorly influences the hand-eye coordination, because the box shifts a bit downwards compared to the place of mouse
FB	S3		Chatbot	2	An incorrect choice in the chatbot results in closing the chatbot
FB	S2		Searchbar	1	All hits of the searchbar are uncategorised, which is confusing, the participant does not know where to start reading
FB	S3		Searchbar	1	If the searchbar has 0 hits, a page is displayed with solely english text
FB	S3		Chatbot	3	Using the chatbot takes too long
FB	S0		Public/professional profile choice menu	1	Participant did not expect to go back to the public/professional profile choice menu when you click on the OHH title at the top left of the page
FB	S2			1	The participant expected that the *'Publiek'*-subtitle above the page title would be a button to go back to the main page
FB	S0	T4		1	Participant thinks that the information of the *'Hoe voorkom ik als varkenshouder besmetting met MRSA?'*-article does not directly answer the question of task 4 (is not the correct article for task 4)
FB	S3		Chatbot	5	You cannot ask a second question to the chatbot
FB	S2			1	Participant expected that all information about the treatment of MRSA would be available in the *'Is MRSA te behandelen?'*-article
FB	S1			1	The categories in the MRSA list of contents are not evident enough
FB	S0	T1		1	Participant did not have the feeling to have accomplished task 1 with the *'Wat is MRSA?'*-article
FB	S2	T2		1	Participant expected that how to get infected with MRSA would be answered in *'Algemene informatie'*
FB	S3	T3	Amount of text	2	Participant states that (s)he thinks the answer for task three is too short-/the extra information paragraph is missing
FB	S2		Chatbot	1	Launching the chatbot goes slow
FB	S3		Chatbot	1	The chatbot asks if you work in a care facility, however you have already answered that question by choosing public in the public/professional profile choice menu
FB	S2		Chatbot	2	Participant thinks the chatbot is too steering
FB	S0	T5		1	Participant expected to find the answer to task five at the *'Contact met anderen'*-chapter
FB	S0			1	Participant thinks it is annoying that if she clicks on the tag *'dragerschap-behandeling'* underneath the article, the same article appears as search result
FB	S2		Chatbot	1	Participant expect personal contact with the chatbot, but does not receive that
FB	S0		Chatbot	1	Participant states that certain places of the website can only be accessed using the chatbot
FB	S1		Images	1	The same image for all the farm-articles results in that you have to read the text very carefully before making a decision
FB	S2		Chatbot	1	Distracting that the chatbot goes away and comes back with the loading of a page
FB	S0		Amount of text	1	Some articles contain a lot of text and others almost none
FB	S2			1	In the *'Hoe lang duurt een gemiddelde behandeling van MRSA-dragerschap?'*-article it is not stated if the disease can come back
FB	S2	T2		1	Participant expects the answer to task two would be in the *'MRSA in de zorg'*-category
FB	S3		Chatbot	2	The questions the chatbot poses are not directly above the place where you should give answer to the question

Table C.3: Identified feedback usability problems

Problem type	Severity rating	Task	Subject problem	Count total	Usability problem
FB	S3		Chatbot	1	The chatbot scrolls downwards because it gives new information, which is annoying if you want to look at the information at the top of the chatbot
FB	S0			1	Participant thinks the text in the articles of the *'Verloop van MRSA'*-chapter are too long, she is searching for one concrete answer (participant stated that she always looks at the paragraph with the most text and therefore skips the answer paragraph)
FB	S3		Tags	1	The tag *'Behandeling'* gives only three articles from which the answer to task three is not one of
FB	S2			1	Participant thinks there are little protocol at the professional part of the website
FB	S3		Public/professional profile choice menu	1	You cannot click on the public-tile, you first have to flip the card and click on *'Lees verder'* button (annoys the participant)
FB	S2			1	Participant misses at the side of an article the possibility to search further (into other articles)
FB	S2			1	Participant thinks the website is clear, but that finding the answers to the task could have gone a bit faster
FB	S2		Chatbot	1	The chatbot goes too fast
FB	S2	T3	References	1	Participant wants to click a reference but decides not to because it has an English title

Table C.4: Identified comprehension usability problems

Problem type	Severity rating	Task	Subject problem	Count total	Usability problem
C	S0	T3		1	The tiles of the *'Diagnostiek'*-chapter did not fit task three according to the participant (T3 is treatment not diagnostics)
C	S2		Chatbot	1	The text in the chatbot goes too fast, he asks *'Yes/No'*, but you do not know on what you nee to answer Yes or No
C	S2		Search problem	1	Participant does not know if he should look for answers on his questions at the public or professional part of the website
C	S3		Public/professional profile choice menu	1	It is unclear whether you are public or professional because there is no text on the tiles
C	S2	T4		1	Participant is unsure whether she has found the correct answer
C	S2		Chatbot	1	Participant thinks it is unclear which article of the chatbot choice menu she should choose
C	S2		Public/professional profile choice menu	1	Participant thinks the public/professional profile choice menu is unclear
C	S2		Chatbot	2	Participant is confused by everything that appears when opening the chatbot
C	S2	T3		1	Participant did not understand task three
C	S2			1	Participant goes to the professional part of the website because she did not expect to find information about a disease at the public part of the website
C	S2	T4		1	Participant did not understand task four
C	S2			1	Because of the most read articles the participant doubts whether to click those or the categories in the MRSA list of contents

Table C.5: Identified data entry usability problems

Problem type	Severity rating	Task	Subject problem	Count total	Usability problem
DE	S3		Searchbar	3	The searchbar gives zero hits
DE	S0			1	Participant cannot click on the bullet points of the answer in an article (these are not meant to be clickable)
DE	S0			1	Participant verbalises that the link behind a button does not work (most likely he did not click exactly on the button)
DE	S3		Searchbar	1	The searchbar does not give any suggestions
DE	S0			2	The website froze (probably due to the internet connection)
DE	S4		Searchbar	1	Participant enters *'draagschapbehandeling'* in the searchbar, which gives zero hits
DE	S3		Searchbar	3	Participant enters *'intraveneus'* in the searchbar, which gives zero hits
DE	S3		Chatbot	3	You cannot manually enter (type in) a question in the chatbot
DE	S4		Searchbar	1	You cannot enter a new search term in the searchbar when the previous term did not give any hits, you have to use the browser navigation to get back
DE	S3		Searchbar	1	Participant enters *'waarom intraveneuze behandeling'* in the searchbar, which gives zero hits
DE	S0		Searchbar	1	Participant wanted to use the searchbar, but when he started typing Asian characters appeared in an external window (probably due to the usability test computer and not the OHH website)
DE	S0			1	Participant wanted to use CTRL+F to search on the website, but that did not work (does work on the OHH so probably due to the usability test computer and not the OHH website)
DE	S0	T5	Chatbot	1	Participant cannot find the answer on task five in the chatbot (second subject of the choice menu, second article)
DE	S0			1	According to the participant you are not able to search with keywords on the OHH website
DE	S3	T5	Searchbar	1	Participant enters *'Partner MRSA'* in the searchbar, which gives two hits from which the answer to task five is not one
DE	S3		Searchbar	1	Participant enters *'Is MRSA besmettelijk?'* in the searchbar, which gives zero hits
DE	S3		Searchbar	1	Participant enters *'Hoe lang duurt MRSA behandeling'* in the searchbar, which gives zero hits
DE	S2		References	1	The *'Zipnet - Focus op hygiëne Infectiepreventie in verpleeg-, verzorgingshuizen en thuiszorg: MRSA-informatiefolder'*-reference in the *'Wat zijn de risico's van mijn MRSA-dragerschap voor de mensen om mij heen (huisgenoten, familie, vrienden)?'*-article gives no result

Table C.6: Identified navigation usability problems

Problem type	Severity rating	Task	Subject problem	Count total	Usability problem
N	S2	T2	Searchproblem	1	Participant indicates to not be able to quickly find the answer to task two
N	S2	T2	Searchproblem	6	Participant indicates that task two is hard to find/does not know where to search for the answer
N	S3			16	Participant goes to the professional part of the OHH website
N	S2	T3	Searchproblem	3	Participant indicates to not have found the answer to task three
N	S2		Searchproblem	2	Participant indicates to have issues with where to search for answers to the tasks
N	S2		Public/professional profile choice menu	1	Participant thinks that the way to search for information is cumbersome, because you have to go back to the public/professional profile choice menu
N	S3			3	Participant has difficulties with getting from an article back to the MRSA mainpage
N	S3		Navigationbar	4	Participant expected that the button *'Home'* in the navigationbar would lead to the public/professional profile choice menu instead of to the zoonoses choice menu of the public
N	S2	T5	Searchproblem	5	Participant indicates to not have found the answer to task five
N	S2		Naviagtionbar	2	Participant did not expect that 'Informatie' in the navigationbar would lead to the zoonoses choice menu with only MRSA as option
N	S3		Scroll problem	7	Participant figures out (accidentally) only after a while that (s)he can scroll on the category pages for more information/tiles
N	S3			1	Participant takes a long time to fulfil a task/cannot fulfil it, because he is on the professional part of the OHH website
N	S2	T6	Search problem	2	Participant indicates that task six is hard to find/does not know where to search for the answer
N	S2	T3	Search problem	2	Participant indicates that task three is hard to find/does not know where to search for the answer
N	S3	T3	Search problem	1	Participant does not know which category in the MRSA list of contents holds the answer about antibiotics
N	S2	T5	Search problem	7	Participant indicates that task five is hard to find/does not know where to search for the answer
N	S3		Scroll problem	1	Participant cannot find *'Behandeling'* because she does not now she has to scroll further than *'Diagnostiek'* on the *'Diagnostiek en Behandeling'*-category page
N	S2	T3	Searchbar	1	Participant indicates to not be able to find the answer to task three

Table C.6: Identified navigation usability problems

Problem type	Severity rating	Task	Subject problem	Count total	Usability problem
N	S3		Scroll problem	1	Participant states that it is not well indicated that there are multiple chapters on one category page
N	S2	T2	Searchproblem	1	Participant thinks it is hard to search on the website because he does not know it yet
N	S3			1	Participant indicates that he first has to learn how the website work prior to be able to easily find an answer
N	S2	T2		1	Participant chooses the category *'Besmetting via dieren'* for task two, because it is the only category that has the term *'besmetting'* in its name
N	S3		Scroll problem	1	Participant does not know she can scroll down on a page

C.2 Participant Remarks

Table C.7: Participant quotes

Remark type	Task	Subject remark	Count total	Remark
RD	T6		1	*"I thought it all went quite fast actually, that everything could be found quite fast"*
RD		Chatbot	1	*"The chatbot is always at the bottom right"*
RD			1	*"The website was super clear"*

Table C.8: Participant recommendations

Remark type	Task	Subject remark	Count total	Remark
RI		Navigationbar	1	A sidebar with all elements of the website
RD		Chatbot	2	Put the question on which *'Yes/No'* has to be answered directly above the *'Yes/No'* buttons in the chatbot
RI		Searchbar	1	Show suggestions in the searchbar
RT			1	When you search for something about time/how long something takes in a text, you always search for *digits* that are *close to each other*
RI		Chatbot	3	You should be able to ask a follow-up question tot he chatbot
RI		Searchbar	1	If a search term gives several various hits, categorise these hits
RD		Chapter link buttons	2	Make the chapter link buttons more clear/larger so that they stand out better more
RI		Searchbar	1	Give the possibility to enter a new search term in the searchbar when then previous one did not give any results
RT		Amount of text	1	Shorten the titles on the tiles
RD			1	Make the categories in the MRSA list of contents more apparent
RD		Images	1	Give each tile another image that supports in content the best
RD		Tags	1	Make the tags underneath the articles more apparent
RD			1	Put the *'Lees verder'* buttons on the article-tiles at the same height
RD			1	Make the *'Lees verder'* buttons on the tiles more prominent (e.g. make them also blue)
RI		Chatbot	1	Give the possibility to enter a key-word in the chatbot, after which the chatbot then searches articles based on that key-word, and presents its possible articles
RI			1	At the left side of an article a way to navigate to other articles
RI		Chatbot	1	Let the chatbot remind whether he has already given its introduction within a session, so that is is not given again when the chatbot is used a second time
RI		Chatbot	1	Let the chatbot ask more targeted questions with less text

Table C.9: OHH plus points

Remark type	Task	Subject remark	Count total	Remark
RT	T3		1	The short piece of text in the *'Waarom worden sommige antibiotica via een infuus en andere in pilvorm verstrekt?'*-article is convenient, clear, and fast
RD	T1	Public/professional profile choice menu	2	Public/professional profile choice menu page looks clear
RI		Chatbot	1	Chatbot is apparent, straight forward, *'Yes/No'*
RI		Chatbot	3	Pleasant that you do not have to type anything in the chatbot
RD		Chatbot	2	The bold words in the chatbot are useful since you can directly see what you need
RT			1	The *'Wat is MRSA?'*-article is clear and gives a good grasp of what MRSA is
RT			7	Helpful that the answer to the question is at the top and underneath extra information for when you would like to know more about it
RI		Chatbot	4	The choice menu in the chatbot with varioious articles is helpful
RT		References	3	The references are pleasant, then you know where you should go if you would like more information
RI		Searchbar	1	The searchbar is apparent and easy in use
RD			5	The various colours in the text are nice, make the website apparent
RD			1	Nice that the question is positioned so large at the top of the article
RT			2	The text in the articles is good to read, enough space between the text
RD		Navigationbar	1	Pleasant that the navigationbar is black, makes is clearly distinct from the rest
RD		Tags	5	The tags are nice since you can search quite directly
RT			1	Convenient that there are more articles in the chapter *'Wat is MRSA?'*
RI		Chatbot	1	Pleasant that the text in the chatbot goes so fast
RT			1	Convenient that for each article you have an answer on one question, then you immediately know if you are on the right page or that you have to search further
RD			1	The *'Most read in MRSA Public:'*-articles are convenient
RD		Public/professional profile choice menu	1	Pleasant that when you are in an article, you do not have to go all the way back to the public/professional profile choice menu page
RD			1	The website is tranquil, pleasant that there are not so many things in sight

Table C.9: OHH plus points

Remark type	Task	Subject remark	Count total	Remark
RD		Navigationbar	1	Pleasant that via *'Informatie'* in the navigationbar you immediately can click on the MRSA categories
RI		Chatbot	1	Pleasant that the chatbot is interactive
RT			1	Pleasant that you have multiple options for articles from which you can choose on the *'Algemene informatie MRSA'*-category pages
RT		Amount of text	2	Pleasant that there is not too much text in the articles
RI		Chatbot	4	The chatbot works simple and gives fast, clear, and accurate answer on the correct part of the website
RT			1	The information on the website is educational
RI		Chatbot	1	The chatbot looks kind and hospitable
RD			1	Pleasant that the text colour alters when you hover over a heading, is clarifying
RI		Chatbot	1	The chatbot looks funny
RD			1	The website looks apparent

Appendix D

Root Causes, Solutions and Recommendations

D.1 Root Causes

All usability problems identified during the cRTA sessions (Appendix C.1) have been evaluated using the 5-whys method [43] to identify the root causes. Table D.1 holds all root causes identified with accompanying solutions which is either an in the prototype implementable solution (I-) or an recommendations (R-) for improvement.

Table D.1: Identified root causes

Severity level	RC number	Root cause	# Usability problems	Accompanying solution
S4	1	The tags underneath the chapter tiles give the indication that it is the end of the page (incorrect designed)	1	I-1
	2	The algorithm of the searchbar is not sufficiently programmed to handle logical search terms (incorrect programmed)	7	R-1
	3	Entering an "incorrect search term" leads you to a new page from which you can only navigate back using the browser navigation (incorrect programmed)	1	I-2
S3	4	The navigation is not intuitively designed and programmed	1	I-3
	5	The B1 text level is not taken into account	6	R-2
	6	There are too many navigational options (navigationbar, browser navigation, breadcrumb)	3	I-4
	7	The searchbar is not programmed to give suggestions (incorrect programmed)	1	R-3
	8	Entering an "incorrect search term" leads you to a new page which is in English (incorrect designed/programmed)	1	R-4
	9	The chapter link buttons are too small	1	I-5
	10	The chapter link buttons are too light of colour	2	I-6
	11	The colour of the chapter link buttons is light grey, which usually indicates that something is not clickable	2	I-6
	12	*'Home'* for the participant means the first page of the website, however it is programmed/designed to be the first page of the chosen profile	1	I-3
	13	The text of the chatbot goes too fast (incorrect programmed)	1	R-5
	14	Chatbot is not designed and programmed for participants to be able to manually enter a question/search term	17	R-6
	15	Chatbot is not designed and programmed to enter a follow-up question	4	I-7
	16	The chatbot is not designed/programmed to keep track of where the user is on the website	1	R-7
	17	The chatbot explains its question (between the question and the answer possibility)	1	I-8
	18	The chapters are too wide-ranging	1	R-8
	19	The *'Extra information'* section is missing in the *'Why are some antibiotics administered intravenously and others in pill-form?'* because there is no additional information provided about the topic on the OHH website	1	R-9
	20	(Too) much text on the tiles due to long titles	3	R-10
	21	The category titles comprise too much information to be self-explanatory	1	R-8
	22	Too much space between the end of a chapter and the beginning of a new one / Tags indicate the end of a page	6	I-9

Table D.1: Identified root causes

Severity level	RC number	Root cause	# Usability problems	Accompanying solution
	23	The tile-titles are so programmed that they turn blue if you hover over it, irrespective of the image colour	1	I-10
	24	All articles of the same chapter have the same image	5	R-11
	25	There is too little explanatory text/figures on the public/professional choice menu page	2	I-11
	26	An introduction text on the profile choice menu page is missing	8	I-11
	27	The public/professional tiles first need to be flipped before you can press *'Read more'* (incorrect designed)	1	I-12
	28	The articles have not been tagged properly	2	R-12
S2	29	The information about living together on a farm when being a healthcare professional is not added to the professional part of the website	1	R-13
	30	The chapter (title) *'What is MRSA?'* is too wide-ranging	1	R-8
	31	The task-question (T4) is not exactly the same as the article-question	2	
	32	The subjects of the chapters are not logically categorised	1	R-8
	33	The *'Contact with others'*-chapter has a title that is non representative for its content	1	R-8
	34	The article-question (*'How long does an average MRSA carrier treatment take?'*) is not answerable since it is situation dependent	1	R-14
	35	There is not taken into account that the type of zoonotic diseases might not be general knowledge	1	R-15
	36	The category title *'MRSA in healthcare'* is too wide-ranging	1	R-8
	37	Not all articles of the public part of the OHH website are relevant for the general public and should be on the professional part of the website	1	R-37
	38	The category titles are too wide-ranging and therefore do not represent their content	12	R-8
	39	There are no recommended articles as result of the current article	1	I-13
	40	The usability test task (T5) is too hard for the participant	1	
	41	The usability test task (T4) is too hard for the participant	1	
	42	The MRSA main page contains too much clickable navigation possibilities	2	I-14
	43	The navigational elements do not stand out	1	I-15
	44	There is no way of navigating back to the MRSA main page when on a category page	1	I-4
	45	The category titles are misleading	1	R-8
	46	The *'Extra information'* section is missing in the *'What measures must a nursing home take, when a MRSA-patient goes to the nursing home after being discharged from the hospital?'*-article	1	R-9
	47	Some articles lack the *'Extra information'* section	1	R-9
	48	Prior to every message in the chatbot an animation of three wiggle stripes is displayed	2	I-8
	49	The chatbot gives the idea of a conversation because the information is send in multiple messages with an animation of three wiggle stripes indicating that someone is typing	1	I-8
	50	The *information* button in the navigationbar goes to a new zoonosis choice menu (incorrect designed/programmed)	1	I-3
	51	The tags on the MRSA main page contain all subjects of the OHH, since there the user has not yet specified its search	1	I-14
	52	The tags are too small/have an inconspicuous colour	3	I-16
	53	The chapter link buttons are too small/have a too light colour	2	I-5
	54	The searchbar does not have its own fill-in box	2	I-17
	55	Searchbar results are not categorised in a logical manner (e.g. per chapter)	1	R-16
	56	An English reference is not an invite to get information from for the general public	1	R-17
	57	There is an incorrect link behind the reference *'Zipnet-Focus op...'* in the *'What are the risks of me being a MRSA-carrier on the people around me (housemates, family, friends)?'*-article	1	R-18
S1	58	There is no blank line in the *'How can MRSA spread?'* article since a clear new line is used	1	
	59	An article is designed and programmed to be a new page of the website, not an overlay on the website	1	
	60	The 'Read more' buttons are not programmed to be on one line with the other *'Read more'* buttons on the tiles	1	I-18
	61	The colour of the *'Read more'* buttons have too little contrast to their background	1	I-19
	62	The *'Answer'*-section is not eye-catchy enough	2	I-20
S0	63	Participant does not know that bullet points are used for listing; Participant ignorance	1	
	64	Participant misinterprets the category title *'MRSA in healthcare'*	1	R-8
	65	Participant probably does not click on the button (he says the button does not work); Participant ignorance	1	
	66	Probably an internet problem caused a brief website-freeze	1	
	67	It is the participants habit to click on the tile-title rather than on the *'Read more'* button	1	I-21
	68	Participant does not know that clicking the logo of a website usually bring you back to the first page of the website	1	
	69	Participant is used to scientific terms	1	
	70	There is no need for a blank line since it the extra information is only composed of subparagraph	1	

Table D.1: Identified root causes

Severity level	RC number	Root cause	# Usability problems	Accompanying solution
	71	The *'What is MRSA?'* answers the question of what kind of infection MRSA is; Participant ignorance	1	
	72	The article is the only article that is tagged with the *'carrier treatment'*-tag, therefore she gets the same article as a result; Participant ignorance	1	
	73	Via navigation and the tags you can reach every part of the website; Participant ignorance	1	
	74	Participant always looks at the section with the most amount of text, thereby skips the answer	1	I-20
	75	CTRL + F is probably disabled for the usability test	1	
	76	Something went wrong with the usability test computer during this usability test, by which the searchbar did not work properly	1	

D.2 Prototype Implementable solutions

Based on the root causes, solutions have been drawn up. 21 of the solutions fell within the scope of this study to be solved, meaning solutions implementable in the prototype of the redesigned OHH.

Table D.2: Prototype implementable solutions

Solution number	Solution	Accompanying RC's
1	Alter the place of the tags, place all the tags of the whole page in one tag cloud on the page, not a tag cloud for every chapter	1
2	The searchbar should: 1. not lead to a separate, different designed webpage 2. have navigation buttons to go back to the previous article/page 3. have the possibility to enter a new search term	3
3	*'Home'* should lead to the public/professional choice menu page *'Information'* should be replaced by the zoonosis' name (e.g. MRSA or Q-koorts) An additional *'Zoonoses'* button should be added and lead to the public or professional home page	4, 12, 50
4	In addition to prototype solution 3: There should be an arrow that goes back to either the category page (if you are on an article page) or to the MRSA main page (if you are on the category page)	6, 44
5	The chapter link buttons should be bigger (at least two times as big as their current size)	9, 43, 53
6	The chapter link buttons should not be light grey, but green/purple	10, 11, 43, 53
7	The chatbot should give the possibility to enter a follow-up question. Instead of (offering excuses and) telling the user to close the chatbot, there should be a box where the user can enter a new question/search term	15
8	The chatbot should not explain why he is asking its questions The typing-animations should be removed since it gives the incorrect message of personal contac	17, 48, 49
9	In addition to prototype solution 1: Decrease the space between the chapters	22
10	Do not turn the text of the tile-titles blue if you hover over it	23
11	Add an introductory line/section of text on the first page that explains: 1. what the website its goal is 2. how the profiles work	25, 26
12	The public/professional cards should: 1. not have to be flipped 2. be clickable as a whole (not only the *'Read more'* button) 3. be more evident about their purpose	27
13	Add recommended/comparable articles at the bottom of an article, so that the user can look further for information that is an extension to the just acquired information	39
14	Organise the MRSA main page better so that it is clear and there are not three ways to navigate	42, 51
15	Informationbar elements should be more apparent (not a greyed-out colour)	43
16	The tags on the MRSA main page should not have the greyed-out colour	52
17	Put the searchbar in a box, so that it is a separate piece and not an element of the navigationbar	54
18	Put the *'Read more'* buttons on the tiles on one line	60
19	Change the colours of the *'Read more'* buttons on the tiles to green or purple	61
20	Make the *'Answer'* section: 1. bigger than the *'Extra information'* section 2. more apparent coloured than the *'Extra information'* section	62, 74
21	Make the whole tile clickable, not just the title or *'Read more'* button	67

D.3 Recommendations

Based on the root causes, solutions have been drawn up. 18 of the solutions fell outside of the scope of this study to be solved, meaning solutions not implementable in the prototype of the redesigned OHH. These solutions are therefore posed as recommendations for improvement of the OHH's usability.

Table D.3: Recommendations

Recommendation number	Recommendation	Accompanying RC's
1	The searchbar algorithm should be altered: it should be extended so that search terms get more hits (e.g. the term *'intraveneus'* should lead to the article *'Why are some antibiotics administered intravenously and others in pill-form?'*, rather than give no result)	2
2	The text should be rewritten to B1 text level	5
3	Let the searchbar give suggestions based on the already typed in letters, by use of a drop down menu	7
4	The searchbar results should be in the selected language (i.e. Dutch or German)	8
5	The text in the chatbot should go on average reading speed	13
6	The chatbot should give the possibility for the user to manually enter a question or search term at the start. The chatbot search strategy should be based on the entered term.	14
7	The chatbot should be so programmed that it looks at the URL, where it is visible whether the user has a public- or professional profile, and about which zoonosis the user is searching for information	16
8	Re-examine the categories, chapters, and public/professional distribution	18, 21, 30, 32, 33, 36, 37, 38, 45, 64
9	All the articles without *'Extra information'* section need to be re-written so that there is one line of text with a clear answer and more information supporting the answer in the *'Extra information'* section	19, 46, 47
10	Shorten the article titles	20
11	Alter the article images so that they fit the content of the chapters	24
12	The articles should be tagged better (e.g. the article *'Why are some antibiotics administered intravenously and others in pill-form?'* is not tagged with the tag *'Treatment'*, but it does belong to the *'Treatment'*-chapter)	28
13	Add the information about living together on a farm when being a healthcare professional to the professional part of the website	29
14	Re-write the article, maybe change the question, so that it is answerable, and is generic for all cases of MRSA infections	34
15	Explain (briefly but clear) what a zoonotic disease is on the public/professional choice menu page	35
16	The searchbar results should be categorised per chapter	55
17	Find Dutch references for articles, to make the website more accessible for the general public	56
18	Change the link behind the reference *'Zipnet-Focus op...'* in the *'What are the risks of me being a MRSA-carrier on the people around me (housemates, family, friends)?'*article	57

Appendix E

Quantification Dataset Variables

Table E.1: Variables of the quantification dataset

Name	Type	Definition
Group	Numeric	Gaze or video cue group [1,2]
UXHP.ID	String	The ID of the participant [UXHP1, UXHP41]
Task.No	Numeric	Task number [1,6]
Task performance		
Task.duration	Date	The time it took the participant to finish the task (only GVC)
Total.task.duration	Date	The time it took the participant to finish all the tasks (only GVC)
Success	String	The type of task success [*y, n, a, w, s*]
cRTA session		
cRTA.task.duration	Date	The time it took the participant to talk about a task
cRTA.total.duration	Date	The time it took the participant to talk about all tasks
Word.count	Numeric	Amount of words verbalised during a task
Total.word.count	Numeric	Amount of words verbalised during the cRTA session
Usability problems		
UP.comprehension	Numeric	Number of comprehension usability problems found
UP.data.entry	Numeric	Number of data entry usability problems found
UP.feedback	Numeric	Number of feedback usability problems found
UP.layout	Numeric	Number of layout usability problems found
UP.navigation	Numeric	Number of navigation usability problems found
UP.total	Numeric	Total number of usability problems found
Severity ratings		
S0	Numeric	Number of severity level 0 identified usability problems
S1	Numeric	Number of severity level 1 identified usability problems
S2	Numeric	Number of severity level 2 identified usability problems
S3	Numeric	Number of severity level 3 identified usability problems
S4	Numeric	Number of severity level 4 identified usability problems
Operational comments		
Manipulative.comment	Numeric	Number of manipulative comments verbalised
Cognitive.comment	Numeric	Number of cognitive comments verbalised
Visual.comment	Numeric	Number of visual comments verbalised
Comments.total	Numeric	Total number of comments verbalised

Appendix F

User Experience Questionnaire Results

Table F.1: UEQ OHH items

No	Item	Mean	Variance	Scale	Evaluation
1	Does not meet expectations <> Meets expectations	0.2	1.4	Dependability	*Neutral*
2	Boring <> Exciting	0.2	1.0	Stimulation	*Neutral*
3	Dull <> Creative	0.5	2.1	Novelty	*Neutral*
4	Usual <> Leading edge	0.7	2.9	Novelty	*Neutral*
5	Complicated <> Easy	0.7	2.0	Perspicuity	*Neutral*
6	Unpredictable <> Predictable	0.7	1.0	Dependability	*Neutral*
7	Difficult to learn <> Easy to learn	0.9	2.1	Perspicuity	*Positive*
8	Conventional <> Inventive	0.9	2.1	Novelty	*Positive*
9	Confusing <> Clear	0.9	1.9	Perspicuity	*Positive*
10	Not secure <> Secure	0.9	1.7	Dependability	*Positive*
11	Demotivating <> Motivating	0.9	1.2	Stimulation	*Positive*
12	Impractical <> Practical	1.0	1.7	Efficiency	*Positive*
13	Conservative <> Innovative	1.0	1.5	Novelty	*Positive*
14	Slow <> Fast	1.1	1.7	Efficiency	*Positive*
15	Inefficient <> Efficient	1.2	0.9	Efficiency	*Positive*
16	Unattractive <> Attractive	1.3	1.1	Attractiveness	*Positive*
17	Annoying <> Enjoyable	1.3	0.9	Attractiveness	*Positive*
18	Unpleasant <> Pleasant	1.3	0.9	Attractiveness	*Positive*
19	Unfriendly <> Friendly	1.3	0.9	Attractiveness	*Positive*
20	Cluttered <> Organised	1.4	1.9	Efficiency	*Positive*
21	Not understandable <> Understandable	1.4	0.9	Perspicuity	*Positive*
22	Inferior <> Valuable	1.5	1.7	Stimulation	*Positive*
23	Obstructive <> Supportive	1.5	1.5	Dependability	*Positive*
24	Unlikable <> Pleasing	1.5	0.9	Attractiveness	*Positive*
25	Bad <> Good	1.7	1.2	Attractiveness	*Positive*
26	Not interesting <> Interesting	1.7	0.5	Stimulation	*Positive*

Appendix G

OHH Prototype and Recommendations

The usability of the OHH was evaluated to identify which elements of the OHH cause user interaction problems. 149 unique usability problems were identified during the cRTA sessions of the OHH usability tests, which were brought back to 76 unique root causes, for which 20 unique in prototype implementable solutions and 18 unique recommendations were established (Section 3.1). The prototype implementable solutions have been realised in a prototype, accessible via this link: https://xd.adobe.com/view/f645a4c4-a246-4401-481e-803224b946ab-8074/. Both types of root cause solutions (protoype implementable solutions & recommendations) are depicted in this appendix.

G.1   Colour Palette

During the cRTA sessions of the OHH usability test, many participants expressed that they liked the way the colours were used to make distinctions between the different elements of the OHH website. Therefore, the accent colours were re-used in the prototype of the renewed OHH design. However, a lot of the clickable element in the beta version had a light grey colour which was not re-used in the prototype since light grey is a colour often used in graphical user interfaces to indicate that something is not clickable, which is also called *greyed out* [46, 47]. This could possibly have been a reason why many participants indicated that they did not know where to click and some even verbalised that they thought elements were not clickable (mainly the *chapter link buttons*). Therefore, the light grey colour was removed from the colour palette and instead there was made use of the contrast between white and the accent colours.

In the beta version the accent colours did not differ for profile (i.e. *public* or *professional*). But in the usability test some participants unintentionally searched at the wrong profile, resulting in elongated or unsuccessful searches. Therefore, the green accent colour was assigned to the public profile and the purple colour to the professional profile, to make it visual apparent for the user when (s)he enters the other profile page [usability guideline 16.9 in [45]].

Both OHH profiles were virtually the same designed in the prototype, except for the accent colour and textual content. Since this study is focused on the general public's opinion on the OHH's usability, the prototype pages depicted in the rest of this section will be of the public profile.

G.2   Profile Choice Menu Page

The first page users see when accessing the OHH caused some confusion among the participants of the OHH usability test. According to them it was not directly clear what the website was about, and which profile had to be selected. Therefore, an introductory line of text about the OHH was added underneath the website title (solution 11) [usability guidelines 5.4, 5.5 in [45]].

In the beta version, the profiles were explained on a tile that first had to be flipped before the user was able to read the text, which was annoying according to the participants. In the renewed design the user is guided by illustrations representing members of the general public and healthcare professionals. When hovering over the illustrations with the mouse, an explanatory text of the profile appears, as depicted in Figure G.1 (solution 12).

The profile name *professional* was altered to *healthcare professional* since many participants first read the whole descriptive text on the professional tile prior to choosing a profile. Additionally, one participant indicated that there are many types of professional, and that the profile name *professional* was thus not self explanatory.

(a) Profile choice menu

(b) Public profile hovered over

(c) Healthcare professional profile hovered over

Figure G.1: Profile choice menu

G.3 Profile Home Page

In the beta version of the OHH, the profile home page showed only two different zoonoses to choose from. However, 61% of all pathogens infecting humans are zoonotic of nature [5]. Therefore, the new design was fitted with a searchbar on the profile page to enable the user to manual input a zoonosis, see Figure G.2. On the profile choice menu page a line about the website its goal and the definition of zoonoses is incorporated. However it is recommended to add a small explanatory text on the profile home page (recommendation 15), since the cRTA sessions made apparent that the term zoonoses did not per definition belong to the participants' knowledge.
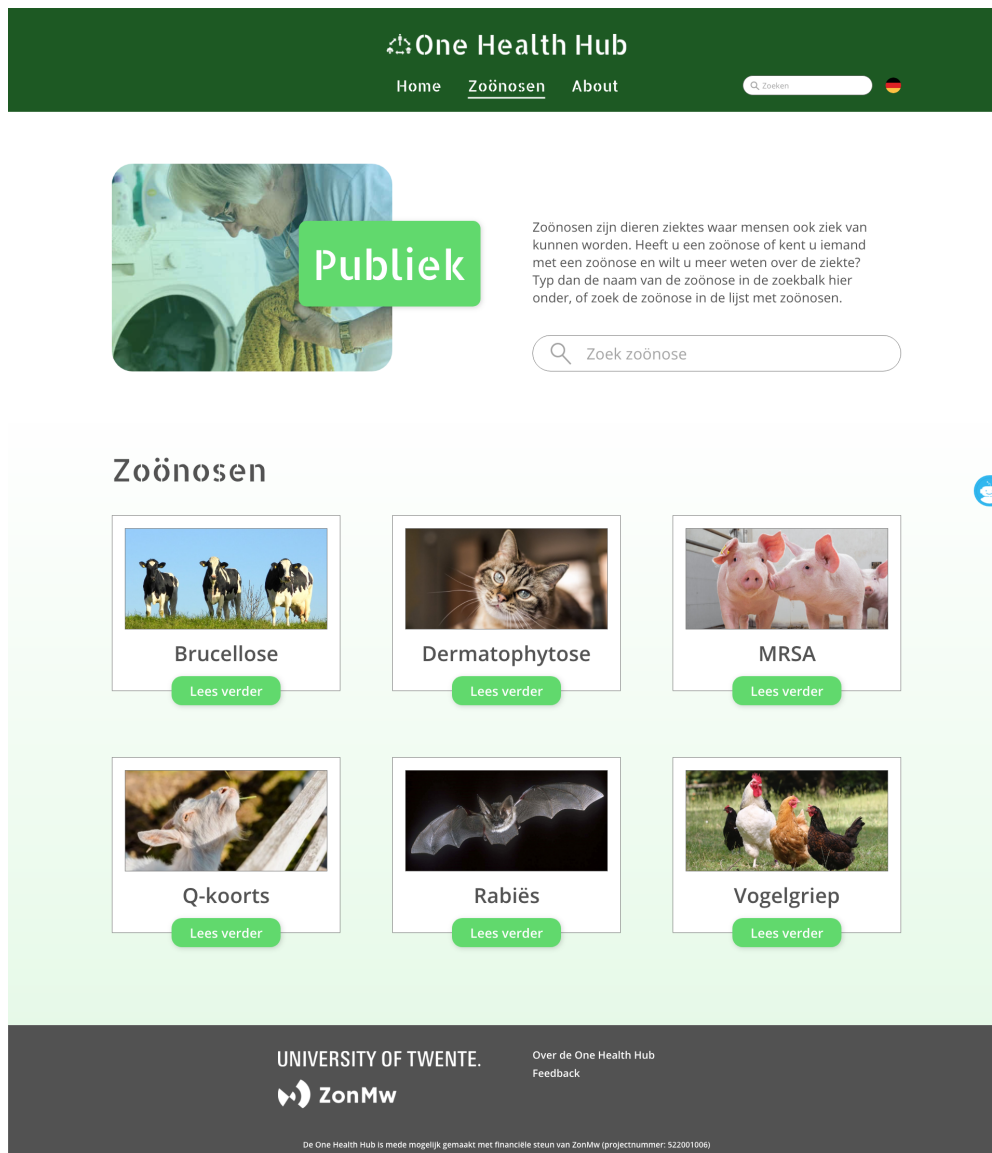
Figure G.2: Public profile home page

G.4 MRSA Main Page

Clicking the MRSA tile on the public profile home page leads to the MRSA main page, depicted in Figure G.3. Participants indicated that there were too many navigational elements on the MRSA main page in the beta version, and that especially the list of contents was unclear. Therefore, the list of contents was replaced by tiles, the *most read articles* were removed, and the colour of the tags was changed from their greyed-out colour to the blue accent colour (solution 14 & 16).

Figure G.3: MRSA main page

G.5 Category Page

A phrase often expressed by the participants was *"Ohw, here I did not know that I could scroll down the page"*. The category pages did thus not give the impression that the participant could scroll further downwards. The reason for this was explained by a participant, who indicated that the tags underneath the articles of a chapter gave the impression that it was the end of the page. This is also known as a *scroll stopper*, and should be prevented [usability guideline 6.9 in [45]]. The tags of all chapters were therefore put into one tag-cloud at the bottom of the category page, as depicted in Figure G.4 (solution 1), and the distance between the chapters was decreased (solution 9).

Another problem on the category pages was that their chapter link buttons (the green *Boerderij* & *Huisdieren* buttons in Figure G.4) were often noticed after interacting with the OHH for several minutes (i.e. more than halfway through the task execution in the usability tests). Participants indicated that the chapter link buttons were not apparent due to their colour (light grey) and that they did not know what to do with them, whether they were clickable or not. Therefore, the chapter link buttons were made more apparent in the prototype: they were increased in size (solution 5) and were filled with the dark accent colour (solution 6) [usability guideline 7.2 in [45]].

Figure G.4: Contamination via animals category page

G.6 Article Page

The design of the article pages was well received by the participants, that is, usability problems identified with respect to the article pages were of minor severity, and participant verbalised that the articles were clear. Therefore, the design of the article page in the prototype was kept similar to its design in the beta version.

The text of the *Answer* section was given the dark accent colour and was slightly increased in size (solution 20). This was because participants indicated that they liked the *Answer - Extra information* division, but some participants skipped the *Answer* section because it was quite small in comparison to the *Extra information* section and subsequently indicated that it was quite a large answer for the question.

A participant indicated that on the article page, he missed a redirection to articles with information similar to or as extension of the information acquired in the article. Therefore, at the bottom of the article three similar articles are presented (*Vergelijkbare artikelen* in Figure G.5, solution 13).

In the beta version, all articles of the same chapter were supported by the same image, which visually shows cohesion between the articles. But the usability test revealed that it was not beneficial when searching for the articles, because the images were not article specific. Therefore it is recommended to alter the images for the articles so that they better fit their content (recommendation 11).

Figure G.5: MRSA via pigs article page

G.7 Navigational Elements

G.7.1 Navigationbar

Participants multifariously indicated to have problems with navigating through the website. As an example, participants expressed that they expected to go to the profile choice menu, when clicking *Home* in the navigationbar, rather than going to the profile home page. Therefore, the navigationbar and its accompanying elements were altered, Figure G.6.

The link behind the *Home* button was adjusted to lead to the profile choice menu [usability guideline 5.1 in [45]]. The *Information* button was replaced with the zoonosis' name (e.g. MRSA), which revealed a drop down menu with the MRSA categories, when clicked on.

An additional button named *Zoonoses* was added, leading to the profile home page which contains the database with all zoonotic diseases on the OHH website. Lastly, an *About* button was added that leads to a page with extensive information about the OHH website (solution 3) [usability guidelines 7.2, 9.1 in [45]].

Although the browser navigation buttons were functioning during the usability test, some participants indicated to have had issues with returning from the article back to the category page. Therefore, an arrow pointing backwards accompanied by the category name, was added at the top left of the articles (solution 4). To keep consistency on the website [48, 49], this arrow was also added to the category page, leading back to the MRSA main page.

The colour of the navigationbar was adjusted to the dark accent colour, to fit within the website colour palette. As the elements of the drop down menu in the beta version were light grey (i.e. *greyed-out*), the colours were adjusted to convey the message of the buttons being clickable (solution 15) [46]. The drop down menu was made smaller so that it does not cover the whole width of the page, but rather visually focuses on its content (i.e. the list of MRSA categories).

The searchbar in the beta version was not apparent enough, as identified by participants. One participant even expressed that he found it a pity that there was no possibility to enter keywords anywhere on the OHH website. Therefore, the searchbar was put in a white box, contrasting with the dark green navigationbar (solution 17).

Figure G.6: Navigationbar

G.7.2 Searchbar

The usability tests revealed that the searchbar did not work as was expected. The searchbar did not have results for logical search terms (e.g. *carrier treatment*, for task 6). When the searchbar had no results for the entered search term, a different designed page was shown containing English text and no navigational elements or the ability to enter a new search term. When the searchbar did have results for the entered search term, the articles were display intermingled without categorisation. These searchbar inconveniences were identified by the participants as problematic. Therefore, it is recommended to alter the algorithm of the searchbar in such a way that it searches the whole website and allows for simple, and for users logical search terms (recommendation 1) [usability guidelines 17.2, 17.5, 17.6 in [45]].

To increase search efficiency, the results of the searchbar should be ordered in a logical manner (recommendation 16) [usability guideline 16.1 in [45]].

In Figure G.7 the searchbar result page is depicted. It has the same language and layout as the other pages of the OHH, and to solve the navigational problems, a return button and the possibility to enter a new search term were added (solution 2 & recommendation 4) [usability guidelines 7.1, 11.2, 15.2 in [45]].

Lastly, it is recommended both by a participant and the usability guidelines to let the searchbar give suggestions based on the already typed in letters (recommendation 3) [usability guideline 17.9 in [45]]. As an example, when the user already typed *Anti*, the searchbar should give a suggestion for *Antibiotics* in a small bar below the searchbar.
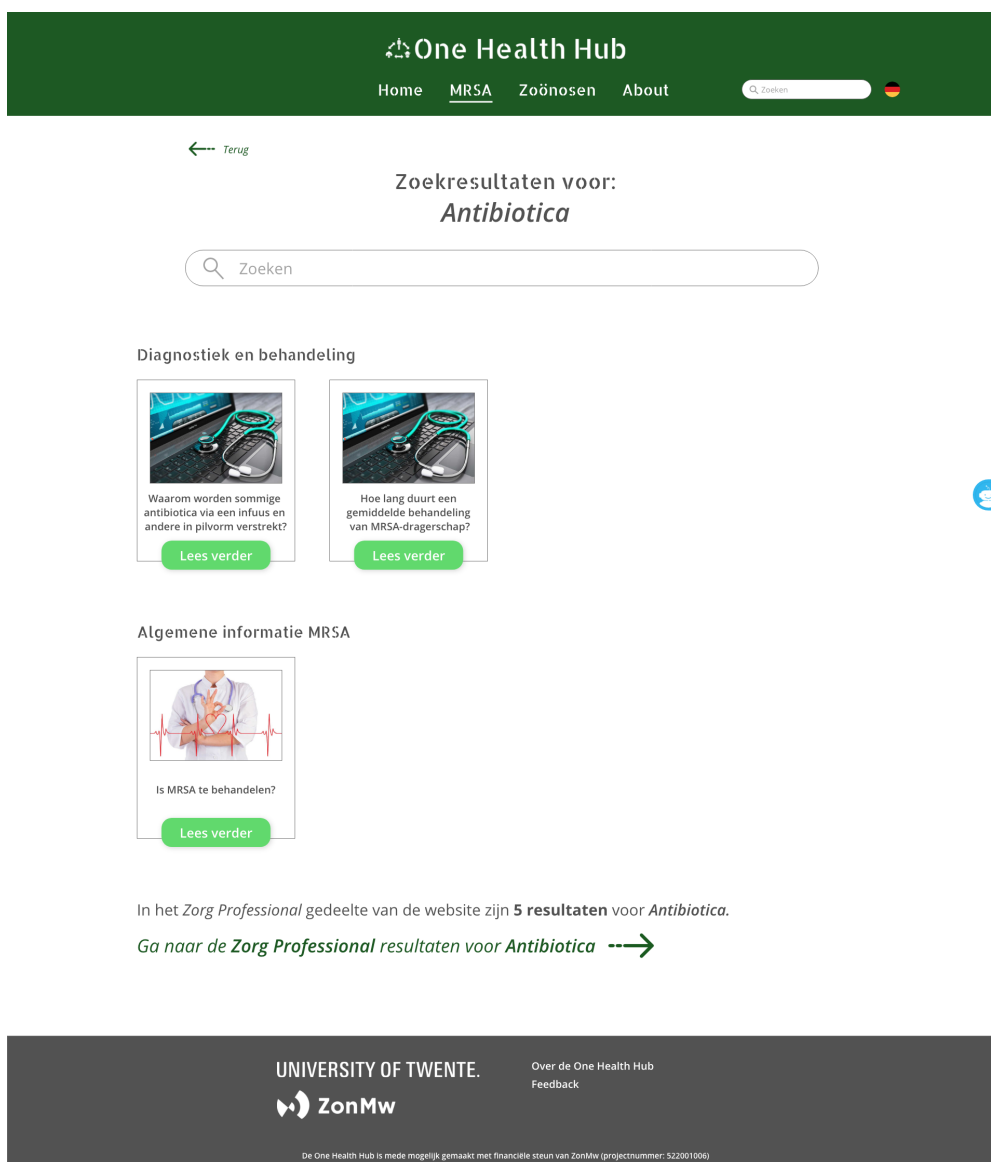

Figure G.7: Categorised searchbar results

G.7.3 Chatbot

The largest amount of usability problems identified were on the topic of the chatbot (N=27). Too much text in the chatbot was the most often mentioned chabot usability problem. Via the root cause analysis there was identified that this was due to the fact that the user was not able to enter in what direction (s)he was searching. Therefore, the chatbot has to go through all possibilities in the same way the navigation does (i.e. first public/professional, then categories, then chapters, and lastly the recommended articles). This was also noticed by a participant who therefore did not see the added value of the chatbot. Another reason why there was a lot of text in the chatbot was because the chatbot explains why he asks his questions, which was redundant according to the participants. To solve the matter of too much text in the chatbot, it is recommended that the chatbot will be programmed so that the user can manually enter a search term (recommendation 6) and that the chatbot does not explain its questions (solution 8), as depicted in Figure G.8. Next to too much text, it was also identified that the text in the chatbot was displayed too fast, Therefore it is recommended to program the chatbot in such a way that the text appears at average reading speed (recommendation 5).

As part of the chatbot explaining its questions, the chatbot apologises if he cannot find the correct article and tells the user to close the chatbot. This was perceived as highly annoying by the participants, who indicated that they did not want to close the chatbot, but rather wanted to enter a new search term. Therefore itis recommended to program the chatbot so that a follow-up search term can be entered (solution 7), see Figure G.8b.

The second question the chatbot poses is whether the user is a healthcare professional. Which was identified by a participant as annoying, since he had already selected that at the profile choice menu. It is also not in line with guideline 13.6 of the Web Design & Usability Guidelines [45] which holds that a user should not have to enter its information more than once. Therefore itis recommended that the chatbot will be programmed in such a way that it already knows which profile the user has, which is already integrated in the URL of the website (recommendation 7).

(a) Chatbot stage 1: user can enter a search term

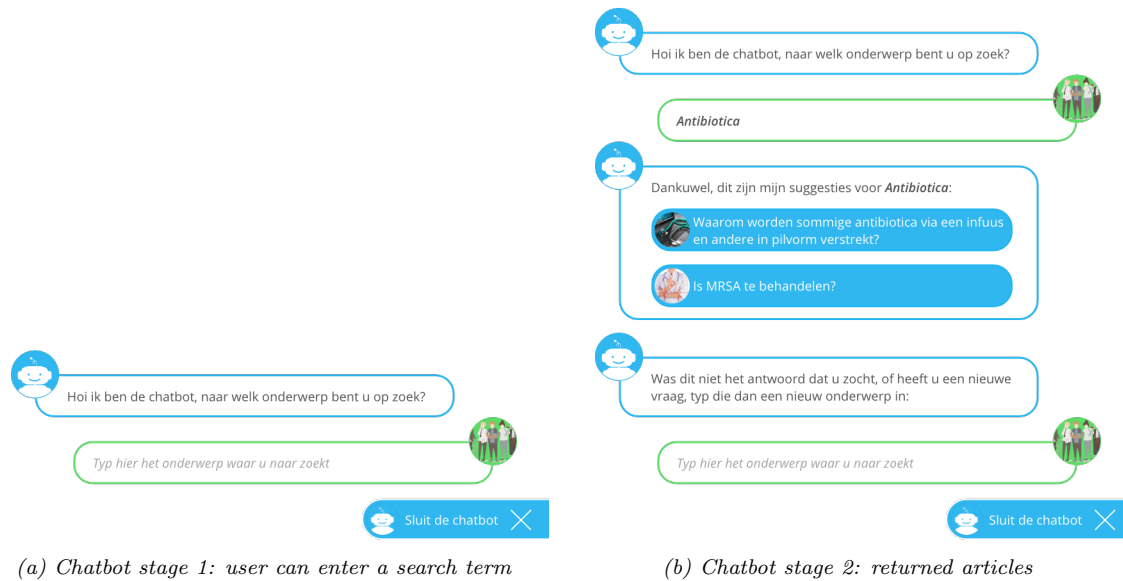(b) Chatbot stage 2: returned articles

Figure G.8: Chatbot

G.8 Consistency of Tiles

It is important to have visual consistency on a website to decrease interaction problems [usability guidelines 11.2, 11.4 in [45]] [48, 49]. That is why the same elements are used throughout the whole prototype. The most important reoccurring element is the tile. In the beta version the public profile home page, MRSA main page, and category page all had different designed tiles. In the prototype the same type of tile is used to ensure consistency [48, 49].

Figure G.9: Tiles of the Wat is MRSA? chapter

A participant indicated that it bothered her that the *Read more* buttons were not on the same height in the beta version, which is in conflict with guideline 6.7 of the Web Design & Usability Guidelines [45] which holds that items should be vertically and/or horizontally aligned on a page. Therefore, the *Read more* buttons were all aligned at the same height in the prototype (solution 18). The same participant also remarked that the *Read more* buttons were not so much apparent, because of their light grey colour (*greyed-out*). The *Read more* buttons were therefore assigned the accent colour in the prototype (solution 19). Lastly, multiple participants indicated that they did not like that they had to specifically click the

Read more button, rather than just clicking on the tile. Therefore, the whole tile was made clickable in the prototype (solution 21).

G.9   Text

The text on the OHH was not written on B1 level, which became apparent when participants indicated to not understand parts of the text in the articles. Since the OHH public profile is meant for the general public, it is strongly recommended to adapt its text content to the B1 level (recommendation 2) [usability guidelines 15.2, 15.3, 16.8 in [45]]. In addition to writing in B1 level for the general public, it is recommended to find Dutch references for the articles (recommendation 17), since a participant revealed to not have clicked a reference because it was written in English. A participant accidentally revealed that the link of a reference was not working anymore, so to keep the website up to date, it is recommended to check the references' links (recommendation 18).

It is recommended to make sure that all article are generic to all cases of MRSA or hold information for all cases of MRSA (recommendation 14). As an example identified by multiple participants, the answer in the *'length of carrier treatment'*-article was that the treatment takes *several weeks*, which is not specific enough for the question *How long does an average carrier treatment take?*, according to the participants. If answers are not possible to be so specific because, for example the disease is different for every patient, the questions should be altered. For the carrier treatment article, many participants doubted whether the article was the correct answer to the task, because no specific amount of days or weeks were mentioned.

Participants indicated that searching for the correct article out of many articles could take a lot of time, since many tiles had too long questions. In order to comply with guideline 6.4 of the Web Design & Usability Guidelines [45] which holds that elements should be structured to allow for comparison, it is recommended to shorten the article tiles so that users can easy compare the articles (recommendation 10).

Most of the articles contained an *Answer* and *Extra information* section. However, it were also articles that did not have an *Extra information*, which was inconvenient according to the participants, since they got used to a short answer in the *Answer* sections of other articles. Therefore it is recommended to check all articles and add an *Extra information* section when it is absent (recommendation 9).

Next to not all articles having an *Extra information* section, they are also not tagged correctly, which was identified by both the participants and researcher. As an example, a participant was unable to find task 3, *Why are some antibiotics administered intravenously and others in pill-form?*, using the tag *treatment*. Therefore, it is recommended to revise the tags of all articles in a manner that the tags represent not only the article title but also its content (recommendation 12).

Lastly, the recommendation for solving the root cause of 21 usability problems, is to re-examine the categories, chapters, and public/professional distribution of the articles (recommendation 8). A lot of participants verbalised to not know at which category or chapter the answer to the task could be found. Reorganising the articles per chapter and category is

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way beyond the scope of this study, but would have the potential to make a big improvement to the usability of the OHH [usability guidelines 16.4, 16.5 in [45]].

Appendix F holds the lists with all root causes identified and their accompanied solutions and recommendations.