Acceptance of 3D-gestures based on age, gender and experience

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Master's Thesis
Master of Science in Interaction Design
30 ECTS
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Gjøvik University College, 2013

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2013/06/02

Abstract

Older people are increasingly using technology in their daily lives, but at the same time, they often experience problems when interacting with new technology. Younger adults have more experience in using new technology, but are being challenged by the development towards mobile computing with new interaction options like 3D-gestures. In gaming, 3D-gestures are perceived as natural and enjoyable, thereby promising to be a matching interaction technique for future interaction scenarios. Nevertheless, relevant research areas agree on the challenge whether or not 3D-gestures are better than existing techniques in a human computer interaction context.

Less experience means fewer expectations and assumptions about how novel interaction techniques work and how they should be approached. Differences in experience are also an interesting domain when looking into the intuitiveness of technology, meaning the extent to which the specific technology can be used without earlier experience or training. Rather than age or gender, experience could therefore be an important factor for the acceptance of 3D-gestures, which is what this project aims to investigate further in carrying out a between-subject study.

An experimental laboratory set-up was used to simulate a TV interaction and game task to evoke natural gestures. The performed gestures were recorded on video by using a kinect for XBox and Windows. Gestures were also recorded with an accelerometer device around participants wrists. The acceptance of the 3D-gesture interaction was analyzed by a triangulation of open questions, observations and the UTAUT2 research model [1].

The findings indicate that both age groups enjoyed performing 3D-gestures. Previous experience with certain devices has an influence on the acceptance, however gender was not found to have any influence. Likewise, age has no influence on the acceptance, although the fun factor seems to be less important with increasing age. Both age groups want a 3D-gesture-based system to be helpful, easy and supporting. The findings also indicate that participants had slightly varying opinions on whether 3D-gestures are helpful or unnecessary.

Together with the results from the gesture recognition, this thesis contributes with success-factors and characteristics of the research group. The discovered differences and similarities can be used for future developments and designs, as well as improve the acceptance of 3D-gesture interaction.

Keywords

ACM Classification Keywords *(The ACM 1998 Computing Classification System)*
H5.2 [Information Interfaces and Presentation]: User Interfaces: Interaction techniques: *Gestural input (2012 system)*

Author Keywords
Human Computer Interaction (HCI), gestures, gesture recognition, gesture-based interaction, mobile device, wearable

General Terms

Human Factors, Design, Experimentation

Preface

This thesis was written as partial fulfillment of the Master of Science program in Interaction Design / User-Centered Media Design at Gjøvik University College. The experiments were conducted at the Centre for Human Computer Interaction (HCID) at City University London, where I was stationed from January until April 2013.

I would like to thank the Centre for HCID for making me feel so welcome during my stay. It was inspiring and exciting to experience the broad field of User Experience research and praxis in the pulsing environment of London. I would also like to especially thank *Stephanie Wilson* who was my supervisor and counselor at City University. Her guidance in the starting phase of my project was of great help.

Also I would like to thank *Simon McCallum* at Gjøvik University College, who has been my Norwegian supervisor for the proposal, and then the master thesis. His confidence and broad knowledge was of great value. I am very thankful for the meetings we have had and the knowledge I have gathered from those. His help in the ending phase of my project was of great help.

Furthermore I would like to thank *Keren Wiltshire* from St. Luke's Community Center in London who supported me in finding older participants for the study.

My brother *Paul* visited me in London after I had done my experiments. He helped me to visualize gesture spaces by listening to the jungle of ideas and concepts I had in my head. I am very happy to have been able to share some of my experiences in London with him.

Finally I would like to thank my wonderful wife *Maia*. She encouraged me to start my academic curriculum and had to renounce from the dining table for the last two years as I was doing my masters. I am very thankful for all her support and looking forward to the next adventure with her.

Hans Comtet, 2nd of June 2013

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1 Introduction

1.1 Review

We are living in a time in which we are moving away from desktop computers to mobile computing. Modern Smartphones are taking an increasing part in our daily lives and can be helpful in carrying-out several and various tasks. This development will most likely continue and with it we are moving away from traditional interactions to exploring more suitable interaction techniques.

In this regard, gestures offer a great opportunity for natural and intuitive interactions [2], which could make technology accessible for a wider range of people than today. In the user testing of a younger and an older user group, the difference besides age and gender may be various levels of experience in carrying out gestures, as the two age groups have different technological experience. Moreover, the recent mobile paradigm shift encourages to investigate if gesture interaction can have the same success and acceptance as gestures have had in gaming.

Comparing two age groups has been done in the work of Hurtienne et. al [3] and Stössel et. al [4]. The aim of Hurtienne et. al was originally to uncover to what extent both age groups agree on primary metaphors. However, the results proved that both age groups differed in their prior experience. The aim of Stössel et. al was, on the other hand, to test motor capabilities. The results indicate that older adults might be slower in performing gestures, but not necessarily less accurate. Although the study was concentrating on touch gestures, the results indicate the potential value of gestures in making technology accessible for a wider range of people than today. Investigating acceptance has been done in the work of Rico et. al [5, 6], and Bobeth et. al [7]. Here the acceptance was focusing more on a social setting and performance measures. The study of Bobeth et. al shows that older adults accept 3D-gestures and enjoy interacting this way, although they may prefer cursor-based interaction techniques. On the other hand Bobeth et. al argues that to be able to better understand the performance results of older adults, studies with younger persons are required.

Rather than age or gender, experience could therefore be an important factor. Less experience means fewer expectations and assumptions about how novel interaction techniques work and how they should be approached. Comparing two age groups on the basis of previous experience and to what degree gestures are perceived as positive could therefore contribute to increased knowledge in this emerging research area in form of a gesture set hierarchy and a user indication of the acceptance of 3D gestures. The results could also be valuable for companies developing future mobile interactions and improve gesture based interfaces for novice and experienced users.

1.2 Problem statement

This study investigates the importances of age, gender and previous experience on the acceptance and usage of gestures as a user input for human computer interaction.

As for example *Kathrin M. Gerling, Frank P. Schulte and Maic Masuch* discuss in the field of gaming, experienced players generally outperformed users who had never played video games before [8]. This shows that previous gaming experience may affect player performance and which gestures are carried out. Also, the article discusses that players without prior gaming experience seemed to encounter more problems when interacting with the game, which is supported by a lower level of perceived usability and an increased level of negative effect [8]. This could mean that previous experience has an effect on the acceptance of an unfamiliar interaction technique.

Rather than to sample novice users and experienced users, this study wishes to compare two age groups with the assumption that the age groups have different previous experience with modern devices. The distinction between novice users and experienced users could then follow users' age, as shown in the study of *Calkin S. Montero, Jason Alexander, Mark T. Marshall, and Sriram Subramanian* [9]. Although participants were recruited based on their technology usage patterns, they also found that the groups aligned around participants age. The majority of early adopters ranged from 20-40 years, late adopters were all 61 years or older.

Moreover, to the same extent that older adults may have a low level of confidence when dealing with a new technology [10], there might be a difference in gender on the usage and acceptance of gestures. The influence of gender on the usage and acceptance of gestures is therefore another demographic value this project wants to investigate. This leads further to the following research hypothesis:

> Previous experience is more important than age or gender for the usage of gestures and preference for gesture interface

This research hypothesis is divided into hypotheses within previous experience and gesture acceptance.

Previous experience

- Younger people perform different gestures than elderly people.
- Gender has an effect on the types of gestures performed.
- More experienced users perform different gestures then novice users.

Gesture acceptance

- Younger people accept gesture-based interaction more then elderly people.
- Gender has an effect on the acceptance of gestures.
- More experienced users accept gesture-based interaction more then novice users.

1.3 Research question

The purpose of this study is to investigate if previous experience is more important than age or gender for performance of gestures and preference for gesture interface. The literature review explains the relevant terms and presents a conceptual framework used to categorize the research areas. This is followed by a discussion of the design and methodology, and the presentation of the

results. The analysis of the results in relation to the hypotheses is then followed by a discussion of the open research questions and the direction of future investigation.

2 Review of the background literature

This chapter presents gesture research areas from a literature review and a conceptual framework to explain related terms and related work.

2.1 Literature review and framework

This traditional literature review follows the overall structured phases of identification, categorization and analysis.

2.1.1 Identification

The available databases at Gjøvik University College and City University have been used in the literature search, and are restricted to *ISI web of science*, *ACM*, *Springer Link* and *Science direct*. *Google Scholar* supplemented the identification process. In addition I used *Zotero* as library-tool to organize visited download-pages and the *LaTeX* tool *BibTex* to organize references.

2.1.2 Categorizing

The identified articles are divided into three areas: the recognition of gestures, the interaction with gestures and the output of gestures. The recognition of gestures is motivated in finding solutions to capture gestures, and the interaction with gestures is motivated in finding appropriate gestures. The output of gestures covers the actual application of gestures and what this means for the people applying them. The Figure 1 below can be seen as an illustration of the different research areas.

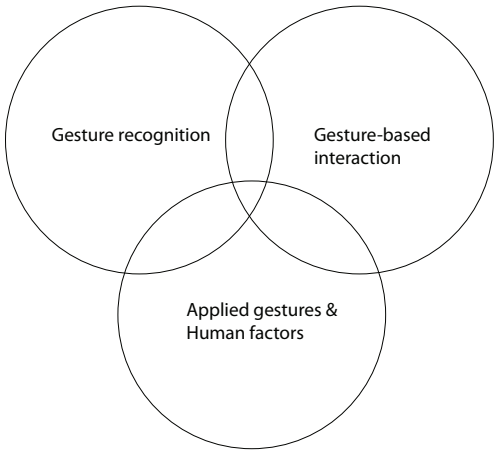

Figure 1: Illustration research areas

Although the three chosen research areas have differences, they are at the same time interwoven to some degree, as several research experiments capture gestures, explore gestures and

apply them to systems. Nevertheless, researchers have within these areas different perspectives on challenges and future work, which has been the basis for the conceptual framework. Moreover, the research areas are characterized by different success factors.

Gesture recognition defines success in the accuracy of gestures, as for example when repeating gestures several times or by different people. Important elements in this research area are technology, hardware and algorithms.

Gesture-based interaction focuses on the actual gestures. Finding natural and intuitive gestures which are easy to remember and to learn are typical success factors.

Applied gestures and human factors are defined as the third research area. The characteristic of this area is the attention to the human carrying out the gestures and on physical or cognitive boundaries. Success is defined by the acceptance and ability to perform the gestures.

2.1.3 Analysis

The analysis phase follows the three areas described, starting with an explanation of related terms and continuing with related work.

2.2 Explanation of terms

There are many terms which are used across the literature and which are quite specific to the area of gesture interaction. These terms are explained in the following section.

2.2.1 Gesture recognition

Gesture recognition is the mathematical interpretation of a human motion by a computing device [11]. A suggested classification of gesture recognition could be based on the input device [12, 13], which means either movement-sensor based approaches or camera-based approaches.

Movement-sensor based approach

Movement-sensor based approaches rely on different kinds of sensors [12], such as accelerometers, gyroscopes, compasses, GPS receivers and cameras that can be used for 3D interaction and which are typically built into devices, such as Smartphones [14] or into other separate wearable devices, such as the Nike Plus [1], or a recent Smartwatch [2].

Accelerometer sensors capture motion and produce signal patterns of the captured gestures. These signal patterns are further used in generating models that allow the recognition of distinct gestures, as for example to control home appliances with simple hand movements, where up and down movements could be used to operate a garage door or adjust the volume of your stereo equipment [12]. The acceleration force is measured in meters per second squared to a predefined sampling rate, as for example two times a second. Measurement is further applied on all three physical axes (x, y, and z), including the force of gravity.

[1] The Nike Plus device is an accelerometer sensor attached to a shoe and connected to an iPod/iPhone through a wireless Bluetooth connection. Users interact with the mobile device without the need to remove the iPod/iPhone from their pocket [15]

[2] A Smartwatch can be described as a normal digital watch, which has implemented functions known from Smartphones, as for example accelerometer or changeable apps

Camera-based approach

Camera-based approaches rely on a combination of digital cameras and computer vision algorithms to detect gestures without further tools [14, 12]. Game players are today familiarized to interact with gestures, for example when using a kinect sensor.

The kinect sensor was launched in 2010 by Microsoft for its Xbox 360 gaming platform, followed by kinect for Windows in early 2012. The kinect device and accompanying SDK (Software Development Kit) provide access to color and infrared (used to calculate depth) cameras at 640x480 pixel resolution, 20-point skeleton [3] tracking [4] for multiple simultaneous skeletons, and a microphone array [16]. The measurement characteristics of the Microsoft kinect use an infrared emitter and sensor to capture body movements by isolating the x, y, and z coordinates of 20 nodes roughly representing joints in the body. Each camera can capture movement of up to four people at once, from a range of 4 to 12 feet, even in low light conditions. Finally, data is interpreted through the use of algorithms, that interpret the input as well as pull out the desired information [17].

Gesture recognition systems

While humans are particularly sophisticated regarding analyzing gestural selection of other humans, this task is very complex for computers [18] because gestures do not rely on a one-to-one mapping of form to meaning [19]. In other words the same gesture can mean several things the user wishes to accomplish or express, which causes challenges for gesture recognition systems. One way to distinguish gestures is between continuous- and discrete gesture recognition [20, 21, 22, 13], also known as online- and offline gestures [23, 11].

Online or continuous gestures are evaluated and processed while they are being performed [23]. Reaction follows within a timeframe of 100 milliseconds [18]. For example a pinch gesture to zoom into a map can be applied constantly while it is performed.

Offline or discrete gestures include symbols to create new objects or shortcuts to execute application commands. Their effect is evaluated after they are completely performed [23]. Reaction to a gesture follows in the scope between several hundred milliseconds and a few seconds [18]. For example virtual buttons with a plus and minus could be used to zoom in and out a map after a gesture is pointing towards the buttons.

2.2.2 Gesture-based interaction

Human Computer Interaction can in general be described as the process of communication between human users and computers (or technologies in general). Users communicate actions, intents, goals, queries, and other such needs to computers. Computers, in turn, communicate to the user information about the world, about their internal state, about the responses to user queries, and so on [24]. To communicate with computers, several interaction techniques can be used, as traditionally for example a mouse. However, using gestures to interact with an interface can be described as a new interaction technique and as gesture-based interaction.

[3] To avoid intensive computational calculations, processing virtual 3D models of a human, one can just use a simplified version of a skeletal representation of the human body [11]

[4] To be able to use gestures as interaction technique information about the user in 3D space has to be provided. This information is tracked, for example by following the users hand position

Gestures (2D and 3D)

Dan Saffer [25] describes a gesture as any physical movement that a digital system can sense and respond to without the aid of a traditional pointing device such as a mouse or stylus. Gestures can be done in the 2D-space, typically as touch movements, or in the 3D-space around the users' body. In this project, I refine the scope to 3D free-form gestures in space, and not gestures via a touch screen or any other interactive surface.

Natural gestures

The physical movements in a gesture-based interaction are often described as natural or intuitive without any further definition. *Albrecht Schmidt, Bastian Pfleging, Florian Alt, Alireza Sahami Shirazi and Geraldine Fitzpatrick* believe that user interaction with a system should be invisible, at least to an extent where the person can focus on performing the tasks, albeit mediated by the system, without worrying about the technology itself [26]. This means, that natural or intuitive interaction should come spontaneously, with the most attention on the task and not by being disturbed by the system. The term spontaneously can be described as unplanned and not self-conscious [19].

Gesture language

Another reason for describing gestures as natural or intuitive has its origin from gesture language. Gestures accompanying spoken language are used to convey information to another person and are mostly done spontaneously. Gestures are normally categorized into four types [19, 27].

- *Iconic gestures* involve controlled and conventionalized ways of giving information visually
- *Metaphoric gestures* represent a common metaphor
- *Deictics gestures* are abstract, pointing gestures used to indicate objects and events in the real environment
- *Beat gestures* occur with comments on a persons own linguistic contribution

Wizard-of-Oz

The "Wizard-of-Oz" approach is a useful technique to trigger natural gestures and to determine a user's "first guess". After asking participants to perform certain activities, a hidden "Wizard-of-Oz" (the researcher) is simulating the system by using the remote control. This approach allows testing ideal applications that do not exist in the real world [28], and additionally, the participant remains unaware that some or all of the system's functions are actually being performed by a human operator [29].

2.2.3 Applied gestures and human factors

Although gestures show promising results when it comes to recognition and being natural or intuitive, there may still be problem-areas in the applied interaction of the 3D-gestures.

Ergonomic challenges

As devices are getting smaller or more integrated into other devices, it can be important to look at ergonomic design challenges. The term ergonomic describes how well a device has been designed to match the human body. For instance the interaction with small-screen devices reveals the conflict of interests between creating the smallest physical size that will give the user unrestricted mobility and flexibility, whilst maintaining dimensions that are defined by the size and the motor functions of the human hand [30]. In other circumstances gestures could be experienced as stressful and tiring, impossible to perform, or having illogical imposed functionality. Gestures should therefore be physically easy to perform.

Cognitive challenges

Gestures can moreover challenge cognitive abilities, which can have an impact on memory. Gesture-based interfaces require that the users recall, rather than recognize the gesture [31]. Memory may not be studied meaningfully in isolation [32], because memory is related to attention which in turn is related to making mistakes, having accidents or doing things unintentionally. Memory, attention and error are also related to emotion. It can therefore be necessary to take a holistic view on applying gestures to any interaction.

Acceptance challenges

Additionally, issues are referring to how well gestures are accepted and suited for different situations, especially in regard to mobile contexts, where users can be distracted or disturbed. The acceptability of gestures can also be a matter of context. Maybe some gestures are well suited in gaming, while performing gestures in public may be accepted in one location and problematic in another [33]. But, as *Julie Rico, Andrew Crossan and Stephen Brewster* argue, this is not simply an issue of "acceptable" or "unacceptable", but a dynamic decision process that occurs in different social contexts at different stages of experience [5]. Furthermore different people usually prefer different gestures, which could lead towards challenges in finding a common denominator.

User Experience

In general, the consideration of positive usability has coincided with a move of technology away from work-oriented, desktop computing to handheld, mobile and ubiquitous systems [34]. Technology is now perceived as something that provides an experience unique to the individual rather than a means to achieve a task. Although the composition of factors which creates individual experiences may vary, user experience has the intent to create a positive experience to influence the user on the acceptance and behavior [35], which will attract them in future [36].

As 3D gesture interaction can be seen as a new design-principle, the user experience may be an important factor for acceptance, which further influences its use. There is therefore an urgent need to understand user experience related to novel modalities [37]. Different researchers have tried to build a basis of factors to define user experience [38, 39, 40, 31]. Table 1 shows an overview of these different factors. These factors may not all be valid for this project, since they focus more on the ease of learning gestures and interacting with complex system such as a display interface. The user experience in this study concentrates on the acceptance factor and to what degree gestures are perceived as being positive.

Table 1: User experience

Factors	Description	Researchers
Learnability	The ease with which people can understand the gesture and begin using it	[38, Nielsen et. al] [39] [40, Kortum]
Efficiency	Steady-state performance of expert users	[38, Nielsen et. al]
Memorability	How easy is it to remember what to do and when to do it	[38, Nielsen et. al] [39] [31] [40, Kortum]
Errors	Error rate for minor and catastrophic errors as well as the ease of error recovery	[38, Nielsen et. al] [39]
Coverage	The amount of operators discovered vs. the total operators	[38, Nielsen et. al]
Functionality	How easy it is to use the experience once it is learned	[39] [40, Kortum]
Fatigue	Level of enjoyment in the experience of using a gesture	[31, Barclay et. al] [40, Kortum]
Accuracy	Indicator of both its difficulty, and its uniqueness	[31, Barclay et. al]

2.3 Related work

In the related work section, the analyzed articles, which were found by searching literature according to the keywords mentioned in the introduction part are presented. After the general topics in the three research areas have been outlined, the articles are summarized in tables. And finally, a conclusion from the literature review is drawn.

2.3.1 Gesture recognition

Starting to find an answer to the question of how gestures can be recognized by technology, is still a challenging issue in gesture-based research. Especially recognition accuracy [41, 42, 43, 2, 17] and recognition accuracy enhanced by gesture training [43, 44, 45] or both [12] are active research areas.

Studies show a range from experimenting [42], feasibility [44] and investigation [45, 43, 17] on possible gestures recognition techniques, to more concrete cases, where body and hand movements [2], just free-hand gestures by using an embedded wireless bracelet [41] or by using a separate control device [12] were tested.

Since gesture recognition focuses in general on the recognition and capturing of gestures, the actual gestures have in most cases been chosen in advance [41, 2, 42, 44, 43, 17]. An exception is the study of *Joha Kela, Panu Korpipää, Jani Mäntyjärvi, Sanna Kallio, Giuseppe Savino, Luca Jozzo and Sergio Di Marca* [12], who examined the potential suitability of gestures through a pre-study in form of a questionnaire. Altogether the studies show differences in the kind and number of gestures selected. The study of *Radu-Daniel Vatavu* [45] describes several gesture scenarios, without actually testing gestures.

Although sensors are increasingly available and of low cost, there might still be technical

limitations and disturbances of gesture recognition, as for example while moving [12]. Research is often limited to one source of input signal [2] and might not meet the varying gestures a user can perform. Moreover users might prefer traditional interfaces, when a gestures interface in comparison does not yield more value for the user [43].

The research area is mainly driven to find valid methods to capture gestures and on further research of usage scenarios [45], involvement of user groups [43, 12], testing of new sensors [41, 42] and feedback mechanisms [42, 2]. Although the technical perspective on gestures is an important part in gesture interaction, it plays a minor role in this study and contributes mainly in regard to the chosen hardware to capture gestures. Table 2 provides an overview of the analyzed articles and their main contribution.

Table 2: Gesture recognition

Researchers	Approach	Contribution
[44, Lu et. al]	Movement-sensor based	Capturing gestures with a wearable belt in connection to a mobile phone
[43, Amft et. al]	Movement-sensor based	Evaluation of gesture input on a questionnaire interface running on a developed watch
[42, Mäntyjärvi et. al]	Movement-sensor based	Experiment with selected gestures to control a DVD player
[41, Hein et. al]	Movement-sensor based	Testing recognition rate and performance of a bracelet input device
[12, Kela et. al]	Movement-sensor based	Defined application in mind. Two user studies: What kind of gestures are natural and useful; and an evaluation of gestures compared to other modalities
[2, Song et. al]	Camera-based	Gesture recognition of both hand and body movements
[45, Vatavu]	Camera-based	Evaluating a gesture storage device for public display interaction
[17, Won et. al]	Camera-based	Investigation on gender specific gestures

2.3.2 Gesture-based interaction

A further question within gesture research is to identify intuitive gestures. One straightforward approach is to ask participants to make free spatial movements according to given tasks [22, 46], specific activities [33], given functions [14] or given target words [3]. Other more indirect approaches showed participants a "before" and "after" picture and asked them to perform a suitable gesture [47] or held a brainstorming session where experts were encouraged to find specific gestures for an interface [48].

Although the analyzed articles agree on the potential of gesture-based interaction, they still

face challenges, as that it can be difficult to find natural, intuitive and meaningful gesture vocabularies [47]. Thus, for example the absence of affordances [3] and the possibility to give proper feedback [48, 46]. Moreover gestures could potentially be affected by user demographics and cultures [22] and may change over time [14].

Investigating in gesture-based interaction could contribute to a better understanding of natural and intuitive gestures, although it may be restricted to the investigated interaction, which again can be limited in the number of gestures. Nevertheless technological problems on the recognition of gestures can lead to a decrease in available gesture choices. Such drawback could potentially lead to poorer communication solutions in comparison to display technologies [48]. On the other hand, the recent development in Smartphone usage has shown that the adaptation of content towards smaller devices might be beneficial, because it is focusing on the main message and intention with the content. Table 3 shows an overview of the gesture-based interaction and their relevant contribution.

Table 3: Gesture-based interaction

Researchers	Gestures/device	Contribution
[22, Ruiz et. al]	3D-gestures with a Smartphone	Developed a taxonomy for 3D-gestures
[46, Wolf et. al]	2D- and 3D-gestures	Focus on an auditory interface and to what degree gestures can be used in this context
[33, Kray et. al]	2D- and 3D-gestures with a Smartphone	Investigated whether gesturing with a mobile phone can help to perform complex task involving two devices
[14, Löcken et. al]	3D-gestures	Conducted a user-centered approach in finding gestures for a music player
[3, Hurtienne et. al]	2D- and 3D-gestures with a Smartphone	Based their research on 12 primary metaphors and if those metaphors can be used for mapping between physical gestures and abstract concepts
[47, Grandhi et. al]	3D-gestures	Designed guidelines through understanding of gestures
[48, Pasquero et. al]	2D- and 3D-gestures on a watch interface	Tested and developed a watch which can acquire information from a companion mobile device through simple gestures

2.3.3 Applied gestures and human factors

Facing the problems within applied gestures and human factors are the analyzed articles related to memory [49, 13], ergonomics [7, 4, 50], context challenges in relation to mobility [51, 52] as well as social acceptance [6, 5].

The studies show some interesting results. Both *Eamonn O'Neill, Manasawee Kaenampornpan,*

Vassilis Kostakos, Andrew Warr, Dawn Woodgate [49] and *Christine Kühnel, Tilo Westermann, Fabian Hemmert, Sven Kratz, Alexander Müller, Sebastian Möller* [13] suggest that gestures could fit for a small set of semantically distinct services with memorable and distinct gestures.

The results of *Mantei Negulescu et al.*; *Andrew Crossan et al.*; as well as *Julie Rico et a.* [51, 52, 5], show that gestures in walking conditions were significantly affected by errors [52, 5] and slower walking [51]. This may not be so surprising since the accelerometer signals contain both the tilt from the users targeting, and the noise generated by the walking behavior [5]. The results also show that there can be differences between experiments conducted in the laboratory or in a real world context.

In general, it is important for users to feel comfortable and in control while using an interface. Of course basic usability requirements should not change with a gesture-based interaction compared to traditional interactions. This relatively new way of interacting should rather improve usability and inclusion of different user groups, since gesture-based interaction could decrease cognitive load and degree of attention.

Nevertheless, it may be a tough challenge to reach those noble goals. Even though many Smartphones now have the capabilities through accelerometer based sensing, to recognize gestures, users seem unwilling to accept gesture-based interaction outside of the gaming or novelty application [5]. It may therefore be important to instigate research on the acceptance and adoption of the new input paradigm. Research should reflect on specific needs and abilities to succeed in applying gestures to an interface. Table 4 shows an overview of the analyzed articles.

2.3.4 Conclusion

Although the three described areas have different success-factors, they agree on the challenge whether gestures in an interaction context with computers are better than existing techniques. Traditional user interfaces have the advantage of minimal hardware and sensing requirements, and being well established and ubiquitous.

On the other hand, natural techniques may be seen as more fun and engaging [53]. In addition, they open up for future developments, improving computing power, as well as offer mobile and wearable devices new possibilities for interacting with various applications. As they become capable of sensing movement in space [22, 3], gesture input could be integrated into clothing, wristwatches, or mobile terminals to provide a means for interacting with different kinds of devices and environments [12, 42].

The focus area of this thesis is the overlapping domain of all three research areas, as it is shown in the Figure 2 below. As a starting point this project wishes to captures gestures with both accelerometer (movement-sensor based) and kinect (camera-based) signals. Although it is less important to find accurate gestures, gesture recognition technology and hardware will be used. Gesture-based interaction impacts this study through finding natural gestures in the interaction with a TV. Moreover, the captured gestures are applied to a system, where previous experience, age and gender are important factors for acceptance and investigation.

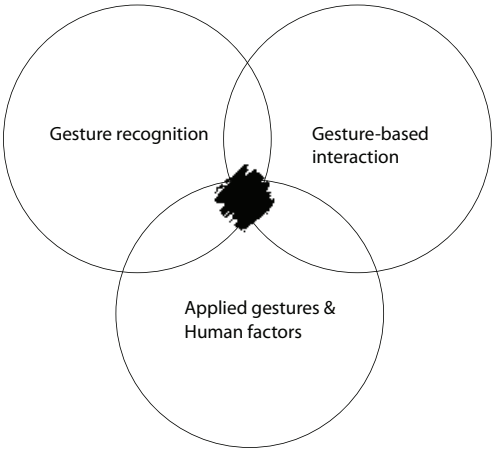

Figure 2: Illustration research focus

2.4 Statement of the problem

Existing technology could be used to stimulate this kind of future interaction, with the objective to find answers of which gestures to chose for a defined activity and if people are motivated to use 3D gesture interaction. In the following subsections, it is further described how this study touches on the three research areas.

2.4.1 Gesture recognition

Although touch is currently the dominating form of interaction with mobile devices, gestures are increasingly perceived as an equivalent interaction option via the use of accelerometers. Seeing that acceleration sensors are widely available, small of size and low in cost, their integration into embedded devices is encouraged. In addition hardware is available to support hand gestures to control objects and systems with for example the Xbox Kinect. This project will therefore include the usage of an accelerometer and a kinect to capture gestures. Additionally the interaction with the TV task is video and audio recorded.

2.4.2 Gesture-based interaction

Similarly to different user groups having varying needs or sharing common needs, gestures may vary. Either users share similar gestures [22, 33] or exercise very different gestures [45, 12, 42, 33]. In user testing a younger and an older user group, the difference besides age may be varying experience in carrying out gestures. Nevertheless, it can be expected to not only discover differences, but also similarities, which could be used to either develop inclusive or specific gesture-based applications. Categorizing gestures according to age, gender and user experience could further lead to increased acceptance and hopefully to similar positive user experiences with interactions as in gaming.

2.4.3 Applied gestures and human factors

In comparing two different age groups, different problems can occur. On the one hand, elderly are increasingly using technology in their daily lives, but at the same time having problems when

interacting with new technology. These problems can be attributed to the physical, perceptual and cognitive changes that accompany the normal aging process [3, 4]. On the other hand, younger adults have more experience in using new technology, but are being challenged by the development towards mobile computing, when interacting in a mobile context and being disturbed. Valid for both age groups can be different personal factors, as for example gender, age and/or experience.

Table 4: Applied gestures and human factors

Researchers	Research area	Measuring factors
[49, O'Neill et. al]	Memory	Number of incorrect gestures and the processing time for producing correct gestures
[13, Kühnel et. al]	Memory. Gestures in a smart-home	Asking if participants could map gestures back to functions followed by asking for their memorability, how well gestures fit to the functions, and assessed the ease of performing the gesture
[7, Bobeth et. al]	Ergonomic. Gesture based interaction with a TV	Usability and acceptance
[4, Stössel]	Ergonomic.	Completion time and error rate
[50, Scott et. al]	Ergonomic. Ergonomic challenges of foot movements	Human capability associated with performing foot-based interactions
[51, Negulescu et. al]	Mobile context. Cognitive demands while walking and eyes-free. Gestures with a mobile phone	Reaction time, walking speed and visual focus
[52, Crossan et. al, 2008]	Mobile context. Wrist rotation while resting, seated, standing or walking	Results for time and accuracy under different conditions
[6, Rico et. al, 2009]	Social acceptability	Internet survey to examine the social setting where gestures might be used
[5, Rico et. al, 2011]	Social acceptability factor in whether or not these gestures will be adopted	Social acceptability as a factor

3 Design and methodology

The design of this study was a between-subjects study. A between-subjects study is used to compare results for different participants [54], as here the differences in satisfaction between novices and experts or gesture performance for younger versus older participants.

3.1 Independent and dependent variables

Data variables can be divided into independent or dependent variables. Additional nuisance variables can be undesired sources of variation, that may affect the dependent variables.

Independent variable

An independent variable of a study is an aspect that you manipulate to answer specific questions [54] (What do I change). As for this study, the independent variables were differences in performance, and acceptance between males and females, between novices and experts, and between two different age groups.

Dependent variable

On the other hand, the dependent variables (also called outcome or response variables) describe what happened as the result of the study (What do I observe). A dependent variable is something you measure as the result of, or as dependent on, how you manipulate the independent variables [54]. Dependent variables included metrics or measurements such as number of "online" vs. "offline" gestures, intensity, temporal component and position.

The independent and dependent variables for this study are shown in Table 5.

3.2 Participants

This study sampled two different age groups of both male and female participants. Younger participants in this project were between 18 and 31 years old. Older participants in this project between 48 and 73 years old.

3.3 Procedures

The operation of a TV was chosen as task, because it allows limiting the interaction to a few distinct gestures. Moreover both younger and older user groups watch television or are at least familiar with it, which could be helpful to compare differences based on experience and the validity of the resulting gesture set.

As this study created an experimental simulation to compare a younger age group with an older age group, the order and sequence of events was consistent for every experiment. The "script" experiment sequence of events for this study can be seen in Figure 3 bellow. The complete script can be seen in the Appendix E.

Having an additional game task has several advantages. The interaction with the TV can be seen as a menu control. The combination of a menu control and gaming is present for many

Table 5: Independent and dependent variables

Independent variables	Dependent variables	Measuring
Whether the participant belongs to the younger age group or the older age group	Previous experience	Questionnaire on previous experience
	User experience	Questionnaire with different ratings
	Acceptance	Acceptance measured with a standardized questionnaire (UTAUT2) in the end
	Performance	Gestures categorized according to "online" vs. "offline", intensity, temporal component, and position. Gesture recognition checked with a binary classifier. Video observation

games, which makes it therefore reasonable to include the two tasks. Secondly, the TV task requires certain tasks, such as changing the channel. Participants in the game task are on their own, which has some interesting value for the study. For example in regard to participants' engagement in the game and how fun they experience it. The disadvantage of having two tasks could be that one task influences the other regarding the answers given in the acceptance questionnaire. On the other hand different experiences in executing the TV-task or playing the game could lead to more holistic results, as the users can have a broader overall experience. The study applied the following procedures:

1: Previous experience

After having signed the informed consent, participants were asked to scale their previous experience with modern devices, as for example Smartphone, Wii, Kinect and Tablet. Furthermore, participants were asked to scale their previous experience with 3D-gesture and touch gesture usage. Prior experience with technological devices could be biased by real world experiences. For example if somebody plays Bowling, this could influence the person's attitude towards a Bowling game. Rating real world experience was therefore chosen as an additional section. The whole questionnaire was electronic, using Google Docs. The submissions were time logged. (Appendix C – Previous Experience Questionnaire)

2: TV-task

Participants in the interaction lab were then asked to take place in front of the canvas screen, where an accelerometer device was tied around their wrist on their dominant arm. They were

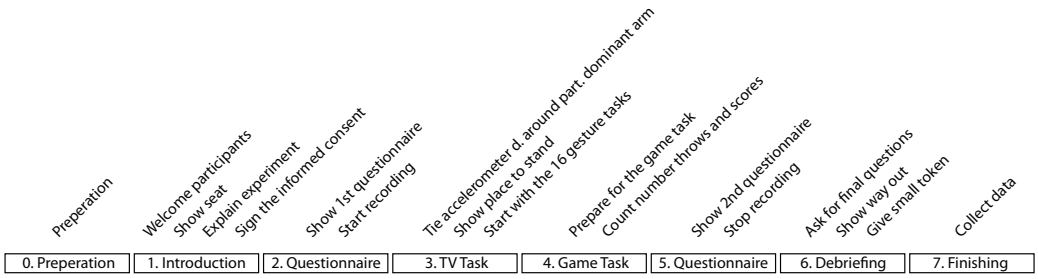

Figure 3: Sequence of events

told that the instruments would be calibrated, and that they can interact with the TV as soon as this has been done. They were then asked to execute activities such as to turn the TV on/off, change channel, volume and/or go back to the menu. The session stopped when the TV turned off. Data was captured from the kinect and accelerometer device.The interaction was in addition recorded on video including audio.

3: Game task

In the next session participants were given time to interact with a simple general rated game on the kinect. Participants were still located in the interaction lab.

4: Questionnaire

After the interaction session the participants were asked to fill out a questionnaire with standardized questions about their experience with this form of interaction. Questions from the UTAUT model [55] in its second version from 2012 [1] were used. Furthermore, an additional module was used to scale different words describing participants' individual user experience. The post-questionnaire was again electronic, using Google Docs, with time logged submissions. (Appendix D – Gesture Acceptance Questionnaire)

3.4 Instrumentation

In this study several instruments were used, which will be described further in the related subsections. Starting with gesture recognition, where both a camera-based and sensor-based approach were used to capture gestures.

3.4.1 Camera-based gesture recognition

Brekel Kinect

In the first test-series, a kinect for XBox was used, which is primarily developed as a game console. To be able to capture and save gestures, one can use the free software Brekel kinect [56]. The Brekel Kinect software uses color pictures or infrared pictures to recognize people. In testing both options previous to the experiments, the infrared option showed quicker response. It was therefore used for the experiment. To start the recording of bvh files, the first step is to calibrate for user tracking. Sunlight, bright cloth colors, or little movement can delay user tracking. Besides closing all curtains during the study, participants were additionally asked to step forward, backward, or to move their arms, when the software did not manage to find the user.

GesturePak

In the second test-series, the purchased kinect for Windows arrived. The kinect for Windows is developed for the use with Windows and has several options for developers. Also it does not require any hack software, as does the kinect for XBox, and a windows SDK can be used to develop suitable solutions. Another option is to use existing software to capture movements, which was chosen for this project. The often as useful mentioned software GesturePak [57] was purchased for 99 $ (Appendix 69).

GesturePak allows to take snapshots of gestures, and then to decide which axes and body points to track. Performed gestures can be saved as a XML file. As the user is occupied performing gestures, snapshots can be done by speech control. While participants followed the instructions according to the TV task, the researcher was able to give the speech commando "snapshot" to trigger a snapshot.

3.4.2 Sensor-based gesture recognition

QSensor

The QSensor from Affectiva [58] measures movement with a built in three axis accelerometer sensor, besides temperature and electrodermal activity. The sensor comes additionally with a wristband, which was very convenient for this study (Figure 4). To secure the QSensor, it has to be placed in a pocket and fastened by a velcro. The wristband could thereafter be fastened by a velcro as well, and therewith easily adjusted for a comfortable fit for different participants (Figure 5). To read the captured movement data from the QSensor device, one can either use the free off–the–shelf software from Affectiva, or export files as csv, which can then be imported to Excel for further processing.

Figure 4: QSensor and wristband

Four categories in a binary classifier are used to log the events and detections (Figure 6). The binary classifier is used in hypothesis testing, where there are two ways to be right and two ways to be wrong [59]. It can also be used to test alternatives, with two true outcomes and two false outcomes.

Figure 5: QSensor on arm

By analyzing the measurement characteristics the results further show the reliability and validity of the chosen instruments, but most importantly which kind of gestures are being recognized.
A gesture is handled as an event and the x,y,z-movement data acts as the detecter:

1. True positive: Event occurs and the detecter detects it
2. False positive: Event does not occur but the detecter shows an event
3. False negative: Event occurs, but the detecter fails to detect it
4. True negative: Event does not occur and the detecter correctly shows no event

Furthermore, gestures are categorized based on them being "online" vs. "offline", their intensity, temporal component, and position (Table 6). The framework which was used to place gestures as being online or offline is shown in Table 7.

3.4.3 Materials used

Questionnaire

A semi-structured questionnaire was used with both open- and scalable questions using a Likert scale. The open questions in the post-questionnaire asked participants whether they experienced gestures to be negative or positive.

Previous experience, age, and gender

Previous experience was measured in regard to different devices and gesture experience. Device usage frequency was using a 5-point Likert scale, where 1=never, 2=rarely, 3=sometimes, 4=of-

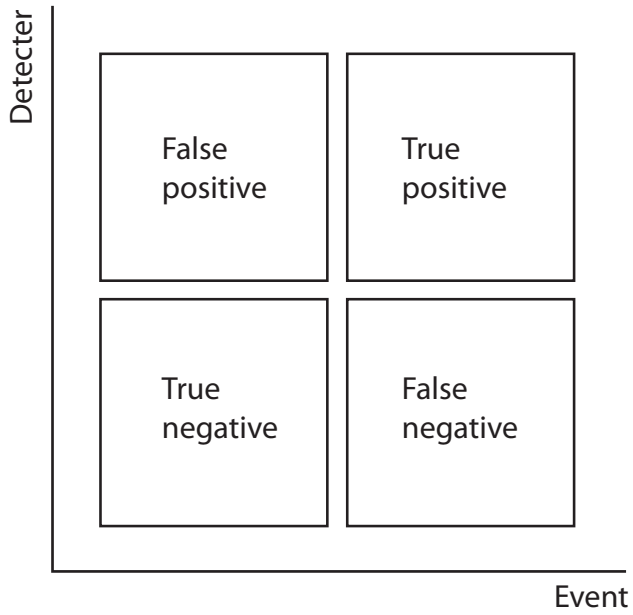

Figure 6: Binary classifier

Table 6: Gesture categorization

Factors	Description
Offline gestures	Include symbols to create new objects or shortcuts to execute application commands
Online gestures	Evaluated and processed while they are being performed
Intensity	Gravitational *g-force*
Temporal component	time duration
Position	X,Y, and Z values

ten, and 5=many times. Gesture experience was measured in regard to 3D-gesture- and touch-gesture usage. The Likert scale here ranged from 1=not experienced, 2=1-3 months, 3=3-6 months, 4=6 months-1 year, 5=2-3 years, to 7=more than 3 years. Age was measured in age-ranges, where 1 represents the younger age group and 2 the older age group. Gender was coded using a 1 or 2 dummy variable where 1 represent male. Current position was coded using 1 to 7, where 1 represent Arts and Social Science, 2=Business, 3=Engineering and Mathematical Science, 4=Health Science, 5=Informatics, 6=Law, and 7 for other backgrounds.

User experience

The user experience was measured by asking participants to scale how well different words or phrases described their experience with the gesture-based interaction. The five-point Likert scale ranged from Strongly disagree to Strongly agree. The chosen words ranged from being positive:

Table 7: Framework for online and offline gestures

Online gestures	Type	Description
	Iconic	Controlled and conventionalized ways of giving information visually
	Navigational	Gestures to move in a menu structure
	Dynamic	Dynamic gestures to execute a commando
Offline gestures		
	Deictic	(Abstract) Pointing gestures used to indicate objects and events in the real environment
	Static symbols	Symbols with conventionalized meaning

Fun to use, Engaging, Easy to use, Helpful, to being negative: Frustrating, Annoying, Boring and Unnecessary.

Acceptance

Acceptability is about fitting technology into people's lives [32], and to what extend gestures could be a new way of interaction. The Unified Theory of Acceptance and Use of Technology (UTAUT) as a construct of different technology acceptance models has already served as a theoretical foundation for technology acceptance studies [60, 61, 62] and is reported to explain as much as 70 percent of user acceptance of technology [55].

The original UTAUT research model from 2003 was extended in 2012 with the UTAUT2 research model. Key moderator values Age, Gender and Experience are taken into account. Hedonic motivation as a construct was added to the model and herby giving a further indication on user experience. The UTAUT2 research model was therefore chosen for this study and it is further explained in the next section.

The UTAUT2 research model [1]

The UTAUT2 research model consists of seven constructs, which are moderated by the variables age, gender and experience. The constructs are furthermore measured in comparison to a behavioral intention, which can explain determinants of user acceptance and usage behavior.

Four constructs and moderators are used in this project. Performance expectancy, effort expectancy and hedonic motivation are predicted to be direct determinants of behavioral intention. Performance expectancy is defined as the degree to which participants believe that using the system will help them improve their performance which may be moderated by age and gender. Effort expectancy is the degree of ease perceived with the use of the system, which is moderated by age, gender, and experience. Hedonic motivation is defined as the fun or pleasure using a technology, which is moderated by age, gender, and experience. Behavioral intentions and facili-

tating conditions are direct determinants of use behavior. Facilitating conditions are the degree to which a participant believes that an organizational and technical infrastructure exists to support the system, which is moderated by age, gender, and experience.

The hypothesized relationships mentioned in the theoretical model are outlined in Figure 7 and Table 8.

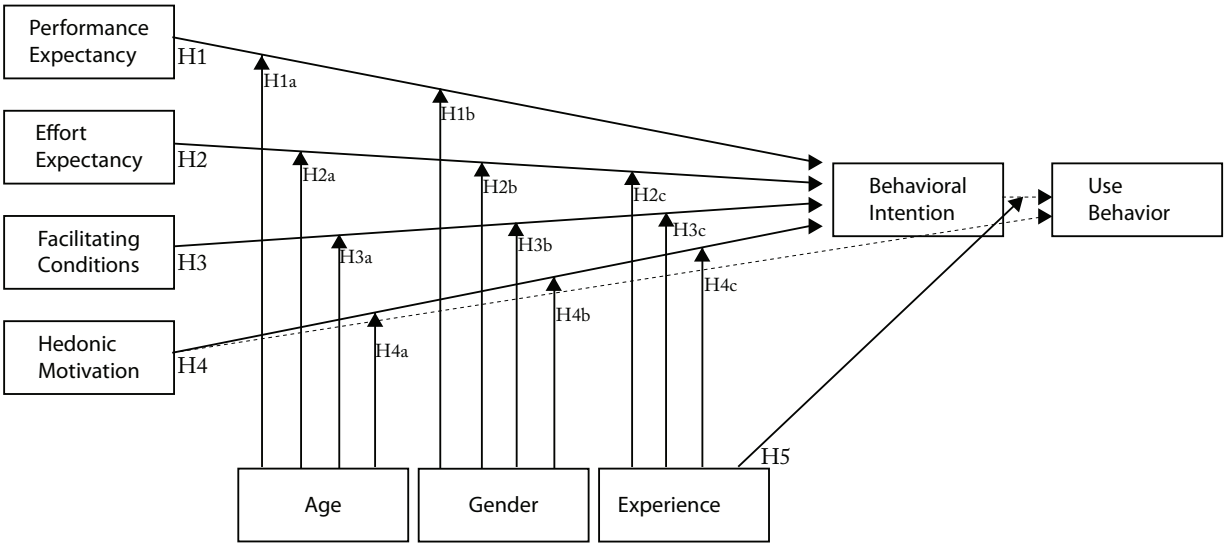

Figure 7: UTAUT research model

UTAUT2 questionnaire items The UTAUT2 research model includes standardized questions for each construct. The advantage of using standardized questions is to collect numerous user options to equal questions, which can be further used for an indication on the acceptance and motivation of using gestures in the interaction with technology. The questionnaire items were adapted by including questions from the original UTAUT research model [55] and excluding some of the questions from the latest UTAUT2 model. In contrast to the original seven-point Likert scale, a five-point Likert scale was used. The scale was ranging from disagree to agree. The respondents needed to answer the following questions:

Performance Expectancy

Using gestures helps me accomplish things more quickly
I find gestures useful in my daily life
If I were to use gestures, I would increase my chances of completing an assigned task

Effort Expectancy

Learning how to use gestures is easy for me
My interaction with gestures is clear and understandable
I find gestures easy to use
It would be easy for me to become skillful at using gestures

Facilitating Conditions

I have the resources necessary to use gestures
I have the knowledge necessary to use gestures
Gestures are not compatible with other systems I use

Hedonic Motivation

Using gestures is fun
Using gestures is enjoyable
Using gestures is very entertaining

Behavioral Intention

I intend to continue using gestures in the future
I plan to continue to use gestures frequently

Use

Please choose your usage frequency for each of the following
(Never _ Rarely _ Sometimes _ Often _ Many times):
Playstation games
Wii games
Microsoft kinect games
Smartphone app games
Computer app games
PC games
Smartphone
Tablet
E-book reader

Your experience in 3D gesture usage

Not experienced __ __ __ __ __ __ __ Very experienced

Your experience in touch gesture usage

Not experienced __ __ __ __ __ __ __ Very experienced

Gender

Male
Female

Age

18-31
48-73

3.4.4 Methods of data collection used

The benefit of concentrating the experiment on an interaction with a TV, are the relatively restricted interaction possibilities. Activities as turn the TV on/off, change the channel and the volume, are all activities a "Wizard-of-Oz" can control with a remote control. During the TV task a MacBook with a TV-screen as background picture was used to simulate a TV screen (Figure 8). In addition, Apple's remote control was used to simulate the TV interaction.

Figure 8: Picture of TV as background picture during the TV-task

Concentrating on specific types of gestures, has the advantage of being able to provide guidance on which gesture should be chosen for a particular action. This approach follows the study of *Roland Aigner, Daniel Wigdor, HrvojeBenko, Michael Haller, David Lindlbauer, Alexandra Ion, Shengdong Zhao, and Jeffrey Tzu Kwan Valino Koh* [63].

Video observation

The validity of the captured data from the movement recognition was further analyzed in comparison to the video observation. The videos can be used to record parameters such as:

- Gesture time
- Online or Offline gesture
- One arm or two arms
- Gesture type
- Used space

The analyzing outcome is then listed in one excel sheet per participant. The advantage of having an excel sheet is to facilitate the use of data for different comparison studies, for example the amount of online vs. offline gestures.

Verbal observation

The additional audio recording is providing valuable verbal information. Verbal information includes anything the participant actually says, which accompanies the interaction event. As the researcher made it clear not to be able to ask any questions during the study, verbal behaviors are restricted. Nevertheless, some participants expressed their positive or negative experience, which will be recorded in the analysis phase.

Together with the outcome from the open questions, participants are asked for any positive or negative experiences. A summary of positive vs. negative impressions gives a further indication on the acceptance of performing 3D-gestures.

3.5 Limitations

Technology is rapidly changing, for example in regard to mobile devices. This rapidness of development makes it harder to abstract technology from the context of use. The experiment was conducted partly in a laboratory and partly under controlled circumstances. Although laboratory studies help to control unknown variables and simplify data collection, the experience of technology in normal usage situations and emotions may be different than in an artificial laboratory setup. The simulation can therefore serve as indication of user experience only, not as evidence.

Additionally the interaction is limited to a certain number of activities to interact with a TV. The results may be valid for similar interaction, but cannot be used in general. Nevertheless, results may point towards general observations and theories.

A standardized questionnaire was chosen which removes one source of bias. However, whether these questions are understood in the same way is another matter [64]. Large numbers of respondents can indicate the quality of data gathered from the questionnaire.

The quantitative approach involves the complex and socially based phenomena Human Computer Interaction, which cannot be easily quantified [34]. In addition to observing participants carrying out gestures, information users provide beyond standardized questionnaires is further detailed and also more design relevant [62]. The open questions and the recording of verbal behaviors may help to fulfill this study more holistically. Additionally, this triangulation, which brings together data from different sources [65], can enrich the analysis by examining findings from different perspectives.

Table 8: UTAUT hypothesized relationships

Num.	Hypothesis
H1	There would be a significant positive relationship between performance expectancy and behavioral intention to use gestures.
H1a	There would be a significant positive relationship between performance expectancy and behavioral intentions to use gestures, and this relationship would be moderated by age.
H1b	There would be a significant positive relationship between performance expectancy and behavioral intentions to use gestures, and this relationship would be moderated by gender.
H2	There would be a significant positive relationship between effort expectancy and behavioral intention to use gestures.
H2a	There would be a significant positive relationship between effort expectancy and behavioral intention to use gestures, and this relationship would be moderated by age.
H2b	There would be a significant positive relationship between effort expectancy and behavioral intention to use gestures, and this relationship would be moderated by gender.
H2c	There would be a significant positive relationship between effort expectancy and behavioral intention to use gestures, and this relationship would be moderated by experience.
H3	There would be a significant positive relationship between facilitating conditions and behavioral intention to use gestures.
H3a	There would be a significant positive relationship between facilitating conditions and behavioral intention to use gestures, and this relationship would be moderated by age.
H3b	There would be a significant positive relationship between facilitating conditions and behavioral intention to use gestures, and this relationship would be moderated by gender.
H3c	There would be a significant positive relationship between facilitating conditions and behavioral intention to use gestures, and this relationship would be moderated by experience.
H4	There would be a significant positive relationship between hedonic motivation and behavioral intention to use gestures.
H4a	There would be a significant positive relationship between hedonic motivation and behavioral intention to use gestures, and this relationship would be moderated by age.
H4b	There would be a significant positive relationship between hedonic motivation and behavioral intention to use gestures, and this relationship would be moderated by gender.
H4c	There would be a significant positive relationship between hedonic motivation and behavioral intention to use gestures, and this relationship would be moderated by experience.
H5	There would be a significant positive relationship between experience and behavioral intention to use gestures.

4 Implementation

4.1 Research approval

Conducting research with humans requires fully informed consent to participate. Privacy and confidentiality are important factors to keep in mind.

4.1.1 Video recording

Video recording can be problematic in regards to privacy concerns, because participants can be recognized on the video footage. In Norway it is required to seek approval from the Norwegian Social Science Data Service (NSD). The approval for this project was sent on the 25th of January 2013. (Appendix H – Notification form and Appendix I – NSD approval).

4.1.2 Ethical approval

Seeking approval for video recording was less important in London where it is more important to select participants outside of certain age groups. Given the time limits on the project and the time required by the ethics committees to properly assess the merits of a proposal, participants were targeted to be above 18 and beneath 65 years of age. The project followed the general guidelines of the ethical committee on the information sheet and informed consent.

4.1.3 Information sheet

The information sheet or explanatory statement is designed to give participants information about the research project, such that they can give informed consent to participate in the project. Another benefit of having a written statement in comparison to telling participants about the study, is that every participant gets the same information. The information sheet which was used during the study, can be seen in the Appendix A. However, before giving participants the informed consent sheet to sign, the researcher verbally told the next steps as indicated in the script (Appendix E).

4.1.4 Informed consent

To obtain informed consent from participants is one key element of conducting ethical research [66]. This document informs participants briefly about the nature of the research and what participation will involve. It includes a statement that participation is voluntary and may be terminated at any time without penalty. Finally this document guarantees confidentiality with the obtained data and how the researcher can be contacted. In the Appendix B is the template form which was used for both the pilot studies and the experiments. The signed forms for every participant are on file.

4.2 Interaction lab

As laboratory facilities for the simulation for this research project, the interaction lab at City University was made accessible. Starting with becoming acquainted with the lab and instruments,

the set-up was designed using hardware such as kinect for XBox, an XBox game console, the QSensor, a PC running Windows 7 with a connected webcam and an additional MacBook. The applied software included a webcamViewer and Skeletal Viewer.

The webcamViewer is a free off-the-shelf software, which already was installed on the PC. The webcam was set up to film the big canvas screen and therewith to capture the interaction output. The SkeletalViewer sample comes together with the Windows Software Development Kit (SDK) Beta and demonstrates the use of rendering depth, video, and skeleton data. The screen was recorded as flv (Flash Video File) with the free off-the-shelf software FreeScreenToVideoV2.0. Both softwares had already been installed on the PC. The audio was captured by using the kinect as input line-in. Figure 9 below illustrates the chosen set-up. The then following Figure 10 shows the screen content, which was recorded on video.

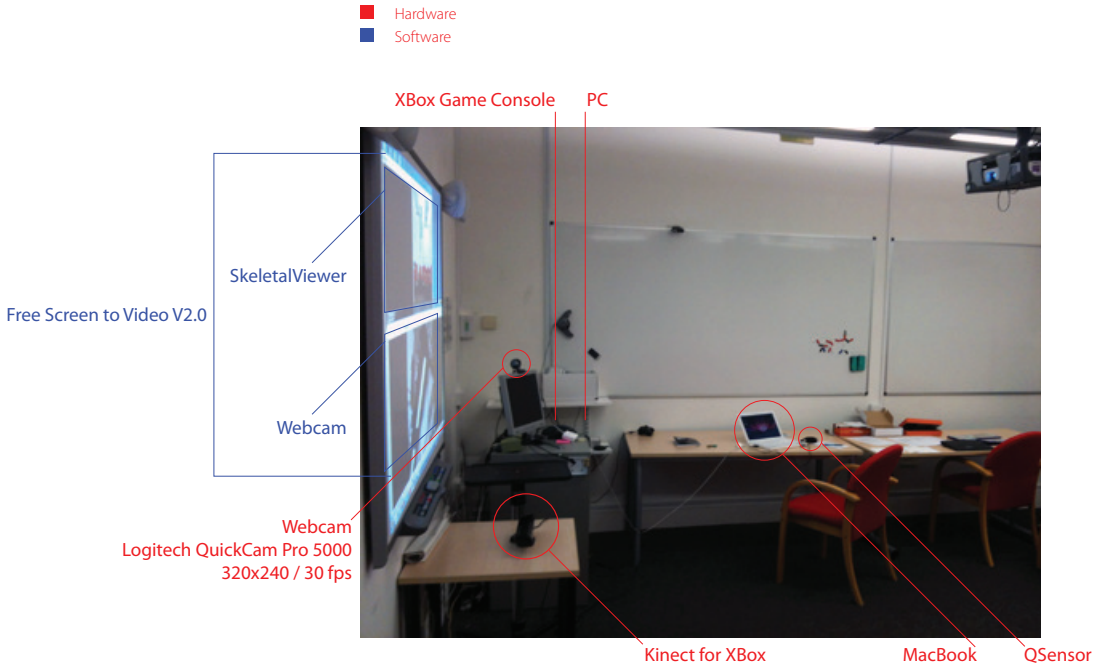

Figure 9: First set-up

4.2.1 TV-task

Based on the basic idea of simulating a TV-interaction in combination with available instruments, the initial solution was to use an available online platform, as iplayer from BBC or Netflix. The benefit of using the iplayer would have been that participants may have had knowledge about it, and therewith would react more naturally in their interaction with it. The drawback was that it has to be controlled by the mouse, which could have been problematic in regard to playing a convincing wizard-of-oz. That was the same for Netflix, which additionally demands a monthly fee for its service.

In trying to find a more convenient solution, the Apple Media Center seemed to be a good choice, as it can be controlled by a remote control and act as a TV interface. The fact that several

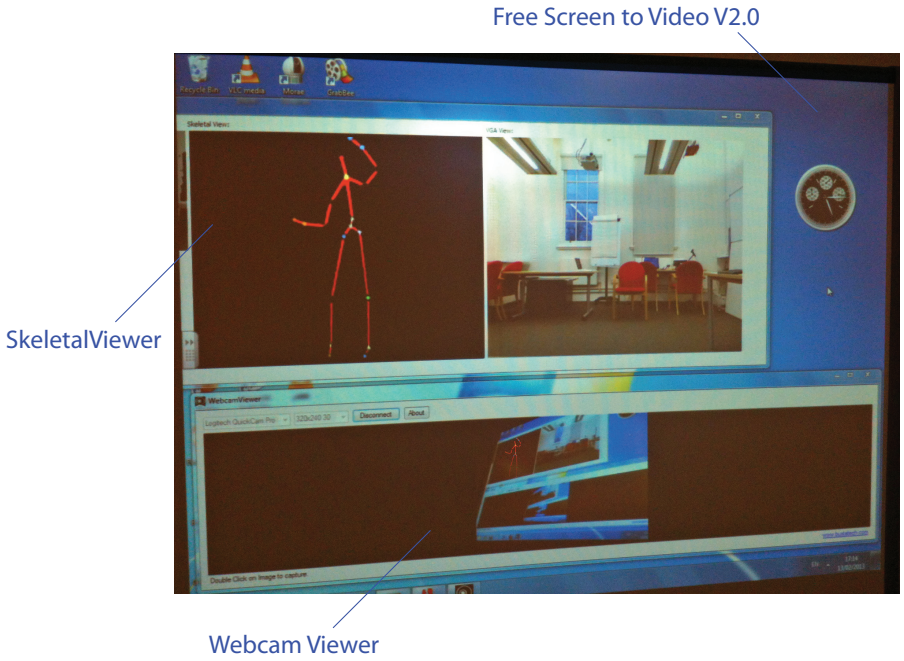

Figure 10: Video content recorded from scree

remote controls where available as backup, confirmed the choice of this solution. In being able to change the input to the overhead projector from PC to laptop and visa versa, it was possible to run the PC and screen recording in the background, while showing the Apple Media Centre to interact with. Subsequently, the following tasks were picked to design a TV experience:

1. Turn the TV on
2. Move downwards in the menu to the label "Podcasts"
3. Move upwards in the menu to the label "Movies"
4. Select "Movies"
5. Move upwards in the menu to the label "iTunes Top Films"
6. Select "iTunes Top Films"
7. Move downwards in the menu to the label "5th ranked Movie"
8. Select movie "5th ranked Movie"
9. Pause the movie
10. Play the movie
11. Increase the volume
12. Decrease the volume
13. Fast forward

14. Stop
15. Fast backward
16. Stop
17. Go back to the menu
18. Turn the TV off

4.2.2 Game task

Three XBox Game CDs were available at City University (Figure 11). Although the game task was not to record gestures, but more likely to provide a holistic gesture experience, the game should nevertheless be comparable and controlled between subjects. The adventure game was therefore not taken, as it may be difficult to control. The evaluation of a baseball game showed that it can be demanding, as the player both has to hit balls, catch balls and run from base to base. Although it might be fun and a good exercise, the intention was not to demand too much from participants. Also, not everybody might understand the concept of playing baseball. Bowling from the kinect sports CD seemed therefore to be a good choice. It is a familiar sport for both younger and older age groups, easy to control with six throws for everyone, and points can be compared.

Figure 11: Available Xbox games

Having decided on the TV-task and game-task, the next step was to design the sequence of events.

4.2.3 Sequence of events

Starting with charging devices and turning on computers, the XBox, and the overhead projector, the sequence of events started with the TV-task.

1. TV-task
   - Open SkeletalViewer
   - Open WebcamViewer
   - Open Free Screen to Video 2.0 (Records SkeletalView, Video, Sound, and Screen)
   - Plug kinect into PC

- Connect Laptop with screen adapter (Laptop screen is shown on overhead projector)
- Control Apple Media Center with the Apple Remote

2. Game task
   - Unplug Laptop
   - Unplug kinect from PC
   - Plug kinect into XBox
   - Choose PC on changer (XBox screen is showing on overhead projector)
   - Bowling game with six throws
3. Stop video recording

Having decided on the sequence of events, the next step was to test the experiment in subsequent pilot studies.

4.2.4 First pilot

The first pilot study revealed the need to control the experiment even more. Having a controlled set-up, also makes it possible to compare different groups. Another interesting lesson from the first pilot study was the researcher's placement in relation to the participant. In sitting too close to the first participant, the researcher was captured by the kinect as well. Moving on the other side, while having the second participant, problems with the remote control occurred, because the participant crossed the line between the researcher and his laptop, simulating the TV task. The pilot also revealed that participants needed a confirmation prior to the experiment that there were no right or wrong gestures.

4.2.5 Second pilot

Both changes in comparison to the first set-up are marked with a green star in Figure 12. The main lesson from the second pilot was to be aware of demanding situations, for example when wires had to be switched in the change from TV task to game task. Moreover, the opportunity of having a test person was used to estimate time used for the different tasks, as well as to evaluate a system to count bowling scores. Further improvements were made in regards to having open questions in the acceptance questionnaire.

4.2.6 Third pilot

The third pilot study revealed some improvements made in the questionnaire. Mostly in regards to structure and meaning, for example having all positive wordings first and then the negative, and not mixing them. One of the participants commented that situations should be captured, where participants have had a kinect, but do not use it. This question would to some extend reveal the acceptance of a gesture-based system. Nevertheless, to ask that question in an open interview situation would probably be better, as it may require additional questions to follow up on. Because closed questions were chosen, this question would require too many alternatives to rate. Alternatives could for example be seen in the fact that game-playing is a social activity, which could mean that your friend has a kinect. A follow up question would therefore be how

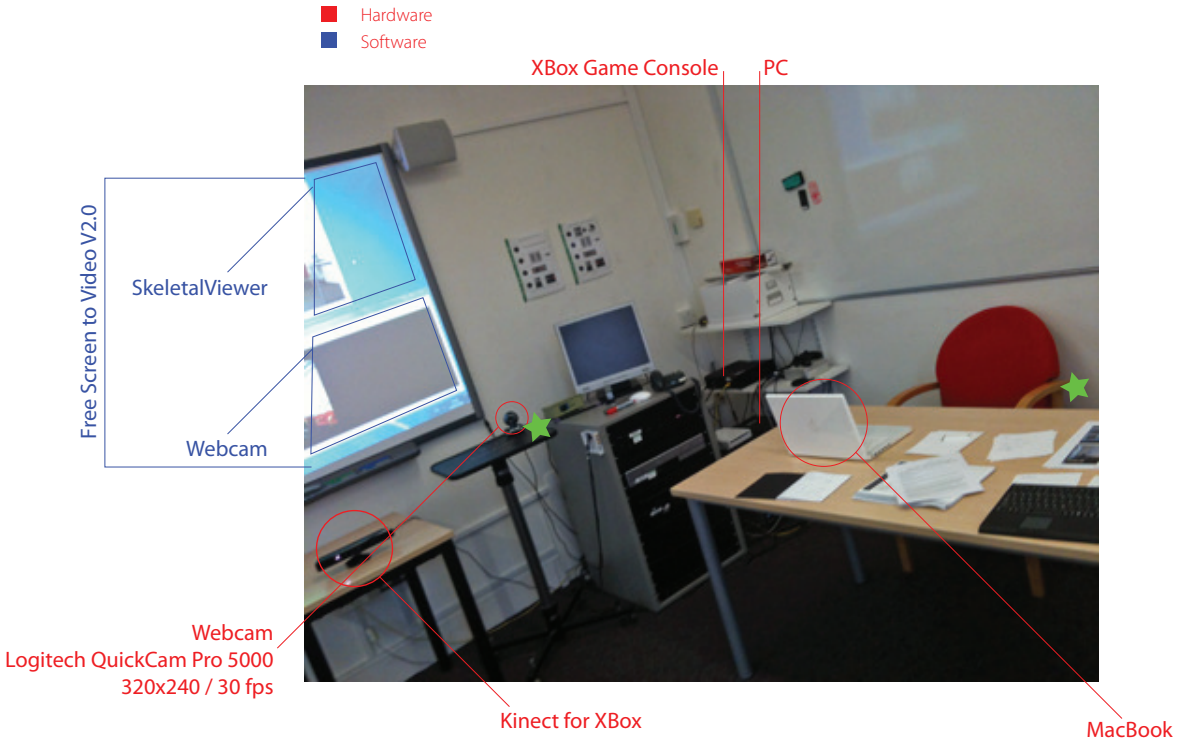

Figure 12: Second set-up

many times you visit your friend. Alternatively the question for how long participants had owned a kinect or wii was added. In comparing those answers with the answers given in the 3D-gesture usage rating, it would then be possible to cross-check answers. Once more were notes taken of the time used for the different tasks and the score chart was improved. On the basis of the time frames, it was then possible to estimate the time for the experiments to be around 20 minutes (Table 9), which was further used as information in posters, the information sheet, informed consent sheet, and a schedule of daily events for the test days.

Table 9: Time (min) spent per participant

Sequence	P1 (2. Pilot)	P1 (3. Pilot)	P2 (3. Pilot)	Average
Q 1	3	2	8	
TV	8	5	7	
Game	5	4	5	
Q 2	3	4	6	
Total	21	15	30	20

4.2.7 Camera-based gesture recognition

After having structured and tested the set-up, the next step was to implement a camera-based gesture recognition, as the SkeletalViewer just shows the outcomes of movements, but does not record them automatically. However, using the kinect for XBox for the SkeletalViewer in the TV-task, a second kinect was needed, which could be used as gesture recording device during the TV-task and then as kinect for the XBox during the game task (Table 10).

Recording gestures with a kinect for XBox can be done with the Software Brekel Kinect. The free software saves gestures as bvh (Biovision Hierarchy) files, which can be read by different 3D animation programs. Nevertheless, Brekel Kinect is a kinect hacked software, which is not necessarily supported or accepted by the already installed Windows kinect SDK on the used PC. Therefore, a second PC was required, to run the second kinect with the Brekel Software to capture gestures. The improved set-up, which was then used for the first test-series with the younger participants can be seen in the following Figure 13 and Figure 14. The green stars in Figure 13 are again showing the changes made.

Table 10: The usage of both kinects

	1. Kinect	2. Kinect
	Plugged into PC1 (SkeletalViewer)	Plugged into PC2 (Brekel Kinect)
TV	X	Y
	X	Change to XBox
Game	X	Z

In having two kinects, an ongoing problem with the WebcamViewer occurred during the recording. Because the error message was blocking the video captured by the SkeletalViewer, it was decided not to use the WebViewer during the experiment series.

4.2.8 Summary pilot studies

Conducting pilot studies prior to the experiment improved iteratively the chosen methods and structure of the set-up. It helped to estimate the time frames for the experiment and to schedule it. The QSensor showed valid results in being used as accelerometer device. Moreover the MacBook was used to fill out the questionnaires during the pilot studies. To have an additional device for the questionnaires during the experiment would be more convenient. Altogether, three pilot studies were conducted. The first pilot study was on the 5th of February 2013, with two participants. The second pilot study was on the 13th of February 2013, with one participant. The third pilot study was on the 19th of February 2013, with two participants. The informed consent forms are on file.

4.3 Vouchers

Getting participants to participate in studies can be difficult to achieve. To motivate participants vouchers may be a good solution to give something in exchange for peoples offered time, as well

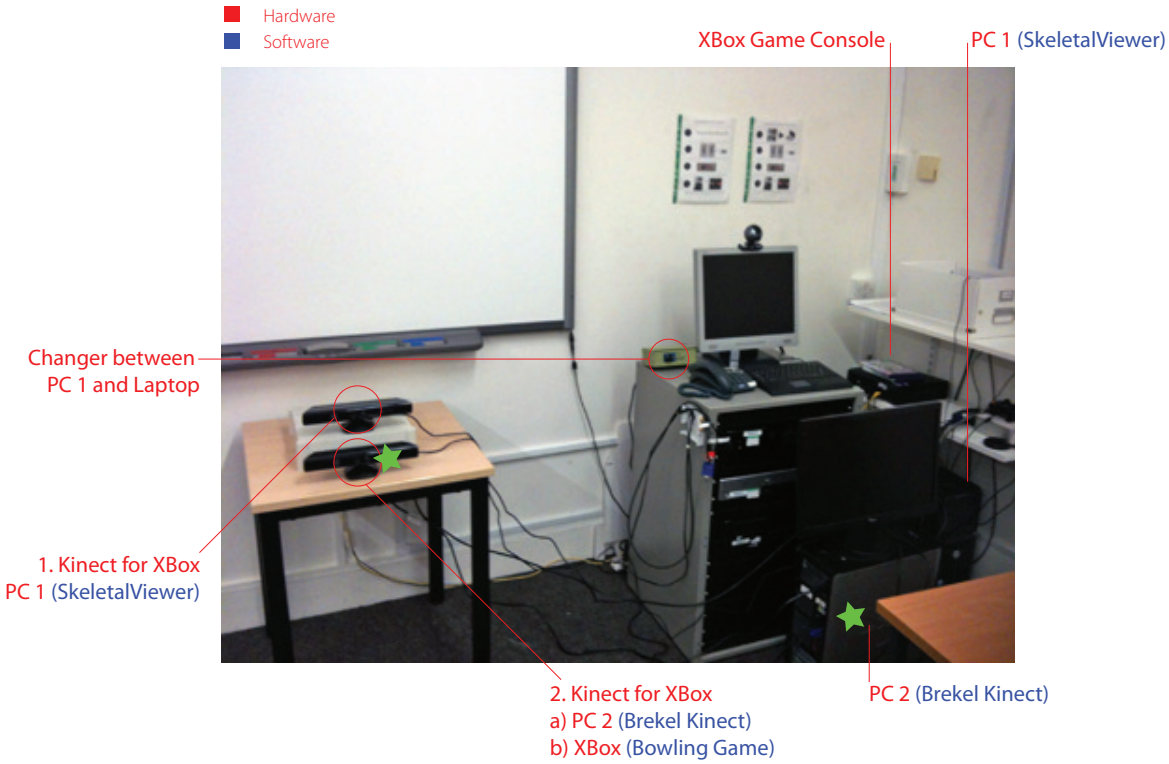

Figure 13: Third set-up

as appreciation. This project handed out cake vouchers, as they are something else then purely money, liked by both age groups, affordable, and the cake stall selling the cakes was located in the neighborhood. (Appendix 67 – Receipt 1; Appendix 68 – Receipt 2; Appendix G – Designed number system with claim codes).

4.4 First test series

The first experiments were running on Wednesday 27th, Thursday 28th of February 2013 and Friday 1st of March 2013. In total, 26 participants participated during those three days, of which 15 were males and 11 were females, all except two being right handed. 20 participants were under 30 years old and 6 participants over 30.

Seven participants from the hockey team, six participants from the centre for human computer interaction, four interaction design master students, one participant from the school of informatics, one participant working in the administration, and three participants from the department of health research. In addition four participants took part of whom two where asked on the hallway, and two where brought by another participant. None was above 50 years old. New time slots on the 13th, 14th and 15th of March, with the objective of finding participants above 50 were scheduled.

Figure 14: Third set-up with MacBook

4.4.1 Recruiting participants

The progress of getting participants is time consuming, certainly getting a certain amount of participants. The first test series was planned with participants from the younger age group, and then a second test series with participants from the older age group. Two weeks in advance of the first booked test series in the interaction lab, the search for participants started.

The hockey team was asked and email addresses were followed up from persons who have expressed interest in taking part. Starting by asking participants to write an email or call to arrange a suitable time was later improved by having a doodle link where participants could look for a suitable time slot themselves.

In addition social media channels such as twitter, facebook and linkedin were used to promote the research project. The researchers' twitter message was retweeted by three persons from the university to create a greater impact zone. Flyers in the University and a local library were hung up. One of the library employees told about St Luke's, a community centre close bye where the researcher could meet older people. Later on a meeting with their Service department was arranged.

4.4.2 Set-up

To capture movements, two kinects for XBox and the QSensor, which was tied around participants' dominant arm were used. One kinect was plugged into a PC running Windows 7. Here the software SkeletalViewer used the kinect to show participants' movements in a depth color window, a skeletal point window, and a color video window. All three windows where recorded during both interaction sessions by the software FreetoScreenVideo as Flash Video file. Additionally audio information was captured during both interaction tasks.

The second kinect was plugged into another PC running Windows 7, which ran the kinecthack Software Brekel Kinect. The movement data was captured as bvh files during the TV task. After the TV task the kinect was plugged into the XBox, which was used for the Bowling game. After the Bowling game the recording of both the SkeletalViewer and the QSensor was stopped.

A MacBook was used to simulate a TV by having a TV background picture. The screen was mirrored to the overhead and display canvas. An Apple Remote Control was used to simulate the gesture outcomes.

4.5 Second test series

The experiments ran on March 13th, 14th and 15th. In total 12 participants took part, one being 42 and 11 within the age range from 48-73 (8 females and 4 males). The majority of 8 participants were between 53-73. All participants were right handed.

Having participants coming from outside the University, it was necessary to provide the front desk employees a list with the researchers mobile number to contact when participants had arrived. Because the interaction lab was on the second floor, participants could choose between taking the stairs or the elevator. Different to the first test series participants could choose to use the ipad, Windows laptop or print-out questionnaire as alternative ways to answer the questionnaire. Moreover beverages and cookies were made available (Figure 15), and more cake vouchers had been purchased.

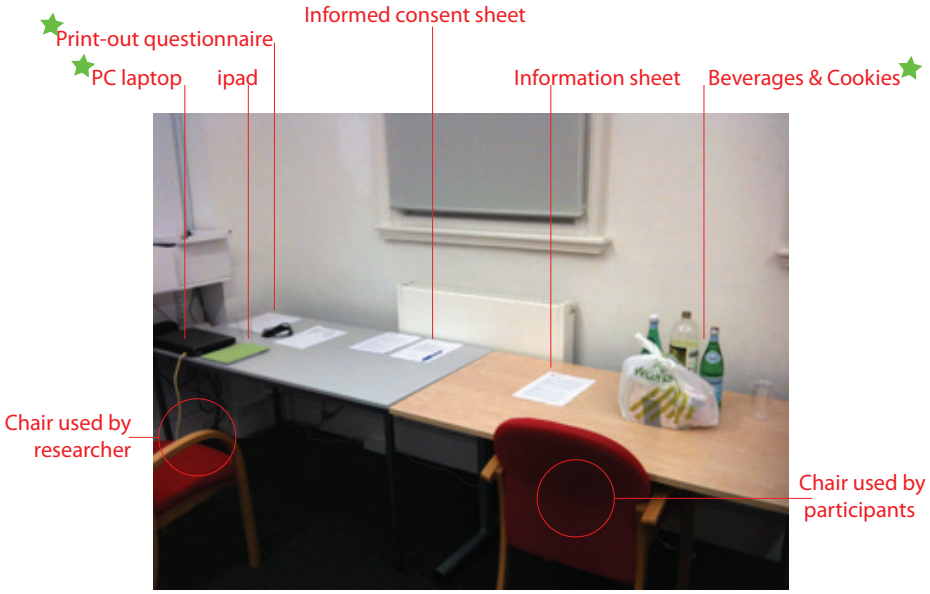

Figure 15: Prepared lab room for the older participants

4.5.1 Recruiting participants

Finding older participants can be challenging because of several reasons. London as a city itself and maybe the city district in particular is more inhabited by younger people. People over 50 are often very busy. Either having senior positions, or in general busy with their lives, which makes

it difficult to meet them in situations where they have time.

Because of insurance issues and existing cable spaghetti, it was not possible to move equipment outside the University facilities. Participants needed therefore to come to City University, which could be another barrier to find people in that age range. Participants were looked for inside the University, by hanging up 40 improved posters. Interested participants could use a QR-Code with a link to a new doodle schedule. In addition was the poster showing the researcher's email address and telephone number.

In general age can be a delicate factor for many and some may be offended if you assume them to be over 50, when they are not. Colleagues often don't know how old people are, and age may first be revealed if you know them very well.

Moreover, the contact to St Luke's community center was followed up. First via email and then with a second meeting. Chocolate was brought as a thank-you gift for the promotion of the project. Having one person with good knowledge of everybody at the center helped a lot in getting the possibility to introduce the project, as well as getting email addresses for further promotion.

In the end, twelve participants were recruited. Two from the centre of human computer interaction. Another city student was responding to the posters and one participant who had previously worked at the centre. From St Luke's 8 participants came.

4.5.2 Set-up

To capture movements the kinect for windows and the QSensor, which was again tied around participants dominant arms were used. The kinect for windows was plugged into a PC running Windows 7. The position of the kinect for Windows had to be changed to an approximate eye height, which was the same for every participant. A kinect for XBox, which during the first TV task was plugged into a second PC running Windows 7 was used. As in the previous set-up, the software SkeletalViewer was used to show participants movements in a depth color window, a skeletal point window, and a color video window. All three windows and audio information were recorded during the TV task with the software FreetoScreenVideo as Flash Video file.

Different to the previous set-up, the recording was stopped after the TV task, and then the kinect for XBox was plugged into the XBox to start the bowling game. The set-up can be seen in the Figure 16 bellow. In addition to the required changes by using the kinect for Windows, was a smaller table used for the placement of the researcher, as it was less restrictive in changing plugs (green stars).

Similar to the first set up, the MacBook was used to simulate a TV by having a TV background picture. The screen was mirrored to the overhead and display canvas. The Apple Remote Control was used to simulate the gesture outcomes. The image bellow shows the two PC screens, which had been in use during the test series. The screen above shows PC 1, running the GesturePak Software. The screen below shows PC 2, running the SkeletalViewer Software Figure 17.

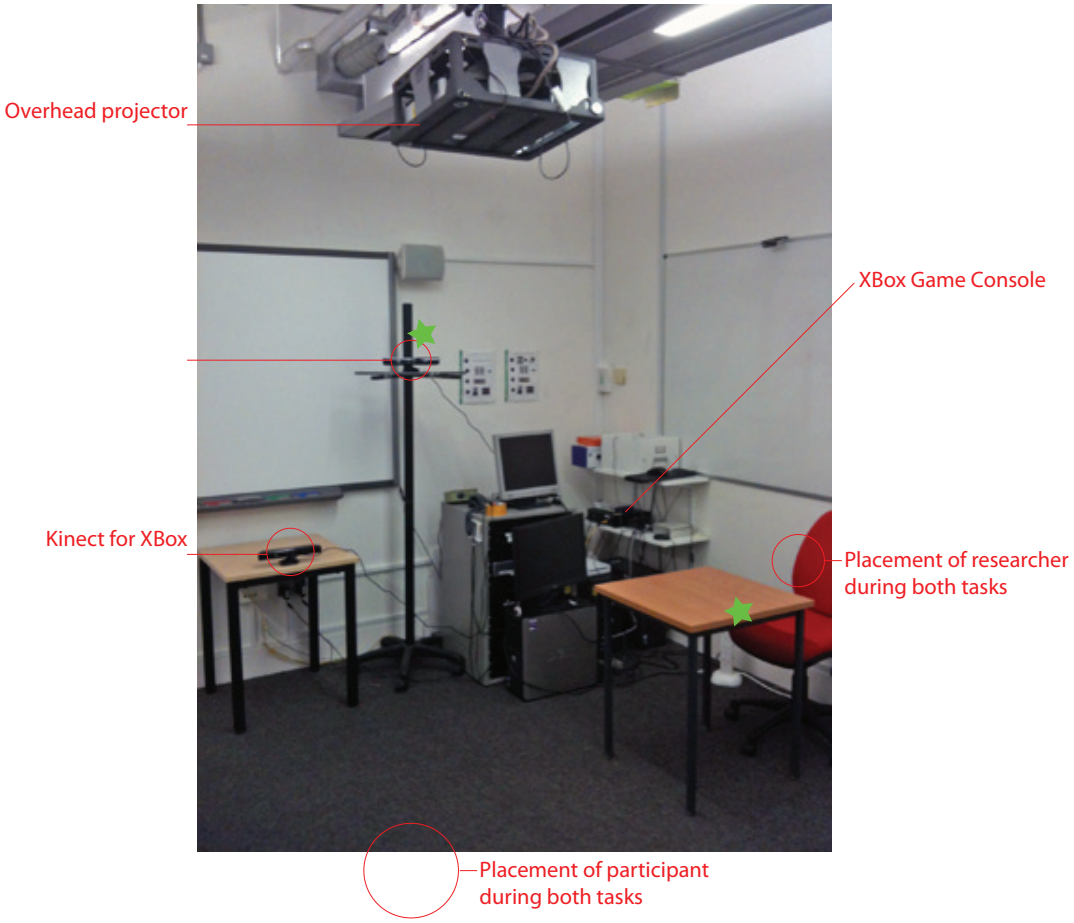

Figure 16: Set-up with the kinect for Windows

Figure 17: Researchers view on instruments during the second test series

5 Presentation and analysis of data

5.1 Demographics

A total of 38 people completed the final experimental session. 21 were aged 18-31, 11 between 48-73, and six who fell in-between the defined research group. The young group includes 12 male and nine female participants. The older group includes four male and seven female participants. All participants had previous experience with computer usage as the word cloud in Figure 18 is showing.

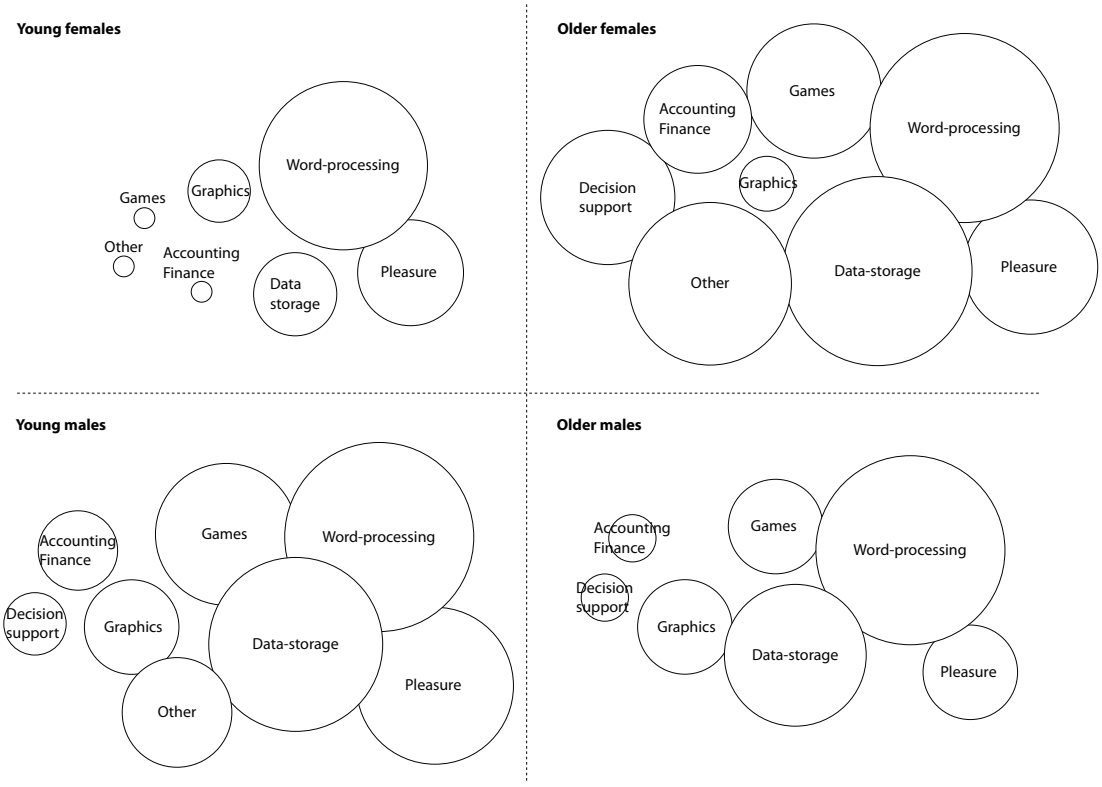

Figure 18: Word cloud of computer usage

Additionally were participants asked about their current position and chose between Arts and Social Science, Business, Engineering and Mathematical Science, Health Science, Informatics, Law, and Other. The areas followed programs at City University. Two participants from the younger age group chose "other", writing in the position as Researcher and Graphic Designer. Six participants from the older age group chose "other", writing in the position as Retired and University Lecturer.

The majority of participants had a background in informatics. Nevertheless, the amount of non-informatics respectively non-technical can oppose the amount of informatics.

5.2 Triangulation

Triangulation can bring together data from different sources [65], which can enrich the analysis by examining findings from different perspectives. This study is observing participants carrying out gestures in the video analysis and the quantitative material from the gesture recognition and the UTAUT2 questionnaire. Moreover are the open questions, the recording of verbal behaviors and the user experience scale analyzed.

5.3 Video analysis

In total 37 videos were captured. The total amount of analyzed videos was 31. 20 videos of the young age group, and 11 videos of the old age group. The captured Flash video files (flh) were then converted into mp4 video files by using the free software FLV Crunch. The converted video files could then be analyzed with the free software Subs Factory. Subs Factory was chosen as analyzing tool, because it has a timeline window, showing hours, minutes, seconds and milliseconds.

By opening and playing the videos in Subs Factory, gestures could then be marked according to their start and stop time. From that, gesture duration could be calculated. This time analysis was done for every video and transferred into an excel file per video. This excel sheet was then further used to script what was said during the TV-task.

Additionally, gestures were described and placed into either offline or online. Moreover, the excel file was used to record which arm the participant was using, and which gesture space the performed gesture required.

Together with the qualitative information of the open questions from the acceptance questionnaire, the excel file presents the analysis of the video files. The excel sheets can be seen in the Appendix Q. The results will be presented in the following subsections.

5.3.1 Verbal behavior

The results of the verbal behavior are divided into comments from the younger group, and a second list from the older group. Because participants were told that the researcher would not answer any questions during the TV-task, not everyone made comments. Nevertheless, this small representation of both participants in both age groups show similar enjoyment. The complete list can be found in the Appendix K.

Comments from the younger age group

- Cool
- Fun
- Great
- Amazing

Comments from the older age group

- Fun
- Amazing and intuitive
- Natural

5.3.2 Questionnaire responses

The presentation of the answers given in the open questions in the acceptance questionnaire are summarized responses. Participants were asked if they experienced any problems or issues, and if they would describe their experience as positive. The questionnaire was given to participants after they had absolved the TV- and game tasks. A complete list of all responses can be found in the Appendix L.

In using 3D gestures, did you experience any problems or issues?

Responses given by the younger age group (19 responses)

- No problems (eight participants)
- Minor problems (seven participants)
- Problems (four participants)

Responses given by the older age group (9 responses)

- No problems (four participants)
- Minor problems (three participants)
- Problems (two participants)

In using 3D gestures, would you describe your experience as positive?

Responses given by the younger age group (19 responses)

- Agree (19 participants)

Responses given by the older age group (11 responses)

- Agree (seven participants)
- Moderate agreement (four participants)

5.3.3 Online and offline gestures

The frequency of performed online or online gestures was calculated by using SPSS. Online gestures where coded as 1, and offline gestures 2. The results for each TV-task can be seen in Table 11.

5.3.4 Gesture space

The video analysis was also used to develop a gesture space grid system, to show the space volume each participant was using during the TV-task. The grid system was developed to show

Table 11: Frequency of online and offline gestures during the TV-task

Task	Online Gestures	Offline Gestures
Turn the TV on	20	11
Move downwards in the menu to the label "Podcasts"	27	4
Move upwards in the menu to the label "Movies"	29	2
Select "Movies"	8	23
Move upwards in the menu to the label "iTunes Top Films"	28	3
Select "iTunes Top Films"	9	22
Move downwards in the menu to the label "5th ranked Movie"	28	3
Select movie "5th ranked Movie"	9	22
Pause the movie	12	19
Play the movie	16	15
Increase the volume	30	1
Decrease the volume	30	1
Fast forward	28	3
Stop	10	20
Fast backward	29	2
Stop	10	21
Go back to the menu	24	6
Turn the TV off	23	7

hand-movements of the dominant arm along the axes x, y, and z. The coordinates were transformed into the excel file, and used for data visualization, which is presented in the visualization chapter 7.

5.4 Camera-based gesture recognition

During the first test-series with the younger age group, gestures were captured using the Brekel kinect software and a kinect for XBox. The captured files were saved as bvh (Biovision Hierarchy) files. From the 21 younger participants, 18 files in total were recorded. During the second test-series with the older age group, gestures were captured using the GesturePak software and a kinect for Window. The captured files were saved as xml (Extensible Markup Language) files. From the 11 older participants, six files in total were recorded.

Whereas Brekel kinect tracks every point of the body in regard to the 20 kinect points, GesturePak had the option to chose which points to be tracked (Figure 19). Because gestures were mainly made with the dominant arm, the selected tracking-points in the xml files include the x, y, and z position of the dominant arm and one point from the chest.

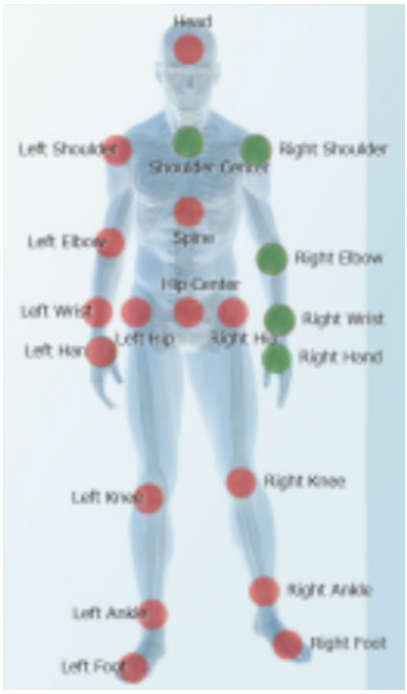

Figure 19: Chosen tracking points in GesturePak

5.5 Sensor-based gesture recognition

Participants were asked to wear the QSensor with the accelerometer sensor on their dominant arm during both interaction sessions. The captured files were saved as eda files, which here is used as short-form for electrodermal activity. The files could then be opened with the software Q, which is developed by the company behind the QSensor device [58]. The software has the option to export files as csv (Comma-separated values), which then can be imported to Excel. Time information was not available for every capturing, but was added to the software after an written enquiry (Appendix F).

The excel file included x, y, and z positions, captured every 500 milliseconds, starting to count from the actual time, for example 10:03:25,500 (h:t:m:s,ms). The factor time was further used to map gestures in the excel data. This was done with help from the video analysis, where the recording starting-point and gesture time-range was apparent. However, the gesture starting point had to be added to the video starting-point, because Subs Factory always started to count time form zero. Excel was used to do the calculations.

Furthermore, Excel was used to calculate the magnitude value of the x, y, and z values and present it as a graph. The magnitude value is showing the direction towards gravity. For instance, a negative value would indicate a "free fall", whereas a vertical up movement would draw a spike in the graph. The graph is showing time on the x-axis, and gravity on the y-axis. Moreover is every gesture performed in the TV-task marked with a starting line and dashed stoping line.

In total 34 eda files were captured. Subtracted by six files from the middle age group, and

one file from participant three who could not be analyzed because of the missing video, 27 files had been exported, and imported to Excel. The graphs outcome are shown in the Appendix R.

5.6 Bowling score results

Bowling is a game where a player has to throw a bowling ball towards ten pins which are placed in a triangular form. In the gaming tasks, players were asked to throw the bowling ball six times. The number of points, strikes and spares during the interaction were recorded. The player has a strike when all pins are cleared in one throw. Remaining pins can be cleared in a second throw, which would be a spare. If the player neither throws a strike or a spare, points of the cleared pins are counted. The final result is put together from cleared pins and its bonus system by the number of strikes and spares. To calculate the final result per participant, an Excel template [67] was downloaded and used.

The resulting number of points, strikes and spares was then analyzed in regard to gender, age and level of experience. The widespread and accessible software SPSS was used for the statistical analysis. In total, the results of 32 participants were analyzed, of which 16 were males and 16 females. Males had in sum, 665 points, 16 strikes and 10 spares with an median score of 38. Females had in sum, 653 points, 15 strikes and 11 spares, with an median score of 32.5.

Divided into age, the young group consisted of 21 participants, whereas the old group consisted of 11 participants. The median number of points of the young group was 33, whereas it was 40 for the old group. The highest number of points and strikes had one older female participant, with 98 points and 4 strikes.

The level of previous real life bowling experience was asked by the gesture experience questionnaire. Participants could rate on a 5-point Likert scale, between never, 1-2 times, under 10 times, and more than 20 times. Those five options were coded from 1 to 5 in SPSS, where 1 represented never, 2 rarely, 3 sometimes, 4 often and 5 many times.

In identifying relationship between points, strikes, spares, and experience, the Pearson's *r* correlation coefficient test can calculate if there is any significant relationship between those factors. The value of *r* ranges from –1.00 to 1.00 [28]. If a score between two factors is –1.0, it means that any increase in one of the factors, will predict a decrease in the score of the other factor. On the opposite, when a score between two factors is 1.0, it means that any increase in one of the factors, will predict a increase in the score of the other factor. When the score between two factors is 0, it means that there is no relationship between the two factors.

The analysis shows, that there is no relationship between previous experience and number of points, strikes or spares (Figure 20). However, strikes and spares are positive correlated towards the value of points, which makes sense. The best example would be the older female participant, who had the most points and highest number of strikes.

5.7 Previous Experience Questionnaire results

The first questionnaire asked participants about their previous experience with computers and technology, as well as experience in 3D- and touch-gestures. The personal information section asked participants for how long they had owned a kined or wii, as well as demographic data such as gender, age and profession. The following subsections present the respective results.

Correlations

		Points	Strikes	Spares	Experience
Points	Pearson Correlation	1	.877**	.337*	.028
	Sig. (1-tailed)		.000	.030	.440
	N	32	32	32	32
Strikes	Pearson Correlation	.877**	1	.029	.053
	Sig. (1-tailed)	.000		.437	.386
	N	32	32	32	32
Spares	Pearson Correlation	.337*	.029	1	-.018
	Sig. (1-tailed)	.030	.437		.461
	N	32	32	32	32
Experience	Pearson Correlation	.028	.053	-.018	1
	Sig. (1-tailed)	.440	.386	.461	
	N	32	32	32	32

**. Correlation is significant at the 0.01 level (1-tailed).
*. Correlation is significant at the 0.05 level (1-tailed).

Figure 20: Correlations between points, strikes, spares and level of previous experience

5.7.1 Experience in 3D-gesture usage

Participants were asked to rate their experience in 3D-gesture usage. They could rate on a 7-point Likert scale, between 1=not experienced, 2=1-3 months, 3=3-6 months, 4=6 months-1 year, 5=1-2 years, 6=2-3 years, and 7=More than 3 years. Those seven options were coded from 1 to 7 and sorted in Excel according to age and gender.

In regard to age, the younger age group has more experience (Figure 21). Seeing the level of experience in regard to gender, both young and old males claim to have more experience (Figure 22).

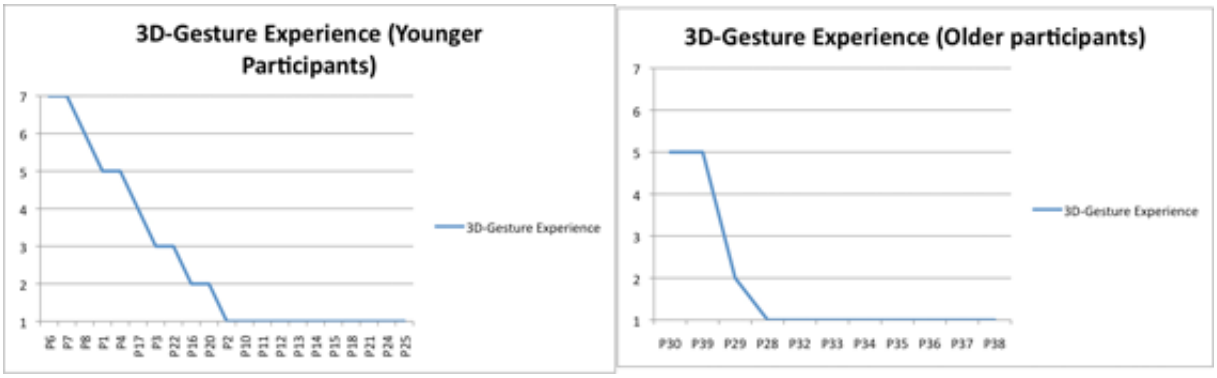

Figure 21: 3D-gesture experience divided by age

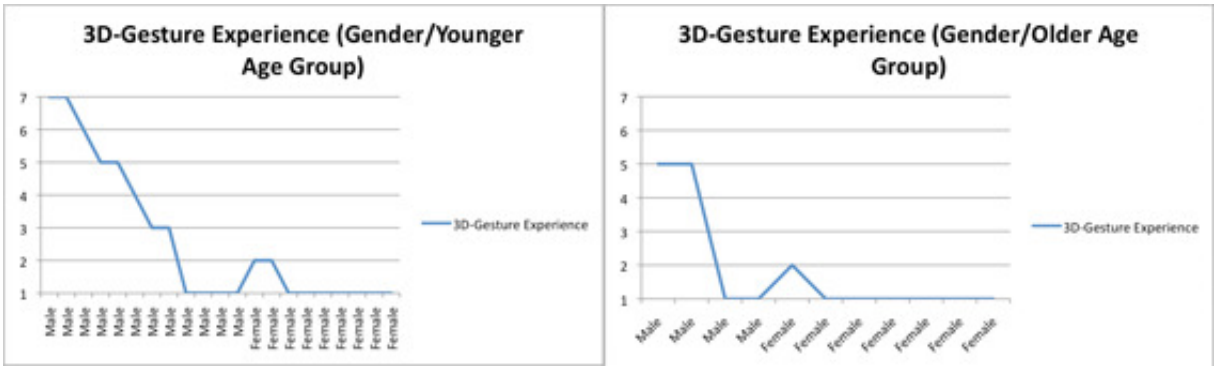

Figure 22: 3D-gesture experience divided by gender

5.7.2 Experience in touch gesture usage

In a second question, participants were asked to rate their experience in touch gesture usage. Again, they could rate on a 7-point Likert scale, between 1=not experienced, 2=1-3 months, 3=3-6 months, 4=6 months-1 year, 5=1-2 years, 6=2-3 years, and 7=More than 3 years. Those seven options were coded from 1 to 7 and sorted in Excel according to age and gender.

In regard to age, the distribution of touch gesture usage is more equally distributed (Figure 23). In regard to gender, the young age group seems to be equally distributed, whereas older females might have more experience in touch gesture usage than older males (Figure 24).

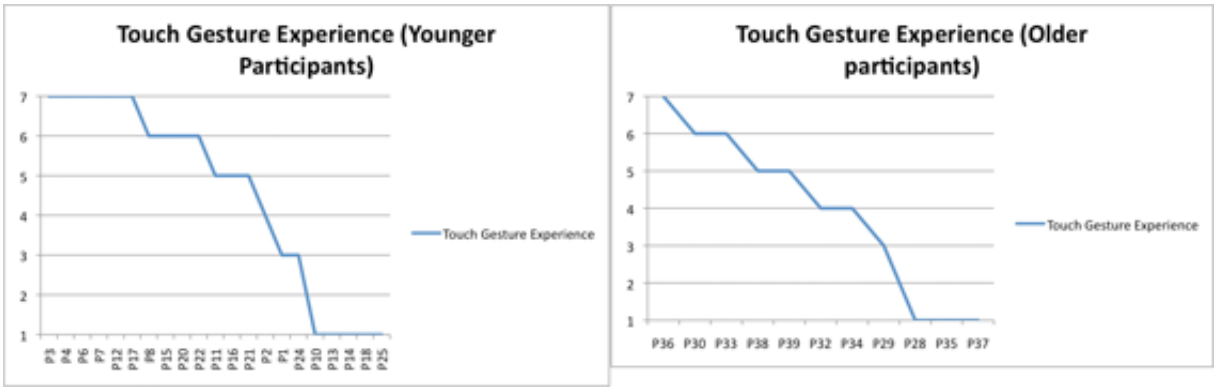

Figure 23: Touch gesture experience divided by age

5.7.3 Own game console

In the personal information section, participants were asked for how long they had owned a gesture-based game console. A Microsoft kinect and Wii represented a gesture-based game console. Participants could choose between I don't own a game console, just bought, 1 year, 2 years, and 3 years. SPSS was again used for the analysis, showing following results in Figure 25 and Figure 26. The majority does not own a game console. The ones who owned a game console, owned a Wii rather then a kinect. Furthermore male participants rather owned a game console

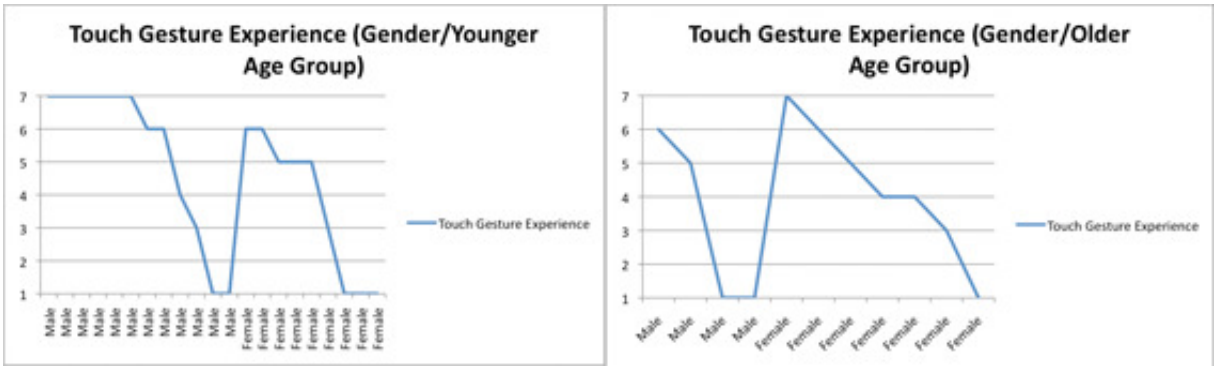

Figure 24: Touch gesture experience divided by gender

than females.

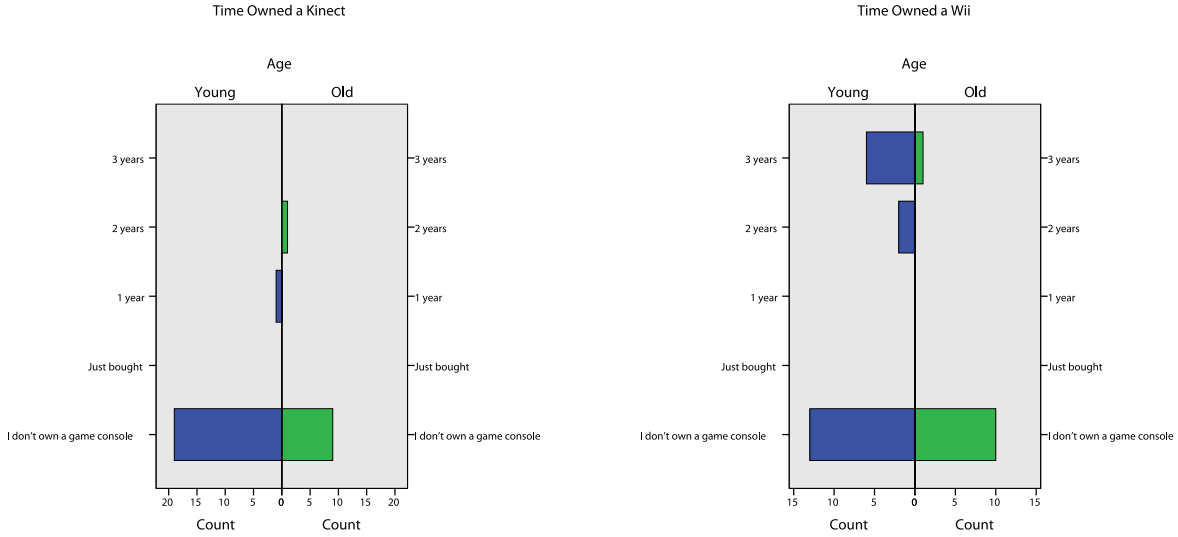

Figure 25: Own game console distributed in regard to age

5.8 Gesture Acceptance Questionnaire results

After the TV-task and game task participants were asked to fill in a questionnaire about their experience with those gesture based interactions. One section asked participants to scale different words or phrases, which described their current experience closest. Here participants could chose between Fun to use, Engaging, Easy to use, Helpful, Frustrating, Annoying, Boring, and Unnecessary. The range went from strongly disagree to strongly agree, and was coded from 1 to 5. Table 12 below present the frequency for each phrase.

The results show, that participants agree on gestures to be Fun to use, Engaging and Easy to use. Furthermore gestures are not perceived as Annoying or Boring. However, the relative high amount of participants answering undecided to the questions if gestures are perceived as Helpful,

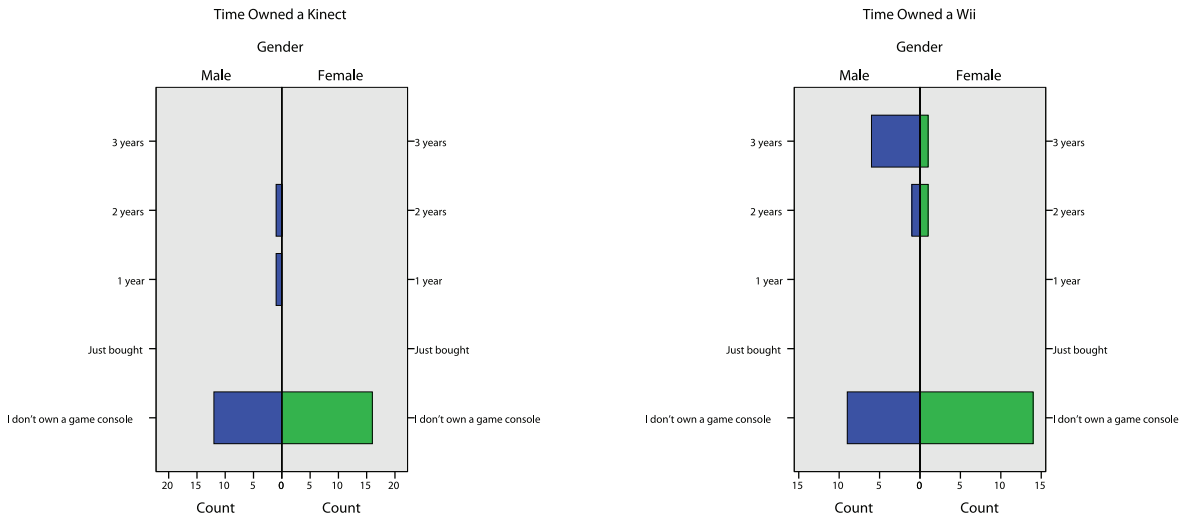

Figure 26: Own game console distributed in regard to gender

Frustrating and Unnecessary, might indicate less agreement to those wordings. Presenting the results in a graph shows that the modus of Helpful is placed on undecided (Figure 27). The factor helpful might therefore be the most critical towards a positive gesture experience.

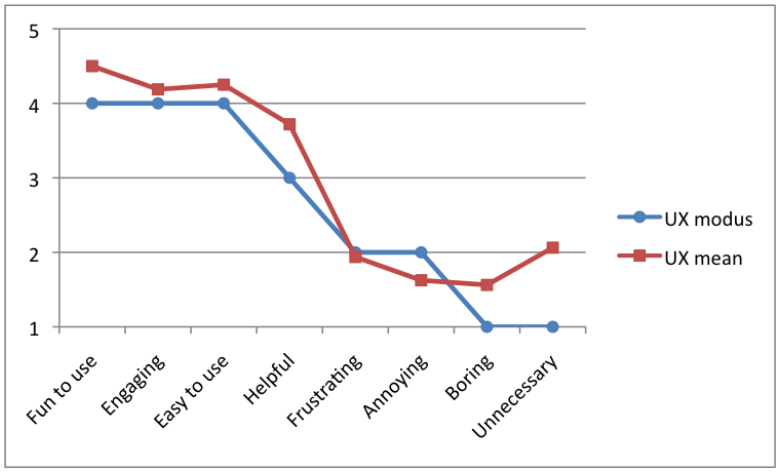

Figure 27: UX graph, showing modus and mean

5.9 UTAUT2

The response rate of the UTAUT2 questionnaire was 100 percent. The number of answers given in case of previous experience with Kinect games, Computer App games and PC games was 31 instead of 32. In regard to previous experience with Tablets or E-books was the number of answers given 30 out of 32. Furthermore did one participant not answer the second hedonic

Table 12: User Experience

	Strongly disagree - -	Disagree -	Undecided + -	Agree +	Strongly agree + +
Fun to use				16	16
Enganging			3	15	13
Easy to use		1		21	10
Helpful		1	13	12	6
Frustrating	9	16	7		
Annoying	14	16	2		
Boring	19	9	3	1	
Unnecessary	11	10	9	2	

motivation question.

5.9.1 Descriptive statistics

Results generated from the UTAUT2 questionnaire were again analyzed by using SPSS. Given the range of participants who participated in this research project and the relative big sample size the UTAUT2 model requires, descriptive statistics can be used to reflect the results from the sample used for this study [65]. Descriptive statistics describe data, which can be done by calculating the mean of the given answers (Table 13). The mean is the average of all data points and most commonly used in statistical analysis [68].

Given the range on a five-point scale from disagree to agree, Performance Expectancy ranged from 3.53 to 4.03. Effort Expectancy ranged from 3.97 to 4.44. Both ranges can be seen as high. Facilitating Conditions ranged from 2.91 to 4.13, showing a more moderate average. Hedonic Motivation ranged from 4.28 to 4.59. Behavioral Intention ranged from 3.91 to 4.28. The two latest constructs show again a high score. The respective standard deviations indicate how much variation there is from the mean. A low standard deviation indicates that data points are close to the mean, which proves the mean to be more reliable for the data set [36]. The standard deviations show nevertheless a normal distribution with a valid point of gravity.

5.9.2 Instrument reliability

The Cronbach's alpha test can be used to estimate to what extent all items within a single instrument yield similar results. The Cronbach's alpha is the most common used measure and calculates the mean of all possible split-half coefficients. The Cronbach's alpha value for all 15 items was calculated by using SPSS and was .833, indicating a high level of internal consistency for the scale within this specific sample.

In testing the constructs separately the Cronbach's alpha value indicated a negative value for the facilitating conditions -.012, which can be a reason of both using the mean as central point of tendency and having a relatively small sampling size. The further data analysis indicated that

Table 13: Descriptive analyzis

Survey items	Mean	Std. Deviation
[Performance Expectancy]		
PE1: Using gestures helps me accomplish things more quickly	3.84	.847
PE2: I find gestures useful in my daily life	4.03	.999
PE3: If I were to use gestures, I would increase my chances of completing an assigned task	3.53	1.047
[Effort Expectancy]		
EE1: Learning how to use gestures is easy for me	4.31	.693
EE2: My interaction with gestures is clear and understandable	3.97	.782
EE3: I find gestures easy to use	4.28	.772
EE4: It would be easy for me to become skillful at using gestures	4.44	.619
[Facilitating Conditions]		
FC1: I have the resources necessary to use gestures	3.88	1.385
FC2: I have the knowledge necessary to use gestures	4.13	.942
FC3: Gestures are not compatible with other systems I use	2.91	1.118
[Hedonic Motivation]		
HM1: Using gestures is fun	4.59	.560
HM2: Using gestures is enjoyable	4.45	.675
HM3: Using gestures is very entertaining	4.28	.813
[Behavioral Intention]		
BI1: I intend to continue using gestures in the future	4.28	.888
BI2: I plan to continue to use gestures frequently	3.91	.995

the data set in FC1 was not normal distributed, with 15.6 percent negative answers (disagree and 2), 15.6 percent neutral answers (3), and a peak with 68.8 percent positive answers (4 and agree). Additionally indicated the data set in FC3 a negatively skewed distribution.

However, the other constructs are indicating a high level of internal consistency (PE .671, EE .863, HM .914, BI .729) and reliability.

5.9.3 Relationships between variables

The Person's product-moment correlation was again used to discover relationships between the constructs and key moderators. Table 14 shows significant correlation between the constructs and a behavioral intention towards gesture usage. The Facilitating Condition shows a negative correlation between FC3 (Gestures are not compatible with other systems I use) and the first behavioral intention BI1 (I intend to continue using gestures in the future). Gender shows no

correlation. However, age is negative correlation towards hedonic motivation (HM1,2,3).

A positive correlation between experience and Effort Expectancy (EE) can be seen with the usage of Smartphone App games, Computer App games, and Smartphone. Facilitating Conditions (FC) are correlated with touch gestures, Wii games, Computer app games, PC games, and Smartphone. PC games is negative correlated with FC3 (Gestures are not compatible with other systems I use). Hedonic Motivation (HM) is correlated with PC games. Furthermore the correlation analysis reveals a negative correlation between hedonic motivation and age.

In addition shows the correlation analysis, that experience with Wii games is positive correlated towards a behavioral intention.

1 2

[1] ** Correlation is significant at the 0.01 level (1-tailed).

[2] * Correlation is significant at the 0.05 level (1-tailed).

Table 14: Correlation with Behavioral Intention

Constructs	BI1	BI2	PE1	PE2	PE3	EE1	EE2	EE3	EE4	FC1	FC2	FC3	HM1	HM2	HM3
PE1	.618**	.594**													
PE2	.389*	.587*													
PE3	.424**														
Age															
Gender															
EE1	.324*	.325*													
EE2															
EE3	.351*	.371*													
EE4	.356*	.331*													
Age															
Gender															
Smartphone App Games						.392*	.449*								
Computer App Games							.411*								
Smartphone						.306*									
FC1	.370*	.670*													
FC2	.419*	.357*													
FC3	-.395*														
Age															
Gender															
Touch											.338*				
Wii games											.399*				
Computer app games											.380*				
PC games												-.323*			
Smartphone												.317*			
Tablet											.369*				
HM1	.691*														
HM2	.685*														
HM3	.736**	.472**													
Age													-.302*	-.301*	-.337*
Gender															
PC Games														.350*	
Wii games	.324*	.328*													

6 Discussion

6.1 Gesture recognition

Camera-based gesture recognition

The camera-based gesture recognition initially used the kinect for XBox in cooperation with the software Brekel kinect. However, due to noisy data output, the second test series used a kinect for Windows in cooperation with GesturePak to capture gestures. Although the xml files from GesturePak are of better quality and can be more easily imported to other programs, such as Excel, they just capture x, y, and z values between two snapshots. The advantage of this approach is that the software can be used to develop specific gestures, without capturing too much data. The disadvantage is that a natural gesture flow can be difficult to capture, as the software needs to be interrupted to take snapshots. Also participants might try to adapt their gestures intensity until a picture is taken. However, the software is relatively inexpensive and the output can be used for further developments.

The video recordings from the kinect devices were also used in the analysis. The frequency analysis in the presentation chapter presented some interesting agreement on which gesture type was performed.

Online and offline gestures

The distinction between online and offline gestures was made with the following characteristics: Online or continuous gestures are iconic, navigational or dynamic. Offline or discrete gestures are deictic or static symbols.

The framework made it possible to place gestures to be online or offline. Iconic gestures could be simulating a remote control or turning the wrist to indicate that a button is turned around. Furthermore, primary metaphors as high means up and low means down were recorded as Iconic gestures. Dynamic commands are movements in one direction, maybe most similar to touch gestures, performed in a 3D-space. Navigational gestures are dynamic movements in a menu structure. Offline gestures were distinguished between Deictic and Static symbol gestures. Deictic gestures are pointing gestures towards the screen, indicating that something is clicked. Static symbols are signs given to the system. A prominent symbol was the open palm hand, indicating a stop sign. Static symbols were also performed and held in position until the action was performed.

The frequency analysis shows that participants performed online gestures to turn the TV on and off. Online gestures were also chosen when interacting with the menu, leaving the menu or playing the movie. The actions fast forward and fast backward also tended to be performed as online gestures. Interesting is the nearly 100 % agreement on using online gestures to increase or decrease the volume. Offline gestures were performed when conducting distinguished actions such as selecting or pausing the movie. The action "stop" was often performed as a static symbol gesture, pointing the open palm hand towards the screen. The pie charts in Figure 28 illustrate

the gravity points towards online (blue) or offline (green) gestures. Besides the order "play the movie", the charts advise that there were high agreement.

Online gestures

- (1) Turn the TV on
- (2) Move downwards in the menu to the label "Podcasts"
- (3) Move upwards in the menu to the label "Movies"
- (5) Move upwards in the menu to the label "iTunes Top Films"
- (7) Move downwards in the menu to the label "5th ranked Movie"
- (10) Play the movie
- (11) Increase the volume
- (12) Decrease the volume
- (13) Fast forward
- (15) Fast backward
- (17) Go back to the menu
- (18) Turn the TV off

Offline gestures

- (4) Select "Movies"
- (6) Select "iTunes Top Films"
- (8) Select movie "5th ranked Movie"
- (9) Pause the movie
- (14, 16) Stop

6.1.1 Sensor-based gesture recognition

The sensor-based gesture recognition used an accelerometer device, which continuously captured x, y, and z values. The benefit of the data output was that it could be further used for a visual presentation of the movement and the development of a binary detector. Nevertheless, the computed graphs from the QSensor accelerometer data revealed time and recording issues. Time had to be matched between the QSensor and the video recording, which was done manually by finding the start and stop time-points of each gesture. Moreover, data was captured every 500 milliseconds, which may cause deviation in the gesture sequences. Nevertheless, the graphs clarify gesture signatures which can be read and translated into gesture movements. For example the image in Figure 29 below shows how a circular gesture can be read from the data.

Individuals can be recognized according to the graphs. For example, participant 39 was per-

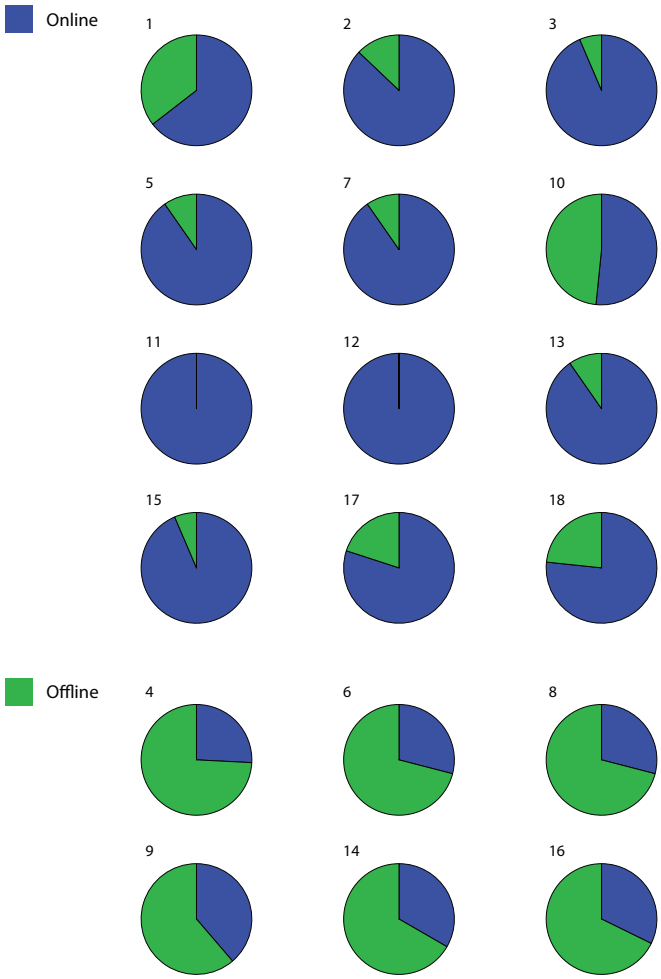

Figure 28: Frequencies online and offline gestures illustrated in pie chart

forming fast and powerful gestures, which is visible in the computed graph with both high positive and negative peaks. However, intensity in comparison to each of the graphs did not reveal any difference in regard to age, gender or experience.

The data issues indicate, that the capturing of only accelerometer data might not be good enough. For example, the magnitude graph does not show if gestures moved to the right or left. This may explain why common Smartphones in addition to accelerometer sensors use gyroscope-sensors to measure orientation. Although the magnitude value may not be good enough for all gestures, it can illustrate the functions of a detector, which is discussed further in the next section.

Binary detector

The binary detector was developed by using the standard correlation in Excel (Correl). The formula calculates if a window over selected magnitude values correlates.

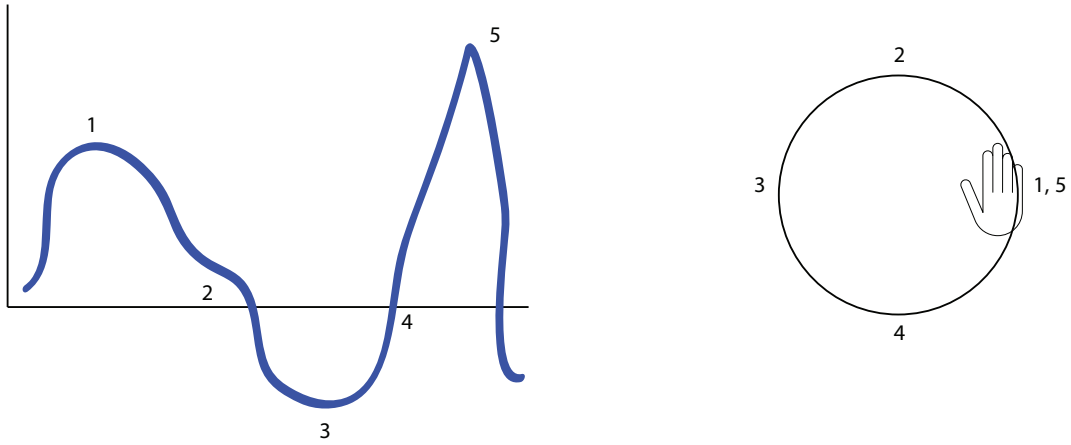

Figure 29: Magnitude graph indicating a circle gesture

$$Correl(x,y) = \frac{\sum(x-\overline{x})(y-\overline{y})}{\sqrt{\sum(x-\overline{x})^2(\sum y-\overline{y})^2}}$$

Several binary detectors can be used, as for example orientation in calculating angle differences and many more. However, the basic idea of a detector is to recognize signatures. The incoming data set is writing zeros, until the gesture is recognized and written as 1 (binary numeral system), which can give an electrical impuls. Some gestures may have a clear signature, which can be used to identify them in a data set.

The graph of participant 1 is used as an example. Gesture sequence number 2 (Turn the TV on (2nd time)) was used in the detector. The gesture sequence went from 10:09:20.386 to 10:03:23.838, which correspond to nine rows of data. The data in this window was then correlated to the whole dataset, resulting in being recognized seven times. This means that the detector detected one true positive and six false positives. Gesture sequence number 4 (Move upwards in the menu to the label "movies") is used as second example, as the magnitude value is showing a higher spike. The gesture sequence went from 10:09:40.826 to 10:09:45.327, which correspond to 11 rows of data. Here, the detector detected only one true positive.

The advantages of the developed detector are that it detects a correlation between a template and a sequence of action. In addition, the detector is adaptable in regard to range and sequence, which makes it flexible and easy to use. For example, the sequence could be made blurrier by removing numbers or conversely rounding up. On the other hand, the detector struggles in case of changed values or if the chosen values are too flat, as sequence number 2 showed with six false positives.

The detector also suits offline gestures, as it would read the incoming x, y, and z values from a gesture interaction and for example return a true positive, which releases an action. Online gestures on the other hand are much harder to detect, since they need an initiation phase, like touching a surface when interacting with a touch gesture based system.

6.2 Gesture-based interaction and human factors

To begin with, participants expressed concerns about not knowing which gestures to perform in the open questions. The relatively short session shows nevertheless, that the interplay between the participant on one hand and the simulated system by the wizard-of-oz on the other hand, was learned quickly by the participants. For example, participant 18 said that "*. . . got better as I used it more*" or participant 39 answered "I had a positive experience *. . . after some practice*. This can furthermore lead to the assumption, that people can adapt to a gesture based interaction technique relatively quickly.

On the other hand, some participants experienced problems with the system, not knowing that it was controlled by the wizard-of-oz. For example participant 20 was worried that the system had not detected her. Participant 21 described her negative experience as *. . . some movements were over the top which made some actions unrecognizable*. The answer of participant 33 *I wanted and tried unsuccessfully to move up and down several menu items in one gesture; I'm not sure if that is possible* was difficult to simulate. In a menu-navigation, the wizard-of-oz had to simulate constraints. Nevertheless, in observing people dealing with this constraints can confirm the assumption that people adapt quickly.

Also, people answered that they might not want too many gestures to interact with a system. Not necessarily because it would be more difficult to learn or to remember all the gestures, but because it can be challenging for the participant to come up with fitting gestures. Having no clear instructions was experienced as negative. All those findings may be important success-factors for 3D-gesture developments.

The verbal behavior showed, that the younger age group often was concerned if they did "ok" after the TV-task. On one hand, this reaction can be affected by having a laboratory set-up, which might indicate to participants that their individual performance is measured. On the other hand, this behavior might be a normal human reaction when interacting with an unknown system. From this, it could be argued that new technological systems need a way to confirm to users that they did "ok" or that they need to improve. To design for motivation has been done in gaming or for the social web [69], and can improve an ongoing participation as well as accept.

Although the general purpose of computer usage was asked for in the questionnaire, it was not part of the experience correlation because the primary concern was gesture usage. Nevertheless, the data shows that particularly the older age group used a computer for a variation of tasks by selecting and describing "other" as a purpose option for computer usage. The descriptions ranged from social networking to Skype, and from holiday planning to editing video. It shows clearly that although having less technological experience, the older age group still used the computer for a variety of tasks. Hence, when designing a 3D-gesture system, the tool itself should be designed for a usage and the targeted users, not the technology.

6.3 Hypothesis

This research project investigated hypothesis within previous experience and gesture acceptance, which are discussed in the following subsections.

6.3.1 Previous experience

Young males seem to have more experience with 3D-gesture usage than young females or the older age group. In regard to the experience with touch gesture usage, older males seem to have the least experience, whereas the younger age group and older females have similar levels of experience. The time period participants had owned a kinect or wii game console was also measured. The findings indicate that young males have owned a wii game console the longest. The majority had not owned a kinect or a wii game console.

Previous experience was related to performed gestures. In discussing performed gestures in light of gesture recognition, it is important to distinguish between online and offline gestures as they require different gesture recognition. Offline gestures define meaning after the gesture is performed. Online gestures, on the other hand, define meaning while they are performed. Online gestures might therefore be closest related to a natural interaction, whereas offline gestures still represent pointing gestures. The discussion about the naturalness of gesture recognition systems has been ongoing [20], but points towards the interesting question of which kind of gestures people perform.

The characteristic of performed online and offline gesture was counted from the excel sheets. Although participants performed gestures of all categories (Online: Iconic, Dynamic, and Navigational; Offline: Deictic and Static symbols), differences were detected. Young males and old females performed mostly deictic gestures, whereas young females performed more iconic gestures. Old males on the other hand performed more dynamic gestures.

The simulation of the system may have had an influence on which gestures participants performed. For example the upper menu list of the Apple menu was showing on the canvas screen. No indications were given as to which gesture to perform. Factors as how participants felt with the concept of a gesture-based interaction and their different mental models can have had an influence on which gestures they performed.

For example, participants 28 and 20 performed iconic gestures when simulating a remote control. Participant 28 was imagining her TV at home to perform the required gestures. Participant 20 asked after the second task "*Like I was holding a remote control?*". A primary success in an early task might indicate to participants to continue using this "first-guess gesture", as participant 20 did throughout the task. Other participants tried to challenge the system by trying out different gestures for the same kind of command, as for example participant 6, when holding his ear to increase volume and placing his index-finger on the mouth to decrease volume. However, this may also be an indication on how secure you feel in the interaction with technology.

The gesture analysis shows further that almost every participant used his or her dominant arm to perform gestures. This can be interesting in regard to a watch-like device on the wrist sensing gestures, as it will show a high reliability. Additionally, participants tended to have a starting position to perform a gesture to which they returned after the gesture was performed. This could be used as an initiation phase for online gestures.

Although the data shows differences between younger and older participants, respectively between male and female participants, this project could not identify significant differences in age, gender or experience, which influenced performed gestures.

6.3.2 Gesture acceptance

The presentation of the verbal behaviors shows that both the younger and older age group enjoyed the gesture interaction. It seems that the older age group primarily liked that the interaction was intuitive and natural. This finding can indicate that when gestures are experienced as natural, an interaction is experienced as very positive. It also shows, that a positive user experience score can lead to a purchase intention, as participant 14 is saying "*Are they selling it already?*".

The answers given to the open question if the 3D-gesture usage was experienced as positive, shows that both age groups had a positive experience. Young males seem to have a more mature and restrictive opinion about the usage of 3D-gestures. For example, participant 4 mentions that . . . *for games and pleasure activities it is really good* . . . or participant 13 says . . . *no need for controllers which may be dirty or broken.* whereas participant 7 excludes a 3D-gesture usage when tired or feeling lazy. This can of course again prove that young males have more experience with the usage of 3D-gestures. In comparison to the younger age group, the data shows that older participants had a ambivalent experience, because they worried about how the technology and usage of 3D-gestures would affect their every-day lives.

The analysis of both the verbal behaviors and answers to the open questions do however not show differences in regard to gender.

The result from the user experience scale shows no significant differences in comparison to age, gender or previous experience. The scale nevertheless indicates that participants vary in their experience in regarding gestures as helpful and/or unnecessary. For 3D-gesture development companies, those factors could be important success-factors for the acceptance of 3D-gestures. 3D-gesture acceptance was also investigated with the UTAUT2 research model in the next section.

UTAUT2 Questionnaire

The significance of factors was tested by establishing hypothesis (Table 15), which followed the UTAUT2 [1] research model.

The hypothesis H1 was found to be significant, whereas age H1a and gender H1b had no influence as moderators. The significance means that participants who believed in gestures to be helpful, most likely tend to have a higher intention of using gestures. Neither age or gender had a significant influence on the correlation between performance expectancy and behavioral intention.

Moreover, the hypothesis H2 was found to be significant. Age H2a and gender H2b had again no influence as moderators. The significance means that participants who associated the system with being easy, most likely tend to have a higher intention of using gestures. Participants who had a higher level of experience with Smartphone App games, Computer App games, and Smartphones' associated the system with being easier.

Additionally, hypothesis H3 was found to be significant, with nonsignificant moderators age H3a and gender H3b. The significance means that when a participant believed in a supporting infrastructure, he or she would tend to have a higher intention of using gestures. The negative significance in the 3rd facilitating condition means that an increase in that factor, will predict a

decrease in the intention of using gestures. FC3 asked participants if gestures were not compatible with other systems they used. If gestures would be compatible with other systems, it would mean that the intention of using gestures decreases. This might indicate that participants are not sure if existing systems would provide a satisfying infrastructure to use gestures. However, the correlation analysis just found BI1 to be significant, with a relative weak correlation (the weaker the relation, the closer the value to 0 [36]). Experience with Wii games, Computer App games, Smartphone and Tablet showed a positive correlation, whereas PC game experience showed a negative correlation.

Furthermore, hypothesis H4 was significant. The significance means that an increase in having fun or pleasure with a gesture-based system, will predict an increase in the intention of using gestures. Gender H4a was found to be nonsignificant, whereas age H4b showed a negative correlation. This means, that an increase in age, will predict a decrease in perceived enjoyment with gestures. PC games showed moreover a positive correlation towards the enjoyment with gestures.

Lastly, hypothesis H5 showed a positive correlation between Wii game experience and the intention of using gestures.

The analysis shows that experience with certain devices has an influence on the UTAUT constructs. Especially experience with Wii games is positively correlated with a behavioral intention of using gestures. Gender as another key moderator has not shown any correlations with the UTAUT constructs. Age on the other hand was negatively correlated with hedonic motivation.

The conclusion might therefore indicate that experience with certain devices is influential on the acceptance of performing gestures. Gender was not found to have a specific influence on 3D-gesture acceptance. Furthermore, younger people tend to enjoy gestures more than older people, although the analysis was showing a weak correlation. Nevertheless, the other constructs correlate positively with the behavioral intention of using gestures, which might indicate that older adults prioritize to have a system which is helpful, easy and supporting, whereas the younger group also requires the system to be fun.

Table 15: Summary of UTAUT findings

No	Dependent variables	Independent variables	Moderators	Significance
H1	Behavioral Intention	Performance Expectancy	None	Significant
H1a	Behavioral Intention	Performance Expectancy	Age	Nonsignificant
H1b	Behavioral Intention	Performance Expectancy	Gender	Nonsignificant
H2	Behavioral Intention	Effort Expectancy	None	Significant
H2a	Behavioral Intention	Effort Expectancy	Age	Nonsignificant
H2b	Behavioral Intention	Effort Expectancy	Gender	Nonsignificant
H2c	Behavioral Intention	Effort Expectancy	Experience	Significant for Smartphone App games, Computer App games, and Smartphone
H3	Behavioral Intention	Facilitating Conditions	None	Significant
H3a	Behavioral Intention	Facilitating Conditions	Age	Nonsignificant
H3b	Behavioral Intention	Facilitating Conditions	Gender	Nonsignificant
H3c	Behavioral Intention	Facilitating Conditions	Experience	Significant for Wii games, Computer App games, Smartphone and Tablet. Negative Significance for PC games
H4	Behavioral Intention	Hedonic Motivation	None	Significant
H4a	Behavioral Intention	Hedonic Motivation	Age	Negative significant
H4b	Behavioral Intention	Hedonic Motivation	Gender	Nonsignificant
H4c	Behavioral Intention	Hedonic Motivation	Experience	Significant for PC games
H5	Behavioral Intention	Experience	None	Significant for Wii games

7 Data visualization

7.1 Introduction

In analyzing the TV-task video recordings, the required space for different gestures, performed by different people, was varying. In the comparison between a younger and older age group, and between males and females, the basic question was how to visualize potential differences between those four groups, and how gesture space should be calibrated.

7.2 Data visualization

The goal of data visualization is efficient communication, with the challenge to find the right amount of data to convey the most information. The inclusion of too many details can add more complexity than necessary, and cause the viewer to miss what is most important [70]. Most important to show was if gestures were performed by a young or old, male or female person. Also the gesture volume the participant was using is important information.

7.3 Methodology

Gestures are in general movements in space and numerically expressed through values along the three axes x, y, and z (3D). Time is an additional value providing information on when the gesture starts and stops.

7.3.1 Gesture space raster

Although human bodies can be very diverse, structural proportions can be used to part a body. For example, the size of a head can be placed eight times along the vertical length of a body as indicated in Figure 30.

Because the video frames are just showing the participants' upper body, the division in five parts is sufficient (Figure 31). If the arm then is moved 90 degrees towards the head, another 4 parts can be placed towards the side and 2 parts above the head (Figure 32).

Including the extremities can nevertheless be too accurate, because it is based upon a theoretical ideal of a static and non-moving human body. Because the video was showing humans in movement, and the accurate partition caused overlap (red circles), which again made it difficult to place gestures, the partition into three parts to the side and one to the top was sufficient. The sum of all parts are further shown in the following grid, into which gestures can be placed in regard to their x and y position (Figure 33).

In being able to position gestures along the x and y axis, the next step was to include the z axis. In the video material, gesture movements are shown towards the screen. This makes it again difficult to have an accurate grid structure. Nevertheless, distances can be positioned being close to the body (0), at middle distance (1), and at long distance (2) (Figure 34) with approximately 0-20 cm (0), 20-40 cm (1), and 40-60 cm (2).

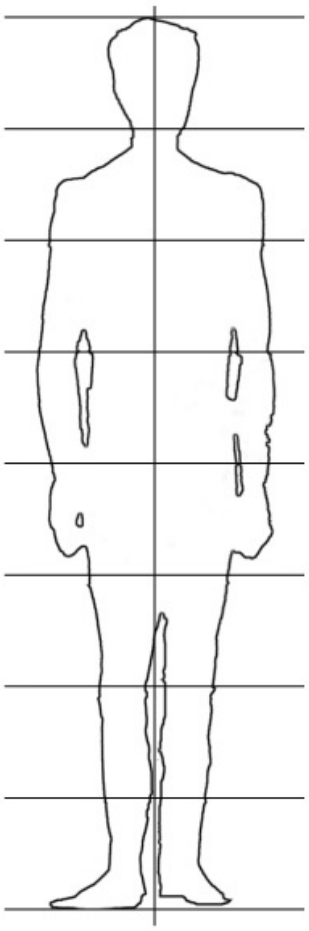

Figure 30: Human body with the proportion of 8 times the head

7.3.2 Using the grid - Data collection

Having a 3-dimensional grid structure, gestures could now be positioned through space. For example participant 38 was in turning the TV on, moving her hand from (x,y,z) r5,1,0 to r5,4,1, to r5,6,2 as indicated in the following figure Figure 35. The data collection was done for all participants and for every task, and then transferred into the analysis excel file (Appendix Q).

7.3.3 Collapsing 3D into 2D

Having analyzed every gesture and placed them into the x, y, z grid, it was now possible to visualize the data.

An image can have three dimensions, and was therefore chosen as format for the visualization. The x and y axis positioned the gesture, whereas the z position differed in size. In general a dimension can vary in size, value, texture, color, orientation, or shape [71]. Size was chosen as a consequence of gestures made towards the viewer and the increased space volume away from the body. This can be explained by looking on the following top-down image in Figure 36. In the

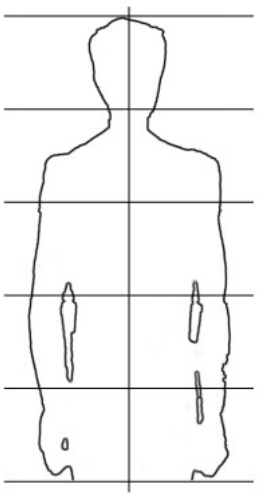

Figure 31: Human upper body with the proportion of 5 times the head

figure it is clearly visible that gestures can be made along the x axis from left to right, and away from the body along the z axis in the distance ranges 0, 1, and 2.

Flattening the gesture space into the seven three divided sections, illustrates again why size was chosen as mode to draw the z-dimension (Figure 37). Less gesture space is required close to the body, which increases in size away from the body. Furthermore the image describes why gesture spaces are drawn as layers upon each other.

Moreover layers are drawn with a twenty percent visibility, which makes background layers visible (Figure 38). The opacity indicates if sections have been less or more distinct. Less distinct will be marked as blurry, while more distinct will be marked sharply. This leads to the claim that blurriness or darkness can be used as indication of how often a participant has used a section in the gesture-interaction. Because all gestures performed in the eighteen TV-tasks lay on each other, a maximum color indicates big space volume and visa versa.

Of course, if layers had been drawn with hundred percent opacity shown in Figure 39, just the top-layer would be visible. This visualization is not useful as it does not show how much a section was distinct. The distinction is indicated by the histograms in the shown image.

Another option would have been to draw marks as outline, as figure Figure 40 is showing. The outer ring here is biggest, and visualizes more space. However, the grid was designed as indication of space, and how gestures occurred within this space. Adding more complexity to the drawing, can distract the basic message of how much space was required. By removing unnecessary information, a visualization demands a lower cognitive load.

3D-volume is cumulative by summarizing all z-sections from 0-60 cm as the arm will be throughout all sections. To visualize for instance a basic gesture as in Figure 41 with an out-stretched arm as the outline drawing (a), would distract the message that space is also required from 0-40 cm (b). To visualize marks as fill is therefore more valid and makes it easier to read where the most exposed areas are.

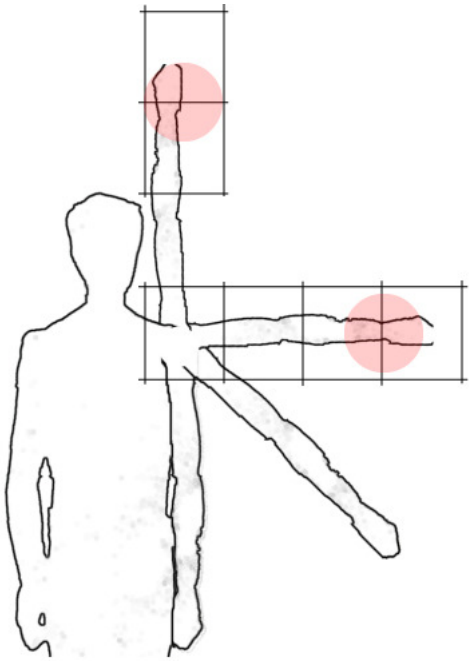

Figure 32: Human upper body with the proportions to the side and to the top

A second argument in favor of having a fill rather then an outline will be the fact that the z-dimension is produced by a variation in light energy, which on a paper medium can be produced by variation in size or value [71]. In using size as the indicator, a bigger fill (z=2) is producing less light energy, which means being closer to the viewer. In contrast, a smaller fill (z=0) is producing more light energy, which means being further away from the viewer. As gestures are made towards the screen (camera), the argument is valid.

From this it is clear that the x and y axis are used to have a mark at the top/bottom, to the right/left, whereas z is indicated as a fill in three different sizes according to z0, z1, or z2.

7.4 Presentation

To visualize age and gender, an easy system was designed. Circles are used for the young age group, whereas squares with round edges are used for the old age group. A gap on the top is used for females, whereas a gap on the right side indicates males. In addition three different sizes are used for the z values (Figure 42).

Moreover, an outline of the human body and metadata in form of a number indicated the amount of captures within that square used as visual cues in the visualizations. Contrary to gesture space shown for every participant in the appendix, the image here in Figure 43 is showing a collective of the young females, young males, old females, and old males. The collective consists of nine young females, ten young males, seven old females, and four old males. The young male participants p7 and p12 are excluded, because they both were left handed.

Appendix M shows gesture space for young females; Appendix N for young males; Appendix O

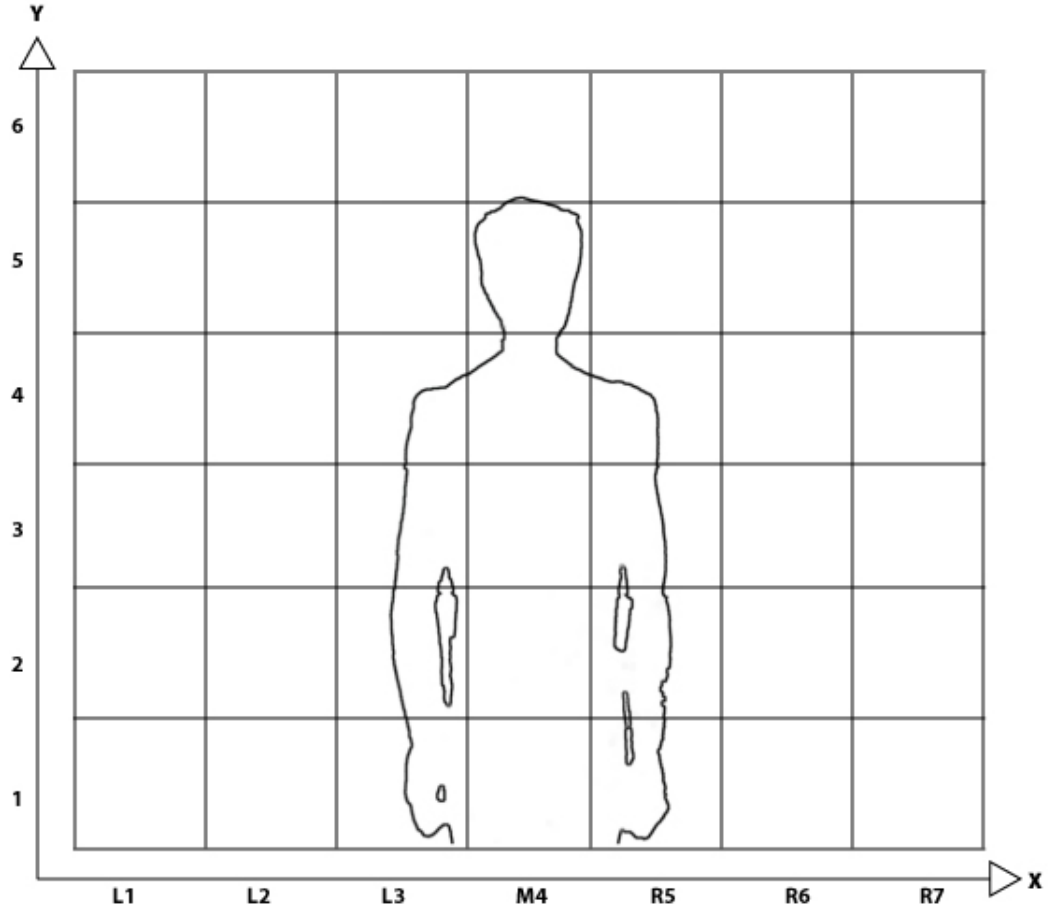

Figure 33: Human upper body placed in the gesture grid system

for old females; and Appendix P the gesture space for for old males.

7.5 Discussion

The visualization in Figure 43 indicates that older females used the upper space more then the other groups. This finding is also confirmed from the gesture categorization, showing that older females used more deictic gestures. Both young groups used the vertical side of the dominant arm, whereas it seems that the older group used most space from the body center and upwards in a v-form.

Nevertheless, the young age group was almost double in size, which can cause a wrong impression. Also include the layers all 18 tasks of which some are more or less identical, as moving in the menu or doing a selection. Future work could categorize the layers differently. Also the developed grid system can be used for further developments.

The knowledge of gesture space can be important in the design of gesture interactions and virtual realities. It may further affect how environments are designed to support gesture-based

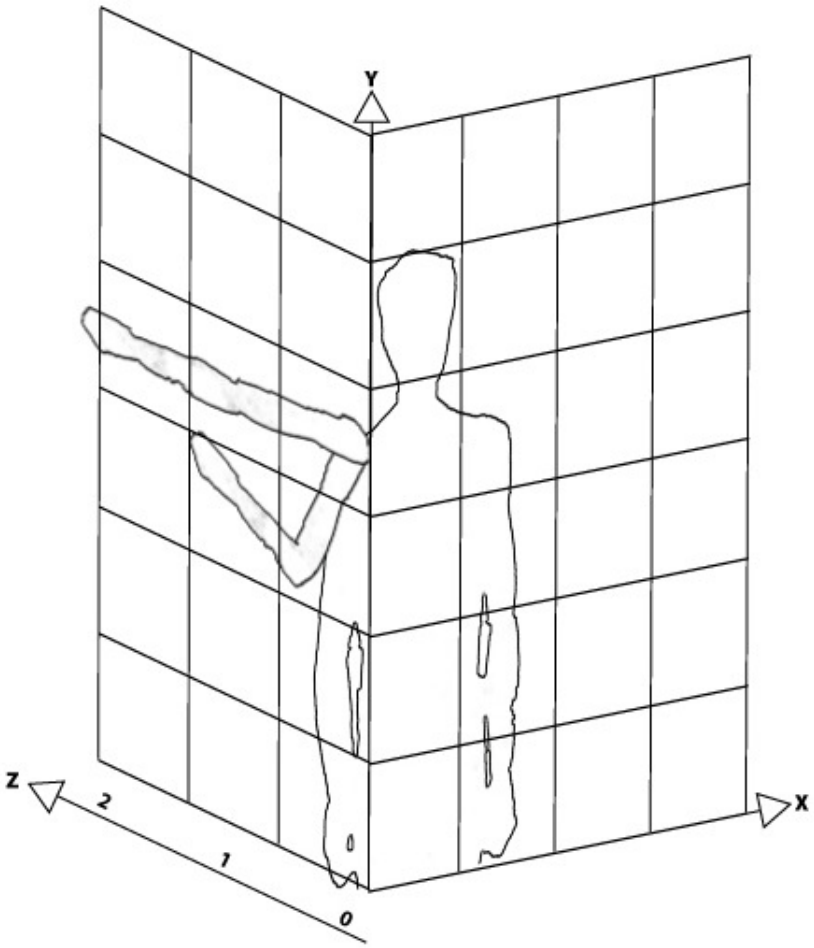

Figure 34: Z-postion

interaction systems. An interesting comparison could for example investigate if used gesture space in virtual realities varies to real world scenarios.

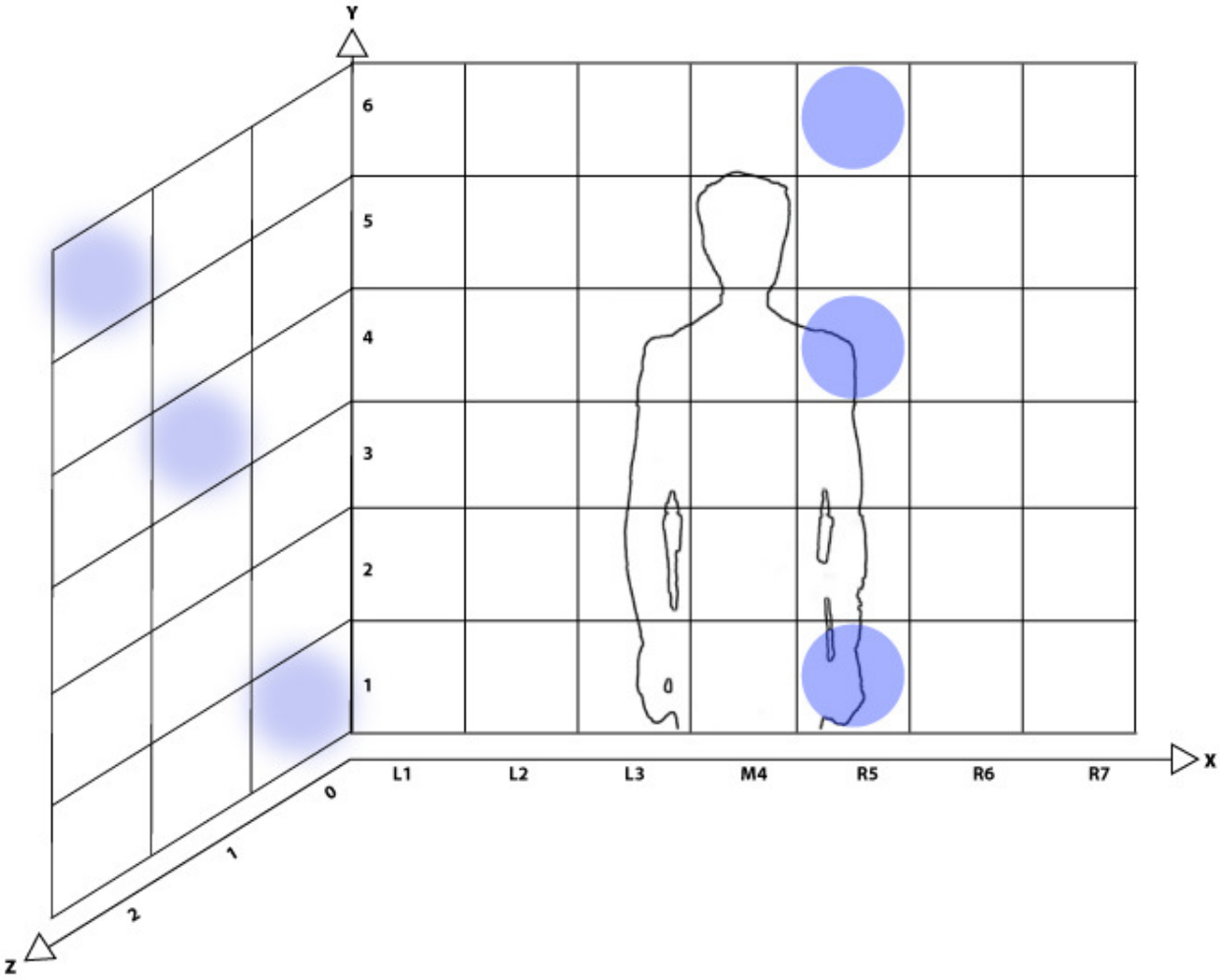

Figure 35: Required space by participant 38 when turning the TV on

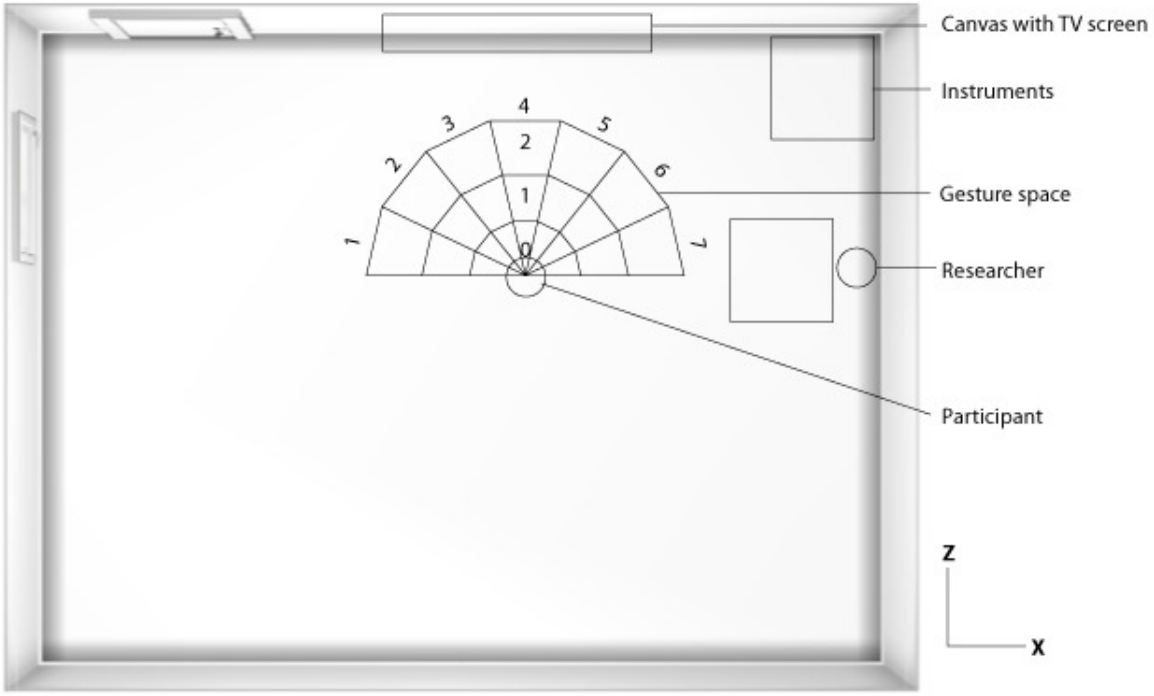

Figure 36: Top-down perspective on participant and gesture space in the interaction lab

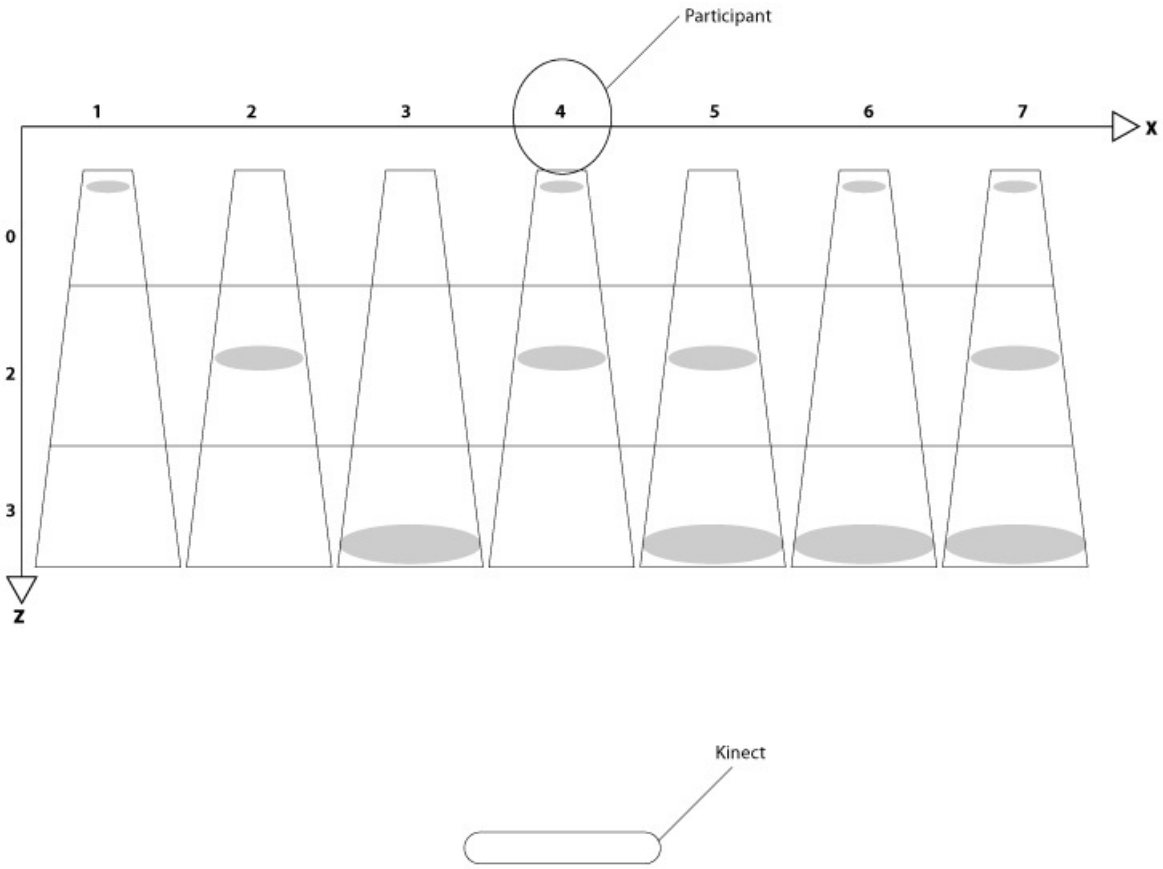

Figure 37: Top-down perspective flattened into seven three divided sections

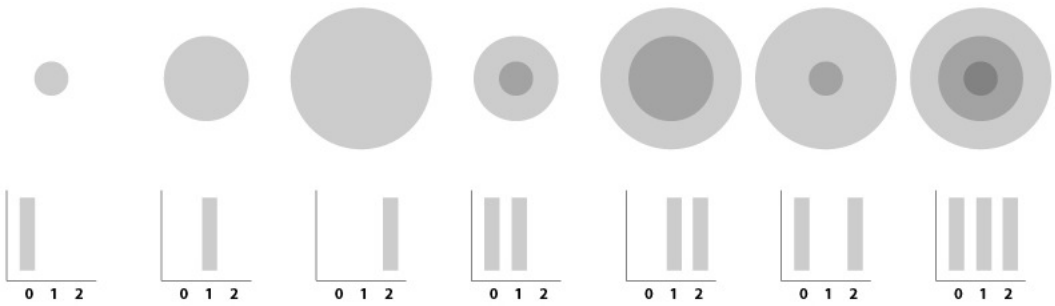

Figure 38: Layers drawn with a twenty percent opacity

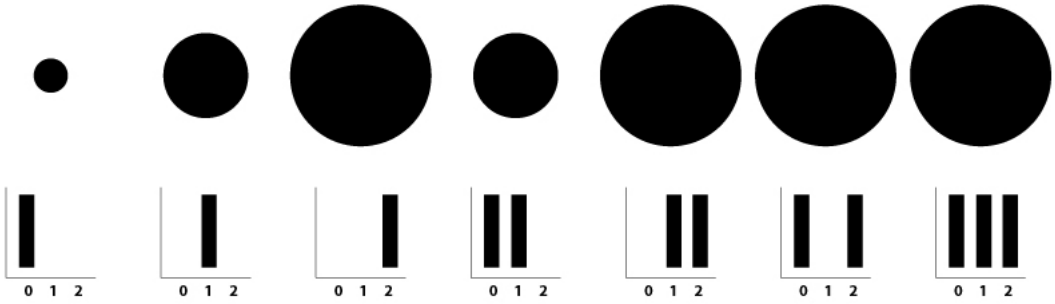

Figure 39: Layers drawn with a hundred percent opacity

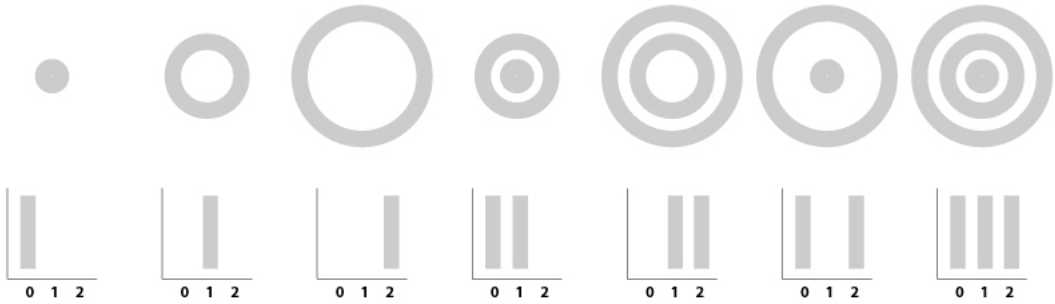

Figure 40: Layers drawn as outline

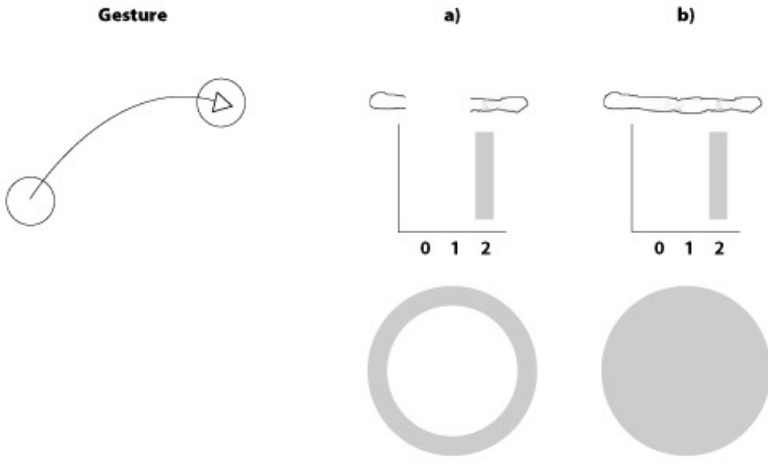

Figure 41: Cumulative gesture space

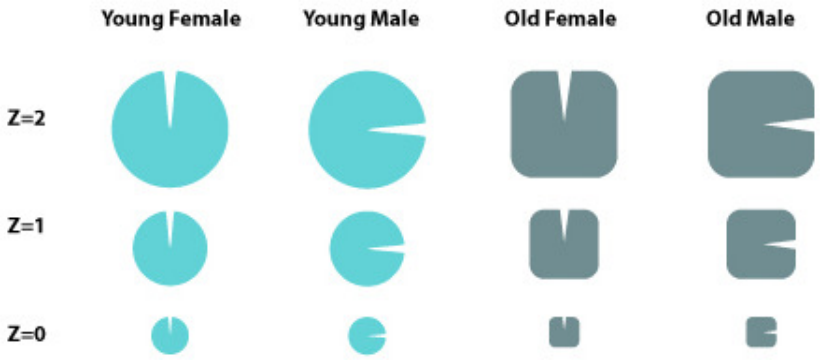

Figure 42: System to differ between age and gender

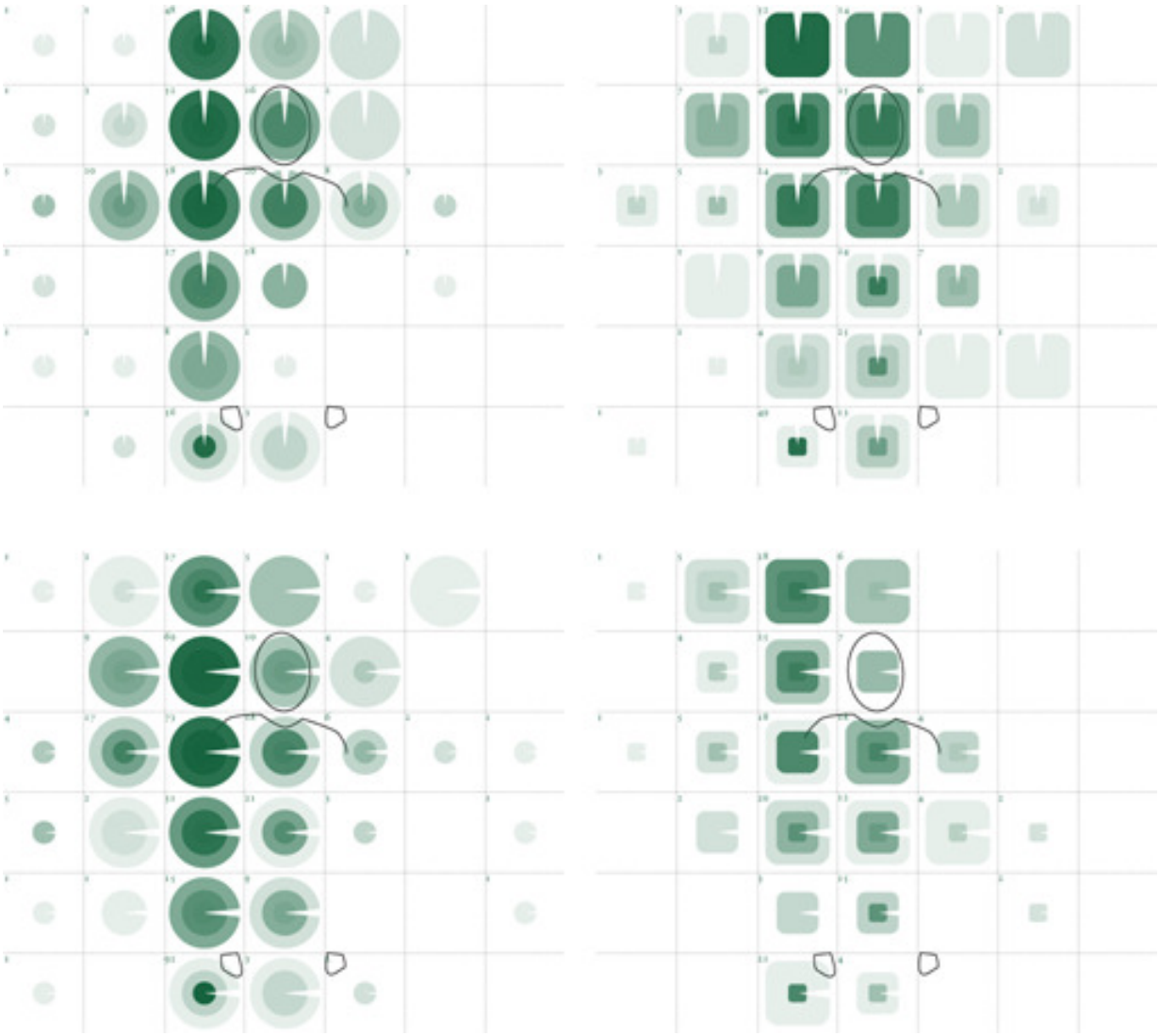

Figure 43: Gesture space comparison between young females/males and old females/males

8 Summary and conclusion

8.1 Summary

The findings in the discussion have shown that previous experience is more important than age or gender for the usage of gestures and preference for gesture interface. The research question has been proven to be true. However, the findings have also shown differences between the research groups, which are summarized in Figure 44.

8.2 Implications for the future

The outcomes of this project open for future work. The visualization of the gesture space was done manually, which was time consuming. An automatization of the process can help to draw the diagrams. Another improvement could be done in regard to adding time as an additional axis to the visualization. This could be done in form of a cube, where three faces are used to show the x, y, and z coordinates, and the fourth face to show time. Having the visualization animated could be another future development. The advantage of an animation would be that it focuses on the gesture movement, without showing the person performing it. Another time measurement could also be to count how long participants needed to come up with a gesture, and if it shows differences related to age, gender or experience.

The six participants who were outside the age groups in scope for this project, can be used for later analyses. Additionally, future work could narrow down the age groups. Moreover, this project presented the verbal behavior and positive/negative answers to the questionnaire as a summary. Future work could code the outcome in a ratio of positive to negative and compare the results with other design iterations or systems. Also, a non-verbal video analysis could give valuable information on user behavior during the study. The young age group was for example not analyzed while playing with their stickman animation or while the Breckel kinect was calibrated.

Additionally, the data files from the Breckel kinect can be filtered for noise and used in future developments. The binary detector could then be used to test if true positives are detected for similar gestures of other participants. This would allow to extract gestures which have a high detection and discard gestures with a low detection level. Also, it would test the reliability of the gesture detector.

Finally, the simulated system could be developed. With the system set up, the similarities between the age groups regarding high recognition rate and positive user experience can be validated. Also it would be interesting to see if online gesture can be initiated from a starting position.

8.3 Strengths and weaknesses

The results of this project were analyzed from different perspectives, which indicates a high validity. Also different tools were used from the three research areas gesture recognition, gesture-

based interaction and applied gestures and human factors. The development of the gesture grid system to place and visualize gestures can make it easier to design 3D-gesture based systems, which otherwise have a strong technological focus. Alltogether, this work presents a broad picture of the 3D-gesture research area.

The weakness of this project may be seen in different group sizes and relative narrow age groups. The oldest participant had noticeably more difficulties with the concept of performing 3D-gestures. But as he answers if he experienced gestures to be positive *I think **I** was very positive*, there is a good chance for 3D-gesture based systems to make technology accessible for a wider range of people than today.

Young females

Gesture performance
- Usage experience with touch-gesture
- Perform mostly **Iconic** gestures
- Gesture space is used along the vertical side of her dominent arm
- Dominant arm is used for gestures

Gesture acceptance
- Enjoy gesture interaction
- Have a generaly positive user experience with gesture interaction
- Request a system to be helpful, easy, supporting and **fun**

Older females

Gesture performance
- Usage experience with touch-gesture
- Perform mostly **Deictic** gestures
- Use V-form gesture space with upper space tendency
- Dominant arm is used for gestures

Gesture acceptance
- Enjoy gesture interaction
- Have a concerned positive user experience with gesture interaction
- Request a system to be helpful, easy and supporting

Young males

Gesture performance
- Most **3D-gesture usage experience**
- Most **owner** of a Wii game console
- Usage experience with touch-gesture
- Perform mostly **Deictic** gestures
- Gesture space is used along the vertical side of his dominent arm
- Dominant arm is used for gestures

Gesture acceptance
- Enjoy gesture interaction
- Have a mature positive user experience with gesture interaction
- Request a system to be helpful, easy, supporting and **fun**

Older males

Gesture performance
- **Little** usage experience with touch-gesture
- Perform mostly **Dynamic** gestures
- Use V-form gesture space
- Dominant arm is used for gestures

Gesture acceptance
- Enjoy gesture interaction
- Have a concerned positive user experience with gesture interaction
- Request a system to be helpful, easy and supporting

Figure 44: Summary of main findings

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A Appendix - Participant Information Sheet

CITY UNIVERSITY
LONDON

A comparison study between a younger and older age group on the acceptance of performing 3D-gestures

PARTICIPANT INFORMATION

We would like to invite you to take part in a research study. Before you decide whether you would like to take part it is important that you understand why the research is being done and what it would involve for you. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information.

What is the purpose of the study?
In this study I want to compare two age groups (18-30 years old and 50+ years old) with the objective to investigate to what extend the factors previous experience, age and/or gender has on the acceptance of using body movements (3D-gestures) as interaction style in the communication with modern devices. Furthermore, I am interested to investigate what kind of gestures people do.

This study is performed as partial fulfilment of the requirements for my Master degree in Interaction Design, undertaken at Gjovik University College in Norway, under the guidance of City University London.

The research will be carried out in week 9. Your participation will be required for approximately 15-20 minutes.

If you choose to participate please contact me via phone (07544 995 709) or email (hans.comtet.1@city.ac.uk) to arrange a suitable time.

Why have I been invited?
The study samples two different age groups, namely a group with older people with an age from above 50 years and younger people with an age range from 18-30 years. This study draws further more a sample of convenience, which includes anyone willing to participate. You will be one of some ~30 participants to volunteer for his study.

Do I have to take part?
Participation in the project is voluntary, and you can choose not to participate in part or the entire project. You can withdraw at any stage of the project without being penalised or disadvantaged in any way. It is up to you to decide whether or not to take part. If you do decide to take part you will be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason.

What do I have to do?
You will first be asked on previous experience by rating questions in a questionnaire. You will thereafter be asked to interact with a TV interface and a simple game, which will take about 15 minutes. During that time you will be asked to wear a motion detection sensor on your wrist.

Figure 45: Participant Information Sheet (Page 1 of 3)

CITY UNIVERSITY LONDON

A comparison study between a younger and older age group on the acceptance of performing 3D-gestures

Data from this interaction sessions is captured by the motion sensor and by a kinect (skeleton tracking and audio information) from the Microsoft Xbox game console. To capture your movements with the kinect, the researcher speaks out loudly the commando “snapshot”. After both interactions, you will finally be asked to complete questions on a questionnaire, asking for your experience with this form of interaction.

Expenses and Payments
As appreciation for your participation you will get a voucher for a delicious slice of cake from Ion Patisserie at Exmouth Market.

What are the possible disadvantages and risks of taking part?
There are no perceived risks or disadvantages associated with participation in this study.

What are the possible benefits of taking part?
The main potential benefit is in contributing to scientific knowledge on this topic, in form of a gesture set hierarchy and a user indication on the influence of age, gender or previous experience on the acceptance of using body movements as an interaction style.

What will happen when the research study stops?
For the duration of the project, your data will be stored electronically and in accordance with the principles of the Data Protection Act. No personally identifiable information will be passed to third parties, or retained for beyond the duration of the project. Should this project be stopped prematurely for any reason, all associated data will be destroyed.

Will my taking part in the study be kept confidential?
All data from this project are confidential and will be used for research purposes only. No information that could lead to your identification will be disclosed in any reports on the project, or to any other party. Data from questionnaires and instruments are animus. Names of participants will not be connected to information and scores. No identifiable personal data will be published.

What will happen to results of the research study?
The findings of this study are ultimately to be included in a master thesis and associated documents. Where published, data will not include any personal or identifiable information.

What if there is a problem?
If you would like to complain about any aspect of the study, City University London has established a complaints procedure via the Secretary to Senate Research Ethics Committee. To complain about the study, you need to phone 020 7040 3040. You can then ask to speak to the Secretary to Senate Research Ethics Committee and inform them that the name of the project is:

Figure 46: Participant Information Sheet (Page 2 of 3)

CITY UNIVERSITY LONDON

A comparison study between a younger and older age group on the acceptance of performing 3D-gestures

A comparison study between a younger and older age group on the acceptance of performing 3D-gestures (Run by Hans Comtet, HCID)

You could also write to the Secretary at:
Anna Ramberg
Secretary to Senate Research Ethics Committee
Research Office, E214
City University London
Northampton Square
London, EC1V 0HB
Email: Anna.Ramberg.1@city.ac.uk

Further information and contact details
This consent form may use language or terms, which you are not familiar with, and if you wish to have anything in this form elaborated on, explained in other terms or in more detail, please ask and I will be glad to expand or explain. Also, if you have any questions at a later date, please feel free to contact me, either via email or phone, and I will try my best to answer your questions.

I can contact the researcher by calling +44 (0) 7544 995 709 or writing to:

Researcher: Hans Comtet
Address of researcher: 382 St John Street, EC1V4NN London
Email: hans.comtet.1@city.ac.uk

Research Supervisor: Stephanie Wilson
Address of researcher: City University London, Northampton Square, EC1V 0HB
Email: s.m.wilson@city.ac.uk

Thank you for taking the time to read this information sheet. Please retain this copy.

Figure 47: Participant Information Sheet (Page 3 of 3)

B Appendix - Informed consent form

INFORMED CONSENT FORM FOR PROJECT PARTICIPANTS

Project title: A comparison study between a younger and older age group on the acceptance of performing 3D-gestures

I have had the project explained to me, and agree to participate in this research project. I understand that:

1) The time required for this study is about 15-20 minutes.
2) The nature of my participation includes
    a. Rate frequency of use and previous experience with modern devices
    b. Testing two interfaces on a screen, and
    c. Filling out an experience questionnaire in the end
3) The testing of the interaction with the interfaces will be video and audio recorded.
4) Movement data will be captured from a kinect and a sensor device, which is tied around your wrist
5) All my data is confidential and no information that could lead to the identification of any individual will be disclosed in any reports on the project, or to any other party. No identifiable personal data will be published. The identifiable data will not be shared with any other organization and will be used for research purpose only.
6) Data from questionnaires and instruments are anonymous.
7) My participation is entirely voluntary. I can choose not to participate in part or the entire project, and that I can withdraw at any stage of the project without being penalized in any way.
8) If you feel exhausted of the activities in this research project, please feel free to decline from participation at any point in this project.
9) I agree to City University London recording and processing this information about me. I understand that this information will be used only for the purpose set out in this statement and my consent is conditional on the University complying with its duties and obligations under the Data Protection Act 1998.
10) If I have questions about the research, or if I would like to receive a copy of the aggregate findings of the study when it is complete, I can contact the researcher by calling 07544995709 or writing to:

Hans Comtet, 382 St John Street, EC1V4NN London

Please print your name (Participant) _____

Signature _____

Date _____

Please print your name (Researcher) _____

Signature _____

Date _____

Figure 48: Informed consent

C Appendix - Questionnaire Gesture experience

What do you typically use your computer for?

- ☐ Games
- ☐ Pleasure
- ☐ Accounting / Finance
- ☐ Word Processing
- ☐ Decision support
- ☐ Graphics
- ☐ Data storage
- ☐ Other

If you have chosen "other", please specify further:

Please choose your usage frequency for each of the following

	Never used	1–2 times	under 10 times	10–20 times	more than 20 times
Playstation games	○	○	○	○	○
Wii games	○	○	○	○	○
Microsoft Kinect games	○	○	○	○	○
Smartphone app games	○	○	○	○	○
Computer app games	○	○	○	○	○
PC games	○	○	○	○	○
Smartphone	○	○	○	○	○
Tablet	○	○	○	○	○
E-book reader	○	○	○	○	○

Figure 49: Gesture experience (Page 1 of 3) - Previous experience

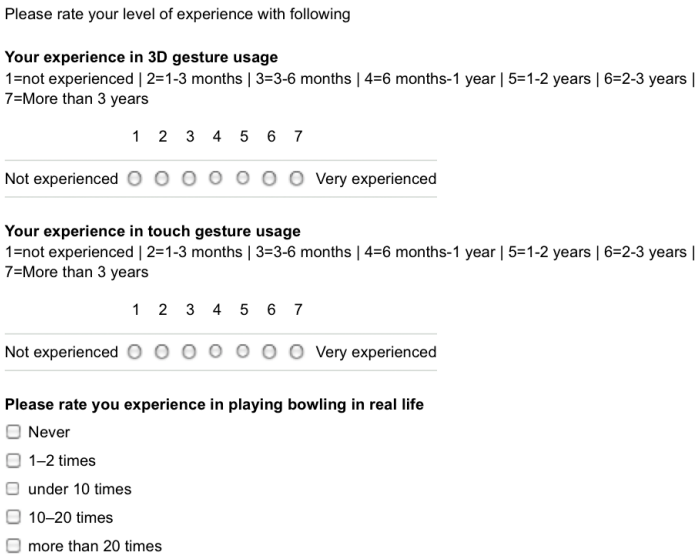


Figure 50: Gesture experience (Page 2 of 3) - Previous experience

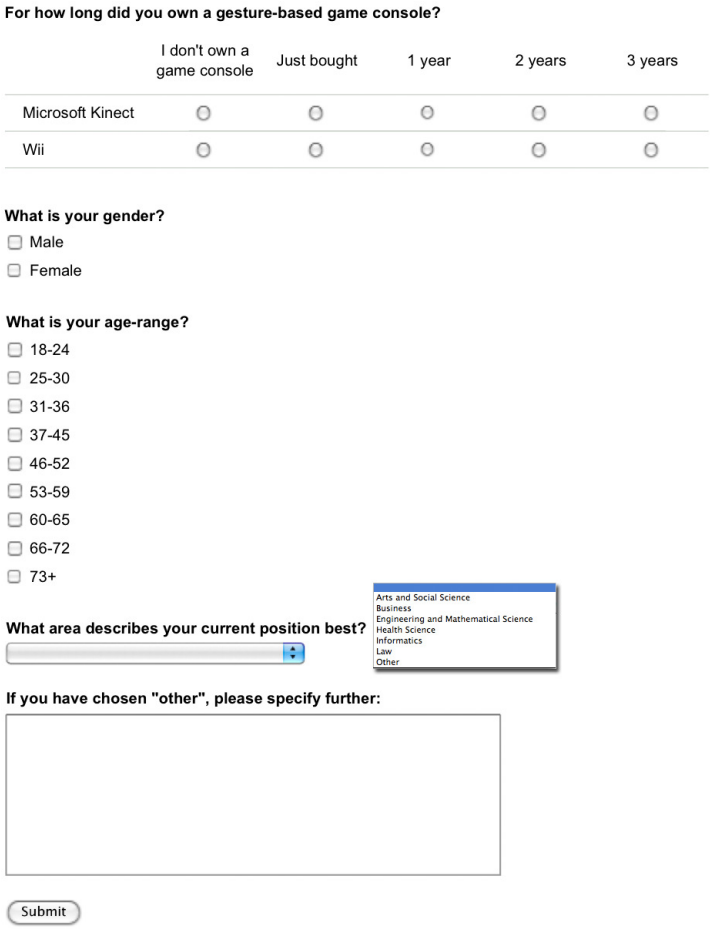


Figure 51: Gesture experience (Page 3 of 3) - Personal information

D Appendix - Questionnaire Gesture acceptance

Please range the items on a five-point scale, from disagree to agree.

Using gestures helps me accomplish things more quickly

1 2 3 4 5

Disagree ○ ○ ○ ○ ○ Agree

I find gestures useful in my daily life

1 2 3 4 5

Disagree ○ ○ ○ ○ ○ Agree

If I were to use gestures, I would increase my chances of completing an assigned task

1 2 3 4 5

Disagree ○ ○ ○ ○ ○ Agree

Learning how to use gestures is easy for me

1 2 3 4 5

Disagree ○ ○ ○ ○ ○ Agree

My interaction with gestures is clear and understandable

1 2 3 4 5

Disagree ○ ○ ○ ○ ○ Agree

I find gestures easy to use

1 2 3 4 5

Disagree ○ ○ ○ ○ ○ Agree

It would be easy for me to become skillful at using gestures

1 2 3 4 5

Disagree ○ ○ ○ ○ ○ Agree

Figure 52: Gesture acceptance (Page 1 of 3) - UTAUT

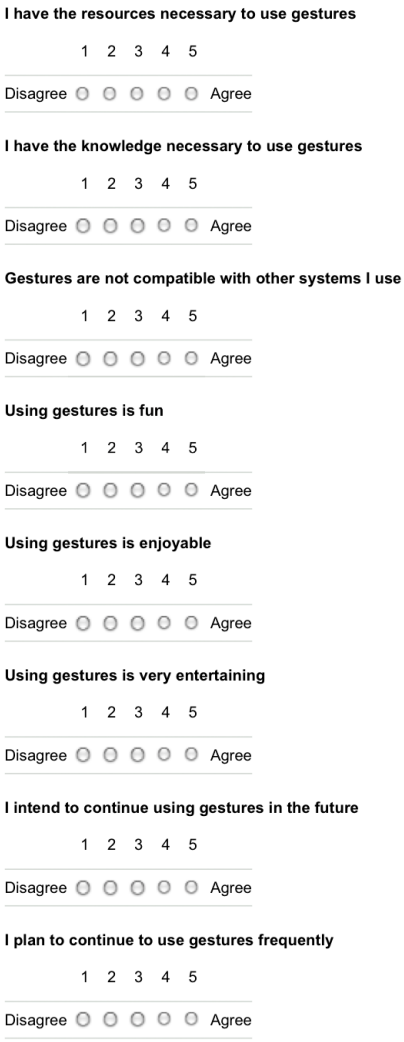
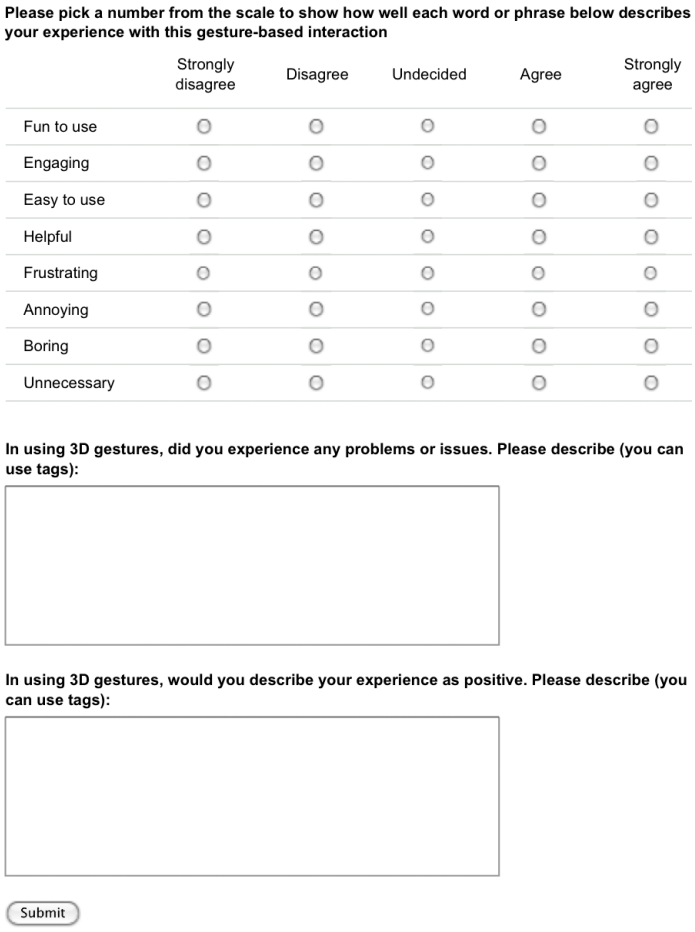


Figure 53: Gesture acceptance (Page 2 of 3) - UTAUT



Please pick a number from the scale to show how well each word or phrase below describes your experience with this gesture-based interaction

	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
Fun to use	O	O	O	O	O
Engaging	O	O	O	O	O
Easy to use	O	O	O	O	O
Helpful	O	O	O	O	O
Frustrating	O	O	O	O	O
Annoying	O	O	O	O	O
Boring	O	O	O	O	O
Unnecessary	O	O	O	O	O

In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):

In using 3D gestures, would you describe your experience as positive. Please describe (you can use tags):

Submit

Figure 54: Gesture acceptance (Page 3 of 3) - Experience scale and open questions

E Appendix - Script used during the experiments

0. Preparation
< Check batteries: Accelerometer, Remote Control >
< Prepare kinect game >
< Prepare sheets: 1xParticipant information, 2xInformed Consent >
< Prepare Pen to write >
< Prepare Beverages and cups >

1. Introduction
< Welcome participants >

"Welcome to this research setting in the interaction lab and thank you for your participation. Please take a seat."

< Show seat >

"Please start to read the participant information sheet. If you have any questions, please feel free to ask me."

< Explain experiment >

"Please keep in mind that I don't test you, but just the gestures you do. There are no right or wrong gestures. Just perform any gestures, which come to your mind."

"During the study I will first ask you to rate your frequency of use with modern devices. Thereafter I will tie an accelerometer device around your dominant arm and ask you to interact with two interfaces. The first interaction will be a TV-task, where I ask you to perform 16 different tasks. The second interaction will be with a bowling game on the Microsoft Xbox kinect game console. Here you will be asked to throw a bowling bowl six times. After those interactions I will ask you to fill out an experience questionnaire."

"Furthermore I can not answer to your questions during the study, but have time after the study to discuss any question you may have."

< Sign the informed consent >

"If you agree to participate in this study, I will now kindly ask you to sign the informed consent."

< Hand out cake voucher >
< Show 1st questionnaire "Previous experience" >

2. Questionnaire
"I would like you now to fill in the first questionnaire about your previous experience with gesture-based interaction". "Please rate all the questions and submit the questionnaire in the end by pressing the submit button."

"While you are filling out the questionnaire, I will prepare for the TV task"

< Start recording >

Figure 55: Script (Page 1 of 2)

3. TV Task
"Thank you. I will now tie the accelerometer device around you wrist and show you where to stand." "Which is your dominant arm?"

< Tie accelerometer device around participants strong arm >
< Show area to stand >

"Please stand here. I will give you a ready signal to process gestures according to the tasks I will speak out loudly."

< Start with the 16 gesture tasks >

"Thank you." "Are you alright?" "OK, I will now prepare for the second tasks, where you are asked to interact with a bowling game. "If you want to sit down in the meantime, you are free to do so".

< Prepare for the game task >

4. Game Task
"Please retake your position. On the screen you now see a bowling game. Please start interacting with the game. You can throw the bowling ball six times."

< Count throws and scores >

5. Questionnaire
"Thank you." "Are you alright?" "OK, I would like you now to fill in a second questionnaire about your experience with a gesture-based interaction". "Please rate all the questions and submit the questionnaire in the end by pressing the submit button."
< Show 2nd questionnaire "Gesture experience" >
< Stop recording >

6. Participant debriefing
"Thank you, again, for your participation." "Are there any more questions you would like to ask?" "OK, good-bye".

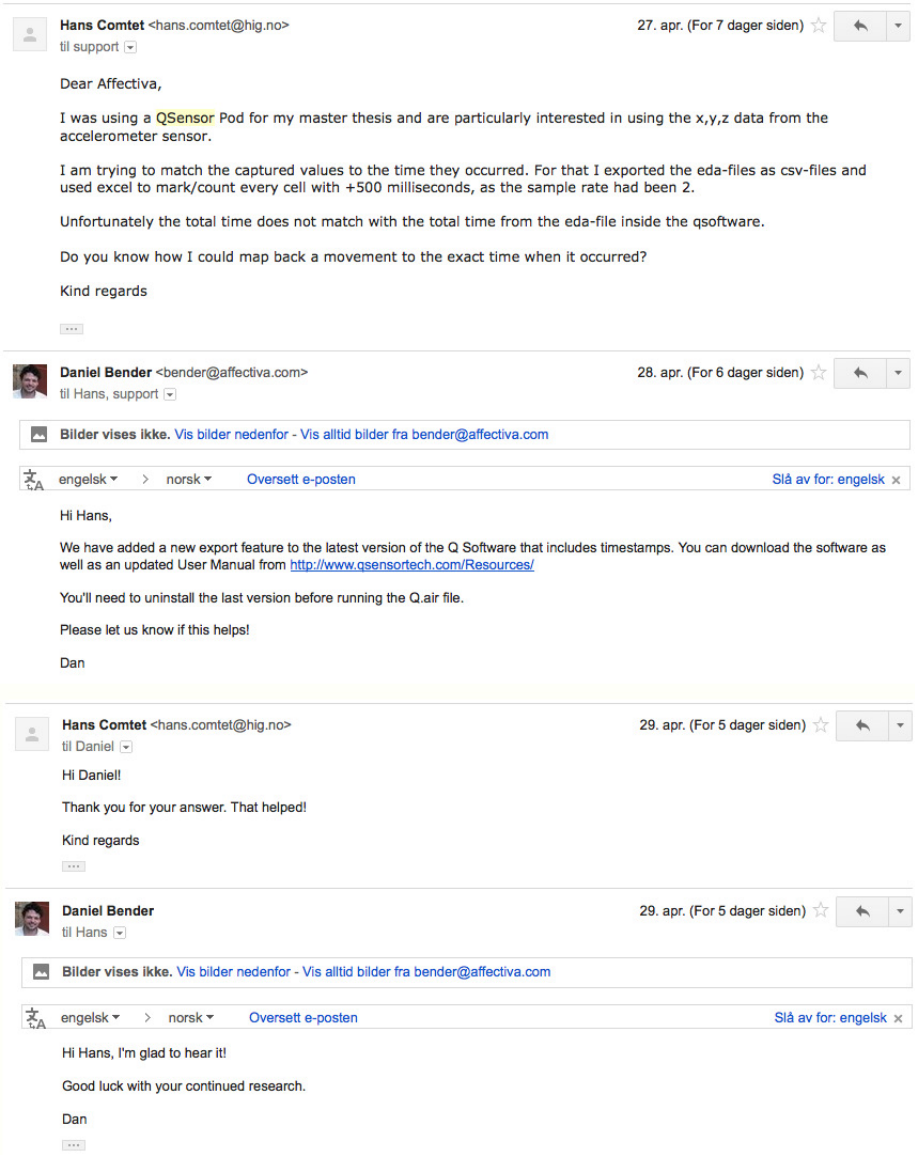
< Show way out >

7. Finishing

< Collect data, a file per participant >
< Restart kinect game >
< Tidy up for next participant >

Figure 56: Script (Page 2 of 2)

F Appendix - Correspondence



Hans Comtet <hans.comtet@hig.no> 27. apr. (For 7 dager siden)
til support

Dear Affectiva,

I was using a QSensor Pod for my master thesis and are particularly interested in using the x,y,z data from the accelerometer sensor.

I am trying to match the captured values to the time they occurred. For that I exported the eda-files as csv-files and used excel to mark/count every cell with +500 milliseconds, as the sample rate had been 2.

Unfortunately the total time does not match with the total time from the eda-file inside the qsoftware.

Do you know how I could map back a movement to the exact time when it occurred?

Kind regards

Daniel Bender <bender@affectiva.com> 28. apr. (For 6 dager siden)
til Hans, support

Bilder vises ikke. Vis bilder nedenfor - Vis alltid bilder fra bender@affectiva.com

engelsk › norsk Oversett e-posten Slå av for: engelsk

Hi Hans,

We have added a new export feature to the latest version of the Q Software that includes timestamps. You can download the software as well as an updated User Manual from http://www.qsensortech.com/Resources/

You'll need to uninstall the last version before running the Q.air file.

Please let us know if this helps!

Dan

Hans Comtet <hans.comtet@hig.no> 29. apr. (For 5 dager siden)
til Daniel

Hi Daniel!

Thank you for your answer. That helped!

Kind regards

Daniel Bender 29. apr. (For 5 dager siden)
til Hans

Bilder vises ikke. Vis bilder nedenfor - Vis alltid bilder fra bender@affectiva.com

engelsk › norsk Oversett e-posten Slå av for: engelsk

Hi Hans, I'm glad to hear it!

Good luck with your continued research.

Dan

Figure 57: Email correspondence with QSensor

G Appendix - Cake vouchers

Slice of cake	Claim Code	OK
1	9937	
2	2735	
3	2612	
4	6843	
5	8153	
6	7192	
7	3399	
8	2674	
9	4109	
10	9062	
11	4456	
12	9444	
13	3631	
14	7410	
15	5763	
16	3123	
17	2458	
18	7775	
19	8864	
20	8600	
21	7530	
22	3488	
23	8936	
24	8570	
25	9205	
26	8201	
27	5758	
28	9883	
29	3953	In case of questions or problems:
30	9317	Hans Comtet
31	3203	E-Mail Address: hans.comtet.1@city.ac.uk
32	1616	Contact Phone number: 07544 995709

Figure 58: Voucher Code Numbers

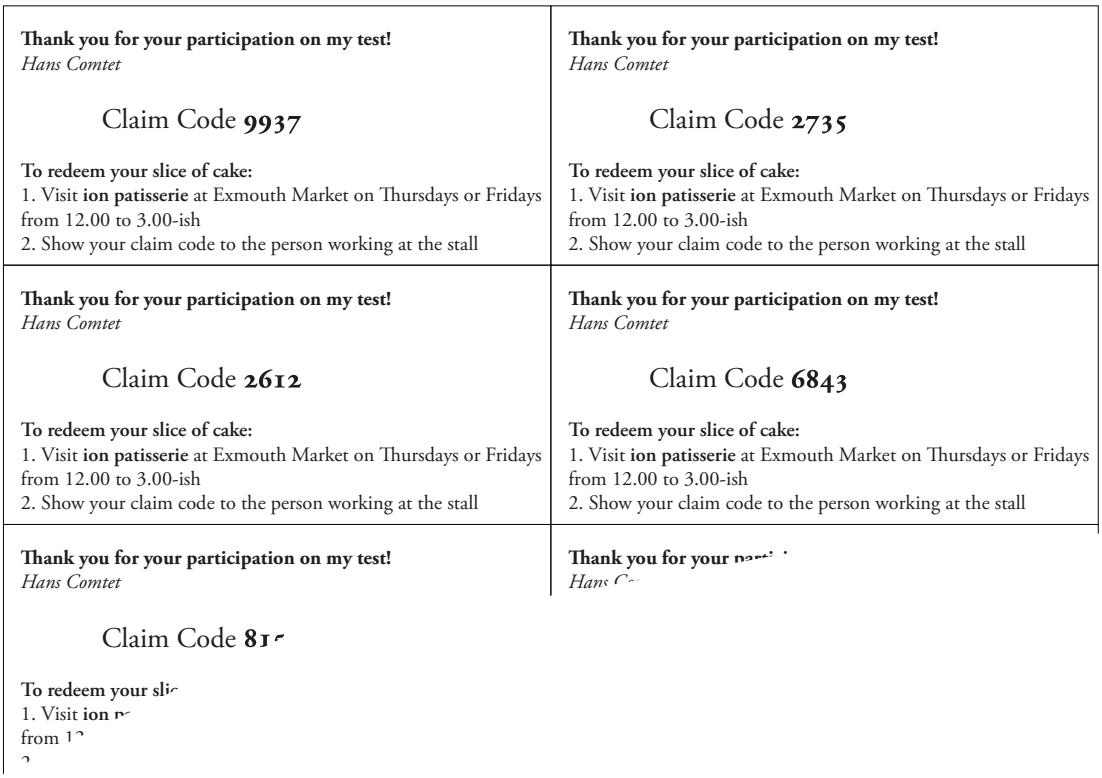


Figure 59: Vouchers with claim code

H Appendix - NSD notification form

Norsk samfunnsvitenskapelig datatjeneste AS
NORWEGIAN SOCIAL SCIENCE DATA SERVICES

MELDESKJEMA

Meldeskjema (versjon 1.4) for forsknings- og studentprosjekt som medfører meldeplikt eller konsesjonsplikt (jf. personopplysningsloven og helseregisterloven med forskrifter).

1. Prosjekttittel		
Tittel	Interaction with 3D-gestures	
2. Behandlingsansvarlig institusjon		
Institusjon	Høgskolen i Gjøvik	Velg den institusjonen du er tilknyttet. Alle nivå må oppgis. Ved studentprosjekt er det studentens tilknytning som er avgjørende. Dersom institusjonen ikke finnes på listen, vennligst ta kontakt med personvernombudet.
Avdeling/Fakultet	Avdeling for informatikk og medieteknikk	
Institutt		
3. Daglig ansvarlig (forsker, veileder, stipendiat)		
Fornavn	Simon	Før opp navnet på den som har det daglige ansvaret for prosjektet.Veileder er vanligvis daglig ansvarlig ved studentprosjekt. Veileder og student må være tilknyttet samme institusjon. Dersom studenten har ekstern veileder, kan biveileder eller fagansvarlig ved studiestedet stå som daglig ansvarlig.Arbeidssted må være tilknyttet behandlingsansvarlig institusjon, f.eks. underavdeling, institutt etc. NB! Det er viktig at du oppgir en e-postadresse som brukes aktivt. Vennligst gi oss beskjed dersom den endres.
Etternavn	McCallum	
Akademisk grad	Doktorgrad	
Stilling	Førsteamanuensis	
Arbeidssted	Høgskolen i Gjøvik	
Adresse (arb.sted)	Teknologiveien 22	
Postnr/sted (arb.sted)	2815 Gjøvik	
Telefon/mobil (arb.sted)	61135268 /	
E-post	simon.mccallum@hig.no	
4. Student (master, bachelor)		
Studentprosjekt	Ja ● Nei ○	NB! Det er viktig at du oppgir en e-postadresse som brukes aktivt. Vennligst gi oss beskjed dersom den endres.
Fornavn	Hans	
Etternavn	Comtet	
Akademisk grad	Høyere grad	
Privatadresse	Skjelderupsgate 16	
Postnr/sted (privatadresse)	0559 Oslo	
Telefon/mobil	40493127 /	
E-post	hans.comtet@hig.no	
5. Formålet med prosjektet		
Formål	Problemstilling: Although gestures offer great opportunity for natural and intuitive interactions, there are currently little to no rules for creating a set of gestures for a given application. The main problem is therefore to know which gestures to choose for any given interaction. Prosjektets formål og basis for forskningspørsmålene: We look to see if there are stronger differences based on experience rather than age. Part of the move away from just assuming everyone born at a certain date have the same experiences. Looking at gestures relative to user characteristics could be the basis for mapping certain gestures to defined user groups. Further more do we wish to look at usability in doing gestures.	Redegjør kort for prosjektets formål, problemstilling, forskningsspørsmål e.l. Maks 750 tegn.
6. Prosjektomfang		

Figure 60: Notification form (Page 1 of 5)

Velg omfang	● Enkel institusjon ○ Nasjonalt samarbeidsprosjekt ○ Internasjonalt samarbeidsprosjekt	Med samarbeidsprosjekt menes prosjekt som gjennomføres av flere institusjoner samtidig, som har samme formål og hvor personopplysninger utveksles.
Oppgi øvrige institusjoner		
Oppgi hvordan samarbeidet foregår		
7. Utvalgsbeskrivelse		
Utvalget	Ønsket utvalg består av 20 eldre voksne (60-65) og 20 yngre voksne (typisk studenter).	Med utvalg menes dem som deltar i undersøkelsen eller dem det innhentes opplysninger om. F.eks. et representativt utvalg av befolkningen, skoleelever med lese- og skrivevansker, pasienter, innsatte.
Rekruttering og trekking	Studenter ønskes å rekrutteres gjennom høgskoler og universiteter. Eldre ønskes å rekrutteres gjennom eldrehjem, omsorgsbolig, kontakt med seniornett.no, og lignende.	Beskriv hvordan utvalget trekkes eller rekrutteres og oppgi hvem som foretar den. Et utvalg kan trekkes fra registre som f.eks. Folkeregisteret, SSB-registre, pasientregistre, eller det kan rekrutteres gjennom f.eks. en bedrift, skole, idrettsmiljø, eget nettverk.
Førstegangskontakt	Hans Comtet oppretter førstekontakt og foretar den.	Beskriv hvordan førstegangskontakten opprettes og oppgi hvem som foretar den. Les mer om dette på temasidene Hva skal du forske på?
Alder på utvalget	□ Barn (0-15 år) □ Ungdom (16-17 år) ■ Voksne (over 18 år)	
Antall personer som inngår i utvalget	minst 40 (20 av hver aldersgruppe)	
Inkluderes det myndige personer med redusert eller manglende samtykkekompetanse?	Ja ○ Nei ●	Begrunn hvorfor det er nødvendig å inkludere myndige personer med redusert eller manglende samtykkekompetanse. Les mer om Pasienter, brukere og personer med redusert eller manglende samtykkekompetanse
Hvis ja, begrunn		
8. Metode for innsamling av personopplysninger		
Kryss av for hvilke datainnsamlingsmetoder og datakilder som vil benyttes	■ Spørreskjema □ Personlig intervju □ Gruppeintervju □ Observasjon □ Psykologiske/pedagogiske tester □ Medisinske undersøkelser/tester □ Journaldata □ Registerdata ■ Annen innsamlingsmetode	Personopplysninger kan innhentes direkte fra den registrerte f.eks. gjennom spørreskjema, intervju, tester, og/eller ulike journaler (f.eks. elevmapper, NAV, PPT, sykehus) og/eller registre (f.eks. Statistisk sentralbyrå, sentrale helseregistre).
Annen innsamlingsmetode, oppgi hvilken	Opptak av bevegelser gjennom sensorer (accelerometer og infrarød), samt opptak av video.	
Kommentar	Videoopptaket og sensordata brukes for å velge bevegelser som har blitt registert av både video, accelerometer og infrarød. I tillegg skal videopptaket hjelpe til å ha en visuell støtte mot dataen fra sensorene. Opptakene skal ikke brukes for å si noe om personene, kun til å forbedre systemet.	
9. Datamaterialets innhold		
Redegjør for hvilke opplysninger som samles inn	Spørreskjema med spørsmål om opplevelsen og akseptanse av den beveglsesstyrte interaksjonen. I tillegg spørs det etter erfaringn med teknologier, samt informasjon om alder og kjønnn.	Spørreskjema, intervju-/temaguide, observasjonsbeskrivelse m.m. sendes inn sammen med meldeskjemaet. NB! Vedleggene lastes opp til sist i meldeskjema, se punkt 16 Vedlegg.

Figure 61: Notification form (Page 2 of 5)

Samles det inn direkte personidentifiserende opplysninger?	Ja ○ Nei ●	Dersom det krysses av for ja her, se nærmere under punkt 11 Informasjonssikkerhet.
Hvis ja, hvilke?	□ 11-sifret fødselsnummer □ Navn, fødselsdato, adresse, e-postadresse og/eller telefonnummer	Les mer om hva personopplysninger er NB! Selv om opplysningene er anonymiserte i oppgave/rapport, må det krysses av dersom direkte og/eller indirekte personidentifiserende opplysninger innhentes/registreres i forbindelse med prosjektet.
Spesifiser hvilke		
Samles det inn indirekte personidentifiserende opplysninger?	Ja ○ Nei ●	En person vil være indirekte identifiserbar dersom det er mulig å identifisere vedkommende gjennom bakgrunnsopplysninger som for eksempel bostedskommune eller arbeidsplass/skole kombinert med opplysninger som alder, kjønn, yrke, diagnose, etc. Kryss også av dersom ip-adresse registreres.
Hvis ja, hvilke?		
Samles det inn sensitive personopplysninger?	Ja ○ Nei ●	
Hvis ja, hvilke?	□ Rasemessig eller etnisk bakgrunn, eller politisk, filosofisk eller religiøs oppfatning □ At en person har vært mistenkt, siktet, tiltalt eller dømt for en straffbar handling □ Helseforhold □ Seksuelle forhold □ Medlemskap i fagforeninger	
Samles det inn opplysninger om tredjeperson?	Ja ○ Nei ●	Med opplysninger om tredjeperson menes opplysninger som kan spores tilbake til personer som ikke inngår i utvalget. Eksempler på tredjeperson er kollega, elev, klient, familiemedlem.
Hvis ja, hvem er tredjeperson og hvilke opplysninger registreres?		
Hvordan informeres tredjeperson om behandlingen?	□ Skriftlig □ Muntlig □ Informeres ikke	
Informeres ikke, begrunn		
10. Informasjon og samtykke		
Oppgi hvordan utvalget informeres	■ Skriftlig □ Muntlig □ Informeres ikke	Vennligst send inn informasjonsskrivet eller mal for muntlig informasjon sammen med meldeskjema. NB! Vedlegg lastes opp til sist i meldeskjemaet, se punkt 16 Vedlegg. Dersom utvalget ikke skal informeres om behandlingen av personopplysninger må det begrunnes. Les mer om krav til samtykke
Begrunn		
Oppgi hvordan samtykke fra utvalget innhentes	■ Skriftlig □ Muntlig □ Innhentes ikke	Dersom det innhentes skriftlig samtykke anbefales det at samtykkeerklæringen utformes som en svarslipp eller på eget ark. Dersom det ikke skal innhentes samtykke, må det begrunnes.
Innhentes ikke, begrunn		
11. Informasjonssikkerhet		
Direkte personidentifiserende opplysninger erstattes med et referansenummer som viser til en atskilt navneliste (koblingsnøkkel)	Ja ○ Nei ●	Har du krysset av for ja under punkt 9 Datamaterialets innhold må det merkes av for hvordan direkte personidentifiserende opplysninger registreres. NB! Som hovedregel bør ikke direkte personidentifiserende opplysninger registreres sammen med det øvrige datamaterialet.
Hvordan oppbevares navnelisten/ koblingsnøkkelen og hvem har tilgang til den?		

Figure 62: Notification form (Page 3 of 5)

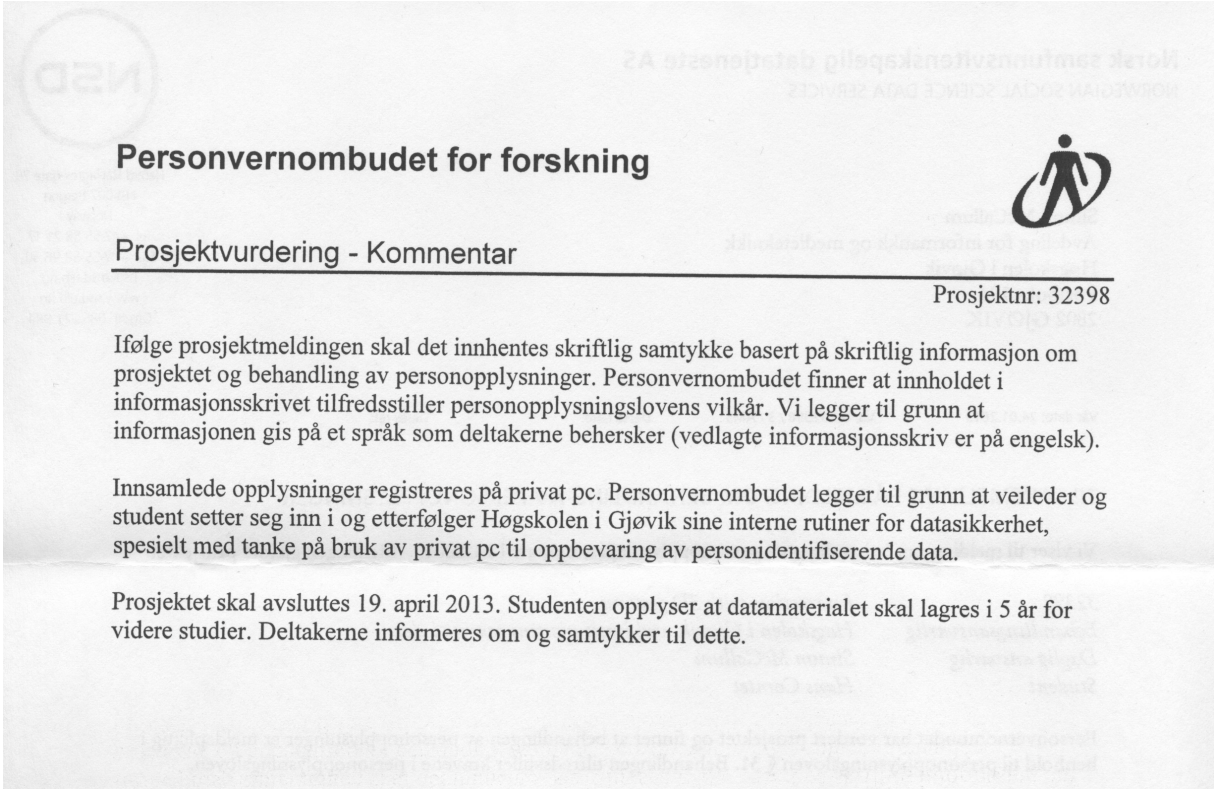
Direkte personidentifiserende opplysninger oppbevares sammen med det øvrige materialet	Ja ○ Nei ●	
Hvorfor oppbevares direkte personidentifiserende opplysninger sammen med det øvrige datamaterialet?		
Oppbevares direkte personidentifiserbare opplysninger på andre måter?	Ja ○ Nei ●	
Spesifiser		
Hvordan registreres og oppbevares datamaterialet?	□ Fysisk isolert datamaskin tilhørende virksomheten □ Datamaskin i nettverkssystem tilhørende virksomheten □ Datamaskin i nettverkssystem tilknyttet Internett tilhørende virksomheten □ Fysisk isolert privat datamaskin ■ Privat datamaskin tilknyttet Internett ■ Videoopptak/fotografi □ Lydopptak □ Notater/papir □ Annen registreringsmetode	Merk av for hvilke hjelpemidler som benyttes for registrering og analyse av opplysninger. Sett flere kryss dersom opplysningene registreres på flere måter.
Annen registreringsmetode beskriv		
Behandles lyd-/videoopptak og/eller fotografi ved hjelp av datamaskinbasert utstyr?	Ja ○ Nei ●	Kryss av for ja dersom opptak eller foto behandles som lyd-/bildefil. Les mer om behandling av lyd og bilde.
Hvordan er datamaterialet beskyttet mot at uvedkommende får innsyn?	Datamaskintilgang er beskyttet med brukernavn og passord.	Er f.eks. datamaskintilgangen beskyttet med brukernavn og passord, står datamaskinen i et låsbart rom, og hvordan sikres bærbare enheter, utskrifter og opptak?
Dersom det benyttes mobile lagringsenheter (bærbar datamaskin, minnepenn, minnekort, cd, ekstern harddisk, mobiltelefon), oppgi hvilke		NB! Mobile lagringsenheter bør ha mulighet for kryptering.
Vil medarbeidere ha tilgang til datamaterialet på lik linje med daglig ansvarlig/student?	Ja ○ Nei ●	
Hvis ja, hvem?		
Overføres personopplysninger ved hjelp av e-post/Internett?	Ja ○ Nei ●	F.eks. ved bruk av elektronisk spørreskjema, overføring av data til samarbeidspartner/databehandler mm.
Hvis ja, hvilke?		
Vil personopplysninger bli utlevert til andre enn prosjektgruppen?	Ja ○ Nei ●	
Hvis ja, til hvem?		
Samles opplysningene inn/behandles av en databehandler?	Ja ○ Nei ●	Dersom det benyttes eksterne til helt eller delvis å behandle personopplysninger, f.eks. Questback, Synovate MMI, Norfakta eller transkriberingsassistent eller tolk, er dette å betrakte som en databehandler. Slike oppdrag må kontraktsreguleres Les mer om databehandleravtaler her
Hvis ja, hvilken?		
12. Vurdering/godkjenning fra andre instanser		
Søkes det om dispensasjon fra taushetsplikten for å få tilgang til data?	Ja ○ Nei ●	For å få tilgang til taushetsbelagte opplysninger fra f.eks. NAV, PPT, sykehus, må det søkes om

Figure 63: Notification form (Page 4 of 5)

Kommentar		dispensasjon fra taushetsplikten. Dispensasjon søkes vanligvis fra aktuelt departement. Dispensasjon fra taushetsplikten for helseopplysninger skal for alle typer forskning søkes Regional komitè for medisinsk og helsefaglig
Søkes det godkjenning fra andre instanser?	Ja ○ Nei ●	F.eks. søke registereier om tilgang til data, en ledelse om tilgang til forskning i virksomhet, skole, etc.
Hvis ja, hvilke?		
13. Prosjektperiode		
Prosjektperiode	Prosjektstart:07.01.2013 Prosjektslutt:19.04.2013	Prosjektstart Vennligst oppgi tidspunktet for når førstegangskontakten med utvalget opprettes og/eller datainnsamlingen starter. Prosjektslutt Vennligst oppgi tidspunktet for når datamaterialet enten skal anonymiseres/slettes, eller arkiveres i påvente av oppfølgingsstudier eller annet. Prosjektet anses vanligvis som avsluttet når de oppgitte analyser er ferdigstilt og resultatene publisert, eller oppgave/avhandling er innlevert og sensurert.
Hva skal skje med datamaterialet ved prosjektslutt?	□ Datamaterialet anonymiseres ■ Datamaterialet oppbevares med personidentifikasjon	Med anonymisering menes at datamaterialet bearbeides slik at det ikke lenger er mulig å føre opplysningene tilbake til enkeltpersoner.NB! Merk at dette omfatter både oppgave/publikasjon og rådata. Les mer om anonymisering
Hvordan skal datamaterialet anonymiseres?		Hovedregelen for videre oppbevaring av data med personidentifikasjon er samtykke fra den registrerte. Årsaker til oppbevaring kan være planlagte oppfølgningsstudier, undervisningsformål eller annet. Datamaterialet kan oppbevares ved egen institusjon, offentlig arkiv eller annet. Les om arkivering hos NSD
Hvorfor skal datamaterialet oppbevares med personidentifikasjon?	For videre forskning innhentes samtykke til oppbevaring av datamateriale.	
Hvor skal datamaterialet oppbevares, og hvor lenge?	Datamaterialet oppbevares ved egen institusjon for maksimal 5 år.	
14. Finansiering		
Hvordan finansieres prosjektet?	Egen finansiering	
15. Tilleggsopplysninger		
Tilleggsopplysninger		
16. Vedlegg		
Antall vedlegg	2	

Figure 64: Notification form (Page 5 of 5)

I Appendix - NSD response



Personvernombudet for forskning

Prosjektvurdering - Kommentar

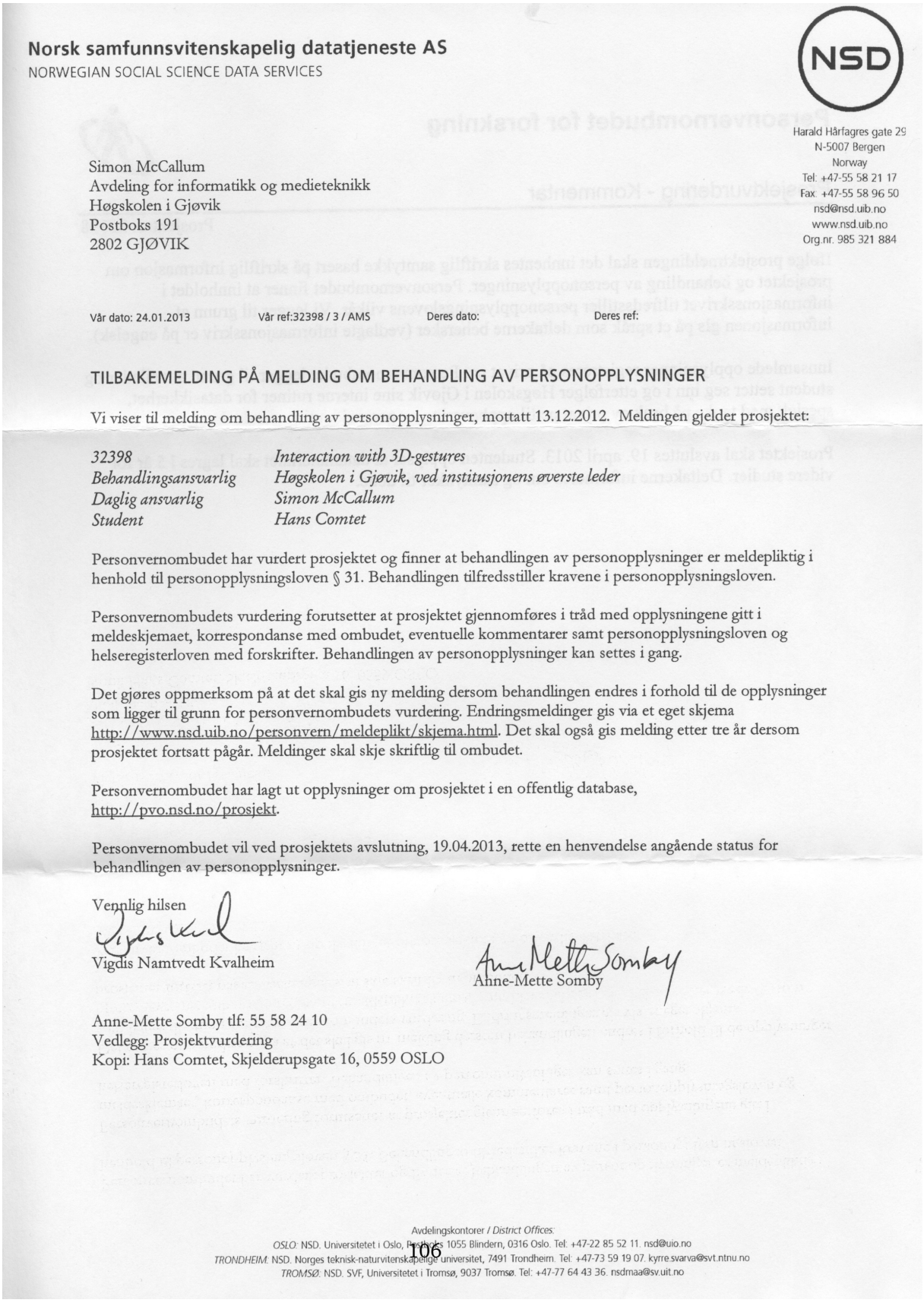
Prosjektnr: 32398

Ifølge prosjektmeldingen skal det innhentes skriftlig samtykke basert på skriftlig informasjon om prosjektet og behandling av personopplysninger. Personvernombudet finner at innholdet i informasjonsskrivet tilfredsstiller personopplysningslovens vilkår. Vi legger til grunn at informasjonen gis på et språk som deltakerne behersker (vedlagte informasjonsskriv er på engelsk).

Innsamlede opplysninger registreres på privat pc. Personvernombudet legger til grunn at veileder og student setter seg inn i og etterfølger Høgskolen i Gjøvik sine interne rutiner for datasikkerhet, spesielt med tanke på bruk av privat pc til oppbevaring av personidentifiserende data.

Prosjektet skal avsluttes 19. april 2013. Studenten opplyser at datamaterialet skal lagres i 5 år for videre studier. Deltakerne informeres om og samtykker til dette.

Figure 65: Privacy letter (Page 2 of 2)



Norsk samfunnsvitenskapelig datatjeneste AS
NORWEGIAN SOCIAL SCIENCE DATA SERVICES

NSD

Harald Hårfagres gate 29
N-5007 Bergen
Norway
Tel: +47-55 58 21 17
Fax: +47-55 58 96 50
nsd@nsd.uib.no
www.nsd.uib.no
Org.nr. 985 321 884

Simon McCallum
Avdeling for informatikk og medieteknikk
Høgskolen i Gjøvik
Postboks 191
2802 GJØVIK

Vår dato: 24.01.2013 Vår ref:32398 / 3 / AMS Deres dato: Deres ref:

TILBAKEMELDING PÅ MELDING OM BEHANDLING AV PERSONOPPLYSNINGER

Vi viser til melding om behandling av personopplysninger, mottatt 13.12.2012. Meldingen gjelder prosjektet:

32398	*Interaction with 3D-gestures*
Behandlingsansvarlig	*Høgskolen i Gjøvik, ved institusjonens øverste leder*
Daglig ansvarlig	*Simon McCallum*
Student	*Hans Comtet*

Personvernombudet har vurdert prosjektet og finner at behandlingen av personopplysninger er meldepliktig i henhold til personopplysningsloven § 31. Behandlingen tilfredsstiller kravene i personopplysningsloven.

Personvernombudets vurdering forutsetter at prosjektet gjennomføres i tråd med opplysningene gitt i meldeskjemaet, korrespondanse med ombudet, eventuelle kommentarer samt personopplysningsloven og helseregisterloven med forskrifter. Behandlingen av personopplysninger kan settes i gang.

Det gjøres oppmerksom på at det skal gis ny melding dersom behandlingen endres i forhold til de opplysninger som ligger til grunn for personvernombudets vurdering. Endringsmeldinger gis via et eget skjema http://www.nsd.uib.no/personvern/meldeplikt/skjema.html. Det skal også gis melding etter tre år dersom prosjektet fortsatt pågår. Meldinger skal skje skriftlig til ombudet.

Personvernombudet har lagt ut opplysninger om prosjektet i en offentlig database, http://pvo.nsd.no/prosjekt.

Personvernombudet vil ved prosjektets avslutning, 19.04.2013, rette en henvendelse angående status for behandlingen av personopplysninger.

Vennlig hilsen

Vigdis Namtvedt Kvalheim

Anne-Mette Somby

Anne-Mette Somby tlf: 55 58 24 10
Vedlegg: Prosjektvurdering
Kopi: Hans Comtet, Skjelderupsgate 16, 0559 OSLO

Avdelingskontorer / *District Offices*:
OSLO: NSD. Universitetet i Oslo, Postboks 1055 Blindern, 0316 Oslo. Tel: +47-22 85 52 11. nsd@uio.no
TRONDHEIM: NSD. Norges teknisk-naturvitenskapelige universitet, 7491 Trondheim. Tel: +47-73 59 19 07. kyrre.svarva@svt.ntnu.no
TROMSØ: NSD. SVF, Universitetet i Tromsø, 9037 Tromsø. Tel: +47-77 64 43 36. nsdmaa@sv.uit.no

Figure 66: Privacy letter (Page 1 of 2)

J Appendix - Invoice

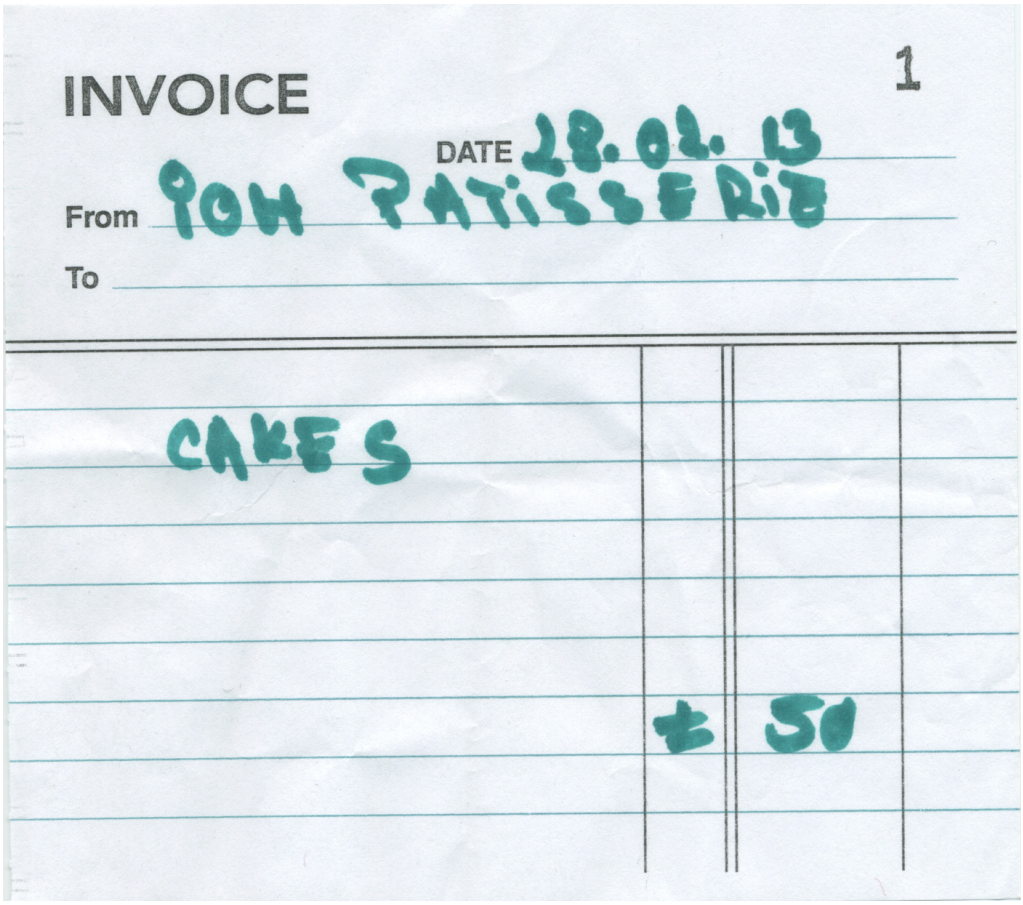


Figure 67: ion patisserie (1)

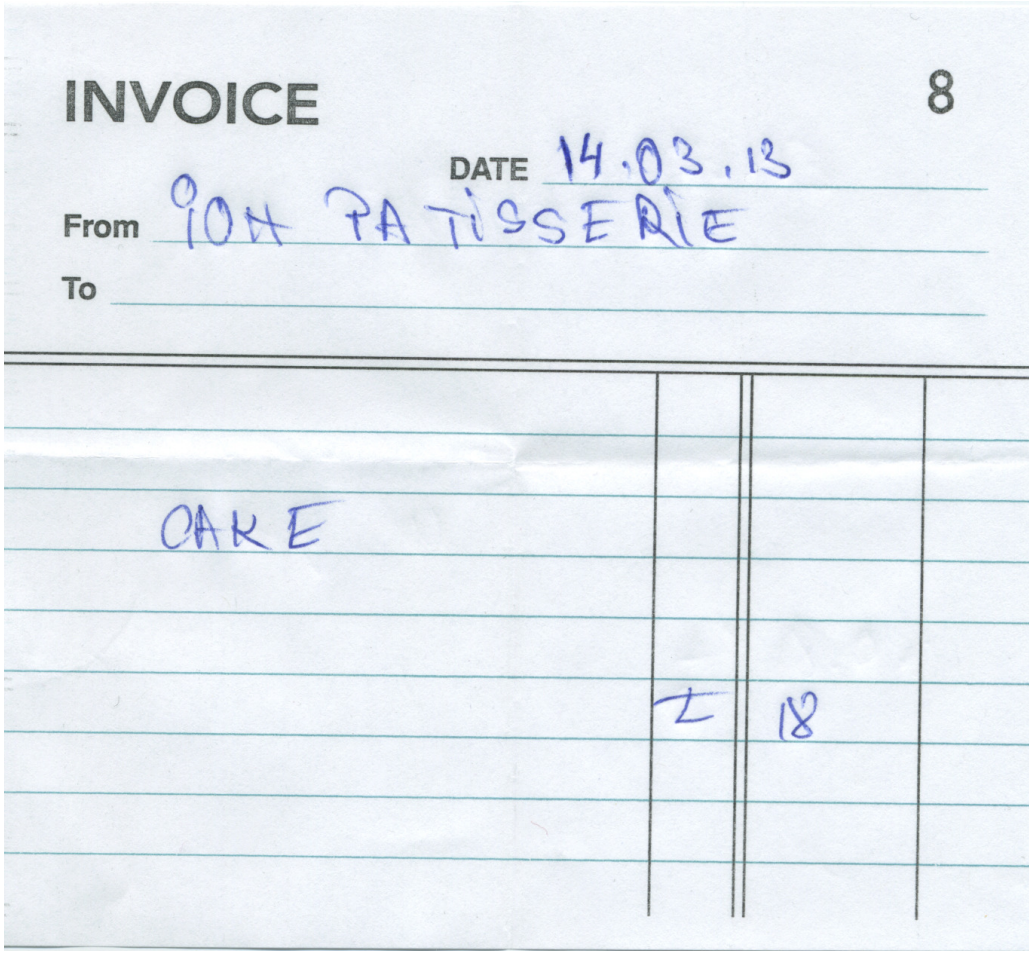


Figure 68: ion patisserie (2)

Figure 69: Invoice GesturePak Software

K Appendix - Verbal behavior

Comments from the younger age group

- "Oh, wow. That's cool."–Participant 4, turning the TV on
- "This is very good."–Participant 6
- "That's it? Oh, that's amazing."–Participant 8
- "Are they selling it already?"–Participant 14
- "That is cool."–Participant 16
- "It is knowledgeable. I mean it is great."–Participants 17
- "This is fun."–Participant 22

Comments from the older age group

- "Oh, isn't that fun. I don't know what I was doing, but I was imagining my tele at home. You know, in front of me. What a shame that it is just for 15 minutes. I enjoyed this."–Participant 28
- "Ah, wow! It is amazing and intuitive! I can hardly believe it. Wow, (Laughing), cause I had no idea what I was doing. Gosh, that is amazing! That is very surprising, because, I had no idea. I just guessed, and it worked! That is really amazing! (Astonished)."–Participant 29
- "It is so funny, jumping with . . . (moving her arms) . . . coming so natural . . . "–Participant 33
- "That was fun!"–Participant 38

L Appendix - Questionnaire responses

In using 3D gestures, did you experience any problems or issues? (Answers given by the younger age group)

No problems

- No problems at all.–Participant 4
- No it was fairly easy as these were the gestures I already use in my routine.–Participant 8
- No problems.–Participant 10
- No issues!–Participant 11
- No, very easy to use and fun.–Participant 13
- No.–Participant 16
- No.–Participants 22
- None.–Participant 25

Minor problems

- A few glitches as I was adjusting to the system.–Participant 1
- Not really. I did find it somewhat problematic to find fitting and easy gestures for all assignments. So a lot should depend on how well the gesture fits the task at hand, and how many gestures you can have to easily fulfill all required functions (i.e., the amount of good gestures might limit the amount of functions a system could have or vice versa).–Participant 2
- In the bowling example, it was hard to orientate the ball without a physical item in ones hand.–Participant 6
- No issues but slightly hard to play the movie in the right place after fast-forwarding.–Participant 14
- It was a little bit confusing at first but got better as I used it more.–Participant 18
- I worried a little that it hadn't detected me at times.–Participant 20
- No, however some movements were over the top which made some actions unrecognizable.–Participants 21

Problems

- If the gestures are predetermined/predefined, then it is a bit difficult knowing what to do. I don't know of gesture 'conventions' yet.–Participant 7
- Prompt wasn't clear from the beginning sometimes it take a while to know how to use it. UI wasn't design for gesture friendly.–Participant 15
- At the TV task I had to naturally come up with gestures that was kind of difficult because

I have never thought of such gestures interactions. Usually the gestures are instructed not invented by me when using a gesture app/game/etc, that was challenging as I didn't know what gesture to do for thing I undertake in my every day life.–Participant 17

- Unaccustomed to wii type games so takes time to learn movements required.–Participant 24

In using 3D gestures, did you experience any problems or issues? (Answers given by the older age group)

No problems

- No.–Participant 29
- No.–Participant 30
- No.–Participant 34
- No.–Participant 35

Minor problems

- It took a moment to know how to play the bowling game.–Participant 37
- I found it odd I could see my avatar when picking up the bowling ball, but once I had it in my virtual hand, my avatar disappeared. I could not see immediately how to make the bowling ball more forward until I took a backward swing i.e. I completed a more lifelike gesture, for some reason (as the virtual ball is weightless, I think) I did not immediately undertake the "real life" action.–Participant 38
- Only at first.–Participant 39

Problems

- I work best with clear instructions. Having no instructions as to how to use things can be frustrating.–Participant 32
- I wanted and tried unsuccessfully to move up and down several menu items in one gesture; I'm not sure if that's possible.–Participant 33

In using 3D gestures, would you describe your experience as positive? (Answers given by the younger age group)

Agree

- Yes, very positive if used in the right way. Gestures are an important part of the way we naturally interact with the world. I would prefer that over something artificial that needs to mediate my interaction with a technology.–Participant 2
- Yes, very positive. It makes navigating the UI more natural and intuitive as well as being quicker and more efficient a lot of the time. For games and pleasure activities it is really good as it brings an added dimension to what you are doing as well as being more engaging than an ordinary game.–Participant 4

- It is a positive experience especially when your assumption of what gesture to use something is true.–Participant 6
- Yes, it is fun and it feels a lot more interactive. Bowling for example feels a lot more lifelike with 3D gestures.–Participants 20
- Yes it was fun and I enjoyed it. I would buy the system for gestures, as it is very interactive and more advanced than other features.–Participant 1
- Yes, enjoyable and engaging. Although there are some times when I might prefer not to use gestures (e.g. Being tired and feeling lazy after a long day, or if one hand is busy e.g. On phone or eating).–Participant 7
- Yes, it was a good experience. It was fun, and I think you can do so much more with gesture based interfaces.–Participant 8
- Yes indeed.–Participant 10
- Yes, they are very easy to use and the experience was positive!–Participant 11
- It was fun, plus no need for controllers which may be dirty or broken.–Participant 13
- Yes very much so.–Participant 14
- It's fun to use like you are playing games.–Participants 15
- Yes.–Participants 16
- Absolutely positive! Very fun, quite easy.–Participant 17
- Yes.–Participant 18
- Yes. It was an enjoyable experience, one in which I picked up quickly. I would use it again.–Participants 21
- Yes. It was fun and I wish the game was longer so that I can play more.–Participants 22
- Yes it was a good experience.–Participant 24
- Yes.–Participant 25

In using 3D gestures, would you describe your experience as positive? (Answers given by the older age group)

Agree

- It is easily informative.–Participant 28
- Yes.–Participant 29
- Yes.–Participant 30
- Yes, very. I enjoyed it and I am intrigued. It has made me want to find out more and how I can incorporate gestures into my daily life.–Participant 33
- Yes.–Participant 35

- Yes, I think I was very positive.–Participant 37
- . . . Good fun! . . . –Participant 38

Moderate agreement

- Yes, I feel sure this is the way things will go but am concerned how this might affect me as income older, less mobile and slower to learn new skills.–Participant 32
- Yes as managed to do what requested.–Participant 34
- Today's experience was positive. I have little other experience to compare with.–Participant 36
- Yes after some practice.–Participant 39

M Appendix - Gesture space of young female

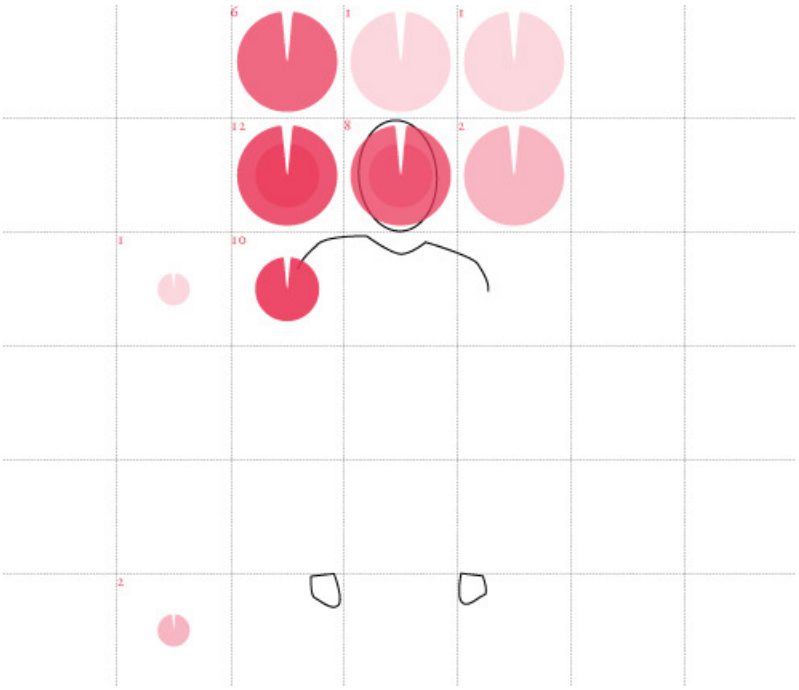


Figure 70: Gesture space (p11)

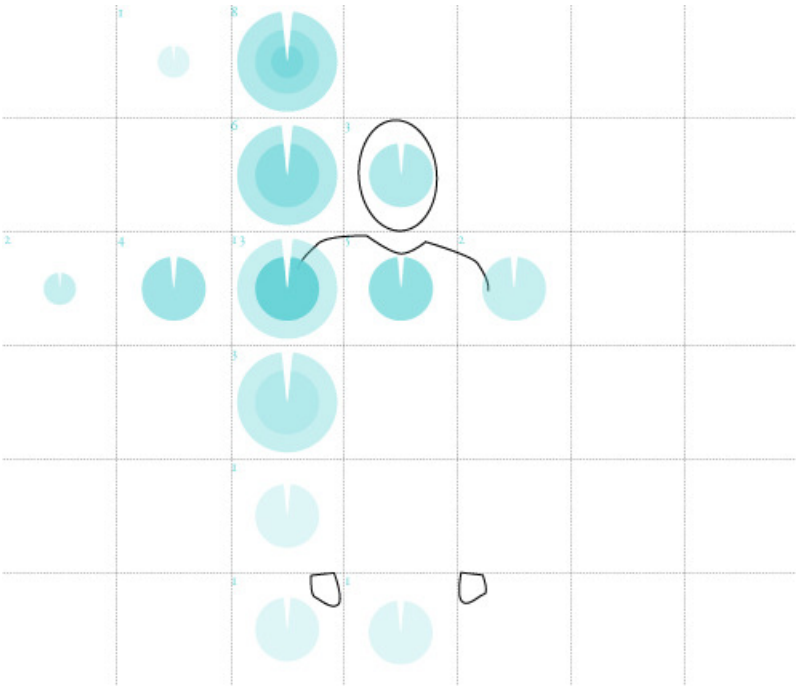


Figure 71: Gesture space (p14)

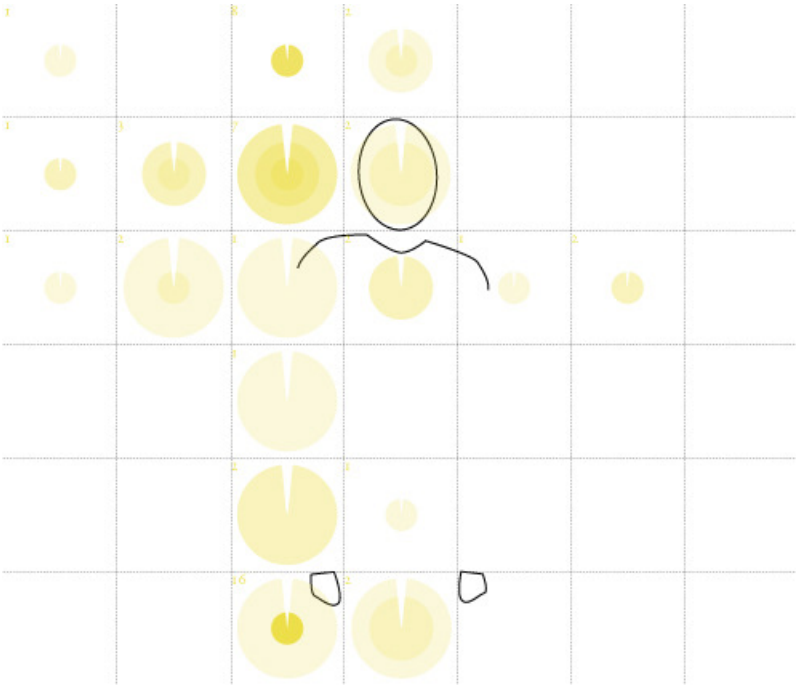


Figure 72: Gesture space (p15)

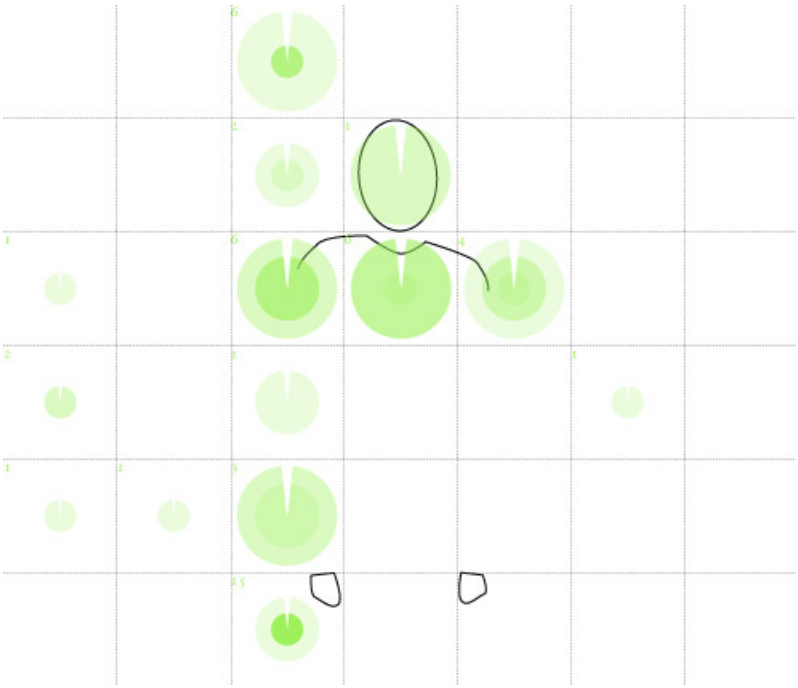


Figure 73: Gesture space (p16)

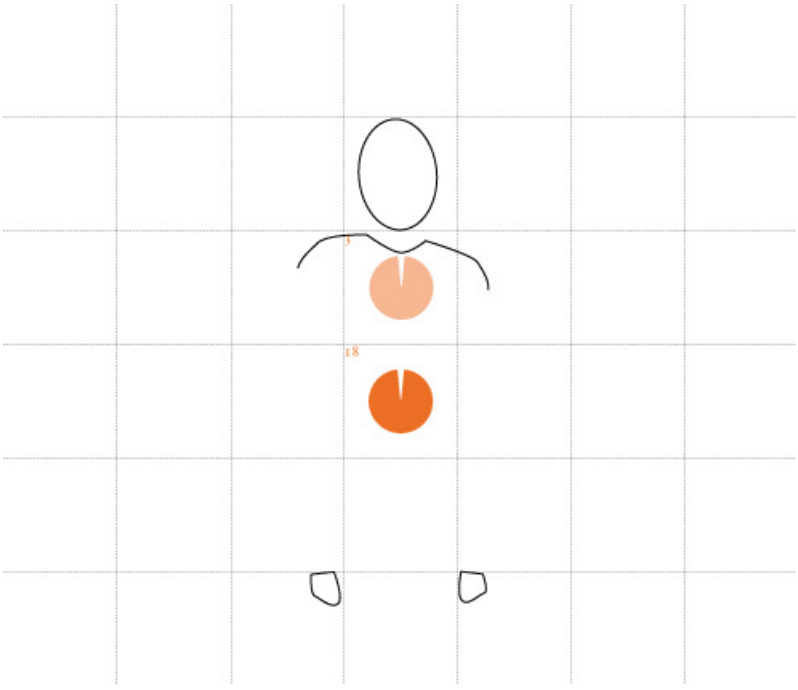


Figure 74: Gesture space (p18)

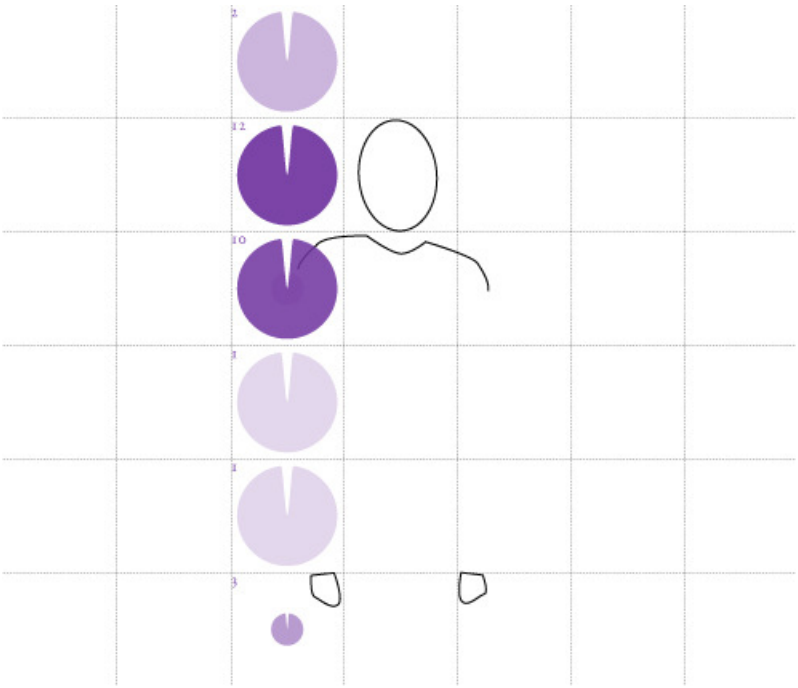


Figure 75: Gesture space (p20)

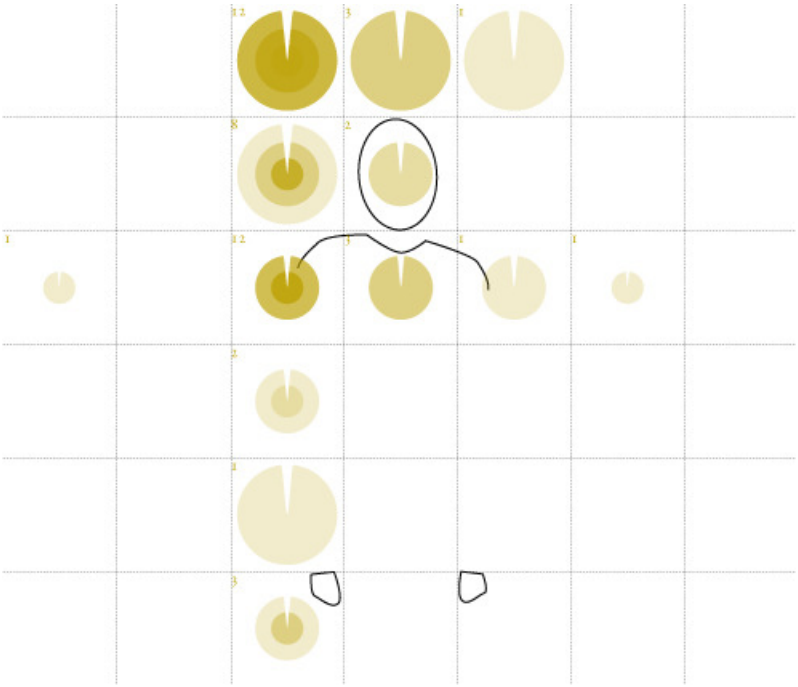


Figure 76: Gesture space (p21)

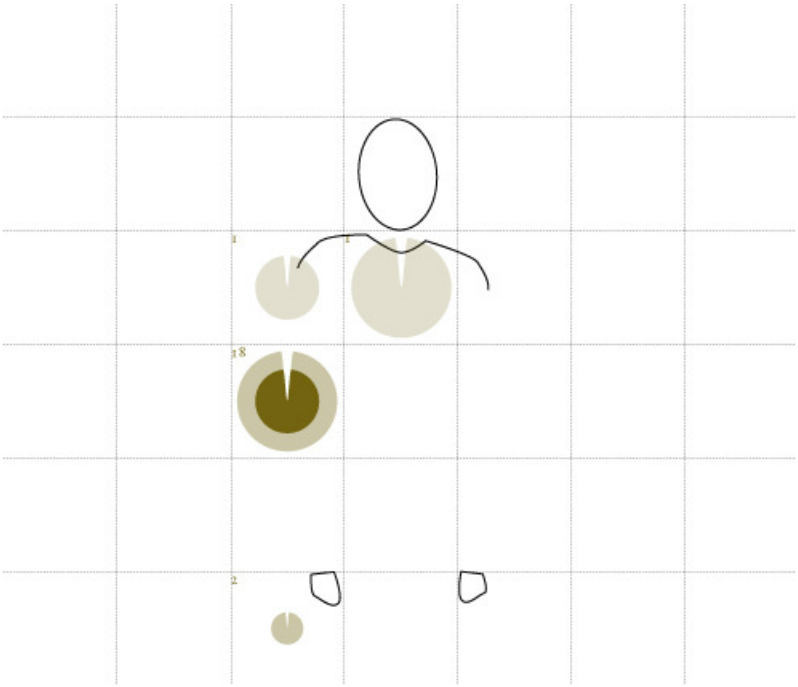


Figure 77: Gesture space (p24)

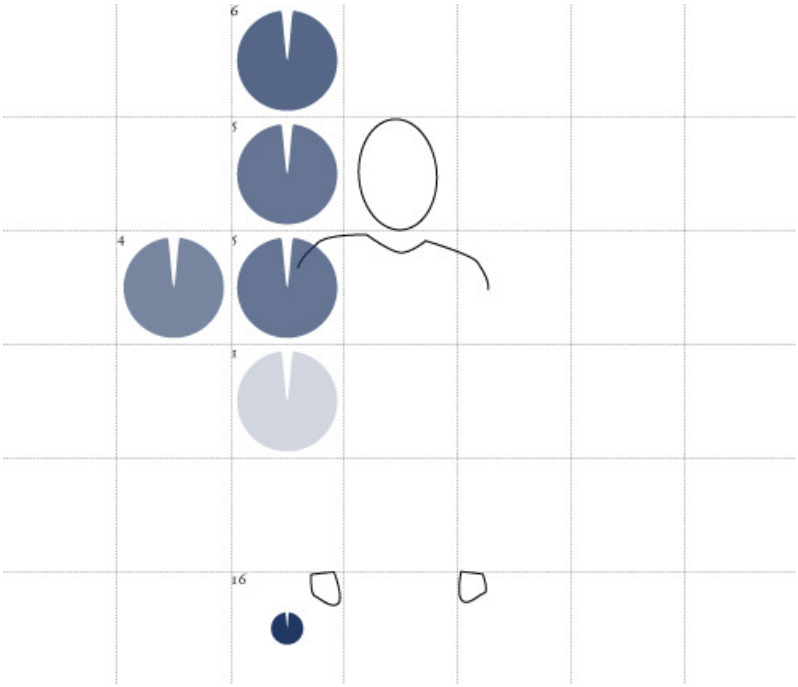


Figure 78: Gesture space (p25)

N Appendix - Gesture space of young male

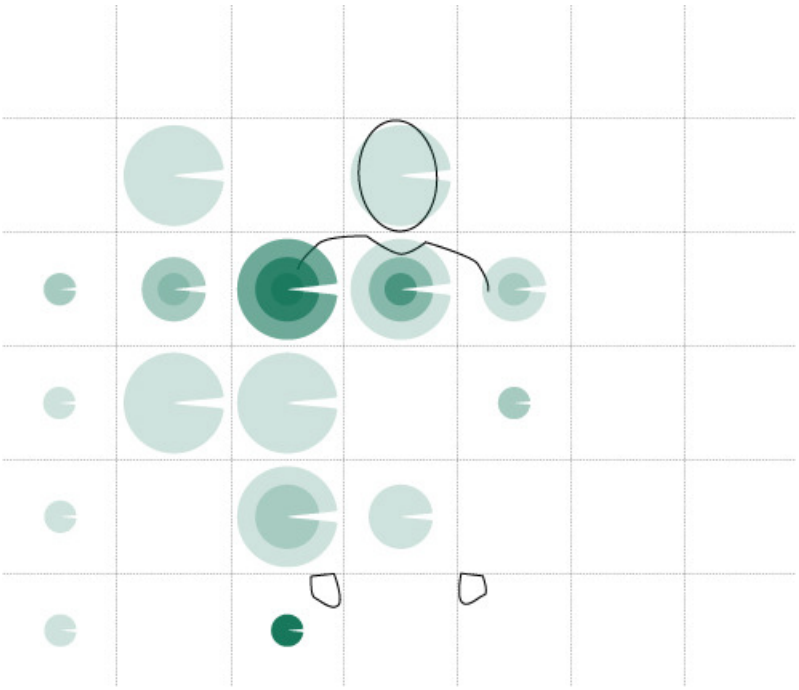


Figure 79: Gesture space (p1)

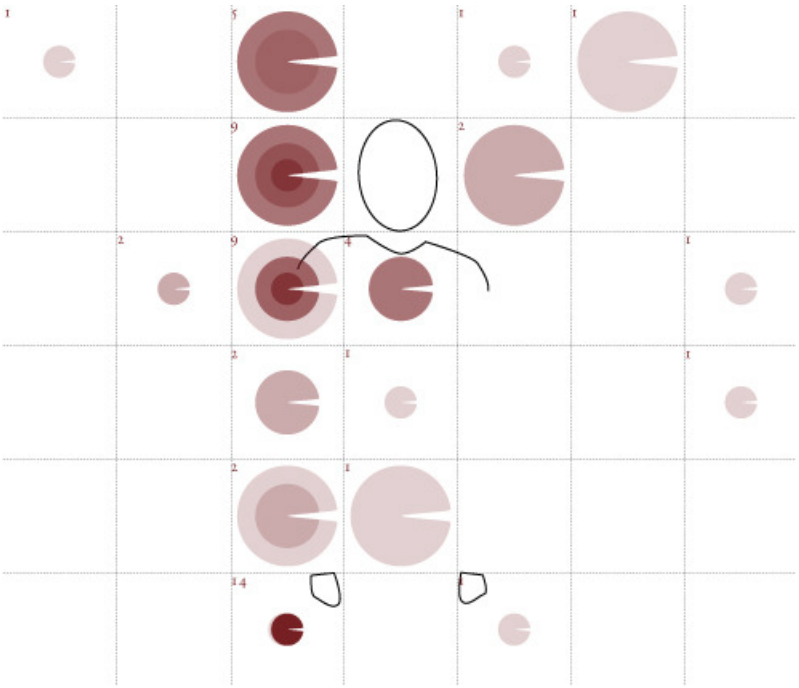


Figure 80: Gesture space (p2)

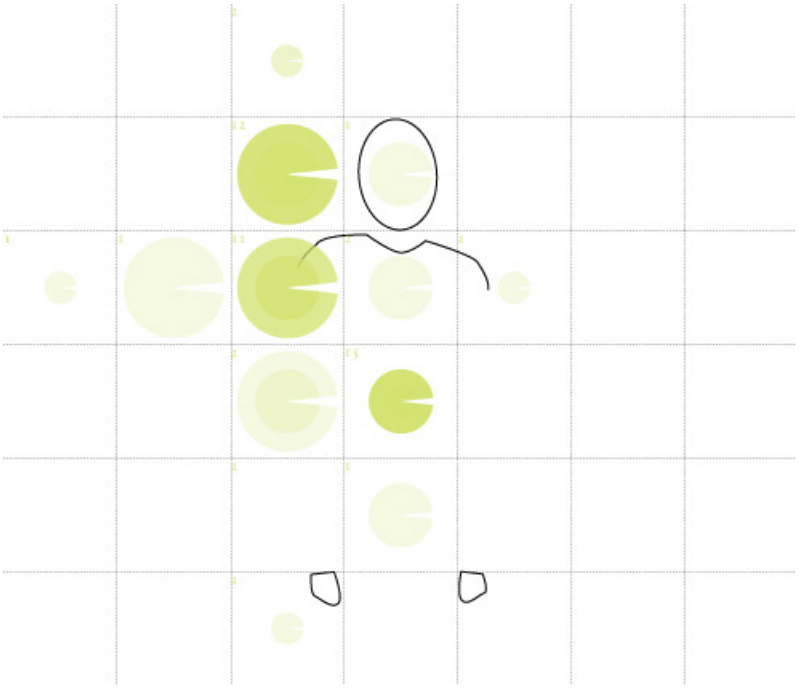


Figure 81: Gesture space (p4)

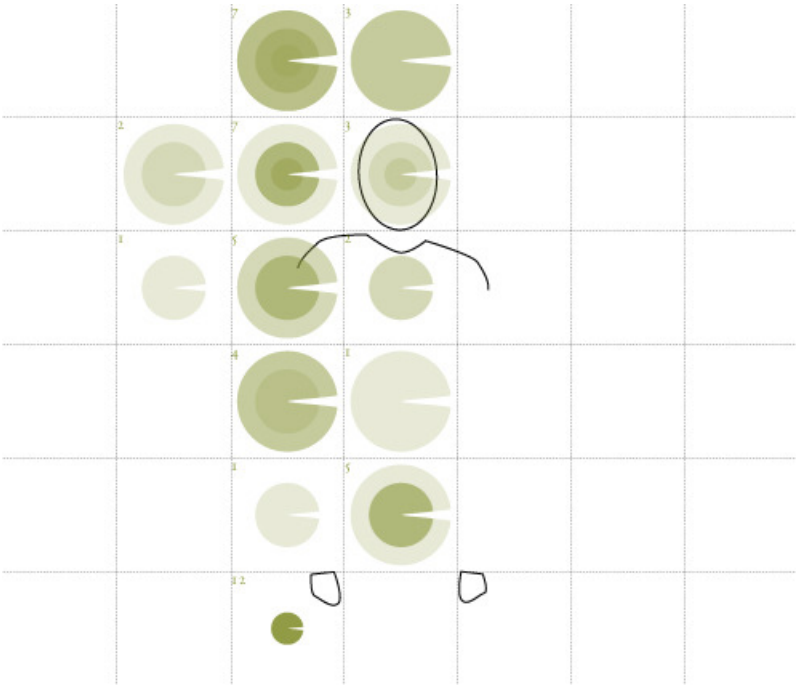


Figure 82: Gesture space (p6)

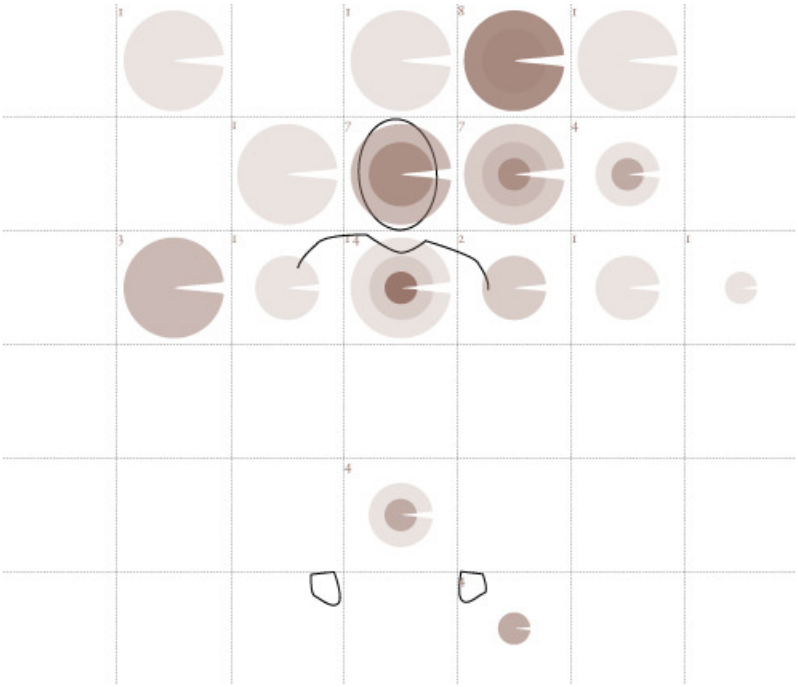


Figure 83: Gesture space (p7)

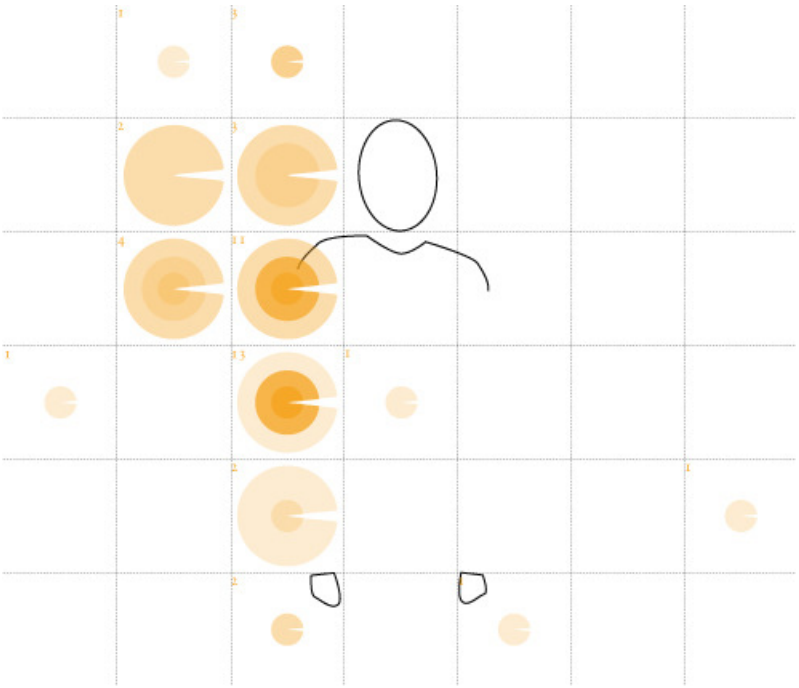


Figure 84: Gesture space (p8)

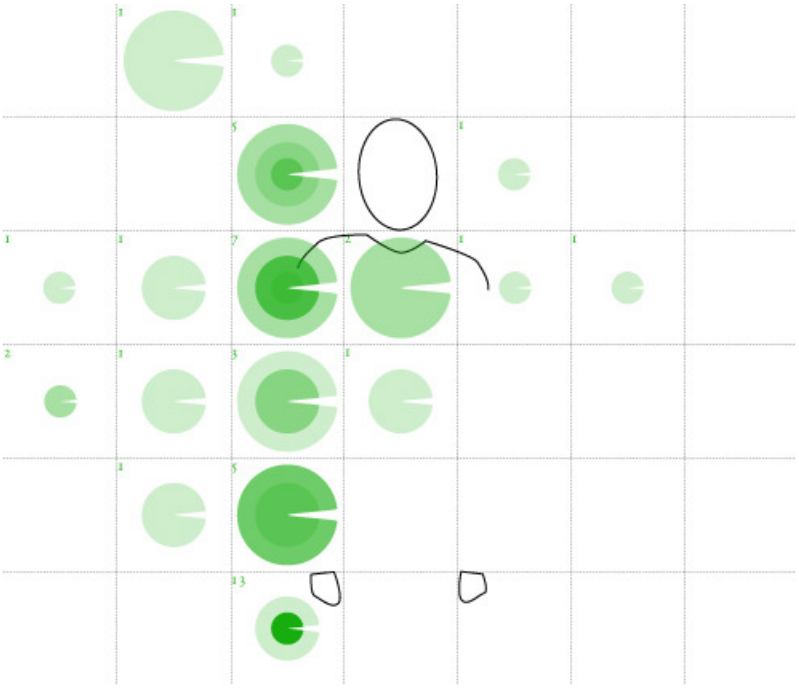


Figure 85: Gesture space (p10)

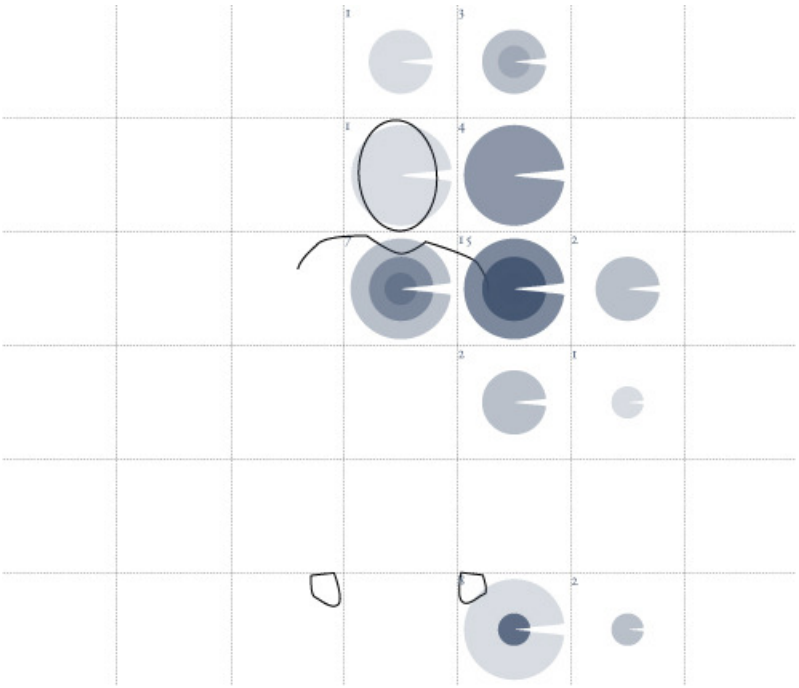


Figure 86: Gesture space (p12)

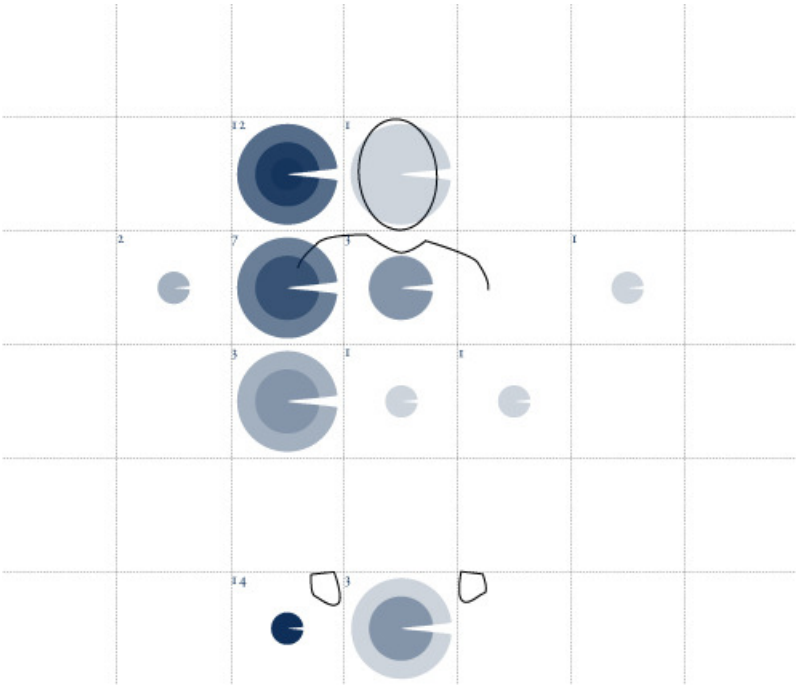


Figure 87: Gesture space (p13)

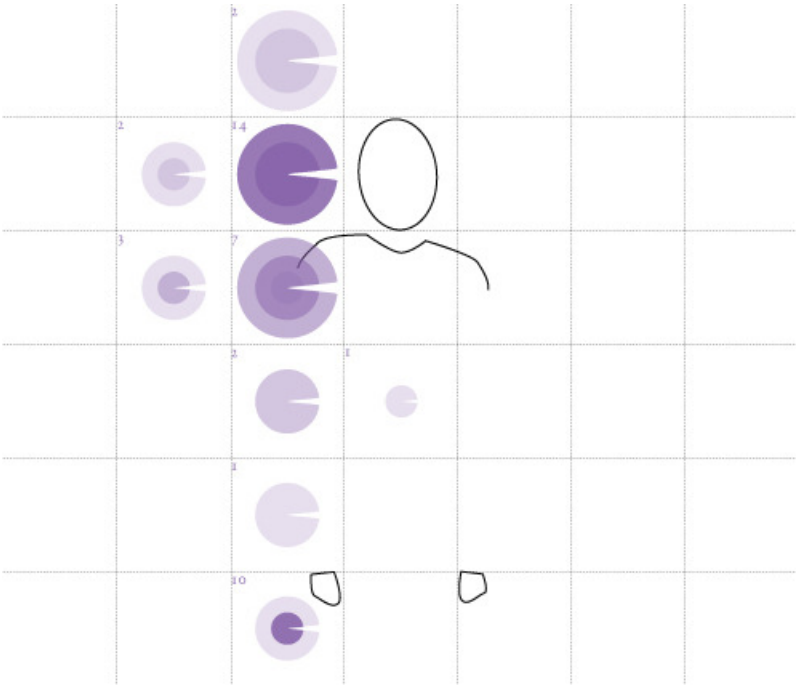


Figure 88: Gesture space (p17)

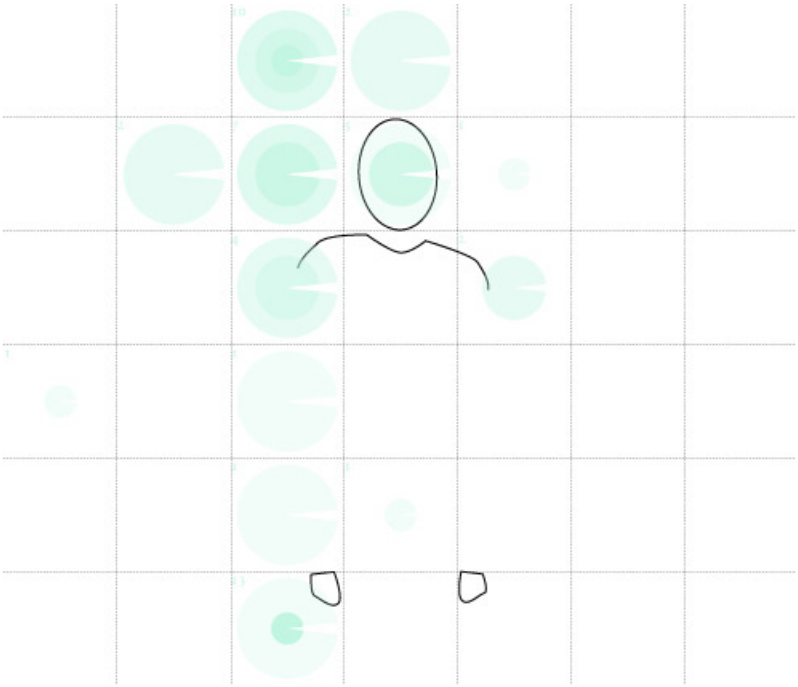


Figure 89: Gesture space (p22)

O Appendix - Gesture space of old female

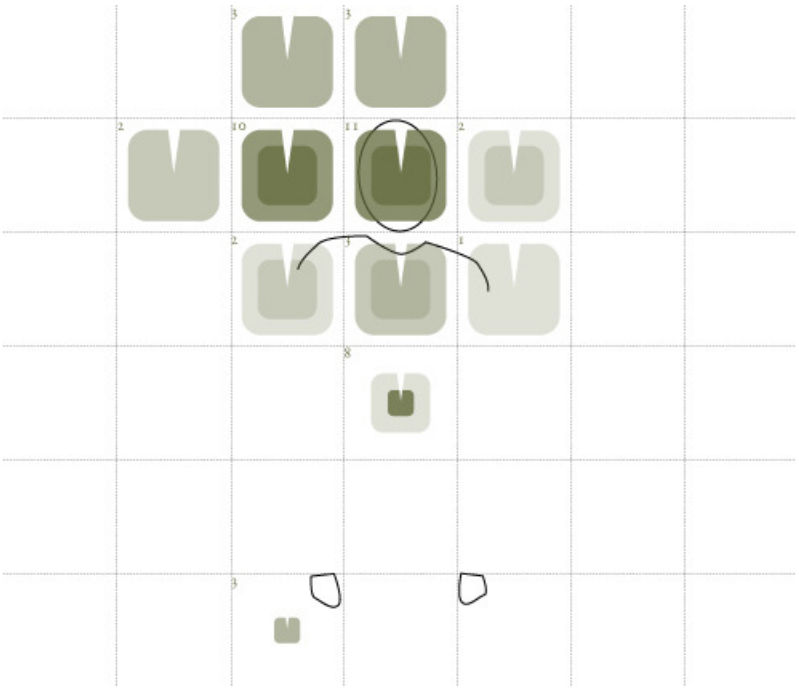


Figure 90: Gesture space (p28)

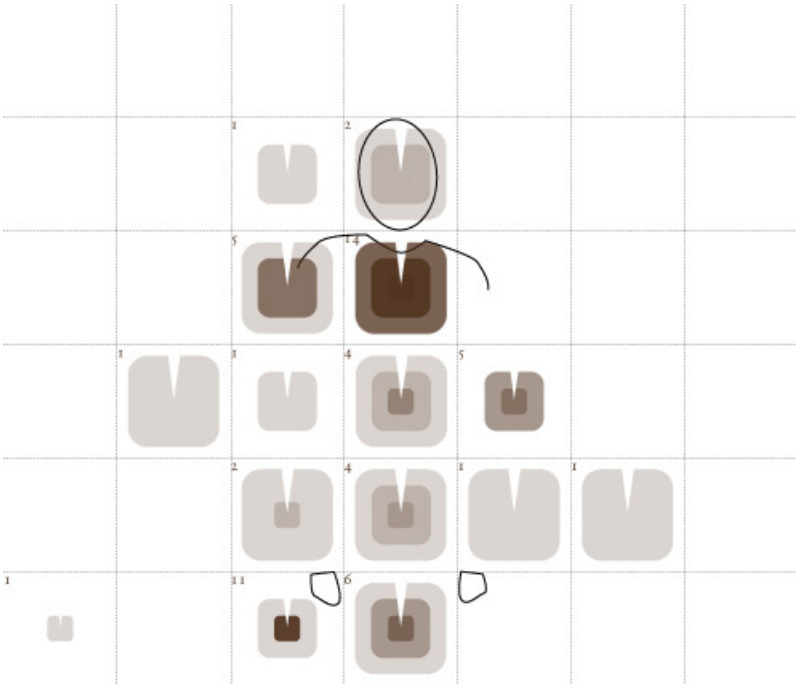


Figure 91: Gesture space (p29)

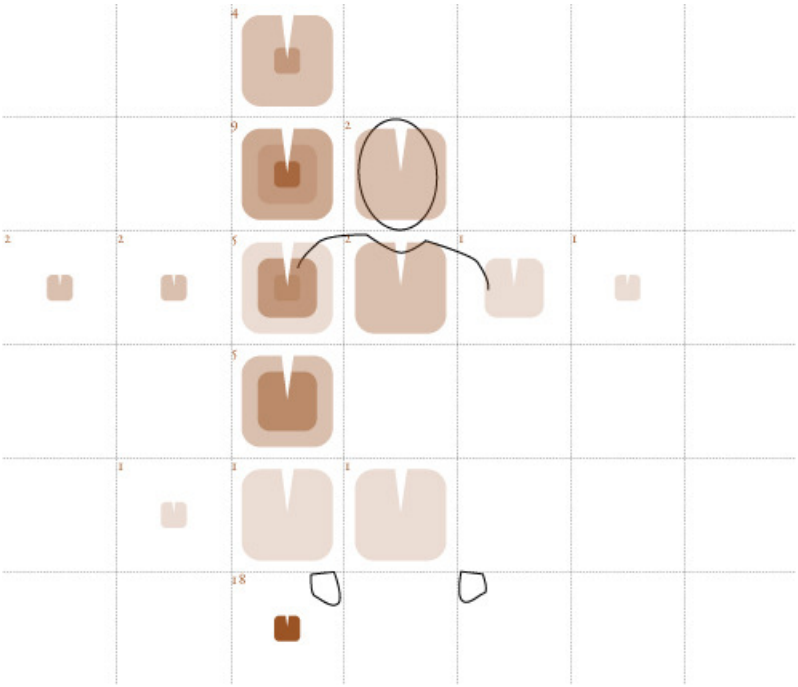


Figure 92: Gesture space (p32)

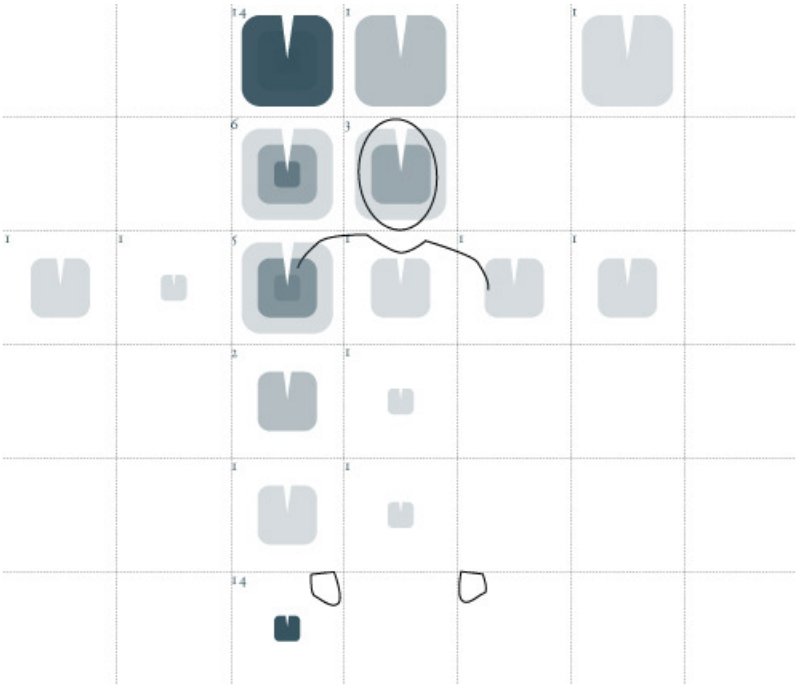


Figure 93: Gesture space (p33)

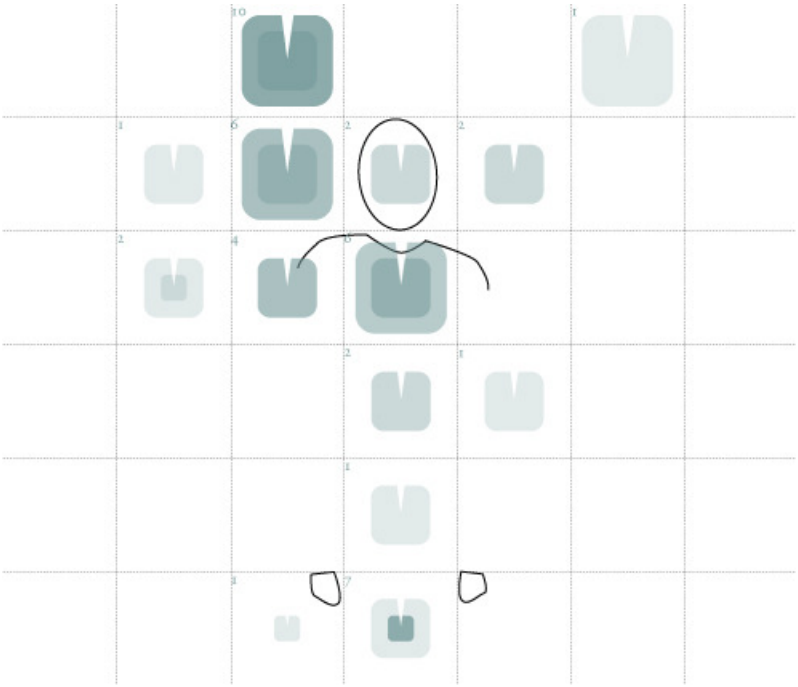


Figure 94: Gesture space (p34)

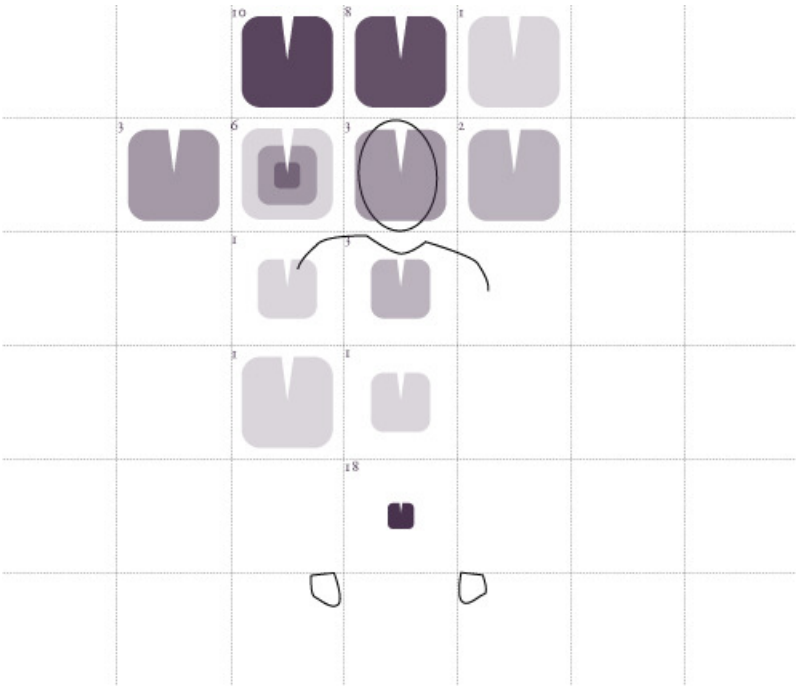


Figure 95: Gesture space (p36)

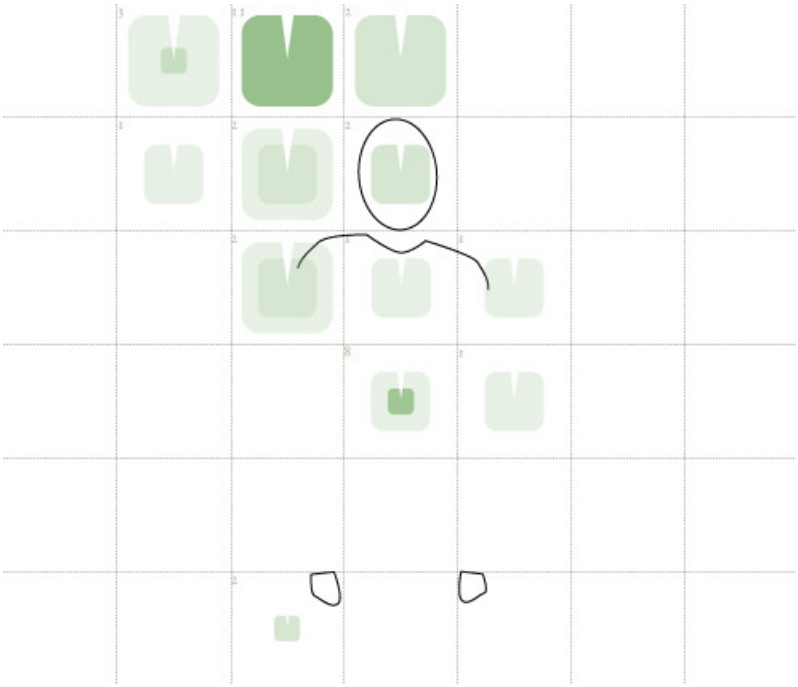


Figure 96: Gesture space (p38)

P Appendix - Gesture space of old male

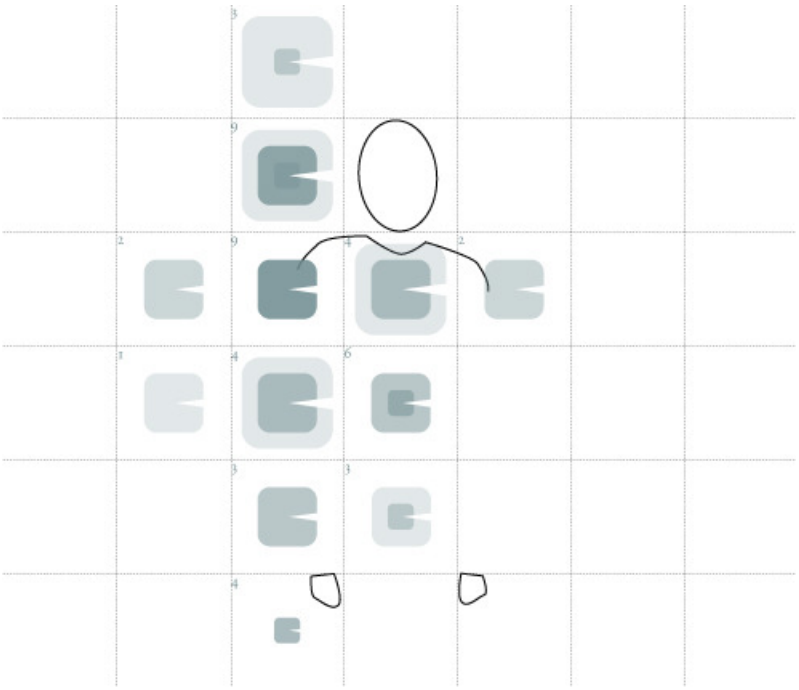


Figure 97: Gesture space (p30)

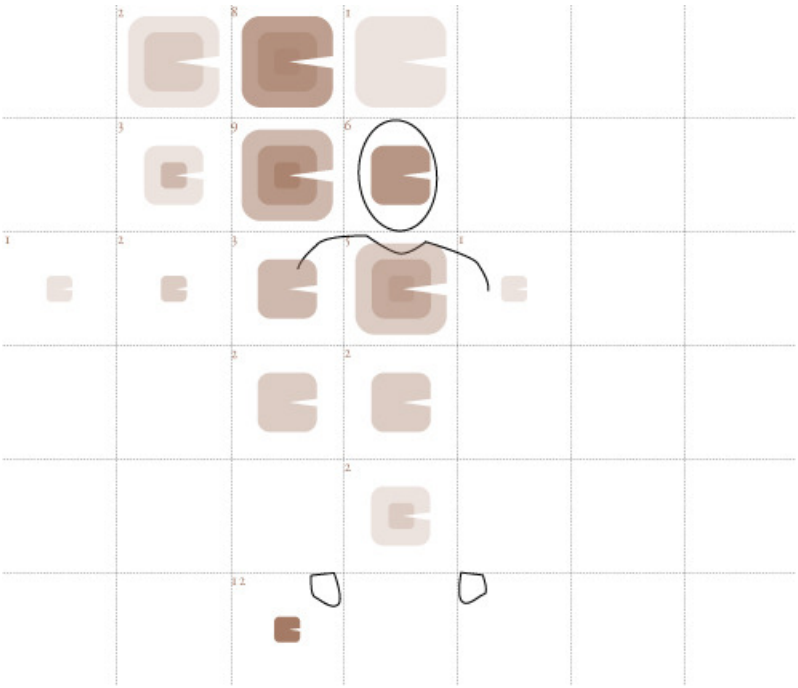


Figure 98: Gesture space (p35)

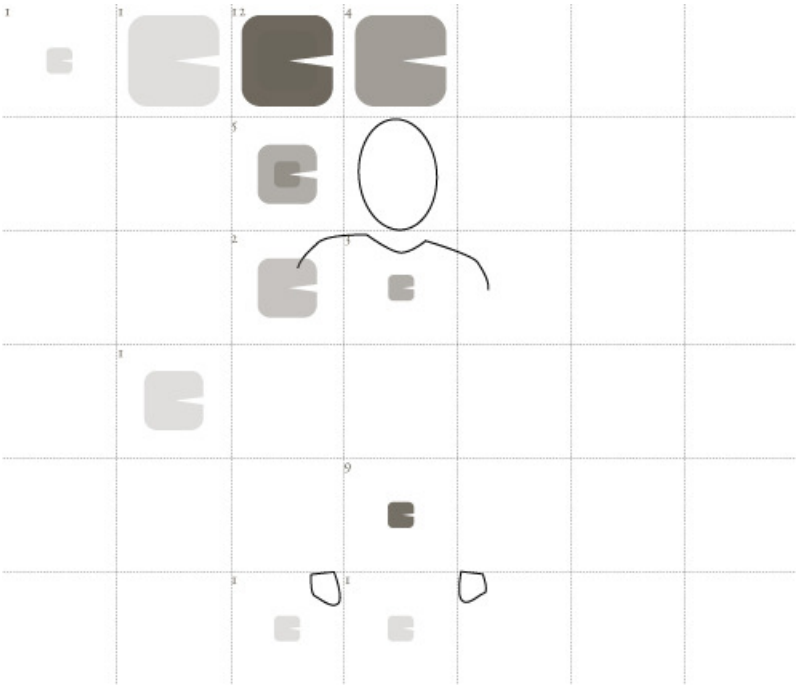


Figure 99: Gesture space (p37)

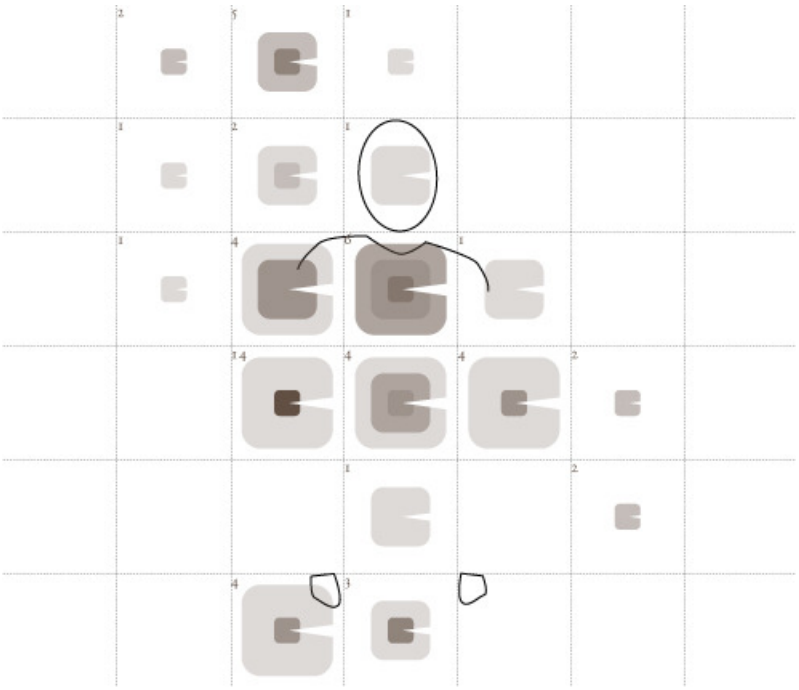


Figure 100: Gesture space (p39)

Q Appendix - Video Script

P1 – Male – 18-24 – Right
Experiment 27.2.2013

Time #10:07:04,000		Time	Researcher	Participant	Offline	Online	Description		Arm	Gesture space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):	A few gltches as I was adjusting to the system						
			In using 3D gestures, would you describe your experience as positiv. Please describe (you can use tags):	yes it was fun and i enjoyed it. I would buy the system for gestures as it is very interactive and more advanced than other features.						
			Nonverbal behavior				Playing around with the stickman			
				Haha. Ok, yeah. I mess up. Messing around. That's a fact going around with the stickman.						
			OK, this is the first task, the TV task.							
00:00:56,291	00:01:01,682	00:00:05,391	Turn the TV on			Online	Iconic	Pointing towards screen. Remote Control. Thumb towards palm	R	r5,1,0-r5,4,2
				I don't know how I turn it on						
			Sorry, I forgot one thing, Sorry							
				Don't worry about it. Trust me, these things happen						
				When ever you are ready						
			I am just calibrating …							
				That's fine. Turn the TV on.						
				How would you turn the TV on?						
00:02:16,386	00:02:19,838	00:00:03,452	Turn the TV on			Online	Iconic	Pointing towards screen. Remote Control. Thumb towards palm	R	r5,1,0-r5,4,2
00:02:26,604	00:02:36,392	00:00:09,788	Move downwards in the menu to the label "podcasts"			Online	Navigational	Dynamic movement from top right position downwards. Repeated	R	r5,1,0-r7,4,0-r6,5,2-r5,3,2-r5,2,1
00:02:36,826	00:02:41,327	00:00:04,501	Move upwards in the menu to the label "movies"			Online	Navigational	Dynamic movement upwards. Repeated.	R	r5,1,0-r5,4,1-r5,4,0
00:02:42,947	00:02:46,991	00:00:04,044	Select movies			Online	Dynamic	Dynamic movement to the right, then left	R	r5,1,0-r5,4,1-r7,4,0-l3,4,0
00:02:51,451	00:02:56,655	00:00:05,204	Move upwards in the menu to the label "iTunes top Films"			Online	Navigational	Dynamic movement upwards. Repeated.	R	r5,1,0-r5,4,1-r5,4,0
00:02:56,597	00:02:59,394	00:00:02,797	Select "iTunes top Films"			Online	Dynamic	Dynamic movement to the right, then left	R	m4,4,0-r6,4,1-m4,4,0
00:03:05,494	00:03:12,567	00:00:07,073	Move downwards in the menu to the label "Rust and Bone"			Online	Navigational	One dynamic movement downwards.	R	r5,1,0-r6,4,0-r5,2,2
00:03:14,888	00:03:18,920	00:00:04,032	Select movie "Rust and Bone"			Online	Dynamic	Dynamic movement to the right, then left	R	m4,4,0-r6,4,1-m4,4,1
00:03:29,480	00:03:33,107	00:00:03,627	Pause the movie		Offline		Static symbol	Stop sign. Open palm hand pointing towards screen	R	r5,1,0-m4,5,2
00:03:33,900	00:03:37,523	00:00:03,623	Play the movie			Online	Dynamic	One dynamic movement upwards.	R	r5,1,0-r5,4,1-r5,4,0
00:03:41,172	00:03:45,800	00:00:04,628	Increase the volume			Online	Iconic	Hand turning towards right. (Turning a button)	R	r5,1,0-r5,4,2
00:03:45,884	00:03:48,672	00:00:02,788	Decrease the volume			Online	Iconic	Hand turning towards left. (Turning a button)	R	r5,1,0-r5,4,2
00:03:50,438	00:03:54,459	00:00:04,021	Fast forward			Online	Dynamic	One dynamic movement to the right, then left.	R	r5,1,0-r6,3,2-l3,3,0
00:03:54,489	00:03:57,237	00:00:02,748	Stop		Offline		Static symbol	Stop sign. Open palm hand pointing towards camera.	R	l3,3,0-m4,4,2
00:03:57,557	00:04:01,589	00:00:04,032	Fast backward			Online	Dynamic	Dynamic movement to the left, then to the right. Repeated.	R	m4,2,1-l3,4,1-r7,2,0
00:04:02,700	00:04:04,533	00:00:01,833	Stop		Offline		Static symbol	Stop sign. Open palm hand pointing towards screen	R	r7,3,0-r5,4,1
00:04:06,977	00:04:11,397	00:00:04,420	Go back to the menu			Online	Iconic	Dynamic movement to the left, then to the right. (shuffel by side) both arms do the same movement	R	r5,1,0-m4,4,1-r7,1,0
00:04:12,489	00:04:18,224	00:00:05,735	Turn the TV off			Online	Iconic	Pointing towards screen. Remote Control. Thumb towards palm	R	r5,1,0-r5,4,2
				Did I do ok?						
			Yes							
				Cause, I have never used the kinect that well, so I was kind of trying to pick it up as it was going on.						
			No, you were good.							
				Ok, right now I was recently not knowing how to handle it, how to go downwards. To give it a good go with that.						

Figure 101: Videoscript (p1)

P2 – Male – 25-30 – Right
Experiment 27.2.2013

Time #11:54:16,500	Time	Researcher	Participant	Offline	Online	Description	Arm	Gesture space
			Not really, I did find it somewhat problematic to find fitting and easy gestures for all assignments. So a lot should depend on how well the gesture fits the task at hand, and how many gestures you can have to easily fulfill all required functions (i.e., the amount of good gestures might limit the amount of functions a system could have or vice versa).					
		In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags).						
		In using 3D gestures, would you describe your experience as positive. Please describe (you can use tags).	Yes, very positive if used in the right way. Gestures are an important part of the way we naturally interact with the world. I'd prefer that over something artificial that needs to mediate my interaction with a technology.					
			Nonverbal behavior			Playing around with the stickman		
			I am spastic, but how?					
			It is ok when I move, right?					
		Yes						
			It's good.					
00:03:42,770	00:03:46,857	00:00:04,087	Turn the TV on		Online	Iconic	Dopple clapp. Both arms doing the same	R+L	r5,1,0r-5,4,1-rn4,4,1
00:03:54,949	00:04:11,839	00:00:16,890	Move downwards in the menu to the label "podcasts"	Offline		Deictic	Pointing with index finger	R	r5,1,0l-13,6,0-l3,5,2
00:04:14,893	00:04:22,665	00:00:07,772	Move upwards in the menu to the label "movies"		Online	Navigational	One dynamic movement upwards.	R	r5,1,0r-5,4,2-r5,6,2-r5,6,1
00:04:23,786	00:04:27,680	00:00:03,894	Select movies	Offline		Deictic	Pointing towards screen with open palm hand.	R	r5,1,0r-5,4,1-r5,6,2
00:04:31,586	00:04:39,700	00:00:08,114	Move upwards in the menu to the label "iTunes top Films"		Online	Navigational	Dynamic movement upwards. Repeated.	R	r5,1,0r-5,5,2-r5,5,1-r5,5,0
00:04:40,540	00:04:42,994	00:00:02,454	Select "iTunes top Films"	Offline		Deictic	Pointing with index finger towards screen	R	r5,1,0r-5,5,0-r5,6,2
00:04:51,567	00:04:58,400	00:00:06,833	Move downwards in the menu to the label "Rust and Bone"		Online	Navigational	Dynamic movement downwards. Repeated.	R	r5,1,0r-5,5,1-r5,6,2-r5,2,2
00:04:59,708	00:05:02,960	00:00:03,252	Select movie "Rust and Bone"	Offline		Deictic	Pointing towards screen with index and middle finger.	R	m4,3,0r-5,4,0-r5,5,2
00:05:10,390	00:05:14,436	00:00:04,046	Pause the movie	Offline		Static symbol	Showing stop sign towards screen. Open palm hand.	R	r5,1,0r-5,5,0-r5,5,2
00:05:15,990	00:05:17,775	00:00:01,785	Play the movie		Online	Dynamic	One dynamic movement to the left, then to the right top.	R	r5,1,0-rn4,4,1-r7,6,0
00:05:21,360	00:05:24,947	00:00:03,587	Increase the volume		Online	Iconic	Lifting up. Both arms doing the same movement.Small repetations.	R+L	r5,1,0r-5,3,1-r5,4,1
00:05:26,308	00:05:29,409	00:00:03,101	Decrease the volume		Online	Iconic	Pressing down. Both arms doing the same movement. Small repetations.	R+L	r5,1,0r-5,3,1-r5,2,1
00:05:31,225	00:05:36,232	00:00:05,007	Fast forward		Online	Iconic	Turning body towards right. Both arms doing the same up/down movement to visualize a forward movment (running)	R+L	r5,1,0r-6,4,0-r5,4,0
00:05:36,259	00:05:40,751	00:00:04,492	Stop	Offline		Static symbol	Showing stop sign towards screen. Open palm hand. Both arms doing the same.	R+L	r5,4,0r-5,5,2
00:05:42,397	00:05:55,680	00:00:13,283	Fast backward		Online	Iconic	Turning body towards right. Both arms doing the same up/down movement to visualize movment (pulling rim)	R+L	r5,1,0r-6,4,0-r5,4,0
00:05:55,680	00:05:57,569	00:00:01,889	Stop	Offline		Static symbol	Showing stop sign towards screen. Open palm hand. (Using left arm)	L	m4,4,1-l3,5,2
00:06:00,958	00:06:07,920	00:00:06,962	Go back to the menu		Online	Iconic	One dynamic movement to the left, then to the bottom. Using left arm. Closing curtin.	L	l3,1,0-l1,1,3,0-l1,4,0-l2,6,2-rn4,2,2
00:06:10,985	00:06:14,599	00:00:03,614	Turn the TV off		Online	Iconic	Dopple clapp. Both arms doing the same movement	R+L	r5,1,0r-5,4,1-rn4,4,1

Figure 102: Videoscript (p2)

P4 – Male – 18-24 – Right
Experiment 27.2.2013

Time	#13:39:54,500	Time	Researcher	Participant	Offline	Online	Description		Arm	Gesture space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):	No problems at all.						
			In using 3D gestures, would you describe your experience as positiv. Please describe (you can use tags):	Yes, very positive. It makes navigating the UI more natural and intuative as well as being quicker and more efficient a lot of the time. For games and pleaure activities it is really good as it brings an added dimension to what you are doing as well as being more engaging than an ordinary game.						
			Nonverbal behavior				No playing with the stickman			
			The TV …							
				Uh, iTV, exactly …						
			I am just calibrating the second kinect							
				So do you had to design, how to set it up everything your selv?						
			Yes							
				That took some time						
			Yes							
			I will start with the TV task now							
				Cool						
00:01:24,296	00:01:26,973	00:00:02,677	Turn the TV on	Oh, wow. That's cool.		Online	Iconic	Pointing towards screen. Remote control. Thumb towards index finger.	R	r5,1,0-r5,4,2
00:01:35,585	00:01:40,781	00:00:05,196	Move downwards in the menu to the label “podcasts”			Online	Navigational	Dynamic movements downwards. Repeated.	R	m4,3,1-r5,5,1-r5,4,2-r5,5,2
00:01:44,196	00:01:48,440	00:00:04,244	Move upwards in the menu to the label “movies”			Online	Navigational	Dynamic movements upwards. Repeated.	R	m4,3,1-r5,4,2-r5,5,1
00:01:49,291	00:01:51,554	00:00:02,263	Select movies		Offline		Deictic	Pointing towards screen with index and middlefinger.	R	m4,3,1-r5,4,1-r5,5,2
00:01:56,273	00:02:01,500	00:00:05,227	Move upwards in the menu to the label “iTunes top Films"			Online	Navigational	Dynamic movements upwards. Repeated.	R	m4,3,1-r5,3,1-r5,3,2-r5,4,1
00:02:01,462	00:02:03,469	00:00:02,007	Select “iTunes top Films”		Offline		Deictic	Pointing towards screen with index and middlefinger.	R	m4,4,1-r5,5,2
00:02:08,170	00:02:11,944	00:00:03,774	Move downwards in the menu to the label “Rust and Bone”			Online	Navigational	Dynamic movements downwards. Repeated.	R	m4,3,1-r5,5,1-r5,5,2-r5,4,2
00:02:13,790	00:02:15,306	00:00:01,516	Select movie “Rust and Bone”		Offline		Deictic	Pointing towards screen with index and middlefinger.	R	m4,4,1-r5,5,2
00:02:24,204	00:02:26,473	00:00:02,269	Pause the movie		Offline		Deictic	Pointing towards screen with index and middlefinger.	R	m4,3,1-r5,5,2
00:02:27,962	00:02:29,687	00:00:01,725	Play the movie		Offline		Deictic	Pointing towards screen with index and middlefinger.	R	m4,3,1-r5,5,2
00:02:32,538	00:02:36,343	00:00:03,805	Increase the volume			Online	Iconic	One dynamic movement upwards.	R	m4,3,0-r5,2,2-r5,6,0
00:02:36,931	00:02:39,630	00:00:02,699	Decrease the volume			Online	Iconic	One dynamic movement downwards.	R	m4,3,1-r5,6,0-r5,4,2-m4,2,1
00:02:41,930	00:02:43,643	00:00:01,713	Fast forward			Online	Dynamic	Dynamic movement from the left to the right.	R	m4,3,1-m4,5,1-r7,4,0
00:02:45,294	00:02:48,705	00:00:03,411	Stop		Offline		Static symbol	Stop sign. Open palm hand showing towards screen.	R	m4,3,1-r5,4,1
00:02:49,960	00:02:51,991	00:00:02,031	Fast backward			Online	Dynamic	Dynamic movement from right to left.	R	m4,3,0-r6,4,2-l3,4,0
00:02:52,270	00:02:54,311	00:00:02,041	Stop		Offline		Static symbol	Stop sign. Open palm hand showing towards screen.	R	m4,3,1-r5,5,2
00:02:56,875	00:03:01,216	00:00:04,341	Go back to the menu			Online	Iconic	Grapping towards screen and then closing hand and pulling towards body	R	m4,3,0-r5,4,1-r5,5,2-r5,4,1
00:03:02,651	00:03:05,128	00:00:02,477	Turn the TV off			Online	Iconic	Pointing towards screen. Remote control. Thumb towards index finger.	R	m4,3,1-r5,4,2
				It’s pretty cool. Have you heard about something called Leap, Leap motion control? Doing fruit ninja like this. I have pre-ordered it since last summer. It should be out soon. You see, I want to control my actual tele like that. It would be some much easier. There is an app called “flatter” for the mac and you can control itunes, videoplayer, you just do like this and control it. Bowling, fantastic.						
			And now it’s a bowling game, and you can throw the bowling ball six times.							
				I played kinect at my dad’s house and dented the ceiling, in jumping to high.						
				Ok, cool. What I do now. Its finish. Oh, cool, it was fun.						

Figure 103: Videoscript (p4)

P6 – Male – 25-30 – Right
Experiment 28.2.2013

Time	#12:19:29,500	Time	Researcher	Participant	Offline	Online	Description		Arm	Gesture space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):	In the bowling example, it was hard to orientate the ball without a physical item in ones hand						
			In using 3D gestures, would you describe your experience as positiv. Please describe (you can use tags):	It is a positive experience especially when your assumption of what gesture to use something is true.						
			Nonverbal behavior				No playing with the stickman			
			I am just calibrating the second kinect	OK						
			This is the TV task	Ah, ok, cool.						
00:01:07,364	00:01:10,414	00:00:03,050	Turn the TV on		Offline		Deictic	Pointing with index finger towards screen.	R	r5,1,0-r5,5,1-r5,6,2
00:01:10,740	00:01:16,788	00:00:06,048			Offline		Deictic	Pointing with index finger towards screen.	R	r5,1,0-m4,5,2-m4,6,2
00:01:24,240	00:01:30,117	00:00:05,877	Move downwards in the menu to the label “podcasts”			Online	Navigational	Dynamic movements downwards. Repeated.	R	r5,1,0-r5,6,1-r5,3,2
00:01:33,498	00:01:37,922	00:00:04,424	Move upwards in the menu to the label “movies”			Online	Navigational	Dynamic movements upwards. Repeated.	R	m4,2,1-r5,6,0
00:01:38,529	00:01:41,671	00:00:03,142	Select movies		Offline		Deictic	Pointing with tumb towards screen.	R	m4,2,1-m4,6,2
00:01:46,112	00:01:51,851	00:00:05,739	Move upwards in the menu to the label “iTunes top Films"			Online	Navigational	Dynamic movements upwards. Repeated.	R	r5,1,0-r5,3,2-r5,6,1
00:01:57,582	00:02:00,347	00:00:02,765	Select “iTunes top Films”		Offline		Deictic	Pointing with index finger towards screen.	R	m4,2,1-m4,6,2
00:02:03,600	00:02:09,131	00:00:05,531	Move downwards in the menu to the label “Rust and Bone”			Online	Navigational	Dynamic movements downwards. Repeated.	R	r5,1,0-r5,5,1-m4,2,2-m4,2,1
00:02:10,140	00:02:13,123	00:00:02,983	Select movie “Rust and Bone”		Offline		Deictic	Pointing with index finger towards screen.	R	r5,1,0-r5,4,1-r4,6,2
00:02:22,807	00:02:26,404	00:00:03,597	Pause the movie		Offline		Static symbol	Stop sign. Showing open palm hand towards screen.	R	r5,1,0-r5,5,1-r5,6,2
00:02:26,527	00:02:29,337	00:00:02,810	Play the movie		Offline		Deictic	Pointing with thumb finger towards screen.	R	r5,1,0-r5,3,1-r5,6,2
00:02:31,604	00:02:38,994	00:00:07,390	Increase the volume			Online	Iconic	Holding hand towards right ear	R	r5,1,0-r5,5,1-r5,5,0
00:02:41,691	00:02:46,430	00:00:04,739	Decrease the volume			Online	Iconic	Performing a pssst sign with the index finger.	R	r5,1,0-m4,5,0
00:02:47,579	00:02:51,100	00:00:03,521	Fast forward			Online	Iconic	Dynamic movement. Circle towards right. Repeated.	R	r5,1,0-m4,4,1-r6,4,1-m4,3,2-m4,5,2-r6,5,1
00:02:51,166	00:02:55,680	00:00:04,514	Stop		Offline		Static symbol	Stop sign. Showing open palm hand towards screen.	R	r5,2,1-r5,5,2
00:02:55,284	00:02:58,922	00:00:03,638	Fast backward			Online	Iconic	Dynamic movement. Circle towards left. Repeated.	R	r5,4,1-m4,5,1-r5,3,2-r6,5,2
00:02:58,922	00:03:01,593	00:00:02,671	Stop		Offline		Static symbol	Stop sign. Showing open palm hand towards screen.	R	m4,4,1-r5,6,2
00:03:05,393	00:03:10,318	00:00:04,925	Go back to the menu			Online	Iconic	One dynamic movement. Showing backwards (behind shoulder with the thumb)	R	r5,1,0-r5,4,2-r5,5,0
00:03:11,216	00:03:17,229	00:00:06,013	Turn the TV off		Offline		Deictic	Pointing with thumb finger towards screen.	R	r5,1,0-r5,4,1-r5,4,2
				This is very good.						
			This was the first task.							
				Oh, ok, of 34.						
				Oh, excellent, that was a really good interface.						
				Are they all trailers, or have you downloaded them illegal film there? I think they don’t have Rust and bone, yet.						

Figure 104: Videoscript (p6)

P7 – Male – 25-30 – Left
Experiment 28.2.2013

Time	#12:40:47,500	Time	Researcher	Participant	Offline	Online	Description		Arm	Gesture space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):	If the gestures are predetermined/predefined, then it is a bit difficult knowing what to do. I don't know of gesture'conventions' yet						
			In using 3D gestures, would you describe your experience as positiv. Please describe (you can use tags):	Yes, enjoyable and engaging. Although there are some times when I might prefer not to use gestures (e.g. Being tired and feeling lazy after a long day, or if one hand is busy e.g. On phone or eating)						
			Nonverbal behavior				No playing with the stickman			
00:02:17,716	00:02:38,335	00:00:20,619	Turn the TV on	I usually go for a button or something. Eh, I am assuming, that it is all gesture control, eh, pointing at it? Right, eh, not sure.	Offline		Deictic	Pointing with the thumb towards the screen.	L	l3,1,0-l3,4,1-l2,5,0-l3,6,2
00:02:44,371	00:02:49,521	00:00:05,150	Move downwards in the menu to the label “podcasts”			Online	Navigational	Dynamic movement with index and middelfinger. Repeated.	L	l3,1,0-l3,5,2-m4,5,2
00:02:52,154	00:02:57,326	00:00:05,172	Move upwards in the menu to the label “movies”			Online	Navigational	Dynamic movement upwards. Repeated.	L	m4,4,0-l3,5,1-l3,6,2
00:02:57,789	00:03:03,211	00:00:05,422	Select movies		Offline		Deictic	Pointing towards screen.	L	m4,4,0-l3,5,0-l3,5,2
00:03:08,773	00:03:13,810	00:00:05,037	Move upwards in the menu to the label “iTunes top Films"			Online	Navigational	Dynamic movement upwards. Repeated.	L	m4,4,0-l3,6,2-m4,4,1
00:03:16,821	00:03:21,545	00:00:04,724	Select “iTunes top Films”	I don't know … Something like that	Offline		Deictic	Pointing towards screen.	L	m4,4,0-l3,5,0-l3,6,2
00:03:26,680	00:03:30,480	00:00:03,800	Move downwards in the menu to the label “Rust and Bone”			Online	Navigational	Dynamic movement upwards. Repeated.	L	m4,4,0-l3,6,2-m4,5,2
00:03:31,238	00:03:34,755	00:00:03,517	Select movie “Rust and Bone”		Offline		Deictic	Pointing towards screen.	L	m4,4,0-l3,5,0-l3,6,2
00:03:43,810	00:03:49,158	00:00:05,348	Pause the movie			Online	Dynamic	One dynamic movement to the left.	L	m4,4,0-l3,4,1-m4,5,1-l2,5,0
00:03:51,314	00:03:55,310	00:00:03,996	Play the movie		Offline		Deictic	Pointing towards screen.	L	m4,2,0-l3,5,0-l3,6,2
00:03:56,453	00:04:03,961	00:00:07,508	Increase the volume			Online	Iconic	One dynamic movement upwards.	L	m4,4,0-r6,4,2-m4,6,2
00:04:04,960	00:04:08,187	00:00:03,227	Decrease the volume			Online	Iconic	One dynamic movement downwards	L	m4,4,0-r6,6,2-r6,4,2
00:04:09,756	00:04:13,320	00:00:03,564	Fast forward			Online	Dynamic	One dynamic movement from the left to the right.	L	m4,4,0-l3,1,0-l2,4,1-r6,4,2
00:04:14,196	00:04:16,488	00:00:02,292	Stop			Online	Iconic	Showing a Karate sign (Hand sideways) (Movement comes to an and?)	L	m4,4,0-r5,5,2-m4,5,2
00:04:18,767	00:04:21,668	00:00:02,901	Fast backward			Online	Dynamic	One dyamic movement from the right to the left side.	L	m4,2,0-r5,4,1-m4,5,1-l1,4,0
00:04:21,930	00:04:24,399	00:00:02,469	Stop			Online	Iconic	Showing a Karate sign (Hand sideways) (Movement comes to an and?)	L	m4,2,1-l2,5,1-m4,5,1
00:04:28,700	00:04:34,649	00:00:05,949	Go back to the menu			Online	Iconic	One dynamic movement from the top downwards. (Closing down)	L	m4,2,0-l2,5,0-l2,6,2-m4,4,2
00:04:42,169	00:04:46,590	00:00:04,421	Turn the TV off	I can’t remember what I did to turn it on. Eh, why not waving.		Online	Iconic	Dynamic waving "good bye". Repeated.	L	m4,4,0-l3,1,0-m4,5,1-l3,6,1
				Ok, was that ok?						
			Yes							
				I am not sure if I waved it on. It would make more sense to me, but I didn’t really know what I was doing.						
			And now there is the bowling game, and you can throw the bowling bowl six times.							
				This a bit awkward, cause I am usually bowl with my right hand. Should I give it a try with my left hand?						
			Yes							
				This is quite good. I like it. I have not played with a kinect before. It’s better than I expected it to be.						
				Hey.						
				I found it easier than in real life. That what interesting. That was good fun. I liked it.						

Figure 105: Videoscript (p7)

P8 – Male – 25-30 – Right
Experiment 28.2.2013

Time	#13:34:01.500	Time	Researcher	Participant	Offline	Online	Description	Arm	Gesture space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):	No it was fairly easy as these were the gestures I already use in my routine					
			In using 3D gestures, would you describe your experience as positiv. Please describe (you can use tags):	Yes, it was a good experience. It was fun, and I think you can do so much more with gesture based interfaces					
				Nonverbal behavior			No playing with the stickman		
00:01:03,859	00:01:09,849	00:00:05,990	Turn the TV on		Offline		Deictic	R	Pointing with open palm hand towards screen. r5,1,0-r5,4,1-r5,5,2
00:01:12,221	00:01:21,633	00:00:09,412	Move downwards in the menu to the label "podcasts"			Online	Navigational	R	Dynamic movement downwards. Repeated. r5,1,0-r5,6,0-r5,3,2
00:01:24,680	00:01:32,210	00:00:07,530	Move upwards in the menu to the label "movies"			Online	Navigational	R	Dynamic movmement upwards. Repeated. r5,3,1-r5,4,1-r5,6,0
00:01:32,955	00:01:35,552	00:00:02,597	Select movies		Offline		Deictic	R	Pointing with open palm hand towards screen. r5,3,0-r6,5,2
00:01:40,000	00:01:45,249	00:00:05,249	Move upwards in the menu to the label "iTunes top Films"			Online	Navigational	R	Dynamic movmement upwards. Repeated. r5,3,0-r5,3,1-r6,6,0
00:01:46,654	00:01:49,330	00:00:02,676	Select "iTunes top Films"		Offline		Deictic	R	Pointing with open palm hand towards screen. r5,4,0-r6,5,2
00:01:50,589	00:01:58,400	00:00:07,811	Move downwards in the menu to the label "Rust and Bone"			Online	Navigational	R	Dynamic movement downwards. Repeated. r5,4,0-r5,6,0-r5,2,2
00:01:59,260	00:02:01,440	00:00:02,180	Select movie "Rust and Bone"		Offline		Deictic	R	Pointing with open palm hand towards screen. r5,4,0-r6,4,2
00:02:10,788	00:02:12,769	00:00:01,981	Pause the movie		Offline		Deictic	R	Pointing with open palm hand towards screen. r5,3,1-r5,4,1-r5,5,2
00:02:14,133	00:02:16,330	00:00:02,197	Play the movie		Offline		Deictic	R	Pointing with open palm hand towards screen. r5,3,0-r5,4,1-r6,4,2
00:02:19,252	00:02:25,233	00:00:05,981	Increase the volume			Online	Iconic	R	Dynamic movement. Skwizzing/turning hand towards right r5,3,0-r6,4,1
00:02:25,826	00:02:29,310	00:00:03,484	Decrease the volume			Online	Iconic	R	Dynamic movement. Skwizzing/turning hand towards left r5,3,0-r5,4,1
00:02:30,690	00:02:33,963	00:00:03,273	Fast forward			Online	Iconic	R	One dynamic movement from left to right. r5,2,0-r7,3,0
00:02:34,770	00:02:37,322	00:00:02,552	Stop		Offline		Static symbol	R	Showing stop sign. Pointing with open palm hand towards screen. r6,4,0-r5,4,0-r5,5,1
00:02:38,262	00:02:40,593	00:00:02,331	Fast backward			Online	Iconic	L	One dynamic movement from left to left (Using left hand) l3,1,0-l1,2,0
00:02:40,679	00:02:44,412	00:00:03,733	Stop		Offline		Static symbol	R	Showing stop sign. Pointing with open palm hand towards screen. r5,3,1-r5,4,2
00:02:45,805	00:02:49,803	00:00:03,998	Go back to the menu			Online	Dynamisk	R	One dynamic movement from right to left. r5,3,0-r5,3,1-rn4,3,0
00:02:50,371	00:02:54,376	00:00:04,005	Turn the TV off			Online	Iconic	R	Dynamic movement. Turning swith aroung towards left. r5,3,1-r5,4,2
				That's it? Oh, that's amazing.					

Figure 106: Videoscript (p8)

P10 – Male – 25-30 – Right
Experiment 28.2.2013

Time	#14:35:26,000	Time	Researcher	Participant	Offline	Online	Description		Arm	Gesture space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):	No problems						
			In using 3D gestures, would you describe your experience as positiv. Please describe (you can use tags):	Yes indeed						
			Nonverbal behavior				Playing with the stickman			
00:01:51,497	00:01:54,166	00:00:02,669	Turn the TV on			Online	Iconic	Pointing towards screen. Snipping.	R	r5,1,0-r5,5,2
00:01:59,410	00:02:09,869	00:00:10,459	Move downwards in the menu to the label “podcasts”			Online	Navigational	Dynamic movements downwards. Repeated.	R	r5,1,0-r5,4,0-r5,4,1-r5,2,2
00:02:12,954	00:02:18,436	00:00:05,482	Move upwards in the menu to the label “movies”			Online	Navigational	Dynamic movements upwards. Repeated.	R	r5,4,1-r5,5,1-r5,6,0
00:02:19,188	00:02:22,585	00:00:03,397	Select movies	Cool	Offline		Deictic	Open palm hand pointing towards screen.	R	r5,1,0-r5,4,1-r5,5,2
00:02:27,447	00:02:34,190	00:00:06,743	Move upwards in the menu to the label “iTunes top Films"			Online	Navigational	Dynamic movements upwards. Repeated.	R	r5,1,0-r6,4,1-r5,5,0
00:02:34,848	00:02:38,340	00:00:03,492	Select “iTunes top Films”			Online	Dynamic	One dynamic movement towards right.	R	r5,1,0-r7,4,0
00:02:42,979	00:02:54,119	00:00:11,140	Move downwards in the menu to the label “Rust and Bone”			Online	Navigational	Dynamic movements downwards. Repeated.	R	r5,1,0-r5,5,0-r5,2,2-r5,1,0
00:02:55,269	00:02:58,888	00:00:03,619	Select movie “Rust and Bone”		Offline		Deictic	Open palm hand pointing towards screen.	R	r5,1,0-r5,4,2
00:03:09,524	00:03:12,769	00:00:03,245	Pause the movie		Offline		Deictic	Open palm hand pointing towards screen.	R	r5,1,0-r5,4,2
00:03:14,480	00:03:19,334	00:00:04,854	Play the movie			Online	Dynamic	One dynamic movement towards right.	R	r5,1,1-r7,3,0
00:03:21,676	00:03:25,463	00:00:03,787	Increase the volume			Online	Iconic	Hand turning towards right. (Turning a button)	R	r5,1,0-r6,3,1
00:03:25,605	00:03:29,810	00:00:04,205	Decrease the volume			Online	Iconic	Hand turning towards left. (Turning a button)	R	r5,2,1-r5,3,1-r5,4,1
00:03:33,229	00:03:36,865	00:00:03,636	Fast forward			Online	Dynamic	One dynamic movement towards right.	R	r5,3,1-r7,3,0
00:03:37,272	00:03:39,246	00:00:01,974	Stop		Offline		Deictic	Open palm hand pointing towards screen.	R	m4,3,1-r5,3,2
00:03:41,523	00:03:45,272	00:00:03,749	Fast backward			Online	Dynamic	One dynamic movement towards left	R	r6,2,1-r5,2,2-l2,4,0
00:03:45,540	00:03:47,720	00:00:02,180	Stop	He, no.	Offline		Deictic	Open palm hand pointing towards screen.	R	l3,4,0-m4,4,2
00:03:53,523	00:03:57,684	00:00:04,161	Go back to the menu	I don't know how that worked, to be honest …, Hehe, ok		Online	Dynamic	One dynamic movement from the right to the left shoulder.	R	r5,1,0-r5,2,2-m4,4,2-l3,5,0
00:04:06,376	00:04:09,825	00:00:03,449	Turn the TV off	How?		Online	Iconic	Pointing towards screen. Snipping.	R	r5,1,0-r6,6,2
				Ah, I did turn it off? Cool.						

Figure 107: Videoscript (p10)

P11 – Female – 18-24 – Right
Experiment 28.2.2013

Time	#16:04:59,000	Time	Researcher	Participant	Offline	Online	Description	Arm	Gesture space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):	No issues!					
			In using 3D gestures, would you describe your experience as positiv. Please describe (you can use tags):	Yes, they are very easy to use and the experience was positive!					
			Nonverbal behavior				Watching the stickman		
				Wow					
00:02:23,678		00:02:27,705	00:00:04,027	Turn the TV on	(Astonished) Oh, Oh, OK.	Offline		Deictic	Pointing with index finger towards screen.	R	r6,1,0-r6,4,0-r5,5,1-rn4,5,2
00:02:35,595		00:02:43,308	00:00:07,713	Move downwards in the menu to the label "podcasts"	How?, Ok…		Online	Navigational	Dynamic movement downwards. Repeated.	R	r6,1,0-r5,4,1-r5,5,2-
00:02:46,238		00:02:51,123	00:00:04,885	Move upwards in the menu to the label "movies"			Online	Navigational	Dynamic movement upwards. Repeated.	R	r5,4,1-r5,5,2-r5,6,2
00:02:51,774		00:02:54,482	00:00:02,708	Select movies		Offline		Deictic	Pointing with index finger towards screen.	R	r5,5,1-r5,6,2
00:02:58,404		00:03:03,514	00:00:05,110	Move upwards in the menu to the label "iTunes top Films"			Online	Navigational	Dynamic movement upwards. Repeated.	R	r5,4,1-r5,5,2-r5,6,2
00:03:03,808		00:03:06,237	00:00:02,429	Select "iTunes top Films"		Offline		Deictic	Pointing with index finger towards screen.	R	r5,5,1-r5,6,2
00:03:10,248		00:03:14,931	00:00:04,683	Move downwards in the menu to the label "Rust and Bone"			Online	Navigational	Dynamic movement downwards. Repeated.	R	r5,4,1-r5,6,2-r5,5,2
00:03:16,584		00:03:18,756	00:00:02,172	Select movie "Rust and Bone"		Offline		Deictic	Pointing with index finger towards screen.	R	r5,4,1-r5,6,2
00:03:28,897		00:03:30,885	00:00:01,988	Pause the movie		Offline		Deictic	Pointing with index finger towards screen.	R	r5,4,1-rn4,5,2
00:03:32,648		00:03:34,812	00:00:02,164	Play the movie		Offline		Deictic	Pointing with index finger towards screen.	R	r5,4,1-rn4,6,2
00:03:37,654		00:03:43,966	00:00:06,312	Increase the volume	(Researcher showing to fast that gesture was working)		Online	Iconic	Turning hand towards right. (Turning a volume button)	R	r5,4,1-r5,5,1-r5,5,2
00:03:44,432		00:03:47,276	00:00:02,844	Decrease the volume			Online	Iconic	Turning hand towards left. (Turning a volume button)	R	r5,5,2-rn4,5,2-
00:03:49,415		00:03:53,705	00:00:04,290	Fast forward		Offline		Pointing. Deictic	Pointing with index finger towards screen.Repeated.	R	r5,4,1-r5,5,2
00:03:53,815		00:03:56,107	00:00:02,292	Stop		Offline		Pointing. Deictic	Pointing with index finger towards screen.	R	r5,5,2-rn4,5,2
00:03:57,320		00:04:00,100	00:00:02,780	Fast backward		Offline		Pointing. Deictic	Pointing with index finger towards screen.Repeated.	R	r5,4,1-l3,5,2
00:04:00,389		00:04:04,360	00:00:03,971	Stop		Offline		Pointing. Deictic	Pointing with index finger towards screen.	R	l3,5,2-rn4,5,2
00:04:08,392		00:04:11,901	00:00:03,509	Go back to the menu		Offline		Pointing. Deictic	Pointing with index finger towards screen.	R	rn4,5,1-l3,6,2
00:04:14,308		00:04:17,430	00:00:03,122	Turn the TV off		Offline		Pointing. Deictic	Pointing with index finger towards screen.	R	rn4,5,1-rn4,5,2
				Is that it? Did I do all right?					
				Yes.					
				Mm, hehe, its funny.					
			Now there is the game task, a bowling game. You can throw the bowling ball six times.						
				Oh, yes, yes, ask me about bowling.					

Figure 108: Videoscript (p11)

P12 – Male – 18-24 – Left
Experiment 28.2.2013

Time	#16:41:21,000	Time	Researcher	Participant	Offline	Online	Description	Arm	Gesture space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):						
			In using 3D gestures, would you describe your experience as positiv. Please describe (you can use tags):						
			Nonverbal behavior				Playing with the stickman		
			Turn the TV on						
			Do you might it I restart the computer?				System problems		
				Its ok. Now I just have to figure out how to turn it on.					
			I am sorry.						
				Its ok. I just want to make sure how to turn it on this time.					
00:08:53,855	00:09:07,248	00:00:13,393	Turn the TV on	Do you want to try it another time?		Online	Iconic	L	I2,1,0-m4,5,2
00:09:16,386	00:09:22,317	00:00:05,931	Move downwards in the menu to the label "podcasts"			Online	Navigational	L	I2,1,0-I3,6,1-I3,5,2
00:09:25,410	00:09:28,907	00:00:03,497	Move upwards in the menu to the label "movies"			Online	Navigational	L	I3,4,1-I3,4,2-I3,5,2
00:09:29,529	00:09:31,942	00:00:02,413	Select movies		Offline		Deictic	L	I3,3,1-I3,4,1-I3,5,2
00:10:37,772	00:10:40,800	00:00:03,028		Second time (with internet connection)	Offline		Deictic	L	I3,1,0-I3,4,1-I3,5,2,
00:10:47,695	00:10:52,779	00:00:05,084	Move upwards in the menu to the label "iTunes top Films"	iTunes top films?		Online	Navigational	L	I3,3,1-I3,3,2-I3,5,2
				(No internet connections)				L	
			Yes, I am sorry!						
				Second time (with internet connection)		Online	Navigational	L	I3,1,2-I3,4,2-I3,6,1
00:10:54,616	00:10:56,317	00:00:01,701	Select "iTunes top Films"		Offline		Pointing. Deictic	L	I3,4,1-I3,4,2
00:11:00,894	00:11:04,662	00:00:03,768	Move downwards in the menu to the label "Rust and Bone"			Online	Navigational	L	I3,1,0-I3,5,2-I3,4,2
00:11:06,242	00:11:08,150	00:00:01,908	Select movie "Rust and Bone"		Offline		Deictic	L	m4,4,1-m4,4,2
00:11:19,740	00:11:21,396	00:00:01,656	Pause the movie		Offline		Pointing. Deictic	L	I3,1,0-m4,4,0-m4,4,1
00:11:22,712	00:11:24,688	00:00:01,976	Play the movie		Offline		Pointing. Deictic	L	I3,1,0-m4,4,0-m4,4,2
00:11:26,785	00:11:30,358	00:00:03,573	Increase the volume			Online	Iconic	L	I3,1,0-I3,4,1
00:11:31,740	00:11:33,994	00:00:02,254	Decrease the volume			Online	Iconic	L	I3,1,0-I3,4,1
00:11:35,516	00:11:38,201	00:00:02,685	Fast forward			Online	Dynamic	L	I3,4,0-I2,4,1-m4,4,1
00:11:39,197	00:11:41,673	00:00:02,476	Stop		Offline		Deictic	L	I3,3,1-I3,4,1
00:11:43,231	00:11:45,403	00:00:02,172	Fast backward			Online	Dynamic	L	I3,4,1-I2,4,1
00:11:45,540	00:11:47,186	00:00:01,646	Stop		Offline		Deictic	L	I3,4,1-I3,4,2
00:11:52,651	00:11:55,632	00:00:02,981	Go back to the menu			Online	Iconic	L	I3,1,0-I3,4,1-I2,3,0
00:11:57,601	00:12:00,196	00:00:02,595	Turn the TV off			Online	Iconic	L	I3,1,0-I3,6,0-m4,6,1

Figure 109: Videoscript (p12)

P13 – Male – 18-24 – Right
Experiment 28.2.2013

Time	#17:02:29_500	Time	Researcher	Participant	Offline	Online	Description	Arm	Gesture space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags).	No, very easy to use and fun.					
			In using 3D gestures, would you describe your experience as positiv. Please describe (you can use tags).	It was fun, plus no need for controllers which may be dirty or broken.					
			Nonverbal behavior				No playing with the stickman		
							Calibration problems		
			Turn the TV on						
00:02:25,957	00:02:28,660	00:00:02,703	Please try it one more time to turn the TV on	Cool		Online	Iconic	R	r5.1,0-r5.4,2
							Pointing towards screen. Moving thumb towards index finger. Remote		
00:02:38,670	00:02:43,908	00:00:05,238	Move downwards in the menu to the label "podcasts"			Online	Navigational	R	r5.1,0-r5.5,2-r5.3,2
							Dynamic movement downwards. Repeated.		
00:02:46,957	00:02:50,504	00:00:03,547	Move upwards in the menu to the label "movies"			Online	Navigational	R	r5.3,2-r5.5,1
							Dynamic movement upwards. Repeated.		
00:02:52,451	00:02:54,622	00:00:02,171	Select movies		Offline		Deictic	R	r5.1,0-r5.5,1-r5.5,2
							Pointing with index finger towards screen.		
00:02:59,578	00:03:03,868	00:00:04,290	Move upwards in the menu to the label "iTunes top Films"			Online	Navigational	R	r5.1,0-r5.4,2-r5.5,0-
							Dynamic movement upwards. Repeated.		
00:03:05,100	00:03:07,163	00:00:02,063	Select "iTunes top Films"		Offline		Deictic	R	r5.1,0-r5.5,1-r5.5,2
							Pointing with index finger towards screen.		
00:03:12,208	00:03:16,248	00:00:04,040	Move downwards in the menu to the label "Rust and Bone"			Online	Navigational	R	r5.1,0-r5.5,1-r5.3,1
							Dynamic movement downwards. Repeated.		
00:03:18,710	00:03:20,365	00:00:01,655	Select movie "Rust and Bone"		Offline		Deictic	R	r5.1,0-r5.5,1-r5.5,2
							Pointing with index finger towards screen.		
00:03:30,292	00:03:32,535	00:00:02,243	Pause the movie		Offline		Deictic	R	r5.1,0-r5.4,1-r5.4,2
							Pointing with index finger towards screen.		
00:03:34,234	00:03:36,286	00:00:02,052	Play the movie		Offline		Deictic	R	r5.1,0-r5.4,1-r5.4,2
							Pointing with index finger towards screen.		
00:03:39,660	00:03:42,921	00:00:03,261	Increase the volume			Online	Dynamic	R	r5.1,0-m4.4,1-r6.4,0
							One dynamic movement towards right.		
00:03:43,972	00:03:46,485	00:00:02,513	Decrease the volume			Online	Dynamic	R	r5.1,0-r6.4,0-l3.3,0
							One dynamic movement towards left.		
00:03:49,266	00:03:53,276	00:00:04,010	Fast forward			Online	Dynamic	R	r5.1,0-m4.3,0-r5.5,0
							One dynamic movement upwards, back right shoulder.		
00:03:54,332	00:03:56,685	00:00:02,353	Stop	Stop it.	Offline		Pointing. Deictic	R	m4.1,1-m4.5,2
							Pointing with index finger towards screen. (Repeated "Stop it")		
00:03:58,914	00:04:01,860	00:00:02,946	Fast backward			Online	Dynamic	R	m4.4,1-m4.1,1
							One dynamic movement downwards.		
00:04:01,337	00:04:04,490	00:00:03,153	Stop		Offline		Deictic	R	m4.4,1-m4.1,2
							Pointing with index finger towards screen.		
00:04:07,327	00:04:09,776	00:00:02,449	Go back to the menu			Online	Dynamic	R	r5.1,0-r5.4,1-l2.4,0
							One dynamic movement to the left.		
00:04:12,457	00:04:15,241	00:00:02,784	Turn the TV off			Online	Iconic	R	r5.1,0-r5.5,2
							Pointing towards screen. Moving thumb towards index finger. Remote		
			That was the first task	I took few lucky guesses there					
			Hehe, yeah.						

Figure 110: Videoscript (p13)

P14 – Female – 18-24 – Right
Experiment 28.2.2013

Time	#17:15:00,000	Time	Researcher	Participant	Offline	Online	Description		Arm	Gesture space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):	No issues but slightly hard to play the movie in the right place after fastforwarding						
			In using 3D gestures, would you describe your experience as positiv. Please describe (you can use tags):	Yes very much so						
			Nonverbal behavior				No playing with the stickman			
00:01:53,563	00:01:56,578	00:00:03,015	Turn the TV on	Oh, that what. Oh shit. Oh and I am not touching it?		Online	Iconic	Dynamic movement crossing arms (X) repeated (Waving)	R	r5,1,1-m4,1,1-m4,5,1-r5,6,0-r6,6,0-r7,4,0-
			No, with gestures.							
00:02:04,453	00:02:09,119	00:00:04,666	Move downwards in the menu to the label “podcasts”			Online	Navigational	Dynamic movement downwards. Repeated.	R	r5,4,1-r5,6,0-r5,3,2
00:02:13,895	00:02:18,698	00:00:04,803	Move upwards in the menu to the label “movies”			Online	Navigational	Dynamic movement upwards. Repeated.	R	r5,4,2-r5,6,0
00:02:18,916	00:02:21,859	00:00:02,943	Select movies		Offline		Deictic	Pointing towards screen with index finger.	R	r5,5,1-r5,6,2
00:02:25,160	00:02:29,317	00:00:04,157	Move upwards in the menu to the label “iTunes top Films"			Online	Navigational	Dynamic movement upwards. Repeated.	R	r5,4,2-r5,6,1
00:02:31,619	00:02:34,142	00:00:02,523	Select “iTunes top Films”		Offline		Deictic	Pointing towards screen with index finger.	R	r5,5,1-r5,6,2
00:02:37,815	00:02:42,264	00:00:04,449	Move downwards in the menu to the label “Rust and Bone”			Online	Navigational	Dynamic movement downwards. Repeated.	R	r5,6,1-r5,4,1
00:02:43,164	00:02:45,463	00:00:02,299	Select movie “Rust and Bone”		Offline		Deictic	Pointing towards screen with index finger.	R	r5,4,1-r5,5,2
00:02:54,162	00:02:57,283	00:00:03,121	Pause the movie		Offline		Deictic	Pointing towards screen with index finger.	R	r5,3,1-m4,5,1-m4,4,1-r5,5,1-m4,4,1-r5,5,2
00:02:58,668	00:03:00,518	00:00:01,850	Play the movie		Offline		Deictic	Pointing towards screen with index finger.	R	m4,5,1-r5,6,2
00:03:07,813	00:03:11,913	00:00:04,100	Increase the volume	Oh, grap … Go up		Online	Iconic	Dynamic movement upwards. Repeated.	R	r5,4,1-r5,3,2-r5,5,2
00:03:12,705	00:03:15,187	00:00:02,482	Decrease the volume			Online	Iconic	Dynamic movement downwards. Repeated.	R	r5,4,1-r5,2,1
00:03:16,638	00:03:20,680	00:00:04,042	Fast forward			Online	Dynamic	Dynamic movement towards right. Repeated.	R	r5,4,1-m4,4,1-r7,4,0
00:03:20,443	00:03:22,869	00:00:02,426	Stop	Stop, stop, stop.		Online	Dynamic	Dynamic movement towards left. Repeated. Speech.	R	r6,4,1-r5,4,1
00:03:25,314	00:03:27,876	00:00:02,562	Fast backward			Online	Dynamic	Dynamic movement towards left. Repeated.	R	r5,4,1-r6,4,1-l3,4,1
00:03:28,000	00:03:31,112	00:00:03,112	Stop			Online	Dynamic	Dynamic movement towards right. Repeated. (Contra movement)	R	m4,4,1-r5,4,1
00:03:33,950	00:03:38,163	00:00:04,213	Go back to the menu	Oh, no. I don’t know how to do that.		Online	Dynamic	Dynamic movement towards left. Repeated.	R	r5,4,1-r6,4,1-l3,4,1
				Oh, I did.						
00:03:43,621	00:03:49,365	00:00:05,744	Turn the TV off			Online	Dynamic	Dynamic movement towards left. Repeated. (Very uncertain).	R	r5,4,1-r6,4,1-m4,4,1-
				Shit.						
				I did it.						
				Are they selling it already?						
			No. Nice to have.							

Figure 111: Videoscript (p14)

P15 – Female – 31-36 – Right
Experiment 28.2.2013

Time	#17:54:12.800	Time	Researcher	Participant	Offline	Online	Description	Arm	Gesture space
				Prompt wasn't clear from the beginning sometimes it take a while to know how to use it.					
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags).						
				UI wasn't design for gesture friendly.					
			In using 3D gestures, would you describe your experience as positiv. Please describe (you can use tags).	It's fun to use like you are playing games.					
			Nonverbal behavior				No playing with the stickman		
				Oh, this TV (pointing).					
				Oh my god.					
00:01:10,241	00:01:15,737	00:00:05,496	Turn the TV on	I don't know? Does it work? (Waving)		Online	Dynamic	R	r5,1,0-r7,4,0-r5,6,0
				Ehm (Moving to the screen).			Dynamic movement from left to right, repeated (Waving).		
			With gestures.	With gestures. I don't know. (Waving). Oh, Hello …					
				Oh, it went off?					
			No, it's on.						
00:01:31,161	00:01:36,911	00:00:05,750	Move downwards in the menu to the label "podcasts"	Oh, I can't move. Oh, all right.		Online	Navigational	R	r5,1,0-r5,6,0-r5,2,2
							Dynamic movement downwards. Repeated.		
00:01:41,339	00:01:48,440	00:00:07,101	Move upwards in the menu to the label "movies"			Online	Navigational	R	r5,1,0-r5,6,0
							Dynamic movement upwards. Repeated.		
00:01:52,149	00:01:55,157	00:00:03,008	Select movies	How am I doing this?		Online	Dynamic	R	r5,1,0-r5,5,0-r7,5,0
							One dynamic movement towards the right.		
00:02:02,504	00:02:07,508	00:00:05,004	Move upwards in the menu to the label "iTunes top Films"			Online	Navigational	R	r5,1,0-r5,6,0
							Dynamic movement upwards. Repeated.		
00:02:10,383	00:02:13,947	00:00:03,564	Select "iTunes top Films"			Online	Dynamic	R	r5,1,0-rn4,6,1-r7,6,0
							One dynamic movement towards the right.		
00:02:22,165	00:02:26,622	00:00:04,457	Move downwards in the menu to the label "Rust and Bone"			Online	Navigational	R	r5,1,0-r5,6,0-r5,2,2
							Dynamic movement downwards. Repeated.		
00:02:33,153	00:02:35,110	00:00:01,957	Select movie "Rust and Bone"			Online	Dynamic	R	r5,1,0-r6,4,0-rn4,5,2-l2,4,0
							One dynamic movement towards left		
00:02:46,650	00:02:51,650	00:00:05,000	Pause the movie	Oh, what I am going to do…		Online	Dynamic	R	r5,1,0-r5,5,2-r5,6,0
							Dynamic movement upwards. Repeated.		
00:02:52,196	00:02:54,348	00:00:02,152	Play the movie			Online	Dynamic	R	r5,1,0-r5,5,0-r5,6,0-r5,1,0
							Dynamic movement upwards, then downwards.		
00:02:58,350	00:03:00,785	00:00:02,435	Increase the volume	What! Where is the volume?		Online	Dynamic	R	r5,1,0-r5,6,0-r5,3,2
							Dynamic movement upwards, then downwards.		
00:03:03,113	00:03:07,294	00:00:04,181	Decreise the volume			Online	Dynamic	R	r6,5,1-r5,1,2-rn4,6,0-rn4,1-2
							Dynamic movement upwards, then downwards and to the left.		
00:03:17,531	00:03:23,160	00:00:05,629	Fast forward			Online	Dynamic	R	r5,1,0-r6,4,2-r5,5,1-r7,5,0
							Dynamic movement towards the right. Repeated.		
00:03:24,440	00:03:26,452	00:00:02,012	Stop	Ah sorry (stopping to gesture fast forward)					rn4,2,0-r5,5,2-r6,5,0-r6,5,1
				Ah, stop stop stop	Offline		Static symbol	R	
			No, stop				Showing open palm hand toward the screen. (Moving hand while speaking)		
00:03:29,550	00:03:32,945	00:00:03,395	Fast backward	It does not recognize that. (Waving with hand). Ah. ok, that's better.		Online	Dynamic	R	r5,1,0-r5,5,2-r5,5,1-rn4,5,1
							Dynamic movements towards left. Repeated.		
00:03:33,727	00:03:35,851	00:00:02,124	Stop		Offline		Static symbol	R	rn4,4,1
							Showing open palm hand toward the screen.		
00:03:40,403	00:03:42,481	00:00:02,078	Go back to the menu			Online	Dynamic	R	rn4,1,1-rn4,4,1-l3,4,0
							One dynamic movement to the left		
00:03:48,191	00:03:54,567	00:00:06,376	Turn the TV off	Oh, oh, ohh		Online	Dynamic	R	r5,1,0-r5,4,2-l2,4,0
							One dynamic movement to the left		
				I don't know.					

Figure 112: Videoscript (p15)

P16 – Female – 18-24 – Right
Experiment 28.2.2013

Time	#18:20:58,500	Time	Researcher	Participant	Offline	Online	Description		Arm	Gesture space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):	No						
			In using 3D gestures, would you describe your experience as positiv. Please describe (you can use tags):	Yes						
			Nonverbal behavior				Playing with the stickman			
							No camera picture (just depth and stickman information)			
				This is cool.						
00:01:33,673	00:01:38,901	00:00:05,228	Turn the TV on			Online	Iconic	Showing open palm hand towards screen and open/closing hand	R	r5,1,0-r5,4,1
00:01:47,574	00:01:56,191	00:00:08,617	Move downwards in the menu to the label "podcasts"	Oh, oh.		Online	Navigational	Dynamic movement downwards. Repeated.	R	r5,5,0-r5,3,1
				I should go up.						
				You said movies, right?						
			Yes							
00:02:07,685	00:02:11,366	00:00:03,681	Move upwards in the menu to the label "movies"	Ah, ok you said movies, I should move upwards		Online	Navigational	Dynamic movement upwards. Repeated.	R	r5,1,0-r5,6,0-r5,2,2
00:02:14,545	00:02:17,524	00:00:02,979	Select movies			Online	Dynamic	One dynamic movement towards the right.	R	r5,1,0-l3,4,0-r7,3,0
00:02:20,451	00:02:27,170	00:00:06,719	Move upwards in the menu to the label "iTunes top Films"	Shall I select it?		Online	Navigational	Dynamic movement upwards. Repeated.	R	r5,1,0-r5,6,0
00:02:30,213	00:02:32,811	00:00:02,598	Select "iTunes top Films"			Online	Dynamic	One dynamic movement towards the right.	R	r5,1,1-l3,4,2-r7,3,0
00:02:34,249	00:02:41,448	00:00:07,199	Move downwards in the menu to the label "Rust and Bone"			Online	Navigational	Dynamic movement downwards. Repeated.	R	r5,1,0-r5,5,1-r5,6,2-r5,2,2
00:02:42,164	00:02:45,459	00:00:03,295	Select movie "Rust and Bone"			Online	Dynamic	One dynamic movement towards the right.	R	r5,1,0-l3,4,1-r7,2,0
00:02:56,473	00:02:59,870	00:00:03,397	Pause the movie			Online	Dynamic	Pointing towards screen with open hand (opening and closing movement)	R	r5,1,0-r4,4,2
00:03:00,740	00:03:02,350	00:00:01,610	Play the movie			Online	Dynamic	Pointing towards screen with open hand (opening and closing movement)	R	r5,1,0-r4,4,2
00:03:05,688	00:03:09,280	00:00:03,592	Increase the volume			Online	Iconic	One dynamic movement upwards.	R	r5,1,0-r5,4,2-r5,6,0
00:03:10,375	00:03:12,714	00:00:02,339	Decrease the volume			Online	Iconic	One dynamic movement downwards.	R	r5,1,0-r5,6,0-r5,1,0
00:03:15,683	00:03:18,896	00:00:03,213	Fast forward			Online	Dynamic	One dynamic movement towards the right.	R	r5,1,0-l3,4,1-r7,4,0
00:03:19,171	00:03:21,323	00:00:02,152	Stop			Online	Dynamic	Pointing towards screen with open hand (opening and closing movement)	R	r5,4,1-m4,5,2
00:03:23,185	00:03:26,268	00:00:03,083	Fast backward			Online	Dynamic	One dynamic movement towards left.	R	r5,4,1-r6,2,0-m4,4,2-l2,3,0
00:03:26,798	00:03:28,648	00:00:01,850	Stop			Online	Dynamic	Pointing towards screen with open hand (opening and closing movement)	R	r5,2,1-m4,5,2
00:03:30,208	00:03:34,364	00:00:04,156	Go back to the menu			Online	Iconic	Pointing towards screen with open palm hand closing it and pulling backwards towards body)	R	r5,1,0-r5,4,1-m4,4,2-m4,4,0
00:03:39,990	00:03:42,447	00:00:02,457	Turn the TV off			Online	Dynamic	One dynamic movement upwards and back right shoulder.	R	r5,1,0-r5,4,2-r5,6,0
				That was it?						
			Yes							
				That's cool.						
				That was it? It was interesting.						
			No, no, there is the game task.							
				A, sorry.						
			Ah, no … no.							
			(Game task)	Done?						
			Done	I am having a good time.						

Figure 113: Videoscript (p16)

P17 – Male – 25-30 – Right
Experiment 1.3.2013

Time	#11:12:50,000	Time	Researcher	Participant	Offline	Online	Description		Arm	Gesture space
				At the TV task I had to naturally come up with gestures that was kind of difficult because I have never thought of such gestures interactions.						
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):	Usually the gestures are instructed not invented by me when using a gesture app/game/etc, that was challenging as I didn't know what gesture to do for thing I undertake in my every day life.						
			In using 3D gestures, would you describe your experience as positiv. Please describe (you can use tags):	Absolutely positive! Very fun, quite easy.						
			Nonverbal behavior				Playing with the stickman			
00:02:49,600	00:02:57,680	00:00:08,080	Turn the TV on			Online	Iconic	Pointing towards screen. Moving thumb towards index finger. Remote.	R	r5,1,0-r5,5,2
00:03:10,326	00:03:17,325	00:00:06,999	Move downwards in the menu to the label “podcasts”			Online	Navigational	Dynamic movement downwards. Repeated.	R	r5,1,0-r5,5,2-r5,4,2
00:03:26,156	00:03:31,918	00:00:05,762	Move upwards in the menu to the label “movies”			Online	Navigational	Dynamic movement upwards. Repeated.	R	r5,4,1-r5,5,1
00:03:33,338	00:03:36,406	00:00:03,068	Select movies		Offline		Deictic	Pointing with index finger toward screen.	R	r5,4,1-r5,5,2
00:03:42,190	00:03:47,192	00:00:05,002	Move upwards in the menu to the label “iTunes top Films"			Online	Navigational	Dynamic movement upwards. Repeated.	R	r5,1,0-r5,4,2-r5,5,2
00:03:47,790	00:03:51,341	00:00:03,551	Select “iTunes top Films”		Offline		Deictic	Pointing with index finger toward screen.	R	r5,3,1-r5,5,2
00:03:55,924	00:04:01,559	00:00:05,635	Move downwards in the menu to the label “Rust and Bone”			Online	Navigational	Dynamic movement downwards. Repeated.	R	r5,1,0-r5,6,1-r5,4,2
00:04:04,165	00:04:07,125	00:00:02,960	Select movie “Rust and Bone”		Offline		Deictic	Pointing with index finger toward screen.	R	r5,5,1-r5,5,2
00:04:22,159	00:04:25,506	00:00:03,347	Pause the movie		Offline		Static symbol	Showing open palm hand towards screen.	R	r5,1,0-r5,5,2
00:04:38,863	00:04:41,112	00:00:02,249	Play the movie		Offline		Deictic	Pointing with index finger toward screen.	R	r5,1,0-r5,6,2
00:04:49,882	00:04:53,375	00:00:03,493	Increase the volume			Online	Iconic	Turning hand towards right. (Turning a button)	R	r5,1,0-r5,5,1
00:04:53,919	00:04:57,233	00:00:03,314	Decrease the volume			Online	Iconic	Turning hand towards left. (Turning a button)	R	r5,1,1-r5,5,1
00:05:12,158	00:05:20,125	00:00:07,967	Fast forward		Offline		Static symbol	Pointing with open palm hand towards right (Arrow right). Then circling indexfinger towards right	R	r5,1,0-r5,4,1-r6,4,0
00:05:20,462	00:05:22,655	00:00:02,193	Stop		Offline		Static symbol	Showing open palm hand towards screen. Stop sign.	R	r6,4,0-r5,4,0
00:05:26,543	00:05:31,667	00:00:05,124	Fast backward			Online	Dynamic	Turning indexfinger towards left + horizontal movement	R	r5,3,1-r6,4,1-r6,5,1-r5,5,1
00:05:32,653	00:05:36,630	00:00:03,977	Stop		Offline		Static symbol	Showing open palm hand towards screen. Stop sign.	R	r5,5,1
00:06:03,105	00:06:05,378	00:00:02,273	Go back to the menu			Online	Dynamic	One dynamic movement to the right and back	R	r5,1,0-r4,3,0-r6,5,0
00:06:14,788	00:06:17,248	00:00:02,460	Turn the TV off			Online	Iconic	Pointing towards screen. Moving thumb towards index finger. Remote.	R	r5,2,1-r5,5,2
				It was right. (Laughing)						
				Does it read (moving up and down) and my palm as well, so it knows when I am doing like that (volume)?						
				It’s knowledgeable. I mean it’s great.						

Figure 114: Videoscript (p17)

P18 – Female – 18-24 – Right
Experiment 1.3.2013

Time	#12:23:14,000	Time	Researcher	Participant	Offline	Online	Description		Arm	Gesture space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags).	It was a little bit confusing at first but got better as I used it more						
			In using 3D gestures, would you describe your experience as positiv. Please describe (you can use tags):	Yes,						
			Nonverbal behavior				No playing with the stickman (Uses her tommelfinger by simulating a remote in her hand)			
	00:06:44,228	00:06:47,719	00:00:03,491	Turn the TV on		Online	Iconic	Moving thumb towards index finger. Remote	R	m4,3,1
	00:06:55,200	00:07:00,345	00:00:05,145	Move downwards in the menu to the label "podcasts"		Online	Navigational	Dynamic movements downwards. Repeated. (Hand simulating to hold a remote control + moving thumb)	R	m4,4,1-m4,3,1
	00:07:04,516	00:07:08,464	00:00:03,948	Move upwards in the menu to the label "movies"		Online	Navigational	Dynamic movements upwards. Repeated. (Hand simulating to hold a remote control + moving thumb)	R	m4,3,1-m4,4,1
	00:07:09,970	00:07:11,318	00:00:01,348	Select movies		Online	Iconic	Moving thumb towards index finger. Remote	R	m4,3,1
	00:07:17,339	00:07:20,860	00:00:03,521	Move upwards in the menu to the label "iTunes top Films"		Online	Iconic	Dynamic movements upwards. Repeated. (Hand simulating to hold a remote control + moving thumb)	R	m4,3,1
	00:07:21,000	00:07:24,570	00:00:02,570	Select "iTunes top Films"		Online	Iconic	Moving thumb towards index finger. Remote	R	m4,3,1
	00:07:29,249	00:07:33,857	00:00:04,608	Move downwards in the menu to the label "Hopesprings"		Online	Iconic	Dynamic movements downwards. Repeated. (Hand simulating to hold a remote control + moving thumb)	R	m4,3,1
	00:07:35,394	00:07:37,636	00:00:02,242	Select movie "Hopesprings"		Online	Iconic	Moving thumb towards index finger. Remote	R	m4,3,1
	00:08:14,519	00:08:16,470	00:00:01,951	Pause the movie	(Didn't understand "Pause")	Online	Iconic	Moving thumb towards index finger. Remote	R	m4,3,1
	00:08:18,310	00:08:19,849	00:00:01,539	Play the movie		Online	Iconic	Moving thumb towards index finger. Remote	R	m4,3,1
	00:08:24,319	00:08:28,670	00:00:04,351	Increase the volume		Online	Iconic	Moving thumb towards index finger + slightly right. Remote	R	m4,3,1
	00:08:28,911	00:08:31,669	00:00:02,758	Decrease the volume		Online	Iconic	Moving thumb towards index finger + slightly left. Remote	R	m4,3,1
	00:08:34,118	00:08:37,433	00:00:03,315	Fast forward		Online	Iconic	Moving thumb towards index finger + slightly right. Remote	R	m4,3,1
	00:08:37,986	00:08:39,832	00:00:01,846	Stop		Online	Iconic	Moving thumb towards index finger. Remote	R	m4,3,1
	00:08:42,552	00:08:44,270	00:00:01,718	Fast backward		Online	Iconic	Moving thumb towards index finger + slightly left. Remote	R	m4,3,1
	00:08:44,782	00:08:46,756	00:00:01,974	Stop		Online	Iconic	Moving thumb towards index finger. Remote	R	m4,3,1
	00:08:50,996	00:08:53,629	00:00:02,633	Go back to the menu		Online	Iconic	Moving thumb towards index finger. Remote	R	m4,3,1
	00:08:55,146	00:08:57,588	00:00:02,442	Turn the TV off		Online	Iconic	Moving thumb towards index finger. Remote	R	m4,3,1-m4,4,1

Figure 115: Videoscript (p18)

P20 – Female – 18-24 – Right
Experiment 1.3.2013

Time	#14:04:07:500	Time	Researcher	Participant	Offline	Online	Description		Arm	Gesture space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):	I worried a little that it hadn't detected me at times.						
			In using 3D gestures, would you describe your experience as positiv. Please describe (you can use tags): Nonverbal behavior	Yes, it is fun and it feels a lot more interactive. Bowling for example feels a lot more lifelike with 3D gestures.						
							Little playing with the stickman			
							Her thumb is simulating movements on a remote control			
00:02:21,242	00:02:24,656	00:00:03,414	Turn the TV on	Me turn it on, like (doing gesture)?		Online	Iconic	Pointing towards screen. Moving thumb towards index finger (1). Remote.	R	r5.1,0-r5,4,2
			With gestures							
00:02:31,909	00:02:38,620	00:00:06,711	Move downwards in the menu to the label "podcasts"	Like I was holding a remote control?		Online	Iconic	Pointing towards screen. Moving thumb towards index finger (Repeated). Remote.	R	r5,1,0-r5,5,2-r5,4,2
00:02:41,618	00:02:46,900	00:00:05,282	Move upwards in the menu to the label "movies"			Online	Iconic	Pointing towards screen. Moving thumb towards index finger (Repeated). Remote.	R	r5.2,2-r5,5,2
00:02:47,589	00:02:50,350	00:00:02,761	Select movies			Online	Iconic	Pointing towards screen. Moving thumb towards index finger (Repeated). Remote.	R	r5.4,2-r5,5,2
00:02:54,840	00:02:59,274	00:00:04,434	Move upwards in the menu to the label "iTunes top Films"			Online	Iconic	Pointing towards screen. Moving thumb towards index finger (Repeated). Remote.	R	r5.4,0-r5,5,2
00:03:00,847	00:03:03,737	00:00:02,890	Select "iTunes top Films"			Online	Iconic	Pointing towards screen. Moving thumb towards index finger (Repeated). Remote.	R	r5.5,2
00:03:08,100	00:03:12,948	00:00:04,848	Move downwards in the menu to the label "Hopesprings"			Online	Iconic	Pointing towards screen. Moving thumb towards index finger (Repeated). Remote.	R	r5.5,2
00:03:14,693	00:03:16,704	00:00:02,011	Select movie "Hopesprings"			Online	Iconic	Pointing towards screen. Moving thumb towards index finger (Repeated). Remote.	R	r5.5,2
00:03:27,705	00:03:30,428	00:00:02,723	Pause the movie			Online	Iconic	Pointing towards screen. Moving thumb towards index finger (1). Remote.	R	r5.1,0-r5,5,2
00:03:30,902	00:03:32,964	00:00:02,062	Play the movie			Online	Iconic	Pointing towards screen. Moving thumb towards index finger (1). Remote.	R	r5.3,2-r5,6,2
00:03:36,611	00:03:40,101	00:00:03,490	Increase the volume			Online	Iconic	Pointing towards screen. Moving thumb towards index finger (Repeated). Remote.	R	r5.4,2-r5,5,2
00:03:41,282	00:03:43,641	00:00:02,359	Decrease the volume			Online	Iconic	Pointing towards screen. Moving thumb towards index finger (Repeated). Remote.	R	r5.5,2
00:03:45,445	00:03:48,529	00:00:03,084	Fast forward			Online	Iconic	Pointing towards screen. Moving thumb towards index finger (Repeated). Remote.	R	r5.4,2
00:03:48,569	00:03:51,262	00:00:02,693	Stop			Online	Iconic	Pointing towards screen. Moving thumb towards index finger (1). Remote.	R	r5.4,2
00:03:53,576	00:03:56,530	00:00:02,954	Fast backward			Online	Iconic	Pointing towards screen. Moving thumb towards index finger (Repeated). Remote.	R	r5.4,2
00:03:56,812	00:03:58,554	00:00:01,742	Stop			Online	Iconic	Pointing towards screen. Moving thumb towards index finger (Repeated). Remote.	R	r5.4,2
00:04:02,405	00:04:05,567	00:00:03,162	Go back to the menu			Online	Iconic	Pointing towards screen. Moving thumb towards index finger (Repeated). Remote.	R	r5.4,2-r5,5,2
					Offline		Deictic	Pointing with thumb towards screen. Indicating to press a "off" button	R	r5.5,2-r5,6,2
00:04:10,767	00:04:12,872	00:00:02,105	Turn the TV off							

Figure 116: Videoscript (p20)

P21 – Female – 18-24 – Right
Experiment 1.3.2013

Time	#14:56:36.500	Time	Researcher	Participant	Offline	Online	Description	Arm	Gesture space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags): In using 3D gestures, would you describe your experience as positiv. Please describe (you can use tags): Nonverbal behavior	No, however some movements were over the top which made some actions unrecognisable. Yes. It was an enjoyable experience, one in which I picked up quickly. I would use it again.					
00:01:26,788	00:01:30,341	00:00:03,553	Turn the TV on	Oh, I don't know… Oh … OK, God.	Offline		No playing with the stickman Deictic	R	r5,1,0+r5,4,1+m4,6,2 Pointing with index finger towards screen.
00:01:30,752	00:01:32,581	00:00:01,829							
00:01:44,233	00:01:52,158	00:00:07,925	Move downwards in the menu to the label "podcasts"			Online	Navigational	R	r5,1,0+r5,5,0+r5,3,1 Dynamic movement downwards. Repeated.
00:01:55,665	00:01:59,215	00:00:03,550	Move upwards in the menu to the label "movies"			Online	Navigational	R	r5,4,0+r5,4,1+r5,6,1 Dynamic movement upwards. Repeated.
00:01:59,964	00:02:02,167	00:00:02,203	Select movies		Offline		Deictic	R	r5,5,0+r5,6,2 Pointing with index finger towards screen.
00:02:06,573	00:02:10,125	00:00:03,552	Move upwards in the menu to the label "iTunes top Films"			Online	Navigational	R	r5,5,0+r5,5,2+r5,6,1+r5,6,0 Dynamic movement upwards. Repeated.
00:02:10,685	00:02:12,645	00:00:01,960	Select "iTunes top Films"		Offline		Deictic	R	r5,5,0+r5,6,2 Pointing with index finger towards screen.
00:02:23,927	00:02:23,710	00:00:05,783	Move downwards in the menu to the label "Hopesprings"			Online	Navigational	R	r5,4,0+r5,6,1+r5,4,1 Dynamic movement upwards. Repeated.
00:02:23,497	00:02:26,152	00:00:02,655	Select movie "Hopesprings"		Offline		Deictic	R	r5,4,0+r5,6,2 Pointing with index finger towards screen.
00:02:34,281	00:02:38,237	00:00:03,956	Pause the movie		Offline		Deictic	R	r5,1,1+r5,5,0+r5,6,2 Pointing with index finger towards screen.
00:02:39,568	00:02:41,835	00:00:02,267	Play the movie		Offline		Deictic	R	r5,4,0+r5,6,2 Pointing with index finger towards screen.
00:02:45,928	00:02:49,624	00:00:03,696	Increase the volume	(Laughing). Ahh …		Online	Iconic	R	r5,4,0+r5,5,1+r5,6,2+r5,6,1 One dynamic movement upwards
00:02:51,156	00:02:53,789	00:00:02,633	Decrease the volume			Online	Iconic	R	r5,4,0+r5,6,0+r5,2,2 One dynamic movement downwards
00:02:56,310	00:02:58,848	00:00:02,538	Fast forward			Online	Iconic	R	r5,3,0+m4,4,1+r7,4,0 One dynamic movement towards right.
00:03:00,196	00:03:01,901	00:00:01,705	Stop		Offline		Deictic	R	r5,4,0+m4,6,2 Pointing with index finger towards screen.
00:03:03,829	00:03:06,415	00:00:02,586	Fast backward			Online	Iconic	R	r5,5,1+m4,5,1+l2,4,0 One dynamic movement towards left.
00:03:07,700	00:03:08,489	00:00:00,789	Stop		Offline		Deictic	R	l3,4,1-l3,6,2 Pointing with index finger towards screen.
00:03:12,368	00:03:15,372	00:00:03,004	Go back to the menu		Offline		Deictic	R	r5,4,1-m4,6,2 Pointing with index finger towards screen.
00:03:17,645	00:03:21,604	00:00:03,959	Turn the TV off			Online	Iconic	R	r5,4,1+m4,4,1-m4,5,1+m4,4,1 Dynamic movement up and down, (shacking) to turn the TV off.

Figure 117: Videoscript (p21)

P22 – Male – 18-24 – Right
Experiment 1.3.2013

Time	#15:31:40,000	Time	Researcher	Participant	Offline	Online	Description	Arm	Gesture space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):	No.					
			In using 3D gestures, would you describe your experience as positiv. Please describe (you can use tags):	Yes. It was fun and I wish the game was longer so that I can play more.					
			Nonverbal behavior				Playing with the stickman		
				This is so cool.					
00:02:05,654	00:02:13,654	00:00:08,000	Turn the TV on	(Testing). Like how?	Offline		Deictic.	Pointing with index finger towards screen	R	r5,1,0-r5,5,2
				OK.						
00:02:21,348	00:02:27,801	00:00:06,453	Move downwards in the menu to the label "podcasts"			Online	Navigational	Dynamic movement downwards. Repeated.	R	r5,1,0-r5,6,0-r5,3,2
00:02:31,334	00:02:36,918	00:00:05,584	Move upwards in the menu to the label "movies"			Online	Navigational	Dynamic movement upwards. Repeated.	R	r5,4,2-r5,6,0
00:02:38,333	00:02:39,905	00:00:01,572	Select movies		Offline		Deictic.	Pointing with open palm towards screen	R	r5,6,1-r5,6,2
00:02:44,439	00:02:49,418	00:00:04,979	Move upwards in the menu to the label "iTunes top Films"			Online	Navigational	Dynamic movement upwards. Repeated.	R	r5,1,0-r5,5,1-r5,6,0
00:02:50,744	00:02:52,746	00:00:02,002	Select "iTunes top Films"		Offline		Deictic.	Pointing with open palm towards screen	R	r5,5,1-r5,6,2
00:02:56,441	00:03:00,874	00:00:04,433	Move downwards in the menu to the label "Hopesprings"			Online	Navigational	Dynamic movement downwards. Repeated.	R	r5,5,1-r5,6,1-r5,1,2
00:03:01,627	00:03:05,166	00:00:03,539	Select movie "Hopesprings"		Offline		Deictic	Pointing with open palm towards screen	R	r5,4,1-r5,5,2
00:03:13,578	00:03:16,959	00:00:03,381	Pause the movie		Offline		Static symbol	Showing open palm hand towards screen.	R	r5,1,0-m4,5,2-r5,5,2
00:03:17,737	00:03:19,986	00:00:02,249	Play the movie		Offline		Static symbol	Showing open palm hand towards screen.	R	r5,1,0-r5,6,2
00:03:22,958	00:03:25,279	00:00:02,321	Increase the volume			Online	Iconic	One dynamic movement upwards and behind right shoulder.	R	r5,1,0-r5,2,2-r5,4,2-r5,6,0
00:03:25,940	00:03:27,958	00:00:02,018	Decrease the volume			Online	Iconic	One dynamic movement downwards	R	r5,1,0-r5,6,0-r5,1,0
00:03:30,780	00:03:32,405	00:00:01,625	Fast forward			Online	Iconic	One dynamic movement towards right.	R	r5,1,0-m4,5,1-r7,3,0
00:03:33,463	00:03:35,242	00:00:01,779	Stop		Offline		Deictic.	Pointing with open palm towards screen	R	r5,1,0-m4,6,2
00:03:36,611	00:03:38,529	00:00:01,918	Fast backward			Online	Iconic	One dynamic movement towards left.	R	r5,1,0-r6,5,2-l3,4,1
00:03:38,926	00:03:40,376	00:00:01,450	Stop		Offline		Static symbol	Showing open palm hand towards screen.	R	m4,5,1-m4,6,2
00:03:44,480	00:03:48,790	00:00:04,310	Go back to the menu			Online	Iconic	One dynamic movement to the left and backwards the left shoulder	R	r5,1,0-r5,5,1-m4,5,1-l3,5,0
00:03:50,566	00:03:52,911	00:00:02,345	Turn the TV off			Online	Dynamic	One dynamic movement drawing a half circle over left side	R	r5,4,1-r6,5,2-m4,5,1-l3,4,1-m4,2,0
				This is fun.						

Figure 118: Videoscript (p22)

P24 – Female – 25-30 – Right
Experiment 1.3.2013

Time	#16:01:52,000	Time	Researcher	Participant	Offline	Online	Description		Arm	Gesture space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):	Unaccustomed to wii type games so takes time to learn movements required						
			In using 3D gestures, would you describe your experience as positiv. Please describe (you can use tags):	Yes it was a good experience						
			Nonverbal behavior				No playing with the stickman Using her tommel and händledet to simulate remote contraol			
00:02:14,118	00:02:16,170	00:00:02,052	Turn the TV on			Online	Iconic	Pointing towards screen. Moving thumb towards index finger. Remote	R	r5.1.0-m4.4.2
00:02:24,368	00:02:28,119	00:00:03,751	Move downwards in the menu to the label "podcasts"			Online	Iconic	Pointing towards screen. Moving thumb towards index finger (Repeated). Remote	R	r5.1.0-r5.4.1
00:02:41,540	00:02:45,231	00:00:03,691	Move upwards in the menu to the label "movies"			Online	Iconic	Pointing towards screen. Moving thumb towards index finger/Thumb towards screen (Repeated). Remote	R	r5.3.1
00:02:47,371	00:02:48,908	00:00:01,537	Select movies			Online	Iconic	Pointing towards screen. Thumb is pressed towards index finger and moving thumb towards screen (1).	R	r5.3.1
00:02:54,663	00:02:57,870	00:00:03,207	Move upwards in the menu to the label "iTunes top Films"			Online	Iconic	Pointing towards screen. Thumb is pressed towards index finger and moving thumb towards screen (Repeated).	R	r5.3.1
00:02:59,792	00:03:01,448	00:00:01,656	Select "iTunes top Films"			Online	Iconic	Pointing towards screen. Thumb is pressed towards index finger and moving thumb towards screen (1).	R	r5.3.1
00:03:05,541	00:03:09,824	00:00:04,283	Move downwards in the menu to the label "Hopesprings"			Online	Iconic	Pointing towards screen. Moving thumb towards index finger (Repeated). Remote	R	r5.3.1
00:03:11,614	00:03:13,391	00:00:01,777	Select movie "Hopesprings"			Online	Iconic	Pointing towards screen. Thumb is pressed towards index finger and moving thumb towards screen (1).	R	r5.3.1
00:03:22,536	00:03:24,237	00:00:01,701	Pause the movie			Online	Iconic	Pointing towards screen. Thumb is pressed towards index finger and moving thumb towards screen (1).	R	r5.3.1
00:03:25,708	00:03:27,573	00:00:01,865	Play the movie			Online	Iconic	Pointing towards screen. Thumb is pressed towards index finger and moving thumb towards screen (1).	R	r5.3.1
00:03:30,750	00:03:33,898	00:00:03,148	Increase the volume			Online	Iconic	Pointing towards screen. Thumb is pressed towards index finger. Movements to the right. Repeated.	R	r5.3.1
00:03:34,769	00:03:37,201	00:00:02,432	Decrease the volume			Online	Iconic	Pointing towards screen. Thumb is pressed towards index finger. Movements to the left. Repeated.	R	r5.3.1
00:03:39,300	00:03:42,115	00:00:02,815	Fast forward			Online	Iconic	Pointing towards screen. Thumb is pressed towards index finger. One slightly movement to the right	R	r5.3.1
00:03:42,613	00:03:43,826	00:00:01,213	Stop			Online	Iconic	Pointing towards screen. Thumb is pressed towards index finger and moving thumb towards screen (1).	R	r5.3.1
00:03:46,678	00:03:49,403	00:00:02,725	Fast backward			Online	Iconic	Pointing towards screen. Thumb is pressed towards index finger. Movements to the left. Repeated.	R	r5.3.1
00:03:50,320	00:03:51,424	00:00:01,104	Stop			Online	Iconic	Pointing towards screen. Thumb is pressed towards index finger and moving thumb towards screen (1).	R	r5.3.1
00:03:55,561	00:03:57,205	00:00:01,644	Go back to the menu			Online	Iconic	Pointing towards screen. Thumb is pressed towards index finger and moving thumb towards screen (1).	R	r5.3.1-r5.3.2
00:03:59,867	00:04:02,705	00:00:02,838	Turn the TV off			Online	Iconic	Pointing towards screen. Thumb is pressed towards index finger and moving thumb towards screen (1).	R	r5.3.1-r5.3.2

Figure 119: Videoscript (p24)

P25 – Female – 25-30 – Right
Experiment 1.3.2013

Time	#16:36:36,000	Time	Researcher	Participant	Offline	Online	Description		Arm	Gesture space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):	None						
			In using 3D gestures, would you describe your experience as positiv. Please describe (you can use tags):	Yes						
			Nonverbal behavior				No playing with the stickman			
							Uses thumb to interact			
							(Trying to calibrate)			
				It is very funny. I like the stickman.						
				It is amazing.						
	00:01:47,831	00:01:50,439	00:00:02,608	Turn the TV on		Online	Iconic	Pointing towards screen. Moving thumb towards index finger. Remote	R	r5,1,0-r5,3,2
				Over here? (Moving forward)						
				No, with gestures.						
				Oh, with gestures.						
	00:02:06,808	00:02:13,213	00:00:06,405	Move downwards in the menu to the label "podcasts"		Online	Navigational	(No camera pic). Dynamic movements downwards. Repeated.	R	r5,1,0-r5,6,2
	00:02:16,549	00:02:22,291	00:00:05,742	Move upwards in the menu to the label "movies"		Online	Navigational	(No camera pic). Dynamic movements upwards. Repeated.	R	r5,1,0-r5,6,2
	00:02:24,950	00:02:27,860	00:00:02,910	Select movies	Offline		Deictic	(No camera pic). Pointing towards screen.	R	r5,1,0-r5,6,2
	00:02:33,542	00:02:38,631	00:00:05,089	Move upwards in the menu to the label "iTunes top Films"		Online	Navigational	(No camera pic). Dynamic movements upwards. Repeated.	R	r5,1,0-r5,6,2
	00:02:40,239	00:02:42,402	00:00:02,163	Select "iTunes top Films"	Offline		Deictic	(No camera pic). Pointing towards screen with thumb.	R	r5,1,0-r5,6,2
	00:02:47,993	00:02:52,444	00:00:04,451	Move downwards in the menu to the label "Hopesprings"		Online	Navigational	One dynamic movement downwards	R	r5,1,0-r5,6,2-r5,5,2
	00:02:54,454	00:02:56,427	00:00:01,973	Select movie "Hopesprings"	Offline		Deictic	Pointing towards screen with thumb	R	r5,1,0-r5,5,2
	00:03:06,240	00:03:08,615	00:00:02,375	Pause the movie		Online	Iconic	Pointing towards screen. Moving thumb towards index finger. Remote	R	r5,1,0-r5,5,2
	00:03:10,830	00:03:11,650	00:00:00,820	Play the movie		Online	Iconic	Pointing towards screen. Moving thumb towards index finger. Remote	R	r5,1,0-r5,4,2
	00:03:15,529	00:03:18,996	00:00:03,467	Increase the volume		Online	Iconic	Pointing towards screen (right). Moving thumb towards index finger. Remote. Repeated.	R	r5,1,0-r5,4,2-r6,4,2
	00:03:19,560	00:03:22,822	00:00:03,262	Decrease the volume		Online	Iconic	Pointing towards screen (right). Moving thumb towards index finger. Remote. Repeated.	R	r5,1,0-r6,4,2
	00:03:25,118	00:03:28,336	00:00:03,218	Fast forward	Offline		Deictic	Pointing towards screen with fist. Thumb placed upwards indexfinger.	R	r5,1,0-r6,4,2
	00:03:28,821	00:03:30,155	00:00:01,334	Stop		Online	Iconic	Pointing towards screen with fist. Thumb moves one time. Remote.	R	r6,4,2-r5,4,2
	00:03:32,332	00:03:35,380	00:00:03,048	Fast backward	Offline		Deictic	Pointing towards screen with fist. Thumb placed upwards indexfinger.	R	r5,1,0-r5,4,2
	00:03:35,765	00:03:37,165	00:00:01,400	Stop		Online	Iconic	Pointing towards screen with fist. Thumb moves one time. Remote.	R	r5,4,2
	00:03:40,660	00:03:42,822	00:00:02,162	Go back to the menu	Offline		Deictic	Pointing towards screen with fist. Thumb placed upwards indexfinger.	R	r5,1,0-r5,5,2
	00:03:45,150	00:03:46,957	00:00:01,807	Turn the TV off		Online	Iconic	Pointing towards screen. Moving thumb towards index finger. Remote	R	r5,1,0-r5,5,2

Figure 120: Videoscript (p25)

P28 – Female – 53-59 – Right
Experiment 13.3.2013

Time	#12:47:09,000	Time	Researcher	Participant	Offline	Online	Description		Arm	Gesture space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):							
			In using 3D gestures, would you describe your experience as positive. Please describe (you can use tags):	It is easily informatative						
			Nonverbal behavior				No playing with the stickman			
			(Pointing on screen). This is simultating the TV screen	Is it?, Aa, right.						
				(Brushing hair) Make sure I look pretty…Well.			(Clicks with indexfinger and ut fra håndleddet)			
00:00:34,875	00:00:40,687	00:00:05,812	Turn the TV on		Offline		Deictic	Pointing indexfinger towards screen.	R	r5,1,0-r5,4,1-m4,4,1-m4,5,1-r5,5,1-r5,5,2
00:00:52,752	00:00:59,450	00:00:06,698	Move downwards in the menu to the label “podcasts”		Offline		Deictic	Pointing indexfinger towards screen. Repeated.	R	r5,1,0-r5,5,2
00:01:03,322	00:01:08,382	00:00:05,060	Move upwards in the menu to the label “movies”		Offline		Deictic	Pointing indexfinger towards screen. Repeated.	R	r5,1,0-m4,5,2-m4,6,2
00:01:10,382	00:01:13,794	00:00:03,412	Select movies		Offline		Deictic	Pointing indexfinger towards screen.	R	m4,3,1-r5,5,1-r5,5,2
00:01:17,811	00:01:23,670	00:00:05,859	Move upwards in the menu to the label “iTunes top Films"		Offline		Deictic	Pointing indexfinger towards screen. Repeated.	R	m4,3,0-m4,6,2
00:01:26,462	00:01:28,994	00:00:02,532	Select “iTunes top Films”		Offline		Deictic	Pointing indexfinger towards screen.	R	m4,3,0-r5,6,2
00:01:33,401	00:01:39,640	00:00:06,239	Move downwards in the menu to the label “Gambit”		Offline		Deictic	Pointing indexfinger towards screen. Repeated.	R	m4,3,0-r5,6,2-m4,5,2
00:01:40,525	00:01:43,504	00:00:02,979	Select movie “Gambit”		Offline		Deictic	Pointing indexfinger towards screen.	R	m4,3,0-r5,5,1-r5,6,2
00:01:55,360	00:01:57,110	00:00:01,750	Pause the movie		Offline		Deictic	Pointing indexfinger towards screen.	R	m4,3,0-m4,5,2
00:01:58,349	00:02:00,120	00:00:01,771	Play the movie		Offline		Deictic	Pointing indexfinger towards screen.	R	m4,5,2-m4,6,2
00:02:04,604	00:02:08,260	00:00:03,656	Increase the volume			Online	Dynamic	One movement with the indexfinger towards right.	R	m4,3,0-m4,5,1-r5,5,1
00:02:09,332	00:02:12,935	00:00:03,603	Decrease the volume			Online	Dynamic	One movement with the indexfinger towards left.	R	r5,5,1-l3,5,1
00:02:15,645	00:02:20,272	00:00:04,627	Fast forward			Online	Dynamic	Dynamic movement with the indexfinger towards right (+ small circles). Repeated.	R	m4,3,0-m4,5,1-r5,5,2-r6,5,2
00:02:20,517	00:02:22,760	00:00:02,243	Stop		Offline		Deictic	Pointing indexfinger towards screen.	R	r6,5,2-m4,5,2
00:02:25,832	00:02:28,501	00:00:02,669	Fast backward			Online	Continous	One movement with the indexfinger towards left.	R	m4,5,2-l3,5,2
00:02:29,790	00:02:31,131	00:00:01,341	Stop		Offline		Deictic	Pointing indexfinger towards screen.	R	l3,4,2-m4,4,2
00:02:35,443	00:02:38,159	00:00:02,716	Go back to the menu		Offline		Deictic	Pointing indexfinger towards screen.	R	m4,4,2-m4,5,1-r5,5,2
00:02:40,870	00:02:45,260	00:00:04,390	Turn the TV off		Offline		Deictic	Pointing indexfinger towards screen.	R	m4,5,1-r5,4,2
				Oh, isn't that fun.						
				I don't know what I was doing, but I was imagine my tele at home. You know, in front of me.						
				And that's what we do.						
				Oh, great.						
				What a shame that it is just for 15 minutes. I enjoyed this.						

Figure 121: Videoscript (p28)

P29 – Female – 60-65 – Right
Experiment 13.3.2013

Time	#14:24:45,000	Time	Researcher	Participant	Offline	Online	Description		Arm	Gesture Space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):	No						
			In using 3D gestures, would you describe your experience as positive. Please describe (you can use tags):	Yes						
			Nonverbal behavior				No playing with the stickman			
00:01:04,897	00:01:06,340	00:00:01,443	Turn the TV on	(Trying to press a button on the accelerometer device)		Online	Dynamic	Dynamic movement towards screen.	R	r5,1,1-m4,4,1-m4,4,2
			With gestures	With gestures?						
			Yehh.							
00:01:16,519	00:01:20,971	00:00:04,452	Move downwards in the menu to the label “podcasts”			Online	Navigation	Dynamic movements downwards. Repeated.	R	r5,1,0-m4,4,1-m4,1,0
00:01:25,389	00:01:28,544	00:00:03,155	Move upwards in the menu to the label “movies”			Online	Navigation	Dynamic movements upwards. Repeated.	R	m4,1,0-m4,4,1-m4,1,1
00:01:31,194	00:01:33,770	00:00:02,576	Select movies			Online	Dynamic	Dynamic movement towards screen.	R	r5,1,0-r5,4,1-r5,4,2
00:01:39,622	00:01:43,175	00:00:03,553	Move upwards in the menu to the label “iTunes top Films"			Online	Navigation	Dynamic movements upwards. Repeated.	R	r5,1,0-m4,5,1-m4,2,1
00:01:45,536	00:01:47,400	00:00:01,864	Select “iTunes top Films”			Online	Dynamic	Dynamic movement towards screen.	R	r5,1,0-r5,4,1-m4,5,2
00:01:52,392	00:01:56,600	00:00:04,208	Move downwards in the menu to the label “Gambit”			Online	Navigation	Dynamic movements downwards. Repeated.	R	r5,1,0-r5,5,1-m4,1,1
00:01:58,899	00:02:00,590	00:00:01,691	Select movie “Gambit”			Online	Dynamic	Dynamic movement towards screen.	R	m4,2,0-m4,4,1-m4,4,2
00:02:12,797	00:02:14,640	00:00:01,843	Pause the movie			Online	Dynamic	One dynamic movement towards left	R	r5,1,0-r7,1,0-l3,3,0
00:02:16,915	00:02:18,350	00:00:01,435	Play the movie			Online	Dynamic	Dynamic movement towards screen.	R	l3,3,0-m4,4,0-m4,4,2
00:02:32,389	00:02:34,750	00:00:02,361	Increase the volume	(Laughing). Ehhh?		Online	Iconic	Dynamic movement drawing a circle towards right. Repeated.	R	r5,1,0-m4,4,2-m4,2,2
00:02:36,622	00:02:38,818	00:00:02,196	Decrease the volume			Online	Iconic	Dynamic movement drawing a circle towards left. Repeated.	R	r5,2,0-m4,4,2-m4,2,2-r5,2,2-l3,2,2
00:02:43,469	00:02:46,261	00:00:02,792	Fast forward			Online	Dynamic	Dynamic movements to the right and back. Repeated.	R	r5,1,0-m4,3,1-m4,3,2-r6,3,2-l3,3,1
00:02:46,757	00:02:48,608	00:00:01,851	Stop			Online	Dynamic	Dynamic movement towards screen.	R	m4,4,1-r5,4,1-l3,3,1
00:02:51,666	00:02:55,150	00:00:03,484	Fast backward			Online	Dynamic	Dynamic movements to the left and back. Repeated.	R	r5,1,0-r5,3,1-l3,3.1
00:02:55,820	00:02:56,953	00:00:01,133	Stop			Online	Dynamic	Dynamic movement towards screen.	R	m4,1,0-m4,4,0-l2,2,2
00:03:02,863	00:03:04,443	00:00:01,580	Go back to the menu			Online	Iconic	Dynamic movement with the elbow backwards.	R	r5,1,0-m4,1,2-m4,4,1-m4,3,0
00:03:11,500	00:03:13,644	00:00:02,144	Turn the TV off			Online	Iconic	Dynamic movement. Clapping with both hands	R+L	m4,3,0-r5,4,1-m4,4,1
				Ahh, wow!						
				It's amazing and intuitive! I can hardly belive it (feeling relieved)						
				Wow. (Laughing)						
				Cause I had no idea what I was doing.						
				Gosh, that is amazing!						
				That is very surprising, because, I had no idea.						
				I just guessed!, and it worked!						
				That is really amazing! (Astonished)						
				Not to bad.						

Figure 122: Videoscript (p29)

P30 – Male – 66-72 – Right
Experiment 13.3.2013

Time	#14:43:30,500	Time	Researcher	Participant	Offline	Online	Description	Arm	Gesture Space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):	No					
			In using 3D gestures, would you describe your experience as positive. Please describe (you can use tags):	Yes					
			Nonverbal behavior				No playing with the stickman		
00:00:36,949	00:00:54,121	00:00:17,172	Turn the TV on			Online	Dynamic	Dynamic movement from left to right. Waving. Repeated. (Very uncertain)	R	r5,1,0-r5,2,1-r5,4,1-m4,4,1-r5,5,1-r5,6,2
00:01:04,177	00:01:10,689	00:00:06,512	Move downwards in the menu to the label "podcasts"			Online	Navigational	Dynamic movement downwards. Repeated	R	r5,1,0-r5,5,0-r5,3,1
00:01:15,784	00:01:19,163	00:00:03,379	Move upwards in the menu to the label "movies"			Online	Navigational	Dynamic movement upwards. Repeated.	R	r5,4,1-r5,5,1
00:01:21,193	00:01:26,160	00:00:04,967	Select movies		Offline		Deictic	Pointing towards screen with open palm hand	R	m4,3,0-r5,5,0-r5,5,1
00:01:31,777	00:01:36,630	00:00:04,853	Move upwards in the menu to the label "iTunes top Films"			Online	Navigational	Dynamic movement upwards. Repeated.	R	m4,3,0-r5,5,1-r5,4,1
00:01:37,482	00:01:40,380	00:00:02,898	Select "iTunes top Films"		Offline		Deictic	Pointing towards screen with open palm hand	R	r5,5,1-r5,5,2
00:01:48,810	00:01:49,541	00:00:02,731	Move downwards in the menu to the label "Gambit"			Online	Navigational	Dynamic movement downwards. Repeated.	R	m4,3,1-r5,4,1-r5,3,1
00:01:50,906	00:01:52,517	00:00:01,611	Select movie "Gambit"		Offline		Deictic	Pointing towards screen with open palm hand	R	r5,3,1-r5,3,2
00:02:05,606	00:02:08,836	00:00:03,230	Pause the movie		Offline		Static symbol	Showing open palm hand towards screen. (Stop sign)	R	m4,3,1-r5,4,1
00:02:11,455	00:02:13,285	00:00:01,830	Play the movie			Online	Dynamic	One dynamic movement to the right.	R	r5,4,1-m4,4,1-r6,3,1
00:02:19,960	00:02:22,920	00:00:02,960	Increase the volume			Online	Dynamic	One dynamic movement upwards.	R	m4,2,1-r5,2,1-r5,5,1
00:02:24,103	00:02:26,991	00:00:02,888	Decrease the volume			Online	Dynamic	One dynamic movement downwards.	R	m4,2,0-r5,6,0-r5,2,1
00:02:30,320	00:02:34,188	00:00:03,868	Fast forward			Online	Dynamic	Dynamic movement towards right. Repeated.	R	m4,2,0-m4,4,1-r6,4,1
00:02:34,603	00:02:36,449	00:00:01,846	Stop		Offline		Static symbol	Showing open palm hand towards screen. (Stop sign)	R	r5,1,0-r5,4,1
00:02:40,291	00:02:43,760	00:00:03,469	Fast backward			Online	Dynamic	Dynamic movement towards left. Repeated.	R	r5,4,1-l3,4,1-r6,4,1
00:02:43,843	00:02:45,670	00:00:01,827	Stop		Offline		Static symbol	Showing open palm hand towards screen. (Stop sign)	R	l3,4,1-m4,4,2
00:02:51,553	00:02:54,800	00:00:03,247	Go back to the menu			Online	Dynamic	One dynamic movement over the head and backwards	R	m4,3,0-r5,6,0
00:02:58,990	00:03:01,561	00:00:02,571	Turn the TV off			Online	Dynamic	One dynamic movement downwards.	R	m4,3,1-r5,4,1-r5,1,0

Figure 123: Videoscript (p30)

Figure 124: Videoscript (p32)

P32 – Female – 53-59 – Right
Experiment 14.3.2013

Time	#12:37:23,500	Time	Researcher	Participant	Offline	Online	Description		Arm	Gesture space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):	I work best with clear instructions. Having no instructions as to how to use things can be frustrating.						
			In using 3D gestures, would you describe your experience as positive. Please describe (you can use tags):	Yes, I feel sure this is the way things will go but am concerned how this might affect me as income older, less mobile and slower to learn new skills.						
			Nonverbal behavior				No playing with the stickman			
00:00:56,218	00:00:58,471	00:00:02,253	Turn the TV on			Online	Iconic	Dynamic movement left to right. Repeated. (Waving)	R	r5,1,0-r5,5,1-r5,5,2-m4,5,2
00:01:06,550	00:01:12,351	00:00:05,801	Move downwards in the menu to the label “podcasts”			Online	Navigational	Dynamic movement downwards. Repeated.	R	r5,1,0-r5,5,0-r5,1,0
00:01:20,457	00:01:26,362	00:00:05,905	Move upwards in the menu to the label “movies”			Online	Navigational	Dynamic movements upwards. Repeated.	R	r5,1,0-r5,5,0
00:01:30,965	00:01:33,473	00:00:02,508	Select movies		Offline		Deictic	Pointing towards screen with open palm hand.	R	r5,1,0-r5,3,1-r5,6,2
00:01:40,741	00:01:45,570	00:00:04,829	Move upwards in the menu to the label “iTunes top Films"			Online	Navigational	Dynamic movements upwards. Repeated.	R	r5,1,0-r5,3,1-r5,6,0
00:01:49,107	00:01:51,230	00:00:02,123	Select “iTunes top Films”		Offline		Deictic	Pointing towards screen with open palm hand.	R	r5,1,0-r5,5,0-r5,6,2
00:01:59,118	00:02:04,185	00:00:05,067	Move downwards in the menu to the label “Gambit”			Online	Navigational	Dynamic movement downwards. Repeated.	R	r5,1,0-r5,6,0-r5,3,2
00:02:08,383	00:02:10,411	00:00:02,028	Select movie “Gambit”		Offline		Deictic	Pointing towards screen with open palm hand.	R	r5,1,0-r5,4,1-r5,5,2
00:02:23,570	00:02:24,845	00:00:01,275	Pause the movie		Offline		Deictic	Pointing towards screen with flat hand.	R	r5,1,0-m4,5,2
00:02:28,418	00:02:30,390	00:00:01,972	Play the movie			Online	Dynamic	One dynamic movement towards right.	R	r5,1,0-m4,4,2-r7,4,0
00:02:34,759	00:02:38,590	00:00:03,831	Increase the volume			Online	Iconic	One dynamic movement. Lifting both arms up.	R+L	r5,1,0-r5,3,1-r5,5,0
00:02:40,436	00:02:43,110	00:00:02,674	Decrease the volume			Online	Iconic	One dynamic movement. Moving both arms downwards	R+L	r5,1,0-r5,5,0-r5,2,2
00:02:47,868	00:02:52,565	00:00:04,697	Fast forward			Online	Dynamic	Dynamic movement towards right. Repeated	R	r5,1,0-l3,4,1-r7,4,0
00:02:53,684	00:02:55,521	00:00:01,837	Stop		Offline		Static symbol	Showing open palm hand towards screen.	R	r5,4,1-r5,4,2
00:02:58,740	00:03:02,703	00:00:03,963	Fast backward			Online	Dynamic	Dynamic movement towards left.	R	r5,1,0-r6,4,0-m4,4,2-l2,4,0
00:03:02,778	00:03:04,726	00:00:01,948	Stop		Offline		Static symbol	Showing open palm hand towards screen.	R	r5,4,1-r5,5,2
00:03:09,147	00:03:11,600	00:00:02,453	Go back to the menu		Online		Iconic	One dynamic movement. Moving both hands downwards.	R+L	r5,1,0-r5,4,0-r5,3,2-r5,1,0
00:03:22,396	00:03:24,449	00:00:02,053	Turn the TV off		Online		Iconic	One dynamic movement, drawing a circle toward left.	R	r5,1,0-r6,4,0-m4,2,2-r6,2,0

P33 – Female – 46-52 – Right
Experiment 14.3.2013

Time	#13:11:52,500	Time	Researcher	Participant	Offline	Online	Description		Arm	Gesture space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):	I wanted and tried unsuccessfully to move up and down several menu items in one gesture; I'm not sure if that's possible.						
			In using 3D gestures, would you describe your experience as positive. Please describe (you can use tags):	Yes, very. I enjoyed it and I am intrigued. It has made me want to find out more and how I can incorporate gestures into my daily life						
			Nonverbal behavior				No playing with the stickman			
00:00:23,428	00:00:26,975	00:00:03,547	Turn the TV on		Offline		Deictic	Pointing towards screen.	R	r5,1,0-r5,4,1-r5,6,2
00:00:36,115	00:00:42,238	00:00:06,123	Move downwards in the menu to the label “podcasts”		Offline		Deictic	Pointing towards screen with index finger. Repeated.	R	r5,1,0-r5,5,1-r5,6,2
00:00:48,297	00:00:54,600	00:00:06,303	Move upwards in the menu to the label “movies”			Online	Navigational	Dynamic movements upwards. Repeated.	R	r5,1,0-r5,4,1-r5,6,1-r5,6,2
00:00:55,978	00:00:58,157	00:00:02,179	Select movies		Offline		Deictic	Pointing towards screen.	R	r5,1,0-r5,5,0-r5,6,2
00:01:06,700	00:01:09,881	00:00:03,181	Move upwards in the menu to the label “iTunes top Films"		Offline		Deictic	Pointing towards screen. Repeated.	R	r5,3,1-r5,5,0-r5,6,2
00:01:13,501	00:01:16,258	00:00:02,757	Select “iTunes top Films”		Offline		Deictic	Pointing towards screen.	R	r5,4,0-r5,5,0-r5,6,2
00:01:23,633	00:01:29,212	00:00:05,579	Move downwards in the menu to the label “Gambit”		Offline		Deictic	Pointing towards screen. Repeated.	R	r5,1,0-r5,6,1-r5,6,2
00:01:31,415	00:01:33,147	00:00:01,732	Select movie “Gambit”		Offline		Deictic	Pointing towards screen.	R	r5,4,1-r5,5,1-r5,5,2
00:01:43,828	00:01:45,936	00:00:02,108	Pause the movie		Offline		Static symbol	Showing open palm hand towards screen.	R	r5,1,0-m4,4,1-r5,6,2
00:01:49,315	00:01:51,424	00:00:02,109	Play the movie			Online	Dynamic	One dynamic movment upwards.	R	r5,1,0-m4,3,0-r5,6,0
00:01:57,583	00:02:00,690	00:00:03,107	Increase the volume			Online	Iconic	Dynamic movment. Turning hand towards right. (Turning a button)	R	r5,1,0-r5,2,1-r5,6,2
00:02:02,190	00:02:04,785	00:00:02,595	Decrease the volume			Online	Iconic	Dynamic movment. Turning hand towards left. (Turning a button)	R	r5,1,0-r5,4,2-r5,6,2
00:02:09,608	00:02:12,360	00:00:02,752	Fast forward			Online	Dynamic	One dynamic movement towards right.	R	r5,1,0-l3,4,1-r7,4,1
00:02:14,108	00:02:16,623	00:00:02,515	Stop		Offline		Static symbol	Showing open palm hand towards screen.	R	r5,1,0-m4,5,1-m4,5,2
00:02:19,210	00:02:20,963	00:00:01,753	Fast backward			Online	Dynamic	One dynamic movement towards left	R	r5,1,0-r6,4,0-m4,6,2-l2,4,1
00:02:22,594	00:02:24,140	00:00:01,546	Stop		Offline		Static symbol	Showing open palm hand towards screen.	R	m4,2,0-m4,6,2
00:02:28,389	00:02:30,704	00:00:02,315	Go back to the menu		Offline		Deictic	Pointing towards screen.	R	r5,1,0-m4,5,1-l2,6,2
00:02:33,720	00:02:35,988	00:00:02,268	Turn the TV off		Offline		Deictic	Pointing towards screen.	R	r5,1,0-r5,3,1-r5,6,2
				Laughing						
				It is so funny, jumping with ... (showing arms)						
				Coming so natural …						
				(Laughing) You see some wonderful stuff						

Figure 125: Videoscript (p33)

P34 – Female – 60-65 – Right
Experiment 14.3.2013

Time	#14:33:27,500	Time	Researcher	Participant	Offline	Online	Description		Arm	Gesture space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):	No						
			In using 3D gestures, would you describe your experience as positive. Please describe (you can use tags):	Yes as managed to do what requested						
			Nonverbal behavior				No playing with the stickman			
00:00:50,112	00:00:51,912	00:00:01,800	Turn the TV on	Where? I don't have a (showing remote control)		Online	Iconic	Pointing towards screen with bot hands. Moving thumb towards index finger. Remote.	R+L	m4,3,1-m4,4,1
			With gestures	Ahh.						
00:00:59,684	00:01:04,968	00:00:05,284	Move downwards in the menu to the label “podcasts”			Online	Navigational	Pointing with the indexfinger towards the screen. Dynamic movement downwards. Repeated.	R	r5,6,1-r5,5,2
00:01:10,585	00:01:12,424	00:00:01,839	Move upwards in the menu to the label “movies”			Online	Navigational	One dynamic movement upwards.	R	r5,5,2-r5,6,2
00:01:16,627	00:01:17,848	00:00:01,221	Select movies		Offline		Deictic	Pointing index finger towards screen.	R	r5,6,2-r5,6,1-r5,6,2
00:01:23,698	00:01:26,596	00:00:02,898	Move upwards in the menu to the label “iTunes top Films"			Online	Navigational	One dynamic movement upwards.	R	m4,2,1-r5,4,1-r5,6,2
00:01:29,505	00:01:30,973	00:00:01,468	Select “iTunes top Films”		Offline		Deictic	Pointing index finger towards screen.	R	r5,6,2-r5,6,1-r5,6,2
00:01:39,938	00:01:43,568	00:00:04,630	Move downwards in the menu to the label “Gambit”			Online	Navigational	Dynamic movment downwards. Repeated.	R	r5,4,1-r5,6,2-r5,5,2
00:01:47,807	00:01:49,171	00:00:01,364	Select movie “Gambit”			Online	Iconic	Dynamic movement with both hands. Clapp.	R+L	r5,5,2-r5,5,1
00:02:02,883	00:02:05,960	00:00:03,077	Pause the movie			Online	Iconic	Pointing towards screen with bot hands. Moving thumb towards index finger. Remote.	R+L	r5,1,0-m4,4,1
00:02:09,513	00:02:10,957	00:00:01,444	Play the movie			Online	Iconic	Pointing towards screen with bot hands. Moving thumb towards index finger. Remote.	R+L	m4,1,0-m4,4,2
00:02:17,250	00:02:19,541	00:00:02,291	Increase the volume			Online	Dynamic	One dynamic movment with the index finger towards right.	R	m4,1,0-m4,5,1-r6,5,1
00:02:22,805	00:02:25,330	00:00:02,525	Decrease the volume			Online	Dynamic	One dynamic movment with the index finger towards left.	R	m4,1,1-r6,4,1-m4,5,1
00:02:29,948	00:02:33,304	00:00:03,356	Fast forward			Online	Dynamic	Dynamic movment. Pointing thumb towards right. Repeated.	R	m4,1,0-m4,4,1-r5,4,1
00:02:33,661	00:02:34,751	00:00:01,090	Stop		Offline		Deictic	Pointing index finger towards screen.	R	r5,4,1-m4,4,2
00:02:38,791	00:02:41,347	00:00:02,556	Fast backward			Online	Dynamic	Dynamic movment. Pointing index finger towards left. Repeated.	R	m4,1,0-r5,5,1-l3,5,1
00:02:42,357	00:02:43,354	00:00:00,997	Stop		Offline		Deictic	Pointing index finger towards screen.	R	l3,5,1-m4,4,2
00:02:51,105	00:02:52,733	00:00:01,628	Go back to the menu			Online	Dynamic	Dynamic movement towards screen, using left hand.	L	m4,1,0-m4,3,1-l2,6,2
00:02:58,105	00:02:59,677	00:00:01,572	Turn the TV off			Online	Iconic	One dynamic movment with both hands, indicating a X cross out.	R+L	m4,1,0-l3,3,1-r6,4,0
				Happy?						
			Happy!	I invent something …						

Figure 126: Videoscript (p34)

P35 – Male – 53-59 – Right
Experiment 14.3.2013

Time	#15:30:31,500	Time	Researcher	Participant	Offline	Online	Description	Arm	Gesture space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):	no					
			In using 3D gestures, would you describe your experience as positive. Please describe (you can use tags).	yes					
			Nonverbal behavior				No playing with the stickman		
							Video doesn't show row 6. (Hand in y6)		
00:00:48,570	00:00:50,700	00:00:02,130	Turn the TV on			Online	Iconic	Dynamic movement upwards and snipp.	R	r5.1,0-r5.3,1-r6.5,0
00:00:58,118	00:01:04,101	00:00:05,983	Move downwards in the menu to the label "podcasts"			Online	Navigational	One dynamic movement downwards with indexfinger pointing towards screen.	R	r5.1,0-r5.4,1-r5.6,1-r5.5,1
00:01:11,148	00:01:16,127	00:00:04,979	Move upwards in the menu to the label "movies"			Online	Navigational	One dynamic movment upwards with the indexfinger pointing towards screen.	R	r5.1,0-r5.3,1-r5.6,1
00:01:20,369	00:01:23,293	00:00:02,924	Select movies		Offline		Deictic	Pointing with index finger towards screen.	R	r5.1,0-r5.5,0-r5.6,2
00:01:31,142	00:01:35,609	00:00:04,467	Move upwards in the menu to the label "iTunes top Films"			Online	Navigational	One dynamic movment upwards with the indexfinger pointing towards screen.	R	r5.1,0-r5.4,1-r5.6,2
00:01:40,170	00:01:41,621	00:00:01,451	Select "iTunes top Films"		Offline		Deictic	Pointing with index finger towards screen.	R	r5.6,2-r5.6,0-r5.6,2
00:01:50,327	00:01:55,930	00:00:05,603	Move downwards in the menu to the label "Gambit"			Online	Navigational	One dynamic movement downwards with indexfinger pointing towards screen.	R	r5.6,2-r5.5,2
00:01:57,512	00:01:59,197	00:00:01,685	Select movie "Gambit"		Offline		Deictic	Pointing with index finger towards screen.	R	r5.5,2-r5.5,0-r5.5,2
00:02:11,913	00:02:15,716	00:00:03,803	Pause the movie			Online	Iconic	One dynamic movement. Pulling both arms from each other.	R+L	r5.1,0-m4.5,1-r6.5,0
00:02:21,631	00:02:23,162	00:00:01,531	Play the movie		Offline		Deictic	Pointing with index finger towards screen.	R	r5.1,0-r5.5,0-m4.5,1
00:02:31,805	00:02:35,682	00:00:03,877	Increase the volume			Online	Iconic	Dynamic movment with index finger, drawing a circle towards right. Repeated.	R	r5.1,0-r5.4,1-m4.5,1-r5.5,1
00:02:39,384	00:02:42,523	00:00:03,139	Decrease the volume			Online	Iconic	Dynamic movment with index finger, drawing a circle towards left. Repeated.	R	r5.1,0-m4.5,1-r6.5,1-r6.6,1
00:02:49,854	00:02:52,114	00:00:02,260	Fast foward			Online	Dynamic	One dynamic movment towards right.	R	r5.1,0-m4.4,1-r7.4,0
00:02:55,456	00:02:57,380	00:00:01,924	Stop			Online	Dynamic	One dynamic movment downwards.	R	r6.4,0-m4.4,0-m4.5,1-m4.3,1
00:03:02,520	00:03:04,444	00:00:01,924	Fast backward			Online	Dynamic	One dynamic movement to the right, then to the left shoulder.	R	r5.1,0-r6.4,0-m4.4,2-l3.4,0
00:03:06,471	00:03:07,883	00:00:01,412	Stop			Online	Iconic	One dynamic movment downwards.	R	m4.3,1-m4.5,1-m4.2,1
00:03:16,195	00:03:18,449	00:00:02,254	Go back to the menu			Online	Iconic	Dynamic movment with index finger, drawing a circle towards left. Repeated.	R	r5.1,0-m4.4,1-r6.6,2-m4.6,2-m4.4,2
00:03:22,163	00:03:24,391	00:00:02,228	Turn the TV off			Online	Iconic	Dynamic movement upwards and snipp.	R	m4.2,0-r5.5,1

Figure 127: Videoscript (p35)

P36 – Female – 46-52 – Right
Experiment 15.3.2013

Time	#10:12:21.000	Time	Researcher	Participant	Offline	Online	Description		Arm	Gesture space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):							
			In using 3D gestures, would you describe your experience as positive. Please describe (you can use tags):	Today's experience was positive. I have little other experience to compare with.						
			Non-verbal behavior				No playing with the stickman			Video doesn't show row 6. (Hand in y6)
00:00:34,689	00:00:36,706	00:00:02,017	Turn the TV on	I just need to guess how to do that?	Offline		Deictic	Pointing towards the screen (saying "turn it on").	R	m4,2,0-r5,5,0-m4,6,2
			You can do whatever you like							
00:00:44,420	00:00:50,735	00:00:06,315	Move downwards in the menu to the label "podcasts"			Online	Navigational	Dynamic movments downwards. Repeated.	R	m4,2,0-r5,5,1-r5,6,2-r5,5,2
00:00:57,714	00:01:01,470	00:00:03,756	Move upwards in the menu to the label "movies"			Online	Navigational	Dynamic movments upwards. Repeated.	R	m4,2,0-r5,6,2
00:01:05,904	00:01:07,444	00:00:01,540	Select movies		Offline		Deictic	Pointing with index finger towards screen.	R	m4,2,0-r5,5,1-r5,6,2
00:01:13,779	00:01:17,707	00:00:03,928	Move upwards in the menu to the label "iTunes top Films"			Online	Navigational	Dynamic movments upwards. Repeated.	R	m4,2,0-r5,6,2
00:01:20,615	00:01:22,311	00:00:01,696	Select "iTunes top Films"		Offline		Deictic	Pointing with index finger towards screen.	R	m4,2,0-r5,5,0-r5,6,2
00:01:29,170	00:01:35,311	00:00:06,141	Move downwards in the menu to the label "Gambit"			Online	Navigational	Dynamic movments downwards. Repeated.	R	m4,2,0-r5,6,2
00:01:39,186	00:01:40,792	00:00:01,606	Select movie "Gambit"		Offline		Deictic	Pointing with index finger towards screen.	R	m4,2,0-r5,5,0-r5,6,2
00:01:56,554	00:01:58,110	00:00:01,556	Pause the movie	Ehmm (preparing gesture, terminate) Mmmm … Something like that (performing gesture)		Online	Dynamic	One dynamic movment towards left.	R	m4,2,0-r5,3,2-r5,6,2-m4,6,2-m4,3,1
00:02:02,227	00:02:03,781	00:00:01,554	Play the movie			Online	Dynamic	One dynamic movment towards right.	R	m4,2,0-l3,5,2-r6,5,2
00:02:09,494	00:02:11,800	00:00:02,306	Increase the volume			Online	Iconic	Dynamic movement, drawing a circle towards right. Repeated.	R	m4,2,0-m4,5,2-m4,6,2
00:02:14,820	00:02:15,853	00:00:01,033	Decrease the volume			Online	Iconic	Dynamic movement, drawing a circle towards left. Repeated.	R	m4,2,0-r5,4,1-r6,5,2-m4,6,2
00:02:22,970	00:02:23,901	00:00:00,931	Fast forward			Online	Dynamic	Dynamic movement left to right. Repeated.	R	m4,2,0-r6,5,2-m4,6,2
00:02:26,312	00:02:27,954	00:00:01,642	Stop		Offline		Deictic	Pointing towards the screen (saying "stop").	R	m4,2,0-m4,4,1-r5,6,2
00:02:32,135	00:02:34,915	00:00:02,780	Fast backward			Online	Dynamic	Dynamic movement left to right. Repeated.	R	m4,2,0-m4,5,2-m4,6,2
00:02:36,976	00:02:38,276	00:00:01,300	Stop		Offline		Deictic	Pointing towards screen.	R	m4,2,0-m4,6,2
00:02:45,511	00:02:46,787	00:00:01,276	Go back to the menu			Online	Iconic	Pointing towards screen and snipping.	R	m4,2,0-m4,4,1-m4,6,2
00:02:57,376	00:02:59,747	00:00:02,371	Turn the TV off			Online	Iconic	One dynamic movement, drawing a 8 or X	R	m4,2,0-l3,6,2-m4,5,2-r5,6,2-l3,5,2

Figure 128: Videoscript (p36)

P37 – Male – 73 – Right
Experiment 15.3.2013

Time	#11:09:00,500	Time	Researcher	Participant	Offline	Online	Description		Arm	Gesture space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):	It took a moment to know how to play the bowling game						
			In using 3D gestures, would you describe your experience as positive. Please describe (you can use tags):	Yes, I think I was very positive						
			Nonverbal behavior				No playing with the stickman			
00:00:25,531	00:00:28,366	00:00:02,835	Turn the TV on		Offline		Deictic	Pointing towards screen.	R	r5,1,0-r5,4,1-r5,6,2
			with gestures, and you can do whatever you like	Ok …						
00:00:35,183	00:00:40,818	00:00:05,635	Move downwards in the menu to the label "podcasts"	To where am I doing?	Offline		Navigational	Pointing towards screen.	R	m4,1,0-r5,5,1-r5,6,2
00:00:55,747	00:00:58,958	00:00:03,211	Move upwards in the menu to the label "movies"		Offline		Navigational	Pointing towards screen.	R	r5,5,1-r5,6,2
00:01:02,455	00:01:06,107	00:00:03,652	Select movies		Offline		Deictic	Pointing towards screen. (At the same time stepping closer towards the screen)	R	m4,2,0-r5,4,1-r5,5,0-r5,6,2
00:01:18,112	00:01:22,340	00:00:04,228	Move upwards in the menu to the label "iTunes top Films"		Offline		Navigational	Pointing towards screen.	R	m4,4,0-r5,6,1-r5,6,2
00:01:24,305	00:01:26,640	00:00:02,335	Select "iTunes top Films"		Offline		Pointing	Pointing towards screen.	R	m4,4,0-r5,5,0-r5,6,2
00:01:35,627	00:01:44,463	00:00:08,836	Move downwards in the menu to the label "Shifty"		Offline		Navigational	Pointing towards screen.	R	m4,2,0-r5,6,2
00:01:48,612	00:01:50,952	00:00:02,340	Select movie "Shifty"		Offline		Deictic	Pointing towards screen. (At the same time stepping closer towards the screen)	R	m4,4,0-r5,5,1-r5,6,2
			Pause the movie	Sorry?						
00:02:11,613	00:02:13,161	00:00:01,548	Pause the movie	Mmm, I am not … ?	Offline		Deictic	Pointing towards screen.	R	m4,2,0-r6,3,1-r5,6,2
00:02:16,878	00:02:19,657	00:00:02,779	Play the movie		Offline		Deictic	Pointing towards screen. (At the same time stepping closer towards the screen)	R	m4,2,0-m4,6,2
			Increase the volume	Ahh, give me a remote control and I could (showing gesture on remote control)	/		Too close to camera		R	m4,2,0-r5,6,2
00:02:40,274	00:02:43,502	00:00:03,228	with gestures …	Ohh …			No camera pic			
00:02:45,270	00:02:48,602	00:00:03,332	Decrease the volume		/		No camera pic		R	m4,2,0-r5,6,2
00:03:06,954	00:03:08,910	00:00:01,956	Fast forward	Ohh, I am not sure how to do that …		Online	Dynamic. No camera pic	One dynamic movement from left to right.	R	m4,2,0-m4,6,2-r7,6,0
			Stop		/		Data loss. Did not get the task			
00:03:41,443	00:03:43,933	00:00:02,490	Fast backward			Online	Dynamic. No camera pic	One dynamic movement from right to left	R	m4,2,0-r6,6,2-m4,6,2
00:03:47,471	00:03:49,315	00:00:01,844	Stop		Offline		Deictic. No camera pic	Pointing towards screen.	R	m4,2,0-m4,6,2
00:03:59,936	00:04:02,908	00:00:02,972	Go back to the menu	Ohh, I am not sure how to do that …			No camera pic. Uses his left hand. Stepping closer		L	
00:04:08,966	00:04:12,714	00:00:03,748	Turn the TV off				No camera pic. Uses his left hand. Stepping closer			

Figure 129: Videoscript (p37)

P38 – Female – 53-59 – Right
Experiment 15.3.2013

Time	#15:58:21,000	Time	Researcher	Participant	Offline	Online	Description		Arm	Gesture space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):	I found it odd I could see my avatar when picking up the bowling ball, but once I had it in my virtual hand, my avatar disappeared. I could not see immediately how to make the bowling ball more forward untli I took a backward swing ie I completed a more lifelike gesture, for some reason (as the virtual ball is weithless, I think) I did not immediately undertake the "real life" action.						
			In using 3D gestures, would you describe your experience as positive. Please describe (you can use tags):	Once I realized it was necessary to use the complete action, it became easy. I liked seeing the action replays while I was undertaking the initial task I reflected on what I was doing, and I thought that I was using similar actions for fast forward (sweeping right hand to the left) and rewind (posting index finger on right hand to the left), whereas remote controls tend to double arrows to show rewind and fast forward going in different directions. In my interaction, I was imagining moving the "film" physically from a virtual right hand side real to a virtual left hand side need for fast forward, and for the finger pointing gesture for rewind I was thinking "I want you to go backwards" to the "film". So in one sense they are contradictory, as the gestures both pointed the same way, but fast forward was a hand gesture, and rewind was a finger gesture. If I had wearing sensors on both wrists, I think I would have used different hands for fast forward and rewind. I was also thinking of other gestures I could use , e.g. "look at later" or "throw this away" - like screwing up a piece of paper. Good fun! Also made me think of the film minority report, where gestures were used as an interface.						
			Nonverbal behavior				No playing with the stickman			
00:00:23,706	00:00:26,120	00:00:02,414	Turn the TV on	Oh, you are saying TV, you are refering to the screen?	Offline		Deictic	Pointing with index finger towards the screen.	R	r5,1,0-r5,4,1-r5,6,2
00:00:38,499	00:00:43,294	00:00:04,795	Move downwards in the menu to the label “podcasts”			Online	Navigational	One dynamic movment pointing the index finger towards the screen.	R	r5,1,0-r5,6,2
00:00:51,473	00:00:54,820	00:00:03,347	Move upwards in the menu to the label “movies”			Online	Navigational	One dynamic movment pointing the index finger towards the screen.	R	r5,6,2
00:00:58,341	00:01:00,537	00:00:02,196	Select movies		Offline		Deictic	Pointing with index finger towards the screen.	R	r5,6,2
00:01:08,964	00:01:11,904	00:00:02,940	Move upwards in the menu to the label “iTunes top Films"			Online	Navigational	Dynamic movement upwards. Repeated.	R	r5,6,2
00:01:17,743	00:01:18,970	00:00:01,227	Select “iTunes top Films”		Offline		Deictic	Pointing open palm hand towards screen.	R	r5,6,2
00:01:24,637	00:01:28,513	00:00:03,876	Move downwards in the menu to the label “Gambit”			Online	Navigational	Dynamic movments downwards. Repeated.	R	r5,6,2-r5,5,2
00:01:33,923	00:01:35,780	00:00:01,857	Select movie “Gambit”		Offline		Deictic	Pointing open palm hand towards screen.	R	r5,6,2
00:01:47,221	00:01:48,688	00:00:01,467	Pause the movie		Offline		Deictic	Pointing with index finger towards the screen.	R	r5,6,2-m4,6,2
00:01:52,536	00:01:54,836	00:00:02,300	Play the movie		Offline		Deictic	Pointing with index finger towards the screen.	R	m4,4,1-m4,6,2
00:01:57,991	00:02:00,270	00:00:02,279	Increase the volume			Online	Dynamic	One dynamic movment to the right top.	R	m4,3,0-m4,5,1-r6,6,0
00:02:03,118	00:02:04,890	00:00:01,772	Decrease the volume			Online	Dynamic	One dynamic movment downwards.	R	m4,3,0-r6,6,0-l3,3,1
00:02:09,592	00:02:12,700	00:00:03,108	Fast forward			Online	Dynamic	Dynamic movments towards left. Repeated.	R	m4,3,1-r5,5,1
00:02:13,289	00:02:15,103	00:00:01,814	Stop		Offline		Static symbol	Showing open palm hand towards screen.	R	m4,3,0-r5,6,2
00:02:19,431	00:02:21,643	00:00:02,212	Fast backward			Online	Dynamic	Dynamic movments towards left. Repeated.	R	m4,3,0-r6,5,1-m4,5,1
00:02:22,647	00:02:24,436	00:00:01,789	Stop		Offline		Static symbol	Showing open palm hand towards screen.	R	m4,3,0-r5,6,2
00:02:31,453	00:02:33,260	00:00:01,807	Go back to the menu			Online	Dynamic	One dynamic movmement towards the left shoulder.	R	m4,3,0-r5,4,2-l3,4,1
00:02:36,383	00:02:38,346	00:00:01,963	Turn the TV off		Offline		Deictic	Pointing with index finger towards the screen.	R	m4,3,0-r6,6,2
				That was fun!						

Figure 130: Videoscript (p38)

P39 – Male – 66-72 – Right
Experiment 15.3.2013

Time	#16:41 - 16:45	Time	Researcher	Participant	Offline	Online	Description		Arm	Gesture space
			In using 3D gestures, did you experience any problems or issues. Please describe (you can use tags):	Only at first						
			In using 3D gestures, would you describe your experience as positive. Please describe (you can use tags):	Yes after some practise.						
			Nonverbal behavior				No playing with the stickman			
00:00:30,643	00:00:32,170	00:00:01,527	Turn the TV on	Turn the TV on?		Online	Dynamic	One dynamic movement to the left	R	r5.3,0-r6,6,0-l3,3,0
				Ah, ok, that is what I normally do						
				Yes						
				(Performs gesture). Is that ok?						
00:00:41,126	00:00:45,921	00:00:04,795	Move downwards in the menu to the label "podcasts"			Online	Navigational	Dynamik movment downwards. Repeated.	R	m4,3,0-r5,6,1-r5,1,2
00:00:51,698	00:00:56,877	00:00:05,179	Move upwards in the menu to the label "movies"			Online	Dynamic	Dynamik movment upwards. Repeated.	R	m4,1,0-r5,6,0
00:01:04,452	00:01:06,397	00:00:01,945	Select movies			Online	Dynamic	One dynamic movment to the left	R	r5.3,0-r6,6,0-l2,2,0
00:01:13,391	00:01:18,540	00:00:05,149	Move upwards in the menu to the label "iTunes top Films"			Online	Navigational	Dynamik movment upwards. Repeated.	R	r5.3,0-r5,4,1-r5,6,0
00:01:21,196	00:01:23,271	00:00:02,075	Select "iTunes top Films"			Online	Dynamic	One dynamic movment to the left	R	r5.3,0-r6,5,0-l3,3,0
00:01:28,754	00:01:35,695	00:00:06,941	Move downwards in the menu to the label "Gambit"			Online	Navigational	Dynamik movment downwards. Repeated.	R	r5.3,0-r5,6,1-r5,4,2-r5,1,0
00:01:39,749	00:01:41,863	00:00:02,114	Select movie "Gambit"			Online	Dynamic	One dynamic movment to the left	R	r5.3,0-r6,4,0-l2,3,0
00:01:59,990	00:02:01,754	00:00:01,764	Pause the movie			Online	Dynamic	One dynamic movment, drawing a halv circle towards right.	R	r5.3,0-m4,4,0-m4,4,1-m4,4,2-r5,3,2-r5,1,0
00:02:06,335	00:02:08,526	00:00:02,191	Play the movie			Online	Dynamic	One dynamic movment to the left	R	r5.3,0-r5,4,1-l3,3,0
00:02:13,251	00:02:20,287	00:00:07,036	Increase the volume			Online	Iconic	Dynamik movment upwards. Repeated.	R	r5.3,0-m4,3,1-r5,5,0
00:02:21,743	00:02:26,803	00:00:05,060	Decrease the volume			Online	Iconic	Dynamik movment downwards. Repeated.	R	r5.3,0-r5,6,0-m4,4,2-r5,1,0
00:02:30,933	00:02:33,810	00:00:02,877	Fast forward			Online	Dynamic	One dynamic movement towards the screen with a a small back and forth movement in between.	R	r5.3,0-l3,4,1-m4,3,2-m4,1,1
00:02:35,321	00:02:36,710	00:00:01,389	Stop			Online	Dynamic	One dynamic movment downwards.	R	m4,3,1-r5,5,1-m4,1,0
00:02:42,396	00:02:44,689	00:00:02,293	Fast backward	Rewind you mean, or?		Online	Dynamic	One dynamic movement towards left with a a small back and forth movement in between.	R	m4,1,0-m4,2,1-l3,3,2-l2,3,0
00:02:52,691	00:02:55,124	00:00:02,433	Stop			Online	Iconic	One dynamic movment downwards.	R	r5.3,0-m4,5,1-m4,1,0
00:02:59,773	00:03:01,360	00:00:01,587	Go back to the menu			Online	Iconic	One dynamic movment over head	R	m4,4,0-m4,4,2-m4,6,0
00:03:07,623	00:03:09,475	00:00:01,852	Turn the TV off			Online	Dynamic	One dynamic movment to the left	R	r5.3,0-r5,4,1-l2,2,0

Figure 131: Videoscript (p39)

R Appendix - Graph from accelerometer sensor during the TV-task

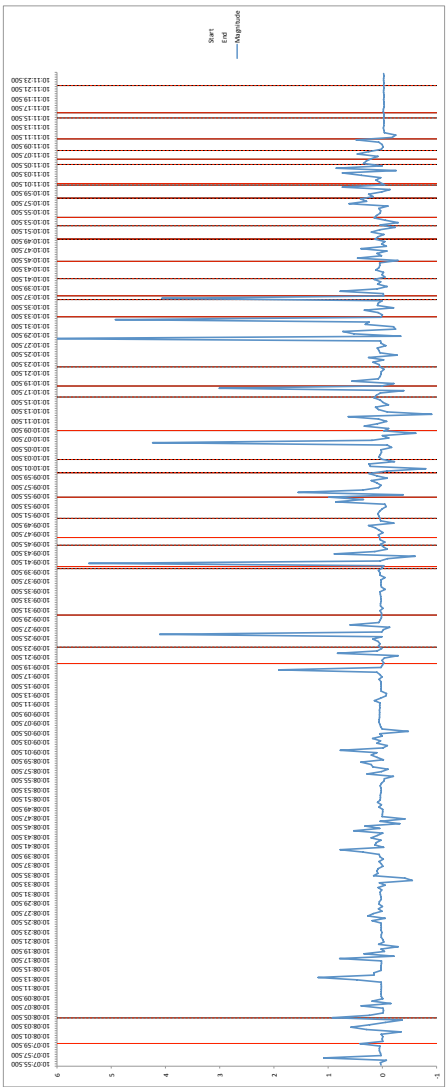


Figure 132: Graph (p1)

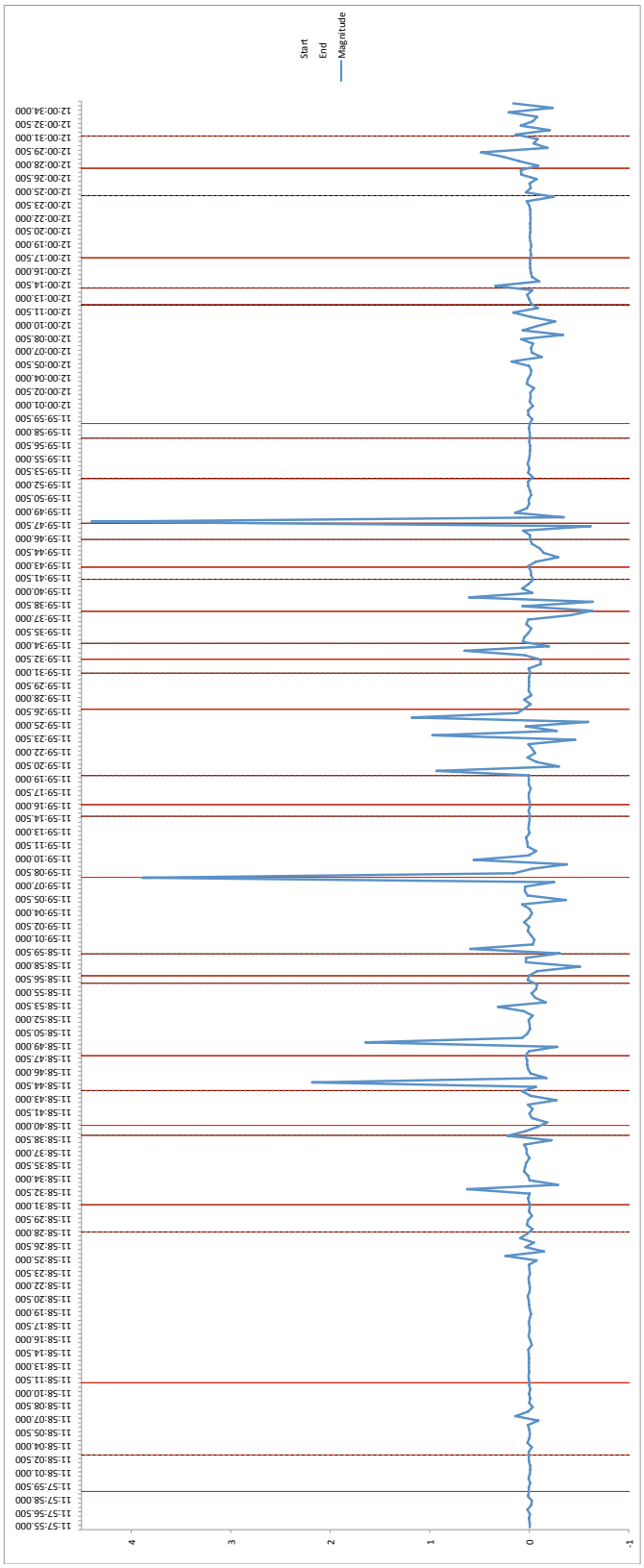


Figure 133: Graph (p2)

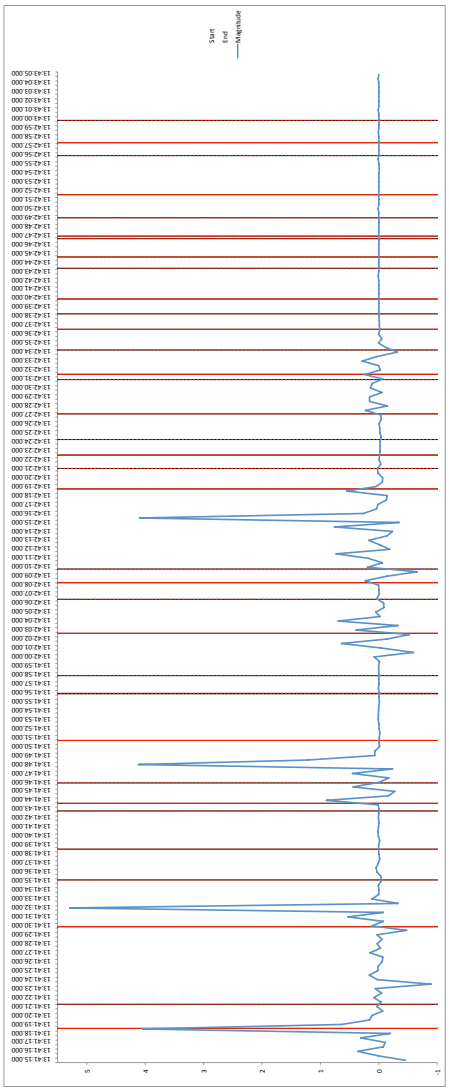


Figure 134: Graph (p4)

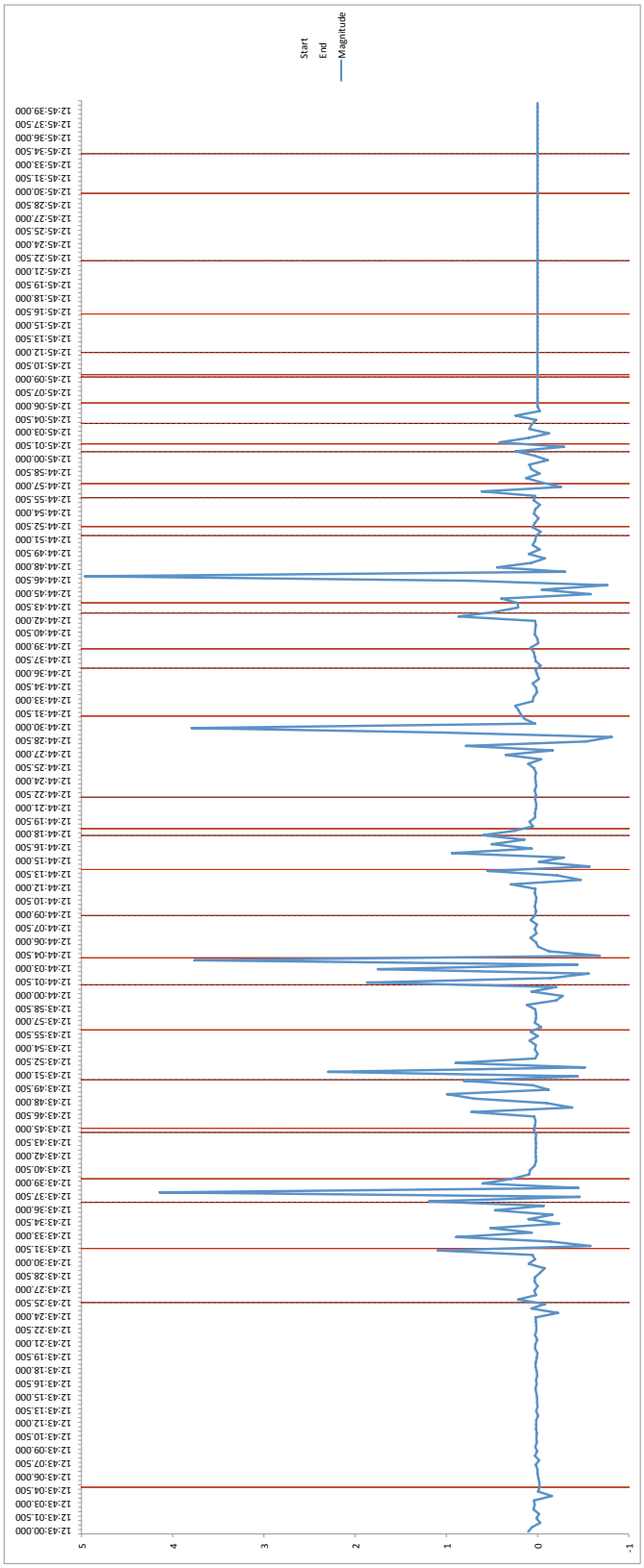


Figure 135: Graph (p7)

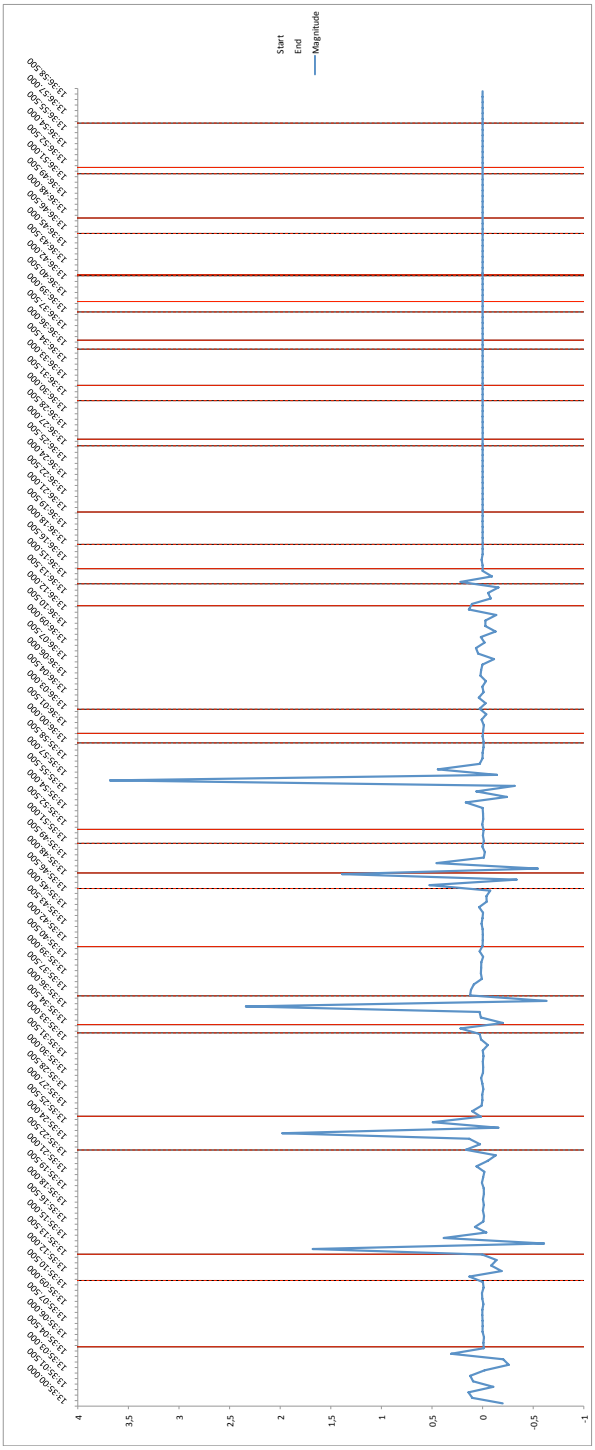


Figure 136: Graph (p8)

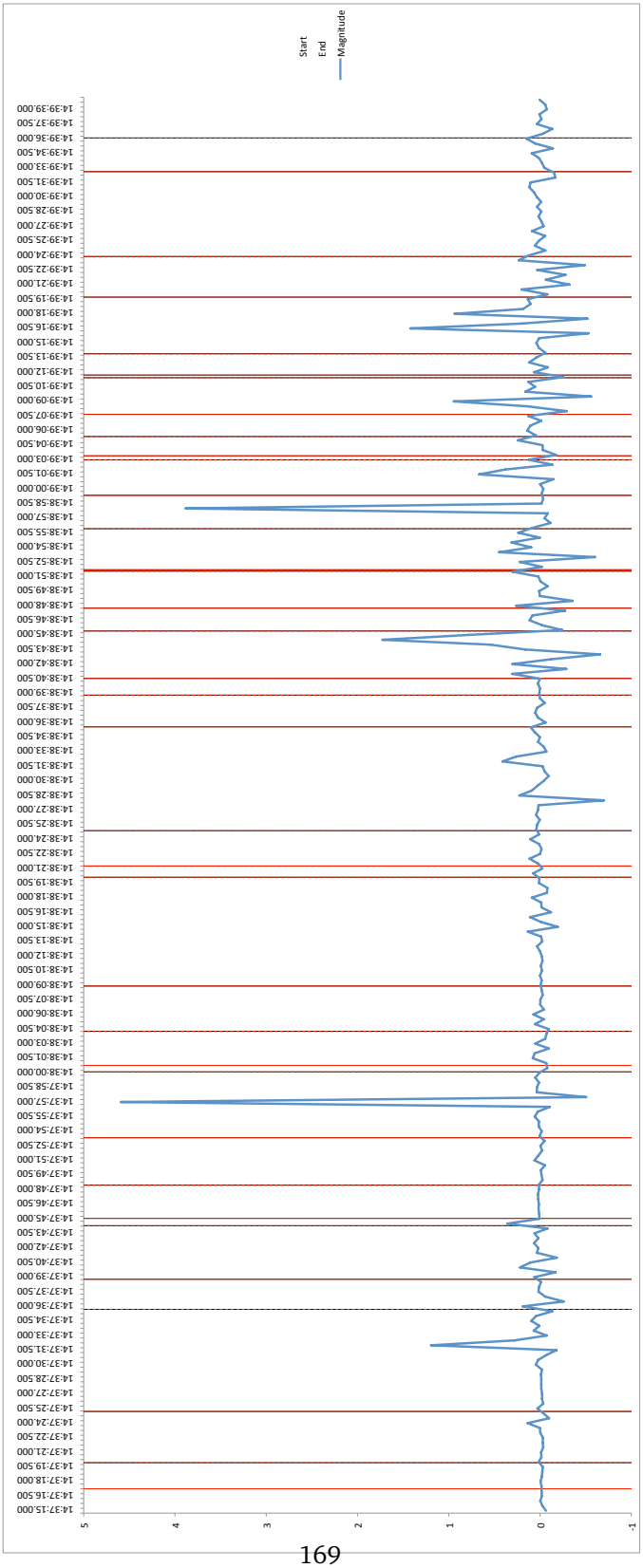


Figure 137: Graph (p10)

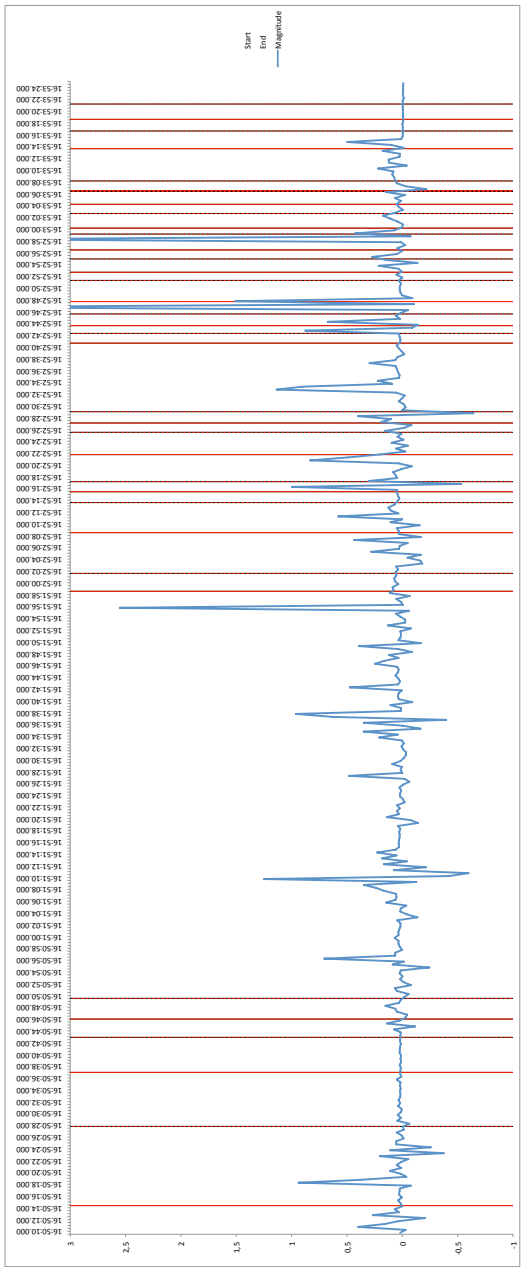


Figure 138: Graph (p12)

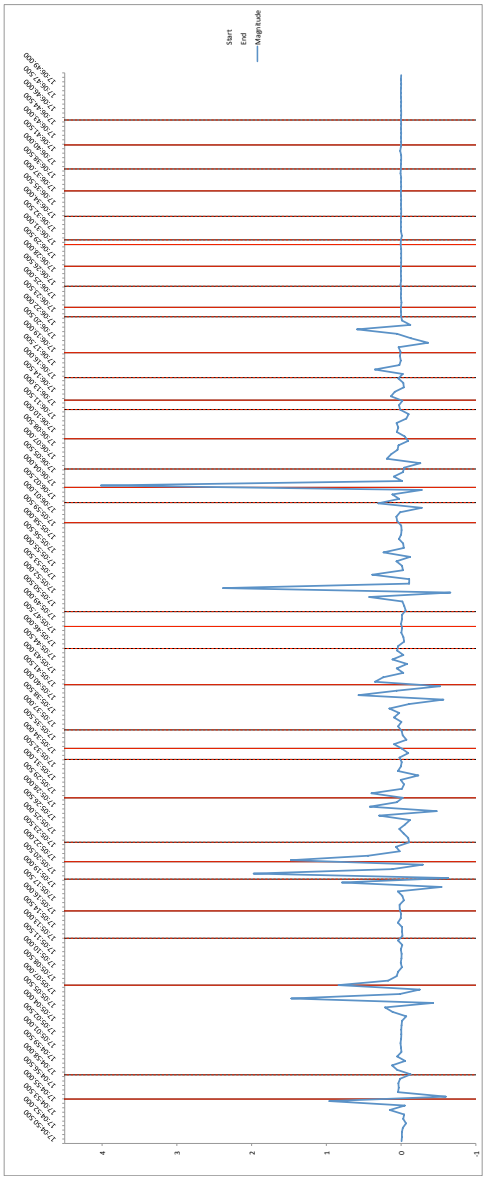


Figure 139: Graph (p13)

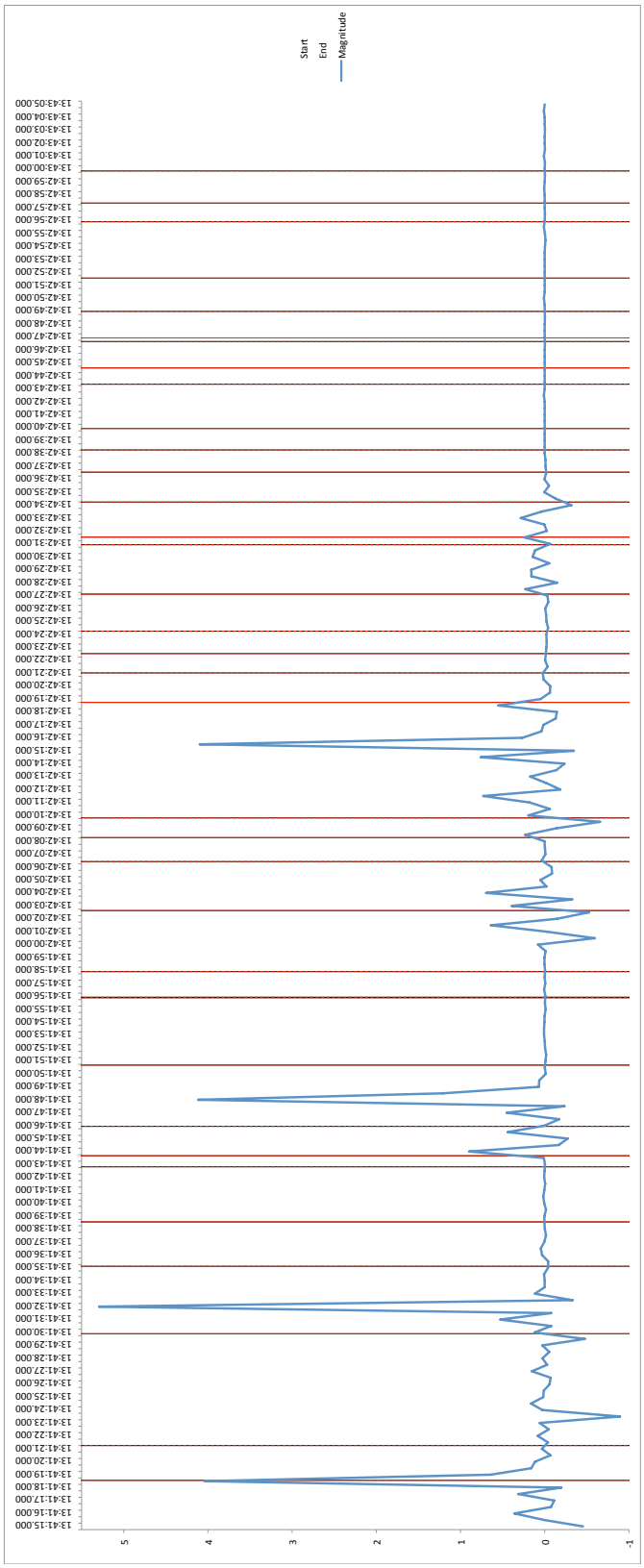


Figure 140: Graph (p14)

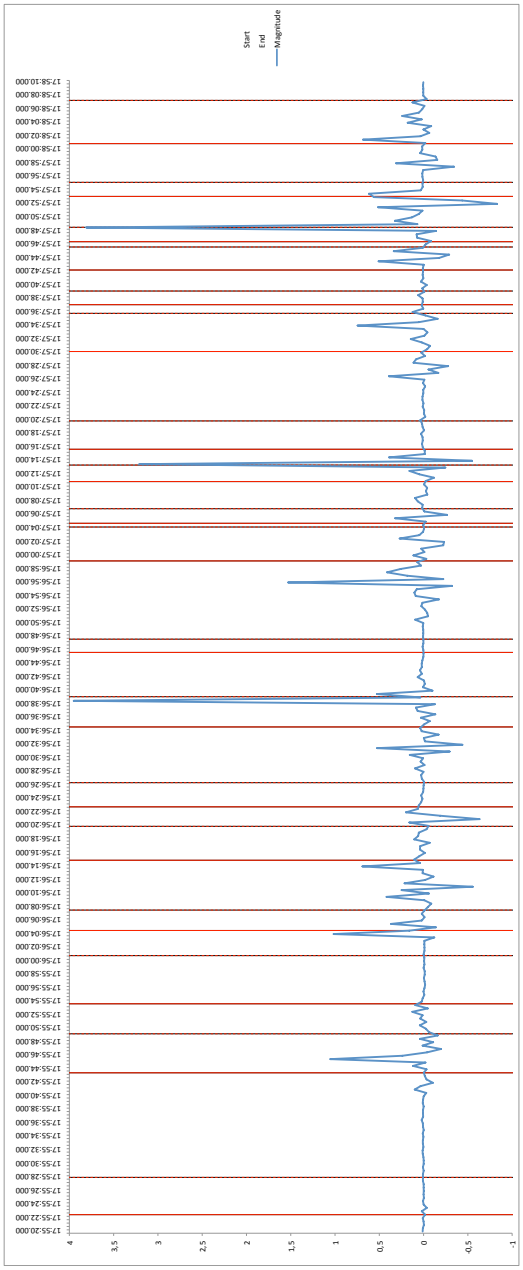


Figure 141: Graph (p15)

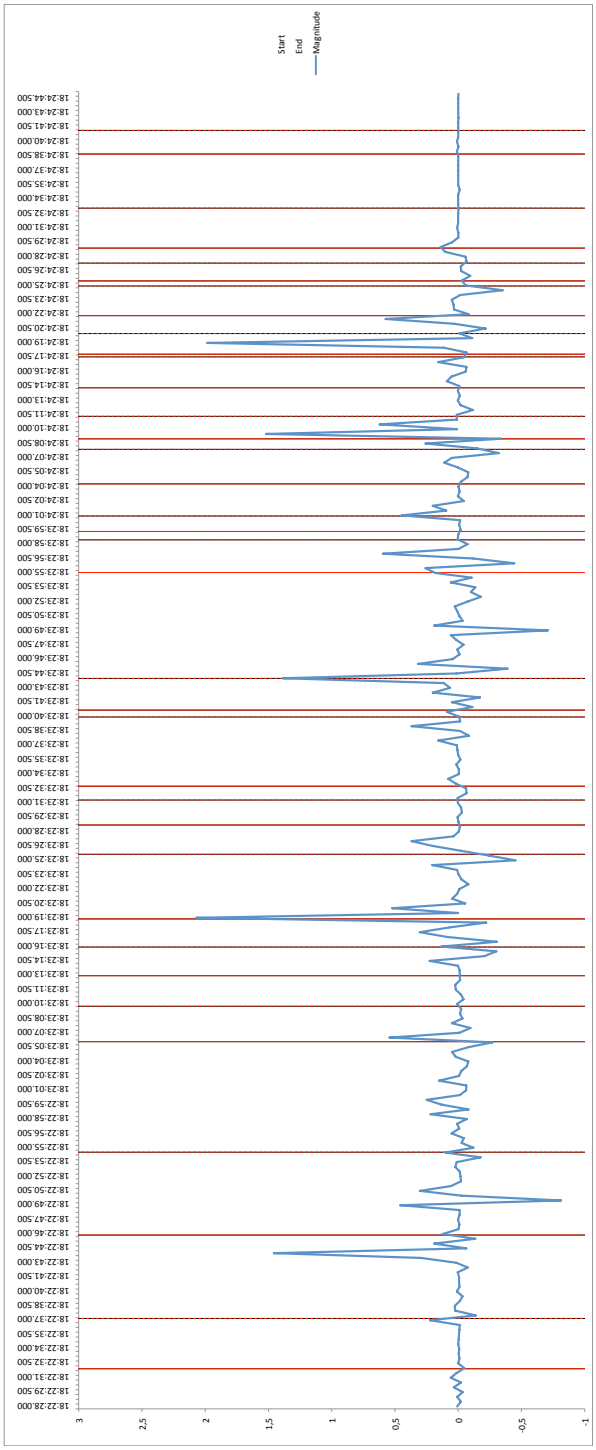


Figure 142: Graph (p16)

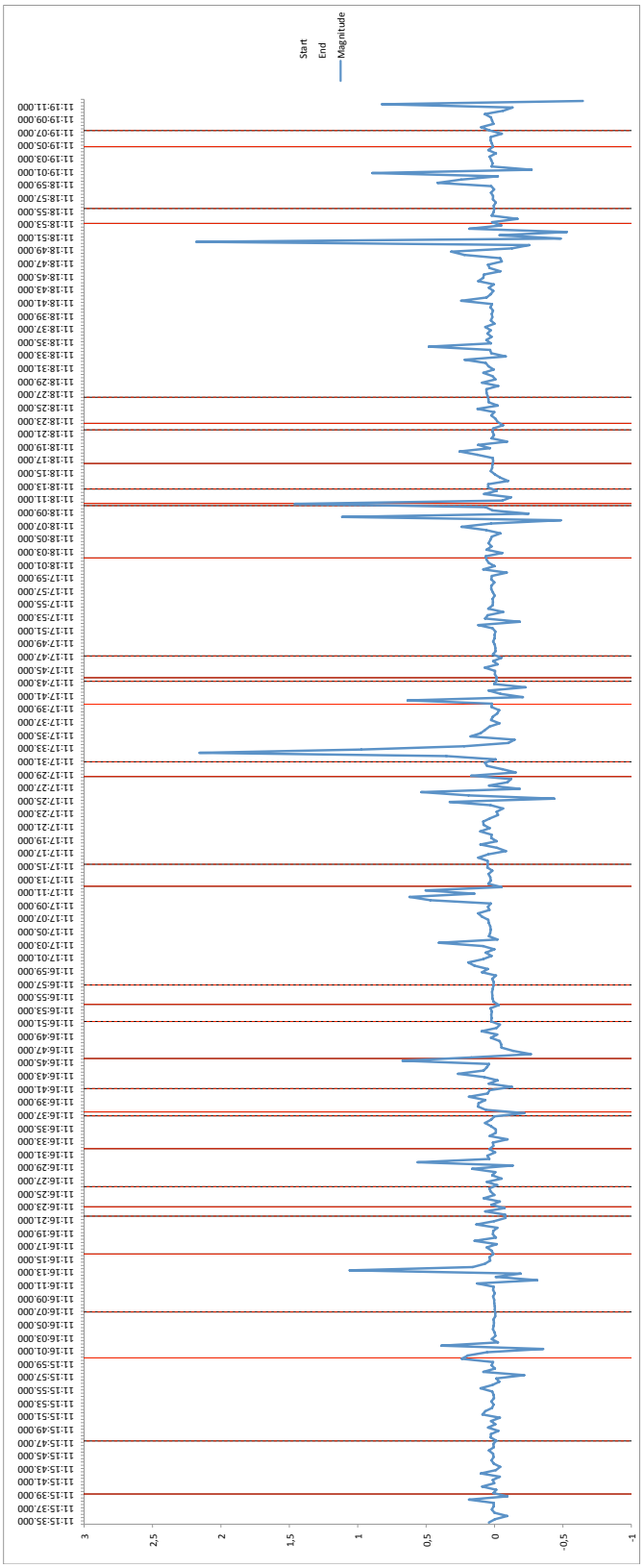


Figure 143: Graph (p17)

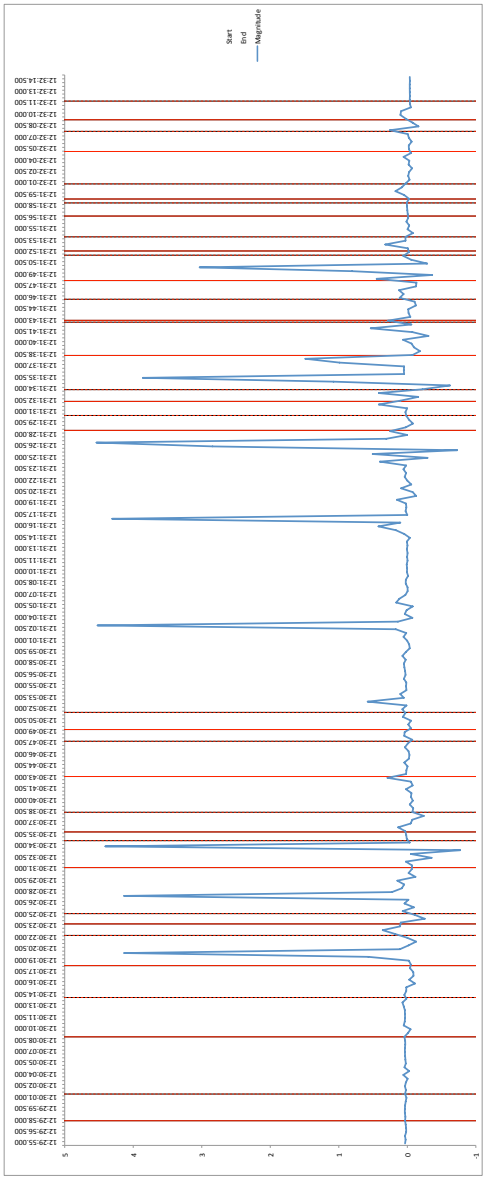


Figure 144: Graph (p18)

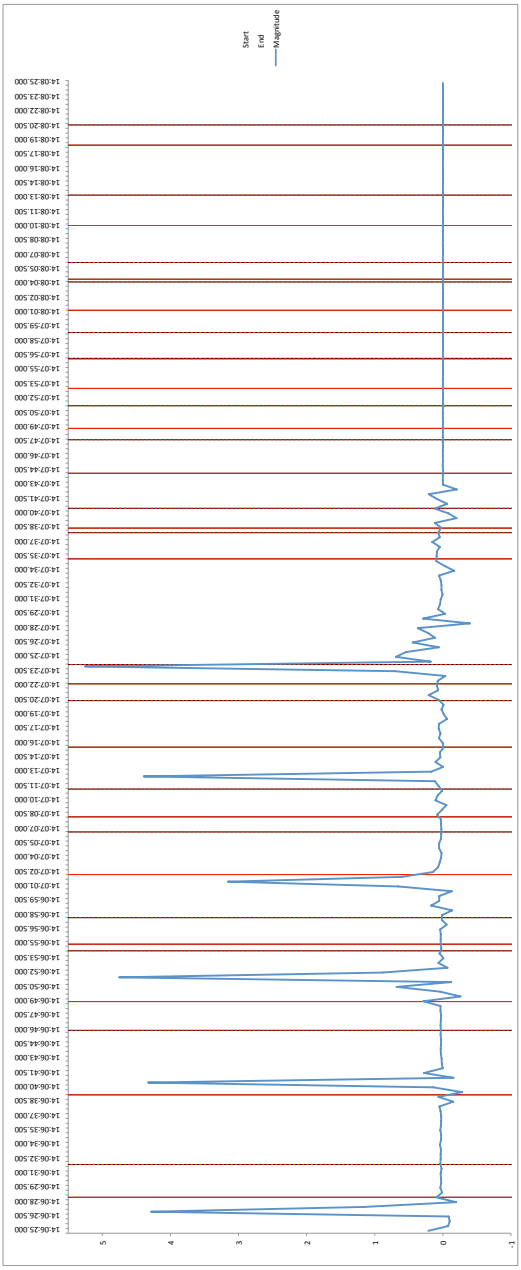


Figure 145: Graph (p20)

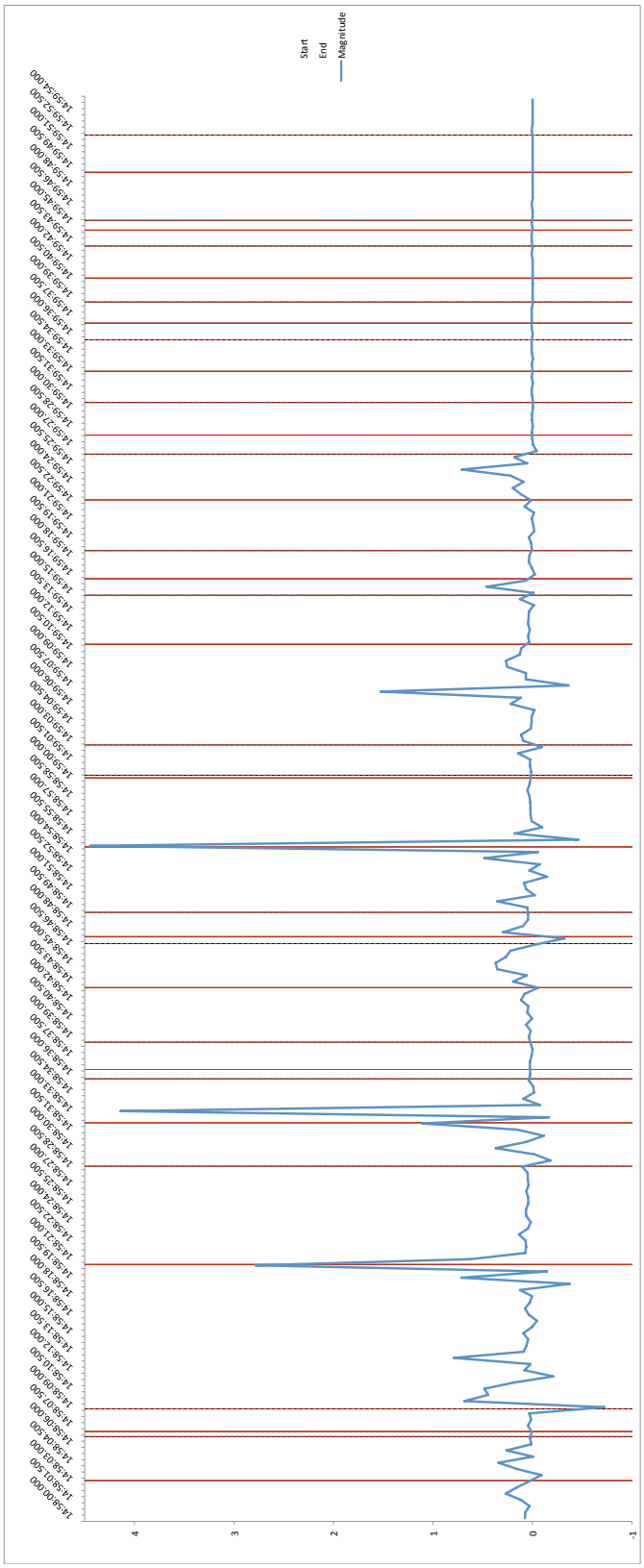


Figure 146: Graph (p21)

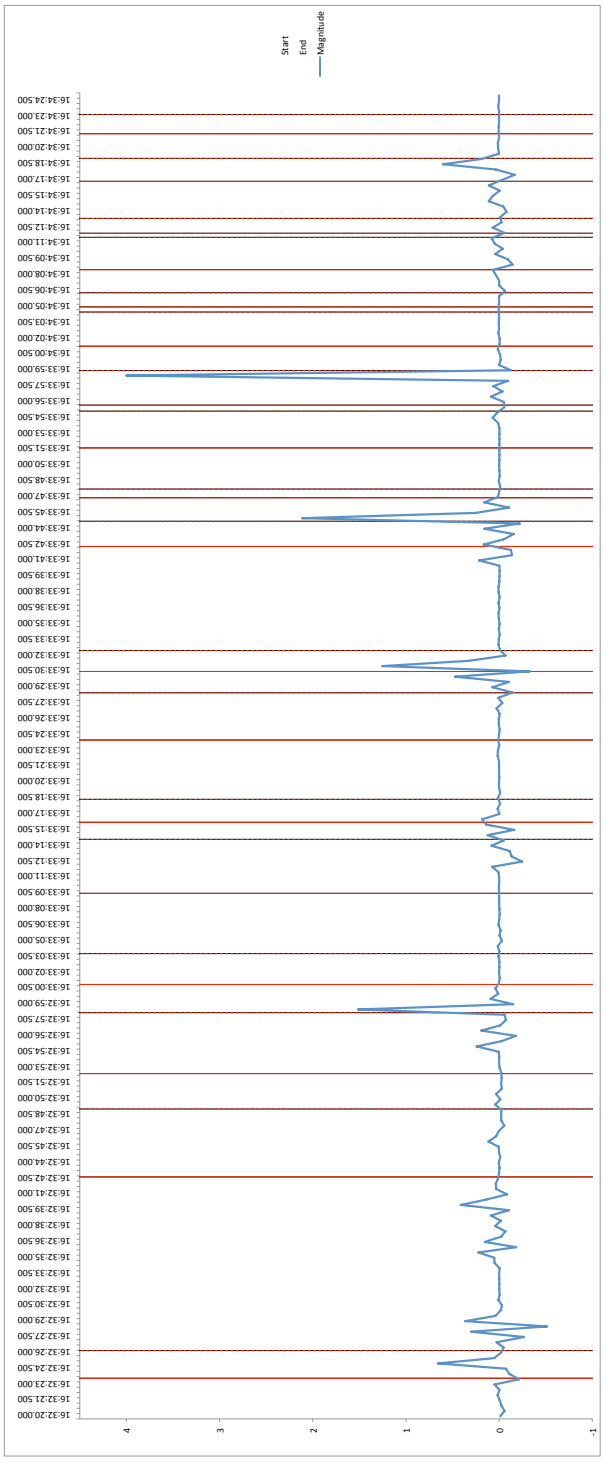


Figure 147: Graph (p25)

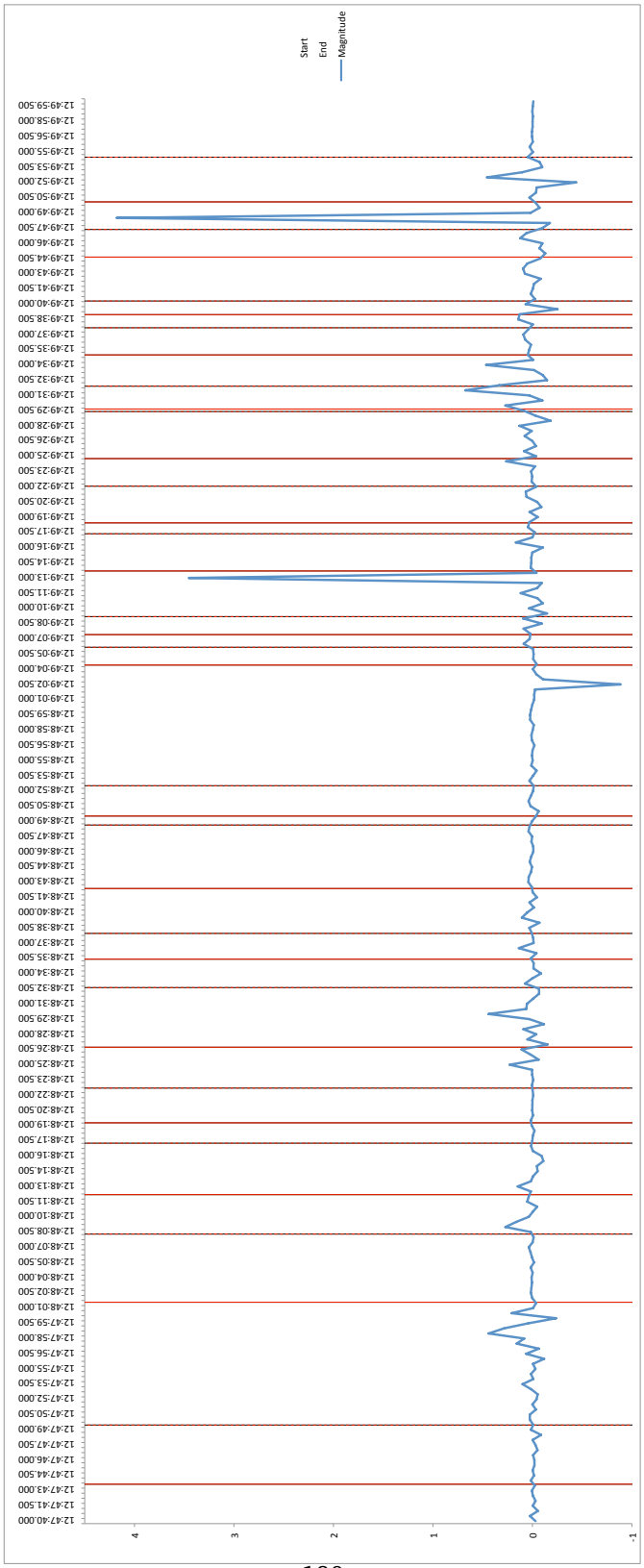


Figure 148: Graph (p28)

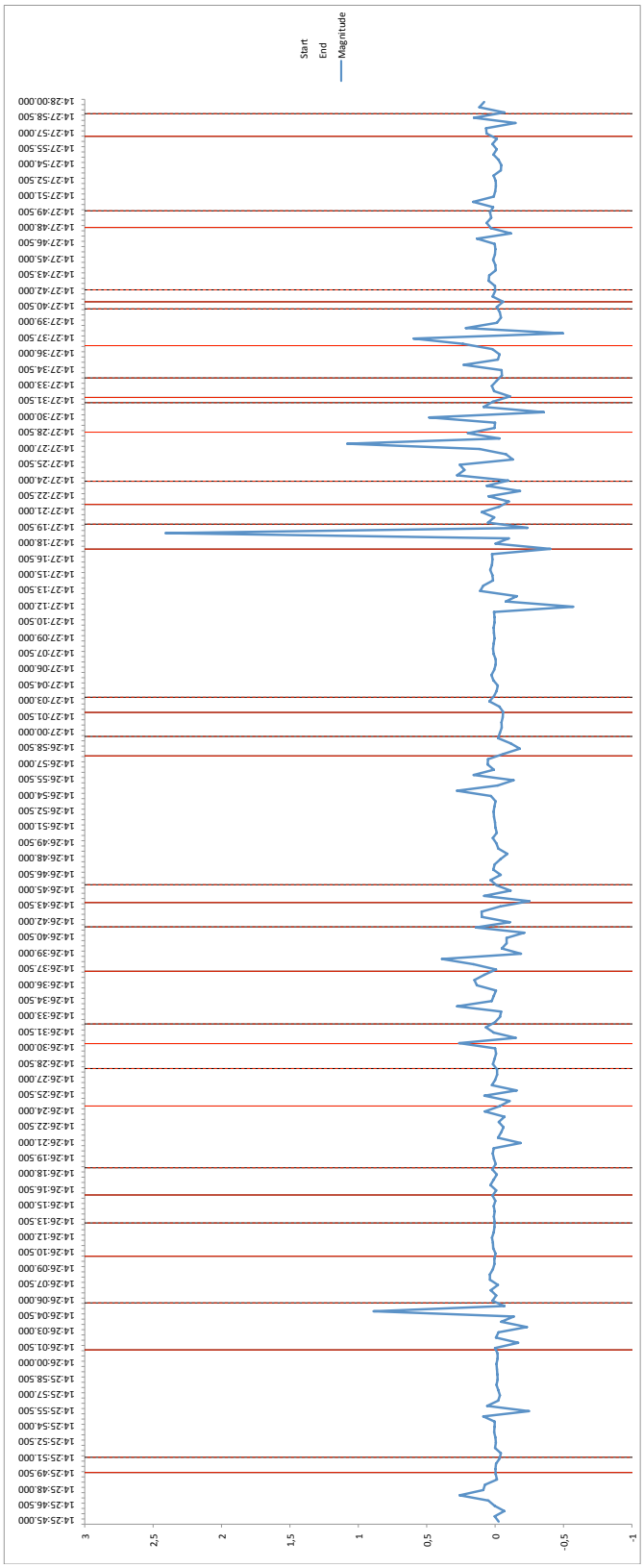


Figure 149: Graph (p29)

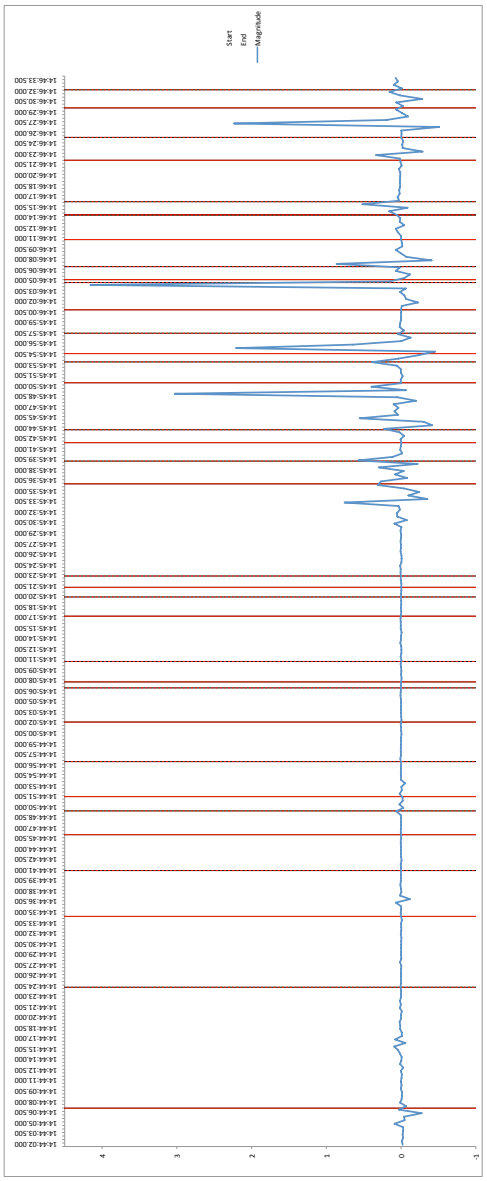


Figure 150: Graph (p30)

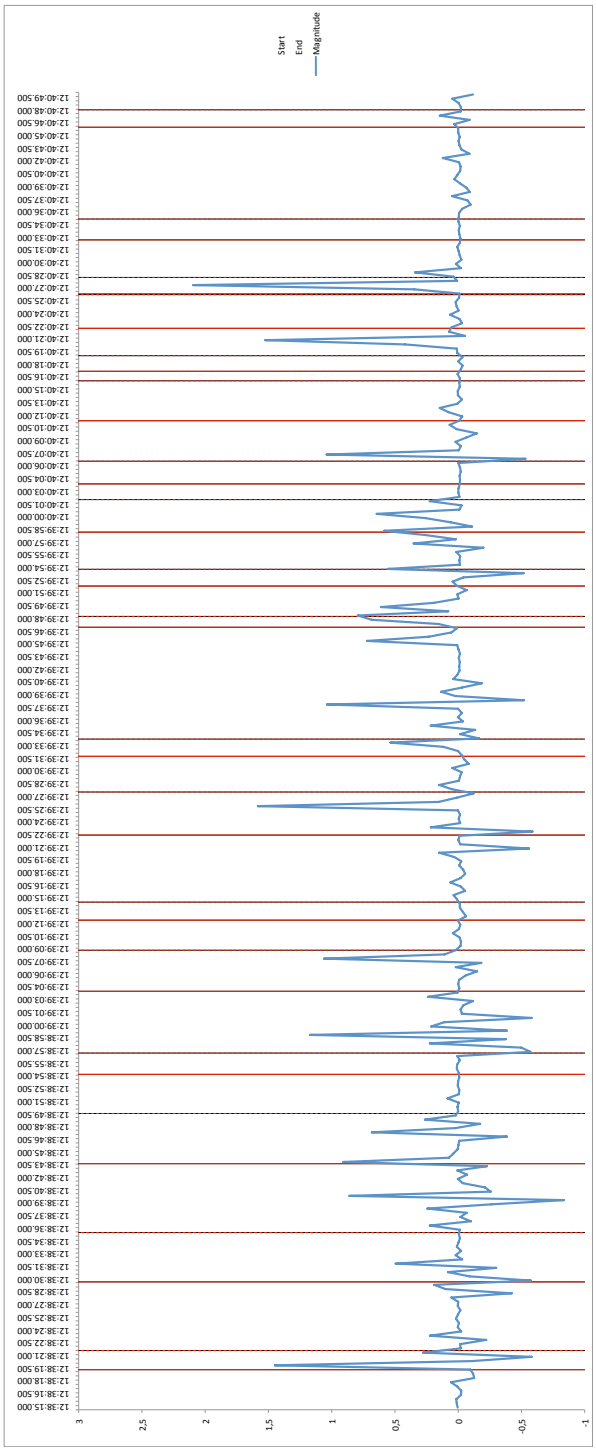


Figure 151: Graph (p32)

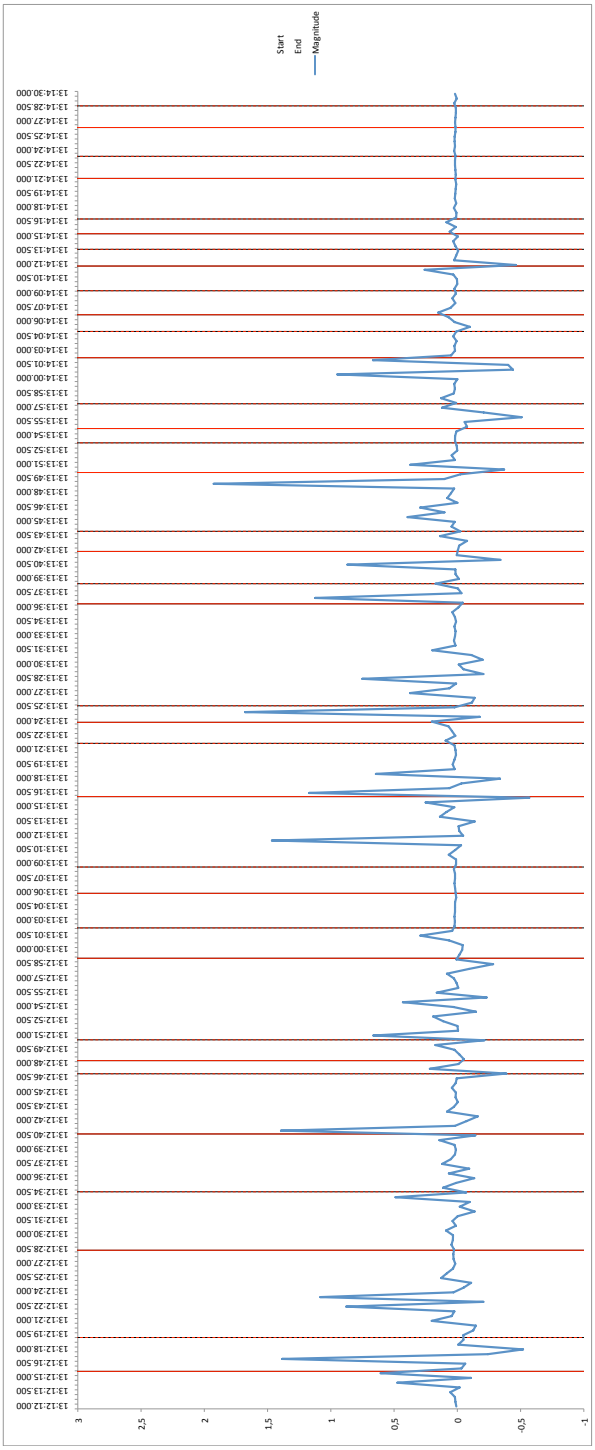


Figure 152: Graph (p33)

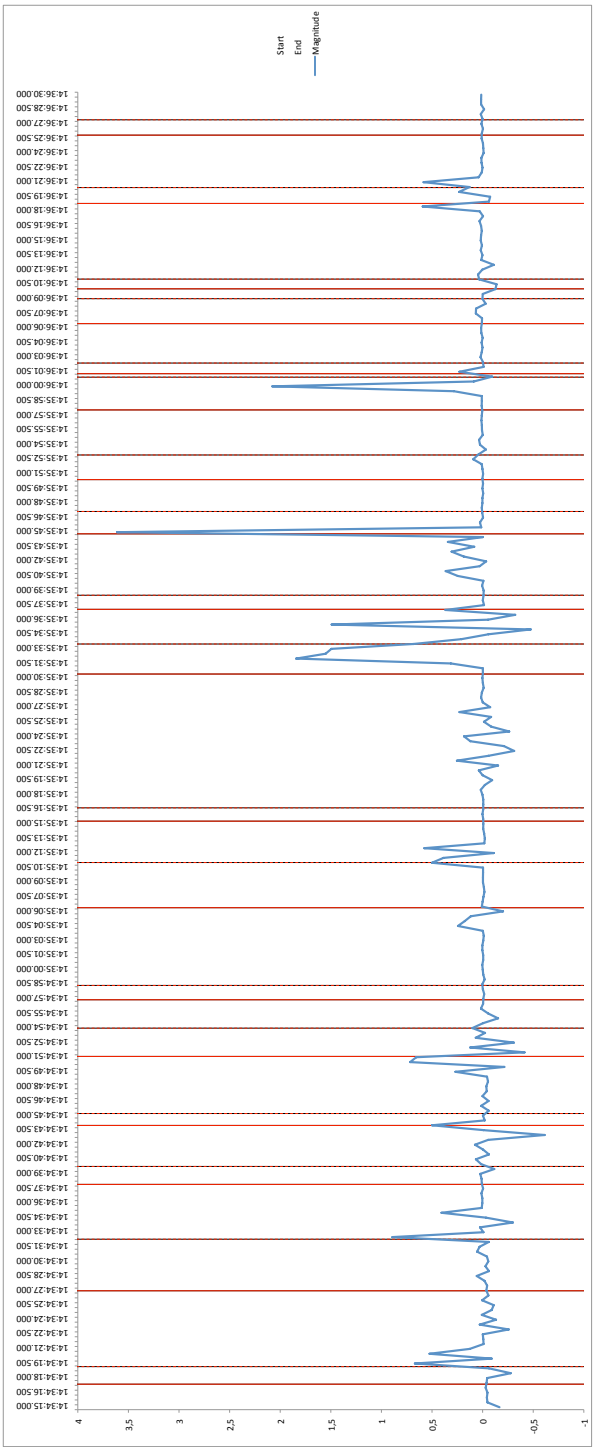


Figure 153: Graph (p34)

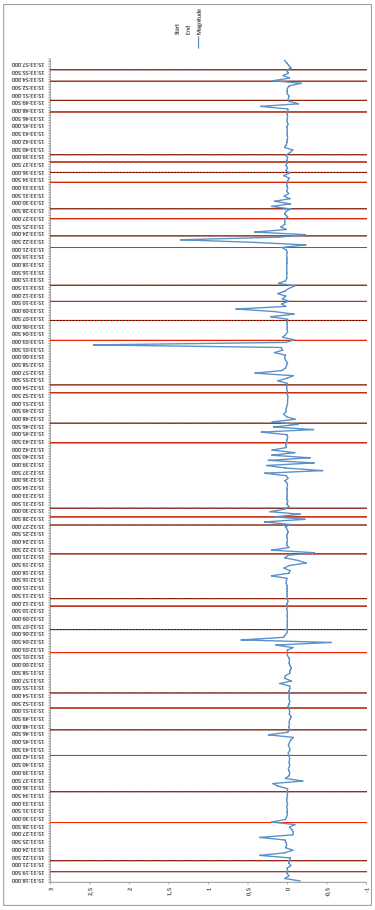


Figure 154: Graph (p35)

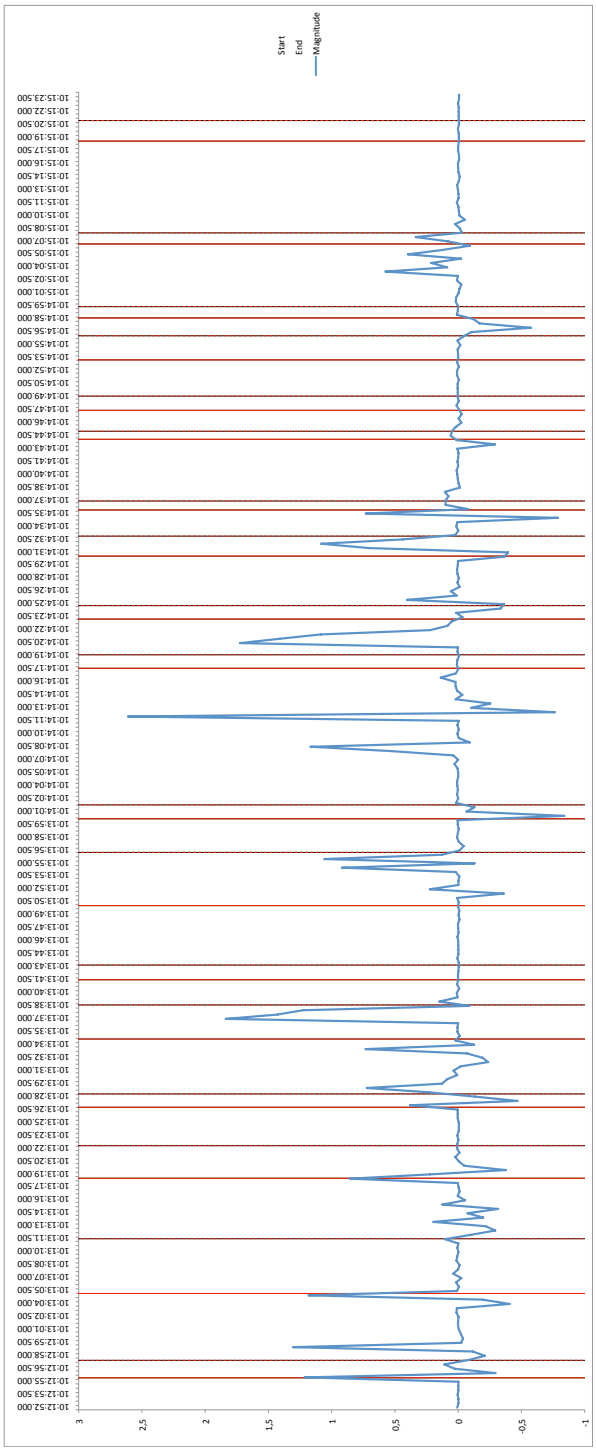


Figure 155: Graph (p36)

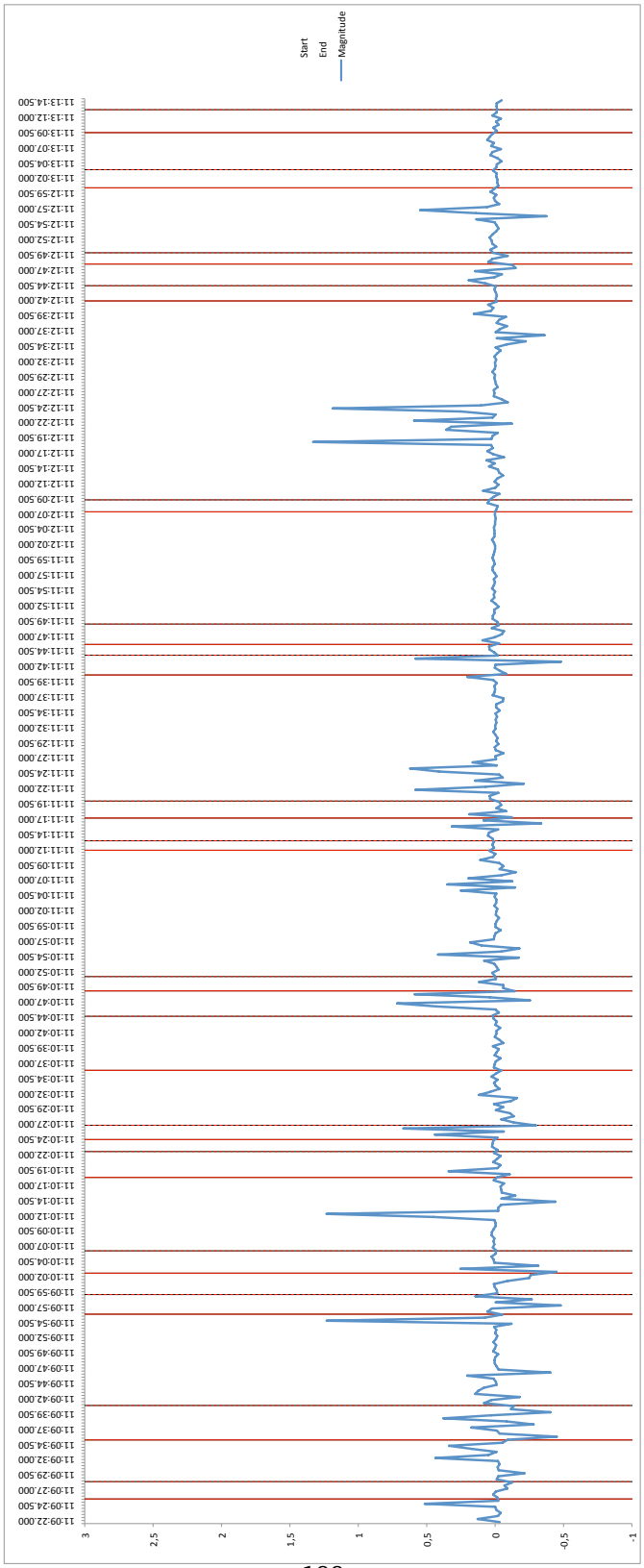


Figure 156: Graph (p37)

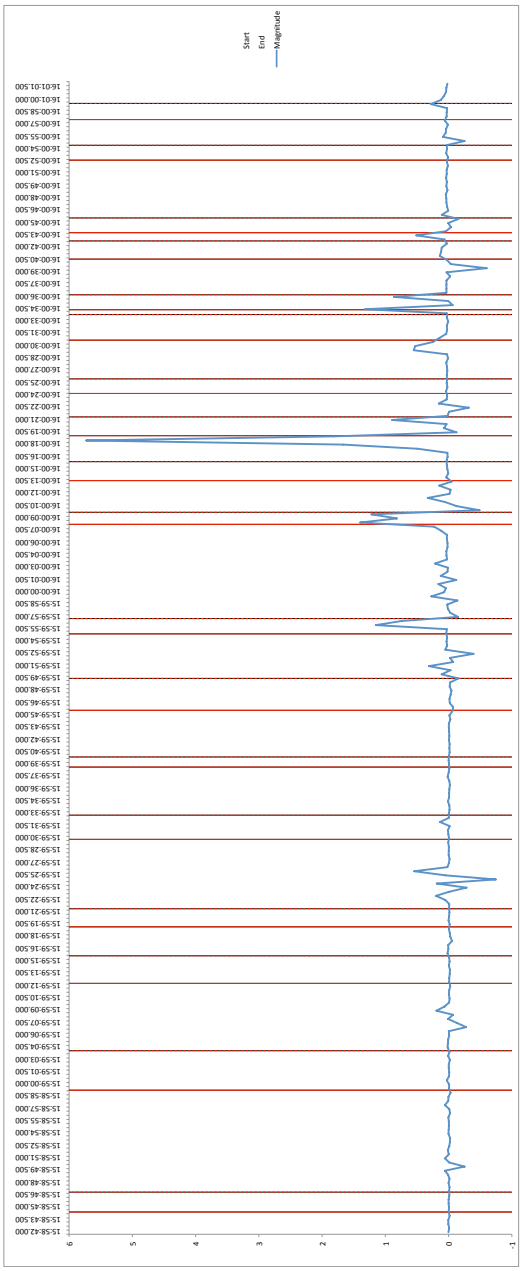


Figure 157: Graph (p38)

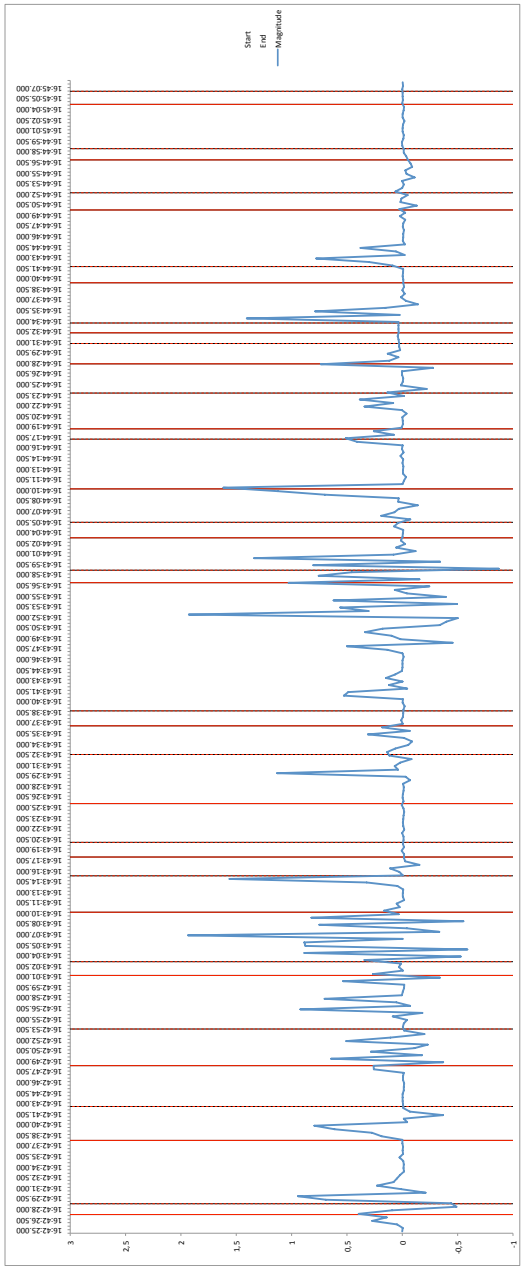


Figure 158: Graph (p39)