TALLINN UNIVERSITY OF TECHNOLOGY

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ACCEPTATION OF SMARTWATCH AND SMART RING TECHNOLOGY IN FINLAND

Bachelor's thesis

International Business Administration, specialisation marketing

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I hereby declare that I have compiled the paper independently and all works, important standpoints and data by other authors has been properly referenced and the same paper

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ABSTRACT

This thesis focuses on the factors and motivations behind smartwatch and smart ring purchases, attitudes towards adapting smartwatch and smart ring technology and possible behavioural changes due to the results received. This Bachelor thesis will contain take on previous literature and provide a study conducted by the author in the form of a questionnaire. The questionnaire was open for answers for three days and reached 120 respondents of which 107 were users of either smartwatch, a smart ring or both. The research relies heavily on the Technology Acceptance model (Davis, 1989) and Extended Technology Acceptance model (Davis, Venkatesh, 2000). The results demonstrated that the factors "Perceived ease of use" and "Perceived usefulness" are indeed important when accepting smartwatch and smart ring technology into use. In addition, respondents' intent to continue using these technology devices in the future is strong. The limitations and recommendations for future research are presented at the end of this thesis.

Keywords: Smartwatch, Smart ring, Wearable Technology, Perceived Ease of Use, Perceived Usefulness

INTRODUCTION

Technology is becoming more and more advanced in the modern world and it is also used for a purpose to examine and improve a person's health. While this technology which allows the tracking of the body's functions is more advanced, it is also more accessible for a common consumer, for example in the form of smartwatches and smart rings. The author has discovered that the popularity surrounding these devices is growing and they are a common sight and not only at gyms but also social media posts and street wear. New models are published and new features added, and the advertising of these devices is hard to miss.

With this new technology, a user can measure his body's functions, like quality of sleep, calorie consumption and exercise recovery. This trend of measuring the body's function seems to have come to stay. Both smartwatches and smart rings are usually connected to another smart device, for example a phone or a pad. The results received from the watch or ring are listed in the application supporting the functioning of the wearable device. These applications allow the user to follow, compare and analyze his or her body’s actions during different activities and thereby, make possible changes to their habits in hope for better results. Smartwatches and smart rings have other functions as well, not directly related to health. Possibility to use this wearable device for listening to music, answer text messages or even to use payment cards remotely, are features that increase the sense of practicality among the users. Smartwatch or a smart ring can also be seen as a way to prove the user's status or wealth and thereby, can be seen as status symbols of the new technological era, like smartphones have been.

The author believes that additional research is needed since smartwatches and smart rings are becoming a more and more recent sight in Finland. It is important to focus on the motives behind the purchasing decisions and willingness to accept this new, wearable technology into use. This will be surveyed through Technology Acceptance Model (Davis, 1898) and its components. The components “Perceived Usefulness” and “Perceived ease of Use” are measured in the survey that the author has conducted to support the research questions. The

author also aims to find out whether receiving data of one's body's function really affects the daily habits of the person using the device.

The aim of this study is to search main motives behind the purchasing of smartwatches and smart rings in Finland and find out if there have been any changes in user's activity due to the data received from these devices.

To receive answers, the author aims to answer the following research questions:

RQ1: What motivates Finnish consumers to purchase smartwatches and smart rings?

RQ2: How high are the factors perceived usefulness and perceived ease of use seen in these technology devices?

RQ3: Has the user changed his/her actions due to the data received from their smart device?

Chapter one is dedicated to theoretical approach. It focuses on two models, Technology Acceptance Model (TAM) and Advanced Technology Acceptance Model (TAM2), which offer support to the survey conducted on Finnish consumers. In the first chapter, the author also discusses the importance of these devices in the daily life of a person, using Maslow's Need Hierarchy Model (1943). In the end of chapter one, the author goes through examples and results of previous studies which have examined technology acceptance through TAM and TAM2.

Chapter two is dedicated to the data collection and analyzing process. The author explains her motives behind the choosing of the population and sample, forming of the survey questionnaire and questions. She will open and analyze the results received through the questionnaire and present her findings. The author will provide recommendations and motivations for the future studies conducted in the same or similar topics. In this chapter, the possible bias and limitations will be listed as well.

Conclusion chapter will once again answer the question presented in the introduction chapter and end the theoretical part of the thesis. The author will finish this thesis with the list of references and appendix.

1. THEORETICAL FRAMEWORK

Technology and its continuously increasing role in everyday life is incontrovertible. It is impossible to go through a day and not be in contact with, or at least be affected by technology. New technology is adapted to support and smooth the users daily life. However, not all the introduced technology is taken into a use nor does it come popular. In this chapter the author explores the factors which affect the level of desire to adapt new technology, using the Technology acceptance model (TAM) and Extended technology acceptance model (TAM2). The author also discovers previous research done on the subject and aims to build a foundation for the questionnaire design.

1.1. Technology acceptance model

The author believes that the increasing usage of wearable smart technology can be explained and supported with Technology acceptance model (Davis, 1989). Technology acceptance model suggests that people choose to adapt or not to adapt new variations of technology for their use considering different factors. Technology Acceptance model has been applied to multiple different studies as a tool to find out the level of willingness to adapt new technology among the users.

Perceived usefulness (PU), which was introduced by Davis in 1989, who described the "the degree to which a person believes that using a particular system would enhance his or her job performance". In the case of smart watches and smartrings, the user has to experience that the measuring of his or her activities through the device is useful and provides added value which the user would not be able to receive without the device.

Perceived ease of use (PEOU) measures "the degree to which a person believes that using a particular system would be free from effort" (Davis, 1989). In this case, if the smartwatch or smart ring is easy to start using and not too complicated, the user will proceed to use the

technology. If the person starting to use the wearable device is a smartphone user, it can be expected that they are able to adapt the usage of a new application connected to the device.
These two components are the key factors to form an "Attitude" towards the usage of the technology. Whether the attitude is positive or negative, the person will make the adaptation decision due to the attitudes formed by the two factors. The ease of use may differ among age groups, since younger generations have grown up using technology from a young age. In contrast to people from age groups, who have been young adults or up when the biggest leap in the technological industry happened and therefore, not grown up with advanced technology.

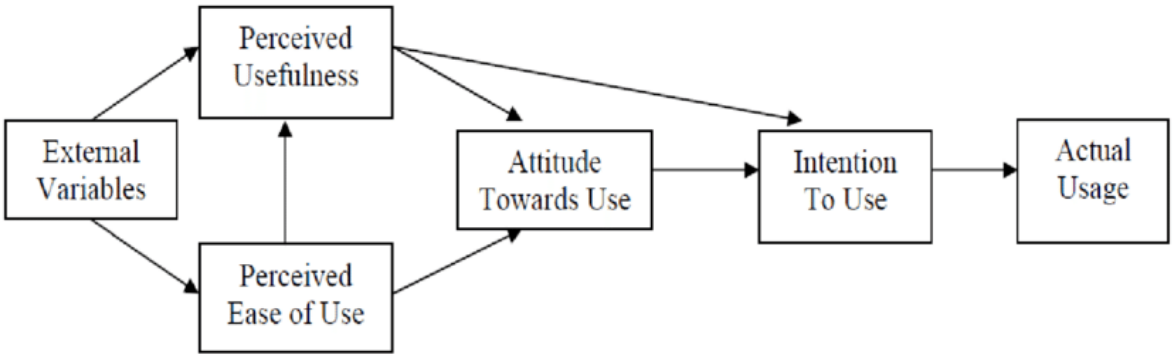

Figure 1. Davis (1989) Technology acceptance model

The two contributors will be used to format the base for the questionnaire questions. The author aims to focus on the level of satisfaction, when measuring these two contributors. Future intent for using the devices will be surveyed through the attitude factors.

1.2. Extended technology acceptance model

In 2000, Venkatesh extended the old form of the Technology acceptance model alongside Davis, calling it the Extended Technology acceptance model (TAM2). The model was formed after data collection from four different organizations using four different technology systems.
New factors were considered and added to the old model when examining the willingness to accept and adopt new technology into use. Social influence processes, covering subjective norm, voluntariness and image, was one of the factors with cognitive process, which added

the job relevance, output quality, result demonstrability and perceived ease of use (Venkatesh and Davis 2000). The Extended Technology acceptance model could be used to support the purchase behaviour of smartwatches and smart rings. Subjective norm directs individuals behavior depending on the belief what is the attitude of people close or important to him or her as described by Fishbein and Ajzen in 1975; "a person's perception that most people who are important to him think he should or should not perform the behavior in question". A person considering buying a smartwatch or a ring may rely on their close circle and their expected opinions on the purchasing decision. This may affect the actual purchasing decision, wearable device type, favored brand, model, color etc. Social norm goes hand in hand with the image factor. Purchase decision can be an attempt to maintain image within one's close circle. For example, if several people close or important to the person contemplating the smartwatch or smart ring purchase decision wears or compliments the device, it may boost the purchase decision. Experience may overrun social influence if the person has bad experience with wearable technology. On the contrary, experience might encourage purchasing or using a smartwatch or smart ring according to positive personal experience, regardless of possible critique from a close circle.

Job relevance means an individual's perception regarding the degree to which the target system is applicable to his or her job (Venkatesh, Davis 2000). In the case of smartwatches and smart rings, the job described could be applied to activities measured by the devices. If one's objective is to exercise more and get into better shape, do the calorie consumption and after exercise recovery measurements, received through the device, have a positive effect on the actions taken to receive the goal?

The phenomenon examined to conclude TAM2 by Venkatesh and Davis (2000) was computer technology adoption at a workplace. Output quality was compared to the results received manually. When measuring the output quality in the usage of smartwatches and smart rings, we compare the quality of the results received through devices to the quality of results, if they were measured manually. Activities like calorie consumption and quality of sleep are, if not impossible, extremely difficult to measure manually without any devices.

Final new factor named in the model is result demonstrability, which relates to the idea that the person using the technology has to be able to point out the direct on indirect relationship between improved results and the technology adapted. This can also be applied to the usage of smartwatches and smart rings, since the user can probably tell if the device has affected their habits or actions positively.

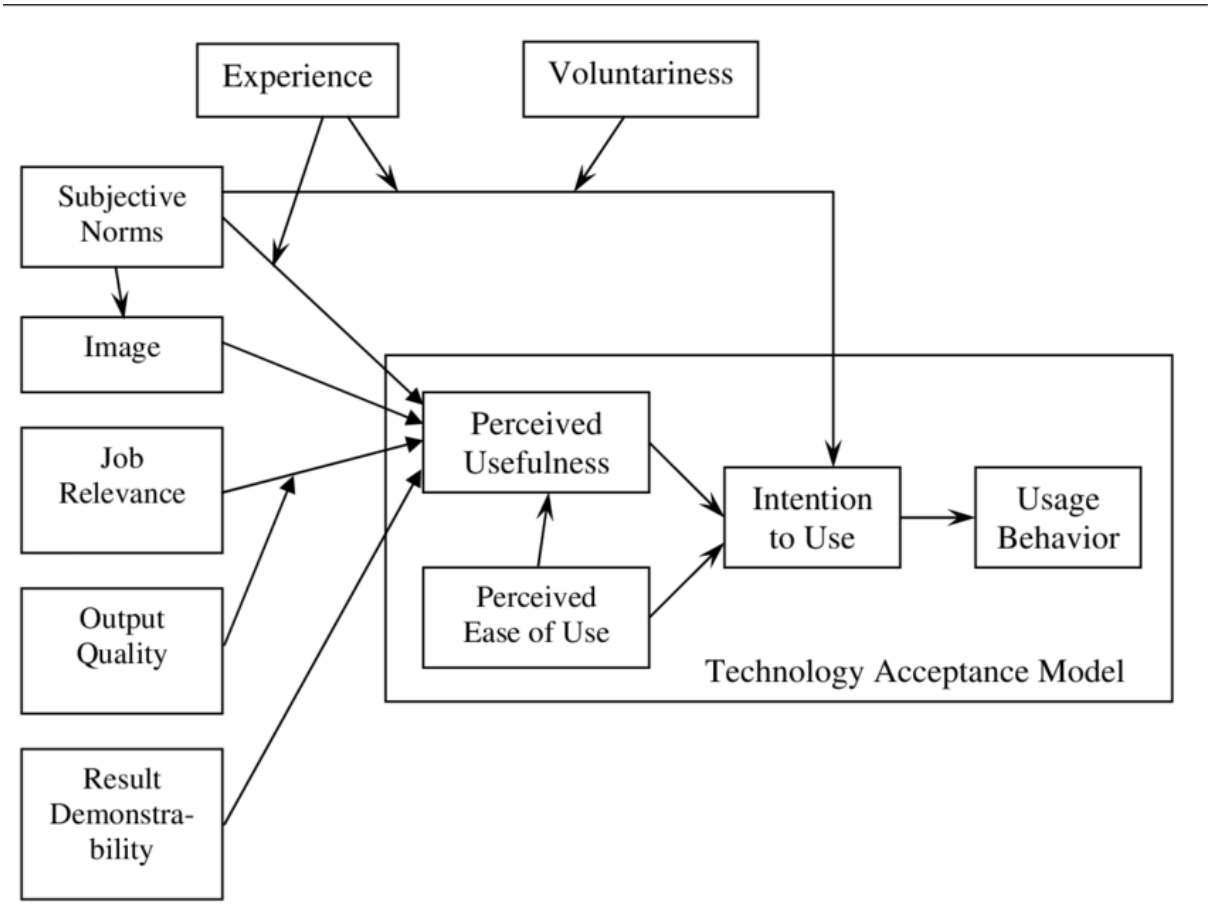

Figure 2. Venkatesh & Davis (2000) Extended Technology Acceptance model

All in all, the author can apply the factors represented in the Technology Acceptance model (Davis, 1989) and The Extended Technology Acceptance model (Venkatesh, Davis 2000) to the usage of smartwatches and smart rings.

1.3. Needs and motivation

Question remains, while living in the new era of technology

Like mentioned before, technology is strongly part of our daily lives and can support humanity's vital needs. Using Maslow's Need Hierarchy Model (1943), the author will discuss how important wearable technology is and on what level it positions in the Need Hierarchy. Maslow's Hierarchy model is in the shape of a pyramid and has five levels which represent stages and priority order in which a person fulfills his needs. On the bottom level,

there are the physiological needs, meaning the needs to stay alive, like water, oxygen and food. Technology does not have a direct relationship to the physiological needs level. Next is the safety level which stands for things like shelter and protection from danger. This level could be handled and improved through technology but the author believes that smartwatches and smart rings do not belong to this level either. Third level is the need of love and belonging which covers the need for loved ones like friends and family and the need of belonging in a group which does not seem to include smart wearable technology either. Esteem layer stands for one's own respect towards himself as well as others' acceptance towards him. On this level, the status received with the smartwatch or smart ring could be related to the level. In the upcoming survey results the author discusses, does the smartwatch or a smart ring have a status value. The upper layer is self actualization which stands for the need to feel able to use one's abilities in daily life and succeed. This level could be directly linked to the relationship between Technology Acceptance Models factor "Perceived Usefulness" and acceptance of wearable technology. If the user can notice an improvement in his results in working out or sleeping, he is more likely to adapt technology into use.

Therefore, the author would place smartwatches and smart rings to the Self actualization level on the Needs Hierarchy, since there they have the greatest value. There is a possibility that some users might place their need for smartwatches and smart rings to the Esteem level, if they were to experience pressure to use one from the people close to them.

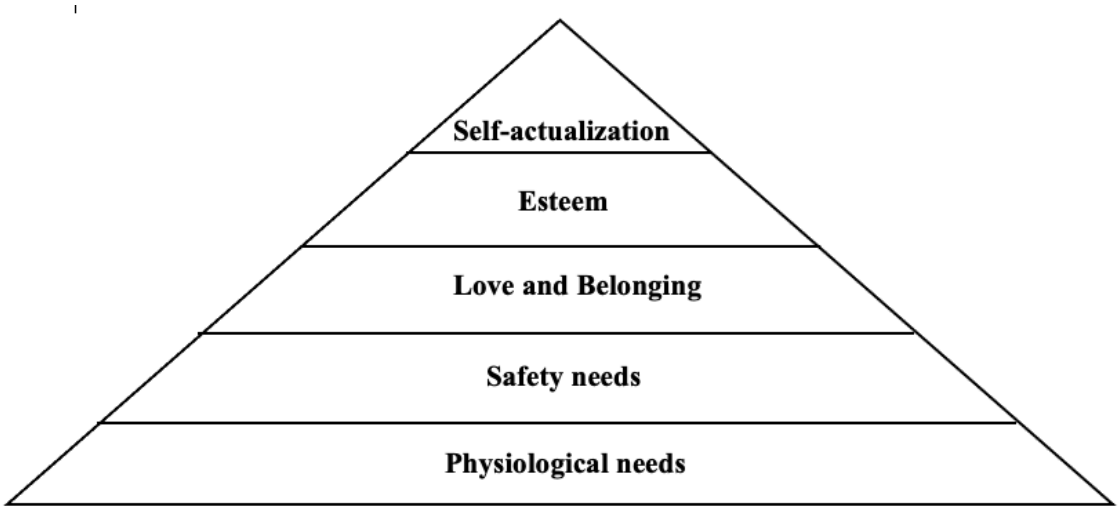

Figure 3. Maslow (1943) Hierarchy of needs

All in all, the author does not believe that these devices have a direct relationship with the most vital levels of the model. However, the devices can offer additional help for following needs in each category, in supporting roles.

1.4. Previous research

Similar studies on usage and behavioural changes related to smartwatches and smart rings have been conducted. In those studies as well, the Technology acceptance model has been a popular model to explain the results. A study conducted in Taiwan was to examine the factor affecting the acceptance and adaptation of smartwatches among 212 participants (Wu, L-H; Wu, L-C; Chang; 2016). The study found the factor perceived ease of use not to be a high motive nor an obstacle for accepting new smartwatch technology. Another survey conducted on Malaysian university level business students focused more on the adaption motives with smartwatches (Chuah, Rauschnabel, Krey, Nguyen, Ramayah & Lade). This study aimed to define a more specific line between users focusing on the technology advantages and users focusing on smartwatches more as a fashionable accessory. They were able to point out the following relationships; consumers who perceive smartwatches as technological attributes, have focus on the perceived usefulness, while consumers who perceive smartwatches as fashion accessories declare visibility to be more important. In this thesis, the author aims to discover the motives behind the smartwatch and smart ring purchase and usage and possibly find similar relationships.

There was less research on purchase motivation towards smart rings compared to smartwatches. Previous studies have been using smart rings to do research on other topics, but the actual consumer behaviour has been discussed less. This can be explained through the fact that smart watch technology has been used longer and smartwatches have been available to the common consumer for a longer period of time. Different smart rings are also intended for different purposes. Smart ring brands like Oura, Go2Sleep and Motiv have designed their rings to specially measure the body's activities like sleep and heart rate. Ring brands like MClear and Token Ring focus on features like contactless payment and near field communication. One of the most popular smart rings in the market is the Oura ring. Oura has gained popularity through its accomplishments in the past few years. The Oura smart ring made it to the yearly list of inventions of 2020 by TIME magazine, in the “Home Wealth”

category. West Virginia University (2020) did research on Oura's capability to alarm the user of possible COVID-19 symptoms even three days before the virus can be seen as positive through any tests. This has resulted in for example the basketball league NBA to start using Oura rings to prevent their players from being infected by the virus. Possibility to predict COVID-19 infection is a possible motivation factor for the purchase of a smart ring.

Thus, the author has reason to expect similar results, which can also be supported through the Technology acceptance model as well as the Extended Technology acceptance model. The author was not able to find similar research done in Finnish markets, nor research covering both smartwatches and smart rings. This thesis will be focusing on the user perception and their individual feelings towards wearable technology, rather than stating differences between the usage of the two different device types (watches and rings). Therefore, this study is justified and can provide additional information to support previous studies.

2. METHODOLOGY

In this chapter, the author goes through the idea behind the decision to collect data through a questionnaire and focus especially on quantitative data. She will also explain her idea on how these particular questions help receive answers to the research questions listed in the Introduction chapter. The sample design is also discussed and possible biases and errors pointed out. In the end of chapter two, the author will go through the findings received through the questionnaire. The author will also provide recommendations for future research.

2.1. Research method

To collect data, the author uses a survey as her research method. This survey will be conducted online, in Google survey. Taking into account the current situation and limitations, the author believes that online surveys are not only time effective, but the safest data collection method to conduct this study because of COVID-19 situation. In addition, it does not cost anything to conduct (Ponto, 2015) Survey's analysis method depends on the data

collected, quantitative data, focusing more on numerical data or qualitative data, when open ended questions offer the participant to explain themselves more deeply (Ponto, 2015). These two data collection methods can be also used as combined together side by side (Johnson, Christensen, 2014). The questionnaire conducted to serve the aim of this study, is mainly focusing on quantitative data in form multiple choice questions and likert scales. The research method is cross sectional, since it t

The mentioned multiple choice questions have an "other" option, which offers the participant to provide qualitative data and in the end, there is one open ended question, to form a better understanding of the feelings and experiences of the participants taking part in the study. In addition, the participants are asked to write their age in an open ended part. The questionnaire will be anonymous, because the author believes that this offers the participants a safer environment to answer the questions more truthfully. The questionnaire was shared in multiple social media platforms like Instagram, Facebook and Linkedin, and it was told in the description, that the survey is especially targeted for consumers who own either a smartwatch, smart ring or both.

2.2. Sample design

The author is using judgement sampling, which is categorised under purposive sampling. In this sampling method, the participants are selected for the study according to the judgement and aspiration of the person conducting the survey (Maul, 2018). The population is finnish consumers, but as mentioned earlier, the current users of smartwatches and smart rings were especially encouraged to take part in the questionnaire. The survey was shared on several social media platforms such as Instagram, Facebook and Linkedin. The platform of the author reaches different perspectives but is expected to gather data specially from young Finnish adults, in which the author is specially interested in. An ideal participant is a smartwatch or smart ring owner who enjoys an active lifestyle and hopes to set himself goals to receive on a daily basis as well as in the longer period of time. These goals are not directly received through smartwatches or smart rings, but the devices offer data to support changes and motivation of the person using them.

The author has decided to focus on Finnish consumers and aim to form an understanding of their motivation behind smartwatches and smart ring purchases. The questionnaire was first planned and designed to be published in English. However, the author translated the questionnaire into Finnish, in hopes to reach more accurate results and avoid bias from possible language barriers.

2.3. Questionnaire design

The author conducted an anonymous online questionnaire which had three parts in order to make the survey easier to fill in and structure. The questionnaire was opened on 15th of April 2021 and closed on the 17th of April, when it reached 120 respondents.

The questionnaire starts with an introduction on the topic and the aim of the questionnaire, to help the participants to form an understanding of the intent of the questionnaire. In the beginning of the survey the author has informed the participant of the requirements he/she must fulfill in order to be a respondent. This questionnaire is targeted for Finnish, current mobile smartwatch and smart ring users. Followed by a demographic sheet, asking the name and the gender of the participant.

First part of the actual survey focuses on purchasing motivation and hopes of the consumer. The participant is to state is he a smartwatch or a smart ring user, or perhaps both. The author believes that the ratio is important when making this study, since there is a possibility that most of the respondents are the users of only one device. If there would be a particularly large number of smartwatch users taking part, the results of the survey would not apply to smart ring users. The author will also add an option “Neither” to leave out the possible participants who have taken part of the survey without possessing a smartwatch or a smart ring.

The author aims to shed light on the motivators behind the purchasing decisions and wishes to do through the first questions. First simply asking “What motivated you to purchase a smartwatch or a smart ring?” This is a multiple-choice question, and the author has listed possible motivations for a purchase and left an option for open ended answers, if the person answering cannot relate to any of the reasons listed. The answers received will be connected to the contributors behind “Perceived Usefulness” and “Perceived Ease of Use” listed in the

Theoretical framework chapter. The original Technology Acceptance model is said to be lacking possible usages and aspects without the intentions (Jones & al. 2002). These attributes are a Subjective norm, Image, Job relevance, Output quality and Demonstrability. In the following table, the author aims to point out the relationship between intentions and motivations.

Intentions (TAM2)	**Motivations (questionnaire options)**	**Motivations added by participants in "other" section**
Subjective norms	"My friends recommended the product"	
Image	"It is a nice accesory"	
Job relevance	"Possibility to use my phone remotely"	"Following my exercise"
Output quality		
Result demonstrability	"To follow my calorie consumption" "To follow my recovery after exercise" "To follow the quality of my sleep"	

Table 1. Relationship between Intentions in TAM2 and Motivations
Source: Author's adaptation of models from the TAM2 model

Next question is "What features are important to you in a smartwatch or a smart ring" is quite personal and gives an idea behind the reason why this particular person is using a smartwatch or a smart ring. Once again, there are listed options related to the intentions from TAM but also an open-ended part for participants' own answer. Relationships between intentions and motivations are demonstrated in the table below.

Intentions (TAM2)	Motivations (questionnaire options)	Motivations added by participants in "other" section
Subjective norms		
Image	"Appearance" "Visibility on the body"	"Invisibility on the body"
Job relevance	"Amount of different features"	
Output quality	"Quality of data"	
Result demonstrability	"Ease of Use"	

Table 2. Relationship between Intentions in TAM2 and Motivations
Source: Author's adaptation of models from the TAM2 model

Part two of the questionnaire will focus on the willingness to accept smartwatch and smart ring technology into use and motivation behind the purchase of the device. In this part, the author will utilize the Technology Acceptance model and its components "Perceived Usefulness" and "Perceived Ease of Use". The author

To measure these two components, the author has conducted the following questions, measured with a likert scale from (1) "Strongly disagree" to (5) "Strongly agree". The scales mode (3) marks the "Neutral" interpretation towards the claim. Five scaled likert scale is commonly used for the measurement of the level of agreement or disagreement of the respondent (Sullivan, Artino, 2013). The likert scale enables the author to measure and study qualitative attributes with quantitative measures (Joshi & al., 2015).

Perceived Usefulness (PU)

Definition by Davis (1989): "the degree to which a person believes that using a particular system would enhance his or her job performance"

Measuring statements:
PU1) Using a smartwatch or a smart ring is enabling me to accomplish my daily goals
PU2) Using a smartwatch or a smart ring is improving my well being
PU3) Using a smartwatch or a smart ring is improving my performance in different tasks

PU4) Using a smartwatch or a smart ring is making it easier to follow my performance
PU5) I find the product to be useful in my daily life

Perceived Ease of Use (PEU)

Definition by Davis (1989): "the degree to which a person believes that using a particular system would be free from effort"

Measuring statements:
PEU1) Learning to operate a smartwatch or a smart ring is easy for me
PEU2) I find it easy to get a smartwatch or a smart ring to do what I want to do
PEU3) My interaction with a smartwatch or a smart ring is clear and understandable
PEU4) It is easy for me to become skilful at using a smartwatch or a smart ring
PEU5) I find my smartwatch or a smart ring easy to use

The third and final part of the questionnaire focuses on the usage and behavioral changes due to the received results. The author will be evaluating the respondents possible changes due to the results received by the devices with two questions. The questions also measure future intent for the use. These questions are “To what extent have you changed your behaviour due to the results received from your smartwatch or smart ring? " and “How likely are you to follow and change your behaviour due to the received results from your smartwatch or smart ring in the future?”. These questions offer additional information on how the users have adapted the results to their lives.
Final likert scaled question relates to possible increase or decrease of motivation. The question is the following: “How likely are you to set more demanding goals for yourself in the future?”. This helps the author to measure if the respondent is motivated by their device, to seek better results in the future.

Lastly, the author has added an open-ended question “Any additional comments on your personal experience with a smartwatch or a smart ring?” The participant can answer if he wants to and the author aims to receive comments to bring forward which summarize the user experience of the smartwatch and smart ring users.

The author has selected specifically smartwatches and smart rings as the center of this study because of their popularity among users and similarity between each other. This thesis will be focusing only on mobile smartwatches and smart rings which work connected to a smart device and application. Separately functioning sports watches and pedometers will be left out of this study to receive more specific results. For the future research, the author recommends asking the participants to specify their usage time and usage activity. In the study conducted, the results could be biased since there was no measure on how actively the respondents use their devices.

3. RESULTS

In this chapter the author will show the results received through the questionnaire using graphs to demonstrate the division more clearly. The author will connect the intentions and motivations and go through both “Perceived usefulness” and “Perceived ease of use” as factors in the acceptance process. She will also draw assumptions for the future based on the questionnaire answers. In the end of the chapter, she will point out possible limitations and offer recommendations for future research.

3.1. Questionnaire results

120 participants took part in the Google survey conducted between 15.-17.4.2021. 65 females and 55 males took part in this Google survey shared through different social media platforms. With 45 smart watch users, 47 smart ring users, 15 using both and 13 participants not using either of the devices, therefore there were 107 participants using at least one of the two devices and able to answer the questions from experience. The participants, not using either of the devices, were documented but directed to end the questionnaire to avoid bias in the results.

The first part of the questionnaire focused on the motives behind the purchasing decisions and asked the participants the question “Why did you start using the smartwatch”. The following options were listed; “To follow my calorie consumption”, “To follow the quality of my sleep”, “It is a nice accessory”, “Possibility to use my phone remotely”, “My friends recommended the product”, “To follow my recovery after exercising” and “To count my steps”. The participant could choose multiple options and also fill out the “Other” part with his own personal motivation. The division of answers is demonstrated in the next graph, made by the author.

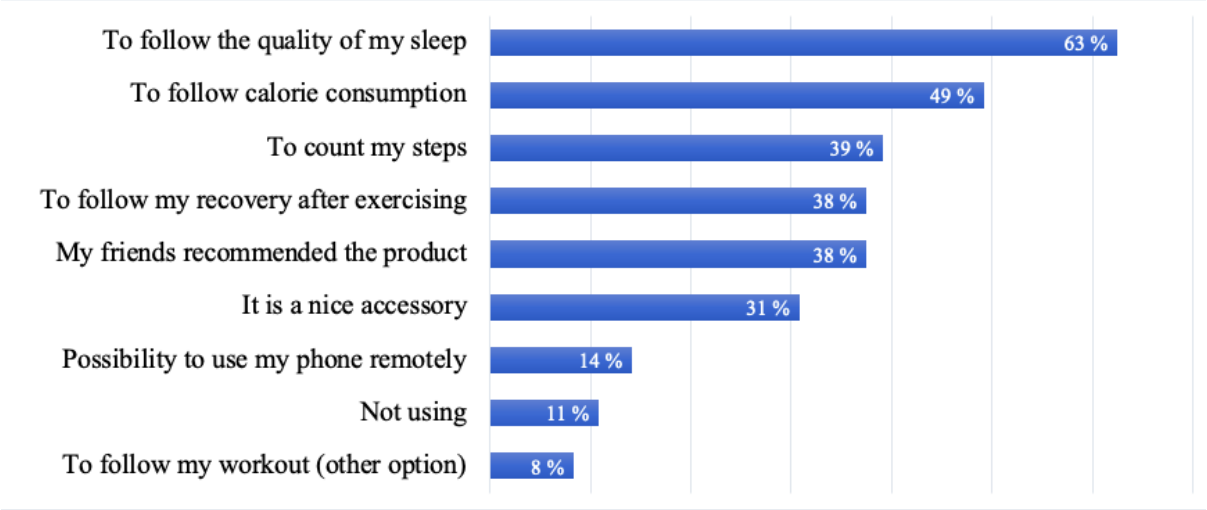

Figure 7. Question: "Why did you start using the smartwatch", n=120

Source: Result from the Questionnaire, calculated by the author in Excel

"To follow the quality of my sleep" was the most popular motivation amongst the respondents. All in all, 63% chose this option as one of their motivation factors. "To follow my calorie consumption" also was marked by 49% of the respondents, also "To count my steps" was marked by 39% of the participants and "To follow my recovery after exercising" by 38%. Thereby, the author can assume that following one's body's activities has been the main motivation for smartwatch or smart ring purchase among the sample and the intention "Result demonstrability" in TAM2 is strong indicator in Intention of buying or accepting technology in the case of smartwatches and smart rings.

"My friends recommended the product" was chosen by 38% of the participants. The author believes that this correlates to the Advanced Technology Acceptance model "Subjective norm" factor if 38% of all respondents have listened to their friend's opinions and that has motivated them to purchase one or even both of the devices. 31% of the participants also chose the option "It is a nice accessory", which relates strongly to the "Image" factor in the Advanced Technology Acceptance model. This can also be an additional motivator, meaning that alone the looks and appearance of the watch or a ring would not be enough to motivate the person to purchase, but if the product is already seen as desirable, it being pleasing to the eye does add value in the consumer's eyes. Only 14% of the respondents chose the option "To use my phone remotely". This can be related to the fact that only the smartwatch has this feature, and since so many smart ring users took part in this questionnaire, they have probably not been choosing this particular option. There were few answers added to the open

ended part, most of them relating to the possibility "To follow my workout", which the author added to the chart. Two of the respondents also received the device as a gift, thus they did not make the actual purchasing decision.

The division of responses in the next question "Which features are important to you in a smartwatch or a smart ring?" is demonstrated in the following graph:

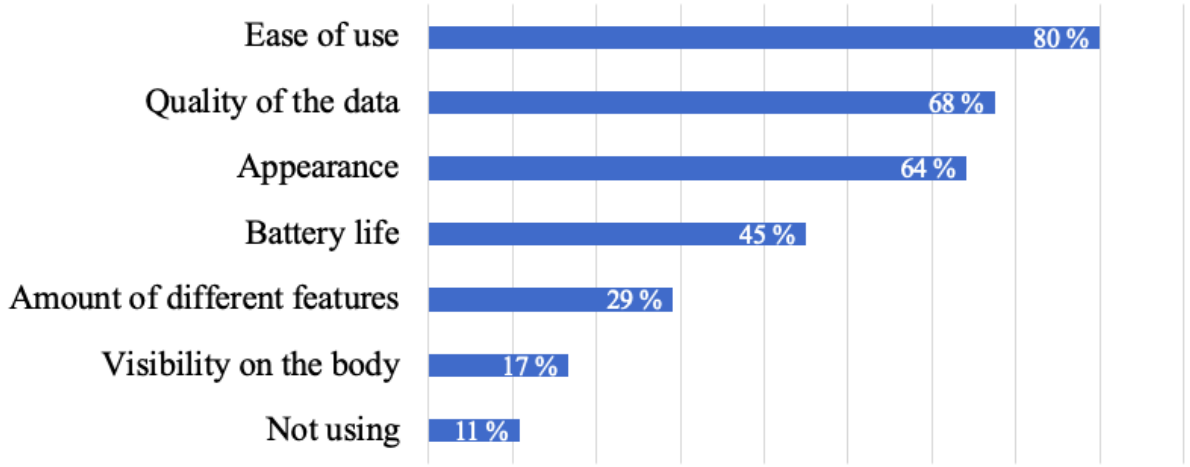

Figure 8. "Which features are important to you in a smartwatch or a smart ring?" n=120
Source: Result from the Questionnaire, calculated by the author in Excel

Ease of use, which was marked by 80% of the participants. This proves that the perceived ease of use is a high factor when adapting a smartwatch or a smart ring into the use.
"Appearance" was marked by 64% of the participants, which the author experiences to be higher than she expected. The appearance is important when talking about a technology device worn in the visible spot on the body. Then again, "Visibility on the body" was answered only by 17% of the participants. From this, the author draws a point that there seems to be a relationship between these two factors. When the "Appearance" is important, but "Visibility on the body" is low, it seems that when it comes to the appearance of the device, the users hope their device to be less noticable. Invisibility was also stated through one of the comments left in the "Other" part.
"Quality of the data" was also important to 68% of the respondents. "Battery life" received marks from 45% of the participants and "The amount of different features" mark from 29% participants.

In conclusion, the possibilities to follow the body's activities like sleep, calorie consumption and steps are the key features for potential smartwatch and smart ring purchasers. The author draws a conclusion that these users have an active lifestyle and set goals for themselves in exercising. They wish to improve their wellbeing and are willing to purchase and adapt technology as their tool to receive their goals. According to the Advanced Technology Acceptance model, the factors "Perceived usefulness" and "Perceived Ease of Use" are present in their answers and motivation. In the second part of the questionnaire, the author focuses on these two motivation factors. To make it more clear, the author has formed a graph with the help of Excel to demonstrate the results. The 107 participants who are users of either smartwatch, smart ring or both, were able to answer these questions. The numbers represent the amount of participants out of the total 107, who ranked their agreement on the level explained in the bottom of the graph.

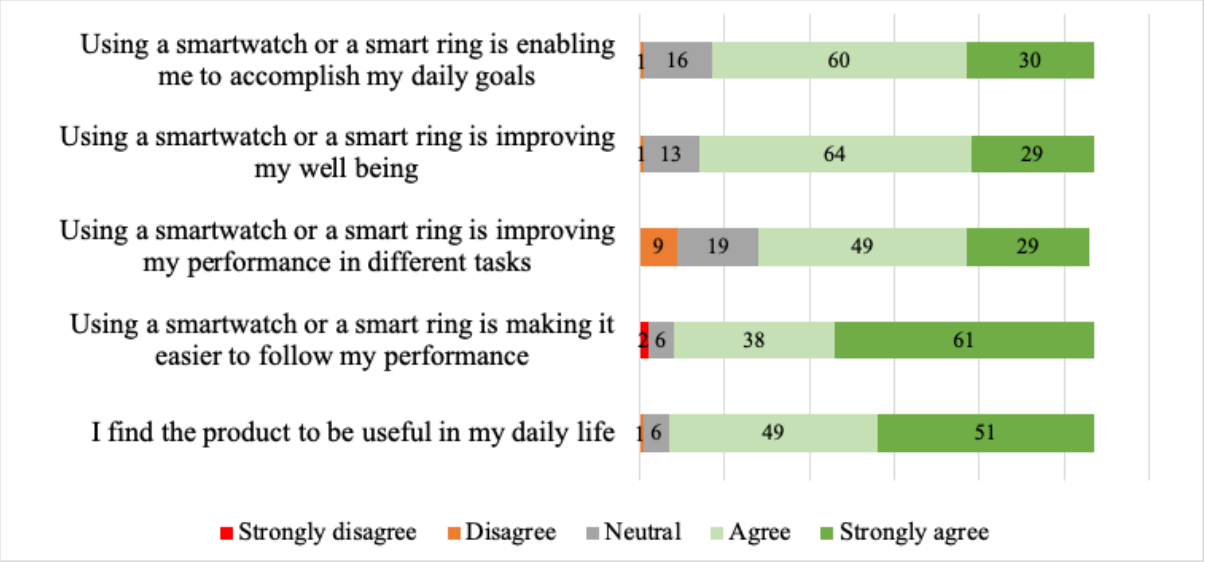

Figure 9. Perceived Usefulness, n=107

Source: Result from the Questionnaire, calculated by the author

As the graph presents, the Perceived Usefulness is strong among the smartwatch and smart ring users. Therefore, Davis was right with the Technology Acceptance Model (1989) and that when the factor in question is experienced strongly, the users are willing to adapt this technology. According to the results, "Perceived Usefulness" is strong among the Finnish consumers answering the questionnaire.

When measuring and focusing on the Perceived Usefulness, the author must leave out the question “I find it easy to get a smartwatch or a smart ring to do what I want to do”, since there was a mistake. The author has used the likert scale where (1) stands for “Strongly disagree and (5) stands for “Strongly agree” in all other questions, but this question had the scale in other way around and it is clear to see that the answers were biased due to the answering technique habit learned through the questionnaire. Thereby, the question will be left out of the study. Nevertheless, the author opens up the result received from other questions considering the factor Perceived Ease of Use in the following graph. As in the “Perceived Usefulness” graph, the numbers represent the amount of participants out of the total 107, who ranked their agreement on the level explained in the bottom of the graph.

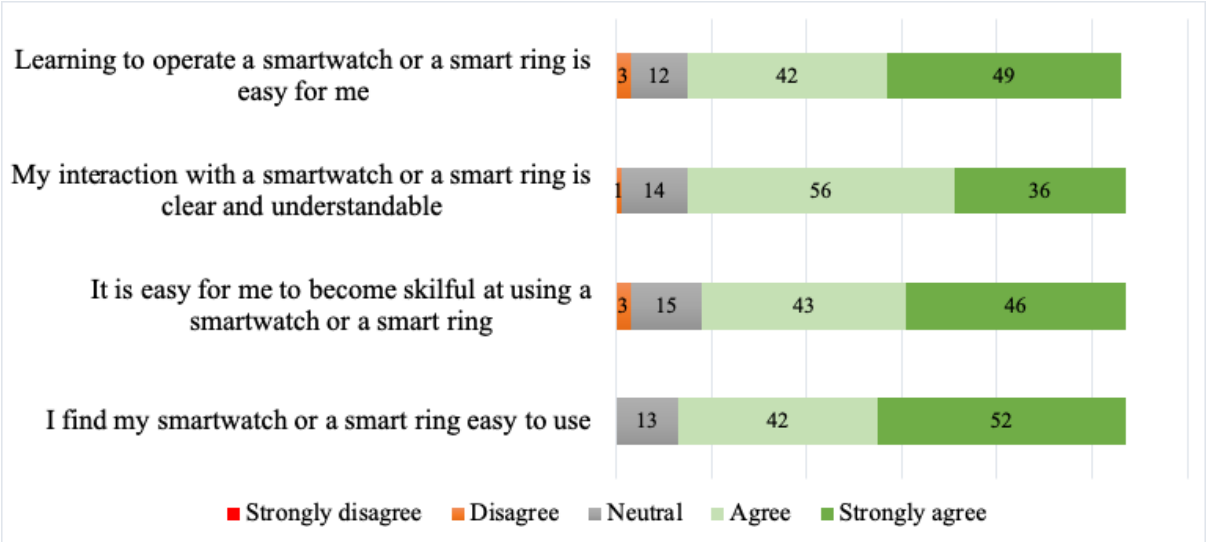

Figure 10. Perceived Ease of Use, n=107

Source: Result from the Questionnaire, calculated by the author

Perceived Ease of Use measurement came out approximately as strong as Perceived Usefulness. Therefore, the author claims that these two factors have an effect on the future intention of usage of smartwatches and smart rings. If the participants have experienced their devices to be this useful and easy to adapt into the use, there must be connection to the behavioural changes as well. This is measured and discussed in the last part of the questionnaire.

Last part of the questionnaire included questions related to the behavioural changes that the participants have possibly gone through due to the results received from their devices. First question “To what extent have you changed your behaviour due to the results received from your smartwatch or smart ring?” demonstrated in the graph below.

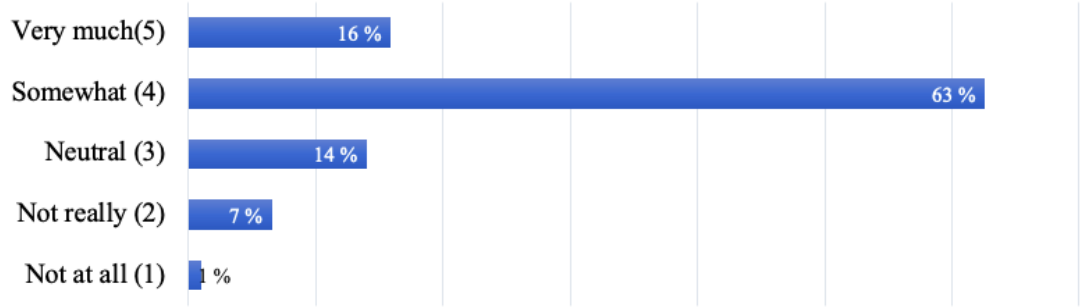

Figure 11. Behavioural change, n=107

Source: Result from the Questionnaire, calculated by the author

The answers were given through a likert scale from (1) “Not at all” to (5) “Very much”. This question assumes that the participant has had a chance to use their smartwatch or smart ring at least once to receive any sort of results and reflect on those. Out of the 107 participants who are using one of the devices or boht, 79% experienced changing their behaviour strongly, choosing option “Somewhat” (4) or “Very much” (5) from the scale. Respondents ranking their behavioural changes neutral by answering the level Neutral (3), covered 14% of the results. Scale “Not at all” (1) and the closest level “Not really” (2) together received 8% of the responses. Thereby, the author can conclude that the data received through each device has an affect on the behavioural changes of the person using the device. Thus, the participants must have strong belief towards the accuracy of the results in order to be willing to change their actual behaviour.

The next question focused on the same topic, but demanded more thought on the possible course of action in the future. The question “How likely are you to follow and change your behaviour due to the received results from your smartwatch or smart ring in the future?”

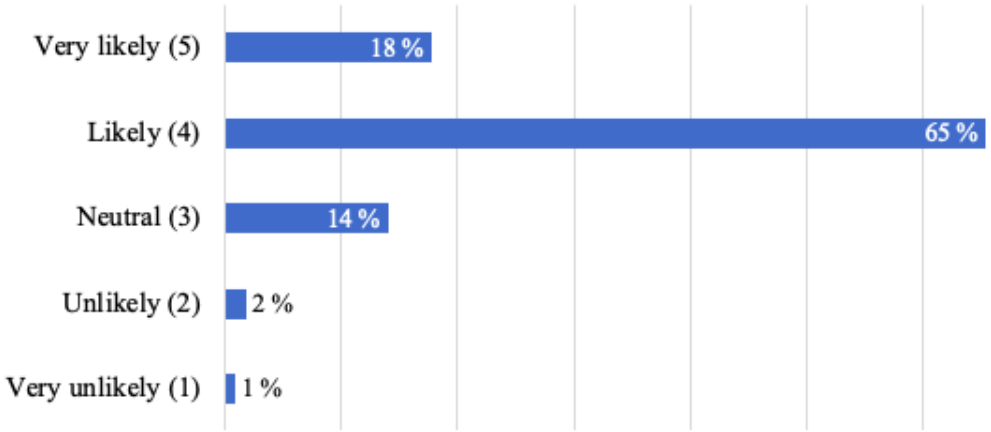

Figure 12. Future intentions, n=107

Source: Result from the Questionnaire, calculated by the author

The question offered options from (1) “Not likely at all” to (5) “Very likely”. The combined percentage scaling their future expectations by “Likely” (4) or “Very likely” (5), was as high as 83%. In the middle, 14% of the respondents were “Neutral” (3) and 3% scaled their future intentions as “Not likely at all” (1) or “Unlikely” (2). These results evoke the idea that the users wish to continue using their devices and have faith in their own process. When discussing action taking place in the future, the participants agree that they will in fact, continue using their devices in the future. They also have experienced their device data to be useful and are willing to rely on it in the future.

The last Likert scale question was “How likely are you to set more demanding goals for yourself in the future?” demonstrated in the following scale:

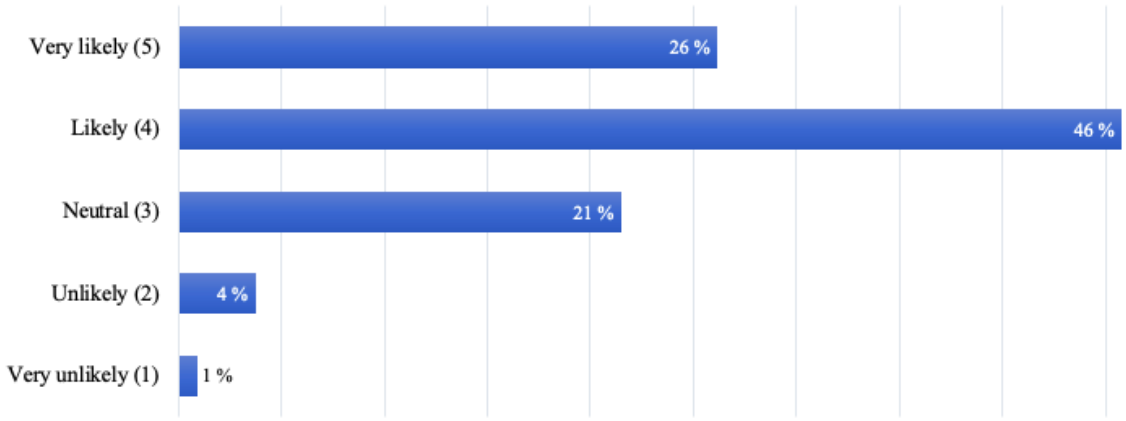

Figure 13. Future goal setting, n=107

Source: Result from the Questionnaire, calculated by the author

The aim is to measure the possible increase of motivation and desire for even better results. 72% of the respondents believed their goal increase to be “Very likely” (5) or “Likely” (4). “Neutral” (3) received 21% of the answers and levels “Very unlikely” (1) together with “Unlikely” (2) were chosen by only 5% of the respondents. The results received through this question underline the point brought up in the context of the previous question. The participants seem to be willing to continue using their devices and accept it as a part of their daily use. Smartwatches and smart rings increase motivation according to the results and the users are willing to set more demanding goals for themselves in the future.

The voluntary qualitative question in the end was following “Any additional comments on your personal experience with a smartwatch or a smart ring?” and it received all together 15 answers, of which the author was very pleased with. When focusing on the numbers and quantitative data, some interesting points and personal opinions of the participants behind the numbers are easily missed. The comments left by the participants were mainly positive and complimented the devices, saying how the increased activity and daily goal feature motivated them. The author will list the translated answers below. The original answers in Finnish can be found at the end of the thesis (Appendix 4.).

Open ended question "Any additional comments on your personal experience with a smartwatch or a smart ring?" answers:

"I am annoyed with my smart ring (Oura) because of its incapability to measure exercise if there are no steps being measured. For example, one hour long cycling class does not register as any kind of exercise, if I do not mark it there myself manually. If I would run the same amount of time, the watch would calculate my consumption."

"Great devices which contain an unbelievable amount of data and features these days, and are also updatable, which is a big plus."

"The devices motivate me to improve my results."

"Reading of the results could be opened more comprehensively somewhere, for example: what is HRV (Heart Rate Variability) of a good result for a person age X. Water resistance is a plus and smartwatch and smart ring give great data for behaviour change. However, I believe it is important to listen to your senses and feelings and not to stress too much what the results of the devices say. If one starts to stress too much and live by only the results, that basically weakens mental well-being."

"Watch motivates to exercise daily when one sets the daily goals."

"With a smartwatch my motivation towards exercising has increased."

"I am a satisfied user of both devices."

"I have liked using a smartwatch and paid attention for example in my sleep. It is easier to follow how differently I sleep on different days of the week."

"I do not use the ring, even though I experience it to be useful."

"For example, Oura has been really good in my opinion, since with it, I can follow my sleep, recovery and activity level. However, I am a bit surprised how little its existence means to me since I have not changed my behaviour (f.e. made sure that the daily "activity goal" is

fulfilled). I have a smartwatch as well which I am using less since it has a bad battery and I have not used it to be honest."

"After noticing with the help of the ring how alcohol affects my sleep, I have reduced my alcohol usage."

"I am using Suunto 9. Otherwise it is a good device but the quality of the screen is weaker compared to the smartwatches (Apple, Samsung etc.)"

"I see the results, but the changes are harder to make."

"I have been very pleased with both devices."

3.2. Discussion

In this chapter the author goes through results more deeply and aims to find motives receiving these particular results.

As the results demonstrate, the motivations for usage and purchasing, which represent themselves strongly among the respondents, are related to the possibility to follow the body's functions like calorie consumption, sleep, recovery and exercising. The author had placed these motivations in the Intention category "Result demonstrability". The respondents are exercising, but need real data to really show the levels of their activities. However, the activity measuring could be also placed and linked to the intention "Subjective norm" since the results might create a feeling of accomplishment and thereby affect the sense of self of the user. "Job relevance" could also be linked to these activities if the person has set himself larger goals such as weight loss or muscle building. In this scenario, the job could state the work out load. In addition, the recommendation from a friend seems to be a relatively high factor, and it can be related to the "subjective norm" category. Many of the respondents seem to listen to their friends when making smartwatch and smart ring purchasing decisions. Word of mouth is known as an important marketing tool and seems to be such in the case of smartwatches and smart rings as well.

“Perceived Usefulness” and “Perceived Ease of Use” were distinctly strong among the sample and thereby the author believes that the two factors should be used when designing new technology or updates for the previous watch and ring models. All in all, the author believes the Technology Acceptance model and Extended Technology Acceptance model can be both utilized well, when considering and willingness to adapt and continue using such devices.

Among the respondents, future intentions for usage are strong and the result states that there has been behavioural changes among the consumers when it comes to receiving and interpreting data from the device into daily lives of the users. When discussing future aspects, challenging oneself is popular. The positive attitude towards future usage tells that the results received and changes made in the hopes of better results, have had presumably positive effect on the lives of the users.

Smartwatches and smart rings have clearly earned their place in the wrists and fingers of the respondents. The author senses that these kinds of wearable devices could have a strong role to play in the future years, and the data received could be analyzed for medical purposes as well. For example, these devices could have a future to be recommended by doctors and the users data could be analysed when needing medical assistance.

At this point, the author claims that the development for these technological devices is not needed but is encouraged. It is hard to imagine any features which could fall into Maslow’s Need Hierarchy’s (1943) most important levels and show themselves in our daily lives as such a vital addition.

Since the questionnaire conducted was intended for Finnish consumers and measured their attitudes towards accepting smartwatch and smart ring technology, the author intended to avoid any language barrier by publishing the questionnaire in Finnish. The translation can have some effect and it always increases the possibility for bias. The social media platforms where the author shared the questionnaire also are limited and the result received from samples collected from those platforms can be very different from for example in the sample was gathered at a technology event or from customers at a technology store.

The author managed to gather a great set of samples in such a short time, but the time frame possibly made the questionnaire unaccessible for many potential candidates.

The author would also be interested in more qualitative data on the topic of behavioural changes and smart wear technology. Even though the attitudes towards adapting smartwatch and smart ring technology can be experimented well through the TAM1 and TAM2, they

leave out the personal opinions and feelings of the participants. In addition, the two models have the same base, thus the results are analyzed entirely through one model format. In the future research, the author recommends using additional models to collect data from another point of view as well. As mentioned earlier, the questionnaire fails to specify how actively do the participants use their smartwatches and smart rings, and how long have they used them for. This can cause unwanted bias since not necessarily all the participants are active users or users atall, but only owners of one or both devices. Therefore, their responses are not necessarily contributing to the results truthfully, based on the actual experience.

Something that would be interesting to have more research of in the future with the case of smartwatches and smart rings, is the discussion of the variety of features that the owners are using. According to Cooper (1999), people tend to adapt the smallest set of features into their use that they experience to be necessary for them and shut off the rest.

CONCLUSION

Smartwatches and smart rings grow their popularity among consumers. These devices are not only adapted into the use by training oriented users like athletes, but regular consumers hoping to understand their bodies' functions better and follow their progress. It is interesting to follow the evolution between people and technology when it comes to physical and mental well-being. In the future, it is possible that technology continues to grow its part as an important tool when measuring one's health.

The aim of this study was to search main motives behind the purchasing of smartwatches and smart rings in Finland and find out if there have been any changes in user's activity due to the data received from these devices. This was done through the research questions:

RQ1: What motivates Finnish consumers to purchase smartwatches and smart rings?
RQ2: How high are the factors perceived usefulness and perceived ease of use seen in these technology devices?
RQ3: Has the user changed his/her actions due to the data received from their smart device?

These questions were examined through a questionnaire to shed light on the attitudes and behaviour of individuals. The results received through the questionnaire in question seemed to follow a clear pattern and responses intended to be similar with each other, and answer directly to the research questions. According to this study, the author claims that the desire to follow the body's functions like sleep, calorie consumption and exercise is the main reason for purchasing smartwatch or smart ring. Friends recommendations also play a part in the motivation process. This data collected from the devices is also expected to be good quality and trustworthy. In addition, the author has found that the two factors "Perceived ease of use" and "Perceived usefulness" are on a strong level among the Finnish consumers taking part in the study. The both components should be considered and taken into account when designing new wearable products and updating the applications of the old ones. It can also be drawn from the survey, that people using the devices are indeed changing their behaviour due to the results and plan to do so in the future. All in all, these devices have a positive reputation and are in use among Finnish consumers.

Through this study, the author has not only received more information on attitudes towards the smartwatches and smart rings but real and personal feelings and user experience from device users. The future research needs to focus on more the personal experience of different customer segments. This should be studied by the smartwatch and smart ring companies, and other possible brands producing smart technology wear.

All in all, the author believes strongly that perceived usefulness, meaning the rate of experience the consumer experiences the device to improve his aimed results and ease of use, meaning clarity in the actual usage, are both highly important factors when considering customer willingness to adapt smartwatch or smart ring technology. These devices have clearly earned their place around consumers' wrists and fingers and the usage will continue in the future. This means that since the devices have a market in the future, the development and innovativeness surrounding them must continue as well. Technology is taking massive leaps in shorter time periods like never before, and smart devices have come to stay. In addition, smart device technology has earned its place on our bodies and lives.

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APPENDICES

Appendix 1. User ratio

Question	Smartwatch	Smart ring	Both	Neither
What device are you using?	45	47	15	13

Appendix 2. Perceived Usefulness question answers

Likert scale

Question	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
Using a smartwatch or a smart ring is enabling me to accomplish my daily goals	0	1	16	60	30
Using a smartwatch or a smart ring is improving my well being	0	1	13	64	29
Using a smartwatch or a smart ring is improving my performance in different tasks	0	9	19	49	29
Using a smartwatch or a smart ring is making it easier to follow my performance	2	0	6	38	61
I find the product to be useful in my daily life	0	1	6	49	51

Appendix 3. Perceived Ease of Use Question answers

Likert scale

Question	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
Learning to operate a smartwatch or a smart ring is easy for me	0	3	12	42	49
My interaction with a smartwatch or a smart ring is clear and understandable	0	1	14	56	36
It is easy for me to become skilful at using a smartwatch or a smart ring	0	3	15	43	46
I find my smartwatch or a smart ring easy to use	0	0	13	42	52

Appendix 4. Answers to behaviour change question

Likert scale

	Not at all (1)	Not really (2)	Neutral (3)	Somewhat (4)	Very much(5)
To what extent have you changed your behaviour due to the results received from your smartwatch or smart ring	1	7	15	67	17

Appendix 5. Answer to intent for behavioural change

Likert scale

	Very unlikely (1)	Unlikely (2)	Neutral (3)	Likely (4)	Very likely (5)

How likely are you to follow and change your behaviour due to the received results from your smartwatch or smart ring in the future?	1	2	15	70	19

Appendix 6. Answers to the open ended question

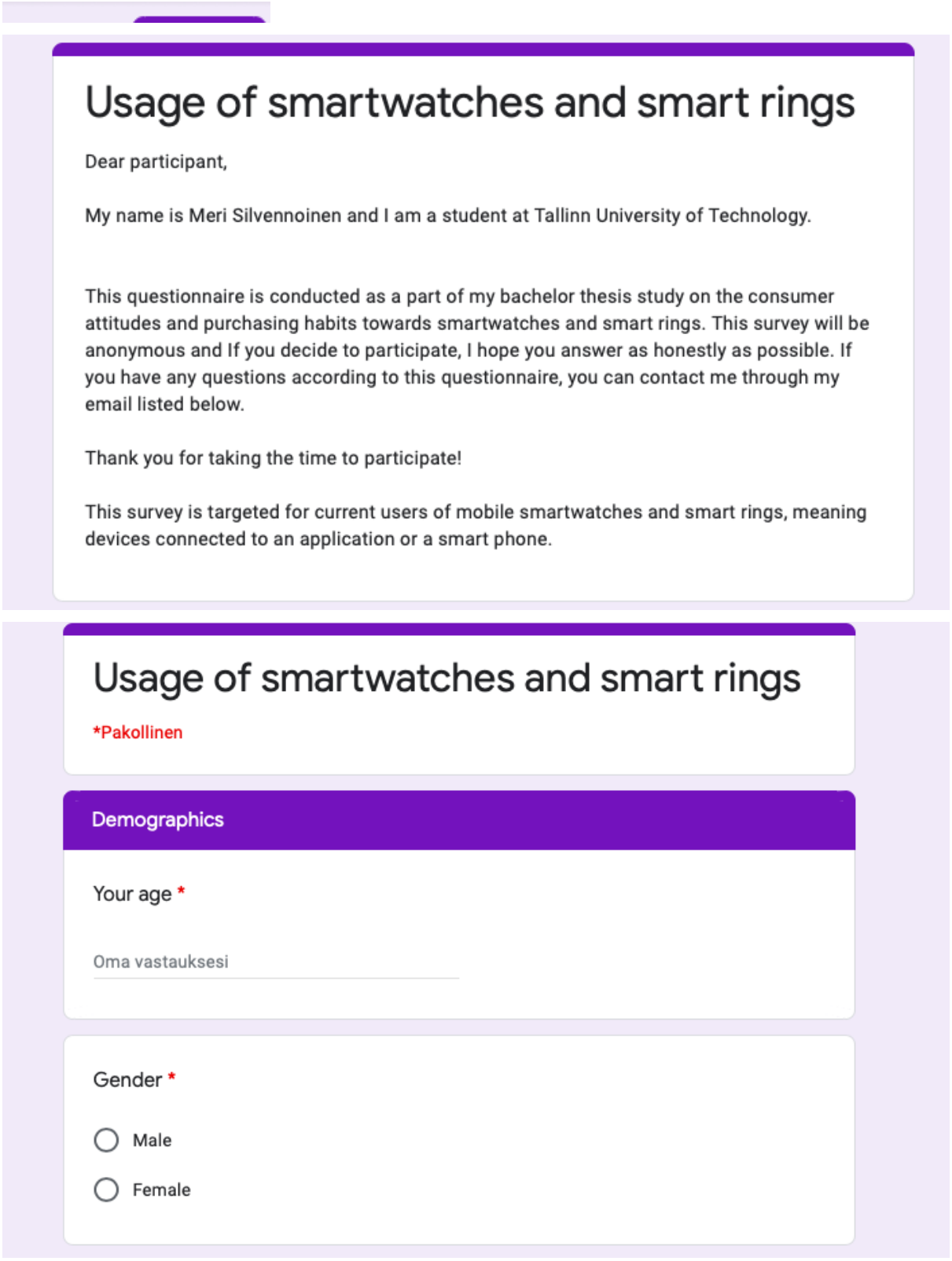
“Any additional comments on your personal experience with a smartwatch or a smart ring?”

Answers in Finnish from the questionnaire	**Author's translation in English**
Minua ärsyttää älysormuksessani (Oura) sen kyvyttömyys mitata urheilua jos siihen ei liity askeleita. Esimerkiksi tunnin cycling ryhmätunti ei rekistöidy kelloon minkäänlaisena urheiluna jos en itse sitä manuaalisesti sinne merkitse. Jos juoksisin saman tunnin kello laskisi kulutukseni itse.	I am annoyed with my smart ring (Oura) because its incapability to measure exercise if there are no steps being measured. For example, one hour long cycling class does not register as any kind of exercise, if I do not mark it there myself manually. If I would run the same amount of time, the watch would calculate my consumption.
Mahtavia laitteita, jotka tänäpäivänä sisältävät uskomattomattoman määrän dataa ja ominaisuuksia sekä ovat myös päivitettävissä mistä iso plussa.	Great devices which contain an unbelievable amount of data and features these days, and are also updatable, which is a big plus.
Laitteet motivoimat minua parantamaan tuloksiani	The devices motivate me to improve my results.

Tulosten tulkintaa voisi avata kattavammin jossain, esimerkkinä: mikä on HRV:n vaihteluväli hyvälle tulokselle X ikäiselle hlölle. Vedenkestävyys plussaa Älysormus ja -kello antavat hyvää dataa oman käytöksen muutokselle. Kuitenkin mielestäni on tärkeää kuunnella tuntemuksia ja oloa eikä stressata liikaa mitä älylaitteiden tulokset sanovat. Jos alkaa stressata liikaa ja elää pelkkien tulosten perusteella, niin se periaatteessa heikentää henkistä hyvinvointia.	Reading of the results could be opened more comprehensively somewhere, for example: what is HRV (Heart Rate Variability) of a good result for a person age X. Water resistance is a plus and smartwatch and smart ring give great data for behaviour change. However, I believe it is important to listen to your senses and feelings and not to stress too much what the results of the devices say. If one starts to stress too much and live by only the results, that basically weakens mental well-being.
Kello motivoi liikkumaan päivittäin kun asettaa päivätavoitteet	Watch motivates to exercise daily when one sets the daily goals.
Älykellon myötä motivaatio liikkumiseen on lisääntynyt.	With a smartwatch my motivation towards exercising has increased.
Olen tyytyväinen molempien laitteiden käyttäjä	I am a satisfied user of both devices.
Olen pitänyt älykellon käytöstä ja kiinnittänyt huomiota esimerkiksi uneeni. On helpompi seurata miten erilaista unta nukun viikon eri päivinä.	I have liked using a smartwatch and paid attention for example in my sleep. It is easier to follow how differently I sleep on different days of the week.
Sormus jää käyttämättä, vaikka koenkin sen olevan hyödyllinen	I do not use the ring, even though I experience it to be useful.

Esimerkiksi Oura on ollut mielestäni todella hyvä, koska sen avulla voin seurata unta, palautumista ja aktiivisuutta. Olen ehkä itsekin kuitenkin yllättynyt siitä, miten vähän sen olemassaolo minulle merkitsee siinä mielessä, että en juurikaan ole muuttanut tapojani (esim. varmistanut että päivän ”aktiivisuustavoite” tulee täyteen). Minulla on sen lisäksi älykello, jonka käyttö jää vähemmälle oikeastaan vain siksi, että siinä on niin huono akku enkä ole tottunut käyttämään sitä.	For example, Oura has been really good in my opinion, since with it, I can follow my sleep, recovery and activity level. However, I am a bit surprised how little its existence means to me since I have not changed my behaviour (f.e. made sure that the daily “activity goal” is fulfilled). I have a smartwatch as well which I am using less since it has a bad battery and I have not used it to be honest.
Huomattuani sormuksen avulla, miten alkoholi vaikuttaa minun uneen, olen vähentänyt sen käyttöä.	After noticing with the help of the ring how alcohol affects my sleep, I have reduced my alcohol usage.
Käytössäni on Suunto 9. Muuten jees vekotin, mutta näyttö on laadultaan heikompi verrattuna älykelloihin (Apple, Samsung etc.)	I am using Suunto 9. Otherwise it is a good device but the quality of the screen is weaker compared to the smartwatches (Apple, Samsung etc.)
Tulokset näkee, mutta muutoksia on vaikeampi tehdä	I see the results, but the changes are harder to make.
Olen ollut todella tyytyväinen molempiin laitteisiin	I have been very pleased with both devices.

Appendix 7. Online Questionnaire in English



Usage of smartwatches and smart rings

Dear participant,

My name is Meri Silvennoinen and I am a student at Tallinn University of Technology.

This questionnaire is conducted as a part of my bachelor thesis study on the consumer attitudes and purchasing habits towards smartwatches and smart rings. This survey will be anonymous and If you decide to participate, I hope you answer as honestly as possible. If you have any questions according to this questionnaire, you can contact me through my email listed below.

Thank you for taking the time to participate!

This survey is targeted for current users of mobile smartwatches and smart rings, meaning devices connected to an application or a smart phone.

Usage of smartwatches and smart rings

*Pakollinen

Demographics

Your age *

Oma vastauksesi

Gender *

- ◯ Male
- ◯ Female

Questionnaire part 1

Smartwatches and smart rings are becoming more and more popular among Finnish consumers. There are multiple different devices and models to choose from with wide set of features, designed to fit the needs of their users. This questionnaire aims to shed light on the motivation behind the purchasing decisions as well as the possible changes in behaviour due to the data received from the devices.

Which device are you using? *

- ○ Smartwatch
- ○ Smart ring
- ○ Both
- ○ Neither

Why did you start to use a smartwatch or a smart ring?

- [ ] To follow calorie consumption
- [ ] To follow the quality of my sleep
- [ ] It is a nice accessory
- [ ] Possibility to use my phone remotely
- [ ] My friends recommended the product
- [ ] To follow the recovery after exercising
- [ ] To count my steps
- [ ] Muu: _____

Which features are important to you in a smartwatch or a smart ring?

- [ ] Ease of use
- [ ] Appearance
- [ ] Quality of the data
- [ ] Visibility on the body
- [ ] Amount of different features
- [ ] Battery life
- [ ] Muu: _____

Using a smartwatch or a smart ring is enabling me to accomplish my daily goals

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

Using a smartwatch or a smart ring is improving my well being

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

Using a smartwatch or a smart ring is improving my performance in different tasks

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

Using a smartwatch or a smart ring is making it easier to follow my performance

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

I find the product to be useful in my daily life

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

Learning to operate a smartwatch or a smart ring is easy for me

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

I find it easy to get a smartwatch or a smart ring to do what I want to do

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

My interaction with a smartwatch or a smart ring is clear and understandable

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

It is easy for me to become skilful at using a smartwatch or a smart ring

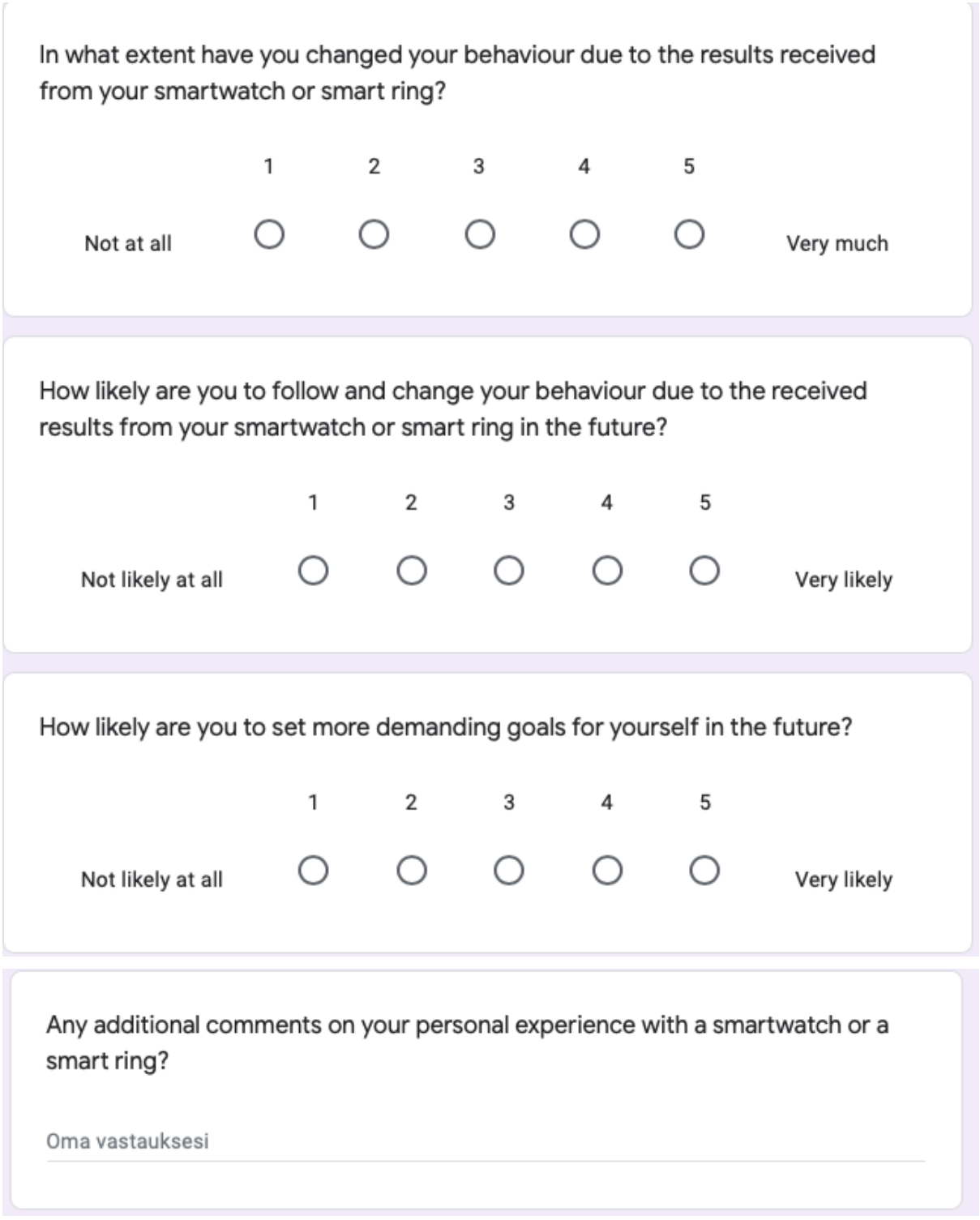
	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

It is easy for me to become skilful at using a smartwatch or a smart ring

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

I find my smartwatch or a smart ring easy to use

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree



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