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Creative analysis of smart home technology from a privacy perspective.

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This report addresses awareness among users of smart home personal assistants, with a focus on privacy. It also describes the process of planning and working on a research-based project. The report includes a literature review and results from an online survey and a focus group. Overall findings from the research conducted have resulted in an unboxing video of the product Google Nest Mini 2nd generation, which is also found in this report.

3 STIKKORD
Smart home personal assistants (SPAs)
Privacy
Awareness

Abstract

A significant number of individuals across various age groups utilise Smart Home Personal Assistants (SPAs) on a daily basis. SPAs have been introduced into households to assist with everyday tasks, such as playing music and setting an alarm. Due to the significant rise of SPAs in households, the importance of communicating the risks in a comprehensive manner is essential in today's digital age. The desired outcome for this research project was to explore risks and concerns among users of SPAs and propose a potential solution to mitigate the associated privacy risks.

In order to accomplish this, a literature review was written to get an overview of the existing research related to the problem. The project has also employed a mixed methods approach consisting of an online survey, a focus group interview, and a video-recorded product analysis. The research unearthed moderate concerns about privacy regarding SPAs, where unauthorised third-party sharing and the device always listening/recording were recurring themes.

Findings from the research indicate a correlation between a lack of user engagement with the terms and conditions and their limited awareness of the risks associated with SPAs. To address this issue, the research emphasises the need for user friendly language and transparency about privacy and data collection. Furthermore, a reduction in the number of pages could positively impact the user’s perceived time to complete reading the document, which would enhance their willingness to read the terms and conditions.

In conclusion, this research project highlights how awareness of the risks associated with SPAs affects individuals' concerns in relation to privacy. Based on research findings, an informative unboxing video has been made to serve as a potential solution to enhance user awareness regarding privacy.

Preface

This project report marks the end of a 3-year study in applied computer technology at Oslo Metropolitan University. The purpose of this report is to inform and shed light on the privacy risks involved with smart technology, mainly focusing on privacy using Smart Home Personal Assistants (SPA).

We would like to express our gratitude towards and thank our internal supervisor Ayanna Samuels for her helpful guidance and engagement in our project throughout the process. Thank you so much for your belief in us and the motivational supervision meetings that have contributed to making the outcome of this project as best as possible. Your knowledge and experience within the field have been an extremely useful asset for the project.

We would also like to thank our external supervisor Henry Mainsah for giving us the opportunity to work on this project and for being a good cooperation partner. The group had been in contact with Henry and had knowledge of his project from a previous course. Your project proposal has made this project feasible and increased our knowledge of Relink's work and its importance.

Other thanks go out to everyone who willingly participated in our focus group interview or took our survey. Without your participation, we would not have been able to collect the valuable information and data for our project that you kindly provided.

May 26th 2023

Oslo, Norway

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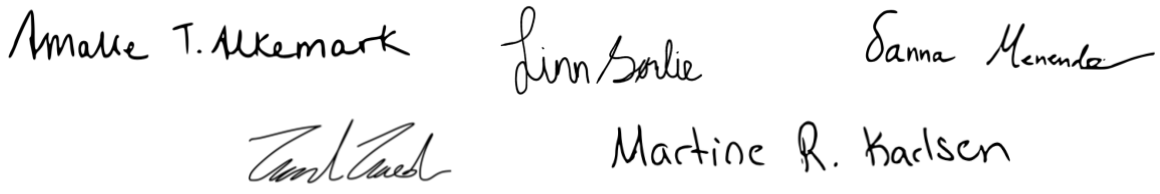

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Presentation of the group and the project

1.1 The group

We are a group of five students from OsloMet who are about to finish our bachelor's degree in Applied Computer Technology at the Faculty of Technology, Art and Design (TKD). We met early in our studies and have worked on several group projects together ever since. We all chose the specialisation Human-Computer Interaction in our second year and have had a good collaboration in both theoretical and practical subjects.

The group consists of:

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1.2 Project provider

"RELINK is a research project that aims to develop frameworks, tools, and scenarios that can address current and future risk and safety issues related to the Internet of Things (IoT) in connected homes and households." (Relink, n.d.). The project manager describes that "RELINK aspires to develop a 'toolbox' that can provide various households with practical advice and tools on how they can put themselves in a better position to handle the vulnerabilities linked to the use of digital technologies and services at home" (Mainsah, personal communication, May 2023).

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Project manager and the group's external supervisor

***Figure 1** - RELINK logo*

Project owner

Forbruksforskningsinstituttet SIFO

2 Introduction

Smart Home Personal Assistants (SPAs), and other forms of smart technology, have become increasingly accessible over the recent years. As technology continues to evolve, many people are now living in smart homes or semi-smart homes. It was predicted that by 2022, SPAs would be integrated into 870 million devices, including smartphones and speakers, in the United States alone (Winkler et al., 2021, p. 2). Furthermore, it is assumed that 10 percent of the world's population owns SPA-integrated devices (Edu et al., 2020, p.2). Statistics Norway, 2022 reported that 21 percent of the Norwegian population between the ages of 16-74 used a virtual assistant in the form of a speaker in 2022.

Considering the fact that how we use technology is constantly changing, digital literacy needs to cover a broad skill set. While digital literacy includes how to use technologies to for instance find, evaluate and communicate information (Loewus, 2016), digital awareness refers to having experience using technology (Ranky, 2022). Both digital literacy and awareness are essential factors in order to enhance users' understanding of privacy risks associated with smart technology. For that reason, the project seeks to address these key concepts and investigate whether digital literacy and awareness affect users' ability to use smart technology when making decisions about their privacy.

The statistics mentioned above highlight the widespread use of SPA technology. This ease of access may lead to introducing new products into our homes without properly considering their impact on our daily lives. For that reason, it is essential to raise questions regarding how to ensure our privacy when the smart devices all around us are constantly collecting our data. In order to address this issue, it is crucial to increase society's digital awareness concerning data collection as well as being well-informed regarding the privacy risks involved (Higgins, 2022).

Therefore, this report aims to explore the risks posed by SPA technology and existing concerns among users. Additionally, it seeks to propose solutions to mitigate these privacy risks, with the goal of enhancing digital awareness and understanding.

2.1 Background of the project

Dialogue between humans and computers has inspired many companies to implement their own voice recognition tools since the 1960s when IBM Shoebox, a forerunner of today's voice recognition systems, was first introduced. (IBM, n.d.-a). Today, voice assistants can be found in numerous devices such as home appliances, smartphones and smart speakers, and have become a central component of the Internet of Things (Young, 2021, p. 5-6).

SPAs, such as Google Assistant and Amazon Alexa, are using machine learning and natural language processing (NLP) in order to provide voice-based interactions that are as seamless as possible (Abdi, 2022). NLP is a subfield within artificial intelligence, with a focus on the interaction between humans and computers using natural language. More specifically, how computers can be given the ability to understand both text and spoken words in the same way humans can (IBM, n.d.-b). SPAs are designed to constantly listen for certain wake words, such as "Hey Google" or "OK Google" if it is a Google Assistant, to know when their users wish for them to perform a task (Gelinas, 2020).

SPAs can also be referred to as systems capable of learning both the behaviour and interests of its user, further adapting and adjusting to respond accordingly (Manikonda et al., 2018). Many of the SPAs have been assigned a name and a gender, such as Amazon's Alexa, making them seem more approachable and making the interaction seem more human-like (Edu et al., 2020, p. 2).

With the rapid increase in both popularity and development, SPAs are not only able to control other devices in the household but will also soon be replacing many of them in the near future. Despite many of the SPA-incorporated devices having integrated security and privacy mechanisms to some extent, the challenges regarding both security and privacy should be discussed. This is especially so given that these devices are placed in intimate domains, such as homes (Edu et al., 2020, p. 2).

Google's privacy statement, which applies to all Google services, indicates that they collect information to improve the user experience and provide personalised services, such as the answers to voice commands, search results and ads (Google, 2022). Google claims that

Google Assistant's voice recognition is designed to maintain user privacy and that every conversation is secure and confidential. Furthermore, Google states that conversations are encrypted when transferred between the user's devices or other Google services (Google, n.d.-a).

The Google Nest Mini 2nd generation is a smart speaker that incorporates Google's virtual assistant software (Google, 2022). In this report, the Google Nest Mini 2nd generation will be referred to as the Google Nest Mini. The device has many functionalities and provides various benefits to its users. However, it is important to be aware of the security and privacy risks associated with these devices. This is particularly important with regard to the collection and use of personal data despite Google's claims and statements. While these devices offer many possibilities, they also have the potential to compromise the security of the users' homes (Lippett, 2022).

Despite Google's claims about valuing privacy as mentioned above, The Norwegian Consumer Council expressed concern when Google Assistant was made available in Norway. They emphasised that introducing this type of assistant has direct consequences for privacy within the households (Drabløs, 2018). Furthermore, other European countries' consumer councils, as well as the Norwegian, have reported Google to their national Data Protection Authorities because of their concern. They all argue that Google is setting up their users to unknowingly give up their privacy in terms of manipulative design, unclear language and misleading and hidden choices (Kaldestad, 2022).

This bachelor's project aims to develop knowledge and increase public awareness of the current and future risks and vulnerabilities as well as potential threats associated with the Internet of Things (IoT) (Relink, 2022). This is with a particular focus on SPAs, in this project the Google Assistant, in connected smart homes and households. It was chosen to analyse the Google Nest Mini due to its prevalence in intimate domains and its interoperability, which raises concerns about data collection and sharing.

Through in-depth research and analysis of existing literature, this project includes conducting a comprehensive literature review. Furthermore, with the development and dispatch of an electronic survey and hosting a physical focus group, the project aims to elucidate the various

security and privacy concerns. In addition, it aims to assess the level of public awareness regarding these concerns.

Additionally, by recording an informative unboxing video, this project aims to promote the best practices for using SPA devices in households. This will be done along with assessing how to best protect users' privacy by thoroughly inspecting the terms and conditions linked to the device being examined in the video, which in this case will be the Google Nest Mini. The video aims to serve as a communication device with the main purpose of enhancing users' awareness of introducing such a product into their homes through a technical review of the product. In addition, the analysis in the video also constitutes research data that gives first-hand insight and an understanding of the privacy issues connected to the Google Nest Mini. The desired outcome of the video is to contribute to being a useful part of Relinks research base, and additionally enhance public competence when it comes to technology security and privacy management regarding the Google Nest Mini.

Ultimately, the main goal is to provide accurate and reliable information in order to help individuals and households make informed decisions about the use of SPA devices while ensuring their privacy and security. Additionally, the project seeks to promote a more secure environment for all users of SPA devices. To achieve these objectives, research questions and hypotheses were created.

2.2 Research questions

To provide a clear purpose and objective throughout this project, three research questions were formulated. These questions have contributed to directing the research process to ensure that the report remains relevant and coherent. Furthermore, the research questions aided in providing a structured report and enabling an organised presentation of the research findings.

It has been important to find answers to these questions as the increase in the use of smart technology could potentially expose users to different and significant privacy risks. The following research questions were composed:

RQ1 - What are the key privacy concerns associated with the use of smart technology?

RQ2 - To what extent are users aware of privacy risks associated with smart technology?

RQ3 - What measures can be implemented to enhance users' understanding of privacy risks associated with smart technology?

The research questions all explore different aspects related to privacy risks and concerns associated with the use of smart technology. RQ1 will seek to find the key privacy risks, while RQ2 will explore how aware the users are of these risks and how the awareness affects the concern. Lastly, RQ3 will discuss and propose a potential solution to enhance the users' understanding of privacy risks.

2.3 Hypotheses

Throughout this research, this project has sought to address the veracity of the two hypotheses below. By including clear and verifiable hypotheses, and given the research questions above, the report has gained further purpose and direction. These hypotheses acted as fundamental guidelines, ensuring a focused and evidence-driven research project that can result in valuable conclusions and contributions to the field. The following hypotheses were created:

H1 - Consumers prioritise convenience over privacy when purchasing and using smart technology.

H2 - Users deprioritize or do not care about the terms and conditions.

These hypotheses were chosen because of the group's perception and knowledge within the field. Hypothesis 1 was important to test as it could have significant implications for how companies approach the design and marketing of smart home technology products. Whilst Hypothesis 2 was important to test to map out users' willingness and understanding to engage with the privacy policies and terms and conditions.

3 Project process

The group has used an agile methodology in terms of working iteratively on the project. This methodology has also been applied to ensure continuous development of the project deliverables and on-time delivery based on deadlines from the project provider, the group's internal supervisor and the administration. In doing so, the group has taken inspiration from and used an approach similar to the Scrum framework. The Scrum framework is an agile project management, using iterative and collaborative development (Scrum, n.d.). For this project, the project deliverables have been divided into smaller parts and phases, known as increments in Scrum, with regular submission of these deliverable parts to the supervisors. This has made it possible to receive feedback from the supervisors along with providing an opportunity to improve various increments, hence achieving a better final product.

Additionally, based on requirements from the administration, the group has also produced and delivered preparatory documents such as a pre-project report, status report and project sketch. These documents created a fundament for further preparatory work so that the group could have a starting point for going forward with the project.

3.1 Planning

To ensure that tasks were accomplished within the given time period and to achieve a high success rate, an important part of this project has been the process of planning before going forward with working on the project deliverables.

From the very beginning of the project, the external supervisor provided the group with the freedom to construct the final deliverables within the realm of reasonability, based on the research program he was conducting. Due to this, the group had to develop a detailed plan of the deliverables before the project was scheduled to start. In the planning phase, constant dialogue with the external supervisor had to be held to make sure that the group understood what the supervisor wanted from the group and was in synchrony with respect to what would be required.

The project provider also provided the group with relevant resources during the entire process. This contributed to continuously being on track and guiding the project in the wanted direction. Resources included inspiration from previous literature reviews, interview agreements and interview guides. The external supervisor also assisted in applying to Sikt (Kunnskapssektorens tjenesteleverandør) and decision-making when it came to what the group wanted to collect from participants.

The planning process consisted of preparatory work including creating various types of management documentation. This project has included, among other things, generating a work schedule and a progress plan. Using these types of management documentation contributed to visualising the project timeframe and keeping track of important milestones and deadlines throughout the project.

The progress plan was visualised in a Gantt Chart, a project management tool used for assisting teams in scheduling work around timelines and properly distributing resources (Meardon, n.d). In this project, the Gantt Chart made it possible to divide the components and deliverables into smaller tasks and estimate the time each task would take. In the Gantt Chart, the project tasks were divided into four sections based on the project deliverables. Each section had its own subsections and the tasks were distributed over the duration of the project, with the unit of time being a week. The entirety of the progress plan can be found in Appendix A.

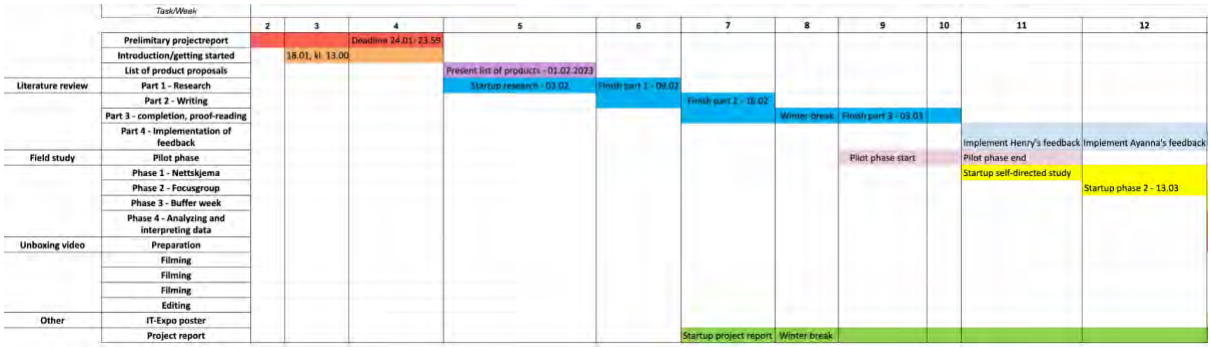


***Figure 2** - The first half of the Gantt Chart*

The work schedule was more in-depth than the Gantt Chart. In the work schedule, the given weeks were divided into days and had more information about what had to be done for each

day of the project. Early in the process, the work schedule was quite general, but eventually, throughout the project it became more detailed. The work schedule was also used by group members as a calendar since it included meeting dates for internal and external supervision, as well as internal group meetings. The work schedule also had internal deadlines and similar to the Gantt Chart it also included important deadlines communicated by the course administrators.

The main tool in the work process was Google Drive. Google Drive allowed everyone to work at the same time, and remotely if preferable. Additionally, each group member could monitor changes in real-time. The ability to have a general overview of each group member's contribution, and the ability to assess progress towards the final deliverable, made it possible to evaluate if the group was on track when it came to deadlines. Everything that was produced in the process (except the results from the Nettskjema survey) was uploaded to the Drive so that it would be easy to find, and accessible for all the group members.

The group had weekly scheduled meetings with both the internal and external supervisors. A few weeks into the project, the external meetings were changed to every other week. During the meetings, the deliverables were discussed and feedback was provided, and all group members alternated responsibility for taking notes. Occasionally, feedback also came in writing via Microsoft Outlook and/or Teams. These were also the channels for communication with the supervisors. The meeting notes were written in the project diary, which also included descriptions of tasks to accomplish.

The project diary has been useful in terms of keeping track of what tasks had been completed and what remained. As the tasks for the project were separated into smaller parts, it assisted in making the distribution of tasks as fast and equitable as possible. Tasks were assigned to each group member based on their individual interests and strengths. Some members had strong language skills, while others had an interest in video editing, so tasks naturally fell to those with the relevant skills. In addition, the project diary made it possible to look back at task distribution to assess whether everyone in the group contributed equally. For every group meeting, the time and date, location, participants and once in a while agendas or important notes from the meetings were logged. Throughout the project, it was important that the

project diary was a low-threshold document with the purpose of documenting the process in an informal way.

4 Literature review

A literature review is a type of research methodology that involves identifying, collecting and synthesising all available literature on a particular research question or topic. To get an overview of areas in which the research is interrelated, an online search was initiated to uncover existing literature that addressed topics related to the problem for this project. The findings from the search formed the literature review in this section.

This section of the report will address different literature and previous research related to SPAs with a specific focus on privacy and awareness. First, an introduction to the search strategy and literature used is described before an overview of privacy risks is considered. Next, this section will look into previous measures that have been taken to enhance users' understanding of terms and conditions. Lastly, the review will summarise the main findings and suggest potential implications for further practice and research.

4.1 Research strategy

The literature review was conducted using a systematic search strategy to ensure a thorough and comprehensive analysis. The first step was to identify the research questions, hypotheses and relevant keywords. The keywords included “Smart Home Personal Assistant”, “privacy”, “digital privacy literacy” and “user awareness”. This helped to clarify the focus of the research and streamline the search process. Various databases and search engines were then used to gather peer-reviewed articles, including Oria, Google Scholar, ScienceDirect, SpringerLink, Scopus and IEEE Xplore. This methodical search strategy substantially enhanced the selection of relevant articles by providing narrowed down search results. The inclusion of applicable resources enhanced the overall quality and validity of the research findings.

In addition to peer-reviewed articles, product reviews were retrieved from Norwegian electronic stores like Elkjøp and Power. This helped to provide a diverse range of sources and perspectives on the topic.
By using a systematic search strategy and a variety of sources, the literature review was able to provide a comprehensive overview of the topic. The research findings were analysed and

synthesised to answer the research questions and provide insights into the privacy policies and security measures of smart speakers like Amazon Echo and Google Nest Mini.

4.1 A synopsis of privacy risks related to Smart Home Personal Assistants

As previously stated in the introduction, the increasing popularity of smart technologies such as SPAs raises several questions regarding potential privacy risks. Particularly in regard to the collection, access and external sharing of data (Valero et al., 2023, p. 12). In this section, a synopsis of these risks will be discussed.

Anthropomorphising, also known as personification, is when nonhuman objects have or get human-like traits and characteristics (Nass & Moon, 2000, p. 82). One way of personifying an object is through the use of speech, which is what the SPAs use as their main form of communication (Lopatovska & Williams, 2018, p. 265). It has been discovered that users engage in conversational politeness with these products, saying “Please” and “Thank you” (Lopatovska & Williams, 2018, p. 265). As suggested by Hurel and Couldrys in their 2022 article, personifying the SPAs can lead the users to trust them more, making users more susceptible to sharing information with the product (p. 5194). Having this lack of vigilance in the interaction between a user and a data-collecting computer as an integrated part of everyday life is prone to several privacy risks that users often are unaware of (Pridmore & Mols, 2020, p. 10).

SPA products will activate and start recording or listening whenever a wake word is said. In order for the product to listen for a wake word, it must remain activated at all times in a constant listening state. Companies providing SPAs, such as Google, Amazon, Microsoft and Apple, all claim that their devices are not recording the conversation until after the wake word has been said. However, this has been disproven due to different factors, such as malfunction and mishearing (Hoy, 2018, p. 85). The “always-on” state can pose a threat, not only to the user's privacy but also to the security of their sensitive information.

If the device mishears the wake word, or the user accidentally says the word or something similar to it, the device might start to record and save the data being recorded without the user's full consent. (Edu et al., 2020, p. 8). One incident where this occurred was regarding the SPA product Amazon Alexa in 2018. A private conversation between a couple from Portland, USA was recorded and sent to a random contact on their contact list. The customer service representative from Amazon claimed that the device misheard the wake word, as well as all the commands required to complete the action (Wolfson, 2018).

The voice assistants have no form of authentication other than that the user needs to know the wake words (Edu et al., 2020, p. 8). This implies that the device will listen to anyone who is able to provide the wake word and give commands. Because SPAs cannot check if a user is in close physical proximity, voice commands given by synthesised speech or through channels like tv, radio and songs are also able to trigger commands (Edu et al., 2020, pp. 8-9). This implies that the devices will read out “calendar contents, emails, and other highly personal information” to anyone who knows the wake word (Hoy, 2018, p. 84). This weak authentication also allows for possible hackers to interfere, causing elaborate security and privacy attacks (Edu et al., 2020, pp. 8-9).

To shop online using SPAs, the only default setting required is voice access to the device. This makes it easy for household members to make purchases on the logged-in account (Hoy, 2018, p. 85). There have been multiple incidents where children have been able to make purchases through the SPA using their parents' accounts. One example is a 6-year-old girl who ordered herself a dollhouse and sugar cookies on her mother's Amazon account, using the Amazon Dot (Liptak, 2017). When this case was broadcasted on the news, the reporter said the words “Alexa, order me a dollhouse” which apparently activated hundreds of Alexa-integrated devices in people's homes (Hoy, 2018, p. 85). This proves that an attacker with malicious intent could broadcast a sentence to attack multiple SPAs around the world, at once (Edu et al., 2020, p. 9).

The Google Assistant has a functionality called “Voice Match”, where the assistant can remember up to six different voices and give personalised responses (Google, n.d.-b). The only default authentication to access personal data is a biometric modality. In this case that is the user’s voice, where the authentication process can have faults (Meng et al., 2020, p.1).

This “Voice Match” uses data analysis known as voice printing, and is one of the newest biometric authentication technologies (Zhu et al., 2022, p. 114.016). This technology has been proven to be vulnerable to backdoor attacks, meaning attackers get unauthorised access to the system through a concealed or undetected entry point (Zhu et al., 2022, p. 114016). Google themselves admit that with the “Voice Match” function, it is possible for users with similar voices to access the other person's personal data (Google, n.d.-b).

Privacy policies are in place to inform users of what personal data is being collected, as well as how the data will be used. Users have to consent to the policy in order to use the product or system. Even though privacy policies are in place to educate the user and address these topics, they are typically lengthy documents with difficult writing. Internet users have been found to avoid reading privacy policies because they perceive them to be too long, boring and overly legalistic, and thereby difficult to understand (Milne & Culnan, 2004, p. 23). Readers would need at least a college-level education in order to understand the contents of privacy policies, because of their “complex words and sentence structures” (Anton et al., 2004, p. 37; Pollach, 2007, p. 104).

Jensen and Potts (2004) provided a comprehensive analysis of the many usability features of privacy policies, concluding with the fact that there were serious issues with policies in regard to structure and content (p. 478). They also claim that too much responsibility is placed on the end users because of the privacy policies being presented using difficult language (Jensen & Potts, 2004, p. 478). It can be speculated that the length of the privacy policy and instructions is intentional in order to discourage people from reading and understanding the policies. Some argue that these policies are being “inappropriately leveraged” (Zeng et al., 2020, p. 782). Instead of establishing trust between the user and the system, this results in increasing the users' fears regarding privacy (Pollach, 2007, p. 103).

SPAs have many built-in features (often referred to as “skills”). However, these features often include third-party skills to expand their interface (Hoy, 2018, p. 83). There are in fact over 50 000 skills developed by third parties. A survey conducted by Major et al. in 2021 found that users of Amazon Alexa are often confused about which skills belong to the device itself, and which are operated by third parties (2021, p. 1). Because the SPA devices let the user interact with the functions using voice control, differentiating between the built-in and

third-party skills can be difficult, especially when it is the same voice being used for all functionalities (Major et a., 2021, p. 2). Third-party skills with malicious intent could retrieve sensitive data from the users by mimicking other functions. An example of this is using a name that resembles the real function, such as creating a skill called “Capital Won”, to imitate the banking skill “Capital One” (Major et al., 2021, p. 7).
Although users have the option of sharing data, they have little influence on what the parties do with the data. The SPA ecosystem can develop additional information about the user from the consensually collected data that the user may not have intentionally provided (Edu et al., 2020, p. 10). Examples of this include behavioural habits, such as sleeping patterns (Edu et al., 2020, p. 7). In addition, there is always a possibility for personal data to be stolen, leaked or hacked, regardless of how thorough the SPA-developing companies are (Hoy, 2018, p. 85).

4.2 Previous research on user awareness and concern

With a growing number of smart devices being introduced in homes (Laricchia, 2022), the proportion of information being collected about users has escalated. For that reason, it is common for users to have concerns regarding their privacy (Barbosa et al., 2019, p.212). A survey by Google showed that nine out of ten Norwegians are concerned about their privacy online and that almost half of them neither know nor believe that they have the opportunity to influence what data is collected (Schwebs, 2022). It is therefore important to uncover and address these concerns in order to increase user awareness.

When it comes to personal data privacy, many users express little or no concern as they have “nothing to hide” or that their data is “not interesting” (Lau et al. 2018, p.11). The research (2018) implied that new privacy-conscious users, despite the statements above, did not trust the companies and were increasingly more concerned with their privacy compared to old users. Contradictory to not expressing any concern, Chhetri & Motti (2022, p. 2085-2086), through semi-structured interviews, identified five categories of privacy concerns related to smart home devices among users. The sections below will describe these categories and related research.

For the first category, named information collection, a major concern was the gathering of video and audio recordings. This can be directly related to Smart Home Personal Assistants

with integrated microphones and cameras as one of the risks of having one is that they appear to always be listening, as mentioned in the previous section. The participants also felt particularly uncomfortable about having conversations related to personal information in the presence of a smart home device (Chhetri & Motti 2022, p. 2085). In the same way, Günay et al. (2023) found that users were concerned about being spied on and recorded through a camera and/or microphone when it comes to having home-virtual assistants. Sharing the same results, both studies indicate that this is a common concern among people with Smart Home Personal Assistants.

Within the second category, which is information processing, concern revolved around the misuse of data, both accidental and intentional, unauthorised access to data and leakage or hacking of data. The participants were particularly concerned about the device itself being hacked and controlled, especially when the device is part of an integrated system, leading to the hacker gaining access to control multiple devices (Chhetri & Motti 2022, p. 2085). This is similar to a study (2023) by Lipford & Tabassum who also found that participants were worried about their smart devices being hacked. Both studies reference hacking as a concern for some users.

When it comes to information distribution, which is the third category, most of the concern was directed at the companies that manufacture smart home devices and collect the data. Not to mention the companies selling that information further which results in users being targeted through advertisements based on their data. This is related to the concern of not knowing what data is being collected (Chhetri & Motti 2022, p. 2085) and is also known as third-party sharing. When users are not aware of what data is being collected about them, the consequences of consenting to data distribution are rarely given thought. That is until potential incidents occur due to unawareness, hence the importance of communicating terms and conditions in a manner that is understandable for the user.

Concerns about privacy invasion, the penultimate category, were similar to the concern regarding data collection without permission. Participants in the study (2022) by Chettri & Motti were particularly worried about the data collected being used against them. As a consequence, many of the participants muted or turned off their smart devices before discussing topics such as political standpoints, religion or secrets (p. 2086). In contrast,

Vieira et al. (2022) found that participants were not concerned about the issue of privacy (p.10). As a matter of fact, the participants were open to certain minor or limited data breaches in exchange for convenience.

Within the last and fifth category, policy and awareness, a study by Zheng et al. (2018) indicated that a majority of users lack awareness regarding potential privacy risks associated with the usage of smart devices. This corresponds with the results in a recent study from 2022 by Chhetri & Motti where participants noted that there was a lack of policies to control the privacy on smart home devices, as well as a lack of awareness among users on data collection and privacy (p. 2086). The same applies to a study from 2011, where Park found that 40% lack comprehension of fundamental data procedures and many do not have familiarity with basic technical terms (p.223).

Park's (2011) and Chhetri & Motti's (2022) findings indicate that even when the user is reading the terms and conditions, the user is not particularly aware of what they are consenting to. Moreover, a lack of online privacy literacy can lead to individuals not being able to protect their privacy online despite being concerned about it Sindermann et al. (2021, p.2). A measure to enhance user understanding is to increase individuals' online privacy literacy as privacy concerns are highly controlled by an individual's knowledge (Bartsch & Dienlin, 2016, p. 153).

4.2.1 User experience, feedback and reviews

Direct feedback and personal opinions offer insight into primary users' perceptions and experiences with the product. Therefore, this section will supplement the literature above and delve into reviews with additional sources to gain a deeper understanding of user experiences and their awareness when it comes to privacy.

In a product review from Elkjøp.no a user said that despite their awareness of Google's ability to monitor their home and record everything being said, they were still highly satisfied with the device and had multiple of them (Espen123, 2022). Similar to (Lau et al. 2018, p.11) who found that users were not particularly concerned as they seemed to have “nothing to hide”, this product review can suggest that this may apply to other SPA users as well.

In an interview with NRK, Norsk Rikskringkasting AS, journalists claim that they have experienced talking about something in the presence of a smart device that has later shown up as a Google Advertisement. Through user agreements to collect data, Google sells this to other companies that can create targeted advertisements based on personal preferences (Schwebs, 2022). This also makes a reference to the aforementioned literature results, regarding both the privacy risks and the user concern, with the device “always listening” or that it can “wake up” even though it is not directly spoken to. As a consequence of these concerning possibilities, additional data can be unknowingly retrieved from the users, without them being particularly aware of when. This highlights the value of providing users with readable and comprehensive amounts of information about terms and conditions whenever introducing a new smart device in their home.

4.3 Previous measures that have been taken to enhance users' understanding of privacy risks

To increase user adoption of SPAs, as well as enhance the user’s understanding, companies are taking measures to improve transparency about what data is being collected, how it is utilised, and how the users can manage their privacy settings. However, a lack of trust and transparency from the companies providing SPAs remains a key barrier to adoption among non-users (Lau et al., 2018, p.18-19). A study by Poticello et al. (2021, p. 482) found that the majority of the participants emphasised the importance of transparency for their perception of security. By providing transparency, companies can reduce the risk of users making wrongful decisions when they are interacting with SPAs.

Voice authentication is being used as a measure to improve authentication security. This type of authentication is capable of distinguishing between individuals based on their speech patterns. Google Assistant is one smart speaker that utilises this feature (Edu et al., 2020, p. 19). As explained on the “Google Assistant Help” webpage, it uses short clips of the user’s voice in order to form a distinctive voice model (Google, n.d.-b). However, Edu et al. (2020, p. 19) note that this function is not enabled by default and the users have to individually discover its existence.

Another measure being used to mitigate against weak authentication is termed a presence-based access control system. This allows the Smart Home Personal Assistant to verify whether the consumer is actually nearby before it accepts voice commands. It has been suggested that this system uses information from the Wi-Fi router's channel states to detect if there is any human motion. Implementation of this system does not introduce any additional cost as it uses the already existing home Wi-Fi (Edu et al., 2020, p. 19-20).

It is important for users to be able to distinguish between built-in features and third-party skills when using SPA devices, both for privacy and security reasons, as noted by Major et al., (2021, p. 2). However, Amazon's current approach to differentiate between these two is not entirely effective. Amazon has created certain safeguards that should help the user to identify some of the native functions, such as the light flashing orange on top of the Amazon Echo device when setting it up. The efficacy of this method remains unclear, as explained by Major et al. (2021).

The animated video by VIRT-EU (2020, 1:22) emphasises the need for companies to carefully select external partners and investors who align with their values and ethics to maintain their reputation and social responsibility. It emphasises the importance of prioritising long-term interests over short-term gains in business decision-making. The video also explains the importance of taking measures to ensure the care of the users' information if a malicious hacker should conduct an attack on an external partner.

4.4 Findings and Discussion for the literature review

4.4.1 Summary of Findings from the literature review

Multiple studies have investigated the privacy risks posed by the use of Smart Home Personal Assistants. It was found that the SPA's personalisation increases user trust, which may cause users to ignore/forget the numerous privacy dangers. SPAs also have a weak authentication process, making it easy for unauthorised people to control the device. Additionally, privacy policies can be quite challenging for users to understand, leaving them with a lack of knowledge about what they are consenting to, as well as what the collected data is being used for. Several sources have reported trouble with the presentation of the privacy policy and

terms and conditions as well as how this is used to mislead users into approving them in order to benefit the product owner.

When it comes to the consumers, previous research, product reviews and user experiences with Google Assistant have proven that there is reported concern when it comes to privacy, especially with regards to the devices ‘always listening’, data collection, distribution and processing, policy and user awareness. This emphasises the importance of increased consumer awareness when it comes to taking a smart product into use.

Studies also show that there have been several incidents with the SPAs being vulnerable to hacking and that some of the users are not aware of the data that is being collected about them. These findings are of great importance as further research can focus on addressing consumers' awareness with regard to reading terms and conditions.

Various measures have been taken to enhance users' understanding of privacy risks with Smart Home Personal Assistants. The main issue regarding privacy risks is the lack of transparency on what is collected and how the data is being utilised by the companies that are providing the devices. However, there are a limited amount of resources that discuss this topic. This demonstrates a concerning gap in present knowledge. Therefore, this project is aiming to identify measures to enhance user understanding, hence RQ3.

4.4.2 Discussion of practise for the literature review

The first draft of the literature review was written too broadly for the project research questions. For that reason, the review was restructured and rewritten based on internal and external feedback. While the first draft included information about the Google Nest Mini, its functionalities, impact on daily life, purchasing factors, privacy concerns and comparison to other SPAs, the second draft shifted its focus to primary privacy. In retrospect, the second draft of the project became more focused, providing a clearer direction for further research. It also helped establish connections with larger parts of the project, which was not as evident in the first draft.

4.4.3 Implications for practice and future research

As a result of this literature review, it was found that there are very few studies that research privacy and whether consumers read the terms and conditions prior to using a SPA. It can be assumed that a majority of consumers are not aware of what they are accepting, as evidence from this literature review demonstrated unawareness among consumers. Therefore, a further approach would be to study whether consumers read the terms and conditions before using a SPA product. Another important direction for future research would be to study how to make consumers more aware of what data they allow the products to collect.

4.5 Conclusion for the literature review

This literature review provided an in-depth review of the privacy risks as well as concerns related to smart home devices, more specifically, SPAs. The findings indicate that despite the fact that companies claim to value consumers' privacy and that it should be easy for the consumer to control what is shared, various consumers have reported that this is not true. The goal for the research in this project therefore became to investigate whether this is the case for more consumers, specifically in Norway, through a focus group interview and an online survey. Moreover, the research for this project included finding out how to simplify the process of making the user more aware of what is being collected and what they accept. This was accomplished by creating an informative unboxing video.

5 Methodology

The overall approach used for this research has been using qualitative research methods. In this project, this methodological approach has included data collection through a digital survey and a focus group interview. The data was collected to see how users feel towards having Smart Home Personal Assistants in the home, as well as to understand their awareness when it comes to data collection. Further, to determine whether the privacy conditions and terms of use are easy to comprehend and if the instructions are informative enough to set up the product, an unboxing video was made.

5.1 Data collection methods

Data collection methods used in this project have included a digital survey through the Norwegian website Nettskjema and a focus group interview supplemented with online research. Nettskjema was used due to its functionalities such as streamlining the process, providing customization options, and automatically collecting and organising data. Additionally, Nettskjema is a secure platform that uses encryption and user authentication to protect sensitive information (Gulbrandsen, 2021).

5.1.2 Online survey

One of the most popular data collection sources is online surveys. This type of data collection contributes to giving organisations, groups or individuals insights and feedback on a specific product or service (Bhat, n.d.). Based on that, an online survey was initiated to get an overview of people's awareness and attitudes towards SPAs, with a special focus on the Google Nest mini.

The survey collected the age group and gender of the respondents as personal information. An application was therefore made to Sikt to ensure that the data was collected in a safe and secure manner to protect the respondents' privacy. Sikt (previously known as NSD) is an administrative body that offers privacy services mainly to educational or scientific institutions (Sikt, n.d). Every educational or science project that is going to process personal data is required to send an application to Sikt to ensure integrity and privacy (Universitetet i

Oslo, 2022). Once the application was approved, the data collection for this project could proceed as planned.

Respondents were mostly recruited through social media in order to reach the ideal target group. Early in the process, Facebook groups for IoT, smart homes, and Google Home/Assistant users in Norway were discovered, which appeared to be a suitable place to search for respondents. For that reason, the survey was published in several of these groups, making it reach its primary audience fast and generate responses quickly. In view of the fact that the survey was published in Norwegian Facebook groups, it seemed most natural to have the questions in Norwegian. In addition, Discord, which is a communication platform, was used to get in touch with fellow students that fulfilled the inclusion criteria and to get increased age diversity in the responses. The online survey was open for answers for one week.

Criteria for inclusion in the study included 18+ years of age, due to Vergemålsloven, which states that an individual can only consent for themselves after the age of 18 (Datatilsynet, 2022) and that the respondent owns a Google Nest Mini. The reasoning for this device being chosen was based on the fact that it makes it possible to define the scope of the project. Additionally, this device will later be used for a video analysis focusing on privacy, security, interoperability and usability, similar to the key aspects of the survey. The chosen product also has an integrated Google Assistant and is a popular, much used device (Power, 2023).

Due to requirements set by Personvernlovverket, consent had to be documented. In this project, consent for participation was collected through a tick box at the very top of the survey, where a document containing terms and conditions was linked. The document containing terms and conditions for participation can be found in Appendix B.

The goal of the survey was to gather qualitative data about users owning a product with an integrated Google Assistant, especially with regard to their attitudes towards SPAs when it comes to privacy and awareness. In order to establish a broad overview, respondents were presented with multiple choice questions, with pre-filled alternatives to make it user-friendly in terms of time and providing simplicity when it came to answering the questions.

In addition to the multiple-choice questions, the respondents also had the opportunity to provide more in-depth answers to some of the questions. This facilitated increased insight into the users' personal thoughts. Furthermore, it also contributed to identifying gaps that potentially could be addressed in the focus group interview.

5.1.3 Focus group

A focus group is a structured group interview where the purpose is to collect qualitative data from a small group of people (Lerdal & Karlsson, 2009; Konsmo, n.d.). Focus groups are used to gather data through group interaction, such as discussion and conversation, sharing opinions and experiences towards a certain topic (Sundstrøm, 2019). This method was chosen due to the fact that it provides the opportunity to go more in-depth than the online survey. The ideal outcome of using this method would be to get an additional understanding of users' attitudes when it comes to using Google Assistant integrated into a smart home product. Additionally, it also allowed the researcher to gain insight into the participant's thoughts and opinions towards SPAs and map the users' habits.

Participants for the focus group were recruited on social media through Facebook and Discord. Some acquaintances who were known to have the product were also reached out to in order to gather a group. To be included, participants had to own at least one home device with an integrated Google Assistant as well as fulfilling the 18+ age criteria. The only difference in inclusion criteria was that to participate in the survey the respondents needed to specifically own a Google Nest Mini, while the focus group participants only needed to own a home product with a Google Assistant.

The interview was structured to follow a script in order to get an overview of the topics that were to be discussed. With the intention that the focus group would complement the survey, the script included many of the same questions, reformulated to be suitable for an informal verbal setting, in order to stay on-topic while still getting the desired insight. To foster a sense of ease and safety in expressing their opinions, participants were provided with refreshments after they arrived. The script was divided into three phases, where phase one consisted of informal conversation, general information and formalities. Phase two included opening

questions and transition questions and phase three had the key questions and a main question followed by a closing question. The entire script can be found in Appendix C.

The interview was led by a moderator and before starting, the participants gave written consent. Consent forms were given to the participants to read through and get an understanding of what they were consenting to before signing the paper. Each of the participants had one person assigned to transcribe their statements, given the fact that the application to Sikt included having no recordings or videos. To be able to distinguish between the answers and to ensure anonymity the participants were randomly assigned the name P followed by a number, for instance P4. In the beginning of the interview questions were asked specifically to the individuals. After a few minutes, however, a natural discussion developed between the participants with everyone actively participating.

5.2 Unboxing video

As a measure to enhance users' understanding of privacy risks associated with Google Nest mini, a video recorded product analysis was made of the product, referred to as "Unboxing video". This section of the report will describe the methods applied and the approaches used for preparing and filming the unboxing video.

5.2.1 The walkthrough method

The walkthrough method is a way of engaging directly with the product and examining its technological mechanisms. This method is also a way to get an understanding of how the product guides users and shapes their experiences. Doing step-by-step observation and documentation is at the core of the walkthrough method. The method aims to reveal hidden features and do a critical analysis of the product being examined (Light et al., 2018, p. 882). By utilising the walkthrough method in the video, the viewer can understand and follow the content step by step, enhancing their learning experience and enabling them to effectively grasp the concepts that are presented.

Based on the premise that the project aims to enhance users understanding of privacy risks, the unboxing video became the result of a product analysis, utilising the walkthrough method, and a research of Google's terms and conditions for the Google Nest Mini with special focus on informing users about the consensual terms and conditions. The video is a result of employing this method and is a contribution to Relinks aims to strengthen users knowledge and awareness when it comes to introducing a Google Nest mini in their home.

5.2.2 Additional methods and techniques employed for the unboxing video

In preparation for the filming, a considerable amount of research was conducted in order to create a video that could be as informative and comprehensive as possible to a viewer. This included looking at similar videos, such as the ethical unboxing series by VIRT-EU on Youtube, and studying the structure and wording of these. Additionally, inspiration also included studying angles and lighting, to achieve the desired outcome, prior to filming. The insight gleaned from similar videos was, together with a study of Google's policies, focused on privacy and terms of use, and was gathered in a file to keep track of the most essential aspects, both when it came to filming and informing the user about the privacy policy. The file was further used to form a script for the video and as a starting point for filming. The video script can be found in Appendix D.

Two Canon cameras were used with the purpose of filming the unboxing from two different angles, one from above (bird’s-eye view) and one with a side view. A ring light was used to ensure good lighting in the video. To assure good audio quality when recording the sound made by the Google Nest Mini, a small microphone was used. After the footage was recorded, the video was edited in CapCut. Afterwards, the audio was added along with subtitles to ensure inclusivity and accessibility to potential users that are hearing impaired.

The filming technique used for the video was A-roll and B-roll. A-roll was the main footage and was shot from above, while B-roll was shot from the side and used as supplementary footage. Using A- and B-roll combined contributes to keeping the audience engaged (Roe, n.d). In addition, the B-roll provides more flexibility in the editing process and creates transitions between shots.

The location for the filming was initially set to be on campus. However, due to an Eduroam connectivity issue that occurred in the middle of filming, the location had to be moved to a place with more accessible Wi-Fi. It was decided that the whole unboxing video had to be reshot, as it was preferable to have all the clips with the same angles, lighting and set-up. After this problem was solved, the filming proceeded as planned as the change of location did not lead to other issues than a short delay. The first day of filming was therefore used as a test day in order to check the lighting, setup and video quality.

For the video, the Google Nest Mini was reviewed based on four main points: privacy, security, interoperability and usability. The video consists of an unboxing of the device, as well as a short introduction to how the device can be set up. The main findings from the terms and conditions are communicated before the video ends by covering some things that are important to keep in mind when dealing with SPAs, especially this particular device.

5.3 Reliability and validity

5.3.1 Pilot testing

Before launching the survey and conducting the focus group interview, a phase of pilot testing was initiated. This provided the opportunity to test the phrasing of questions and determine how long both the online survey and focus group would last (Schade, 2015). Furthermore, to ensure reliability in the tool used for the survey, Nettskjema, pilot testing was conducted to give an indication as to whether this was suitable to use for the online survey or not. Pilot testing was also important to develop an efficient and successful user survey and focus group interview. By conducting this type of testing, potential issues and necessary adjustments could be discovered before moving forward.

The participants for the pilot were recruited through acquaintances and other students at OsloMet. This is a method called street intercept sampling and is essentially investigating the user about an experience, which in this case is how they experienced the survey (Kuhn, 2018). There were no criteria for participation in the pilot other than that the participants had to be over the age of 18.

The pilot tests were carried out on individuals who did not own a Google Nest Mini. This was due to the goal of the pilot being to find out their options and thoughts regarding the survey, rather than finding answers to the questions. Ideally, the results would find improvements to make on the survey in regard to wording and the length of the test. Because of this, the answers to the questions on the survey were not relevant as the participants did not own the product. Therefore, the results from the questionnaire are not included. As the testing was done using street intercept sampling, finding participants for the piloting was not an issue, as there were not any specific requirements for the participants.

5.3.1.1 Results from the pilot testing and improvements

Results from the pilot testing indicated the need for some adjustments to the questions for the focus group. Ideally, the questions formed for the digital survey would also be used in the focus group interview. Based on feedback from the participants in the focus group pilot, the questions were reformulated to be more suitable for an oral conversation. In addition, the participants should have been given the opportunity to briefly think before being presented with answer options as the survey suggests.

Another learning outcome from the pilot was that some of the questions provided an opportunity to ask follow-up questions and therefore the chance to gather additional information from the participants. Given the feeling that the pilot went a little too fast, taking approximately 10 minutes, the response time could be longer. This could have been due to the participants not owning the actual product and therefore not being able to provide supplementary answers.

For the digital pilot survey, a few key insights were gained. Firstly, the pilot included a question asking the respondents if the Google Nest Mini was part of an integrated system in their house, or if it was stand-alone. The pilot found that these terms could be confusing for some, and should therefore be further explained. Further, many of the questions were only possible to answer using checkboxes. The second insight is that it was found that a text field for these questions would be appreciated so that anyone who wanted to could further explain. Lastly, results from the pilot showed that some of the questions could have benefited from

rephrasing to make them more easily understandable. The feedback from the pilot tests was implemented to improve the survey before further data collection.

5.4 Data analysis method

The data collected from the focus group interview along with the online survey consisted of both numerical and textual data. As a majority of the data consisted of text, the research has employed a qualitative text analysis complemented with quantitative information from surveys where applicable. This can be referred to as a mixed-methods analysis. Qualitative text analysis is one of several approaches used to analyse texts to try to understand their meaning (Mckee, 2001) and has been used in this project to get a deeper understanding of the textual answers from the online survey along with the insight gleaned from the focus group interview.

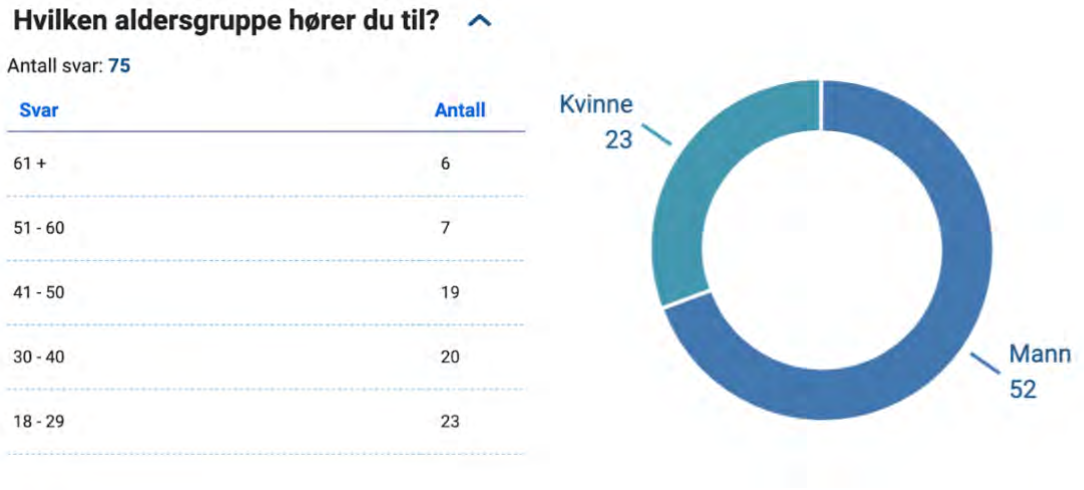
To visualise and increase readability for some of the focus group results, overview tables have been used. In text analysis, overview tables sort the participants' responses based on categories or sociodemographic characteristics (Kuckartz, 2014). In this project, overview tables have contributed to helping identify patterns among participants and get an overview of some of the topics discussed in the focus group.

6 Results

6.1 Online survey

The number of respondents from the online survey exceeded the initial expectations. The expected number of respondents was around 15 - 20 respondents, and when the survey was closed for answers a week later, it had collected 80 responses.

Among the respondents, one individual did not provide consent for the survey's terms and conditions. Additionally, four participants did not own the necessary device (Google Nest Mini) required to complete the remaining portions of the survey. Hence why five of the respondents only answered the two first questions. This brings the total down to 75 respondents who completed the whole survey. The majority of respondents belonged to the age group 18-29. Male respondents accounted for 69.3% of the total responses, while female respondents comprised 30.7%, which is equivalent to 52 male and 23 female. None of the respondents identified as non-binary or declined to disclose their gender.



Hvilken aldersgruppe hører du til?

Antall svar: **75**

Svar	Antall
61 +	6
51 - 60	7
41 - 50	19
30 - 40	20
18 - 29	23

***Figure 3** – Results from the question: Which age group are you? (Left)*

***Figure 4** - Results from the question: Gender? (Right)*

Results from the survey indicate that 89.3% of the respondents use other smart technologies, in addition to the Google Nest Mini, in their everyday life at home. This is equivalent to 67 out of the 75 respondents. Only 10% of the respondents stated that they do not use other smart technologies.

When asked if their Google Nest Mini is part of an integrated system or if the device is a stand-alone, the majority of the respondents (76%) answered that their Google Nest Mini is part of an integrated system. This means that a minority of respondents use their devices without connecting them to anything else in their house.

Results from the survey show that the Google Nest Mini is mostly being used to listen to music, radio or podcasts. A great portion of the respondents (81.3%) also used the device to control other devices such as light bulbs, TVs or other Google devices. This correlates with most of the respondents claiming their Google Nest Mini is part of an integrated system.

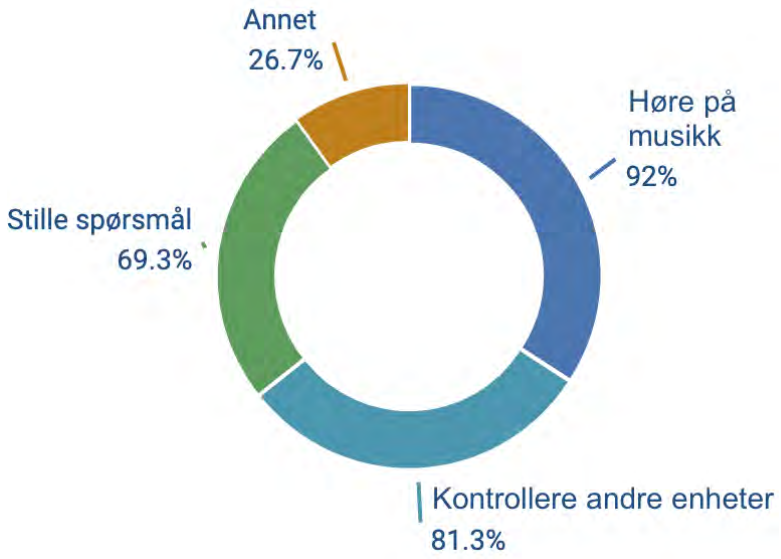


***Figure 5** - Results from the question: What do you use your Google Nest for?*

The respondents had on average more than two Google Nest Mini devices in their household. The results of where the Google Nest Mini device is being placed in the respondent's home show that the device is commonly placed in the living room. Nearly an equal portion of devices are being placed in the bedroom (60%) or in the kitchen (56%).

When asked if their everyday life has changed or improved since taking the Google Nest Mini into use, half of the respondents answered partially. While 8 said no, 12 of the respondents answered yes, to a large extent. The rest of the respondents (22%) stayed neutral.

51 of the 75 respondents who completed the survey provided an in-depth/textual answer to this question. These answers showed a generally positive attitude towards the product, while some expressed their issues and concerns regarding the use of this technology.

Many responders used the text field to specify how and why the product had simplified their life. Common answers explained how the product made it easy to control music, lights and security cameras, as well as set timers and reminders. One respondent explained that they no longer use the light switches in their house, and the lights are now only controlled by voice commands. The product was also heavily used to check the weather and news, in addition to getting answers to questions.

Another popular use of the product was to implement routines. Respondents stated that the automated routines contributed to a pleasant morning routine and saved them time by, for instance, eliminating the need to manually turn on or off several lights. Multiple respondents reported saving electricity by implementing automatic routines to, for example, turn off the lights at a certain time. A respondent explained that the use of automatic routines made them feel safer when they were not home, as the outdoor lights would automatically turn on at nighttime. One wrote that they mainly used the product for automated routines, in addition to controlling music. It was elaborated by a user that they use Google Nest Mini for their daily routines “[...] which gives me an easier everyday life, in that complex functions in the home start easily with simple commands”.

Results from the survey also discovered that many users liked the product because they could control the interconnected devices through voice commands, so they did not have to get up. Some users revealed that they only use the product for certain purposes, which were controlling music or getting the news, and nothing else. It was also mentioned that some respondents liked to use the product as they found it fun. One respondent explained that they found the product “mostly fun” and “quite useful”. Another respondent wrote that they use the product to talk with their children in their bedrooms. The fact that information was so easily accessible for the users was another popular reason for how it had improved the users lives.

However, while most respondents had a positive attitude towards the product, some of the respondents reported that they were not a fan of the product. It was voiced that the product caused frustration as it often lags. One of the respondents said that “The technology is far too bad to have improved anything”. It was stated that by taking the product in use it "Saves time when it understands us. Takes longer when it doesn't understand us". Another respondent reported that they do not use the product much, as it often responds to questions without being asked. A different respondent went on to express how they had not taken the product into use due to “[...] concerns about access to home automation, monitoring, etc.[...]”. Yet another user brought up that they rarely use the product as pressing a switch or pressing a button on the phone generally is faster than using the Google Assistant.

The results from the survey indicate that when it comes to the respondents’ thoughts regarding having smart technologies in their homes, 45,3% of the respondents claim it has enhanced the quality of their lives. This majority is followed closely by 36% of the respondents answering that smart technology is helpful but bothers them sometimes. 29,3% of the respondents answered that they do not feel like they are using it to its full potential, while 10,7% answered they were neutral. The remaining respondents answered that they use it sometimes but do not trust it (5.3%), and lastly that they have other thoughts than the listed alternatives (4%).

Only three respondents supplied an in-depth answer related to this question. Two respondents explained that the quality of life has not been improved. The first of these respondents answered that one's life cannot be improved through the use of smart gadgets, while the other one stated that while it has not improved their quality of life, they do find it interesting and exciting to use. The last respondent had multiple suggestions for functions that could be implemented in order to improve their life.

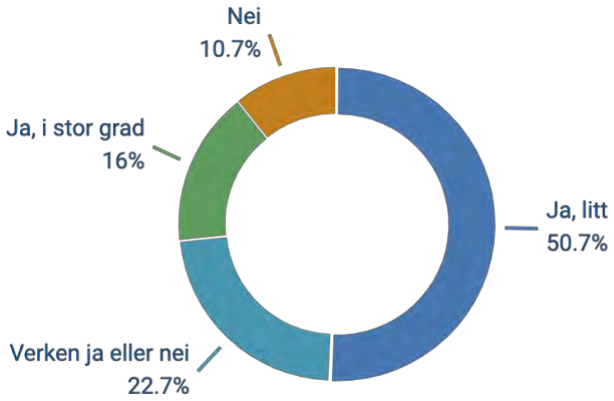


***Figure 6** - Results from the question: Has your everyday life changed or improved since using your Google Nest?*

When it comes to what the respondents consider as important when purchasing a new smart home product, the results show that a majority, almost 100%, consider functionality as an important factor. This was closely followed by the fact that the device can be connected to other devices or things in their home. 85% claimed that as an important factor. The answers were then equally divided between safety and look or design. Then 12% of the respondents selected other peoples' opinions and recommendations as an important factor, while 8% said brand and 4% chose the option "other". The device being trendy was the least important factor according to the respondents.

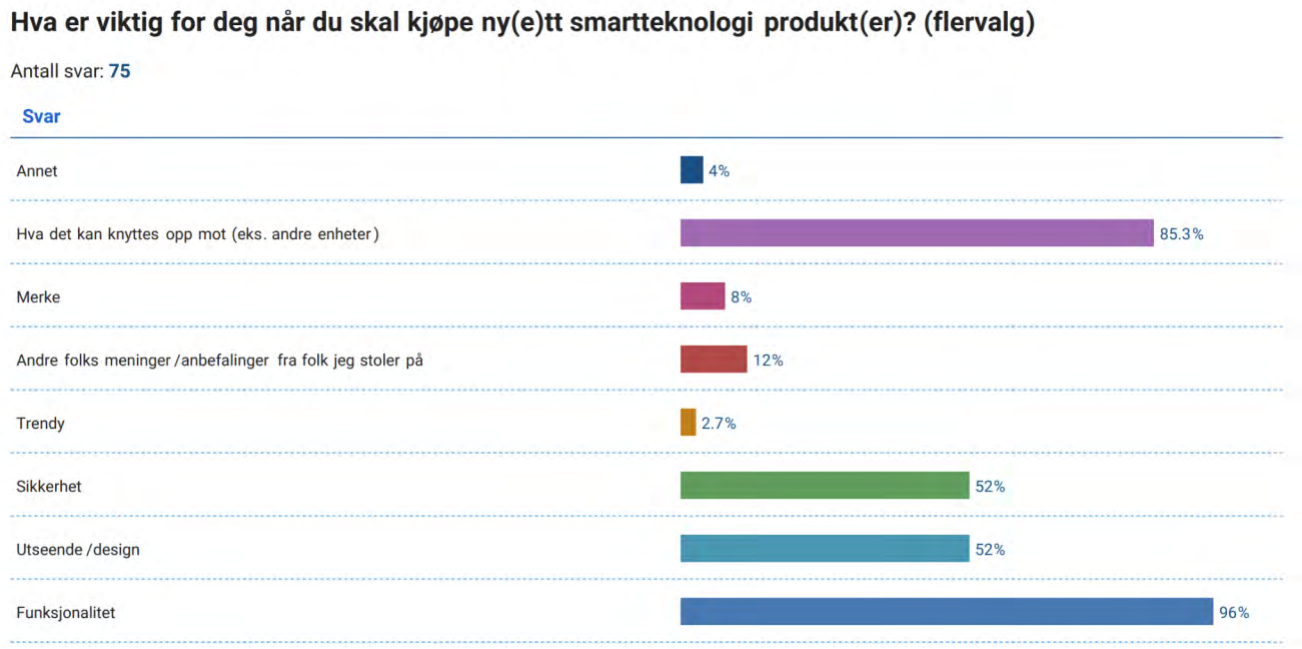


Figure 7 *- Results from the question: What is most important to you when you are to buy new smart technology products?*

The results from the survey concludes with the fact that functionality is something the respondents also valued highly when they bought their Google Nest Mini, with 65% of the respondents choosing this metric as their answer. 54% of the respondents were more intrigued by what the Google Nest Mini could be connected with/to. The third biggest category chosen was that the respondents had another Google device from before, and therefore bought the Google Nest. Next came the look and the design of the product and the quality. How safe the device is, was not a factor that was highly considered by our respondents (6.7%). Neither were other people's opinions or if the product is trendy, these categories having 4% each.

Statistics Norway reported in 2021 that 43,4 percent of men and women between the ages 16-74 had read the privacy policy before giving access to personal information. According to the results collected from the digital survey sent out, 60% of the respondents claimed to not have read the terms and conditions or the instructions for the device. 26% of the respondents read the instructions but not the terms and conditions. The results were then equally divided between the ones who had read the instruction and the terms and conditions, and the ones who had only read the terms and conditions. These groups had 6.7% of the respondents each.

What these numbers do not show is to what degree these respondents read the terms and conditions and when they consider something as “read”.

Users were presented with a Likert scale to rank their level of concern on a scale from 0-10. 0 represented no concern, while 10 represented highly concerned. A visual of the Likert scale can be seen below in Figure 7.

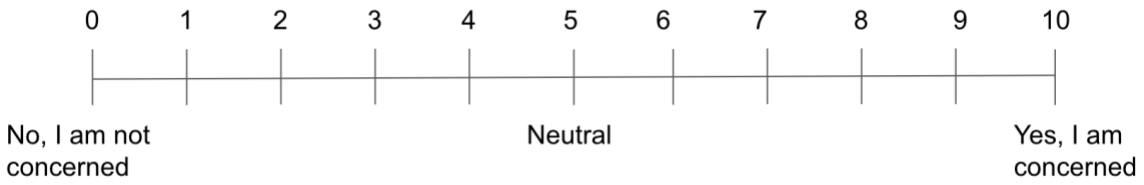


***Figure 8** - Likert scale used to rank the level of concern*

Presented in Figure 8 are the results, where the x-axis is the level of concern, and the y-axis is the number of respondents. The results showed that the average level of concern was 4,63, which is under neutral, meaning that the respondents are not particularly concerned.

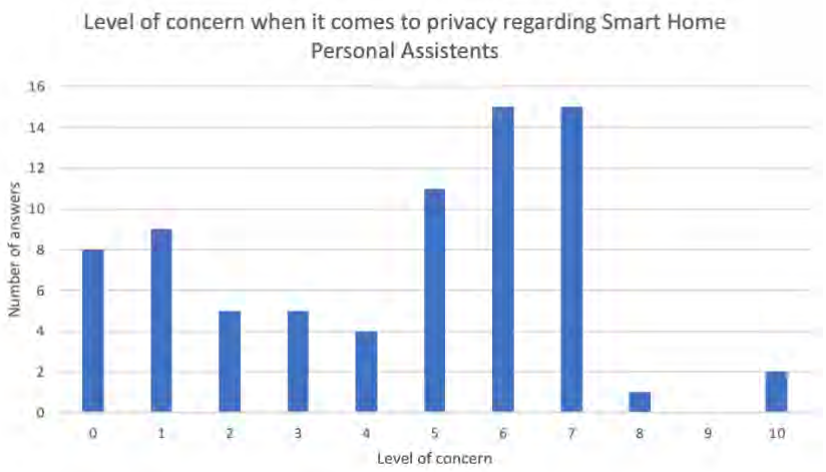


***Figure 9** - Results showing the level of concern among the respondents*

The results from the survey indicate that unauthorised third-party sharing is the major concern among the respondents. This was closely followed by the concern regarding the

device always listening, recording or watching. Hacking was the third biggest concern. 11 of the respondents indicated that not knowing what is being shared with their contacts is what they consider a concern. The remaining respondents chose the option “other”, meaning that they have other concerns than what was listed as choices.

When asked if the respondents feel like they are aware of what data the Google Nest Mini is gathering about them, a majority of the respondents answered that they were partially aware (50%). Only seven out of 75 answered yes, while 30 answered no.

At the end of the digital survey, the respondents were given a text field where they could write their additional thoughts and opinions that they might have in relation to the product or privacy. The in-depth answers here showed that some of the respondents claim to be aware of what type of data is being collected about them. They also argue that data collection is not something that can be avoided and that big companies such as Google and Facebook already have multiple ways to collect data about you. While some respondents view this as negative, one respondent elaborated that “[...] I have nothing to hide, so it doesn't matter what they know about me [...]”. Bringing a SPA into their homes is therefore not the biggest concern.

The entire report of the results from Nettskjema can be found in Appendix E.

6.2 Focus group

Results from the conducted focus group showed a broad range of perspectives and gave interesting insights into how different consumers perceive and use Smart Home Personal Assistants (SPAs). Originally, six people were recruited for the focus group interview. Unfortunately, due to last-minute changes, two of the people could not attend leading to the number of participants being four. Despite the change in the number of participants, it did not take long before the participants engaged in a lively discussion, and the interview ran half an hour beyond the allotted time of an hour. Having only four participants also allowed more room and time for each of the participants to share their opinions on the topics being discussed.

Out of all the participants, one was male and the remaining three were female. The age group categories used in the online survey were also used in the focus group. The ages of the female participants were all 18-29 and the male was in the group 51-60. The topics addressed in the focus group were regarding Google Assistant. Based on the script formed prior to the focus group, there were multiple topics that were expected to be discussed. These topics were the gathering of data, privacy policies, surveillance, the product and the areas of use, and concerns and attitudes regarding smart technology. However, due to the free-flowing conversation between the participants of the focus group, it led to more topics of conversation being introduced than previously planned. These were topics such as GDPR, hacking and search history as well as freedom of speech, politics and echo chambers. The results from each of these subjects are presented below.

The first topic that was discussed was regarding the product itself, such as the reason for purchase and placement. P1 explained that they did not purchase the device themselves but moved into a shared apartment where there was a Google Assistant in the living room. The participant later elaborated that the roommate that owned the Google Assistant in the living room, bought a new Google Assistant for P1s bedroom without being asked for it. The device is then connected to the roommate's Google profile and was mainly purchased to broadcast across the apartment with the roommate. P2 stated that they have several SPAs present in their family home, such as Google Home, Google Hub Nest, Siri, and Alexa. Additionally, they have a baby call that uses some of the same technology as a SPA. In the participant's own apartment, they have a Google Nest Hub. The product was bought out of the desire for convenience and a want for a device that could read research papers out loud for them.

P4 owns a Marshall speaker with Google Assistant integrated. The participant frequently moves the speaker between rooms, mostly the bedroom and the living room, and is therefore considering purchasing a second Google Assistant device to store one in each room. P3, however, distinguished themselves from the other participants by the fact that they used to have a Google Nest Mini, but chose to disconnect it shortly after and have not used it since. The reasoning was that their smartphone is already actively listening at all times, and they do not wish to invite Google into their home more than necessary. The participant did not buy the product themselves but received it from Google for free as customer gratitude.

After explaining what products they have and why they chose to buy them, the conversation moved swiftly to the areas of use for each of the participants. The participants reported using the devices for a range of purposes, from listening to music to being presented with the weather and communicating with others in different rooms of their homes. P1 and P2 both use the Google Assistant to its full extent and have included it as a part of their daily routines. Specifically, P1 uses the product as a timer when they cook and talk to the other roommates in the apartment as several smart speakers in their apartment have been connected. P2 stated that their family uses it mostly for listening to music, but they themselves use it much more frequently. They have an alarm each morning on the SPA to wake them, followed by a reading of the weather forecast, time schedule, turning on the lights and reading research papers out loud. The device is connected to the participant's phone and apartment lights. P4 mainly uses the Marshall speaker for listening to music and reading the weather. P3, as mentioned earlier, does not use their device as they do not want Google to listen.

The participants were then questioned about privacy policy and instructions of use. They were also asked about how they understand the information the company gives about the product and if they read that which is provided. An interesting observation is how age impacted privacy and safety concerns. The results show that the younger portion of the group had fewer concerns regarding privacy and safety, than the elder. Some of the participants have not read through the privacy policies of Google products, nor the terms and conditions regarding the specific product. P3 stated that it was a nightmare to try to read through terms as it is written incomprehensibly to the "[...] ordinary man". They decided that the product is not trustworthy after reading the privacy policy. P4 stated that they had not read the user manual but have tried to read the terms and conditions several times but could not get past more than a few pages as it is way too heavy to read. P1 and P2 on the other hand have not read anything related to the product. P2 clearly stated that it is too many pages to read, while P1 stated that they were not given the opportunity as they did not set up the Google Assistant themselves. P1 later elaborated that they do not have a broad knowledge of what the privacy policy states but assumed that a SPA can gather any personal information if given the chance. They went on to share that "They [Google] will probably be able to obtain any information they want anyway."

Some of the participants naturally started discussing GDPR and the role it plays in protecting the consumer when using the product. P4 stated a hope that their knowledge about GDPR is enough to understand what is being collected about them. To elaborate, P4 explained that by having a background in technology, they know what data the companies can and cannot collect. They also mentioned that to collect sensitive data, you must have a data processor. P2 added that the European Union has several regulations regarding GDPR and that the current laws and regulations are constantly under development to fit the evolution of data security.

The group revealed various attitudes and levels of awareness towards eavesdropping, voice recording, and video recording. The participants' age also had an impact on the attitudes and statements here. The younger portion of the group stated, like P1, a lack of concern about data collection, as they felt like they had nothing to hide. "It creates a false sense of security and trust when the product does not interpret the given messages correctly, in that the product pretends it does not understand, in order to then be able to collect information", P1 explained when talking about how the product often misunderstands the messages given. Although it could create this false sense of trust, they stated that it makes them more comfortable when the product does not understand everything they say.

P4 had little to no worry about being eavesdropped on by the Google Assistant, as they stated, "I have nothing to hide". They explained that the product often struggles to answer when being spoken to and interrupts conversations thinking it is being spoken to. P2 added that they have become more careful with what they talk about around the product after becoming active in politics and explains that they remove smartphones, computers and the product when having meetings. P1 added to what P2 stated and explained that they would take more action to be careful around the product if they were a public figure, more specifically "[...] a person worth cancelling". Here, the term "cancelling" refers to the act of stopping the support of someone who said or did something deemed "unacceptable or highly problematic", usually a public figure (Ng, 2020, p. 623). If something of a private issue were to be obtained by the Google Assistant, they would be more focused on outing the wrong Google made by obtaining this information, rather than worrying about what was obtained. "I don't have anything important to leak and therefore the information that is taken would simply disappear into the hole of the Internet after a while and be forgotten".

Surveillance and hacking was the next topic discussed and P3 joked with the rest of the group that "[...] it is totally fine [if the Google Assistant activates the camera unknowingly], and not dangerous at all". People who know enough can hack into your assistant and record you without you ever knowing it, P3 finished. P2 agreed, adding that they have turned the camera facing the wall as they have the product in the bedroom. The smartphone is mentioned as it is a smart technology that listens to everything and therefore the concern should be the smartphone and not the SPA.

P3 has taken measures to automatically delete search history after a period of time and is measured about conversation topics when close to a SPA due to not wanting to be influenced by tailored information from media and large companies that can affect their political views. P1 agreed and found the smartphone much more concerning than a SPA as they bring the phone everywhere which has more stored data about them. "If anyone wanted to obtain information about me, they would go through the phone and not the SPA that isn't even connected to my own Google". Although P1 themselves are not worried about the Google Assistant listening and obtaining information, visitors they have had have expressed concern when the product's record lights light up without being activated. P3 mentioned earlier that they own several security cameras and have them set up in their home pointing towards the front door, hall, and bedroom. When asked about their concern about the devices recording unknowingly, they state that they have done research about where the manufacturer retains their data and trust this company more than Google. "The cameras are for my dog, and it is a risk I am willing to take to be able to watch him while I am at work".

The conversation drifted into the topic of data collection and the younger portion of the group collectively agreed that data collection is far more convenient than dangerous. P1 stated a bigger fear of accepting cookies on an unknown website than the data collection big companies like Google performs on its consumers, as they constantly have a legal team paying attention to their actions. P2 supported their fellow participant and added that if the Google Assistant has made a profile on you, it can provide better answers to questions. "I like to believe that I am quite informed about what data Google collects from me since I have been studying the field". P4 explained being a lazy person and therefore appreciates personalised advertisements and information that fits their profile. P1 added to this by explaining how it is practical to have personalised advertisements made uniquely for them.

It is worth mentioning that one concern for the younger participants was search history and bank information being leaked. P3 stated a concern for general data collection made by smart technologies and explained that Google stores their data in data centres located in the United States. “If you save your files in Google Drive, one automatically agrees that Google can use what you save in your Drive unless you read the terms and conditions and are informed that you can turn it off”. P3 stated that people are not aware of the risk of using Google products. “All data is collected, and everyone is profiled in one way or another. I try to be careful about the information I share, as I don't want to be influenced”. Table 1 shows some socio-demographic information about the different participants' along with their thoughts about data collection.

Case	Level of concern	Age group	Gender	Statements regarding data collection
P1	Low	18-29	Female	'It is quite practical that I can say things out loud and get personalised advertisements just a few days later'
P2	Neutral	18-29	Female	'I do not really think about that my everyday conversation could be recorded unless they are about politics and personal documents'
P3	High	51-60	Male	'All data is gathered one way or another. I try to be consicous about that so that i cannot get affected by that. I do not want media and big companies to control my personal opinions'
P4	Low	18-29	Female	'I personally think it is okay that it gathers all my data. I am a lazy person and I like that a machine can tell me "I think you would like this" so that I can relax and enjoy life'

Table 1 *- Table showcasing the four participants, their concern level, age group and gender, supported with personal statements.*

A concern for P3 was the media and other big companies controlling their opinions and political views. P1 also stated concern about this but felt comfortable discussing sensitive topics around Google Assistant since they live in Norway. Freedom of speech and press freedom were their main arguments for why one should not be too concerned. They use Norway today and World War 2 as an example when comparing the difference in freedom of speech and if they were to have an SPA in WW2, they could be arrested for speaking freely

at home. P2 stated that the EU has several regulations and Google is too big of a company not to take data collection seriously, or else they would lose customers. P1 agreed with P3 and did not want to be caught in an echo chamber and influenced on their political views by Google Assistant. Echo chambers refer to groups online formed by the algorithmic personalization, consisting of like-minded people who only hear their own opinions echoed back to them (Villa et al., 2021, p.1; Kitchens et al., 2020, p. 1620). “I feel safe from ending up in an echo chamber because I feel the internet doesn't understand my political opinions”, P1 stated when explaining that they often search for other political views to gain different perspectives and therefore did not feel influenced by the Google Assistant. When discussing echo chambers, P4 added that they stay away from politics on TikTok to not be locked in an echo chamber.

The last discussed topic of the focus group was general attitudes and concerns towards Google Assistant and privacy policies with smart technologies. The younger portion of the group had a positive attitude towards the product and collectively agreed that Google Assistant and other smart technologies will create a profile for everyone regardless. P1 described feeling liberated by using Google Home to perform tasks, rather than using their phone and believes this is a positive. They thought it was more harmful than helpful to be constantly paranoid about the possibility of hidden cameras in public spaces. P4 believed that it is difficult to avoid being profiled on social media and stated “If one is first profiled, one can at least enjoy the benefits of the services that they offer".

P2 suggested that algorithms are already gathering information and using it to tailor advertisements and content and therefore it would be stressful to always worry about privacy. They use several digital platforms that constantly gather data about them and therefore the algorithms have already been created. P1 was optimistic about the benefits of technology but acknowledges that there are some people with whom they would prefer not to share their conversations. P3 did not agree with the benefits of Google Assistant and mentioned the importance of being aware of what information is being collected and used by technology companies. “We’ve been through Covid the past three years and in Singapore they demanded virus tracking on everyone’s cell phone. Things can change very quickly, it happens in countries next to us every day”. P3 highlighted the issue of Google creating a free profile on you and explained that it is because they want everyone to use it [Google Assistant]. They

finished with “It is important to be aware of what you do and don't do. I think very few people think about what is collected and what the assistant does.”

Case	Level of concern	Age group	Gender	Statements regarding assistant retrieving personal information
P1	Low	18-29	Female	'It is quite simple to hack or find personal information about someone. You can be skeptical everytime you walk into a bathroom, fearing that someone is secretly recording you or filming you. It's more harmful than helpful to think this way'
P2	Neutral	18-29	Female	'They would find the [personal] information anyways. Even Netflix, VG and such have tailored information about you based on what you like. Artificial intelligence algorithms are configured everywhere'
P3	High	51-60	Male	'It is important to be aware of what you do and don't do. I think very few people think about what is collected and what the assistant does.'
P4	Low	18-29	Female	'It is difficult to get through life without social media, you almost become profiled when they gather your personal info. And if you are already being profiled, you can at least enjoy the benefits of the services they offer.'

***Table 2** - Table showcasing the four participants, their concern level, age group and gender, supported with personal statements*

The results show a widespread attitude and knowledge regarding the use of SPAs. The awareness of privacy concerns varies, but the concern for data leaks in some way or another is universal for the group. One can conclude that the results from the focus group provide valuable insights into how users use and perceive SPA. The results emphasise the importance of regulations and laws that protect privacy and information security in today's digital world.

The entirety of the data collected from the focus group can be found in Appendix F-I.

6.3 Unboxing video

The insight gained from the survey and the focus group interview with additional self-conducted research investigating Google's terms and conditions specifically for the Google

Nest Mini resulted in an unboxing video. The purpose of the unboxing video was to analyse and evaluate the usability of the Google Nest Mini. It was also desired to research how Google informs their consumers about what is being collected about them and how it is utilised.

The video includes a brief presentation of the product and as the name implies, the product is unboxed. The video then explains how to set up the device and gives the user information about how Google collects consent and how their way of collecting data is communicated to the user. Before the conclusion, which gives the user tips and thoughts to keep in mind regarding the product, an introduction to the functionalities and features are given. The finished unboxing video after editing lasts approximately 4 minutes and is available with English speech and subtitles in the links below.

While editing the video, multiple versions were created with different lengths and content. This was in order to explore different ideas and compare these to further extract the various parts that were preferable. After a review with the external supervisor, the versions were revised and discussed to decide upon the best version. Results from this revision meeting came to the conclusion that the script had to be modified after the footage was shot. This was in order to make everything come together as seamlessly as possible, and to make sure that the content of the video was interesting and quick-paced enough to keep the viewer's attention. It was also proposed by one of the supervisors to simplify the language to ensure that the video was accessible and could easily be understood by everyone.

Through the process of working on the video, valuable insights about privacy, security, interoperability and usability were revealed. It was found that Google displays their privacy policies and terms and conditions in accessible language. Accessible in this case refers to the wording used and because of the section “Additional context” which can serve as a dictionary for the reader. However, the privacy policies and terms and conditions are presented as long sentences in lengthy documents, where links up to a chain of three are often used. As a result of this, reading the provided documents can take the average user up to an hour.

As for security, findings showed that the users' data is stored on Google’s servers, and can be deleted in the Google Home app. Additionally, when reading through Google's website about

the device, it was also found that the voice recognition feature did not guarantee reliable identification of the user's voice. The research also uncovered that the Google Nest Mini can be connected to multiple services, such as Spotify and Netflix, and smart devices, such as Chromecast and Hue Lights. Additionally, the research found that when setting up the Google Nest Mini, the user will receive step-by-step instructions in the Google Home app. To give an impression of what the video looks like, a screenshot is provided below.

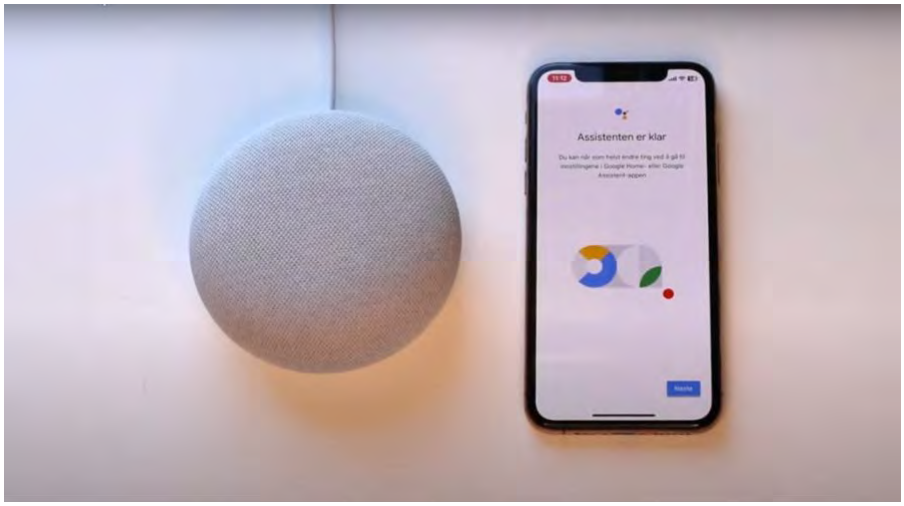


Figure 10 *- Screenshot from the unboxing video*

For convenience and personal preferences the video has both been uploaded as unlisted on Youtube and in Google Drive where everyone with the link can view the video. The links are provided below.

Link to the video with English subtitles on Google Drive:
https://drive.google.com/file/d/1u0gBV9BKGHnS3X_IqiLWvsov33ht-cRf/view?usp=sharing

Link to the video with English subtitles on Youtube:
https://youtu.be/tGGkhX1-_EU

7 Discussion

7.1 RQ1

What are the key privacy concerns associated with the use of smart technology?

The online survey revealed that unauthorised third-party sharing and constant device listening were the primary concerns, which aligns with findings from various studies in the literature review. However, it is important to acknowledge that only 65 out of 75 respondents provided responses to this particular question.

The issue of the device always listening was a common concern raised in both the literature review and the results from the online survey. This concern also gained significant attention during the focus group. Unlike the findings from the literature review, the participants in the focus group stated that hacking was not considered a significant concern. They expressed that they did not perceive hacking as a major threat or vulnerability associated with the use of Google Assistant. They felt that the risk of hacking was more prominent in relation to cameras such as surveillance cameras or SPAs with cameras integrated.

One study in the literature review explained that some users have expressed concerns about privacy invasion. In summary, many chose to turn off their devices before discussing political standpoints and other personal topics. In contrast to this, one of the participants from the focus group stated that they feel comfortable expressing their opinions on sensitive topics, such as politics. However, another participant in the focus group expressed cautiousness when discussing their opinions and political views around a SPA. This is primarily to avoid being influenced by tailored advertisements. This statement supports findings from the literature review regarding privacy invasion. Additionally, results from the online survey indicate that the younger respondents are less concerned about privacy and security-related risks regarding smart home technology, supporting the results from the focus group.

Based on the focus group results, it was evident that all participants were aware of the term echo chambers and some of the risks involved with being caught in one. Most participants expressed caution when discussing sensitive topics around the Google Assistant

demonstrating their desire to avoid being trapped in an echo chamber and subjected to targeted advertising based on their political views. This ties back to the concern of devices constantly listening and gathering information about them to tailor information. In fact, one participant in the group showed concern for the risk of political propaganda through Google Assistant and therefore chose to unplug the product. Considering that a large portion of the product's user base consists of younger individuals who are more susceptible to influence, Google needs to ensure that their advertising and messaging to consumers are ethical and not subject to manipulation.

Multiple respondents answered in the online survey that it is impossible to avoid companies, such as Google, from collecting information about the user. Respondents and participants from the online survey and the focus group expressed that they have nothing to hide [from Google]. Additionally, a study from the literature review indicates that individuals are not particularly concerned regarding the issue of privacy. This lack of concern may contribute to people's limited action in securing their privacy. However, the literature review also revealed that some users are worried about the potential use of collected data against them, prompting them to turn off their devices before engaging in discussions on controversial topics.

Results from the online survey showed that multiple respondents expressed that it is impossible to avoid companies, such as Google, from collecting information about the user. Further, respondents and participants from the online survey and the focus group stated that they have nothing to hide [from Google]. Additionally, a study from the literature review indicates that individuals are not uncommonly worried regarding the issue of privacy. This lack of concern may contribute to people's limited action in securing their privacy. However, the literature review also revealed that some users show concern regarding the potential use of collected data against them, prompting them to turn off their devices before engaging in discussions on controversial topics.

7.2 RQ2

To what extent are users aware of privacy risks associated with smart technology?

In terms of smart technology familiarity, a vast majority of 89.3% reported owning and using other smart technologies than the Google Nest at home, thus indicating a reasonable level of comfort with smart technology. The level of comfort using technology could affect their perceptions and concerns. It is worth noting that eight respondents from the online survey revealed that they do not use other smart technologies. Upon further examination of the individual answers, findings showed that their primary usage of the Google Nest Mini was largely as a speaker for music, news and posing questions. This indicates a degree of familiarity with the technology, but perhaps not the same level of comfort as other respondents. On the other hand, it is possible that these respondents, who chose to answer the question, may have been aware of the associated risks and subsequently made a conscious decision to restrict their usage, unlike those who reported having other smart technology devices in their households.

The second hypothesis states that users either de-prioritise or do not care about the terms and conditions. When asked if they had read the instructions and terms and conditions, a significant amount, equivalent to 60 % of the respondents to the online survey, answered that they had not read the instructions nor the terms and conditions. The findings from the focus group further support this, as none of the participants had completed reading the terms and conditions. Nevertheless, findings from the focus group indicate that users frequently choose not to read the terms and conditions primarily due to difficult reading material and time constraints, rather than a lack of willingness. More than half of the participants from the focus group expressed difficulty comprehending the content of the terms and conditions. Findings from the literature review also indicates that this could be due to the long pages and difficult writing in the documents.

Additionally, it is important to note a general disinterest in thoroughly reading the provided information guidelines and regulations. This insight sets apart from the findings of the literature review, where two studies reported that although users read the terms and conditions, they do not completely understand the full entirety of what they consent to. It is

therefore reasonable to assume that lack of comprehensiveness in Google's terms and conditions could be responsible for some of the responses.

It was mentioned in the literature review that many users have little to no concern when it comes to personal data privacy, as they claim to have “nothing to hide”. The results from the focus group show that a majority of the participants agreed with this, as they claimed that the data would have been collected in another way anyway, and therefore choose to have no filter when it comes to what their devices might be collecting about them. Some of the participants even claimed that it is to their advantage that so much data is being collected about them, as they get a more personalised experience interacting with the smart home devices. This is an important finding as it suggests that younger users may be less cautious about the risks associated with sharing personal information with technology companies. This finding is consistent with the literature, which suggests that younger users are generally more willing to share personal information online than older users.

The results from the online survey showed that the respondents clearly valued convenience features over anything else when buying the Google Nest Mini, as well as smart technology products in general. When asked about what was the reasoning for buying the Google Nest Mini, the respondents’ responses ranked “security” quite low. This may indicate that convenience features have a strong influence on consumers' attitudes towards purchasing the Google Nest Mini. Insight gained from the focus group also largely supports this argument. Additionally, this can correlate with the first hypothesis set for this project, stating that users will value convenience over privacy when it comes to smart technology.

Another reason users may prioritise convenience is because of trust in the device and company. Many respondents stated that they bought the Google Nest Mini due to the brand, Google. As Google is a large company, this could lead users to blindly trust them. It also emerged from the online survey that multiple users already owned Google products. This could be a reason why they feel comfortable buying more Google products, as they have not noticed any major privacy invasions or concerns.

Furthermore, consumers might prioritise convenience over privacy due to lack of awareness. The results showed that users do not feel, or partially feel aware of what information the

Google Nest Mini is collecting about them. The results from the question regarding if the user is aware of what the Google Nest Mini collects about them showed that 50,7% of the respondents said “partially" and 40% answered “no”. This may give an indication that the users are not aware of the privacy risks associated with smart technology.

As previously stated, most of the respondents also revealed that they had not read the terms and conditions. These factors could contribute to users not having a clear understanding of the risks involved, leading to underestimating the privacy risks. When asked about how concerned they were regarding smart technology, the average answer on a scale from zero to ten, was less than five. This shows that most users still are not too worried about their privacy regarding this technology. Results from the focus group, on the other hand, show that the majority of the participants had some level of concern with their privacy being invaded. There is a possibility that the responses differ from each other, due to the focus group giving more in depth answers and the online survey being numeric answers resulting in a lack of elaboration on the topic.

The main findings from the focus group highlight the complexity of users’ attitudes towards smart home technology. Results from the focus group align with the results from the online survey, where the users’ attitudes and general knowledge vary. The survey respondents reported having mixed attitudes towards the product's impact on participants' lives. This suggests that the versatility of these devices is a key factor in their popularity and usage. The results from the focus group and online survey provide valuable insights into the concerns and opinions of users. It is important for technology companies to consider these perspectives in their product development and marketing.

7.3 RQ3

What measures can be implemented to enhance users’ understanding of privacy risks associated with smart technology?

The literature review highlighted the importance of enhancing transparency in data collection to improve users' understanding of privacy risks associated with smart technology. As

mentioned in the discussion for RQ2, respondents and participants from the online survey and focus group expressed difficulty reading the terms and conditions for the Google Nest Mini. Additionally, the online survey findings indicate that over half of the respondents had only a partial understanding of the data collected about them. This highlights the need for improved information flow and transparency in data collection, emphasising the need for user-friendly practices. In line with this, conducting an unboxing video to demonstrate the process of setting up a Google Nest Mini was considered ideal.

The unboxing video serves as an education tool and can be an effective measure to enhance users' understanding of privacy risks associated with smart technology. By creating a video that demonstrates the data collection and explains the set up process of the Google Nest Mini, users are provided with visual and practical information simultaneously. This way of demonstrating can help users understand specifically what information the device may collect and third party sharing as it is hands-on and direct. Additionally, the video allows for privacy settings to be directly explained to the user, enabling users to make informed decisions about their privacy preferences and adjust the device's settings accordingly. The unboxing video provides both theoretical content from the terms and conditions and privacy policy as well as real-world context, creating a direct and transparent solution to enhancing understanding of privacy risks with smart technology.

In addition to the unboxing video, improving consent control could enhance users' understanding of privacy risks regarding smart technology. One study in the literature review found that the Google Nest can collect, store and process data the user has not given full consent to when the device misheard the wake word. Another study found that the user is not aware of what they are consenting to when using the device. Improving the transparency and accessibility of user-controlled consent mechanisms would enhance users' understanding of their ability to limit data collection. Another measure to enhance understanding and improve awareness could be improving the user guides and creating more easily accessible educational resources. The current information given by Google is expressed by users to be too complex and difficult, found in a study in the literature review. In the study, users claimed that there were serious issues regarding structure and content, including difficult language. The issue of difficult language can negatively impact user understanding. To mitigate this, providing user friendly educational resources that utilise an accessible language

and clear instructions could be beneficial in enhancing the users' understanding of privacy risks.

7.4 Further discussion

Online Survey

It is important to take note of the fact that most of the respondents in the online survey were male. One reason for this outcome could be that the survey was shared in a group that seemed to have mostly male members. In addition, most of the respondents were in the age group 18-29. This age group being the most prominent might come from their disposition towards greater technological engagement, possibly because they have grown up with technology hands-on. A consequence of this could lead to a higher level of technological activity among younger individuals.

Another reason for the high number of young respondents could be the fact that the survey was shared on social media, where young individuals likely have a higher online presence than older individuals. This demographic characteristic of respondents, largely young and male, may have influenced the survey outcomes.

7.5 Learning outcomes

This bachelor project has provided the group with a range of valuable learning outcomes that will be highly beneficial in future academic and professional work. The group believes that these learning outcomes have led to both professional and personal growth for all the members throughout this project.

Throughout this project, the group has enhanced their research skills. Particularly in relation to source criticism and techniques in searching for relevant literature. By conducting a thorough review of the relevant literature, the group gained a deeper understanding of the topic and was able to discover gaps in the existing research that could be addressed further in this project.

Undertaking this project has also provided the group with valuable experience in writing an advanced academic work in a foreign language. In view of the fact that the group has had a native-speaking English supervisor, the group has gotten to challenge both their writing and oral communication skills. Through regular meetings and written communication, the group's vocabulary has been enlarged. This has been a valuable experience that the group will bring into their future endeavours.

All members of the group took the course Academic English last semester, and this project has been an excellent opportunity for the skills learned in that particular course to be applied. This for instance has included conducting a literature review using relevant sources, formulating clear and compendious research questions as well as presenting the results in a professional and engaging way. The course also opted for the opportunity to employ critical thinking when using sources and references, which is necessary when performing a literature review.

Further, the group has throughout this process enhanced their critical thinking skills. This bachelor project has required the group to think critically as well as to solve complex problems along the way, strengthening the group's problem-solving skills. This has been relevant when evaluating information and analysing the data collected in this project. Furthermore, the group has applied their knowledge and skills to develop a considerable number of perspicacious conclusions.

This project has required the group to investigate a specific topic within the group’s field of study. This has allowed the group to gain insights into the complexities of the topic. This helped the group identify gaps and propose solutions and recommendations based on the findings from this project. Overall, this experience has highlighted the importance of developing subject matter expertise when wanting to contribute meaningfully to a field of study.

This bachelor project provided the group with a unique opportunity to establish a connection with a professional in our field of study. From this connection, as well as from the research conducted in this project, the group has gained insight into current trends and best practices. In addition, the group has sought guidance from its internal supervisor, who provided the

group with constructive feedback and advice throughout the process.

This bachelor project is built on team effort, and the group has worked closely together throughout the entirety of the project. This required the group to develop collaboration skills, including the ability to communicate effectively and resolve conflicts in a proper manner. Being a group of five students allowed the group to learn from each other, share ideas and achieve important milestones together. The ability to build on each other's strengths and weaknesses has been vital in order to assign tasks and together achieve success in this project.

The group also recognises the importance of maintaining clear and regular communication within a group. This is vital to ensure that everyone is on the same page and aware of any changes to be made. An important learning outcome from this project is that it is crucial to constantly keep the other members updated on the progress.

Both effective time management and organisation were critical factors in reaching the group's goals set for this bachelor project. The group has learned the importance of using buffer days to allow for unexpected delays, setbacks or other challenges. By creating a clear timeline and work schedule, and sticking to it, the group was able to prioritise tasks and ensure that deadlines were met on time.

Another important learning outcome gained has been to start as early as possible with the project report. The group was advised to do so by both of its supervisors and has benefited from implementing this. By starting the report early, the group has had sufficient time to conduct in-depth analyses, seek feedback from supervisors and make necessary revisions. This also helped with time management and ensured that the group met all of the project deadlines. In hindsight, the group recognised that starting the project report early was a key factor in the aim for success, and are planning to implement this approach in future work.

To ensure successful completion of this project, a number of tools had to be learned before being further applied. Among these were Nettskjema, Canva and CapCut. Nettskjema was used to create and distribute the online survey. In addition, Nettskjema provided graphs and visualisations of the results, enabling efficient analysis of the data collected. Canva was used to create the overview tables of the results from the focus group interview. CapCut is the

editor program used to edit and refine the unboxing video. By learning these tools, the group was able to enhance the quality of the work.

7.5.1 Challenges and setbacks

During the course of this project, the group encountered some challenges and setbacks. This has included poor communication both within the group as well as with the administration. One of the key lessons taken from these experiences has been the importance of taking more direct action in order to address issues as they arise. The group engaged in self-critique and recognised that an improvement in communication skills and being more proactive in seeking clarification was highly needed. Furthermore, the group did on some occasions find themselves sending emails or sending over the deliverables for feedback at unreasonable hours to ask questions. This further highlighted the need for more effective communication as well as better time management practices.

The group had a setback when the first draft of the literature review turned out to be too broad and therefore had to be redone in its entirety with a new scope. This led to a major lack of motivation and a delay in moving forward with the project and the other deliverables. The group overcame this challenge by starting over with the literature review to gain a better structure and therefore a more narrow scope on the literature review. This again resulted in a more functioning literature review, revealing more specific knowledge gaps to further investigate.

In addition, the group struggled with the layout of the project report as the documentation standard given was more fitted to a product-developing project rather than a research-based one. It was therefore necessary for the group to adapt, become familiar with and find an alternative solution for the layout of this report.

While editing the video the group found that using the editing program “iMovie” was not suitable, as it did not provide the desired functionality. Therefore, the group found that the ideal solution was to find a new editing program. The final editing program used for the group to edit the unboxing video was CapCut. As the group had a desire to blur out personal information in the video when connecting the device to a Google account, CapCut was therefore chosen due to its functionality of providing this.

7.6 Further work and research

This research project has focused on determining the level of awareness regarding privacy risks amongst users of Smart Home Personal Assistants. However, it was found that there are various limitations which need to be addressed in future research.

7.6.1 Increase diversity

When it comes to further research, studies should aim to recruit more diverse participants for another focus group. This is necessary in order to better present the broader population. This may consist of increasing the number of participants with different ethnicities and biological backgrounds and levels of education. Because of the skew distribution in genders when it came to the focus group and the survey, it was also not possible to draw any conclusions as to whether or not gender impacted the concern. Increased diversity would allow for a wider picture of how aware consumers are of the privacy risks that a SPA device proposes when it is introduced into a household.

7.6.2 Focus group

The results of the focus group may have been affected by the fact that all of the focus group participants were experienced with technology. Additionally, there was limited diversity within the age group of the participants. For instance, the focus group in this project had three female participants between the ages of 18-29 and one male between 51-60 years old. All of the participants also had more experience than the average person within the field of technology. Further work would be to conduct at least one additional focus group with the same amount of females and males, and more diversity within the age range and background.

Most interesting would be to investigate how the participants' age influences the results further. A hypothesis for further work would be that people of older age retain a more sceptical attitude towards privacy risks than the younger population. Although the younger participants of the online survey and focus group adopted a less concerned approach, the group did not require enough participants above the age group 18-29 to conclude and confirm this hypothesis.

7.6.3 Review of Literature

As the research in this report is based on public documents and a self-directed survey with 75 participants, there is a limit to the amount of data and literature that the group was able to utilise in the report. Expanding the viewpoint for the literature review could be facilitated by having access to restricted documents with special access specifications or which require paid subscriptions or journal fees. It would also be beneficial to reach out to companies that have done work or studies within the same topic of this project, to explore the differences. This could add useful information that the group did not have access to during our project.

7.6.4 Video language

It is important to notice that the video is in English, with English subtitles. Therefore, adding subtitles for different languages would be essential to include a larger audience, and make the video accessible to more people globally. Language inclusivity can also help to build loyalty amongst a diverse audience. By providing multilingual options the reach of the video could be across continents and would be more adaptable for sharing on other platforms, such as social media. This would lead to increased engagement and contribute to a broader awareness of privacy concerns when using smart technologies.

Furthermore, as the project provider, Relink, is mainly situated in Norway, the video could be redone to have both Norwegian speech and subtitles. Taking into consideration that a portion of the elderly in Norway might not be fluent in English, it could potentially be hard to target this group of people with the video currently being in English.

7.6.5 User testing

When conducting research for the video, the group found that the step-by-step setup can help increase usability. However, it is important to mention that this may not apply to everyone. Further research could then include diving deeper into whether the step-by-step set-up process of the Google Nest mini is easily understood by all and if the documents containing information about data collection and consent use employed wording that is comprehensive for a diversity of people regardless of their age and technical skills.

8 Conclusion

The purpose of this report has been to investigate the privacy concerns associated with the use of smart technology, users' awareness, attitudes towards privacy risks and terms and conditions. The research questions for the report focused on identifying key privacy concerns associated with smart technology, assessing users' awareness of the privacy risks and lastly, finding measures that can be implemented to enhance the users' understanding of the privacy risks.

A literature review was the first approach used to investigate the research questions. Privacy risks such as weak authentication processes and challenges in understanding privacy policies and terms and conditions were some of the key findings. Previous research shows that consumers have expressed concern with SPAs and data collection, processing, and general user awareness. It was also found that SPAs are vulnerable to hacking. Users also tend to be unaware of the data being collected. Limited research on what measures could be taken to enhance the users' understanding of privacy risks leads to a knowledge gap.

The online survey was conducted as the first data collection method. The respondents favoured functionality over privacy, therefore this confirmed the first hypothesis. The second hypothesis; users de-prioritise or ignore terms and conditions, was confirmed as well as more than half of the respondents did not read terms and conditions. The main concern for the respondents was unauthorised third-party sharing and the device always listening to the user.

A focus group is the second data collection method used in this report. The results align with both the survey and literature review as well as confirm the second hypothesis, that the participants de-prioritised reading terms and conditions due to difficulty and time consumption. A common concern for the group was the device always listening, although data collection and privacy were not major concerns for most of the group. There were a variety of attitudes towards the product ranging from enhancing their everyday lives to unplugging it due to privacy concerns.

Lastly, an unboxing video on the Google Nest Mini was created as a measure to enhance the users understanding of the privacy risks with the Google Assistant. The main finding from

the video was that Google presents the user with difficult information to process and timeconsuming documents for the user. Although the language is simple, the amount of pages and links make it tough for the user to engage.

The two hypotheses in the report offered claims and predictions that could be discussed and concluded independently. The research questions of the project allowed the group to explore the larger context and direct our investigation. By utilising the two, the intention of the group was to achieve a targeted analysis, enabling a more in-depth comprehension of the study issue.

To conclude research question RQ1; the key privacy concerns associated with the use of smart technology involve unauthorised third-party sharing, a constantly listening device, privacy invasion and data collection and processing. The concerns were first mentioned in the literature review and supported by the respondents and participants in the survey and focus group.

As for research question RQ2, the user awareness of the privacy risks associated with smart technology vary. The elder portion of the focus group and online survey shows a higher concern regarding data collection and the device always listening. The younger and greater portion of the respondents//participants show less concern for privacy invasion and deprioritized reading terms and conditions. A key recommendation would then be to further educate users on potential privacy risks associated with smart technology.

Lastly, concluding research question RQ3; To enhance the users' understanding of the privacy risks associated with smart technology, several measures can be taken. First, the unboxing video in this report is a direct measure by simplifying the terms and conditions for the user. This is done by translating the privacy policy and terms and conditions for the user to a lighter way of speech. Additionally, emphasising the importance of reading the privacy policy and terms and conditions, while promoting privacy and security-related features could enhance the users understanding of the risks.

In conclusion, while smart technology can enhance everyday lives for some, it is important to be aware of the potential privacy risks associated with it and take measures to ensure one's

data remains secure. The keynote is that convenience should never come at the cost of privacy.

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