D2.3: Privacy analysis and user requirements on societal implications of RF sensing

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Executive Summary

To identify the requirements for the responsible design and implementation of RF sensing, it is crucial to consider its social implications beyond privacy alone. The technology's capabilities—such as snapshot sensing (TUM), dynamic body and object perception (CNR), and activity and gesture recognition (AALTO)—can profoundly influence how individuals relate to one another, to their environment and to themselves. RF sensing has the potential to reconfigure human interactions, reshape spatial and social relationships, and alter the experience of selfhood. As such, it introduces new responsibilities, power dynamics, vulnerabilities, and possibilities for care.

To explore these implications, a technological appropriation study was conducted, focusing on the new human-technology relations enabled by RF sensing, their social impacts, and potential societal adoption. Besides empirical studies, Technological Mediation Approaches are used to analyze and explain how RF sensing establishes new human-technology-world interactions using the body as an interface. The analysis will lay the groundwork for a comprehensive set of design, usage, and implementation requirements, enabling WP3, WP4, and WP5 to develop scenarios that address the technology's societal implications.

In addition to different types of technological innovations (static, dynamic and active holography), the study distinguishes between appropriation in public spaces like museums and libraries, semi-private environments such as schools and workplaces, and private settings like homes and elderly care facilities. Each context presents unique concerns and opportunities for responsible design and user involvement in design processes.

The primary objective of this study is to conduct an ethical-philosophical analysis of the potential societal implications of RF sensing tools and the extent to which their acceptance and appropriation are envisioned. This analysis will support the responsible development, implementation, and use of the technology, with particular attention to its various applications as outlined in WP6.

Table of Contents

Abbreviations

Abbreviation	Description
3D	Three-Dimensional
AALTO	Aalto University
ATEs	Active Technological Environments
ATGT	Active Technological Gaze Theory
CNR	Consiglio Nazionale delle Ricerche
EC	European Commission
EISMEA	Executive Agency for the European Innovation Council and SMEs
EM	ElectroMagnetic
EU	European Union
HE	Horizon Europe
HOLDEN	Ethical design of holography in dense wireless networks
RF	Radio Frequency
TET	Technological Environmentality Theory
TINAC	This is Not a Camera! The Future of Monitoring Using WIFI (Exhibit)
TMT	Technological Mediation Theory
TUM	Technical University of Munich
TWE	University of Twente
WP	Work Package

1. Introduction

1.1. HOLDEN

HOLDEN is an EU-funded grant dedicated to the ethical development of technology utilizing RF-wave sensing to create "vision." The built environment is awash with electromagnetic waves outside of the scope of human sensing. A portion of these waves derive from wireless network sources such as WIFI routers, telecommunication towers, and cell phones. These radio frequency (RF) waves can travel through walls and reflect off surfaces. HOLDEN aims to visualise the objects, movements and the people in it in a way that respects ethical values and norms, i.e. through the responsible use of sensor feedback from dense wireless networks.

HOLDEN accomplishes this mission using three different methods: 1) forming holography from electromagnetic scattering, 2) discrete point measurement using beamforming/steering and smart antennas, and 3) incorporating machine learning with electromagnetic waves produced from 5G and beyond to understand increasingly complex environments, movements, and behaviours. Built into the grant is the requirement that each phase of the project be ethical. This can be a challenge for socially disruptive technologies with unforeseen impacts. Therefore, this report is a first step for providing an overview of the social implications and preconditions for responsible design.

1.2. Appropriation of RF Sensing Technology

This report investigates the societal implications of RF sensing tools developed within the HOLDEN project, aiming to provide an ethical-philosophical analysis that guides their responsible design, implementation, and use. It specifically examines appropriation across three contexts: public spaces such as museums and libraries, semi-private environments such as schools and workplaces, and private settings like homes and elderly care facilities. Each context presents distinct ethical considerations and opportunities for user involvement in design processes.

Empirical data was collected through three interactive exhibitions showcasing the current state of the technology as well as future potentialities and a Closing Workshop. Data analysis is used to inform design, usage, and implementation requirements, which will help develop new societal scenarios in WP3, WP4, and WP5. Notably, this study's focus extends beyond privacy concerns, exploring broader societal impacts.

2. Study Methodology

Several factors were considered while developing an appropriation study for the three HOLDEN innovations (Object/person Detection, Smart TVs and Elderly care) described in D6.1: Functional Requirements, Privacy Profiles for the Scenarios. Firstly, while designing the experiment, the innovations were (and still are) not developed to the extent where it would be possible to test how users would interact directly with the applications. This consideration made it challenging to examine how different user populations would respond to and adopt the technology. We considered building dummy prototypes of the innovations but found that building prototypes to a high enough fidelity for appropriation testing would result in spending more resources on designing the prototype than on learning how people make sense of and use the technology. On the other end of the spectrum, we considered hosting a workshop, where participants would learn about RF holography and the innovations under consideration and then vote on how they think they might appropriate the technology. The downside of this approach is that it might self-select certain people who are then forced to make considerations at the pace of the workshop. In the end, we developed a more innovative approach: introducing the technology within three public interactive exhibits where participants could explore at their own pace, provide feedback, and contribute without having a long time-commitment or a vested pre-interest in the technology. Alongside these exhibits we hosted a Closing Workshop where more qualitative data was collected.

2.1. This is Not a Camera! Exhibit

The This is Not a Camera! The Future of Monitoring through WIFI (TINAC) Exhibit consists of 16 posters in both Dutch and English (Appendix A). The exhibit was designed to be interactive and collect feedback from visitors on how they experience the planned HOLDEN Innovations and how their perspectives on the technology change whether they are employed in private, semi-private, or public space. To facilitate feedback there were several interventions. Firstly, throughout exhibit there were points where participants could vote with a sticker directly onto the panels. At the start of each exhibit participants could gather their own pack of unique stickers to use throughout the exhibit and discard at the end (See Figure 1). The stickers allowed us to track the same participants responses throughout the exhibit, while keeping the visitor anonymous. Most of interactive elements with stickers asked participants to rank how “Creepy to Cool” a use case is, for example WIFI Care in an Elderly Care Facility (See Figure 2). Additionally, there were Yes/No Boxes through which patrons could cast their vote on whether society would change due to the innovation while providing additional reasoning (See Figure 3). Later in the exhibit there were forms visitors could fill out to express how they thought data sharing should work for WIFI Care and elaborate on its usefulness (See Appendix B). Lastly, participants could suggest applications for RF monitoring on the final panel of the exhibition and submit any additional thoughts into a Q&A box.

Figure 1 Sticker and Clipboard Pick Up

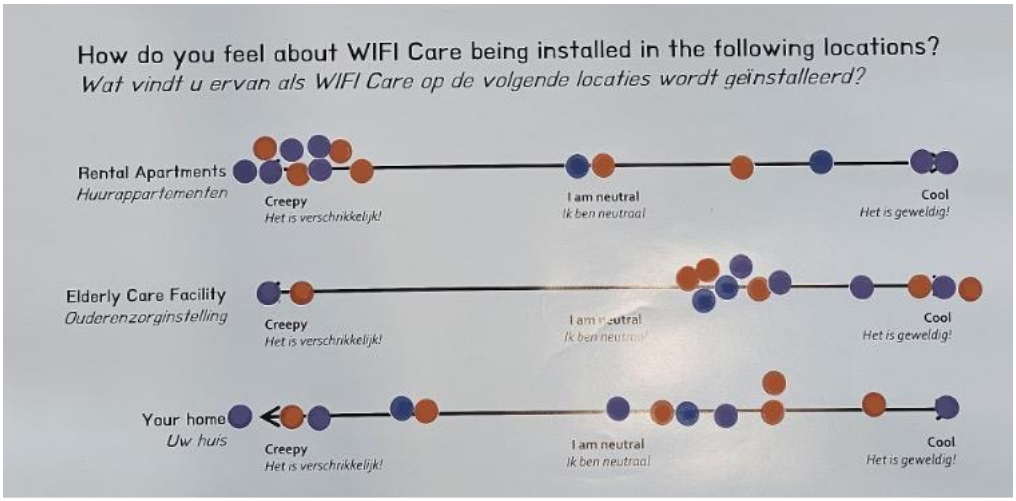

Figure 2 Interactive Ranking for WIFI Care in Three Contexts (*Sticker Numbers are Blurred*)

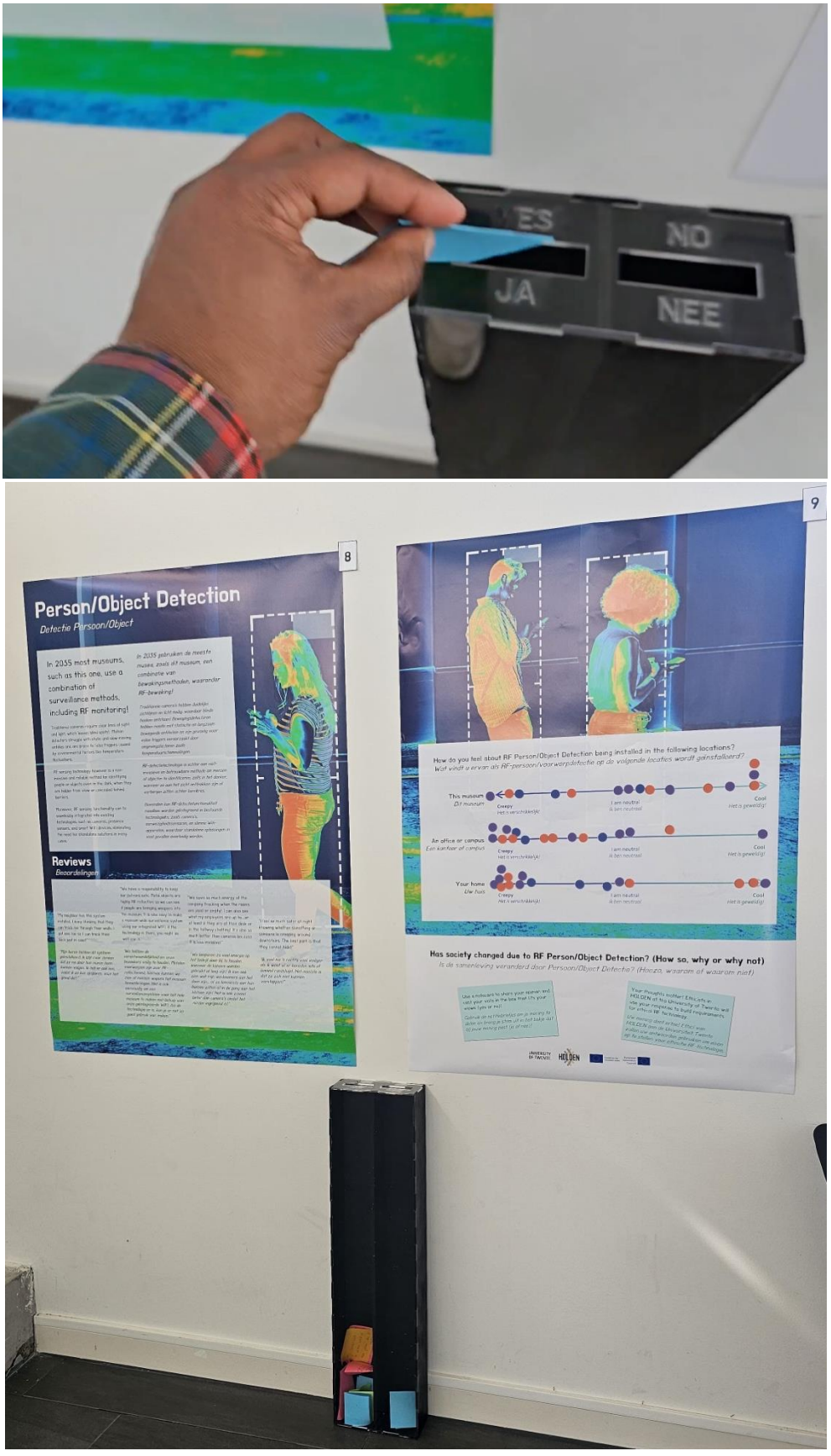

Figure 3 Top and Front View Yes/No Box with Post-It Notes (Stickers are Blurred)

The exhibit was up during the month of April 2025 at three locations in Enschede, the Netherlands. Ethics Review Board approval was granted through the University of Twente. Participants were informed throughout the exhibit that their feedback would be used by HOLDEN for research. The first exhibit at the University of Twente Design Lab was smaller and therefore did not have the Yes/No Boxes or the WIFI Care Form. The Design Lab exhibit was up from March 27th to April 28th and gathered 20 responses. The shortest duration exhibit was up from April 2nd through April 7th at Tetem and garnered 16 responses. The most extensive exhibit at Tankstation, Enschede (April 1st to April 25th) had 45 respondents. In total the exhibits garnered 81 responses. It is possible that some people visited multiple exhibits despite the exhibits explicitly asking people to not participate more than once in the interactive elements. See Figure 5 and Figure 6 for a general sense of what the exhibit setup looked like at Tetem and Tankstation respectively.

Figure 4 Section of the TINAC Exhibit in Tetem

Figure 5 Section of the TINAC Exhibit in Tankstation

2.2. This is Not a Camera! Closing Workshop

In addition to the exhibit, we held a closing workshop at Tankstation the day before the exhibition was taken down. This workshop also received ethics review approval from the University of Twente. During the workshop, participants were asked more qualitatively oriented questions so that we could better understand why people voted the way they did in the exhibit. Workshop participants were divided into three groups, one for each of the three innovations. Each group was paired with a researcher who took additional notes. Participants were asked what they considered to be "creepy" and what they considered to be "cool." Next, they answered a series of questions that repeated for each innovation. Questions centered on why they decided certain contexts creepy or cool, how they would make the technology creepier or cooler, and what (if any) impact they could see the technology having in the life of themselves or someone they know. The full set of workshop questions are in Appendix C. Participants were recruited through email, in-person announcements, online, and LinkedIn. There were six participants in the closing workshop, five of which were viewing the exhibit for the first time.

2.3. Data Digitalization

Once the exhibitions were taken down, submitted Post-it notes and WIFI Care Forms were transcribed in their original language and if in Dutch, translated to English. High-definition photos were taken of each poster. Rankings were digitalized by taking the pixel distance from the start of each arrow to the center of each sticker and dividing it by the pixel length of the line and multiplying by 10. A score of 0 meant that a context was very creepy and a score of 10 meant that the context was cool. (Note that it was possible to have a value lower than 0 or higher than 10 if a participant placed their sticker out of the "bounds" of the line.) These findings were rounded to the nearest integer to account for any measurement error. Using the unique sticker ID (color + number) we were able to note the votes for each individual across the whole exhibit, including if someone voted twice on one section or skipped sections of the exhibit.

2.4. Additional Considerations

Since the exhibits were installed in public locations, the interventions were designed to be privacy preserving and not collect personally identifiable information. Unfortunately, that means that we lack demographic data and cannot confirm if certain cohorts have similar sentiments. Nonetheless, from the populations that frequent each location, we can surmise that most Design Lab participants were local and international students/academics, Tankstation participants were local and international creatives, activists, and community seekers, and that Tetem participants joined for the exhibit. Between 25% and 40% of participants wrote in Dutch for the "Yes/No" Boxes and the WIFI Care Forms, which implies that the results also reflect views from backgrounds outside the region.

It is important to recognize that there are several domains where bias could creep into the results. Participants were able to see the results of others and therefore might have been influenced by other's opinions. Additionally, participants made assumptions based on the information provided in the exhibit. Thus, it is helpful to review the exhibit (See Appendix 1) before considering the results. Given that participation was open, people may have participated more than once, although we doubt that occurred frequently given that custodians often visited and did not witness this behavior, and full participation takes some time. The exhibits only show the thoughts and feelings of those who joined at a given time. Nonetheless, we believe that the study was a helpful starting point to understand public perspectives on RF Monitoring technologies.

3. Appropriation Study Results

The TINAC Exhibit and Closing Workshop amassed a significant amount of data that will be used for later HOLDEN deliverables and is not all included in this report. This section overviews initial findings, combining results of the Closing Workshop and TINAC Exhibit, starting from the participant background knowledge we found appropriate and relevant to attain in this anonymous study (Section 3.1). All results demonstrate the viewponts from those who interacted with that part of the exhibit. Out of 81 contributors, 69 participated almost fully skipping no more than 3 out of the 21 questions and 45 had full participation.

Next, it addresses the data we collected to understand the public's sentiment towards HOLDEN technology (Sections 3.2, 3.3, 3.5, and 3.5). From Panel 6 of the exhibit onward, participants were asked to rank applications and contexts from Creepy (0) to Neutral (5) to Cool (10) by placing a sticker on a bidirectional line with arrows at the end points. While we were not able to ask exhibit participants directly what they considered to be creepy versus cool, we were able to learn from the workshop participants. Creepy was described as making things "much worse," "unpleasant, uncanny feeling from something," "scary uncomfortable, weird," "invasive of private space," "unsure" and "endangering the rights of people or [going] against basic morals." Conversely, cool was seen as making life "a lot better," making one excited and having positive feeling about it, relaxing, "nice agreeable, positive," and benefitting people "without having major drawbacks."

The latter part of the exhibit asked participants to consider the technology as if it was 2035, 10 years in the future and the innovations had been developing over the past decade. Each innovation was described as though it was already on the market and being used in various contexts. There were additionally reviews for each technology to give a sense of possible user perspectives. It is possible that these reviews may have swayed audience perception of the technology. These use cases were chosen to gain understanding of how context affects perception of the technology. This is relevant for Sections 3.3, 3.4 and 3.5.

3.1. Participant Background Knowledge

The study began with initial questions to understand the preexisting knowledge of the participants. Participants felt positively about WIFI in their homes and less positive about 5G towers (see Figure 6 and Figure 7). Next, the exhibit gave a basic overview of what radio frequency waves are, how WIFI works, and how WIFI can be used for monitoring purposes. After the overview participants were prompted to vote on how much of the information was new to them. Most individuals thought that they already knew some of the information with a mix of some already knowing the information at a higher level and others having just learned a lot through the exhibit (see Figure 8).

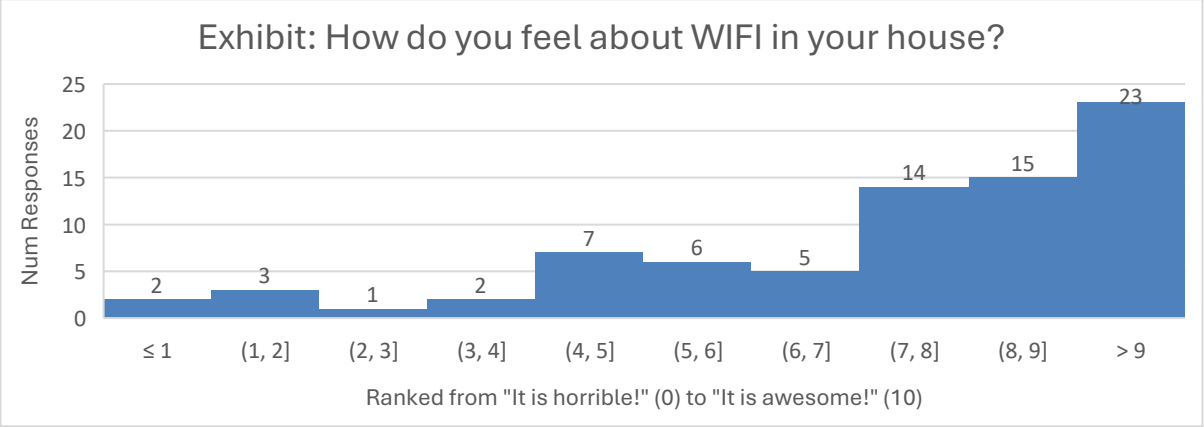

Figure 6 Exhibit Result Histogram WIFI Preference

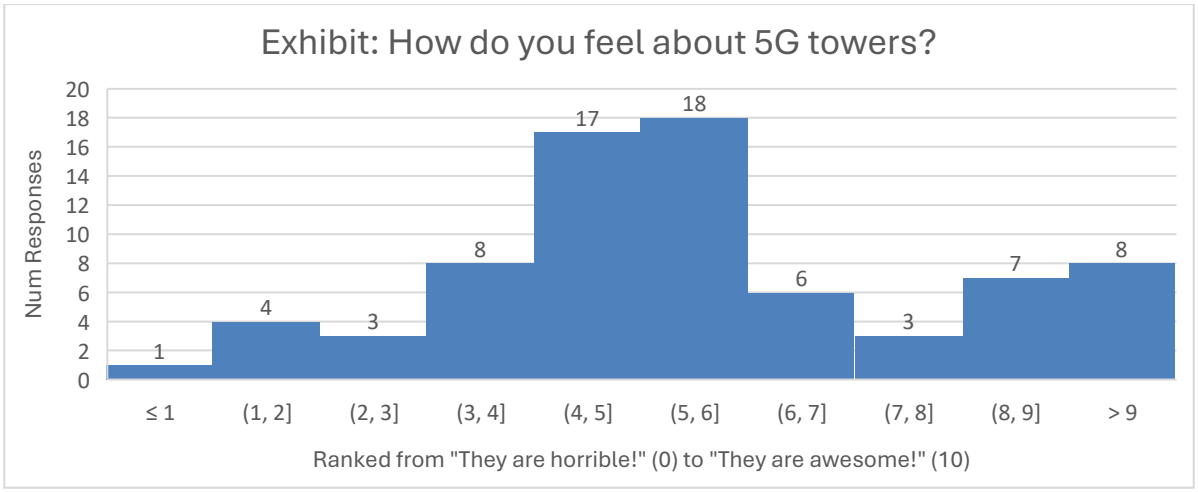

Figure 7 Exhibit Result Histogram 5G Tower Preference

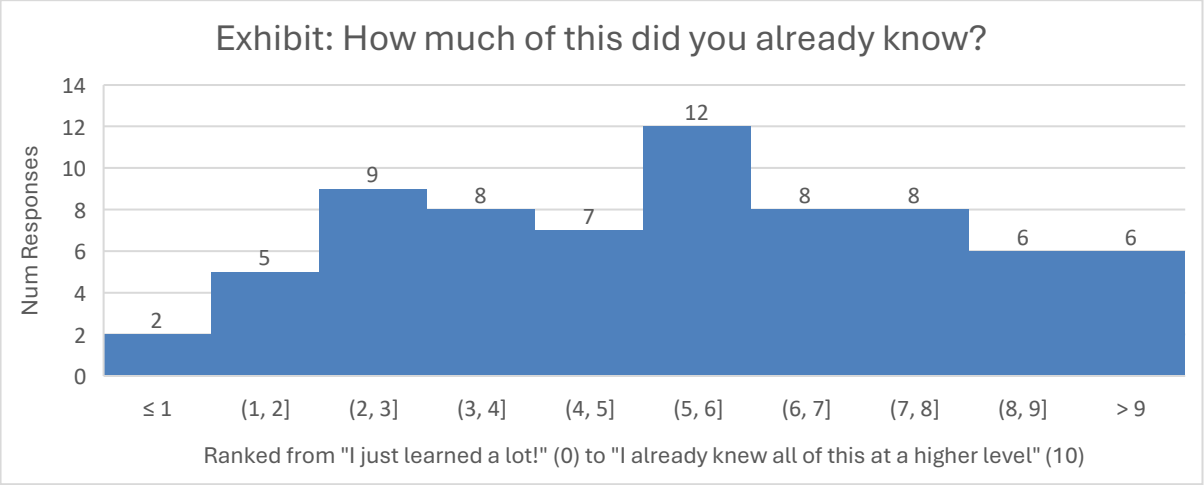

Figure 8 Exhibit Result Histogram Preexisting Expertise

3.2. Application Ranking

Next, the exhibit introduced applications that have already been found in the literature for RF monitoring. Figure 9 shows the average responses of participants for each application. Parkinson's Prediction was seen by far as the most "cool" application. Sleep Tracking was seen on the more positive side of neutral.

Heartrate, Gesture Recognition, and Breath Rate detection were more on the negative side of neutral. Activity recognition was not quite creepy and not quite neutral. Finally, Through-wall Body Detection and Person Identification were seen as creepy functionalities of the technology.

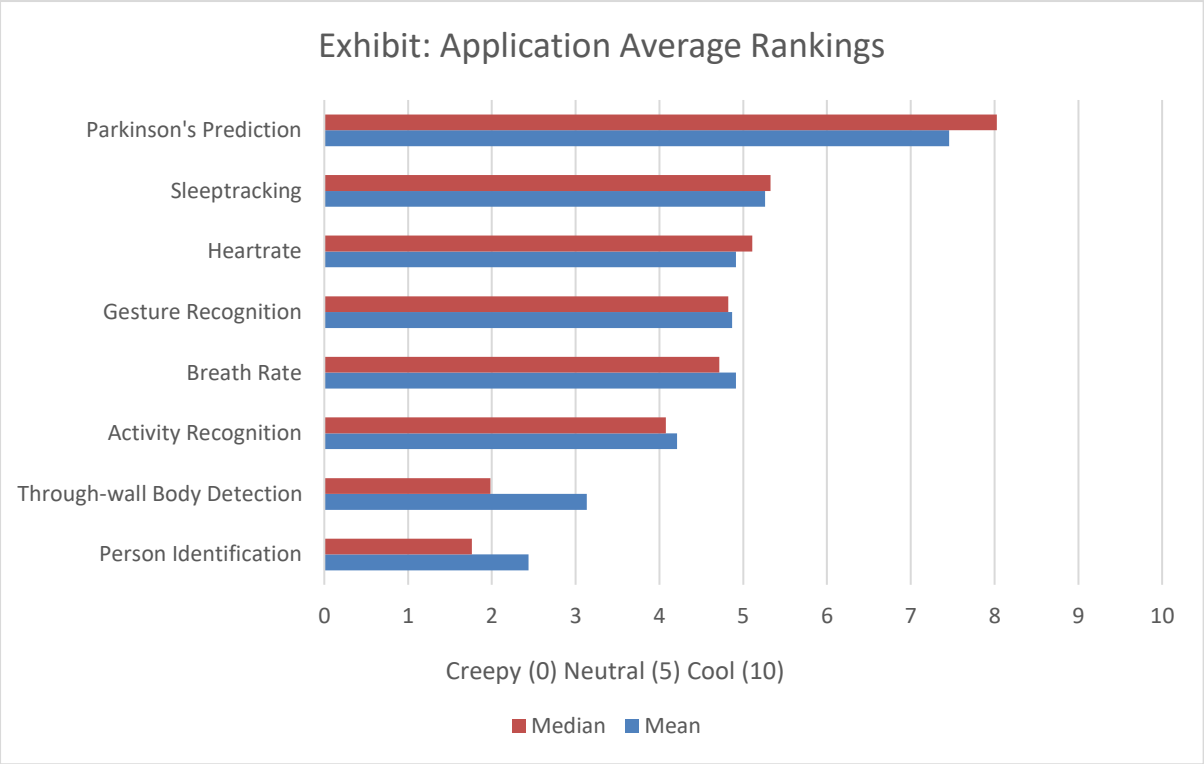

Figure 9 Averages for Application Preferences across Exhibit Locations

3.3. Person/Object Detection

The first innovation introduced was Person/Object Detection, which aligns with WP3 Static RF Sensing. The average preferences across exhibits can be seen in Figure 10. Participants were neutral about person-object detection in a public context (a museum) and more concerned about the technology in a private or semi-private setting such as their home or campus. Feedback from Post-it notes suggests that many found RF person object detection to be a redundant invention. Given that people are already tracked with cameras, they thought it might lead to more mass surveillance. Some suggested that this technology might lead to the development of new laws. Others noted that proper use and data ownership are important for this innovation.

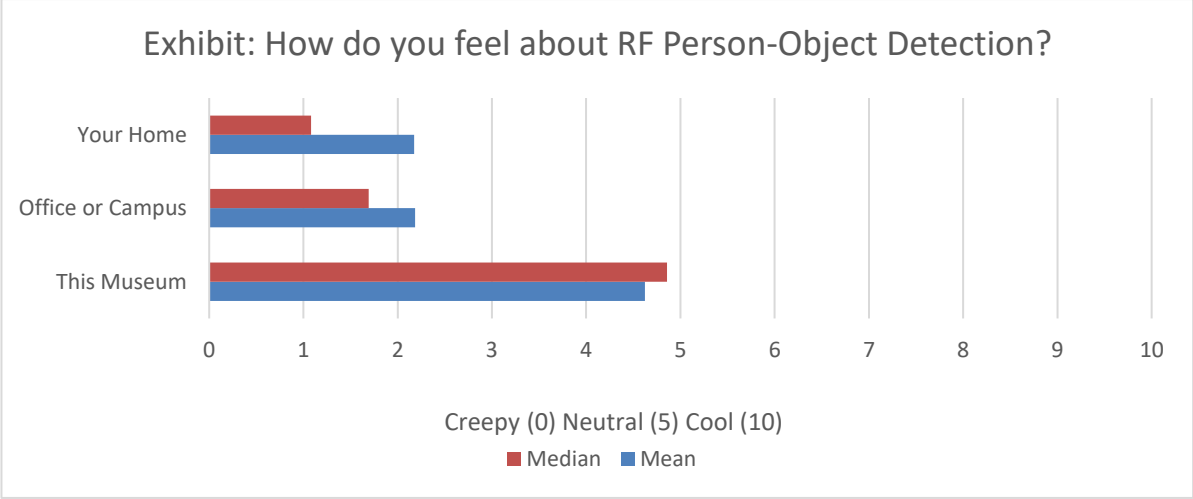

Figure 10 Exhibit Averages for Person Object Detection Preferences

Workshop findings varied slightly from the main exhibit. Use of the technology in a museum was seen as cool, the home context was neutral, and the office or campus context was deemed creepy (See Figure 11). Participants thought that anonymous detection in a public space, where it would provide security was welcome. In an office/campus setting people were worried that it might be used to micromanage. The innovation seemed useless in a home without a specific application. Only one workshop participant (out of six) thought that whether RF Person Object Detection was in public versus private space would not have an impact on whether the innovation feels creepy or cool. Four thought that the public versus private settings have a big impact on how creepy the technology is. Feedback included: "In public space, it is normal to be seen," "Only in the public space of the museum would I be open to its use, because I can imagine that its use for the museum outweighs the anxiety I would get from it. At home (or at work), I don't want to feel that way," "While this technology in public space feels good[,] in private space [it does] not feel cool. [] There is a dilemma.," "In public no creepy. In private creepy," "Public is more anonymous, therefore less creepy." Workshop participants thought that the technology could be made less creepy by not recognizing of individuals, only of behavior, implementing informed consent, restricting access and building laws around the technology.

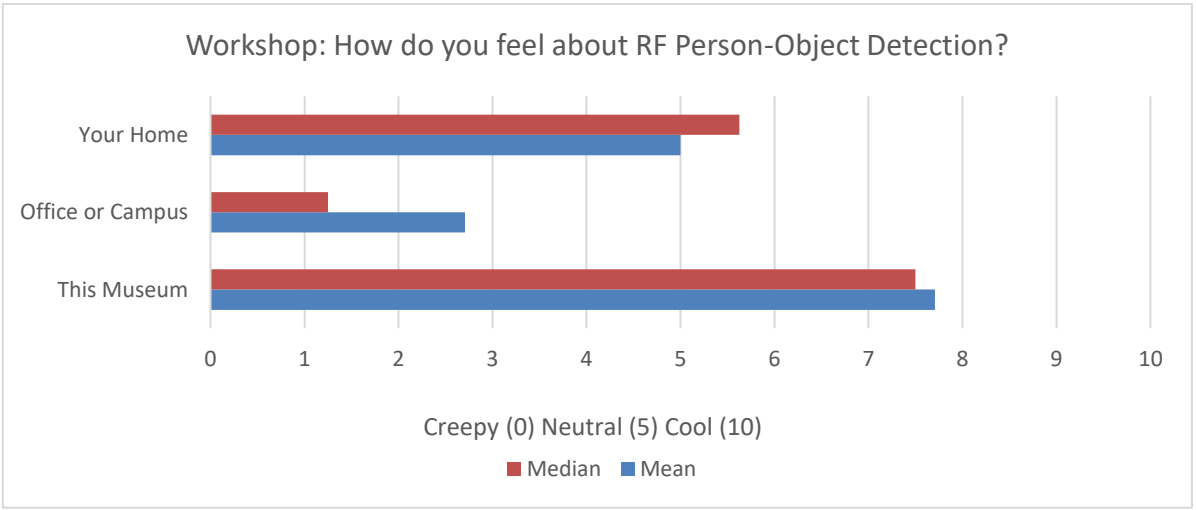

Figure 11 Workshop Averages for Person Object Detection Preferences

3.4. Smart RF TVs

The next section of the exhibit centred on Smart RF TVs. The application was described as having the following features: user identification, gesture recognition, activity recognition, interactive watching, emotion recognition, and always improving based on prior interactions and data. All of these features have potential in WIFI vision. Participants were asked how they felt about Smart RF TVs being installed in supermarkets, hotel rooms and in their homes. Hotel rooms were seen as the most creepy application, but none of the applications were viewed in a positive light on average (See Figure 12). Feedback from the Post-it notes suggested that people were concerned about having control over their data, who would access it, and what they would use it for. Smart TV might be helpful for some by offering tools for increased accessibility. One side effect of the personalization might be increased dependence and laziness, which may even lower individual autonomy. Moreover, people might get even more disconnected from reality and each other. It was suggested that If the TV collects a lot of info, it could become an in-home surveillance device.

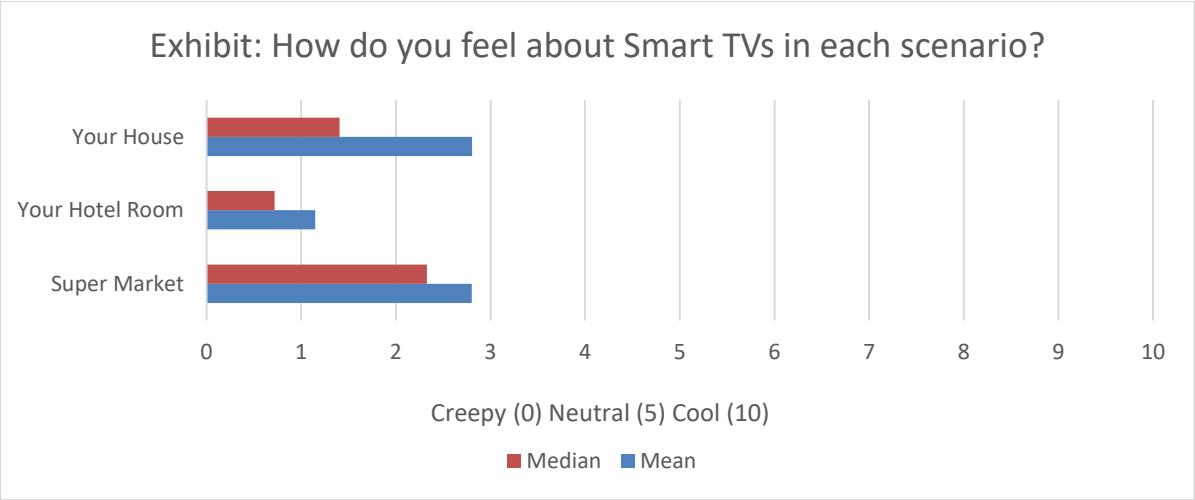

Figure 12 Exhibit Averages Smart TV Preferences

Workshop participants found the hotel application similarly creepy but were more neutral for the home and supermarket examples than exhibit visitors (See Figure 13). One person preferred the application if it did not have user identification: “If it can be traced back to people, it quickly becomes creepy. Whose data is it? At home, it's you[rs]. In a hotel, it's the hotel[‘s]. That's more creepy.” Another, likely referring to the supermarket example shared, “I don't like the idea of being followed in places where I want to retreat into my own bubble.” Yet another thought “in the supermarket and hotel room I don't think that there are any valid use cases to justify the potential privacy intrusion, but it can be useful at home as long as the data is only locally and securely stored.” All except one thought that whether a Smart TV was in public or private would have a big impact on how creepy or cool it is. The person who voted no was the same who voted no for the Person/Object Detection example.

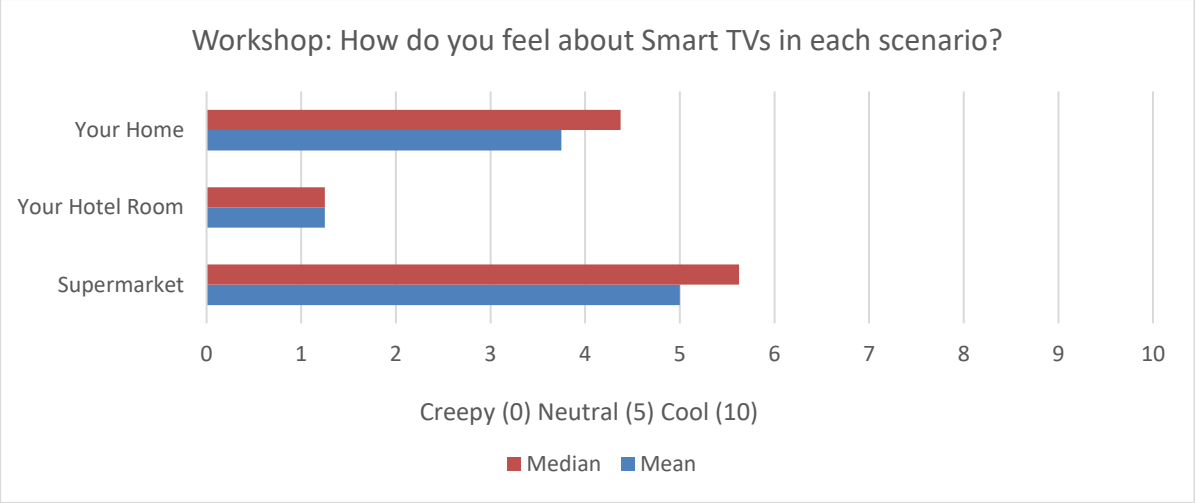

Figure 13 Workshop Averages Smart TV Preferences

When describing the impact public versus private space would have on the application, workshop participants thought that data ownership was important, “At my home, I expect that only I can access the data.” Others seemed to assume that if data was collected in their home, those providing the service would have access to it, therefore making private space more worrisome: “private space is not acceptable to me. In the case of a public space, I have a less strong reaction, but still don't like the idea,” “In a public space the feature is more appropriate. In a private place is questionable,” “Public space can be used for more monitoring, and private space for more control.” To make the feature less creepy participants suggested making it clear when the technology is on/off and when/where it is being employed. Additionally, people preferred if the data was controlled by the user and stored locally. Overall, the technology was already quite creepy. People thought that the data being used by 3rd parties or to manipulate or fine people would make the technology even creepier as well that predictive features “instead of being perceived as helpful may seem as intruding and borderline inappropriate.”

3.5. WIFI Care

The last application presented in the TINAC exhibit was WIFI Care. WIFI Care was described as “an integrated residential system providing non-intrusive insights and preemptive healthcare knowledge. By constantly collecting data on daily activity through WIFI monitoring, [it] assess[es] vitality, vulnerability to diseases like Parkinson’s, sleep health, and mental wellbeing. [The] system will recognize problems before you do!” Those who chose to interact with the exhibit found the elderly care facility more acceptable than use in their home or in a rental apartment (See Figure 14). This is likely because the rental apartment example given in the exhibit was described as a system that comes preinstalled in a home, giving the user less control over whether it is in place. Exhibit feedback from the Post-it notes suggest that the overall sentiment was that WIFI Care has the potential to help a lot of people in an efficient and cost-effective way without wearables. It might be interesting for a data nerd to have WIFI Care in their home. Nonetheless, it is important to be able to choose whether you use the system and how to access your data. Moreover, the system is more permissible to use on those that need intensive care or oversight than others who might be more self-sufficient. Several were concerned that WIFI Care might lead to people feeling lonely and isolated as well as less human-to-human connection and growing dependency on the technology. They also saw a large possibility of profiling and misuse.

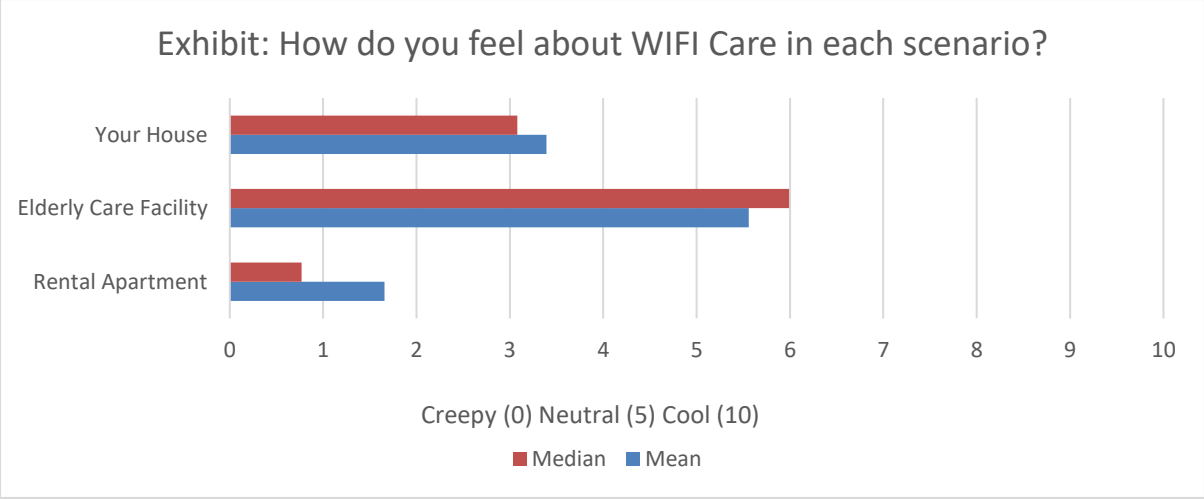

Figure 14 Exhibit Averages WIFI Care Preferences

In the WIFI Care section of the exhibit there was an additional panel asking participants to vote on how WIFI Care would make an elderly resident feel. Participants could choose between "empowered," "scared," "neutral," "alone," "safe," and "supported," and could vote as many times as they had stickers left (those who fully participated in the Tetem and Tankstation Exhibits would have 4 stickers left – Design Lab participants would have more due to smaller stickers with more per sheet). No one voted more than four times and most voted twice. Interestingly around 65% of respondents thought that WIFI Care would make residents feel supported but only around 14% thought it would make them feel empowered. Figure 15 shows the distribution from those who contributed to this section of the exhibit.

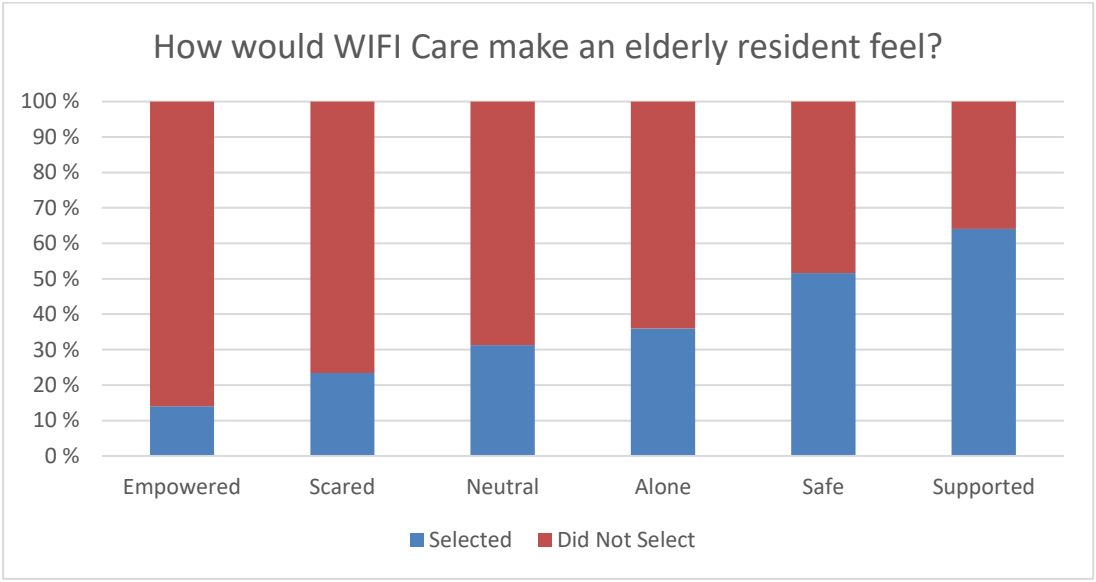

Figure 15 Exhibit Votes on How WIFI Care Would Make and Elderly Resident Feel

For the Closing Workshop, the preference ranking between the three WIFI Care Contexts were the same but more spread out (See Figure 16). Workshop participants on average reacted positively to the Elderly Care Facility example, more neutrally to WIFI Care in their home and found the rental apartment example quite creepy (4 of 6 gave it a 0). One person who ranked "your house" as neutral, the elderly care facility low and the rental apartment even lower reasoned that their choice was based on "autonomy of the observed." Another person found both the rental apartment and house example to be creepy and felt that they were only neutral about the care facility context: "In this case, only for an elderly care facility would I

consider actually applying it (for safety reasons). In my own home, I would absolutely not want it. Ditto for rental apartments." Two others pointed out the need to protect a frail individual. One justified their claim because "elderly care [] residents are already being monitored extensively."

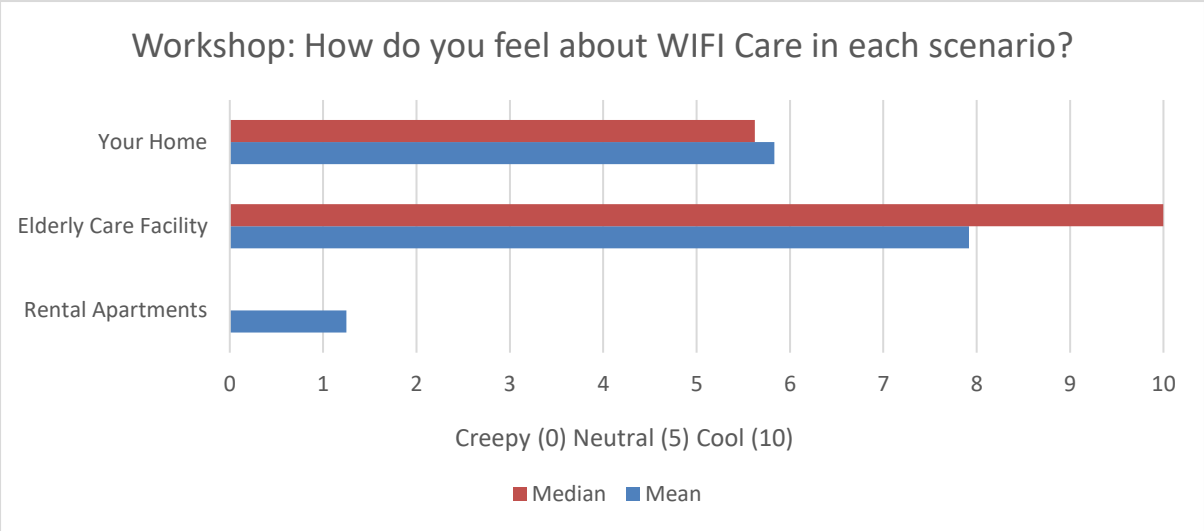

Figure 16 Workshop Averages WIFI Care Preferences

All workshop participants thought that whether WIFI Care was installed in public or private space had an impact on whether the technology was creepy or cool and 5 out of 6 participants thought the impact was significant. One reasoned, "It gets creepy when it's not clear who all can be watching. It gets creepy when you yourself are not in control of what is being monitored." Another shared, "I don't like the idea that I could be 'seen' by others in a way that I have little control over or would not even know it was happening and what that information would be used for." How the data was used had an impact on whether the public or private instances were creepy. If the system was used in public, the data was anonymous, and the system would benefit the public, the application was viewed more favorably. In private spaces participants assumed that it would be more obvious who was there, thus making the data more targeted. On the other hand, some participants reasoned that if they could control their own data in private space and had the autonomy to decide how and when to use the system, then the system might be cooler than being forced to interact with a system in public, especially if the public system could be used to track them or reduce their autonomy.

When it came to making the technology less creepy, workshop participants suggestions were focused on preventing misuse, communicating clearly what the technology is used for and making sure that the application was focused on benefiting the person being monitored. People were concerned about hidden features, deanonymization, and commercialization of the product. Five of six of the participants could envision themselves or someone they know using the technology, mostly for elderly care or monitoring specific occurrences such as a fall.

3.6. General Findings and Trends

Going through the written responses, some patterns emerge in the data. Respondents found that public data collection was okay if the system was anonymous, especially if it was in place to increase the common good such as improve public health and safety. People referred to already being monitored in public through cameras, so a less invasive, more privacy preserving method was seen as more neutral. However, there was also concern of being watched all the time in unavoidable public space. There were multiple

comments referring to George Orwell's 1984 and the Panopticon. If the technology was used in public and then taken over by a larger entity for controlling individuals that would make the technology creepier. Still, people have lower anticipations for privacy in public but expect to be anonymous.

Therefore, it is understandable that semi-private environments were creepy for participants. They thought that environments such as the workplace, hotel, and rental apartment were very creepy because they were spaces that one must occupy, that clearly are not owned by the individual but where one would still want a sense of privacy. People were concerned that they would not have ownership of the data and could be tracked and influenced against their will. Moreover, even if the systems worked anonymously, it might be easy to deduce who was occupying the space.

In private environments that the participants owned, such as their home, there was a sense that the technology would be okay if they had control of the data and could choose whether it was running and what features were made accessible. Some participants noted being fine with others choosing to use the technology of their own free will.

There was a persisting fear of the technology changing and of society growing dependent on a technology that ends up doing more than initially promised and then not being able to go back. Generally, RF monitoring and vision systems were seen as creepy. In specific instances where there was a clear purpose where it might be useful or a subgroup that was already monitored (such as the elderly care example or Parkinson's Prediction) then the technology was seen more positively. Consistently, laws and regulations were mentioned as essential alongside these developments. In the next steps we will compare individual results to see if certain preferences made one more or less likely to find an innovation creepier or cooler.

4. Theoretical Frameworks for Understanding the Impact of RF Sensing Technology

This section outlines the theoretical frameworks used to analyze the societal implications and technological appropriation of RF sensing. We draw on three complementary perspectives, collectively referred to as Mediation Theories: Technological Mediation Theory (TMT), Technological Environmentality Theory (TET), and Active Technological Gaze Theory (ATGT). Each framework provides a unique lens through which to interpret the findings of the appropriation surveys and workshop data.

4.1. Technological Mediation Theories

Peter-Paul Verbeek's Technological Mediation Theory [1,2] builds on Don Ihde's postphenomenology [3], which argues that technologies are never neutral—they actively shape human perception. Technologies can "amplify" or "reduce" aspects of experience, depending on their function and context. Verbeek extends this idea by demonstrating that technologies also mediate action. This makes designers and engineers ethically responsible for how their creations influence user behavior.

TMT introduces the concepts of "invitation" and "inhibition" to describe how technologies subtly guide human conduct. For instance, an ultrasound image with enhanced resolution may invite parents to continue a pregnancy by making the fetus appear more lifelike. This illustrates how technological mediation can alter personal decision-making by reconfiguring perception. Verbeek's framework urges designers to anticipate such effects early in the development process.

Technological Environmentality Theory (TET) [4], as developed by Aydin et al. (2019), shifts the focus from discrete human-technology interactions to the environmental conditions technologies produce. Especially in systems involving AI, sensors, and ubiquitous connectivity, technologies form "active technological environments" (ATEs)—ambient infrastructures that precondition perception, behavior, and self-understanding, often beneath conscious awareness.

Where TMT addresses specific interactions between users and artifacts, TET emphasizes how these interactions scale into systemic, distributed forms of agency. It builds on postphenomenology and Material Engagement Theory but goes beyond them by highlighting how technological environments shape spatial legibility, social norms, and the background of daily life. In doing so, TET extends TMT's emphasis on ethical responsibility beyond individual design choices to encompass the broader configuration of networked environments that structure lived experience.

Active Technological Gaze Theory (ATGT) builds on Jacques Lacan's concept of the gaze [5]—not just as the act of looking, but as the experience of being looked at, often without knowing by whom. In his Seminar XI, Lacan describes the gaze as something that disrupts our sense of control: it reminds us that we are not just observers of the world, but also objects within it, seen and impacted by others. This moment of potentially being seen shapes how we understand ourselves and what we desire.

A key example Lacan gives is Holbein's painting *The Ambassadors*, which includes a distorted skull hidden within the image. The skull becomes visible only from a specific angle, and when it suddenly emerges, it confronts the viewer with the unsettling realization that the image is looking back. This moment strips us of the illusion that we are fully in control of what is seen; instead, it reveals that our view has already been structured by the painting itself. Similarly, technologies today can expose and impact us in ways we do not anticipate, revealing that we are not the sole masters of our own visibility.

ATGT can be used to analyze modern sensing technologies, such as RF sensing, by showing that these technologies do not merely observe us passively—they actively structure how we imagine ourselves being seen, how we act, and how we relate to ourselves. They create specific conditions for visibility and invisibility, determining not only what is seen but also how individuals are positioned, recognized, or ignored within a larger system that defines what counts, what matters, and who is subject to control.

While Technological Environmentality Theory (TET) focuses on how technologies shape habits and normalize behaviors, ATGT highlights how they influence our inner life: how we come to desire, perform, or fear certain forms of visibility. It shows how we internalize the expectations built into technological systems. Together, the three theories offer a complete picture of RF sensing: TMT explains how it changes direct actions and perceptions, TET shows how it shapes the environments and routines around us, and ATGT reveals how it touches our emotions, desires, and very sense of self.

4.2. Applying Technological Mediation Theories to Survey Findings

Drawing on the TINAC exhibit and Closing Workshop, we examine how the public interprets and evaluates three RF sensing applications—Person/Object Detection, Smart TV, and WiFi Care—across public, semi-public, and private environments. Participants articulated their views using a "creepy–cool" spectrum, reflecting both practical and affective judgments. To shed light on these responses and further explain their underlying dynamics, we draw on the three mediation theories, which help unpack how these technologies shape perception, behavior, and subjectivity within different spatial and social contexts.

4.2.1. Person/Object Detection

Public Space: Public applications, such as use in museums or public squares, were met with ambivalence but leaned toward acceptability. Participants viewed use in public areas such as museums as neutral to cool, especially when detection was anonymous and intended for safety. It was seen as less invasive than other forms of monitoring like cameras. However, some still associated it with mass surveillance and stressed the need for regulation and restricted access.

TMT helps make sense of this nuanced response. It shows that the acceptability of Person/Object Detection hinges on how the technology mediates human perception and action. When framed as enhancing collective safety through anonymous sensing, it can invite trust and positive engagement. At the same time, TMT explains why unease persists: even without visual identification, RF sensing transforms public presence into a data point, inhibiting spontaneity and encouraging self-monitoring. Like Verbeek's ultrasound example, it subtly shapes behavior by creating an ambient awareness of being detectable—thus making visible the tension between public safety and personal freedom.

TET reveals how RF sensing restructures public environments into zones of latent surveillance, subtly altering their atmosphere and norms. While participants acknowledged that observation in public spaces is often expected, they emphasized that the invisible and continuous nature of RF sensing introduced a more diffuse and ambient form of control. The space itself began to "expect" certain behaviors, guiding attention, movement, and bodily comportment in ways that felt anticipatory rather than enforced.

ATGT deepens this analysis by illuminating the affective and symbolic weight of being seen without seeing. Drawing on Lacan, the invisible gaze operates as a spectral presence—anonymous yet affectively charged. RF sensing technologies generate a sense of heightened visibility not through overt monitoring, but through the subject's own anticipatory adjustment to imagined observation. The result is a transformation

of public space into a stage of internalized scrutiny, where individuals align themselves with normative expectations as if these were their own, revealing a broader shift toward environments that not only monitor but shape subjectivity from within.

Semi-Public Space: Use of RF sensing in offices or campuses was perceived as distinctly creepy due to concerns about micromanagement and institutional control. Participants feared it could enforce behavioral conformity and reduce autonomy. The semi-public context triggered anxieties about being tracked in spaces one is expected to trust but does not control—spaces that are familiar but not fully private, and where users expect a balance between visibility and discretion.

TMT helps explain this discomfort by showing how RF sensing mediates not just perception but also action. In these contexts, the technology was interpreted as a tool of disciplinary surveillance—one that subtly guides behavior by inviting compliance and inhibiting deviation. It no longer felt like people were watching, but that the technology itself had taken on the role of overseer. This shift illustrates TMT's insight that technologies are not neutral observers; they are actors in shaping conduct, making design decisions ethically consequential.

TET adds a second layer by revealing how RF sensing does more than mediate discrete interactions—it reshapes the entire environment. Semi-public spaces are especially sensitive to such restructuring because they depend on the dynamic negotiation of visibility, informality, and trust. Embedding sensing technology into these spaces turns them into ambient systems of behavioral regulation. Expectations become inscribed in the environment itself, narrowing the room for ambiguity or withdrawal. What had been fluid becomes pre-scripted. TET thus helps clarify how RF sensing technologies codify norms at the infrastructural level, transforming semi-public spaces into structured environments that subtly discipline their inhabitants.

ATGT exposes the deeper psychological consequences of this transformation. Building on Lacan's notion of the gaze, ATGT shows that RF sensing technologies not only observe but also position individuals within an invisible regime of visibility. Participants described feeling scrutinized by a system they could not see or address, generating a persistent awareness of being potentially seen. This spectral presence projected implicit expectations and induced anticipatory self-monitoring. Even without a visible observer, users adjusted their behavior, internalizing the norms embedded in the system. ATGT makes clear that RF sensing does not merely enforce conformity from the outside; it restructures subjectivity from within, making individuals complicit in their own regulation.

Private Space: Person/Object Detection in the home was largely rejected unless justified by a specific safety use case, such as elder monitoring. Participants found the technology unnecessary and intrusive in domestic contexts. Without a clear purpose and strong user control, it was seen as a violation of personal space and privacy—an erosion of the home as a protected sphere of autonomy, rest, and intimacy.

TMT helps explain this strong rejection by showing how technologies reshape not only how we perceive the world but also how we act within it. In the home, RF sensing was experienced as a technology that mediates behavior in ethically troubling ways: it invites scrutiny where people expect discretion, and inhibits informal or unstructured activity that defines domestic life. TMT clarifies that when technologies such as RF sensing are deployed without transparency and user agency, they undermine the existential foundations of the home. Over time, they do not merely monitor privacy—they reconfigure it, introducing new meanings of safety, care, and responsibility that are shaped by technological oversight rather than personal judgment.

TET deepens this understanding by shifting the focus from individual interactions to the systemic transformation of space. The home, traditionally experienced as a zone of opaque interiority, is restructured into an Active Technological Environment—a site of continuous data production and behavioral formatting. TET shows how even mundane actions like resting, lingering, or withdrawing become legible to the system, subtly disciplined by what the environment now affords and expects. This transformation is not just functional but ontological: the familiar intimacy of home life becomes fragile under conditions of ambient surveillance. The domestic environment no longer just shelters; it organizes and anticipates, aligning everyday life with invisible metrics of optimization and control.

ATGT brings into view the subjective and affective cost of this transformation. Drawing on Lacan's concept of the gaze, ATGT reveals how RF sensing enacts a mode of visibility that bypasses consent and saturates the private sphere with symbolic intrusion. The gaze here is not interpersonal but ambient and unlocatable, operating even when the subject believes itself to be alone. Participants expressed a sense of being exposed at their most intimate—where bodily gestures, moods, and unconscious states risk becoming data. Lacan's notion of a rupture in the Imaginary is especially stark in this context: the home, once a site of assumed invisibility, becomes a space where the subject is radically seen. Privacy no longer means the absence of others, but the continual presence of an unseen, data-harvesting observer—turning domestic life into a domain of internalized self-surveillance.

4.2.2. Smart TV

Public Space: Smart RF TVs placed in locations such as supermarkets were often perceived as creepy or unnecessary. Participants expressed discomfort with the idea of being watched in spaces where anonymity is usually taken for granted. Although these environments were not as intimate as the home, the presence of sensing technologies still raised concerns about data use, manipulation, and the absence of transparency. The main anxieties centered on who controlled the data and for what purposes it might be used.

TMT helps explain this response by showing how even passive technologies subtly reshape users' experience of a space. In places where people expect to be socially anonymous—like supermarket aisles or waiting areas—the knowledge or suspicion that one's movements might be tracked introduces a quiet form of behavioral inhibition. TMT's concepts of "invitation" and "inhibition" are especially relevant here: while the Smart TV does not demand interaction, it still alters the perceptual field by suggesting that ordinary, inattentive behavior is now legible and possibly monetized. This produces a detached, self-aware posture, where people adjust their actions without ever being directly addressed. Even in low-stakes environments, mediation still occurs—softly nudging perception and action toward cautious self-regulation.

TET adds a second, more structural perspective by revealing how Smart TVs, even when not actively engaged, help script the broader environment. TET emphasizes that technological artifacts are not isolated—they contribute to the formation of *Active Technological Environments* that guide behavior ambiently. In these spaces, the presence of RF sensing begins to condition how people orient themselves physically: how they pause, wait, stand, or move in relation to the screen. The space becomes quietly performative, infused with unspoken expectations. What was once neutral or transitional—like a checkout line or seating area—becomes subtly structured, anticipating certain behaviors and discouraging others. TET thus shows how technologies designed for minimal interaction can still shape spatial legibility and habitual conduct.

ATGT brings the symbolic dimension of this shift into focus. Drawing on Lacan's concept of the gaze, ATGT reveals how the Smart TV functions as a proxy for an abstract observer—an unseen Other that watches without acknowledging or addressing the subject. This indirect visibility creates a regime of passive control, where the possibility of being seen becomes enough to induce behavioral adjustment. The gaze here is spectral: no one is looking in any personal sense, yet the sense of exposure persists. Participants described this as unsettling precisely because it blurred the boundary between public anonymity and private scrutiny. ATGT helps articulate how such technologies mediate not just behavior but self-awareness, fostering a low-grade pressure to conform even in otherwise casual environments.

Semi-Public Space: Hotel rooms and lounges were rated as the creepiest settings for Smart TVs, with strong discomfort about data collection and emotional profiling. Participants emphasized loss of autonomy and a blurred boundary between service and surveillance. Even accessibility benefits were overshadowed by concerns about commercial misuse and lack of user control.

TMT helps explain this response by revealing how RF sensing disrupts users' experience of spatial and ethical control. In semi-private spaces, where individuals expect temporary ownership and emotional privacy, the use of Smart TVs for affective or biometric data collection was seen as particularly intrusive. TMT shows that technologies do not merely function—they *invite* or *inhibit* behavior through how they mediate perception and action. Here, the technology invited passive compliance while subtly inhibiting informal or unmonitored conduct. The result was a sense that one's intimate states were being accessed and possibly monetized. In such ambiguous environments, TMT underscores the ethical responsibility to preserve a user's sense of situational authority—something that was clearly lost when the space began to feel monitored rather than inhabited.

TET adds a broader structural dimension by showing how RF sensing reconfigures semi-private spaces into ambient systems of behavioral management. Hotel rooms and lounges, which once provided a buffer between public life and private retreat, were described by participants as becoming extensions of corporate or managerial regimes. TET explains that this transformation is not imposed overtly but emerges from the environment itself, as sensing technologies silently normalize expectations and prescribe rhythms of attention and affect. The Smart TV, once a passive screen, becomes an anticipatory interface—responding to predicted user states and aligning behavior with external priorities. In this way, semi-private spaces are *re-ontologized* as sites of soft control, subtly stripping away the ambiguity and freedom that once defined their comfort.

ATGT makes this shift personally and symbolically felt. Participants described the unsettling sensation that the TV was watching them—not in any clear or visible way, but as a background presence that transformed the space from interior to exposed. This affective response aligns with Lacan's idea of the gaze as a disruption in the field of vision: one is no longer simply the subject who sees, but the object potentially seen by an unseen Other. In the semi-private setting of a hotel room or lounge, this rupture is especially charged. These are spaces where people are physically alone but symbolically vulnerable—where the introduction of surveillance does not merely interrupt behavior but alters the subject's sense of self. ATGT reveals how RF sensing in these environments undermines privacy not through direct observation, but through the pervasive ambiguity of being possibly seen, transforming what should be temporary refuge into a site of self-monitoring and unease.

Private Space: At home, Smart TVs were viewed with skepticism and concern, particularly regarding hidden surveillance and the loss of data ownership. While some participants acknowledged potential benefits if

the data remained locally stored and under their control, most found the technology intrusive. Personalization was not welcomed as a convenience, but perceived as a form of manipulation—undermining autonomy by predicting and influencing behavior in ways that bypass conscious consent.

TMT highlights the ethical stakes of this reaction. In the home, a space associated with self-determination and existential freedom, mediation without meaningful control mechanisms—such as explicit consent, local data processing, and the ability to opt out—was experienced as a violation. The Smart TV no longer appeared as a neutral entertainment device, but as a system that reorients perception and action toward commercial ends. Technological Mediation Theory shows that in such contexts, the device subtly inhibits unstructured or spontaneous activity, inviting compliance with preconfigured scripts. The home, traditionally a place of personal discretion, is thus mediated into a site of externally shaped behavior and latent surveillance.

TET reveals how Smart TVs contribute to a more fundamental reconfiguration of the domestic sphere. The home becomes part of an active technological environment—an ambient infrastructure in which everyday life is shaped by predictive systems. As the Smart TV learns, adjusts, and personalizes content, it imposes rhythms and feedback loops that are no longer grounded in the lived needs of the inhabitants but in the operational logic of the system. Over time, routine actions—what to watch, when to pause, how to relax—become aligned with invisible networked agencies. The domestic space is no longer purely organized around family life, rest, or retreat, but becomes entangled in a broader environment of behavioral optimization and data circulation.

ATGT adds a symbolic and affective layer. The Smart TV becomes more than a screen; it becomes a reflective interface through which the user's gestures, preferences, and even moods are interpreted and recorded. Lacan's concept of the gaze is useful here: the subject does not simply watch—it becomes watchable. A glance, a shift in posture, or a pause in viewing becomes legible to the system. This introduces a split between lived experience and its algorithmic rendering, producing an eerie sense of internal exposure. The gaze is no longer external but embedded—operating silently within the intimate contours of the home. The sense of being alone gives way to the awareness that one's presence is already being parsed, analyzed, and archived.

4.2.3. WiFi Care

Public Space: WiFi Care in public settings was deemed acceptable by participants only under strict conditions: data had to remain fully anonymous and be used transparently for collective benefit. While public health objectives were generally supported, there was persistent concern about deanonymization and potential secondary uses. The technology's invisibility and capacity to track individuals across time and context made its deployment in public space ethically sensitive. The system's invisibility and potential to track individuals across contexts made public implementation ethically sensitive.

TMT helps explain this reaction by showing how WiFi Care does not simply gather health-related data—it mediates how individuals perceive their surroundings and their own participation in shared spaces. Even without personal identification, the awareness that one's movements are being tracked can alter how people engage with the environment. TMT reveals that technologies like this invite a mode of cautious, self-aware presence, where spontaneous or idle behaviors may be inhibited in favor of what feels appropriate under ambient observation. Public space, typically associated with informal movement and anonymity, is subtly reoriented toward legibility and utility.

TET extends this insight by showing how WiFi Care contributes to a systemic transformation of public environments. Through the translation of everyday activity—such as walking, queuing, or gathering—into data, public space becomes an active technological environment. TET reveals that this transformation operates not through overt commands, but through the normalization of data production as part of spatial design. What was once unmarked behavior becomes legible, sortable, and potentially actionable. Public life is no longer merely lived—it is continually interpreted by invisible systems. The infrastructure recodes the meaning of presence itself, aligning it with institutional logics of control, optimization, or public management.

ATGT completes the picture by addressing the symbolic and affective experience of being anonymously visible. The individual is no longer recognized in any personal or intersubjective sense, but as part of a statistical aggregate—a moving signal in a managed crowd. ATGT draws on Lacan's concept of the gaze to show how such impersonal visibility produces discomfort, even in the absence of direct surveillance. The gaze in this case is ambient, unlocatable, and without human intention. It forms a kind of data halo around each body, registering presence without recognition. This creates an affective tension: one is visible, but not seen; registered, but not acknowledged. Participants described this as unsettling, particularly when the implications of the observation were opaque or unknowable.

Semi-Public Space: Rental apartments and care homes provoked the most concern among participants, particularly when WiFi Care was installed unilaterally by landlords or institutions. These are semi-public spaces: settings where people reside over extended periods but do not fully control the infrastructure around them. Participants feared a loss of autonomy, profiling without consent, and the erosion of trust in environments where dignity, privacy, and care are expected. Even in elder care contexts, acceptability hinged on clear necessity, transparent communication, and respect for individual boundaries.

TMT shows how WiFi Care mediates not only behavior, but also the relational and ethical structure of the space itself. In these semi-public settings, where individuals live but remain subject to institutional oversight, the introduction of sensing technologies can be experienced as imposed and morally intrusive. TMT helps explain why participants felt that their autonomy was undermined: the technology invited alignment with administrative objectives while inhibiting unmonitored, informal forms of behavior. The home, once a site of personal orientation, begins to reflect the priorities of external actors. The result is a shift in the perceived ownership of space, with users adjusting their conduct not freely, but in response to what they feel the system expects.

TET builds on this by showing how semi-public living arrangements are structurally ambivalent—neither fully private nor entirely institutional. WiFi Care intensifies this ambiguity by embedding care functions directly into the technological environment. Instead of relying on human interaction, observation becomes automated and continuous. TET reveals how this changes the ontology of care: what was once dialogical becomes infrastructural. The environment begins to predefine what counts as normal, healthy, or appropriate, shaping behavior in line with predictive norms rather than individual needs. Over time, oversight becomes ambient and behavioral expectations become internalized, reducing the possibility of negotiation, withdrawal, or reinterpretation.

ATGT adds a final, affective and symbolic layer. The subject in these environments is not merely observed, but algorithmically classified, monitored, and anticipated. The gaze in this context is no longer interpersonal—it is procedural and predictive. ATGT draws on Lacan's concept of the gaze to explain how this shift alters subjectivity: individuals do not simply appear to others, they are acted upon by a system that sees without showing itself. Participants described a sense of depersonalization—being reduced to a

set of behavioral markers or risk profiles. This preemptive visibility produces a loss of agency within one's own living space: the subject feels known before speaking, categorized before acting. What was meant as care is experienced as control.

Private Space: Use of WiFi Care in one's own home was conditionally acceptable, especially when initiated by the user and tied to a clear benefit, such as health monitoring. Participants consistently emphasized the importance of full control, local data storage, and the ability to activate or deactivate the system at will. Autonomy and informed choice were critical: the same technology could be perceived as helpful or invasive depending entirely on whether the user remained in charge. The distinction between "cool" and "creepy" hinged on the preservation of agency within the private sphere.

TMT shows how WiFi Care mediates ethical relations within the home by shaping how responsibility, care, and control are distributed. The home is not merely a backdrop to interaction—it is an active site of meaning, where autonomy carries both practical and moral significance. TMT reveals that without explicit consent and sustained user control, technologies meant to support can come to feel imposed. In this context, even well-intentioned interventions risk being interpreted as intrusions. Care becomes conditional on compliance, and the home shifts from a place of self-direction to one in which behavior is gently but persistently managed. The moral fabric of the space is altered: help is no longer chosen, but structured.

TET adds a structural layer by showing how even beneficial sensing technologies transform the underlying logic of domestic life. With WiFi Care, the caring relation migrates from human-to-human interaction into the infrastructure of the environment itself. The home becomes a self-regulating space—its walls embedded with feedback loops that define well-being through behavioral stability and regularity. Over time, these loops impose an implicit standard of normalcy: sleep patterns, movement rhythms, and rest cycles become data points that either confirm or challenge expectations. TET reveals how such environments, even when perceived as helpful, narrow the range of legitimate variation in everyday life. What does not fit becomes subtly pathologized or flagged for intervention.

ATGT completes the picture by revealing how these transformations affect subjectivity at its most intimate level. Drawing on Lacan's concept of the gaze, ATGT interprets the sensing function of WiFi Care as an intensified and internalized form of visibility. The system does not merely observe—it renders legible what would otherwise remain private: sleep disturbances, pain, restlessness, fatigue. The body becomes readable in ways that bypass speech and intention. Participants described a paradoxical experience: feeling both protected and exposed. The technology offered reassurance, but at the cost of bodily opacity and interior freedom. The home, once a space for retreat and unselfconscious presence, became a place where even silence and stillness were interpreted and stored.

5. Conclusion

The TINAC Exhibit and Closing Workshop offered an initial exploration of how members of the public perceive RF sensing technologies—Person/Object Detection, Smart TVs, and WiFi Care—across public, semi-public, and private settings. While not exhaustive, the responses reveal distinct patterns in how people assess the desirability and risks of these technologies, using a "creepy–cool" spectrum that reflected both practical concerns and affective responses.

Participants consistently emphasized the importance of contextual appropriateness, user control, and clear benefits. Anonymization and opt-in use were generally preferred, but lost meaning in semi-private and private spaces where identification was implicit. Concerns about surveillance, profiling, and autonomy were especially pronounced in environments where trust and discretion were expected. At the same time, there was conditional acceptance—particularly when technologies supported safety or care and were initiated by the user. Across all settings, there was a clear demand for stronger safeguards, transparency, and agency.

The mediation theories helped interpret these patterns by revealing how RF sensing technologies reshape perception, environment, and subjectivity. Technological Mediation Theory illuminated how control and agency are redistributed at the level of interaction. Technological Environmentality Theory clarified how environments themselves become structured around sensing, normalizing behavioral expectations. Active Technological Gaze Theory revealed how users internalize these dynamics, adjusting to invisible regimes of visibility that blur the line between care and control. Together, the theories show how RF sensing technologies do not simply gather data, but transform the spaces, behaviors, and identities they touch.

The findings call for the development of RF sensing systems that prioritize legibility, reversibility, and contextual sensitivity. Designers and regulators must attend not only to functional integration, but also to the subtle ways these technologies mediate meaning, autonomy, and relational trust. The theories offer not a checklist, but a framework for anticipating and addressing the ethical and experiential dimensions of this emerging technological environment.

6. References

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Appendix A. “This is Not a Camera!” Exhibit Panels

Posters at Tankstation and Tetem were A0. The Posters in the Design Lab were A3.

This is Not a Camera!

The Future of Monitoring through WIFI

De toekomst van bewaking via WIFI

WIFI - you cannot see it, or feel it, but it is there. It brings data to and from your phone, laptop, and other devices. It travels at or near the speed of light through darkness, rain, and walls!

Did you know? Light travels at 300,000km/s in a vacuum? The earth is only 12,756km wide. (Light slows down when traveling through materials, such as glass!)

Although we cannot see WIFI, WIFI can be used to monitor us and our environment.

(WIFI can even be used for activity recognition and to measure breath and heart rate!)

Explore this interactive exhibit to learn how WIFI monitoring works, what applications are underway, and vote on what you think about this technology.

Your anonymous interactions will be used for research to help ethicists at the University of Twente form regulations and design constraints for ethical RF wave holography. If you do not want to contribute to the study, simply refrain from partaking in the interactions!

WIFI - je kunt het niet zien of voelen, maar het is er wel. Het brengt gegevens van en naar je telefoon, laptop en andere apparaten. Het reist met of bijna met de snelheid van het licht door duisternis, regen en muren!

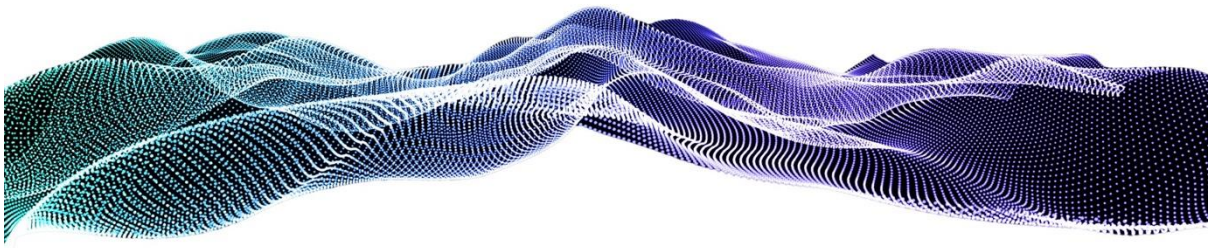
Wist je dat? Licht reist met 300.000 km/s in een vacuüm? De aarde is maar 12.756 km breed. (Licht wordt langzamer als het door materialen reist, zoals glas!)

Hoewel we WIFI niet kunnen zien, kan het wel worden gebruikt om ons en onze omgeving in de gaten te houden.

(WIFI kan zelfs worden gebruikt voor activiteit herkenning en om ademhaling en hartslag te meten!)

Verken deze interactieve tentoonstelling om te leren hoe WIFI-monitoring werkt, welke toepassingen er zijn en stem op wat je van deze technologie vindt.

Je anonieme interacties worden gebruikt voor onderzoek om ethici aan de Universiteit Twente te helpen bij het opstellen van regels en ontwerpbeperkingen voor ethische RF-holografie. Als je niet wilt bijdragen aan het onderzoek, neem dan geen deel aan de interacties.



Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Innovation Council and SMEs Executive Agency (EISMEA). Neither the European Union nor the granting authority can be held responsible for them.

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Gefinancierd door de Europese Unie. Opvattingen en meningen zijn echter uitsluitend die van de auteur(s) en komen niet noodzakelijkerwijs overeen met die van de Europese Unie of het Uitvoerend Agentschap voor de Europese Innovatieraad en het MKB (EISMEA). Noch de Europese Unie, noch de subsidie verlenende autoriteit kan hiervoor verantwoordelijk worden gehouden.

Subsidieovereenkomst nr.: 101099491 https://holden-project.eu/

UNIVERSITY OF TWENTE. HOLDEN Funded by the European Union European Innovation Council

This Exhibit is Interactive!

Deze tentoonstelling is interactief!

(Yes, we want you to put stickers on the panels.)

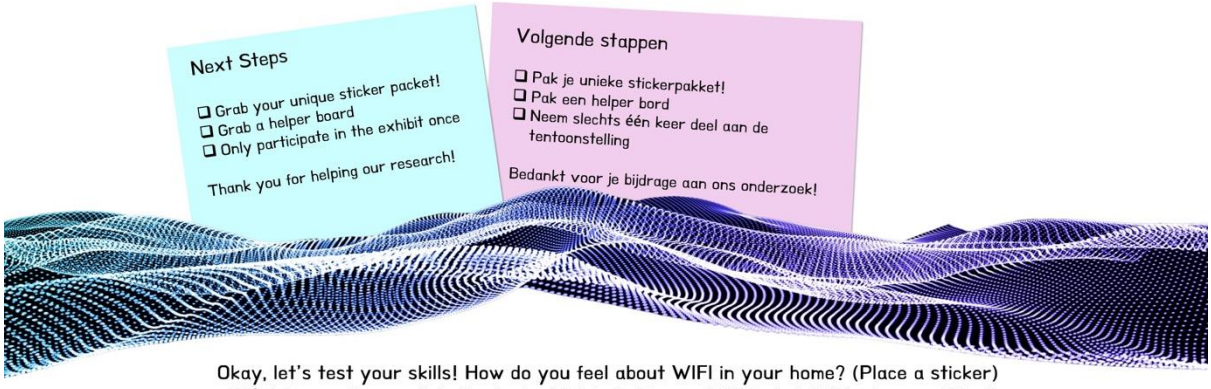
(Ja, we willen dat je stickers op de panelen plakt).

By interacting with the exhibit, you will contribute to a University of Twente study on public perception and appropriation of WIFI monitoring. All data collected will be anonymous and used to further research in this field! You can stop interacting with the exhibit at any time.

Door interactie met de tentoonstelling draag je bij aan een onderzoek van de Universiteit Twente naar de publieke perceptie en toe-eigening van WIFI-monitoring. Alle verzamelde gegevens zijn anoniem en worden gebruikt voor verder onderzoek op dit gebied! Je kunt op elk moment stoppen met de tentoonstelling.

We are not responsible if you share your interactions on social media. Please be respectful of others by not photographing other patrons without their explicit permission!

Wij zijn niet verantwoordelijk als u uw interacties deelt op sociale media. Heb respect voor anderen door geen foto's van andere bezoekers te maken zonder hun uitdrukkelijke toestemming!



Okay, let's test your skills! How do you feel about WIFI in your home? (Place a sticker)

Oké, laten we je vaardigheden testen! Wat vind je van WIFI in huis? (Plaats een sticker)

It is horrible! *Het is verschrikkelijk!* — **I am neutral** *Ik ben neutraal* — **It is awesome!** *Het is geweldig!*

How do you feel about 5G towers?

Wat vind je van 5G-masten?

They are horrible! *Ze zijn verschrikkelijk!* — **I am neutral** *Ik ben neutraal* — **They are awesome!** *Ze zijn geweldig!*

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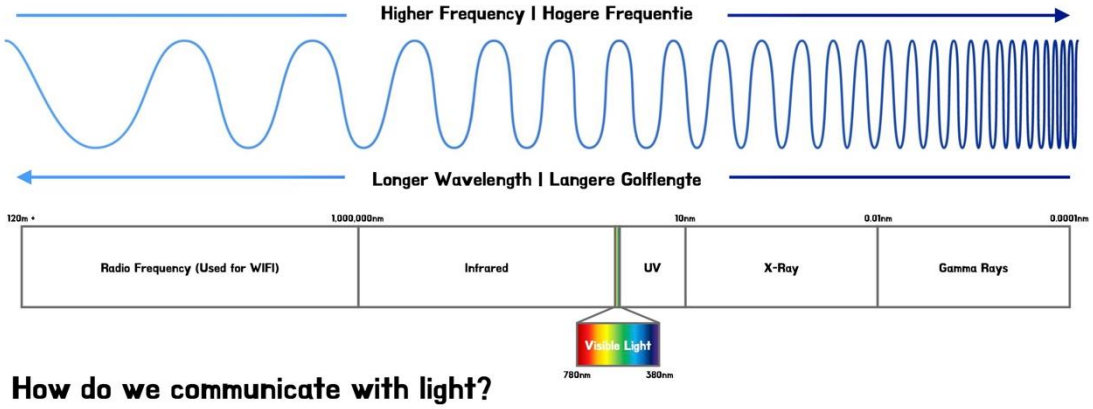
What is WIFI?

Wat is WIFI?

WIFI is a system that uses invisible light to send data. Human eyes can only see light between 380nm-780nm in length. Radio frequency (RF) waves used for WIFI are over 1000x as long. WIFI's wavelength helps it travel far and through walls! The wavelength determines the type of wave (ex: radio, infrared, UV).

WIFI is een systeem dat onzichtbaar licht gebruikt om gegevens te verzenden. Menselijke ogen kunnen alleen licht zien met een lengte tussen 380nm-780nm. Radiofrequentiegolven (RF) die voor WIFI worden gebruikt, zijn 1000x zo lang. De golflengte van WIFI helpt het om ver en door muren te reizen! De golflengte bepaalt het type golf (bijv.: radio, infrarood, UV).

The Light (Electromagnetic) Spectrum | Het Elektromagnetische Lichtspectrum



How do we communicate with light?

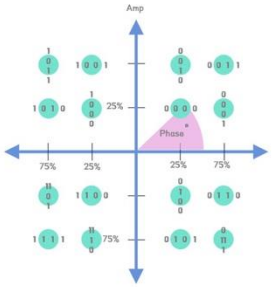
Hoe communiceren we met licht?

Digital information is encoded into 1s and 0s, which are transformed to RF waves that are sent out through antenna. Receivers capture that information which then is translated back to 1s and 0s.

Digitale informatie wordt gecodeerd in 1-en en 0-en, die worden vervolgens omgezet in RF-golven die via een antenne worden verzonden. Ontvangers vangen die informatie op die vervolgens weer wordt vertaald naar 1-en en 0-en.

Depending on the signal, different protocols are used to send more information faster! Shorter RF waves cannot travel as far but may deliver information quicker due to higher frequency. Waves can also be spliced up to share more information at once by adjusting the amplitude or shifting the phase.

Afhankelijk van het signaal worden verschillende protocollen gebruikt om meer informatie sneller te verzenden! Kortere RF-golven reizen minder ver maar kunnen sneller informatie leveren dankzij de hogere frequentie. Golven kunnen ook worden samengevoegd om meer informatie in één keer te delen door de amplitude aan te passen of de fase te verschuiven.



Light can deliver multiple 1s and 0s at once as in this simplified 16QAM Constellation

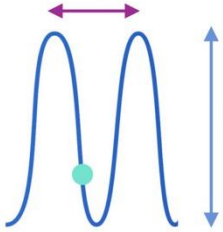
Licht kan worden gebruikt om meerdere 1-en en 0-en tegelijk te leveren, zoals in deze vereenvoudigde 16QAM-constellatie

Amp 75% & Phase 45°= 0011

Amp 75% & Fase 45° = 0011

Wavelength = distance from crest to crest

Golflengte = afstand van kam tot kam



Amplitude = height of the wave

Amplitude = hoogte van de golf

Phase = Position within the wavelength

Fase = Positie binnen de golflengte

IEEE 802.11 is the worldwide standard for wireless networking! Without standards, we would not be able to send and interpret WIFI data all over the world.

IEEE 802.11 is de wereldwijde standaard voor draadloze netwerken! Zonder standaarden zouden we over de hele wereld geen WIFI-gegevens kunnen versturen en interpreteren.

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The Smart World

De slimme wereld

People love being connected! It is estimated that 90% of people in the Netherlands own a smartphone. People also own other "smart" devices such as personal assistants (Alexa, Siri, Google Home) and smart appliances and electronics such as lights. For many, a home is not complete without internet access.

Mensen zijn graag verbonden! Geschat wordt dat 90% van de Nederlanders een smartphone heeft. Mensen bezitten ook andere "slimme" apparaten zoals persoonlijke assistenten (Alexa, Siri, Google Home) en slimme apparaten en elektronica zoals lampen. Voor velen is een huis niet compleet zonder internettoegang.

The monitoring systems of the future
De monitoringsystemen van de toekomst

How to monitor using WIFI?

Hoe bewaken met WIFI?

WIFI uses light to transfer information from one location to another. Light is also what we primarily use to see! Light interacts with the environment reflecting, absorbing, transmitting and more. The environment therefore affects the signals received. By working backwards (reverse image source solving) to calculate where the light is coming from, one can get an idea of an environment and its contents.

WIFI gebruikt licht om informatie van de ene locatie naar de andere over te brengen. Licht is ook wat we voornamelijk gebruiken om te zien! Licht interacteert met de omgeving via reflectie, absorptie, transmissie en nog veel meer. De omgeving beïnvloedt dus de ontvangen signalen. Door achterwaarts te werken (omgekeerde beeldbronoplossing) om te berekenen waar het licht vandaan komt, kan men een idee krijgen van een omgeving en de inhoud ervan.

A lightbulb illuminates a kitten, which reflects light into our eyes, making it visible. No visible light = no seeing the kitten!

Een gloeilamp verlicht een kitten, dat licht weerkaatst in onze ogen, waardoor het zichtbaar wordt. Geen zichtbaar licht = geen kitten zien!

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How to monitor using WIFI?

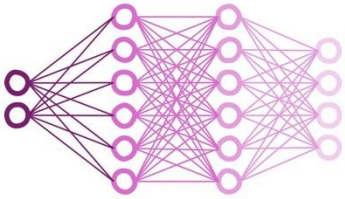
Hoe bewaken met WIFI?

A router emits WIFI that reflects waves off the kitten, changing what the receiver receives, thus making the object "visible!"

Een router zendt WIFI-golven uit, die golven weerkaatsen van de kitten, dit verandert wat de ontvanger ontvangt en hierdoor wordt het object "zichtbaar"!

This can also work for moving objects, especially when we add in machine learning!

Dit kan ook werken voor bewegende objecten, vooral als we machine learning toevoegen!



"90% sure someone is falling!"

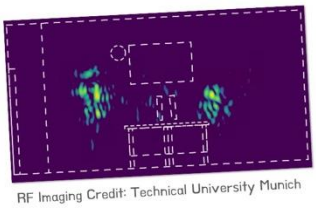
"90% zeker dat er iemand valt!"

That was a LOT of information. How much of this did you already know?

Dat was veel informatie. Hoeveel hiervan wist je al?

WIFI cannot "see" the same way we see! Some argue that this makes it more "privacy preserving."

WIFI kan niet op dezelfde manier "zien" als wij! Sommigen beweren dat dit het "privacybeschermende" maakt.



RF Imaging Credit: Technical University Munich

I just learned a lot!
Ik heb veel geleerd!

I knew some of this
Ik wist hier iets van

I already knew all this at a higher level
Ik wist dit allemaal al op een hoger niveau

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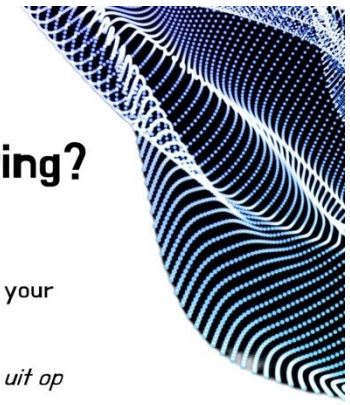

What can you do with WIFI monitoring?

Wat kunt u doen met WIFI monitoring?

WIFI waves have already been used for the following applications! Cast your vote on how it makes you feel on the "Creepy to Cool Meter."

WIFI-golven zijn al gebruikt voor de volgende toepassingen! Breng je stem uit op de "Griezel tot Cool Meter".

Breath Rate
Ademfrequentie

Creepy *Het is verschrikkelijk!* — I am neutral *Ik ben neutraal* — Cool *Het is geweldig!*

Heartrate
Hartslag

Creepy *Het is verschrikkelijk!* — I am neutral *Ik ben neutraal* — Cool *Het is geweldig!*

Sleep Tracking
Slaap Monitoren

Creepy *Het is verschrikkelijk!* — I am neutral *Ik ben neutraal* — Cool *Het is geweldig!*

Parkinson's Prediction
Voorspelling Parkinson

Creepy *Het is verschrikkelijk!* — I am neutral *Ik ben neutraal* — Cool *Het is geweldig!*

Activity Recognition
Activiteit Herkenning

Creepy *Het is verschrikkelijk!* — I am neutral *Ik ben neutraal* — Cool *Het is geweldig!*

Gesture Recognition
Gebarenherkenning

Creepy *Het is verschrikkelijk!* — I am neutral *Ik ben neutraal* — Cool *Het is geweldig!*

Person Identification
Persoonsidentificatie

Creepy *Het is verschrikkelijk!* — I am neutral *Ik ben neutraal* — Cool *Het is geweldig!*

Through-wall Body Detection
Detectie van lichamen door muren

Creepy *Het is verschrikkelijk!* — I am neutral *Ik ben neutraal* — Cool *Het is geweldig!*

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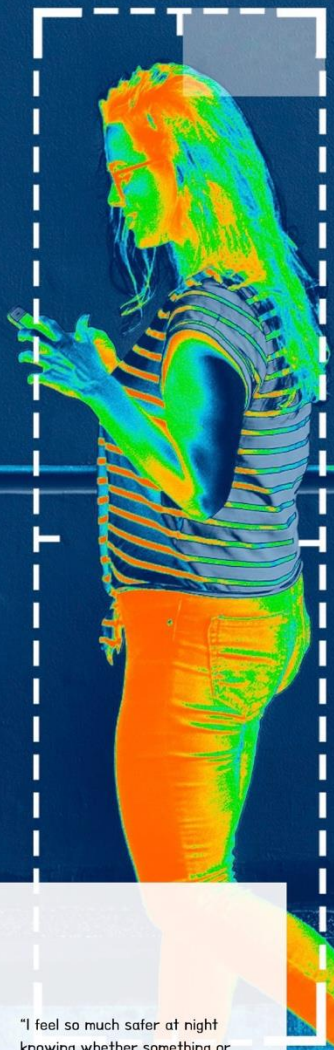
Welcome to 2035
Welkom in 2035
Now that you have learned how WIFI monitoring works, we are dropping you in 2035. The products you are about to view have been on the market for almost a decade. Just like the cellphones, laptops, and digital assistants of the 2020s, they have been adopted and normalized by society.
We need your help to know how these tools affect you and have shifted society.
Are you up for the mission?
Nu u weet hoe WIFI-monitoring werkt, laten we u achter in 2035. De producten die u gaat bekijken zijn al bijna tien jaar op de markt. Net als de mobiele telefoons, laptops en digitale assistenten van de jaren 2020, zijn ze overgenomen en genormaliseerd door de maatschappij.
We hebben jouw hulp nodig om te weten of deze tools jou beïnvloeden en of ze de maatschappij hebben veranderd.
Ben jij klaar voor de missie?
This exhibit does not actually use WIFI monitoring to track you.
Deze tentoonstelling gebruikt geen WIFI-monitoring om je te volgen.

Person/Object Detection

Detectie Persoon/Object



In 2035 most museums, such as this one, use a combination of surveillance methods, including RF monitoring!

Traditional cameras require clear lines of sight and light, which leaves blind spots! Motion detectors struggle with static and slow-moving entities and are prone to false triggers caused by environmental factors like temperature fluctuations.

RF sensing technology however is a non-invasive and reliable method for identifying people or objects even in the dark, when they are hidden from view or concealed behind barriers.

Moreover, RF sensing functionality can be seamlessly integrated into existing technologies, such as cameras, presence sensors, and smart WiFi devices, eliminating the need for standalone solutions in many cases.

In 2035 gebruiken de meeste musea, zoals dit museum, een combinatie van bewakingsmethoden, waaronder RF-bewaking!

Traditionele camera's hebben duidelijke zichtlijnen en licht nodig, waardoor blinde hoeken ontstaan! Bewegingsdetectoren hebben moeite met statische en langzaam bewegende entiteiten en zijn gevoelig voor valse triggers veroorzaakt door omgevingsfactoren zoals temperatuurschommelingen.

RF-detectietechnologie is echter een niet-invasieve en betrouwbare methode om mensen of objecten te identificeren, zelfs in het donker, wanneer ze aan het zicht onttrokken zijn of verborgen zitten achter barrières.

Bovendien kan RF-detectiefunctionaliteit naadloos worden geïntegreerd in bestaande technologieën, zoals camera's, aanwezigheidssensoren, en slimme Wifi-apparaten, waardoor standalone oplossingen in veel gevallen overbodig worden.

Reviews

Beoordelingen

"My neighbor has this system installed. I keep thinking that they can track me through their walls. I got one too so I can track them back just in case!"

"Mijn buren hebben dit systeem geïnstalleerd. Ik blijf maar denken dat ze me door hun muren heen kunnen volgen. Ik heb er ook een, zodat ik ze kan opsporen, voor het geval dat!"

"We have a responsibility to keep our patrons safe. Metal objects are highly RF reflective so we can see if people are bringing weapons into the museum. It is also easy to make a museum wide surveillance system using our integrated WIFI. If the technology is there, you might as well use it."

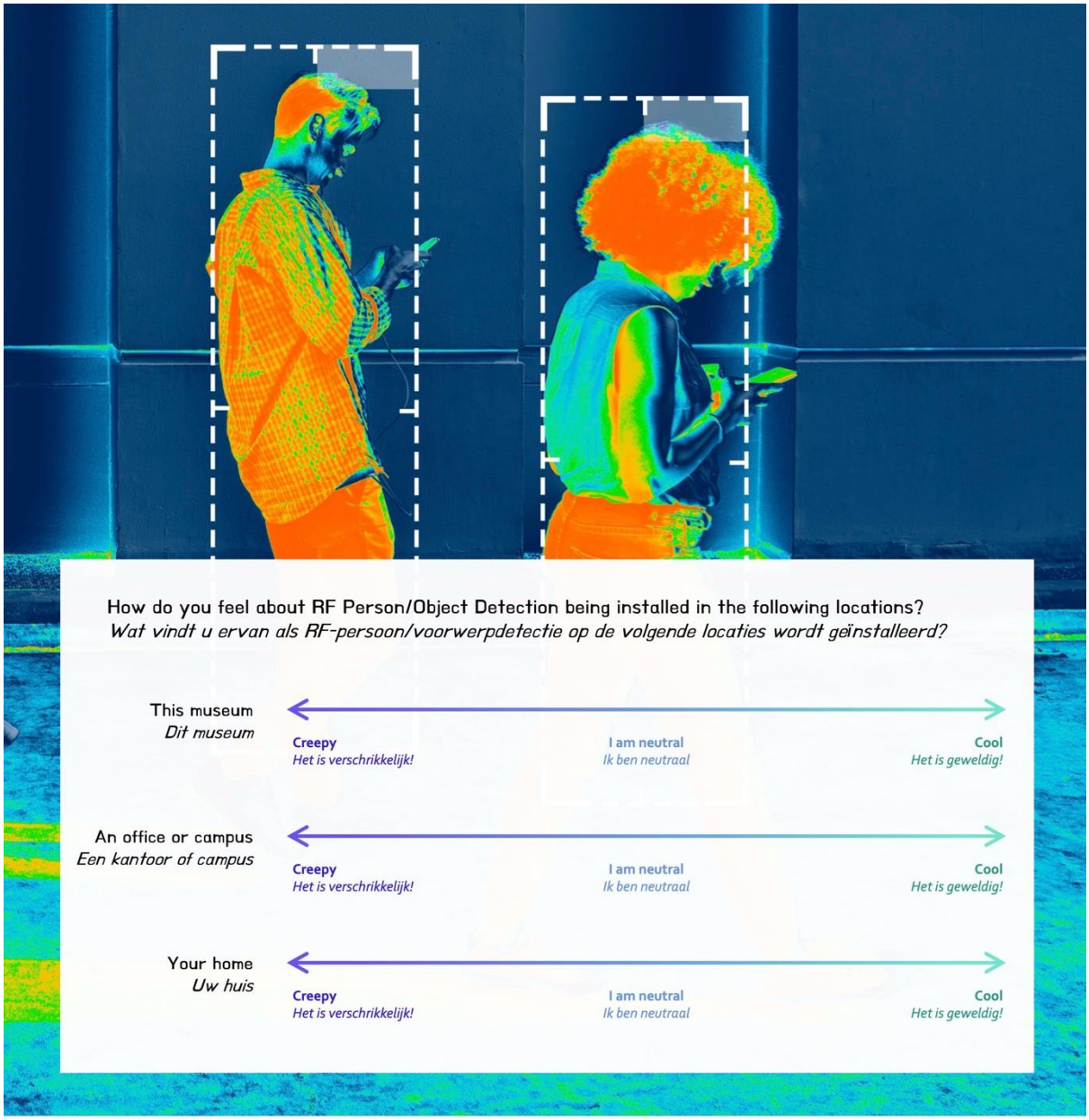
"We hebben de verantwoordelijkheid om onze bezoekers veilig te houden. Metalen voorwerpen zijn zeer RF-reflecterend, hiermee kunnen we zien of mensen wapens het museum binnenbrengen. Het is ook eenvoudig om een surveillancesysteem voor het hele museum te maken met behulp van onze geïntegreerde WIFI. Als de technologie er is, kun je er net zo goed gebruik van maken."

"We save so much energy at the company tracking when the rooms are used or empty! I can also see what my employees are up to...or at least if they are at their desk or in the hallway chatting! It's also so much better than cameras because it is less invasive!"

"We besparen zo veel energie op het bedrijf door bij te houden wanneer de kamers worden gebruikt of leeg zijn! Ik kan ook zien wat mijn werknemers aan het doen zijn... of ze tenminste aan hun bureau zitten of in de gang aan het kletsen zijn! Het is ook zoveel beter dan camera's omdat het minder ingrijpend is!"

"I feel so much safer at night knowing whether something or someone is creeping around downstairs. The best part is that they cannot hide!"

"Ik voel me 's nachts veel veiliger als ik weet of er beneden iets of iemand rondsluipt. Het mooiste is dat ze zich niet kunnen verstoppen!"



Has society changed due to RF Person/Object Detection? (How so, why or why not)

Is de samenleving veranderd door Persoon/Object Detectie? (Hoezo, waarom of waarom niet)

Use a notecard to share your opinion and cast your vote in the box that fits your views (yes or no)!

Gebruik de notitiebriefjes om je mening te delen en breng je stem uit in het bakje dat bij jouw mening past (ja of nee)!

Your thoughts matter! Ethicists in HOLDEN at the University of Twente will use your response to build requirements for ethical RF technology.

Uw mening doet ertoe! Ethici van HOLDEN aan de Universiteit Twente zullen uw antwoorden gebruiken om eisen op te stellen voor ethische RF-technologie.

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"Sure, lots of competitors have integrated RF wave monitoring technology, but we do it best!"

"Natuurlijk, veel concurrenten hebben RF-golftechnologie geïntegreerd, maar wij doen het het beste!"

Smart (RF) TV

Slimme (RF) TV

User Identification

Gebruikersidentificatie

Every person is unique, and we recognize that. Save up to six user profiles and Smart TV will go to the correct profile for individual watching.

Elk persoon is uniek en we erkennen dat. Sla tot zes gebruikersprofielen op en de Smart TV gaat automatisch naar het juiste profiel.

Interactive Watching

Interactief kijken

Follow workouts and get technique tips! Game hands-free and develop your own gesture or movement controls!

Volg workouts en krijg techniektips! Game handsfree en ontwikkel je eigen gebaren- of bewegingsbesturing!

Gesture Recognition

Gebarenherkenning

Our AI software offers gesture recognition and even sign language detection! Sign basic commands and the TV will respond accordingly.

Onze AI-software biedt gebarenherkenning en zelfs gebarentaaldetectie! Gebaar basiscommando's naar de tv en hij zal daarop reageren.

Emotion Recognition

Emotieherkenning

By measuring heart and breath rate we can develop an emotional profile to better recommend (and make) movies.

Door hartslag en ademhaling te meten kunnen we een emotioneel profiel ontwikkelen om films beter aan te bevelen (en te maken).

Activity Recognition

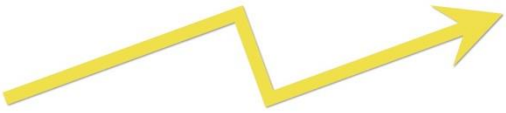
Activiteit Herkenning

Fell asleep while watching? The TV will shut off and note when you fell asleep. Left the room? Don't worry the TV will pause until you return.

In slaap gevallen tijdens het kijken? De tv schakelt uit en noteert wanneer je in slaap bent gevallen. De kamer verlaten? Geen zorgen, de tv zal pauzeren tot je terugkomt.

Always Improving

Altijd verbeteren



Our system is constantly learning from you and your family. Accuracy improves over time as the TV adjusts to its new environment and users!

Ons systeem leert voortdurend van jou en je gezin. De nauwkeurigheid verbetert na verloop van tijd naarmate de tv zich aanpast aan de nieuwe omgeving en gebruikers!

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Us vs. Others *Wij vs. Anderen*

	Us	Not Us	Also, Not Us
User Identification *Gebruikersidentificatie*	90% Accurate | Up to 6 users *90% nauwkeurig | Tot 6 gebruikers*	80% Accurate | Up to 4 users *80% nauwkeurig | Tot 4 gebruikers*	X
Gesture Recognition *Gebarenherkenning*	85% Accurate | 30+ unique gestures *85% nauwkeurig | 30+ unieke gebaren*	80% Accurate | 25 unique gestures *80% nauwkeurig | 25+ unieke gebaren*	85% Accurate | 10 unique gestures *85% nauwkeurig | 10+ unieke gebaren*
Sleep Detection *Slaapdetectie*	95% Accurate *95% nauwkeurig*	90% Accurate *90% nauwkeurig*	90% Accurate *90% nauwkeurig*
Posture Recognition *Houding herkennen*	85% Accurate *85% nauwkeurig*	X	X
Emotion Recognition *Emotieherkenning*	85% Accurate: joy, fear, anger, sadness *85% nauwkeurig: blij, angst, boos, verdriet*	X	X

*Accuracy is determined by over 1000hrs of tests in our lab
**Accuraatheid bepaald op basis van meer dan 1000u lab-testen*

What our customers say
Wat onze klanten zeggen

"My daughter is deaf, and we wanted her to be able to use a smart TV that does not rely on voice controls. For basic navigation and requests it works great - she has figured out how to sign clearly for the TV to understand!"

"Mijn dochter is doof en we wilden dat ze een smart-tv kon gebruiken die niet afhankelijk is van spraakbediening. Voor eenvoudige navigatie en verzoeken werkt het geweldig - ze heeft geleerd hoe ze duidelijk moet gebaren zodat de tv het begrijpt!"

"My doctor says I spend too much time sitting. It is nice that the TV tells me to stand in between shows and has alerted me to my problem of falling asleep while watching TV. Now it shuts off when I am getting tired and tells me to go to bed."

"Mijn dokter zegt dat ik te veel tijd zittend doorbreng. Het is fijn dat de tv aangeeft dat ik tussen de programma's door moet gaan staan en me erop wijst dat ik in slaap val tijdens het tv-kijken. Nu schakelt hij uit als ik moe word en zegt dat ik naar bed moet gaan."

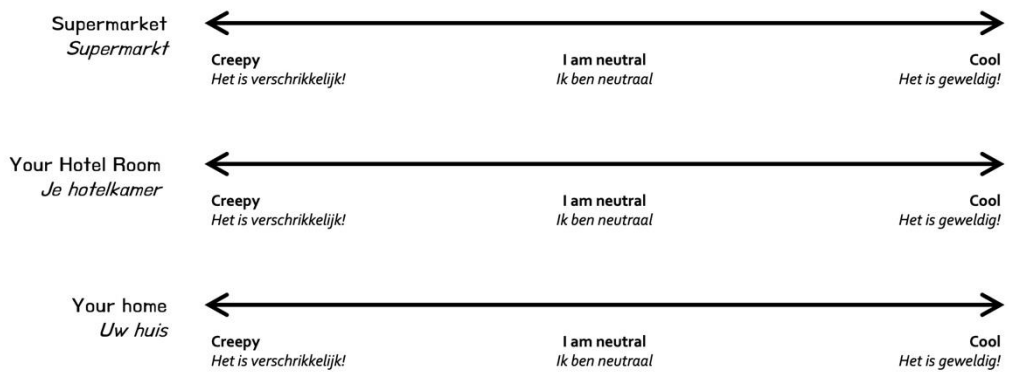
"Our household is 7 people, so my youngest does not get a profile in the system. Luckily, he is 3 now so that is not a problem, but we will have to figure something out when he gets older. For now, they can be a "Guest" user, but that does not fully sit right with the family."

"Ons huishouden bestaat uit 7 personen, dus mijn jongste krijgt geen profiel in het systeem. Gelukkig is hij nu 3 dus dat is geen probleem, maar we zullen iets moeten bedenken als hij ouder wordt. Voorlopig kan hij een "gast"-gebruiker zijn, maar dat zit niet helemaal lekker in ons gezin."

"I used one of these at an Airbnb last month and could not stop wondering if the hosts were spying on me...like they can see what I am watching and if I am in their living room or not, right?! I mean, I guess it does not matter, it's their home, but it's kind of weird, no?"

"Ik heb er vorige maand een gebruikt bij een Airbnb en ik vroeg me af of de verhuurders me aan het bespioneren waren... alsof ze konden zien wat ik aan het kijken was en of ik in hun woonkamer was of niet, eng toch?! Ik bedoel, ik denk dat het niet uitmaakt, het is hun huis, maar het is een beetje raar, niet?"

How do you feel about Smart RF TVs being installed in the following locations?
Wat vindt u ervan als Slimme RF tv's op de volgende locaties worden geïnstalleerd?



Has society changed due to Smart RF TVs? (How so, why or why not)
Is de samenleving veranderd door Slimme RF tv's? (Hoezo, waarom of waarom niet)

Use a notecard to share your opinion and cast your vote in the box that fits your views (yes or no)! Your thoughts matter! Ethicists in HOLDEN at the University of Twente will use your response to build requirements for ethical RF technology.

Gebruik een notitiebriefje om je mening te delen en breng je stem uit in het vakje dat bij jouw mening past (ja of nee)! Uw mening doet ertoe! Ethici van HOLDEN aan de Universiteit Twente zullen uw antwoorden gebruiken om eisen op te stellen voor ethische RF-technologie.

WIFI Care

WIFI Care

What is WIFI Care?

WIFI Care is an integrated residential system providing non-intrusive insights and preemptive healthcare knowledge. By constantly collecting data on daily activity through WIFI monitoring, we assess vitality, vulnerability to diseases like Parkinson's, sleep health, and mental well being. Our system will recognize problems before you do!

Wat is WIFI Care?

WIFI Care is een geïntegreerd woonsysteem dat niet-invasieve inzichten en preventieve gezondheidskennis biedt. Door voortdurend gegevens over dagelijkse activiteiten te verzamelen via WIFI monitoring, beoordelen we de vitaliteit, kwetsbaarheid voor ziekten zoals Parkinson, slaapgezondheid en mentaal welzijn. Ons systeem herkent problemen eerder dan jijzelf!

Data Sharing

Data settings differ by contract and ownership model! Settings determine what entities can access the data: intended user, healthcare team, care facility, insurance, family members, etc. Additionally, what data is collected and shown to each entity can be determined in the contract: breath rate, heartrate, sleep score, vitality measure, chronic disease progression, etc.

Discounts are available for those who choose fully open data settings. Your data will be helpful for research and to improve healthcare worldwide.

Delen van gegevens

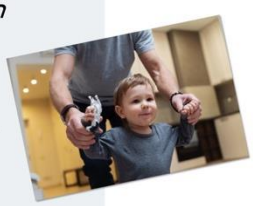
Gegevensinstellingen verschillen per contract en eigendomsmodel! Instellingen bepalen welke entiteiten toegang hebben tot de gegevens: beoogde gebruiker, zorgteam, zorginstelling, verzekering, familieleden, enz. Bovendien kan in het contract worden bepaald welke gegevens worden verzameld en aan welke entiteiten die worden getoond: ademhalingsfrequentie, hartslag, slaapscore, vitaliteitsmeting, progressie van chronische ziekten, enz.

Kortingen zijn beschikbaar voor degenen die kiezen voor volledig open data-instellingen. Uw gegevens zullen nuttig zijn voor onderzoek en om de gezondheidszorg wereldwijd te verbeteren.

Emergency Settings

Note: For safety reasons, certain features are always on such as "Emergency Fall Detection" (falls where the user does not get up) and "Unconsciousness Detection" (when the system believes the user has stopped breathing or rendered unconscious!)

Instellingen voor noodgevallen



Opmerking: om veiligheidsredenen zijn bepaalde functies altijd ingeschakeld, zoals "Valdetectie voor noodgevallen" (vallen waarbij de gebruiker niet opstaat) en "Bewusteloosheidsdetectie" (als het systeem denkt dat de gebruiker gestopt is met ademen of bewusteloos is geraakt!)

Learn how Sunshine Meadows Elderly Home uses our tech

Lees hoe Sunshine Meadows Bejaardentehuis onze technologie gebruikt

Sunshine Meadows has been empowering the elderly with WIFI Care for over a decade and we would love to welcome you and or your loved one into our warm shining doors!

At Sunshine Meadows we believe in non-invasive preemptive healthcare. Your smart room keeps an eye on you so that you and our staff do not need to worry. Our smart rooms offer early Parkinson's detection, breath and heartrate detection, vitality assessments, sleep tracking, fall detection, mood monitoring and more.

Sunshine Meadows geeft ouderen al meer dan tien jaar WIFI zorg en we zouden u en uw dierbare graag verwelkomen met open armen!

Bij Sunshine Meadows geloven we in niet-invasieve preventieve gezondheidszorg. Je slimme kamer houdt je in de gaten zodat jij en onze medewerkers zich geen zorgen hoeven te maken. Onze smart rooms bieden vroege Parkinson detectie, adem- en hartslagdetectie, vitaliteitsbeoordelingen, slaapregistratie, valdetectie, stemmingsmonitoring en nog veel meer.

UNIVERSITY OF TWENTE. HOLDEN Funded by the European Union European Innovation Council

Customer Feedback

Feedback van klanten

"I live alone and am a biohacking nerd. I installed WIFI Care in my home so I can make sure I stay fit as I age without the need for wearables like a smart watch."

"Ik woon alleen en ben een biohacking nerd. Ik heb WIFI Care in mijn huis geïnstalleerd zodat ik ervoor kan zorgen dat ik fit blijf als ik ouder word, zonder dat ik wearables zoals een smartwatch nodig heb."

"I moved my father into Sunshine Meadows three years ago and feel comforted knowing that I can check his mood and health without visiting. When his condition worsens, I always come by!

"Ik verhuisde mijn vader drie jaar geleden naar Sunshine Meadows en voel me gerustgesteld in de wetenschap dat ik zijn stemming en gezondheid kan controleren zonder hem te bezoeken. Als zijn toestand verslechtert, kom ik altijd langs!"

"A year ago, the owner of my building announced that he was installing WIFI Care IN ALL OF OUR APARTMENTS?!? He said that it is not that invasive because he cannot see our faces, but that the internet company is offering it at a discount. I think it's a bit weird, but so far, I have not noticed anything different about my living situation...I would not even know where to go to find the data."

"Een jaar geleden kondigde de eigenaar van mijn gebouw aan dat hij WIFI Care ging installeren in AL ONZE APPARTEMENTEN?!? Hij zei dat het niet zo ingrijpend is omdat hij onze gezichten niet kan zien, maar dat het internetbedrijf het met korting aanbiedt. Ik vind het een beetje raar, maar tot nu toe heb ik er nog niets van gemerkt binnen mijn woonsituatie...ik zou niet eens weten waar ik de gegevens zou moeten vinden."

"I have lived at Sunshine Meadows for three years now. It has slightly less staff than most homes and was more affordable than my other options especially with the "Sell Your Data" plan. I could not handle living alone anymore. I feel a bit safer knowing that I'm being monitored. Eventually, you just get over being surveilled, if everyone else is also being watched, then what is the big deal anyway?"

"Ik woon nu drie jaar in Sunshine Meadows. Het heeft iets minder personeel dan de meeste huizen en het was betaalbaarder dan mijn andere opties, vooral met het "Verkoop Uw Gegevens" plan. Ik kon het niet meer aan om alleen te wonen. Ik voel me een beetje veiliger in de wetenschap dat ik in de gaten word gehouden. Uiteindelijk kijk je er gewoon overheen dat je in de gaten wordt gehouden, als anderen ook in de gaten worden gehouden, wat is dan ook eigenlijk het probleem?"

How do you feel about WIFI Care being installed in the following locations?

Wat vindt u ervan als WIFI Care op de volgende locaties wordt geïnstalleerd?

	Creepy *Het is verschrikkelijk!*	I am neutral *Ik ben neutraal*	Cool *Het is geweldig!*
Rental Apartments *Huurappartementen*	←		→
Elderly Care Facility *Ouderenzorginstelling*	←		→
Your home *Uw huis*	←		→

Has society changed due to WIFI Care? (How so, why or why not)

Is de samenleving veranderd door WIFI Care? (Hoezo, waarom of waarom niet)

Use a notecard to share your opinion and cast your vote in the box that fits your views (yes or no)! Your thoughts matter! Ethicists in HOLDEN at the University of Twente will use your response to build requirements for ethical RF technology.

Gebruik een notitiebriefje om je mening te delen en breng je stem uit in het vakje dat bij jouw mening past (ja of nee)! Uw mening doet ertoe! Ethici van HOLDEN aan de Universiteit Twente zullen uw antwoorden gebruiken om eisen op te stellen voor ethische RF-technologie.

You are in a Sunshine Meadows Studio

Above is a screen with data from the resident in this studio.

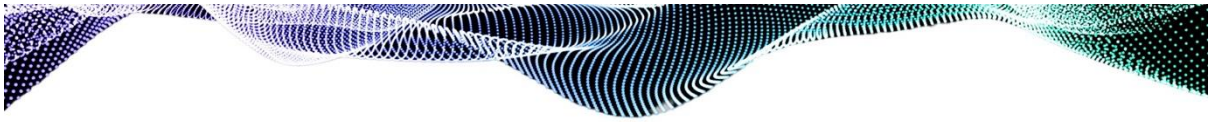
How would you use the data? Check off the form!

Je bent in een Sunshine Meadows Studio

Aan de muur hangt een scherm met de gegevens van de bewoner die hier woont.

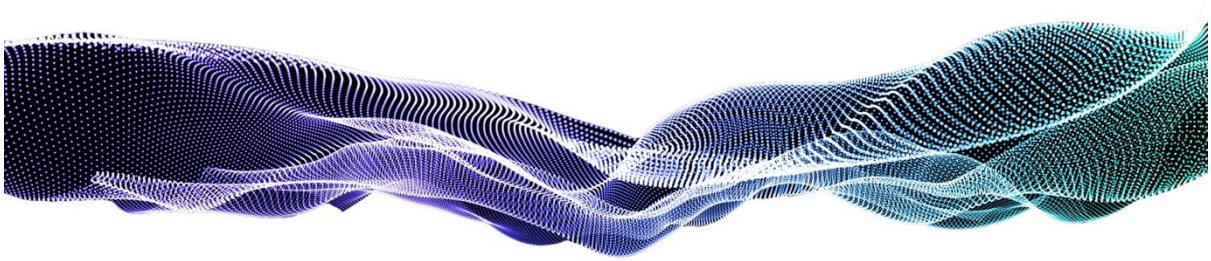
Hoe zou jij de gegevens gebruiken? Vink het formulier aan!


WIFI Care makes a Sunshine Meadows resident feel...
(add a sticker for each you think applies)
WIFI Zorg zorgt ervoor dat een bewoner van Sunshine Meadows zich...
(plak een sticker op elke sticker waarvan je denkt dat deze van toepassing is)
Safe | Veilig
Scared | Bang
Alone | Alleen
Supported | Ondersteund
Empowered | Mondig
Neutral | Neutraal



Suggest Your Own RF Monitoring Application(s)

Deel uw eigen idee voor een RF Monitoren Applicatie(s)



Appendix B. "This is Not a Camera!" WIFI Care Form

WIFI Care Preference Form

Optional: Place a sticker or add your sticker #

Choose ONE use case to fill out the form for:

- ☐ An elderly friend or relative living at Sunshine Meadows Elderly Home with you as the legal representative
- ☐ Yourself living at Sunshine Meadows Elderly Home as an elderly resident
- ☐ Yourself living in a smart home with WIFI Care

Who should have access to which of the resident's data?
check ALL that apply

	Breath Rate	Heartrate	Sleep Tracking	Mental Wellbeing	Physical Wellbeing	Cognitive Function	Sudden Injury	Unconsciousness
Resident/Patient	☐	☐	☐	☐	☐	☐	☐	☐
Doctor	☐	☐	☐	☐	☐	☐	☐	☐
Relative(s)	☐	☐	☐	☐	☐	☐	☐	☐
Advertisers	☐	☐	☐	☐	☐	☐	☐	☐
Insurance Company	☐	☐	☐	☐	☐	☐	☐	☐
WIFI Care Company	☐	☐	☐	☐	☐	☐	☐	☐
Researchers	☐	☐	☐	☐	☐	☐	☐	☐
Government	☐	☐	☐	☐	☐	☐	☐	☐
Law Enforcement	☐	☐	☐	☐	☐	☐	☐	☐
The Person or Organization Paying for the System	☐	☐	☐	☐	☐	☐	☐	☐

This form will be used for research on how people would use WIFI monitoring technology!

Submission is optional!

One more question on the back...

How will WIFI Care data affect the resident's life?

Submit this form in the box! 

English

WIFI Care Voorkeursformulier

Optioneel: Plak een sticker of voeg uw sticker # toe

Kies ÉÉN scenario waarvoor u het formulier wilt invullen:

- ❑ Een oudere vriend of familielid die bij Sunshine Meadows Bejaardentehuis woont, met u als wettelijke vertegenwoordiger
- ❑ U woont zelf in het Sunshine Meadows Bejaardentehuis als oudere bewoner
- ❑ U woont zelf in een slim huis met WIFI Care

Wie mag welke gegevens van de bewoner inzien?

vink ALLE van toepassing zijnde opties aan

	Ademhalingsfrequentie	Hartslag	Slaap Monitoring	Mentale Gezondheid	Fysieke Gesteldheid	Cognitief Functioneren	Onverwachte Ongevallen	Bewusteloosheid
Bewoner/Patiënt	☐	☐	☐	☐	☐	☐	☐	☐
Dokter	☐	☐	☐	☐	☐	☐	☐	☐
Familieleden	☐	☐	☐	☐	☐	☐	☐	☐
Adverteerders	☐	☐	☐	☐	☐	☐	☐	☐
Verzekeringsmaatschappijen	☐	☐	☐	☐	☐	☐	☐	☐
WIFI Care Bedrijf	☐	☐	☐	☐	☐	☐	☐	☐
Onderzoekers	☐	☐	☐	☐	☐	☐	☐	☐
Overheden	☐	☐	☐	☐	☐	☐	☐	☐
Rechtshandhaving	☐	☐	☐	☐	☐	☐	☐	☐
Betalende Partij	☐	☐	☐	☐	☐	☐	☐	☐

Dit formulier wordt gebruikt voor onderzoek naar hoe mensen WIFI-monitoringtechnologie zouden gebruiken!

Nog één vraag op de achterkant...

Inzending is optioneel!

Welke invloed hebben WIFI Care-gegevens op het leven van de bewoner?

Vul dit formulier in en vul het in!

Nederlands

Appendix C. "This is Not a Camera!" Closing Workshop Survey

*The survey was available in Dutch and English

Welcome to the "This is Not a Camera!" Closing Workshop

In this workshop we will go further in depth about the possible ethical considerations of Radio Frequency EM Wave Holography and how it might (re)shape the human condition. Participants will reflect on how their lives will change as WIFI monitoring services become more commonplace. These observations will help design regulations and specifications that ensure ethical development of WIFI monitoring products and services.

Study Lead: s.i.cammers-goodwin@utwente.nl
More on Our Team: https://www.utwente.nl/en/bms/phil/research/current_projects/HOLDEN/

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HOLDEN Website: https://holden-project.eu/

Contact Information for Questions about Your Rights as a Research Participant

If you have questions about your rights as a research participant, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher(s), please contact the Secretary of the Ethics Committee/domain Humanities & Social Sciences of the Faculty of Behavioural, Management and Social Sciences at the University of Twente by ethicscommittee-hss@utwente.nl

Who Are We? We are philosophy researchers at the University of Twente and members of HOLDEN. HOLDEN is an international European Innovation Grant with the goal of developing ethical radio frequency wave holography. Essentially, partners in the project are developing technology to use WIFI to monitor the physical environment.

What Are the Goals of the Research? We are interested in learning how people would appropriate the technology that we are working on. By "appropriate" we mean how people would use the technology, how it might change aspects of society, and how it might change the users themselves. The output of this workshop will be used for a report on the technology and for further research publications.

What Does the Research Entail? For this 1-1.5hr workshop you will be divided into groups to discuss three use cases: Person/object detection (surveillance), Smart TV, and WIFI Care. Note that the WIFI Care example will include examples of end-of-life care and Parkinson's Detection. You will consider the technology as if it has already existed for 10 years. Together as a group you will discuss and then fill in a short questionnaire for each use case. The workshop ends with a Q&A and further information about the technology. Observational notes will be taken during the study. We will not record or take any videos. Anonymous quotations may be used for our research. You may stop participating at any time, even after signing the consent form!

What Happens with the Data? The observational notes and form responses will be organized and further anonymized (if necessary) this data set will be used for continued research related to RF Monitoring.

Taking part in the study			
	I have read and understood the study information presented earlier in the survey, or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	Y ☐	N ☐
	I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions, and I can withdraw from the study at any time, without having to give a reason.	Y ☐	N ☐
	I understand that taking part in the study involves contributing to an interactive exhibit, working in teams, and sharing in forms how I would envision using WIFI Monitoring technologies currently in development. I understand that observational notes will be taken during the study.	Y ☐	N ☐
Risks associated with participating in the study			
	I understand that there is always a risk of my data being associated back to me, especially if I publicly express that I took part in the study.	Y ☐	N ☐
	I understand that this study will involve talking about potentially triggering topics such as surveillance, Parkinson's Disease, and end of life care AND I am willing to discuss these topics in a group setting.	Y ☐	N ☐
Use of the information in the study			
	I consent to anonymous quotes from our group form being published for research.	Y ☐	N ☐
	I understand that anonymized information I provide will be used for HOLDEN reports, articles, technology design, and future research publications.	Y ☐	N ☐
	I understand that personal information collected about me that can identify me, such as [e.g. my name or address], will not be shared beyond the study team.	Y ☐	N ☐
Future use and reuse of the information by others			
	I give permission for the anonymized data from the workshop that I provide to be archived indefinitely so it can be used for future research and learning.	Y ☐	N ☐
Digital Anonymous Signature			
	☐ I consent to taking part in the workshop. This is my signature!		
	☐ I do not consent to taking part in the workshop. (This will close the form.)		

When it comes to technology….

What does "creepy" mean to you?

What does "cool" mean to you?

Person Object Detection

How Creepy to Cool is Person/Object Detection in the following scenarios?

This Museum	----------O----------
Office or Campus	----------O----------
Your Home	----------O----------

How did you decide the ranking for each scenario?

Does whether this technology is in public or private space have an impact on whether it feels "creepy" or "cool"?

☐ Yes, a big impact
☐ Yes, a small impact
☐ No

Describe the impact public or private space has on whether it feels creepy or cool:

For this technology, rank data ownership from best to worst:

Government | Corporation | Private Individual | Community | Academia

What would make the technology **less** creepy/**more** cool?

What would make the technology **more** creepy/**less** cool?

Can you imagine you or someone you know using this technology?

☐ Yes, myself
☐ Yes, someone I know
☐ No

How would this person use the technology?

Would the technology change this person's life?

☐ Yes, significantly
☐ Yes, some
☐ No

Smart TV

How Creepy to Cool is Person/Object Detection in the following scenarios?

Supermarket	----------O----------
Your Hotel Room	----------O----------
Your Home	----------O----------

How did you decide the ranking for each scenario?

Does whether this technology is in public or private space have an impact on whether it feels "creepy" or "cool"?

☐ Yes, a big impact
☐ Yes, a small impact
☐ No

Describe the impact public or private space has on whether it feels creepy or cool:

For this technology, rank data ownership from best to worst:

Government | Corporation | Private Individual | Community | Academia

What would make the technology **less** creepy/**more** cool?

What would make the technology **more** creepy/**less** cool?

Can you imagine you or someone you know using this technology?

☐ Yes, myself
☐ Yes, someone I know
☐ No

How would this person use the technology?

Would the technology change this person's life?

☐ Yes, significantly
☐ Yes, some
☐ No

WIFI Care

How Creepy to Cool is Person/Object Detection in the following scenarios?

Rental Apartments	----------O----------
Elderly Care Facility	----------O----------
Your Home	----------O----------

How did you decide the ranking for each scenario?

Does whether this technology is in public or private space have an impact on whether it feels "creepy" or "cool"?

☐ Yes, a big impact
☐ Yes, a small impact
☐ No

Describe the impact public or private space has on whether it feels creepy or cool:

For this technology, rank data ownership from best to worst:

Government | Corporation | Private Individual | Community | Academia

What would make the technology **less** creepy/**more** cool?

What would make the technology **more** creepy/**less** cool?

Can you imagine you or someone you know using this technology?

☐ Yes, myself
☐ Yes, someone I know
☐ No

How would this person use the technology?

Would the technology change this person's life?

☐ Yes, significantly
☐ Yes, some
☐ No

You have reached the end of the survey! Here are some bonus questions we will discuss later if you join the Q&A

Can a technology be both creepy and cool?

☐ Certainly
☐ Rarely
☐ Never

Do you think RF Holography is "not a camera"?

☐ RF Holography is a camera
☐ RF Holography is basically a camera
☐ RF Holography is not a camera

Any last thoughts or considerations that you wish to share?
