CHALLENGING THE CONCEPT OF SMART DOORBELLS BY DESIGNING NEW INTERACTIONS BASED ON PRIVACY

MASTER THESIS BY
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Challenging the Concept of Smart Doorbells by Designing New Interactions based on Privacy

Challenging the concept of smart doorbells through speculative design, creating alternative doorbells with the starting point in different definitions of privacy, ending in a final exhibition in Amsterdam.

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Education

MSc. Design for Interaction
Delft University of Technology
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Acknolwledgment

This project would not have happened had it not been for an array of amazing people being there along the way.

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TUSIND TAK!

Executive summary

In less than a decade, smart doorbells have become a household stable, introducing a new form of surveillance cameras. But while the cameras have given a new purpose to the doorbell, they also come with an array of privacy concerns. Much critique has been given to the management of data and the effect private surveillance has on society. Smart doorbells have also entered the street of Amsterdam, prompting the municipality to look into how to deal with the arising privacy issues.

In this project, we approach the smart doorbell on the interaction level, zooming in on the interaction between two people - the visitor and the owner - through the medium of a smart doorbell. We explore how this medium facilitates the interchange and how it facilitates an emerging power difference.

To challenge the current design of smart doorbells, alternative smart doorbells were designed, taking a starting point in three different definitions of privacy. Each doorbell opens up for a new form of negotiation of the terms of the interaction between owner and visitor. The end result was an exhibition held in Amsterdam, where three new privacy-centric designs were displayed.

At the exhibition, data was gathered about visitors' opinions and views on the doorbells and analysed to understand better people's values and preferences in regards to privacy in the context of smart doorbells. The result showed that speculative design exhibitions could be a valuable tool for better understanding citizens' values and preferences. The physical manifestations of alternative futures allowed a nuanced and concrete discussion about possible interventions. This shows how speculative design can help institutions such as Amsterdam municipality deal with emerging technologies such as the smart doorbell.

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INTRODUCTION

Introducing the project.

A brief introduction to this project, its stakeholders and the following process.

1.1 Introduction

Maybe you have noticed them when walking in your neighbourhood. Maybe you interacted with one when visiting a friend, or you have one yourself. It might be possible that you have not even noticed them. But smart doorbells are becoming a more common sight as they have entered Dutch cities - with estimates of more than 640,000 doorbells currently present in the country (Dirks, 2021).

A smart doorbell is, at its essence, a doorbell and security camera combined. It allows the owner to be ever-present at their front door through their phone. Unlike a classic security camera, the doorbell can inform the owner when a visitor is present and allows communication between the two through the phone and an intercom.

Smart doorbells are bridging the gap between the private and the public. While the front door is a private area, many cities like Amsterdam experiences that the smart doorbells extend further, by filming towards public roads. This has resulted in surveillance of public space by private individuals, which is illegal by Dutch law (Autoriteit Persoonsgegevens, n.d.), but so far little seem to be done to regulate them by local authorities. Both the police and some municipalities seem to be embracing the system (Hofmans, 2019).

Most critiques of the smart doorbell focuse on its invasive nature and its overall impact on society and neighbourhoods. But few have looked into the interaction: How does the medium of the smart doorbell impact the interaction between a visitor and an owner? And can the doorbell be designed differently to allow for more privacy?

Scope

This project aims to explore how the smart doorbell impacts the interaction between owner and visitor through its design and functionalities. To understand the power dynamic of the interaction, a feminist lens will be applied, inspired by D'ignazio and Klein (2020). This understanding will be applied to generate speculative designs of alternative smart doorbells. The goal is to create a variation of smart doorbells that respect privacy, answering the question: can a smart doorbell be designed to be privacy friendly? And can governmental bodies, like Amsterdam municipality, utilise speculative design to figure out how to regulate smart doorbells in their streets?

For project brief, see appendix A.

The stakeholders of the project

This project was done in collaboration with AMS, focusing on the context of Amsterdam municipality. Here is a short introduction to both stakeholders.

AMS

The Amsterdam Institute for Advanced Metropolitan Solutions (in short, AMS) is an Amsterdam-based research institute working on urban challenges, including energy, food, and digitalisation, to create more livable, resilient, sustainable and just cities (AMS institute, n.d.-b).

One of the urban challenges that AMS is working with is responsible urban digitalisation, focusing on using new digital technologies in the city without losing democratic rights and values (AMS institute, n.d.-a). This includes the responsible sensing lab that has previously worked with the issue of smart doorbells such as the Shutterring (Responsible sensing lab, n.d.).

AMS, n.d.

Amsterdam municipality

Amsterdam is the biggest municipality in the country ('Lijst van grootste gemeenten in Nederland', 2022), and spans over eight city districts (City of Amsterdam, 2022a) and has almost 900,000 inhabitants (All Charts, n.d.).

Digital and technological challenges are a focus in the municipality of Amsterdam. In the coalition agenda from the political coalitions formed in 2018, one of the six ambitions is *"Participatief en digitaall"* (Translation: Participatory and digital) (City of Amsterdam, 2022c). The citizens are invited to participate in shaping the future of Amsterdam, including the challenges and opportunities involving the increasing digitisation of cities (City of Amsterdam, 2022b). This is further elaborated in the digital city agenda document "Een Digitale Stad voor én van iedereen" (Translation: One digital city for and by everyone) (Eemeren et al., 2019). Here, the value of freedom is highlighted: *"Article 1: Free digital city. The ambition is to consciously deal with the opportunities and threats of digital technologies, for protecting civil rights and for fair access to digital technologies."* (translated quote) (Eemeren et al., 2019, p. 17)

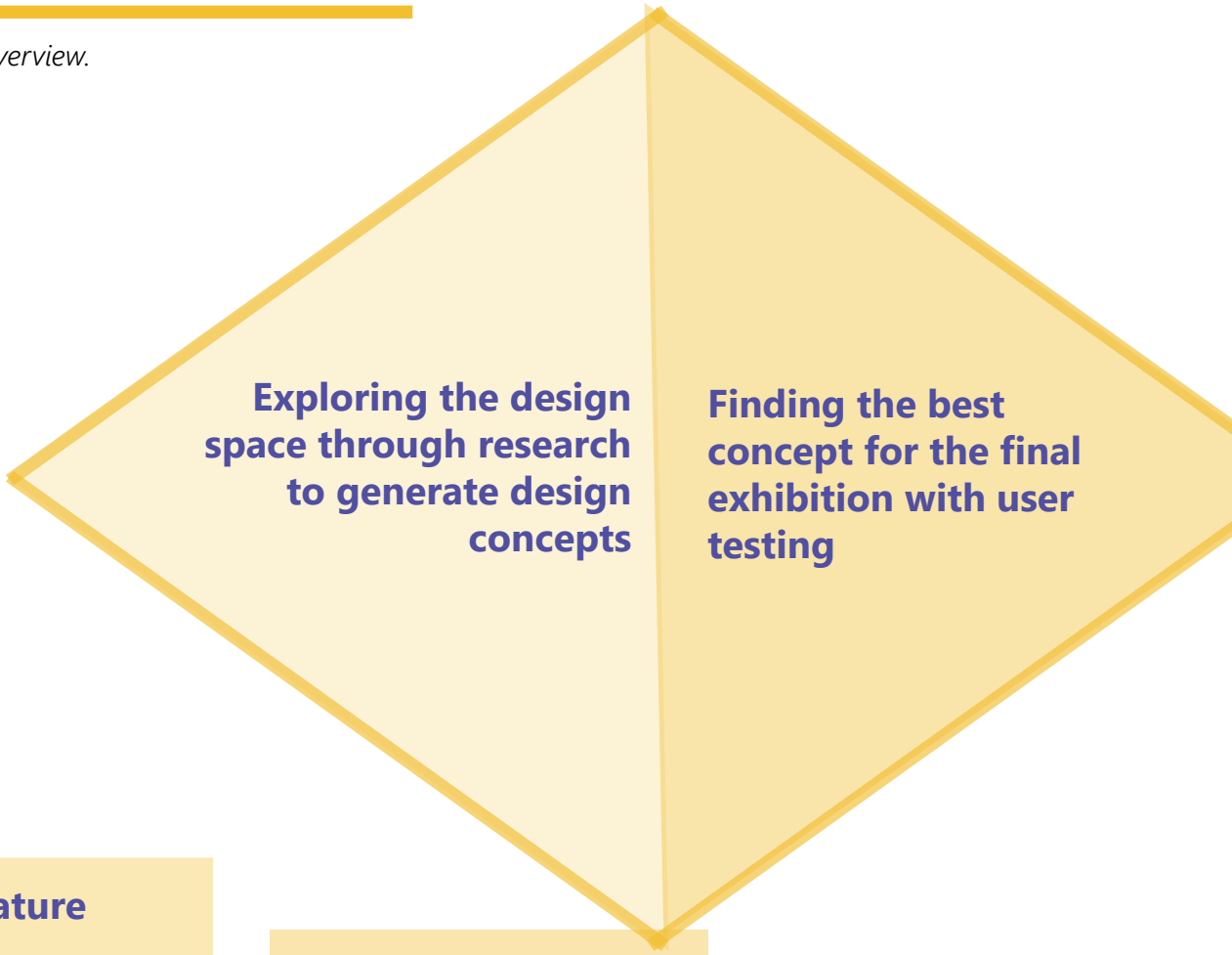
Working with values is an integrated part of policymaking in Amsterdam, as seen in the previously mentioned documents. This project will move from a high-level value-based starting point into concrete design solutions, showing how a municipality like Amsterdam can incorporate speculative design and Research in Design when approaching a product like smart doorbells from an initial value point.

Township Amsterdam, n.d.

Process overview

An overview of the process of the project

Figure 1. Process overview.



Initial literature review and research

Literature reserach

Product and market analysis

Power analysis (Matrix of domination)

Analysis of interaction

Designing alternative smart doorbells

Inspiration from similar projects

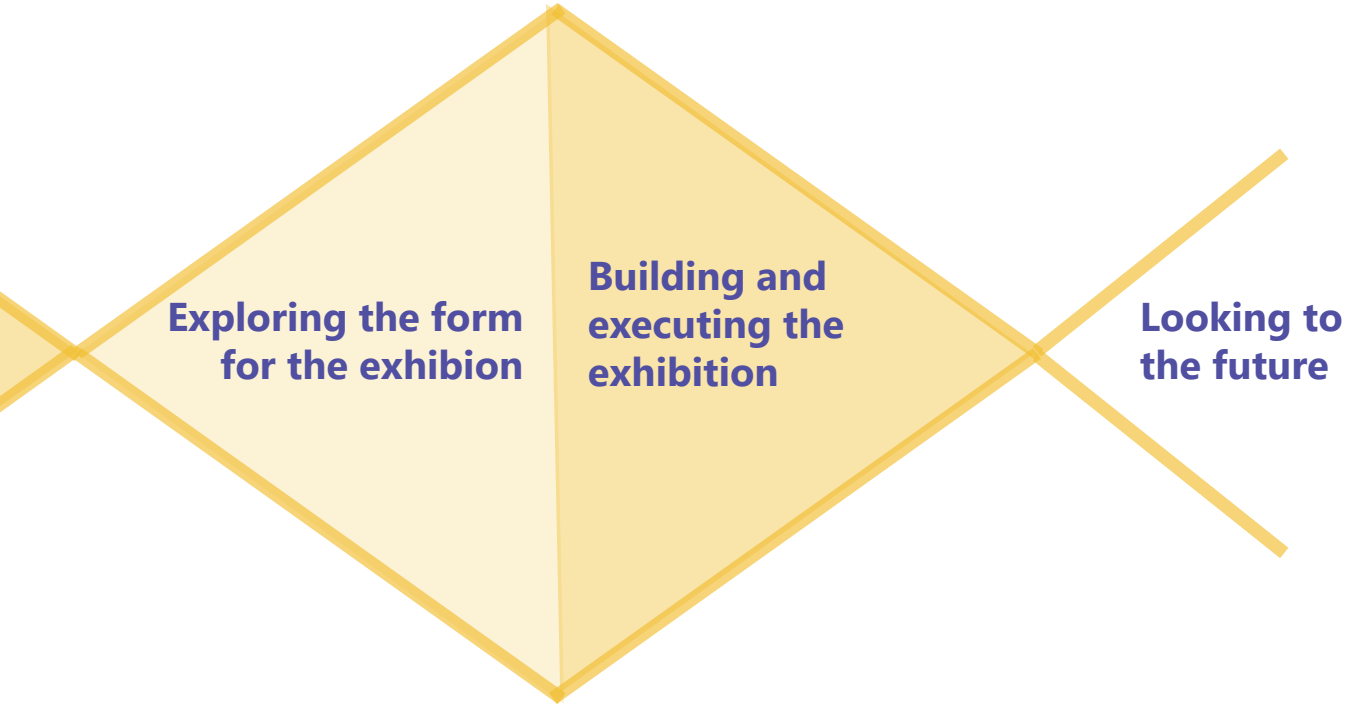
Definition of privacy

Brainstorming

User test to find the final concepts

Prototyping alternative smart doorbells

User test with 17 users



Prototyping final exhibition.

Prototyping and refining the chosen alternative doorbells

Exhibition at AMS in Amsterdam

Two day exhibition in Amsterdam at AMS

Analysing data from the exhibition

Quantitative and qualitative analysis of data

Future recommendations

Ch. 2

RESEARCH

Introducing the smart doorbell

In 2013 the first smart doorbell was launched by a company later known as Ring. The product was the first version of the Ring Video Doorbell and proved to be the start of a new era of doorbells entering our streets (The History Behind Ring, 2014).

This chapter introduces the smart doorbell and aims to provide a good understanding of the product. We will dive into the anatomy of a smart doorbell and its associated apps and have a look at the market for smart doorbells. We will try to understand why people purchase smart doorbells and look at the range of privacy concerns raised in recent years. Finally, we will focus on smart doorbells in the Netherlands specifically as the context of this project.

(Monroe & CNET, n.d.)

2.1 Introducing the smart doorbell

Diving into the anatomy and purpose of the smart doorbell

"I think ringing a doorbell is bridging the outside and the inside and uniting a guest with the resident and they say welcome"
- Robert Dobrin in the Nice Try podcast (Trufelman, 2021, timestamp: 14:51).

This quote nicely captures the essence of a doorbell; it is a way for an outsider to notify the people living inside that they have a visitor. A doorbell can be seen as a medium of communication between a guest and a resident, facilitated by the press of a button and, typically, a sound notification.

Doorbells have had many purposes throughout history. From simply notifying owners of a visit; to noisily scaring off door salesmen; to becoming a status object. Branded with lines such as "A cheerful earful", doorbells became a symbol of an extravagant welcome to homes in the twentieth century. In the 1950's comes the electronic doorbells that people could hear but not see. The electrification of doorbells also heralded the intercom, allowing for verbal communication between visitors and residents. This was the predecessor to smart doorbells first seen in the 21st century (Trufelman, 2021). Smart doorbells have barely been on the market for a decade but have already become a staple household item. Strategy Analytics (2021) market report estimates that in 2020 alone, almost 8 million doorbell units were sold worldwide by more than a dozen different companies.

How does a smart doorbell work?

A short introduction to smart doorbells

A smart doorbell is a doorbell with a camera connected to the owners' phone through wifi. This connection lets the owner see and communicate with the visitor. It has opened up a new purpose for the doorbell.

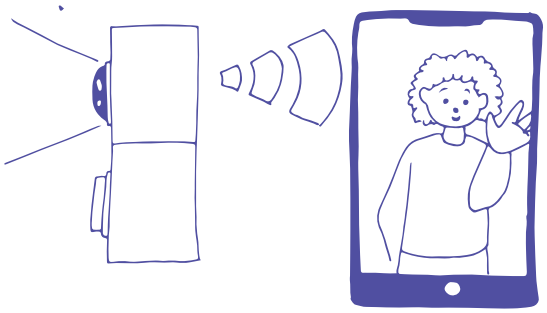


Illustration 1

These functionalities include that when ringing a smart doorbell, not only does a sound go off in the house, the owners phone also receive a notification.

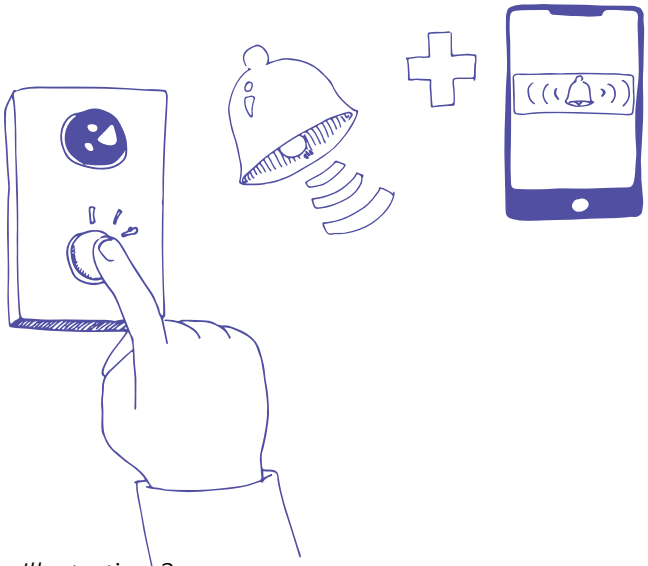


Illustration 2

It allows the owner of a smart doorbell to "answer" their door from anywhere through their phone, even when they are not at home.

Illustration 3

The camera feature of the doorbell is connected to a motion sensor, enabling it to sense motion at a preset distance from the doorbell. It is also possible to turn on through object recognition AI that can recognise human figures or tell the owner what type of activity is going on (Wiesneski, 2021) (Google Store, n.d.-b).

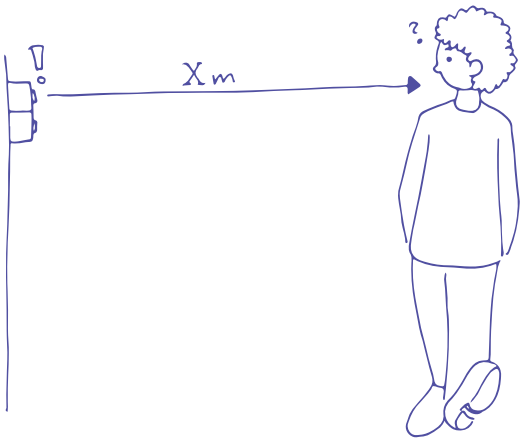


Illustration 4

The video recorded by a smart doorbell is saved directly in cloud storage to which the owner has access (usually, a subscription is needed for this feature). This way, the owner can download the recordings (Fox, 2021). How long the recordings are saved in the cloud and how long they are available for the owner to download depends on the company and the owner's subscription. For the company Ring, their basic protection package for 3 €/month includes the ability to scroll through every recording from the last 30 days, as well as easily downloading and saveing the relevant recordings (Ring NL, n.d.-b).

While it may be explicit in the name, it might not be straightforward what makes a smart doorbell smart. Based on the definition of smart products in Sabou et al. (2009), a smart doorbell can be defined as smart because:

- The doorbell is autonomous and reacts independently based on input. E.g. choosing to start recording because of motion.
- It can react proactively. E.g. notifying a user when someone is at the front door through sensing and input.
- They can be more or less aware of the context, e.g., by person detection.
- They can share their knowledge, e.g. by connecting to smartphones.

Some of these abilities are customisable to the individual situation and owner's wishes. A smart doorbells' settings can be changed regarding:

- If the motion sensor is on or off.
- The motion sensor range (how far away from the house should it react).
- If object recognition is on (if the motion sensor will only react to people and not objects like a driving car).
- Recording settings. If the camera should film constantly or only when someone rings the doorbell or if the motion sensor is activated.

Future customisations may also include activating facial recognition, which is possible to integrate into smart doorbells as proven by Shweta et al. (2021) and also seems to be in the pipeline for companies like Ring (Biddle, 2019).

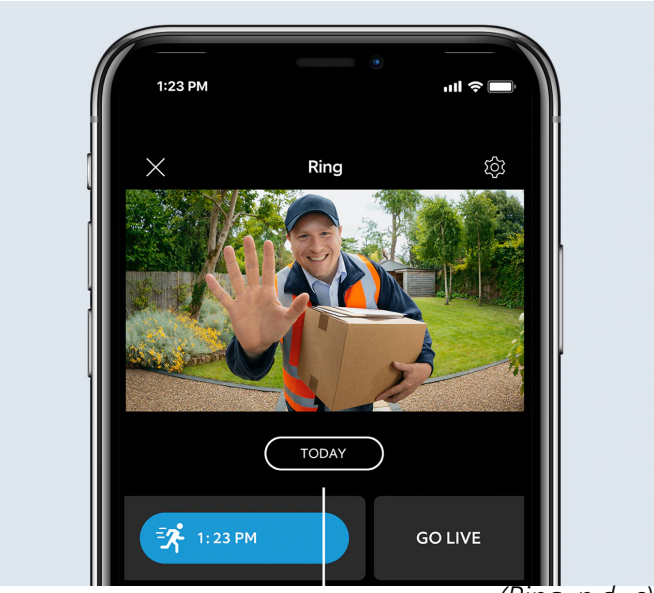
The high level of customisation helps the owner utilise the doorbell as it fits them best and also allows the owner to adhere to their home countries' rules regarding private cameras. The legal laws vary from country to country when it comes to private surveillance. The customisation of smart doorbells allows the user to, based on their property and housing situation, install and use the doorbell in accordance with the law. However, this puts it upon the owner of the doorbell to use it legally. As said by a spokesperson from Ring in the Nice Try podcast (Trufelman, 2021, timestamp 31:47): *"We provide the tools to customers can choose to adhere to the law"*.

Controlling smart doorbells - the apps

Controlling and changing the settings of a smart doorbell can usually be done through an app. Here we will walk through the Ring app.

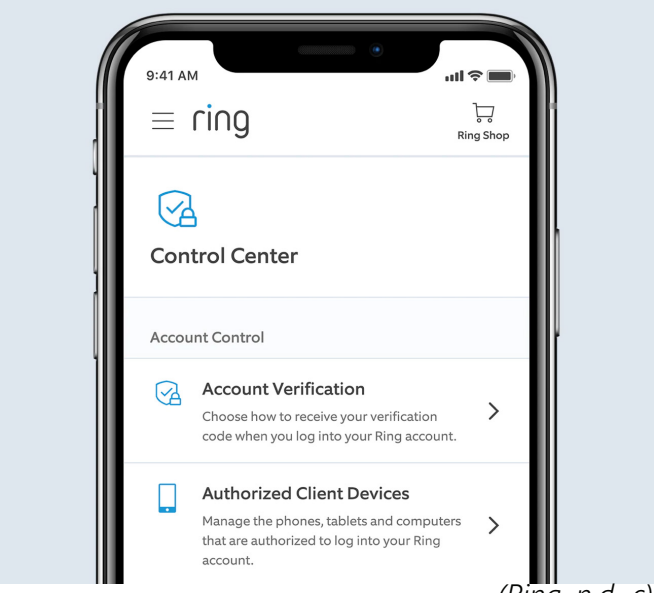
(Ring, n.d.-c)

Notifications
The owner gets notifications on their phone when something happens that the doorbell deems relevant.



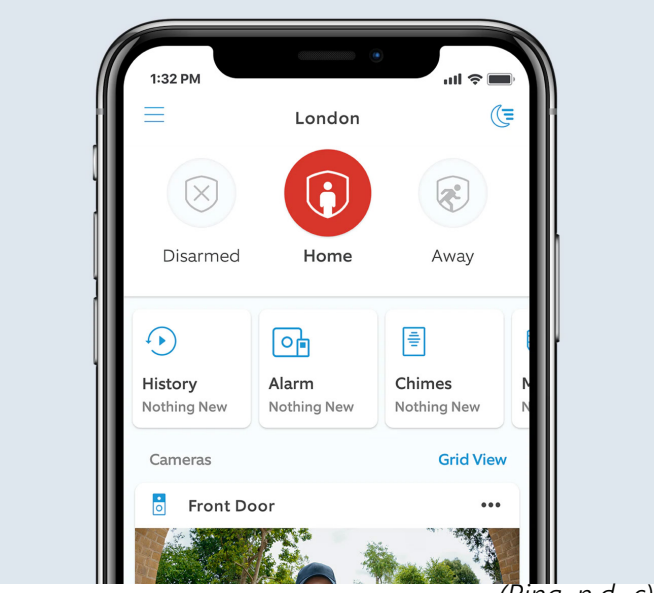
(Ring, n.d.-c)

Accessing videos and live feed
The owner can watch the camera live. If they have the basic subscription, they can also watch recordings from the past 30 days. These recordings can be downloaded or shared directly from the app.



(Ring, n.d.-c)

Customising the setup of the smart doorbell
The owner is able to change the security and privacy settings of the doorbell. This is where the motion sensor is adjusted, person detection activated, etc.



(Ring, n.d.-c)

Connecting multiple devices
If the owner has more than one device, they can connect the different Ring devices in the app to have an overview.

2.2 The market of smart doorbells

To better understand how the companies selling smart doorbells are promoting them, 3 companies' marketing materials were analysed. The 3 chosen companies were Amazon Ring, Google Nest and Arlo. (See appendix D)

In the analysis, overall themes and narratives of smart doorbells were noted, as well as choice of words and choice of images (this was part of a bigger narrative of the hegemonic domain analysed in chapter 3.2).

There are 3 main narratives presented:

Safety

All three companies promoted their doorbell as safety enhancing. Using videos of what looks like actual break ins and weather accidents, this imply a need for safety for the viewer. This safety, or feeling of safety, could be achieved by having a smart doorbell to allow the owner to react or even prevent accidents or crimes. Note that none of the websites refer to their smart doorbell as a security camera.

Convenience

The second focus was on the practical aspects of having a video doorbell, e.g. on how it would allow the owner to answer the door when they weren't home or prevent missed delivery. It is convenient to be able to access your door from anywhere.

The family friendly doorbell

The last marketing element was introducing the smart doorbell as a family friendly product, using videos of puppies and surprise visits. This part of the marketing seemed to try and disarm the surveillance aspect of the product, making it seem as if filming non-criminal activity was a normal and fun part of any household.

Safety and security is a big part of the new purpose added to the product categories of doorbells. It seems to also be a cornerstone of the company's own understanding of the impact of their product:
"If everyone had a Ring, we would have phenomenal neighbourhood watch in every single neighbourhood and hopefully it would deter crime" - Josh Roth, Chief technology officer at Ring (Trufelman, 2021, timestamp 27:29).

For some of these companies, smart doorbells are but one security camera they are selling in a range of home security products. Ring is a good example of that. While the doorbell was the original product of the company, today they also have a range of indoor and outdoor security cameras and security systems with associated alarms and sirens.

Looking at Rings own website, the smart doorbell is introduced first, then followed by security cameras and a security system. The smart doorbell can be seen as a foot-in-the-door device as described by Pierce (2019): *"functional offerings and affordances that lay the groundwork for the future adoption and integration of features that might have been rejected previously as unacceptable or unnecessary"* (Pierce, 2019, p. 45).

The smart doorbell seems to be sold as the first purchase in a line of surveillance products. The narrative of a family friendly product makes it less scary than a real security camera. While some might have rejected the idea of a CCTV camera, the smart doorbell can seem as a more approachable starting point.

Marketing material from Rings website, showcasing their ecosystem of surveillance products.
Ring.(n.d.-b)

But what is the difference between a smart doorbell and a security camera?

Traditional CCTV cameras (closed-circuit televisions) are defined by:

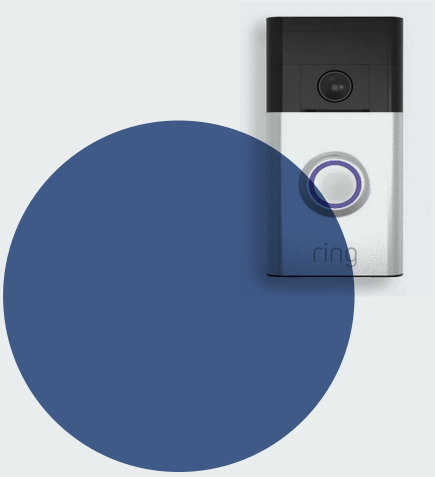
- Requiring a local storage device.
- Only transmitted to a specific place with a certain amount of monitors.
- No connectivity outside the place.

A smart doorbell goes as a internet protocol camera which is why a smart doorbell is allowed for remote computing and storing (Bridges, 2021).

Other differences with most standard security cameras includes:

- A smart doorbell records audio.
- Has additional function of a doorbell.
- Is not set to automatically film 24/7.
- Can be highly customised for when to record.
- Gives notifications on owners phone

So it is important to note that a smart doorbell is different from traditional security cameras, but some functions also overlap.



The market landscape

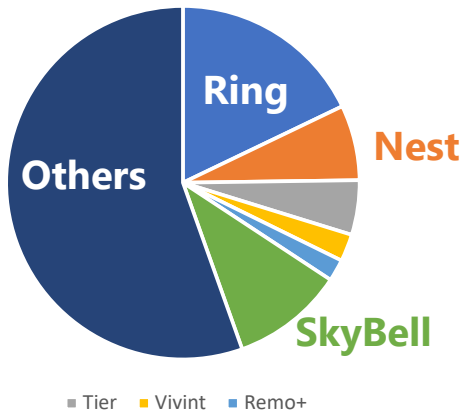
In this chapter, we have mainly been looking at the smart doorbell from Ring. That is because Ring is the global and Dutch leader in the market for smart doorbells, but there are also several other big and small players.

Looking at the numbers from Strategy Analytics (2021) market report on smart doorbells in 2020, Ring had the biggest market share with 17.9 % of the global sales, and the main competitors being Skybell, Google nest, Vivint and Remo+. There are several other competitors on the market, with no specific numbers of companies indicated.

Looking specifically at the Dutch market, numbers from the market research Multiscopes' yearly Smart Home Monitor study estimate that in 2021, around 640.000 Dutch households had a smart doorbell installed, which is a total of 8 % of households. It is also a significant increase from 2020 when Multiscope estimated only 500,000 doorbells (Dirks, 2021).

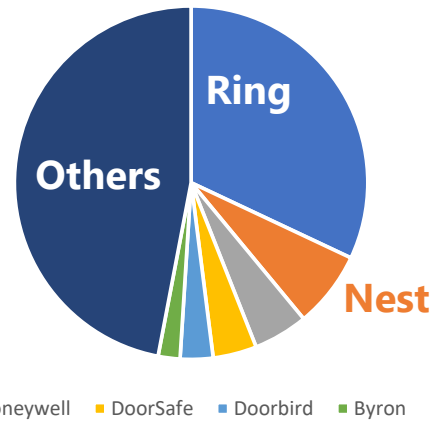
Looking at the numbers, Ring has the largest market share of 32 %, followed by Nest (7 %). When looking across the mentioned doorbells, most are comparable and function in the same manner, with the exception of Honeywell. See Appendix B for a more detailed overview of specific smart doorbells in the Netherlands.

Global market share



(Strategy Analytics et al., 2021)

Dutch market shares



(Dirks, 2021)

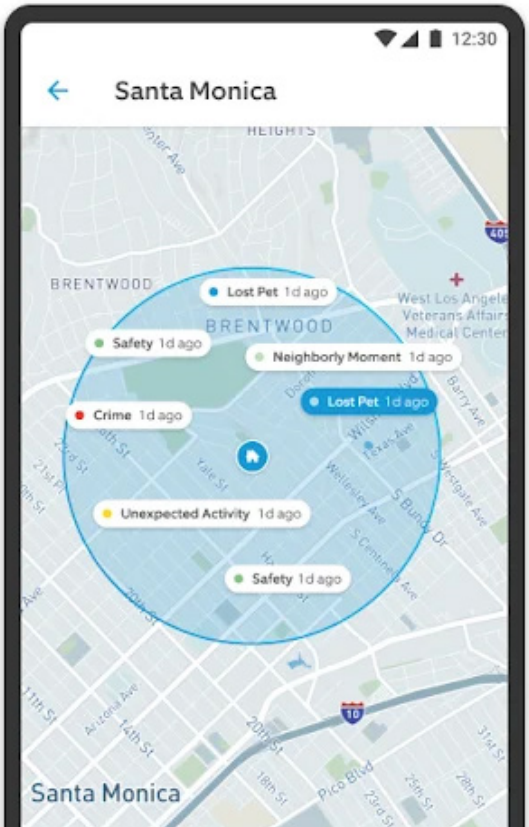
“Neighbor” - Smart doorbells and neighbourhood watches

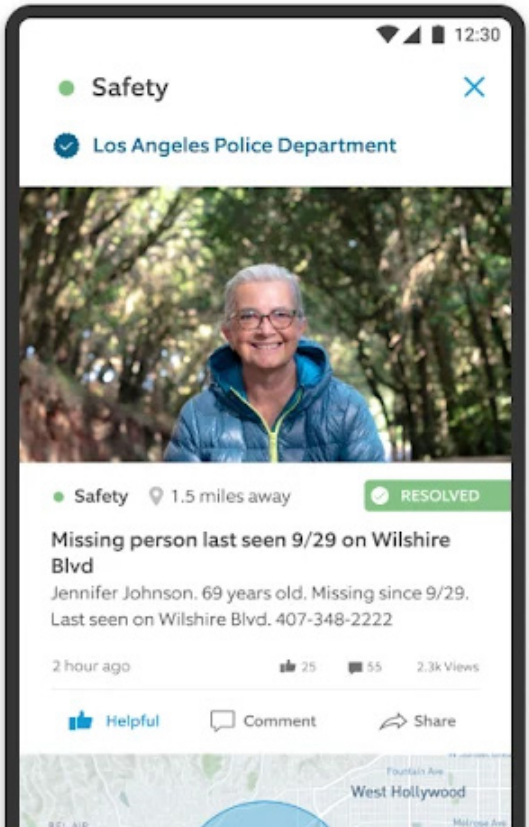
How videos from smart doorbells are being shared in neighbour-hoods.

The videos filmed on smart doorbells are not limited to the owner’s phone. Videos can be shared on other platforms such as Twitter or Facebook. Ring has even made an additional neighbourhood watch app for sharing video material. The app is an example of how smart doorbell videos are affecting communities and has been a big point of discussion on the effects smart doorbells might have on society. We will, therefore, briefly introduce the app in this chapter.

The app is called “Neighbors” and allows users to join local neighbourhood groups regardless of if they have a Ring device or not. In the app, users can easily share video footage from their Ring camera and tag the video in different categories, ranging from “Animals” to “Suspicious” to “Crime”. Users share videos anonymously, except messages from local police departments and Ring. The videos and messages are shown on a map indicating an approximation of the area of the event (Haskins, 2019) (Rubin, 2018). Users can then get notifications when something happens in their neighbourhood.

Currently, the app is only available in the United States (Ring, n.d.).

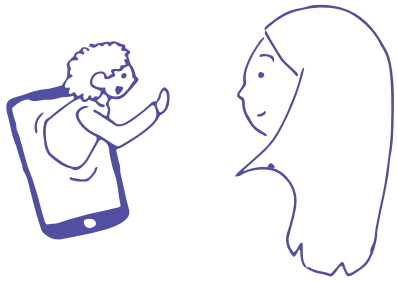




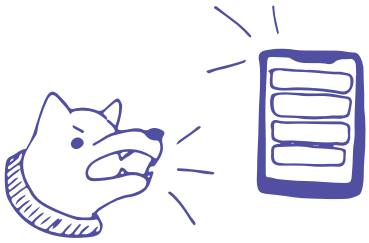
Images from the app Neighbor from Google App store (Ring, n.d.-d)

The new purpose of the doorbell

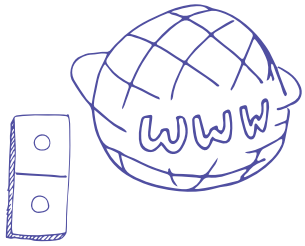
When we look at the design and marketing of smart doorbells, we see that it is introducing a new purpose to the home's doorbell. The addition of a camera allows for a whole new level of convenience for the owner, being ever-present at their home, even when away. This makes the doorbell more than an entryway to the house; it becomes an entryway to the owner.



The smart doorbell's new functionality has also turned it into a watchdog, barking notifications from the front door. It allows the owner to watch anytime at their convenience, 24/7. The doorbell is no longer just a welcome reaching inside a house but has extended its owner's view to what is visible from the entryway.



Lastly, the shareability of the videos in neighbourhood watch groups also makes the doorbell part of the online communities. It lets people create awareness of what they find important by sharing a glimpse of their street. The ease with which videos are shared effortlessly, are affecting how neighbourhood watch groups work online.



Understanding how a smart doorbell works and how it is marketed can help us see the new purpose of the doorbell, which has extended further than just notifying the people of the house of a visitor.

Disclaimer in regards to functionality of the smart doorbell

For this research section, the analysis assumes that the smart doorbell is fully functioning based on the company's descriptions. However, during the research, it was clear that some people who purchase a smart doorbell do not always experience the same smooth user experience described by the companies.

On websites such as Trustpilot (https://www.trustpilot.com), owners describe issues with missed notifications, problems with the wifi connection, or simply missing visitors because the camera turns on too late. It has been hard to verify how big the scale of the problems is, so we will assume that the doorbells work as described by the companies.

Understanding why people purchase smart doorbells

While smart doorbell companies promise convenience and a feeling of safety, there might be many other reasons why someone might decide to purchase a smart doorbell.

In this project, the context is the municipality of Amsterdam. So to gain a better understanding of why people residing in the city have decided to buy a smart doorbell, data was gathered through three different means.

1. Using existing research from AMS. AMS has already conducted research to understand why people have purchased smart doorbells. The research consisted of interviews with five residents.
2. Interviewing a smart doorbell owner. The person did not reside in Amsterdam.
3. Giving out questionnaires in Amsterdam. During a walk through the city (following the approximated route shown in Appendix E), 40 questionnaires were delivered to houses with a smart doorbell. Only four people answered and no one was interested in a follow-up interview.

Through these three different methods, ten different people gave their answers to why they purchased a smart doorbell, nine of them residing in Amsterdam. See Appendix C for more details.

The research showed five general tendencies for why people purchase a smart doorbell:

Feeling safe at home: Some people purchase it to feel safe at home. The doorbell provides them with a feeling of security by having the camera.

Protecting their property: The doorbell helps the owner protect their property if something bad happens (a package being stolen or something being damaged). They only use it when something happens that prompts them to look.

Keeping an eye out: The doorbell helps them gather knowledge on who visits the house, who comes by, who is on the street etc. In general, keeping an eye on the front door, even when nothing suspicious has occurred.

Convenience: A smart doorbell can be very convenient for the owner to interact with visitors when they are not home. The owner is also not bound by the physical limits of hearing the doorbell in their house but can bring the doorbell with them.

Tech fascination: Some are interested in the latest tech, and the smart doorbell is a new product to try.

Another finding was the difference in awareness. Some owners were aware of the rules regarding filming public areas. One had disabled the video function due to GDPR rules: (as a response to the question if they had the video function on): *"No, it is quite complicated in terms of AVG legislation."* Others did not seem aware or to even care. One had the camera on, even though the neighbour had asked questions about privacy in a public area. Therefore, it is fair to assume that not everyone is aware of or cares about the rules and legislation concerning smart doorbells.

It is important to note that this small research is lacking in different ways. First of all, the number of participants is deficient and gathered through 3 different research activities. The questionnaire specifically had a meagre output. Secondly, gender, age, social status etc., are only touched upon in the research from AMS, and it is not possible to know if it is representative. And finally, only one in-depth interview was conducted.

Despite the less-than-ideal number of participants, the research can still help us understand the tendencies for why people in the Netherlands, specifically in Amsterdam, have decided to purchase a smart doorbell. One can assume the same reasons would be present in a more extensive dataset, though we cannot tell which trends are most dominant.

One of the few doors with a sticker to inform they were filming, image from the walk in Amsterdam.

What is the experience of owning a smart doorbell?

While the previous section focuses on why people acquire smart doorbells, they do not cast much light on the experience of owning a smart doorbell. However, some articles have dived into that.

One general thought is that owning a smart doorbell can increase the owner's perception of paranoia and fear (Guariglia, 2019). Especially in combination with a neighbourhood watch app. The constant notification that something has happened or someone might be at your door can result in unrealistic expectations that crime rates are more prevalent than reality and generate fear and suspicion (Ross, 2015). This fits with the knowledge that fear of crime is not directly linked with actual crime rates but can be influenced by other factors (Vlaskamp, 2011). Owning a smart doorbell could likely be such a factor.

In the article: "*I got a Ring doorbell camera. It scared the hell out of me.*" (Read, 2020), author Max Read tried what it was like to live with a Ring doorbell out of curiosity. The doorbell, combined with the Ring "Neighbor" app, quickly gave him an experience of a new sense of unease. He also realised how the camera's video function made him feel in control when he was out, even though all he saw was his neighbour passing his door. The article exemplifies how living with a smart product like the smart doorbell can affect how we view and judge our surroundings and neighbourhood.

Does a smart doorbell actually help fight crime?

Two of the reasons people purchased a smart doorbell were to protect their property and feel safe. However, it is questionable if smart doorbells have an effect on crime. The dominant player on the market, Ring, claims that its product helps fight crime in neighbourhoods. They have conducted research in the United States, showing up to a 55 % reduction in crime after only 10 % of houses received a Ring doorbell (Harris, 2020).

But in a review by MIT by Harris (2020), these findings were hard to prove. Both because Ring refuses to share methods or data, and when trying to replicate their findings with publicly available data, the numbers do not match. Overall, the little research done in the area does not show that smart doorbells affect crime levels, even when looking at different types of crime.

Illustration 5

2.3 Privacy concerns

Smart doorbells have barely been on the market for a decade, yet they have already generated many privacy concerns (de Klerk, 2020).

There are many rules for gathering surveillance footage in the Netherlands and, by extension, the EU, to protect the citizens privacy. By Dutch law, citizens are allowed to film their private property, but not public areas (Autoriteit Persoonsgegevens, n.d.) - though exceptions with good reasons can be made, such as stores that want to protect themselves against crime (EDPB, 2019). These regulations also apply to smart doorbells. An EU court ruling from 2014 judged that a British man had invaded his neighbours' privacy by filming a public area with his home surveillance system (The Conversation, 2021), which also included his smart doorbell.

The legality of the camera is highly dependent on its location and the landscape in front of it. As illustrated, depending on these aspects, the doorbell might be filming only private property, public property or a combination.

It is important to note that most houses in Amsterdam have front doors facing the public road, without any or minimal front gardens. And while handing out questionnaires in Amsterdam, the majority of smart doorbells was faceing public areas: 36 doorbells faced public roads, three doorbells faced potentially private roads, and one was partially turned towards the public road.

Illustration 6. How location and context of a smart doorbell affects the privacy invation.

Citizens also need to comply with GDPR in the EU. This includes, as found in EDPB (European Data Protection Board) (2019), that:

- Citizens cannot film a public area unless they have a good reason (e.g. valid reason for protecting property).
- Citizens inform others about filming the area using signs or stickers if any public area is included.
- Citizens cannot share the data with third parties unless they have a valid reason.

The rules of GDPR are a bit flexible, but overall, wanting to survey the street or know what happens in front of your house is (ibased on the examples from the guidelines) not a valid reason to have a camera filming constantly.

Now, of course, all this only relates to cameras that film 24/7. If the smart doorbell has the camera disabled, it is irrelevant whether it faces a public area. If it only films based on a motion sensor, GDPR is still applicable, but the camera's direction might be less problematic.

So the individual settings of the doorbells can have a significant impact on whether they are legally placed or not - but as a visitor, it is impossible to tell the setting of the doorbell. There is no direct indicator if it is filming. Some doorbells might turn on a small red light in the dark when they film. However, this feature is a technical help to allow the camera to film in the dark. It is not meant to be an indicator to the visitor. So outsiders cannot tell if the camera is illigally filming or not.

Handling the data - storage, infrastructure and sharability

Smart doorbells are connected to the internet and will often store the data in clouds. The general logistic of the data management of smart doorbells are illustrated in the following image:

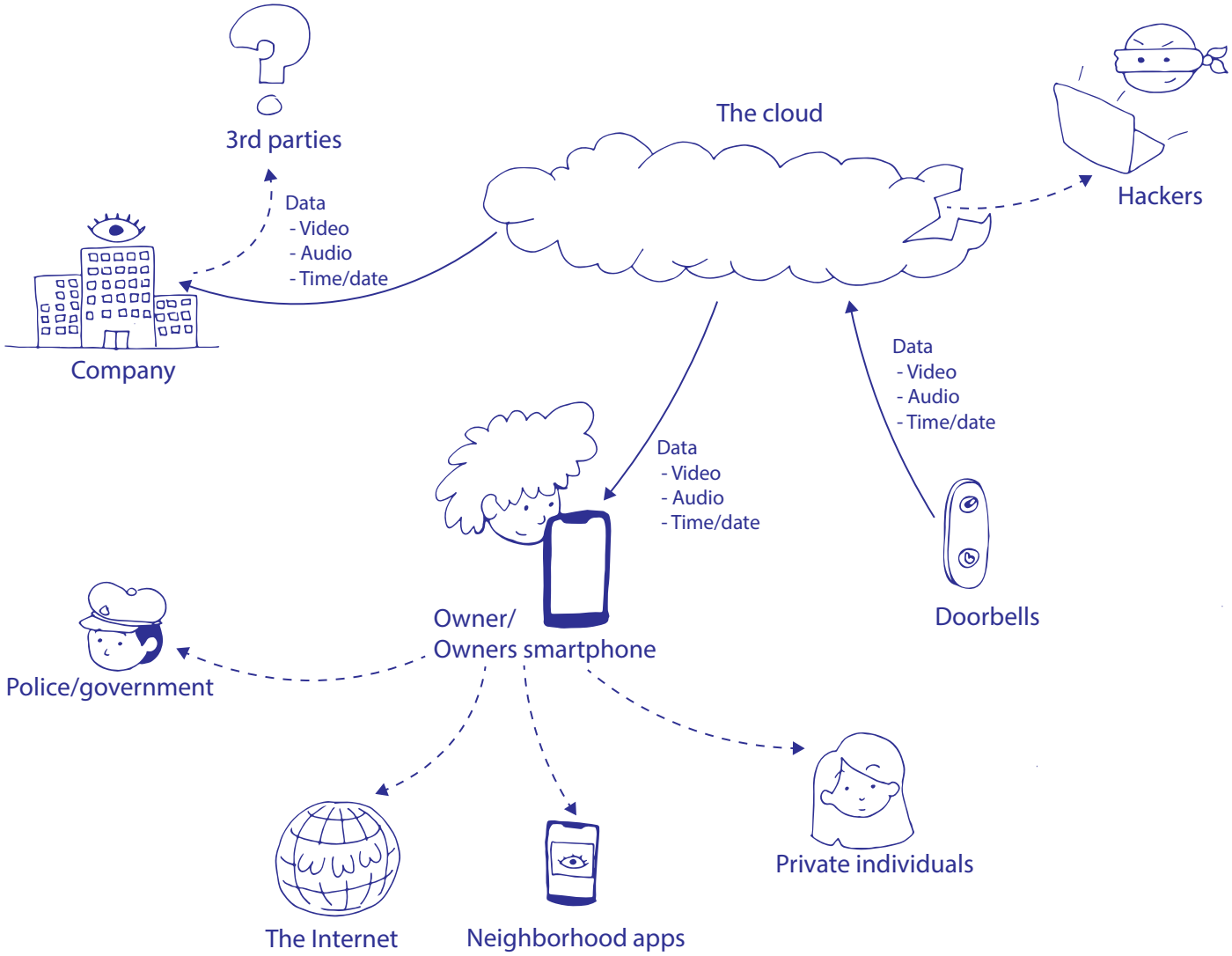


Illustration 7. Depicting the infrastructure of data from smart doorbells.

As shown, the data is uploaded to a cloud, and from there, it communicates with the owners' devices. This logistical setup has resulted in three main concerns regarding the data storage of smart doorbells: the storage, the shareability and hacking.

The obscuration of data usage

The fundamental use of cloud services for the smart doorbells to share their data means that the data is not in a closed loop between the doorbell and the owner. It is also accessible to the cloud service.

While many companies claim that they do not share the data that the smart doorbells upload to their cloud server, there are indications that some companies share the data with third parties or keep it for internal use. The company Amazon is the world's biggest cloud provider (Statista, n.d.) and also the company that owns Ring. According to Rings' website (Ring NL, n.d.-a), the company does not share any video material with third parties or law enforcement agencies without written permission. However, Amazon/Ring has received criticism for not being clear on what data they store from their products and if they share video footage without users' permission.

Some of the issues range from

- Storing data about the device, such as timestamps for motion detection (Kelion, 2020).
- Using footage from its social media platform Neighbor for advertising without consent from the owner or the person in the video (Alba & Mac, 2019)
- Ring granting access to police departments in the US without permission from owners (Ropek, 2021)

These examples indicate that the company is keeping and sharing more data than owners are aware of. Bridges (2021) describes Rings' practice with data as *infrastructural obscuration*. Infrastructure tends to hide in plain sight and only becomes visible when mistakes or errors happen. The data infrastructure for smart doorbells makes it hard for the owner to understand how the company treats their data unless a mistake or breach of data happens.

The shareability of the data

Because it is easy to download and share data from smart doorbells, videos from people's smart doorbell cameras are appearing all over the internet. Even on LinkedIn, people will share videos filmed with smart home security systems (Cameron Gregson on LinkedIn: #viral #BiaggioInspire #samaritan, 2021). Companies even encourage it, such as on Rings's platform, Neighbors.

The platform has received criticism for how it effects society and neighbourhoods. It seems to promote and foster racial policing, and openly racist comments are present (Bridges, 2021) (Molla, 2019). The platform can also create increasing paranoia by making people think there is more crime than actually present. (Guariglia, 2019). Finally, it has been criticised for turning ordinary citizens and neighbours into cops, with heavy policing of petty crimes (Haskins, 2019).

The ease with which the videos are shared means they are becoming part of online communities and affecting how people view their neighbourhood or express their views (sometimes in discriminatory ways). It is impossible to say if the videos are at fault for promoting this behaviour or highlighting existing issues, but they have become a part of the online world.

Hacking the device

The wifi connectivity also makes it easier to hack the product. Unlike products without wifi connections, connected devices can be hacked from afar. When it comes to smart doorbells, two specific aspects make them vulnerable: weak passwords (which is up to the owner) and no encryption of data (which is up to the company) (BBC News, 2020) (de Klerk, 2020). This has resulted in cases of hacking either doorbells (Cox, 2019) or their accompanying apps (List, 2019).

If a smart doorbell is hacked, there are several possible misuses. As reported by Kinza (2021), hacking smart doorbells can lead to:

- *Credential stuffing:* Getting the owner's password and username to hack into other devices.
- *Exploiting the home network:* Get access to other devices using the same wifi.
- *Device control:* Being able to send notifications or control the device. This can be used for jokes and pranks or to plan and carry out a robbery.
- *Online Botnets:* Using peoples' smart products to attack websites, servers and organisations.

As the list shows, hacking a smart doorbell can lead to severe implications to residents' or others' safety.

The benefits of the current system

While connecting the smart doorbells to the internet can result in the aforementioned issues, there are benefits to connecting the devices to cloud services. As discussed w. T. Fiebig some of these are (T. Fiebig, personal communication, November 18, 2021):

- It gives a smooth user experience by allowing the user to store more video through the cloud than they would be able to do physically on the device.
- It is easier to update the product.
- It provides the companies with a stable income through the subscription service.
- It ties the user tighter to the company because it becomes more complicated to change the product.

All this makes connected products attractive to companies and users alike.

Extending surveillance network and giving power to the company

While there has been less written about smart surveillance in Europe, the discussion is more prominent in the USA. One particular issue is the strong relationships between Ring (and, by extension, Amazon) and police departments.

In the US, Ring has set up agreements with local police departments (Guariglia, 2019). The agreement gives the police access to heatmaps of locations of Ring cameras in exchange for promoting Ring's products to citizens. There are also indications that Amazon will allow police access to video footage circumventing the owner if the police cannot get access through the resident. There are many problematic elements regarding this sort of arrangement, but it is maybe best described in the article by Guariglia (2019): "*This arrangement makes salespeople out of what should be impartial and trusted protectors of our civic society*" (Guariglia, 2019, paragraph 12).

In the paper by Bridges (2021), the collaboration between Ring and police forces shows how these collaborations affect American neighbourhoods, such as facilitating policing of citizens with a strong racial bias.

The challenges with Amazon/police collaborations in the US is not the only example of how data management is allowing big companies directly affect society. Fiebig et al. (2021) have looked at academic freedom being under pressure from big tech companies because of universities' dependence on cloud infrastructure.

Data management is becoming a way for companies to gain a growing power and influence on societal values such as fairness and academic freedom.

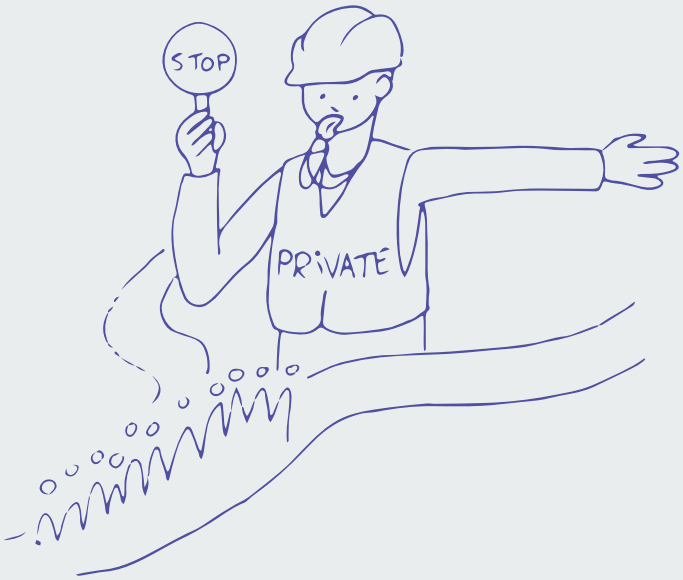


Illustration 8. What impact does it have on society that big private companies own the data infrastructure?

Smart doorbells in the Netherlands

As this project's scope is smart doorbells in Amsterdam, it is relevant to look at the circumstances within the Netherlands. As previously mentioned, an estimate is that there are 640,000 smart doorbells in the country, primarily Ring cameras. There is no indication of what types of households have smart doorbells, so it is not possible to say anything about what groups in society own a smart doorbell. However, a few assumptions can be made:

To put up a smart doorbell, the resident needs to be allowed to change their doorbell. People living in a rented house are probably less likely to decide what doorbell they have. It is easier to set up if the person owns their own house.

Most likely, the resident has a front door to the street. Setting up a doorbell with a camera makes more sense if the resident has their own front door. If they live in an apartment complex, they might already have an intercom.

While this is loose speculation, and there will be many exceptions to these two assumptions, it is more likely that people who own their own house will be able to set up a smart doorbell. In general, this group of people can be assumed to be of a higher social status and having a more considerable income/asset than people living in rented places. This can create a difference in who in society can have surveillance.

Smart doorbells and the police

There is an interesting dynamic when looking at the police and smart doorbells in the Netherlands. On the one hand, the smart doorbell is a product that might be privacy-violating and thereby illegal, depending on its location and setting. But rather than looking into ensuring that the doorbells follow proper legislation, the police have been found to approve of the product.

"Kamera-in-beeld" (Politie, n.d.) is a police project where citizens and companies can indicate if they have a private surveillance camera. The police can see all private security cameras on a map, so if there is an ongoing investigation in the area, they can know if there are relevant cameras accessible. This number of private cameras in the database is not small - in 2017, there were reportedly around 200.000 cameras in it (DutchNews.nl, 2019). One can only assume the number is higher today.

The database is also open to include smart doorbells and would indicate that the police view smart doorbells as a form of security camera useful to their investigation. Even to the point that the Dutch Data protection agency explicitly on their website informs people that should a police officer recommend them to point the camera towards the public road, they should refuse and refer to the privacy laws (Autoriteit persoonsgegevens, n.d.).

POLITIE

(Politie, n.d.-b)

Another relevant collaboration is the smart doorbell projects facilitated by different municipalities and the police. A sum up report by Hofmans (2019) published by Tweakers looked at five such projects where municipalities either gave out doorbells for free or subsidised them. The overarching goals of the projects were to:

- Improve the safety of the neighbourhood (looking at car theft and burglaries before and after doorbell installations)
- Improve feelings of safety (by asking the people living in the neighbourhood)

The five projects were not coordinated overall and used different brands of smart doorbells. The cameras handed out varied from 45 to 100. Some projects had not made the results public, and some were still running at the time of the article.

Locations of test areas

The one project that had ended could not conclude if the doorbells impacted overall safety when looking at crimes rates (in the project, 45 doorbells had been given out in Spijkenisse). They did find that citizens felt safer after the doorbell was installed. So while it is not possible to conclude how safe the doorbells make a neighbourhood from this trial, it does show how the police seem to be actively participating in projects promoting smart doorbells.

Overall, it all indicates that the police see the smart doorbells in society as a different type of video surveillance that is a valuable tool in crime-fighting. This might explain why the police are letting smart doorbells be present in society - even when the product might be breaking the law.

It is important to note that other governmental bodies are not as lenient with smart doorbells. The Dutch Data Protection Agency has warned against the wrongful use of smart doorbells (Hofmans, 2020). It provides information to individuals on their website on how to set up a smart doorbell in accordance with the rules (Autoriteit persoonsgegevens, n.d.).

The type of collaboration between police and smart doorbell companies like Ring, as observed in the US has not been observed in the Netherlands.

AMS - smart doorbells in Amsterdam

The AMS institute (collaborator on this project) has also worked on projects related to smart products. Part of AMS is the department Responsible Sensing Lab that *"...explores how to integrate social values in the design of sensing systems in public space"* (AMS institute, n.d.-a, paragraf 1). This department created the project "Shutterring" (Responsible sensing lab, n.d.) in collaboration with the design agency Incredible machine. A small device that fits a Ring doorbell and obscures the video so the owner can only view the camera when someone rings the doorbell and only for a short amount of time.

This indicates that AMS is looking critically at smart doorbells and how to handle them.

Image of shutterring (Rozinga & Responsible sensing lab, n.d.)

Sum up and scope

This chapter looked at how the new functionality given to the doorbell (a WiFi connection and a camera) has given the doorbell a new purpose. The smart doorbell is a direct connection between the owner and the visitor, allowing the owner to be ever-present at their front door. The smart doorbell is also seen as a security measurement, acting as a security camera without the label.

We further explored why people purchase smart doorbells, finding that convenience and safety/ feeling of safety are the two main reasons. However, academic research has not proven their actual, measurable effect on safety.

Lastly, the chapter explored a range of privacy issues. Those range from product level focusing on installation and invasion of public areas to the managing flow of data. We also look at the societal level at how the police and smart doorbell companies have collaborated and explore how that is impacting society.

While this chapter identifies many different issues and concerns related to smart doorbells, several of these will not be touched further upon in this project since they are out of scope. This concerns specifically the collaborations between police and smart doorbell companies and the use of neighbourhood apps. Instead, it will narrow down and dive into the interaction created between people when interacting with a smart doorbell.

Ch. 3

FACILITATING POWER

Diving into the context of the interaction

In the previous chapter, it is evident that a smart product like the smart doorbell is not a standalone product. It is part of a bigger ecosystem, uploading and actively sharing the data it receives. It is impossible to understand the smart doorbell without looking at it in context.

In this chapter, we will look at the interactions with smart doorbells and see how this product facilitates a new power dynamic between the owner (the one with access to the data) and other people (the ones without access to the data). We will then dissect this power using feminist theory to understand what aspects have allowed this power disruption to happen.

3.1 Understanding the interaction

Diving into the human interactions that happens with a smart doorbell.

Communicating with a smart doorbell can be described as an interaction between two people through the medium "smart doorbell" (Kudina & Verbeek, 2019, p. 297). So rather than the visitor interacting with the smart doorbell, they are interacting with the owner through the device. This meeting is a form of negotiation between two parties, entering the discussion to reach an agreement (Carnevale & Pruitt, 1992, p. 532). But the negotiation premise is set by the medium, the doorbell.

With this specific negotiation, the two parties have different amounts of knowledge - the owner of the doorbell receives a lot more information than the visitor about the situation (see illustration 9).

The visitor only receives the audio when they interact with the owner, while the owner will have access to:

- The audio/voice of the person.
- Face, clothing and other identifiable information about the person.
- Location of the person.
- Context about the situation. E.g. How many people are there, are they carrying something, what is the weather?

All this information makes the owner much more equipped to choose how to act in the interaction. The knowledge gives them more control over the situation. Furthermore, the owner has the whole interaction on video. They can retain the knowledge of the information and share it with others if they want. The visitor does not have access to this storage of knowledge.

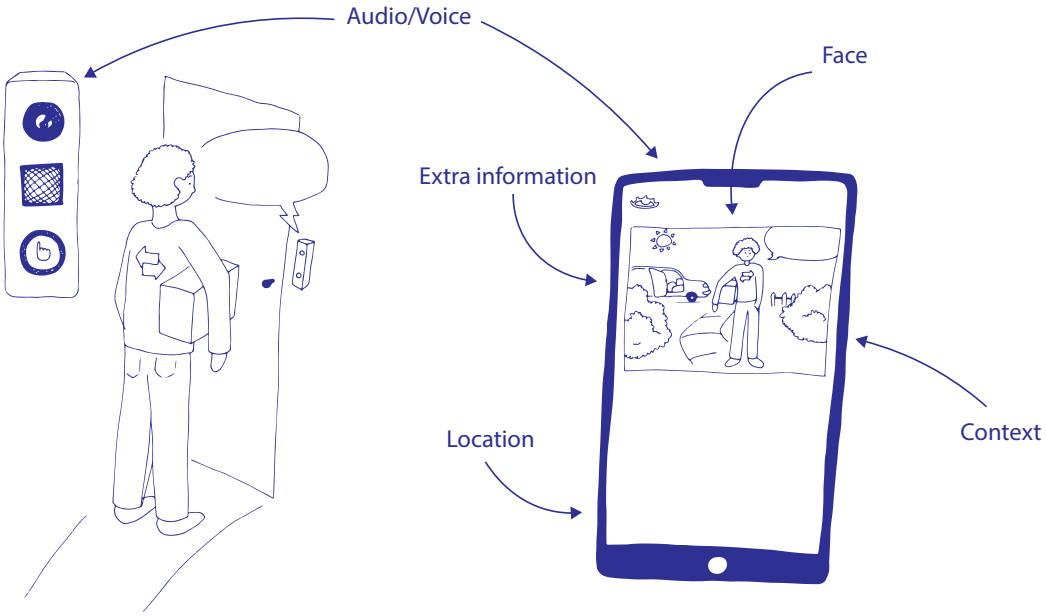


Illustration 9. Info that visitor has vs. the owner

User scenarios

Depending on the wants, needs and situation, there are many different types of interaction that can happen through a smart doorbell. To better understand the negotiation that happens. The following mapping focuses on the possible different actions the individuals can take.

This overview is made based on three different types of users:

- The owner of the doorbell
- A visitor who is actively approaching the house
- A passerby who is not approaching the house

The owner of the smart doorbell

An owner of a smart doorbell have an array of options when they receive a notification on their phone. The actions range from passive (ignoring or observing the visitor) to interacting. They can choose to interact with the visitor at a safe distance by communicating through the intercom or actively approaching them if the doorbell is within their vicinity. They can also base their choice of action on knowledge about the situation such as who is visiting.

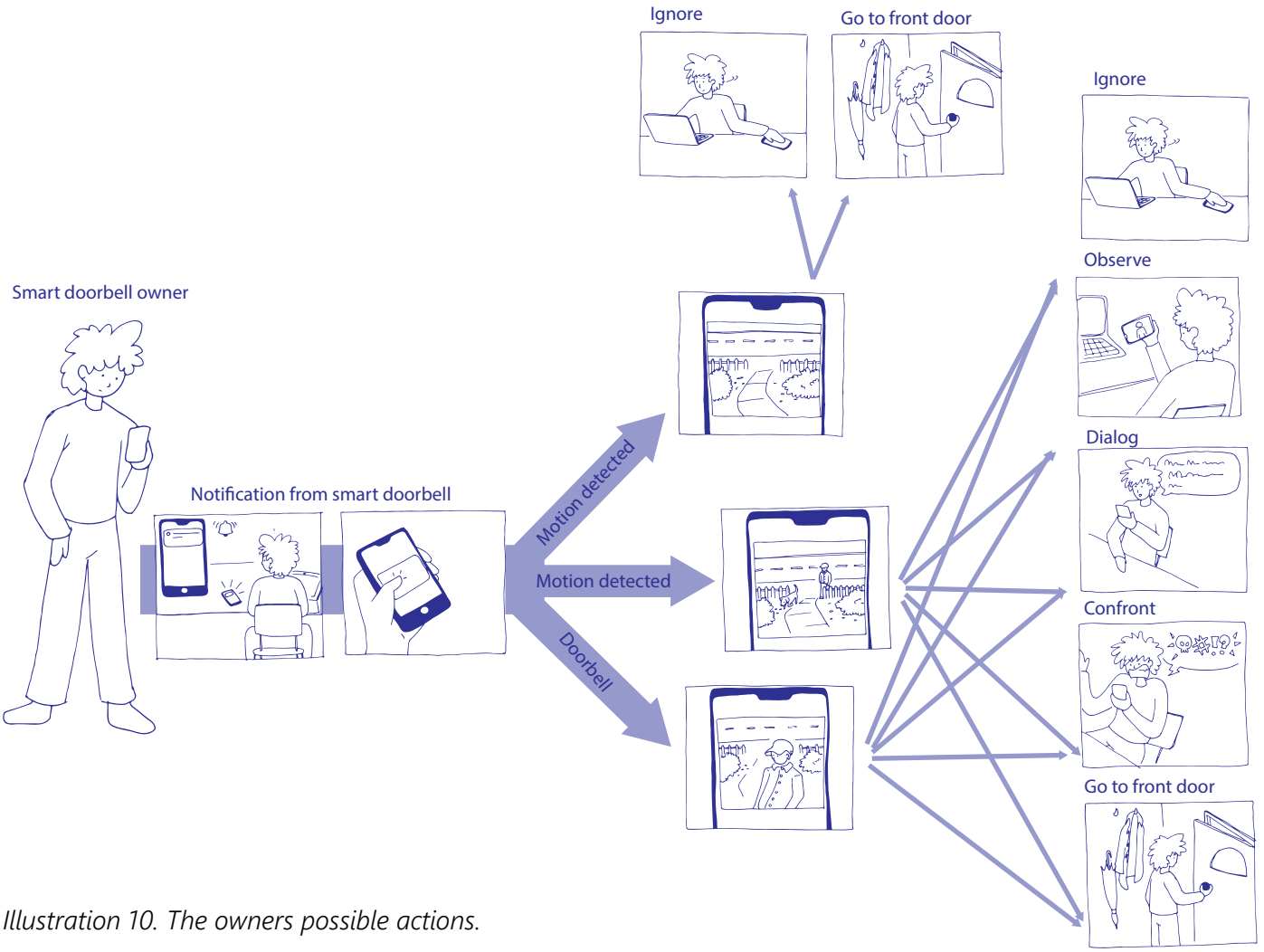


Illustration 10. The owners possible actions.

A visitor (voluntary or in a professional context)

A visitor has fewer options. Their actions are, first of all, based on whether they see and recognise the smart doorbell. If they are not aware they are being filmed, they are participating in the interaction under unknown conditions and are unable to give consent to the filming.

If the visitor sees and recognises the smart doorbell, it might already be too late. They might have been filmed, and cannot reject the data gathering. Furthermore, when they recognize the doorbell, the visitor only has two choices.

- Accept the premise that they might be filmed and enter into the interaction.
- Not accept the premise of the interaction. The visitor can either leave or try to contact the owner in a different way.

The only option where the visitor can give full consent to recording is if they are already aware that the house has a smart doorbell. Then the owner can assume apparent consent (as defined by Sarathy et al. (2019)) because the visitor enters the area knowingly.

It is important to note that some visitors are unable to reject the premise because they have to visit the house. That counts for professionals such as delivery couriers or maintenance operators - their job means they do not have the option of not interacting with the smart doorbell. This is a form of forced consent.

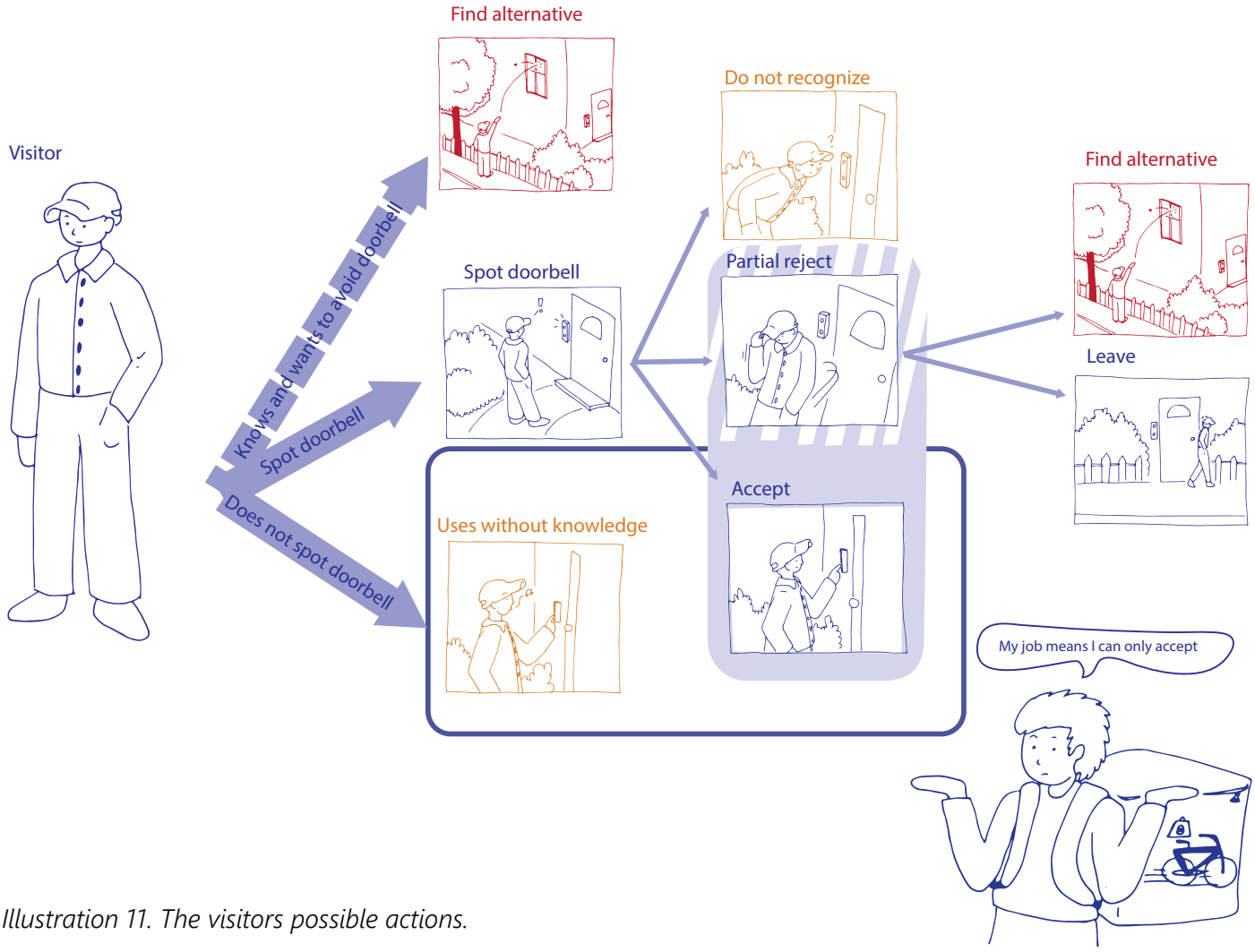


Illustration 11. The visitors possible actions.

A passerby

A passerby only interacts with the doorbell when the motion sensor is on and if the doorbell is located facing a public road. In this scenario, the passerby might activate the motion sensor and be subjected to filming.

Again, just like the visitor, the passersby will first have to notice and recognize the doorbell to be aware that they might be filmed. If they do, they still have minimal choices of action:

- They can accept the presence of the doorbell and continue walking past.
- They can reject future interactions by, for example, finding another route.
- They can confront the owner. However, this action demands that they have to interact more with the doorbell and possibly give more data.

It is important to note that rejecting or confronting are two options that ask a lot of the passerby. Rejecting and finding another route makes the passerby change their behaviour in public areas. And approaching the house owner is a direct confrontation with a stranger.

The dilemma is even trickier because the passerby cannot tell if the camera is filming.

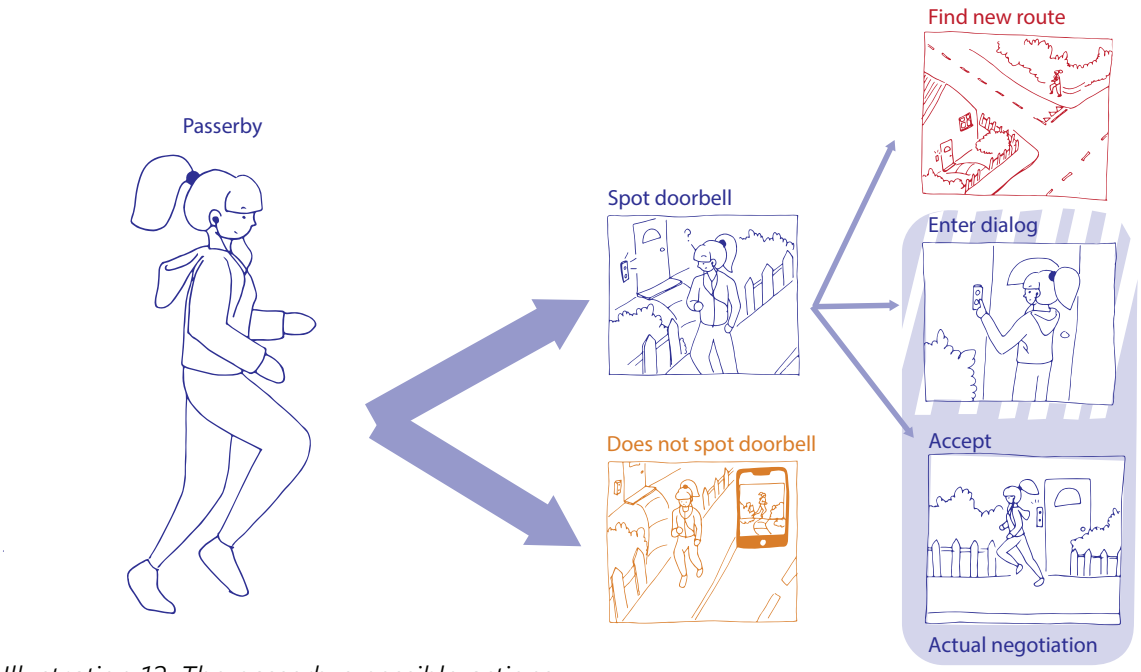


Illustration 12. The passerbys possible actions.

Overall

When we look at the three different overviews, it is clear that there is a big difference in options of actions. Visitors and passersby are mainly left with accepting or rejecting the premise of the negotiation (if not forced to accept). On the other hand, the owner has a lot more options.

Consent to being filmed can only happen when the person is aware of the smart doorbells presence and how it works. If not, they enter the interaction unbeknownst of the premise. This is not consent.

Lastly, the visitors or passersby might be forced into unwanted actions (such as finding ways around the doorbell or changing routes) if they do not want to be filmed.

3.2 Understanding power

Diving into the concept of power and how it relates to our interaction.

When we look at the previous interactions, it is clear that there is a difference in the playing field - one part of the interaction, the owner, has an advantage over the visitor or passerby. This advantage in the interaction comes from the following.

1. The owner are already aware of the presence of the smart camera (and what it does to the interaction)
2. The owner have more ways to react and position themselves in the interaction (viewing, answering, ignoring)
3. The owner have more data and knowledge about the visitor
4. The owner can save and keep the data from the interaction for later use/sharing

This creates an unequal power dynamic in the negotiation. To better understand that, we look a bit more at the concept of power.

One way to define power is from the book Data Feminism by D'ignazio and Klein (2020), chapter 1:

"...Power [describes] the current configuration of structural privilege and structural oppression, in which some groups experience unearned advantage."

In this case, the doorbell gives the advantage in the interaction to the owner over the visitor, making them able to do as they want more easily.

In the TED-Ed video (TED-Ed, 2014, timestamp 1:14) "How to understand power" by Eric Liu, power is defined as

Power (n). The ability to make others do what you would have them do.

This power can take many shapes - here are some imaginary scenarios that show when a smart doorbell might give someone the upper hand in an interaction.

A person is unsatisfied with an interaction with a person delivering their food. They thought they were too rough handling the bag and complained to the restaurant by sending a snippet of the video of the interaction with the delivery personnel.

On the street, someone has had their car scratched. Looking through their video from the day, a neighbour finds a person walking by that they think is the culprit. They share the video on the neighbourhood Facebook group asking if people have seen this person.

A parent has agreed with their daughter that she should be home by midnight from a party. They do not get a notification on their phone from their doorbell until 3.30, saying that their daughter has arrived home.

In all these situations, the owner of the doorbell stands stronger in the interaction than the person being filmed. Whether this person lives in the same house, is a visitor or someone not even aware the interaction was going on.

Now, it is possible that the video might also be an advantage to the other party in the interaction if it shows a negative side of the owner of the smart doorbell. Maybe they were rude or threatening. But, since only the owner has access to the data, the advantage disappears for the other party.

While these examples in this section are imaginary smart home products have been misused to wield power over others in real life. In the article from BBC News by Silva & Franco (2020), "How smart devices are exploited for domestic abuse", two women explained how their partners were monitoring and controlling them using smart devices. One person experienced how their partner tracked them going in and out using the Ring doorbell. In a quote from the article, the person said:

> *"[About the Ring doorbell] I could take the battery out of it if I wanted to, but I didn't feel like I could because he would say to me, "You're compromising our children's safety"... I was worried that he would go to the police and try and suggest that I'm a bad mother."* (Silva & Franco, 2020, paragraph 7)

This is a contemporary example of abuse of power in the cruellest form, facilitated by smart products.

Looking into the future

While the examples mentioned are all current situations, it is also important to note that video materials, like that filmed of smart doorbells, might be abused in the future in ways we have yet to see.

One potential future misuse of video footage is deepfake. While deepfake today is mainly known for funny YouTube videos showing popular movies using other actors' faces, many are concerned about the future use of deepfake (Agarwal, 2020) (Goodwine, 2021).

One such misuse of deepfake is pornographic material. A report from Ajder et al. (2019) shows that almost all deepfake is used for pornographic material (the report estimates a whopping 96 % (Ajder et al., 2019, p. 1)). These pornographic videos are almost exclusively of women from the entertainment industry, because there was large quantities of free video material of these women online to train the algorithm on. But pornographic deepfake material is becoming more accessible and easier to apply - in 2019, a controversial app called DeepNude was able to turn images of clothed women into nudes. Any photo could be deepfaked without the need for extensive data or time (Ajder et al., 2019, p. 8). While the app was shut down, I had no problem finding websites that offered the same service at the time of writing this report.

Suddenly a normal photo uploaded to Instagram or Facebook can be turned into a nude of the person (mainly women). While this practice of turning images of women into involuntary pornographic material has happened before (Sherman, 2021), apps like this are making this process more effortless - and it can be a life-shattering experience.

Now, turning an image from a video doorbell into a deepfake porn might seem unrealistic. However, one can imagine other things happening - fake voices, fake actions, fake proof of a crime or fake proof of being somewhere at a convenient time. Deepfake porn is a scary example of how video material can be easily misused to ruin someone's life. One does not need much imagination to conjure similar scenarios with smart doorbell videos.

Matrix of domination

While it is now clear that the smart doorbell, in its design, allows for an unequal power dynamic, it does not explain how this power is configured on a higher level. One way to better understand how that has happened is to use the model "Matrix of Domination" by Collins as described by D'ignazio and Klein (2020, chapter 1). The model explains how systems of power are configured and experienced through four different perspectives (see illustration 13).

To understand how smart doorbells came to facilitate the power difference in the interaction between two people, we will go through each domain of the matrix.

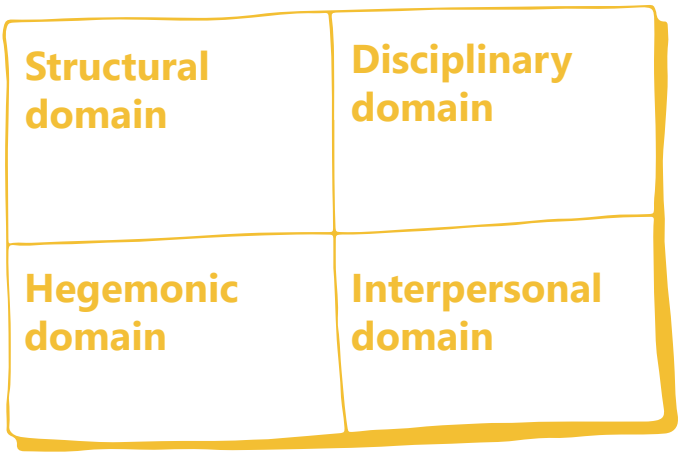


Illustration 13. Matrix of domination.

Structural domain

The structural domain refers to the laws and policies that make up the rules that allow for an unfair advantage to one party. For smart doorbells the structural domain's central element is the apparent lack of policies and laws. This might seem counterintuitive since regulations such as GDPR counts for smart doorbells (as described in chapter 2.3). But looking more generally, there is no active work being done to ensure that smart doorbells are following those regulations.

The Dutch data protection agency (Autoriteit Persoonsgegevens, n.d.) indicates that citizens themselves should figure out issues of smart doorbells on their street or go to the municipality if needed. It, therefore, seems to be up to the citizens to ensure that the rules are met, not a governmental body.

Another indication that smart doorbells are somehow left out of the general surveillance camera regulations is the smart doorbell trials run in four different municipalities in collaboration with the police mentioned in chapter 2.3. This does seem to send the message that the police accepts smart doorbells.

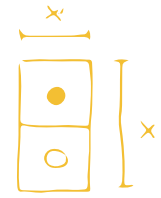
All this together creates a situation where smart doorbells are not actively regulated, allowing the companies to keep a design and a data infrastructure that gives the owner an advantage in the interaction.

There are, of course, institutes and organisations working against this lack of legislation - the work of AMS is an example of that. But while this work is important, it should rather be seen as a reaction to the lack of proper legislation than a preventive solution.

Disciplinary domain

The disciplinary domain is what administers and manages the oppression/power difference. In this case, due to the lack of regulations and control, companies can design it in a way that enhances the power.

The power is administered in 3 different ways.



The design. The design of the smart doorbell means that the visitor is unable to choose if they want to be filmed or even know when they are being filmed. The product's physical design removes the visitor's chance to object to the video recording.

The data infrastructure. The video data is only made available to the owner of the smart doorbell. This puts all the data in their hands, disadvantaging the visitor.

The shareability. It is easy for the owner to share the video footage on the internet. This makes it easier for them to leverage their power over someone else.

These three aspects of the smart doorbell are all design choices. They administer the power difference between owner and visitor. And while the owner can set up their camera so it is less privacy-invasive, the companies are facilitating the oppression by allowing the owner to set up the product in a way that gives them the current advantage.

Later, in this project, we will show how these elements can be challenged with digital and physical changes to the doorbell.

Hegemonic domain

The hegemonic domain refers to culture and media, and how the oppressive ideas that uphold the oppression are circulated.

To understand the different narratives, three types of media were analysed:

- News articles. From both traditional news outlets like BBC to more tech-oriented news outlets (total 15 articles).
- Reviews. From tech review articles to YouTube video reviews (total 8 reviews).
- Marketing materials. Looking at the websites of Arlo, Google Nest and Amazon Ring.

To analyse the discourse of different articles, the method was inspired by Kudina and Veerbeeks (2019) approach to value dynamic. The focus was on what narratives and values are connected to the product and how different values are represented in different discourses pushed by different groups. In this section, we focused overall themes and narratives as well as choice of words and imaginary. For a complete analysis, see Appendix D.

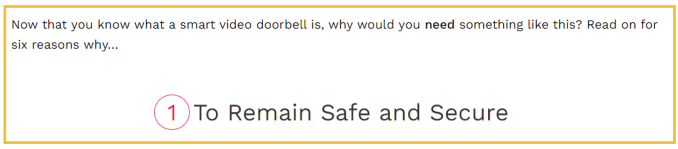
Looking across the narratives showed the following tendencies:

- A strong individual focus is found in the reviews and marketing material. This makes it an individual choice to buy a smart doorbell. On the other hand, the News articles focus on the societal effect of the product.

Article headline focusing on societal challenges regarding smart doorbells. (vpnoverview, n.d.)

- Safety and convenience are two values driven by both marketing and reviews.
- Both reviews and marketing material had a strong narrative stating that we as individuals need to protect ourselves and our property as if we are always in danger. The need for feeling safe/being safe is a given in this narrative.

Marketing material. (Google, n.d.)



Reason to buy a smart doorbell from a review. (ideaing, n.d.)

- A critical approach is all but gone from marketing and is barely present in reviews. News articles focus mainly on the critical sides.
- Only marketing materials focused on a family-friendly image of the smart doorbell, which contrasts the dystopian imagery painted by News websites. The reviews keep themselves more neutral.

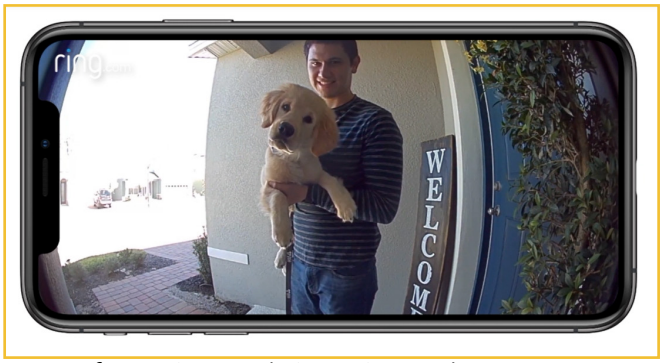


Image from Rings website. (Ring, n.d.-e)

These narratives help enhance the power position of the smart doorbell by providing argumentation for it's place in society.

Interpersonal domain

Lastly, there is the interpersonal domain. This is the individual experience of oppression. When it comes to smart doorbells, the interpersonal experience can be divided into two parts.

- The experience of owning a smart doorbell.
- The experience of being watched by the smart doorbell.

Earlier the experience of owning a smart doorbell is described, but a quick sum up is that it seems that, especially in combination with Neighbourhood apps, the ssmart doorbell generate paranoia for the owner and can give an idea that crime is more prevalent than it is. This might enhance one's perceived need to have a smart doorbell to feel safer at home.

The second perspective, the experience of being watched by smart doorbells is less documented. And initially, the plan was not to explore it for this project. However, during the small user research conducted in Amsterdam (described in section 1.2), I walked around the city to distribute pamphlets into the postboxes of houses with a smart doorbell. This resulted in a coincidental form of autobiographical design research (a form of Autobiographical design, like the one by Desjardin and Wakkary (2016)).

Full description of the experience can be found in Appendix E.

The following were the main findings and qoutes from my notes from the day.

I felt like I was invading someones space

"Walking up to a door with a smart doorbell, I felt like I was intruding on someone's property, as if I was not welcome. I felt very uncomfortable the first 30 min, but the feeling lingered most of the 3 hours.".

When walking around approaching doorbells, I felt like I was going up to houses where I was not welcome. It made me feel uncomfortable, as if the owners property had extended out onto the street.

Feeling like I was at a disadvantage

During the walk, somewhat irrational fears of retribution kept appearing. On the pamphlet, I was giving out was my name and email address. *"I knew that 40 people now not only had my name, my email but potentially also a video of my face approaching their door. How many times had I been filmed? How many servers were my face on? This made me uncomfortable, and (somewhat) irrational fears of it backlashing came to me."*

It was hard to picture what exactly the backlash would be. But the fear was still there.

I changed my behavior

"The bad feeling slowly faded, but it never quite disappeared. I didn't dare knock and ask for a chat at any of the houses (this is usually never a problem)."

I found myself not wanting to interact with the people of the house. I have before collected money for donations and have never been afraid to knock on a door to ask a question. But this day, I found myself holding back because of the doorbells.

The change in experience and behaviour that comes from having my privacy in the public space invaded by the smart doorbells aligns with Roessler and Mokrosinksa (2013). *"When individuals are induced to regard one another as the object of observation and control, they are also induced to regard on another as suspects,"* (Roessler & Mokrosinska, 2013, p. 14)

In this autobiographical study, my reaction to the smart doorbell was to withdraw from interactions, but some people might behave differently. Overall, we can say about the interpersonal domain that smart doorbells seem to move the boundaries of what is public and what is private and can potentially install a sense of suspicion going both ways. This can reinforce the situation, as owners might feel more in need of their video doorbell and outsiders less inclined to ask for an intervention.

Examining the power

Using the Matrix of Domination has mapped out where the power in the interaction stems from and how it is facilitated and upheld:

In the structural domain, the lack of rules and regulations of smart doorbells has allowed the product to locating itself in a grey area and become part of our society on its own terms.

In the disciplinary domain, the design of the doorbell allows for the power to be upheld. This relates to the physical design, the data infrastructure and the shareability of data.

In the hegemonic domain, the overall narrative pushed by companies and reviewers fosters a story where the individual needs to protect themselves and their home by purchasing a smart doorbell. While articles and journalists challenge this narrative, it offers a strong argument for why people should accept the product.

Lastly, in the interpersonal domain, there are indications that both the experience of owning and visiting a smart doorbell can change the individual's behaviour. It can make both the owner and visitor more suspicious of the other, and thereby reinforce the experienced need for the smart doorbell.

Smart doorbells allow for a big power difference to occur because the narrative and origin of the oppression happens on several levels. It is not possible to pinpoint one reason for how this power difference is created, but using the matrix of domination can help give an overview of where the problem stems from.

Sumup

In this chapter we see that in the interaction between owner and visitor or passerby, is an unequal interaction resulting in different options and choices of actions for the different parties. The owner, with access to the data from the smart doorbell and knowledge about its presence and settings, has more choices of action than a visitor or passerby, who might even be unaware that they are being filmed.

To try and understand what is allowing for this power discrepancy to appear, we looked to feminist theory and used the matrix of domination to understand the power from four different domains - structural, disciplinary, hegemonic and interpersonal. All four areas mapped out different ways the smart doorbell facilitated this power.

This project will try to challenge the design of the smart doorbell, with our understanding of the current power differences it creates, and use this existing knowledge of power to try to find designs that disrupt the current balance.

Ch. 4

DESIGN PROCESS

Planning the design process

In this chapter, we take inspiration from other design projects to figure out how to challenge the design of smart doorbells. We then dive into two design methods, speculative design and research through design (RtD), to find the appropriate design approach to reach our desired outcome.

4.1 How to challenge the smart doorbell

Taking inspiration from already excisting design.

As shown in the previous chapters, smart doorbells, with their current design, pose a considerable challenge to privacy in the public room. This invasion of privacy is not just a problem for the individual but creates a power difference between the people who own a smart doorbell and those who do not. To contest this power difference and create fairer and more human-centred AI and IoT products, authors like Dignum (2017) have proposed to focus on the design principle named ART (Accountability, responsibility and transparency). However, D'Ignazio & Klein (2020, chapter 2) claims that these concepts might have good intentions but might potentially secure power by focusing on technical solutions or individual changes.

Why are accountability and transparency concepts that secure power? Because they do not question the need for the system in the first place. In the context of smart doorbells, focusing on ART could make one formulate questions such as: *"Can we make smart doorbells accountable, transparent and fair?"*.

The goal of this project is to question the foundation for smart doorbells and how or if they should be in our city. To obtain this goal, focusing on a turm such as *reflexivity* might be more fititng (as suggested by D'Ignazio & Klein (2020, chapter 2)). The term is efined by Cambridge Dictionary (2022) as:

The fact of someone being able to examine their own feelings, reactions, and motives (=reasons for acting) and how these influence what they do or think in a situation.

How can we challenge the design of smart doorbells in Amsterdam to make the citizens reflect and examine their relationship with smart doorbells in the city?

How has others challenged before?

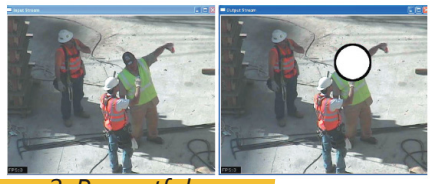
Many previous design and art projects have challenged the invasive nature of new technology like IoT and Ai by focusing on the lack of privacy. To get inspiration for this project, 12 different design projects were looked at (See Appendix F for an overview).

When looking at an array of these types of projects, they can be divided into the following categories:

Technical solution, no. 1-2

These two projects tried to solve the issue of security cameras. The redesign of the Dutch railway security cameras (1) focused on making the cameras more transparent and pleasant. Respectful cameras (2) focus on making a digital anonymiser of people who are not interested in being filmed. While both projects can be seen as solutions to make surveillance more visible and fair, they do not challenge whether the respective cameras should be there in the first place.

1. Dutch railway security cameras, Fabricque (2014)



2. Respectful cameras Senior (2009)

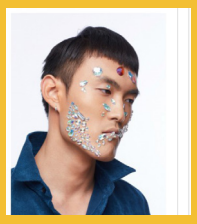
Figure 2. Visual overview of projects in category: Technical solution.

Speculative selfdefence, no. 3-8

These projects try to highlight the issue with surveillance with speculative design by creating self-defence tools for individuals (e.g. with scarfs (5) and makeup (6)). While these projects clearly communicate their intended values in physical design manifestations, they present a negative focus by protecting oneself against the view of the cameras. The obvious value stand of the designer makes it harder to have a nuanced discussion.

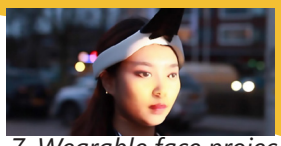
3. URME surveillance, Leonardo Selvaggio (2014)

5. Anonymity scarf Sanne Weekers (2017)



6. CV Dazzle, Adam Harvey (2010)

4. Surveillance exclusion, Jip van Leeuwenstein (2017)



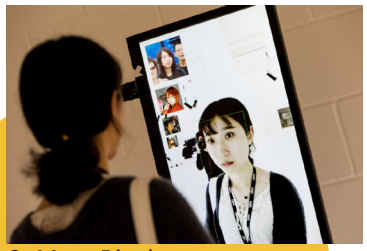
7. Wearable face projector, Jing-Cai Liu (2017)

Figure 3. Visual overview of projects in category: Speculative selfdefence.

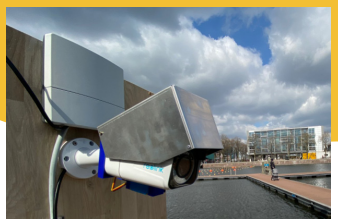
Speculative uses of AI, no. 9-12

The projects in group 3 are all speculative design installations of products that could exist. They are projects that make the viewer consider current uses (9, 10, 11) or potential uses in the future (12). Unlike group 2, which also contained speculative design, these designs did not focus on the individual trying to protect themselves but can be interpreted on several levels, from questioning authorities' use of AI to the individuals' experience of being watched.

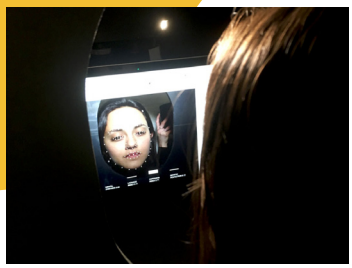
10. Eyecam Marc Teyssir (2021)



9. MegaPixels Adam Harvey (2014)



11. Shuttercam AMS (2021)



12. A B C Advani, S., Salas, B., & Lemaire, L. (2019)

Figure 4. Visual overview of projects in category: Speculative uses of AI.

Overall

These three different approaches all raise different questions. Group 1 gives solutions to the problem but does not question the need for the product in the first place. Group 2 challenges the technology but has already decided that the cameras are wrong and puts the responsibility of protecting one's privacy on the individual. Group 3 tries to challenge the preconceived notion of what is. They open up for reflection for the viewer to consider if they like the current state of things or if things should be different.

In this project, the goal is to challenge the concept of smart doorbells. Not to solve the privacy issue on a product level nor promote a one-sided opinion on smart doorbells. Therefore, the most exciting group to take inspiration from is group 3. This project will explore the use of speculative design to make people reflect by creating objects and designs that challenges.

Using speculative design

Speculative design is when design is used as a tool for imagining alternative futures and questioning the present way of doing things. It does not offer answers to the question it poses but instead reflects back on the role technology and science play in our lives. The goal is to make the viewer aware of current biases and raise discussions and questions about what we want technology to be in our society. This definition is from Mitrovic et al. (2021) in the book Beyond speculative design, which describes speculative design as an approach rather than a defined method.

The book illustrates the road of imaginaries in a three-level diagram (Mitrovic et al., 2021, p. 27). Speculative design follows this road, from (A) looking at a specific element in the present, leading to (B) a speculation; an alternative present, a science fiction story, a revolutionary imaginary product. (B) is driven by a particular agenda or interest, with the goal of changing (C) the future reality. The change can be manifested into actual products, new laws or paradigm changes in society.

For this project, the lifecycle of imaginaries looks as so forth:

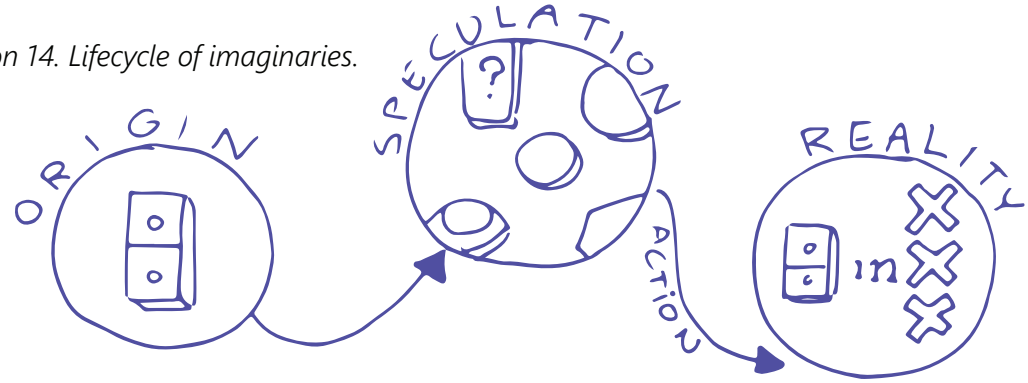
At its best, speculative design can help people reflect on the current way society, culture and technology are put together and envision a different future. It may even suggest or help the viewer take those initial steps towards it.

Some of the critiques and challenges that speculative design faces are the following:

- The Hollywood-fication of Frankenstein: Focusing on the horror of a future scenario in the search for a reaction. This might trigger a strong emotional response but does not allow for reflection of the viewer (Mitrovic et al., 2021, p. 42).
- Being a process aimed "at the people" rather than "with the people": Speculative design can become a voice of the designer's opinion rather than a design that opens up for others to consider their own opinion on the matter (Mitrovic et al., 2021 p. 81).

So to ensure that the project does not fall into any of those two pitfalls and to learn from the speculative design process, we will take inspiration from another method.

Illustration 14. Lifecycle of imaginaries.



Our origin is the increasing use of smart products in society. We extract the smart doorbell (A), and generate alternative doorbells as our speculation (B). We then allow the visitor to voice their opinion to influence how smart doorbells in Amsterdam is regulated (C).

Reserach through design

To ensure that the final design reaches the project's goals, the method research through design (RtD) will be applied to ensure that the result of the speculative design is evaluated on a research basis.

As Zimmerman and Forlizzi (2014) described, RtD is a more future-oriented method compared to classical research that focuses on the past and the present. This is an excellent combination with speculative design since both are looking toward imaginary futures. The difference is that speculative design focuses on the imaginary result, while RtD focuses on what can be learned from the design speculations.

Zimmerman and Forlizzi (2014) describe three approaches to RtD, two of which are relevant to this project:

Rich interaction design (lab)
In this approach, the designer takes their starting point, not in the interaction, but a theoretical stance. That can be a value or an ethic that becomes the starting point for the design to generate new interactions. This is then evaluated in user testing.

The critical design (showroom)
Like speculative design, the critical design uses design to critique a particular aspect of the world and provoke the viewer. The research element is the exploration into finding the proper form and shape of the final product to communicate the critique of the worldview.

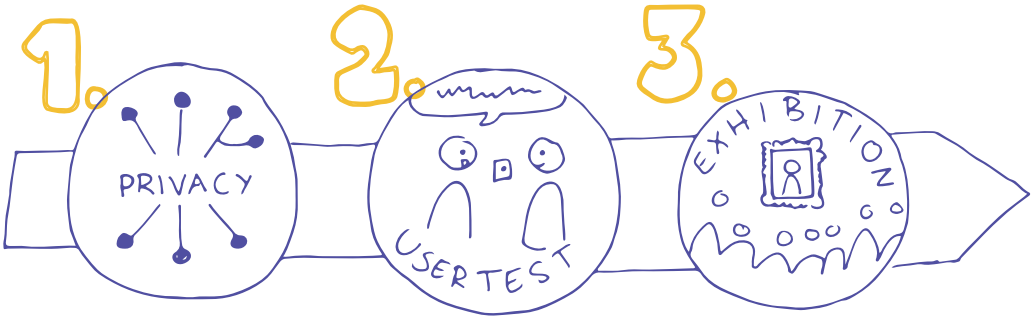
The plan for the project

This project aims to create speculative design that challenges the current concept of smart doorbells through speculative design. To ensure that the speculative design created lives up to the project's goals, the method RtD is used to verify the speculative design.

So how do we plan to go about it?

1. Generate ideas based on privacy, inspired by Rich interaciton design.
2. Test the ideas to find the concepts that best fits our intention.
3. Exhibit the best concepts to trigger discussion about smart doorbells in Amsterdam.

Illustration 15. Design process.



Ch. 5

CREATING ALTERNATIVE DOORBELLS

Creating and evaluating the alternative smart doorbells.

As the design process is laid out, we now start on the first part - designing alternative smart doorbells and finding the right ones for the exhibition.

In this chapter, we will go through the idea-generating phase coming up with a range of smart doorbell concepts based on three definitions of privacy and the following evaluation based on the RtD approach Rich Interaction Lab (Zimmerman and Forlizzi (2014)). It will include the process of designing, prototyping, testing and evaluating to find a range of 3-4 concepts that best fit a final exhibition setup.

5.1 Generating ideas

Diving into the human interactions that happens with a smart doorbell.

Following the RtD approach, Rich interaction, to generate new, rich interactions with smart doorbells, our starting point will be in ethics and philosophies to explore possible interactions. In this project, we will focus on privacy.

Many of the concerns voiced in literature and media regarding smart doorbells are related to privacy. Furthermore, the act of placing a camera facing a public street is a direct invasion of privacy of the visitor/passerby, which enables the difference in power in the interaction with the owner. At its core, smart doorbells empower owners through the invasion of privacy. It, therefore, felt fitting to use privacy as the starting foundation for creating new designs that can challenge the current notion of the product.

However, this raises the question: How do you define privacy?

Privacy is not a set term but can be defined in many ways. Privacy can be personal; what is private to one might be something others openly share. Privacy can also be very well defined; legal rules and laws are set in stone to help companies uphold privacy regulations. Moreover, privacy changes in context; what is shared in one room might not be shared in the next one.

It is not possible to give a set definition of privacy. So instead, three different definitions of privacy were used:

- Legal privacy, as defined by EU law.
- Privacy as a human right, as defined by the human rights convention.
- Privacy as a social norm as defined by Roessler et al. (2013).

These three definitions were chosen because of their relevance to the context (Amsterdam is located within the EU) and their variation in approach: from law to right to norm.

Each definition of privacy is different and opens up different solution spaces. In the following part, we will introduce all three definitions of privacy and the type of design strategies they invite.

Legal privacy

Suppose we want to look at privacy from a legal perspective within Europe. In that case, it is relevant to look at GDPR, the European set of laws related to data privacy and security (Wolford, 2019). Here some of the laws related to video data are:

Article 15 "Right of access by the data subject" (EU, 2016a). One has the legal right to know what data a company/organisation has about you and how that data is handled, stored and shared.

Article 17 "The right to be forgotten" (EU, 2016b). One has the right to have data about themselves removed should they wish so (unless it goes against public interest, juridical matters etc.).

It gives the citizens control of their data. It demands that citizens know that their data is recorded and that individuals can ask for the information and have it deleted should they wish to.

This approach is described by Nissenbaum (2010) (as presented in Daves (2011)) as: "the right to have our expectations about the flow of personal information met" (Daves, 2011, p. 117). The focus is on making the data flow visible, with some ability of citizens to control and manage the data. This makes it possible for companies to process vast amounts of data from individuals, as long as it aligns with our expectations. GDPR means that citizens can understand the flow of data and intersect if the data management does not live up to their expectations.

This way of looking at privacy means that the data gathered should be visible so that the affected individuals can take action if they disagree with the situation.

Strategy: Make it legal

To design for this sort of privacy, one can use the GDPR as a guideline and ask oneself:

What does a smart doorbell look like if it lives up to the GDPR rules?

Privacy as a right

To look at privacy as a human right, one can refer to the human rights declaration (Human rights media, 2020): United Nations Declaration of Human Rights (UDHR) 1948, Article 12: *"No one shall be subjected to arbitrary interference with his privacy, family, home or correspondence, nor to attacks upon his honour and reputation. Everyone has the right to the protection of the law against such interference or attacks."* (Human rights media, 2020, paragraph 5)

In the declaration of human rights, privacy is dealt with as a fundamental right of the individual — a right they deserve to have protected by institutions against governments or companies. People should not request protection against invasion of privacy; it should already be built into the system.

Strategy: Feminism

Inspired by D'Ignazio, C., & Klein, L. (2020), one strategy to deal with this definition of privacy is to look to feminism. Here, the goal is to build in the individual's right to be protected in the product. Using the strategy, one can ask:

What does a smart doorbell look like if it protects the individual's right to privacy?

Privacy as foundation for social relations

Roessler & Mokrosinska (2013) looks at privacy from a more social lens. They argue that privacy is more than protecting the individual's autonomy; it defines our social relations and practices.

Here, privacy is flexible, something that changes depending on context, situation and time. This means that privacy is personal; one person might be comfortable interacting with a smart doorbell at one house but not at another. It also allows society's notion of privacy to change over time and is open to the idea that society nowadays might approve of smart doorbells in our public spaces.

Strategy: Contestability

To design for privacy flexibly to the context and the individual, we can design for contestability. Building contestability in a product allows for differences in action and human intervention in decisions.

What does a smart doorbell look like if it allows the visitor to decide when it films or not?

Generatign ideas

Each of the 3 definitions of privacy and their following strategies was used as a starting point to brainstorm and generate ideas. From this brainstorm 16 concepts emerged, which was then reduced to 11 concepts (see Appendix G for process and more details on the initial 16 concepts).

The 11 spread out over the 3 design strategies for privacy, and were the following:

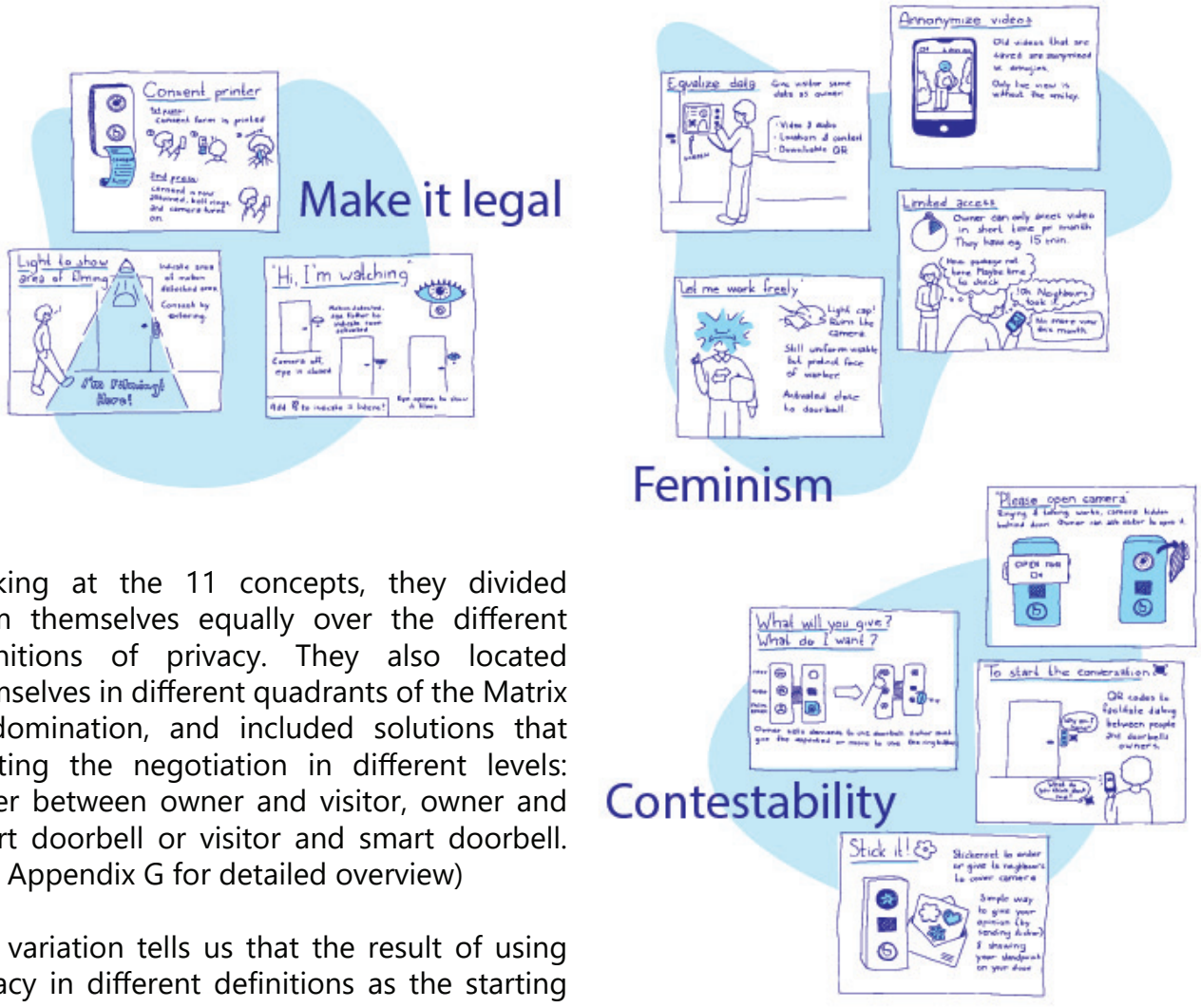


Figure 5. How the 11 concepts spread out over the design strategies.

Looking at the 11 concepts, they divided them themselves equally over the different definitions of privacy. They also located themselves in different quadrants of the Matrix of domination, and included solutions that locating the negotiation in different levels: either between owner and visitor, owner and smart doorbell or visitor and smart doorbell. (See Appendix G for detailed overview)

.

This variation tells us that the result of using privacy in different definitions as the starting point of the brainstrom, helped create a range of varied concepts. It opened up the design space on different levels of negotiation and in different forms.

5.2 User testing

Diving into the human interactions that happens with a smart doorbell.

To know what concepts would be the most fitting for the final exhibition, all 11 doorbells would be empirically evaluated in a user-test.

As the main goal of the exhibition was to inspire reflexivity, the user-test had two main evaluation points.

- Did the concept create reflective and interesting conversations about smart doorbells and surveillance in public space?
- Was the concept understood intuitively or did it not communicate well in an exhibition format?

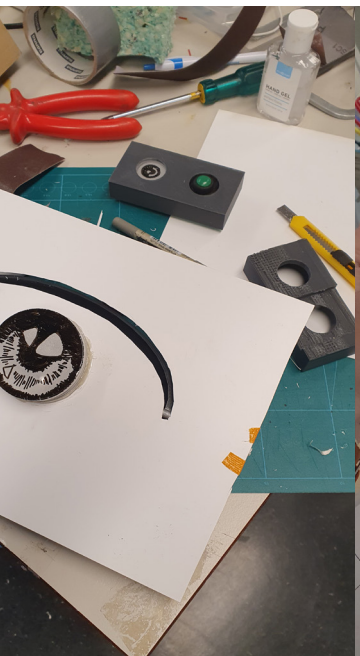
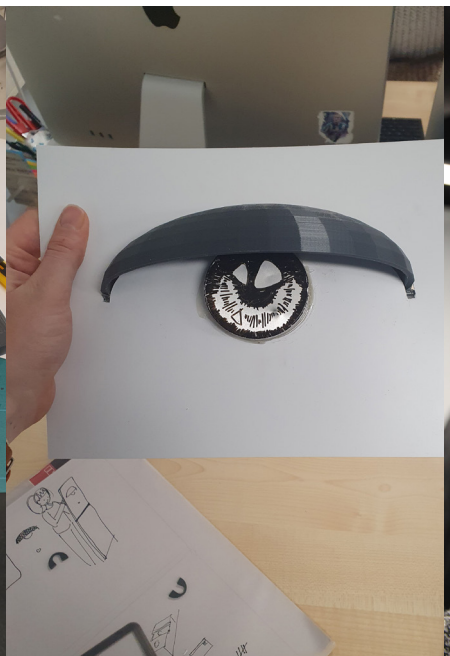
To be able to evaluate the ideas, all 11 concepts would be turned into prototypes to be tested in person. This meant that all prototypes had to be constructed with high enough fidelity to convince the participants of the function, but time did not allow for actual functional prototypes. Therefore the method, Wizard of Oz (Dow et al., 2005), was used to save time, but still built convincing prototypes.

The act of having to build a wide range of prototypes in limited times, meant that during the process many decisions were taken with smaller considerations than usual. It was necessary to make quick decisions on both physical and digital manifestations so shapes, forms and alternative embodiments were not explored in depth. The assumption was, that overall, this would not impact the evaluation, as long as the prototype could convey the overall concept, and that there would be time to explore it when the final concepts had been chosen.

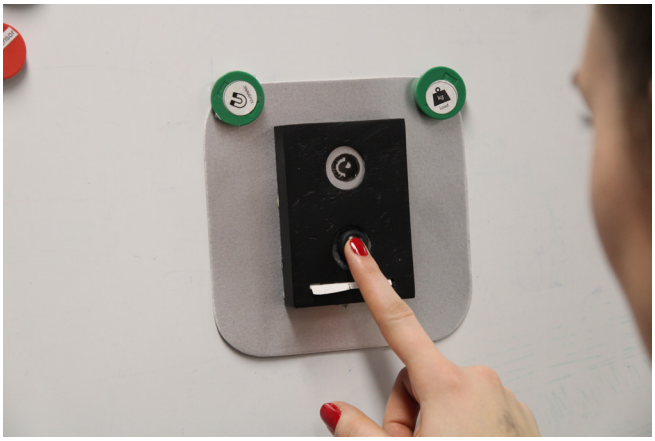
At the usertest, there was a total of 17 participants. Some tested alone, some together 2 or 3 at a time. Each user test lasted 40-60 min and the participants experienced a minimum of 8 randomized doorbells each.

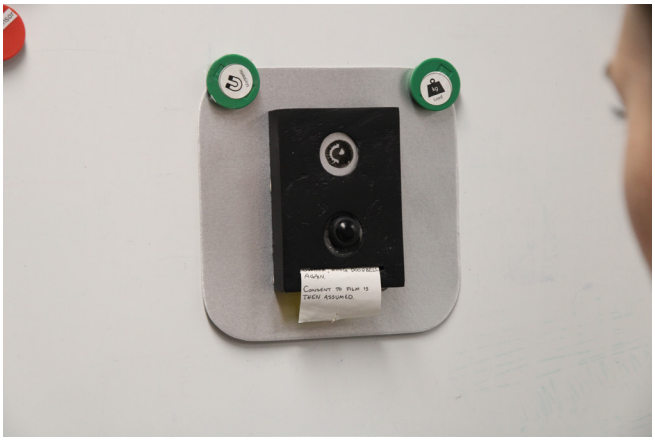
See following appenix for more material on the usertest:

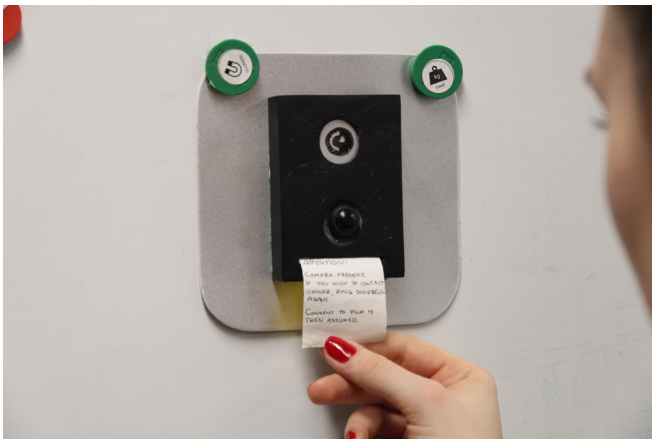
Appendix H - User test plan
Appendix I - Consent form
Appendix J - Sumup of results

No. 1
Consent printer







How does it work?

When a visitor rings the consent printer, the smart doorbell prints a small receipt, informing the visitor that they will be filmed. If they wish to proceed, they can consent to the filming by ringing the doorbell a second time.

The doorbell does not notify the owner of a visitor until the visitor consents to the camera.

The visitor is able to rip off the receipt and bring it with them.

New negotiation:
Between visitor and doorbell.

Location of intervention:
Physical doorbell design.

What was the feedback?

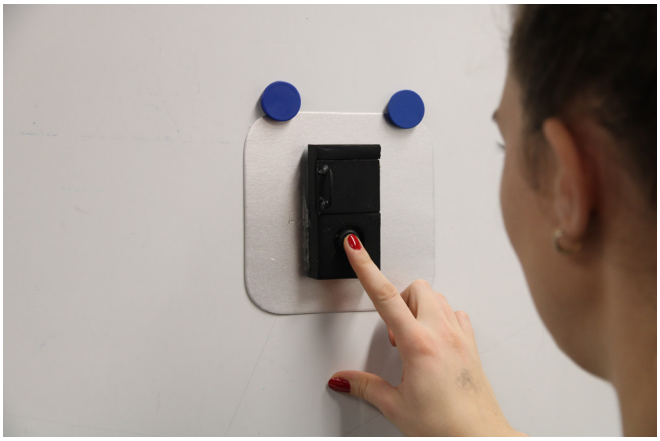
People found it very clear regarding asking for consent before filming but found the solution useless, mainly because they could not contact the owner without consent.

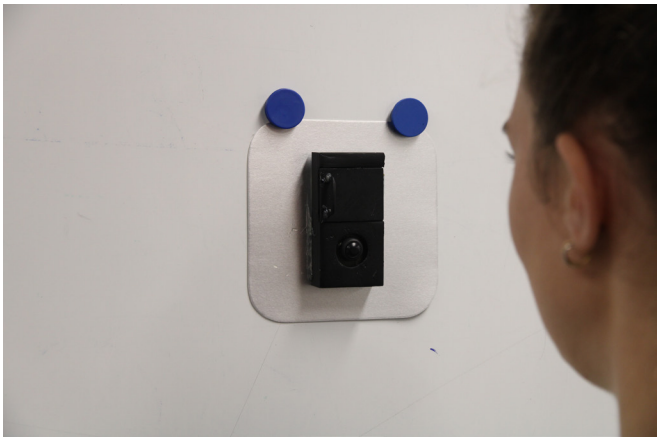
It also forced the visitor to either say yes or walk away.

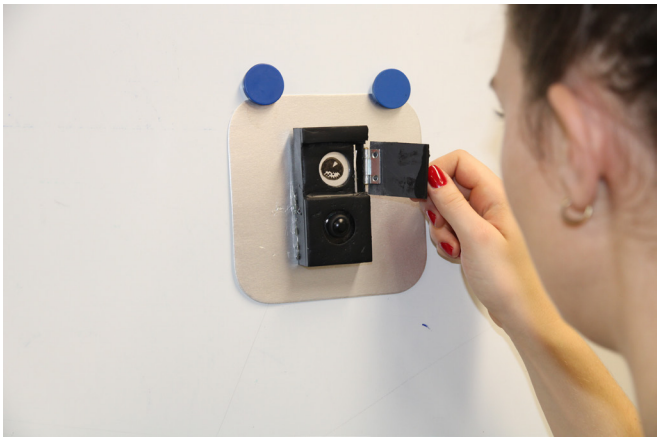
The fact that the doorbell only rung at the second press was also a bit unclear.

Main PrEmo:

No. 2
Please open for the camera







How does it work?

In Please open the camera, the camera is covered by a small door. When the visitor rings the doorbell, the owner can request the visitor to open for the camera.

It is then up to the visitor to allow the owner to see them.

New negotiation:
Between visitor and owner.

Location of intervention:
Physical doorbell design.

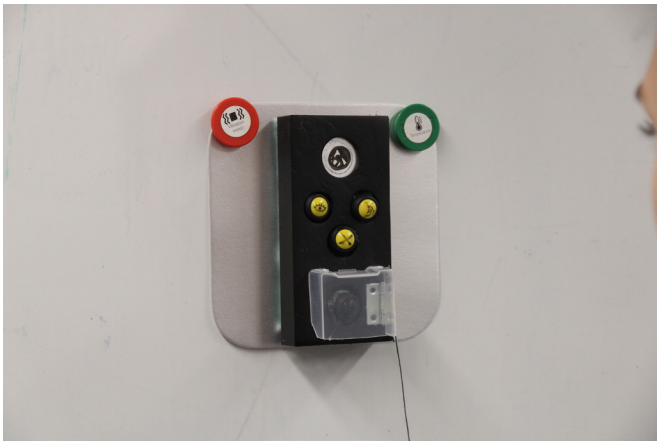
What was the feedback?

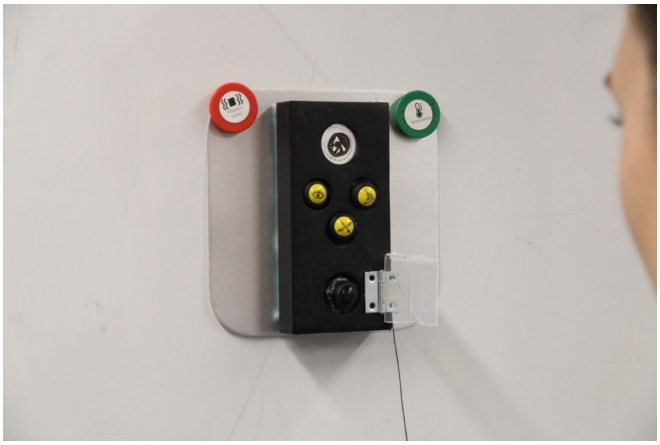
People liked the autonomy the design gave the visitor and the fact that you had to physically allow the camera to film. It was a simple solution and still allowed for conversation between owner and visitor.

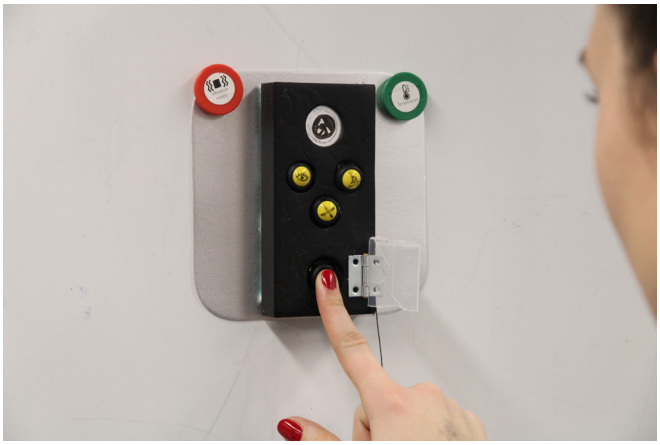
Some found it to obstructing for the owner, feeling that the point of the camera was lost with this design.

Main PrEmo:

No. 3
What will you give







How does it work?

Before being able to ring the smart doorbell in What will you give, the visitor has to choose between either consenting to video, consenting to audio or consenting to none.

Depending on the setting of the doorbell, the owner will only allow the visitor to ring the doorbell if they choose a pre-determined level of consent. In they will not consent, they cannot ring the doorbell.

New negotiation:
Between visitor and doorbell/owner.

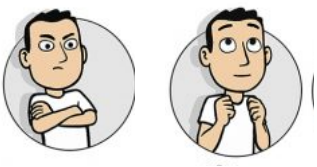
Location of intervention:
Physical doorbell design.

What was the feedback?

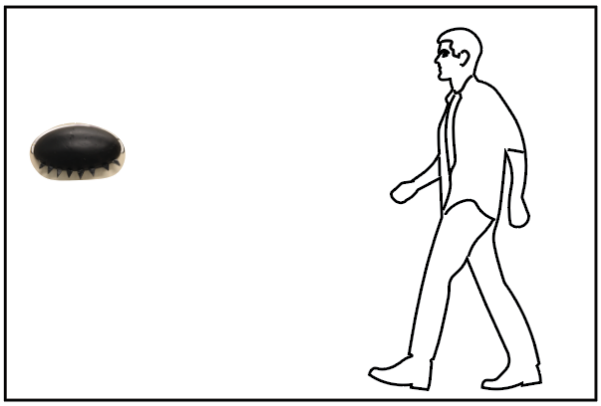
People had a very hard time understanding this concept based on the interaction and physical design. It was too busy and complicated, and gave too little feedback.

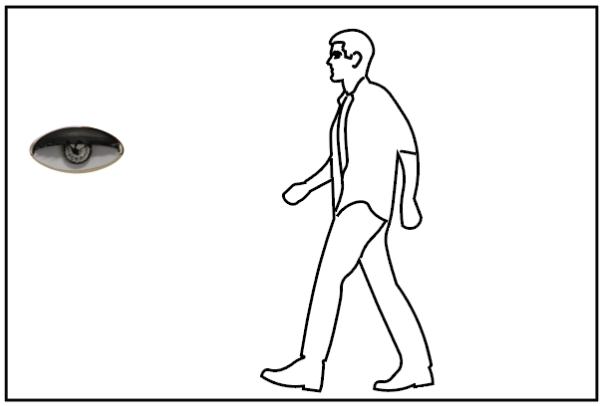
When explained to them, they still thought it was too unclear how it worked.

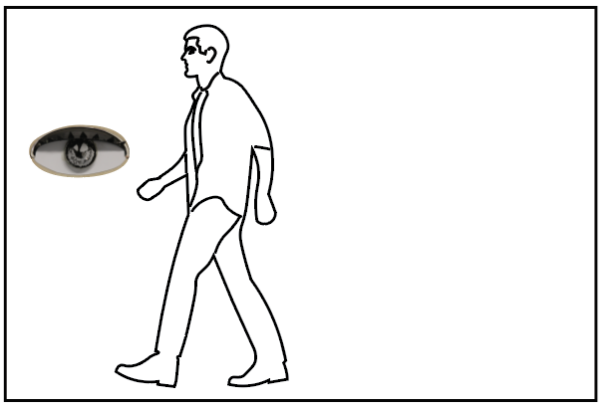
Main PrEmo:

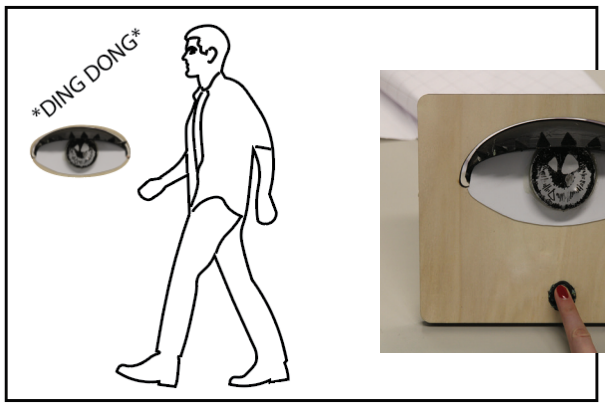


No. 4
Hi, I'm watching









How does it work?

In Hi, I'm watching, the camera is shaped like a giant eye. The eyelid is connected to the motion sensor and will open and close when activated. This allows the visitor to see when the camera is on/open or not/closed.

The visitor rings the doorbell by pressing the button below the eye.

New negotiation:
Between visitor and doorbell/owner.

Location of intervention:
Physical doorbell design.

What was the feedback?

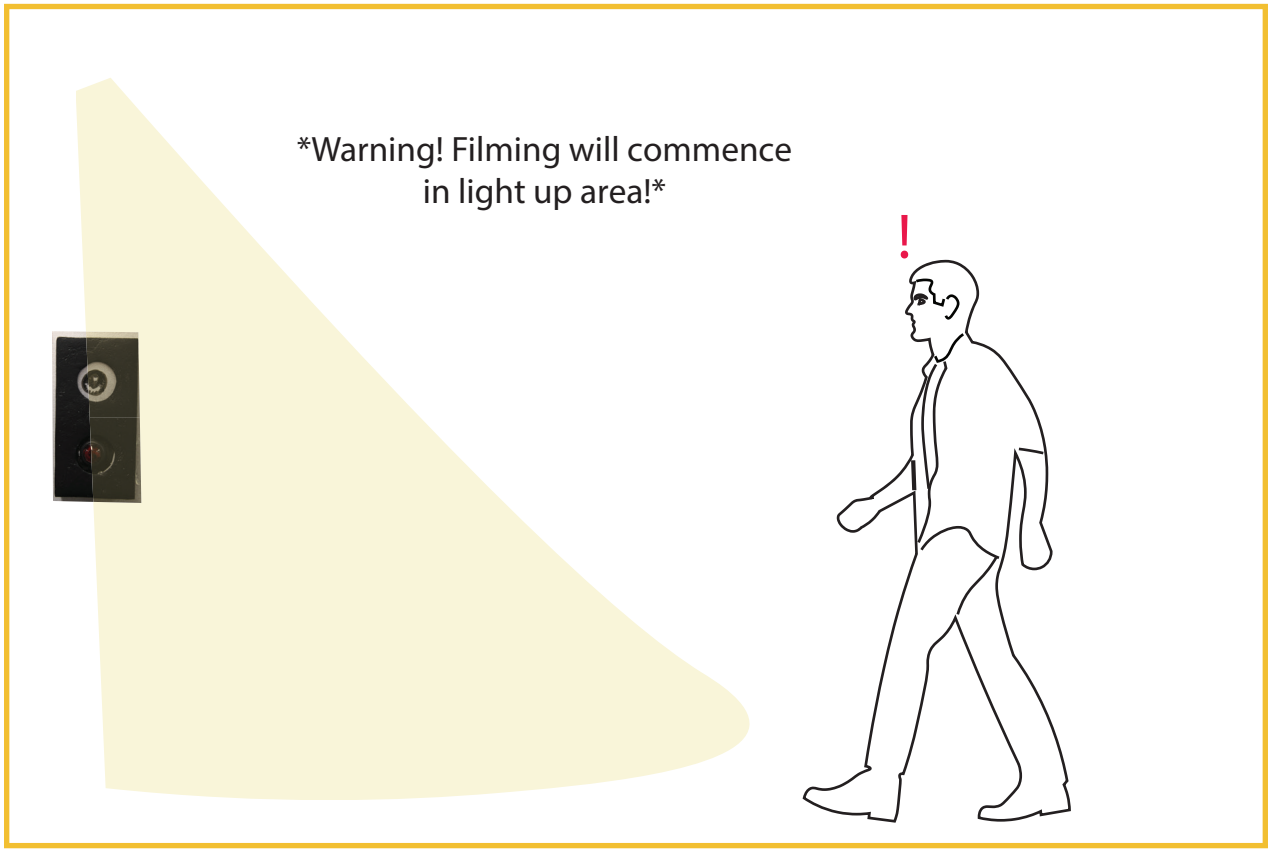
People found the design very clear. One described it as: "it is honest". The look of the doorbell divided people: Some found it cute and friendly, others found it scary and too human.

People doubted if they had to ring the doorbell since the blinking eye seemed to indicate they had already been seen, and they then assumed the owner knew.

People expressed that they felt very watched by the eye.

Main PrEmo:

No. 5
Light up area



How does it work?

The Light-up area works by sending a warning to the visitor before they enter the motion sensor area for the doorbell. This warning takes shape in the form of a light-up circle on the ground, indicating the camera's border, followed by a voice saying: "Warning, filming will commence in light up area". The visitor has to enter the light-up area to ring the doorbell.

New negotiation:
Between visitor and doorbell.

Location of intervention:
The sourroundings of the doorbell.

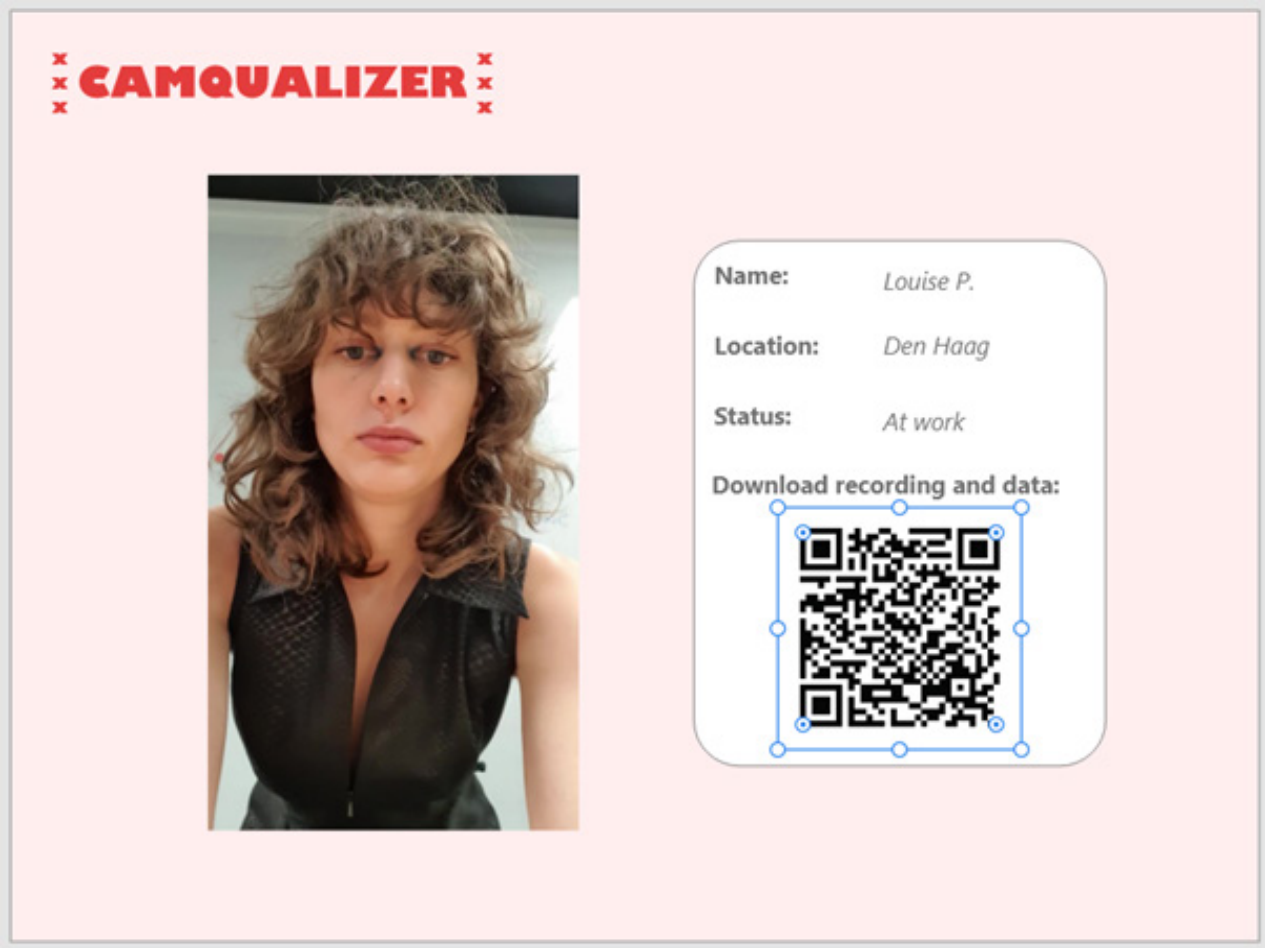
What was the feedback?

People liked the light sensors and the fact that the surroundings changed, clearly indicating and informing them of what would happen. During the test, people actively tried to step around the recording zone to reach the doorbell without being filmed. The interaction became gamified.

Some found the warning too extreme in its form, and some thought it would be annoying for the owner.

Main PrEmo:

No. 6
Equalizer



How does it work?

The Equalizer doorbell includes a video screen next to the doorbell. When the visitor rings the doorbell, they can communicate with the owner as in a video call. The owner cannot watch the visitor without letting the visitor watch them too.

Furthermore, next to the owner's video, the owner's status will be displayed: Their name, current location and the status (at work, home, out etc.). A QR code appears after the call, allowing the visitor to download the whole interaction on their phone.

New negotiation:
Between visitor and owner.

Location of intervention:
Physical design, software.

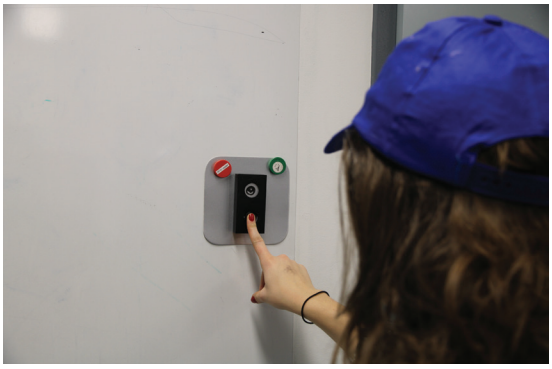
What was the feedback?

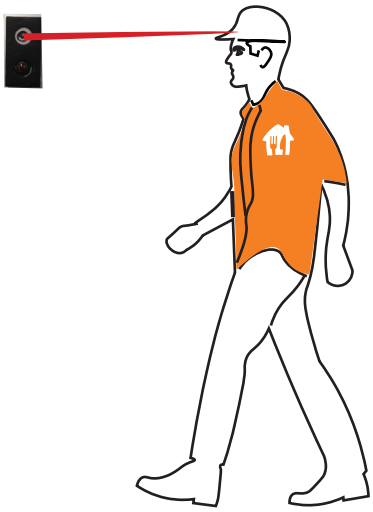
This concept did not work very well. People found it very hard to grasp, and it took much explanation. While people liked the face to face interaction between owner and visitor, they also thought it would be too time-consuming an interaction. They would also feel very uncomfortable as owners sharing this much data with visitors. Some thought it would be nice for a delivery guy to be able to download the interaction as proof of delivery.

Overall, people did not see the need to receive this much information about the owner.

Main PrEmo:

No. 7
Let me work freely





How does it work?

Let me work freely is a product for delivery workers. It is a cap that has an inbuilt sensor and laser. It can detect when a delivery person is being filmed and will turn on the laser. The laser obscures the video when the person is in the camera's view, ensuring the owner can only see the delivery person's clothing/company jacket but not his face.

This ensures that people whose work it is to visit many doors are being protected against excessive recording.

New negotiation:
Between delivery person and doorbell/owner.

Location of intervention:
Assecory to the visitor.

What was the feedback?

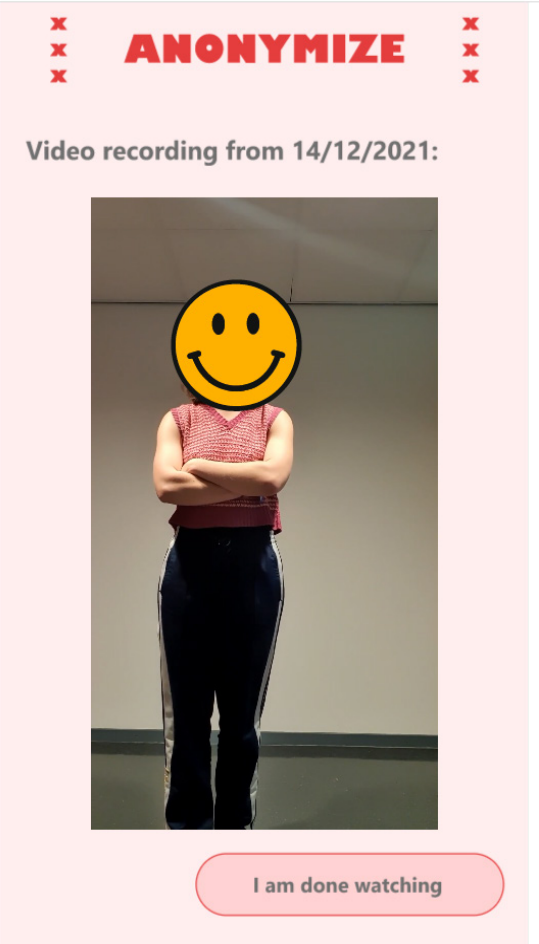
People found it friendly to protect workers' identities and privacy. But many also voiced safety concerns. Someone might be able to steal the hat and misuse it.

Others also said that obscuring the camera view would make them very nervous, and they might not want to open it for the delivery person. They would become suspicious.

Others said that being filmed by such cameras was just part of the job in the delivery sector.

Main PrEmo:

No. 8
Anonymize it



How does it work?

The Anonymize doorbell does not change anything in the physical design of the doorbell but on the software side. When the owner views a visitor through the doorbell, they can only see the visitor's face in real-time. If they look back at old recordings or download a recording, the visitor will have their face anonymised.

New negotiation:
Between owner and doorbell.

Location of intervention:
Software design.

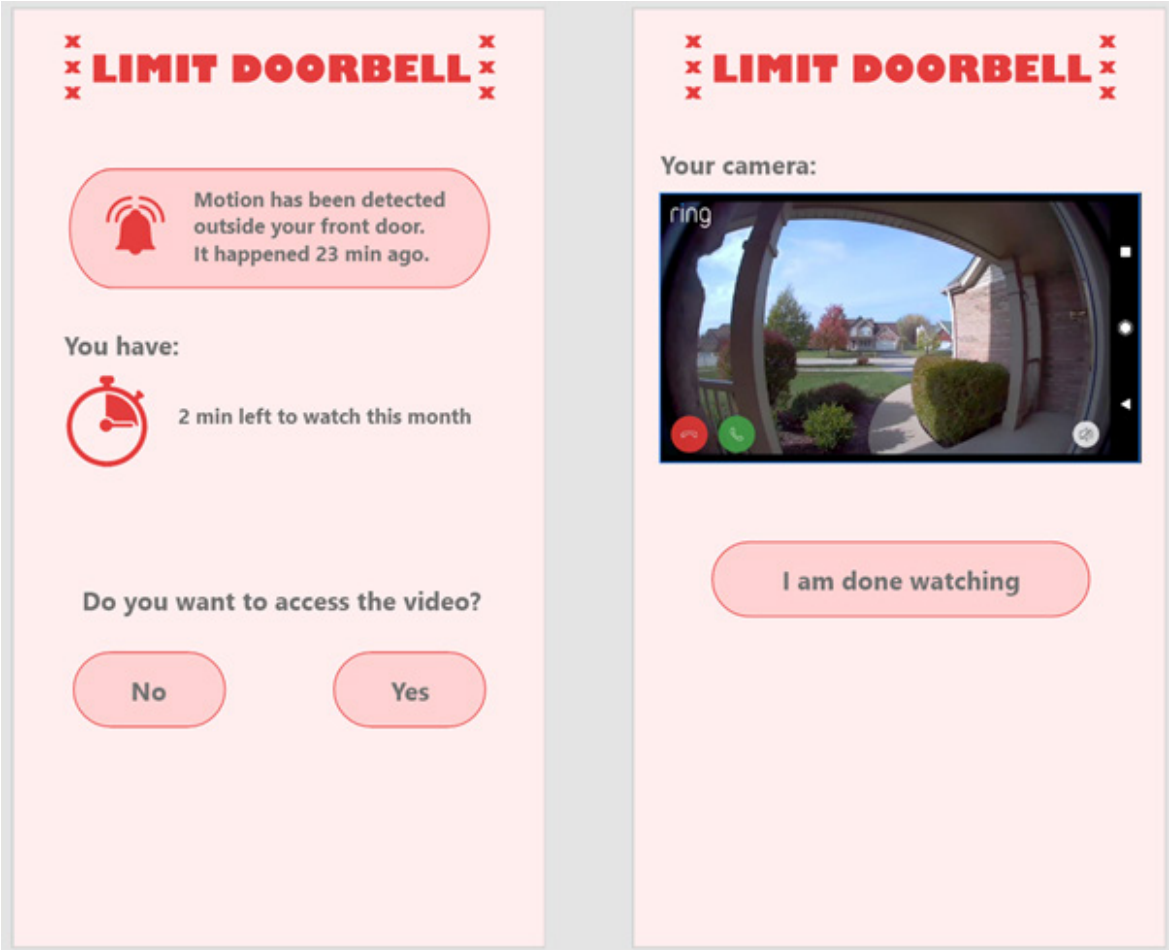
What was the feedback?

People said they would be very frustrated if they saw someone doing something illegal and could no longer see who it was because of the anonymisation. Some suggested that the videos should be able to be decrypted by the police when needed.

Some said that if they or a friend were being recorded, they would be happy they were anonymised. They also found the cartoon look of the face good because it did not look like a police video.

Main PrEmo:

No. 9
Limit doorbell



How does it work?

Limit doorbell is a software solution where the owner can only view X minutes from the camera every month. When they have used all their minutes to watch the recordings or live stream, they cannot get more time until next month.

New negotiation:
Between owner and doorbell.

Location of intervention:
Software design.

What was the feedback?

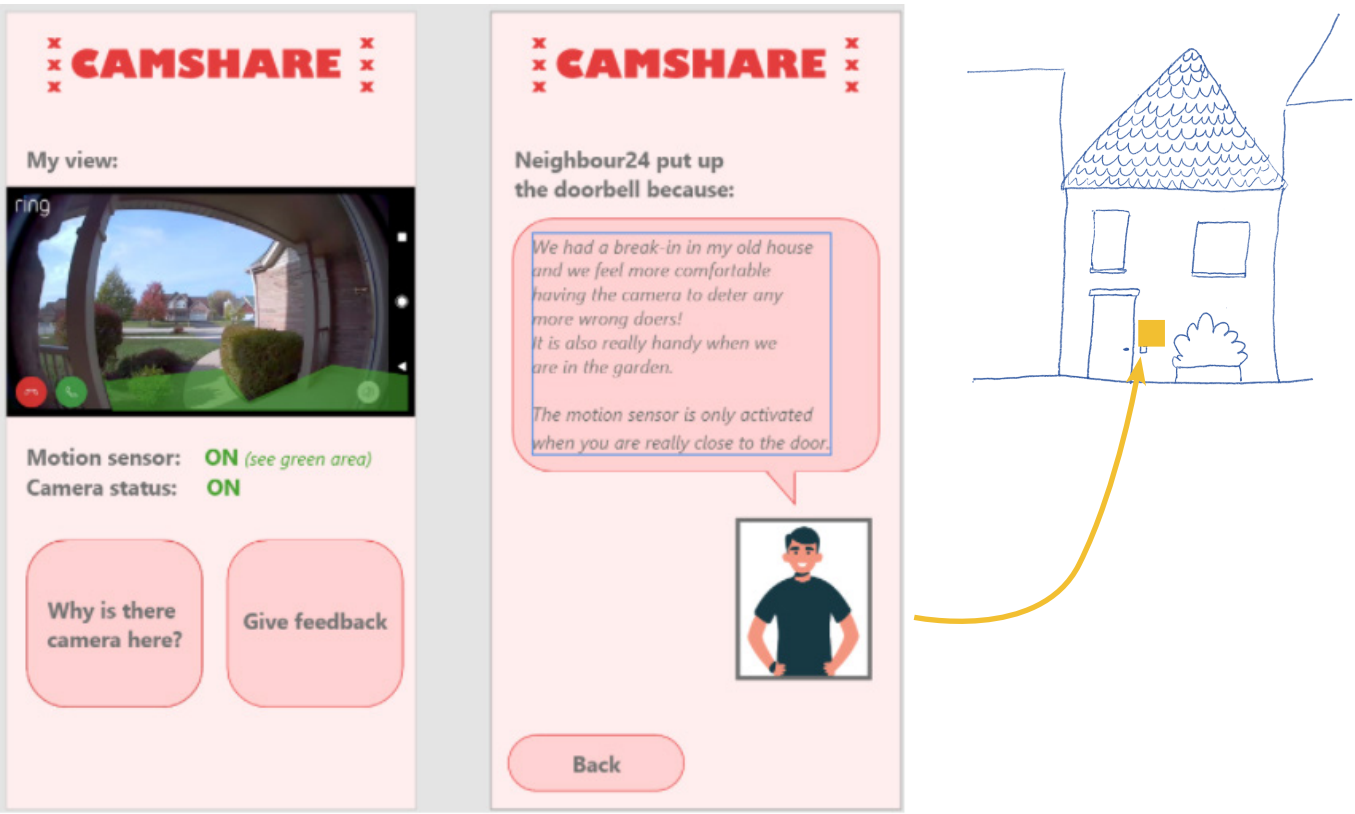
People had a strong emotional response to this doorbell - they got furious at the thought of having their time restricted, and all assumed it was a pay scheme to get them to pay more to the company.

Furthermore, since the visitor would be unaware that the recording was inaccessible, it would not matter to them since they could not tell if they had been filmed or not.

People said this design would make paranoia much worse.

Main PrEmo:

No. 10
Camshare



How does it work?

The central part of Camshare is a QR code located next to the smart doorbell. When someone scans the code, they get access to a website where they can find information about the doorbell.

They can see what is in the camera's view and how far the motion sensor is stretching (if it is on at all). They can also read why the owner has decided to purchase a smart doorbell. Lastly, they can send feedback to the owner or the municipality regarding the camera.

New negotiation:
Between visitor, owner and municipality.

Location of intervention:
Additional online service.

What was the feedback?

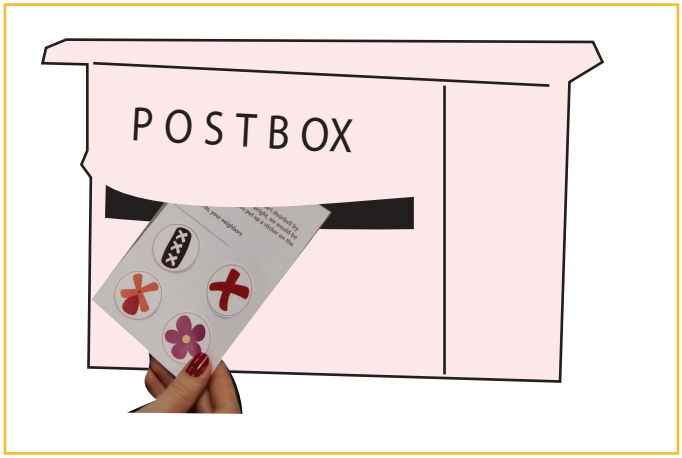
Some people felt tricked because to access the Camshare information, they most likely had to go into the camera's view and be filmed.

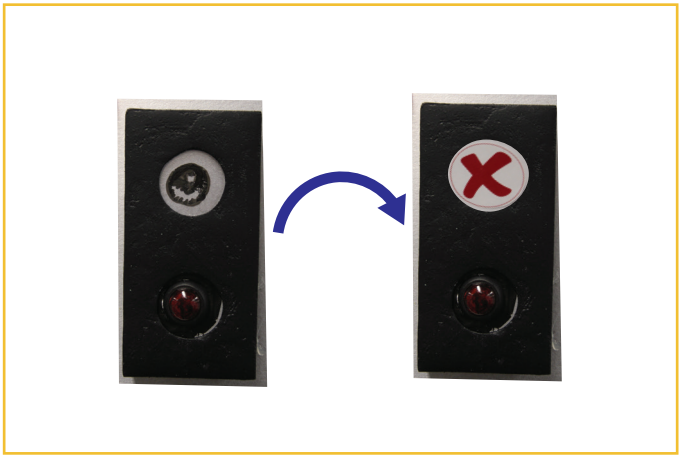
However, people did like the information there - it was clear and relevant, and people liked to know the owner's motivation. It could be a way to control if the owner was filming their house or a way to start a conversation with the owner.

Some said they would not want to contact the municipality and cause problems for their neighbour.

Main PrEmo:

No. 11
Stick it





How does it work?

Stick it is a municipality driven initiative where people can order sticker sets online. The set contains four Amsterdam related stickers on a small letter, informing the owner of a doorbell that their neighbour would like them to put a sticker on their camera.

The sticker is then a clear way for the owner to show they do not use the camera in public settings. It is a way for the neighbour to nicely ask the owner not to point a camera on the street.

New negotiation:
Between visitor and owner.

Location of intervention:
External assecory.

What was the feedback?

People assumed that whoever received the sticker set would not care. They expected the solution to fail. Some also said they would not do this since they assume the owner has the smart doorbell up for a reason.

Others said it might create tension and that the move felt passive-aggressive.

Main PrEmo:

Other analysis findings

Some other findings during the usertest:

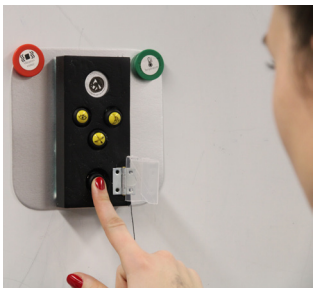
- Digital solutions often need more explanation than physical solutions. The physical concept was easier to experience and more easily communicate the idea.
- As soon as participants start talking about safety, it dominates the following value discussion. Safety is always central and often overrules privacy concerns. It seems as if the safety aspect is a substantial value that people are ready to let overrule other values, such as the individual right to privacy.

What concepts to continue with

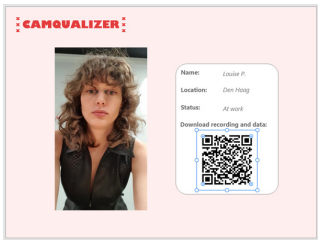
The following is a quick walkthrough of the alternative doorbells: Which did not work, which worked and which do we continue with.

Which did not work?

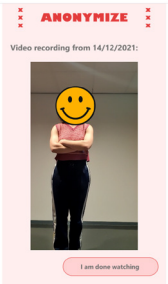
A few of the concepts showed very bad performance in the usertest. Therefore we will not continue with the them. Those were the following:



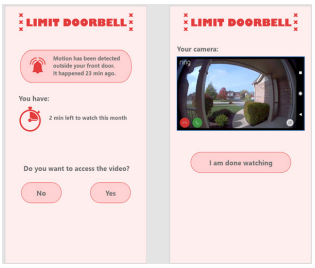
3. What will you give
This doorbell was too complicated in its design, and did not convey its relationship to privacy well.



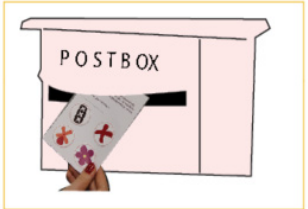
6. Equalizer
People had a hard time grasping the concept, and when they did, it triggered mainly fear and scepticism.



8. Anonymize it
People really liked this concept, but because they thought it was such a good solution, it did not trigger much discussion.



9. Limit doorbell
This doorbell triggered many negative emotions, but the emotional response hindered a nuanced discussion.



11. Stick it
Most people thought it was a bad idea, and did not feel like it encouraged conversation between neighbours.

Concepts that worked

The following concept worked well. They each nice communicated their intentions and also created interesting dialog. The discussion they generated fell into the following three categories:

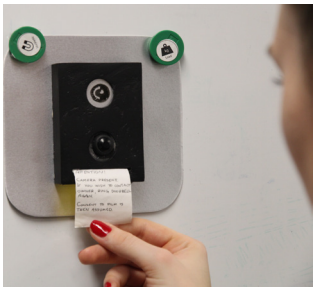
- Visibility
- Contestability
- Power dynamic

The concepts mirrored all three privacy definitions we started with in the brianstorm. To ensure we have a nice variation in the final exhibition, one doorbell in each category will be chosen.

Here we will go through the concepts that work in each category.

Visibility - making it clear that the doorbell is filming

The following concepts nicely triggered discussion on making the recording visible:



1. Consent printer

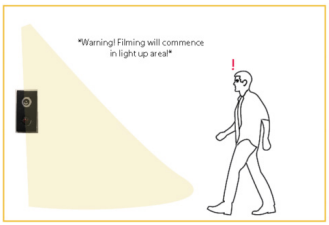
While many people liked the tactile element of the printer, some part of the concept was still unclear - such as if it would ring on the first or second press.

Some people found it useless and focused on that rather than the questions the concept was trying to raise.

4. Hi, I'm watching

Prompting many strong emotions, concept four made people very aware that they were being watched/filmed. It highlighted the camera.

The form and shape did, however, seem disturbing to some.



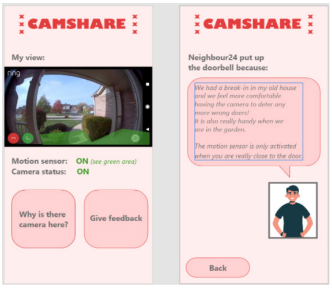
5. Light up area

The light-up area also communicated the concept well, and people found it playful. One challenge would be to recreate the light-up element in daylight.

Concepts four and five triggered the best discussions compared to the Consent printer. Both would be good options to continue with, but the challenge of using light to indicate the area might become tricky to prototype. Therefore, the decision was to go with concept four, Hi I'm watching.

Contestability - opening up for contesting
The following two concepts got good feedback, and the participant found that they would allow them to challenge the recording through a dialog with the owner.

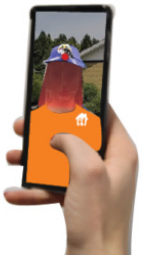
2. Please open the camera
Easily conved how it is possible to allow the visitor to actively consent (or not) to the filming in a simple physical solution.



10. Camshare
People found it a great way to start conversation with their neighbours, being the starting point of discussion.

While both projects translated their purpose well and opened up for interesting dialogue between the participants, physical concepts worked better than purely digital ones. Therefore concept no. 2, Please open the camera was choosen as one of the doorbells for the exhibition.

Power dynamics - doorbells that focuses on vulnarable groups
Only one concept made people consider more vulnarable groups such as delivery people.



7. Let me work freely
As one of the few concepts, no. 7 Let me work freely, made people consider delivery people.
While many did not like the concept in its current form, it did make them think about how others might be affected.

This concept best made participants consider people who are more prone to being filmed. While people did not always emphasise with the group, it did make them think outside the owner/visitor paradigm. While this concept might need another iteration, it is the best concept to highlight the power difference.

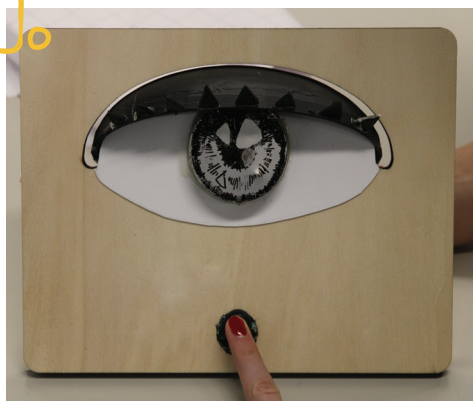
The final concepts

In this chapter, we approached generating smart doorbell designs with a starting point in three different definitions of privacy - privacy as a legal right, privacy as a human right and privacy as a social foundation. Each definition opened up different design solution spaces and generated 16 different design ideas.

11 of the 16 design ideas were chosen to be tested in a user test and evaluated for which would best fit the format of a speculative design exhibition. The focus was on which best communicated the intended design and generated the best conversations and reflections. Based on the user test, three specific concepts were chosen.

The three final concepts were some of the most simple manifestations, but all successfully communicated their intentions and generated interesting discussions. The three concepts were:

1.

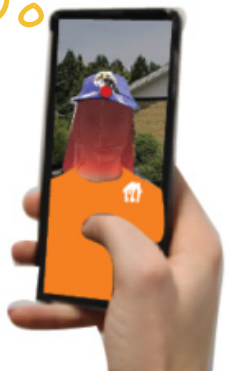


Hi, I'm watching (shorten to HIW)

2.

Please open the camera (shorten to POtC)

3.



Let me work freely (shorten to LMWF)

Ch. 6

MAKING THE EXHIBITION

The process toward the exhibition

In this chapter, we will go through the process of making the exhibition. We will touch upon the final design and setup, the creation and adjustment of the individual elements, and how to make the exhibition impact measurable.

6.1 The road to the exhibition

Guiding the visitor through our worldmaking.

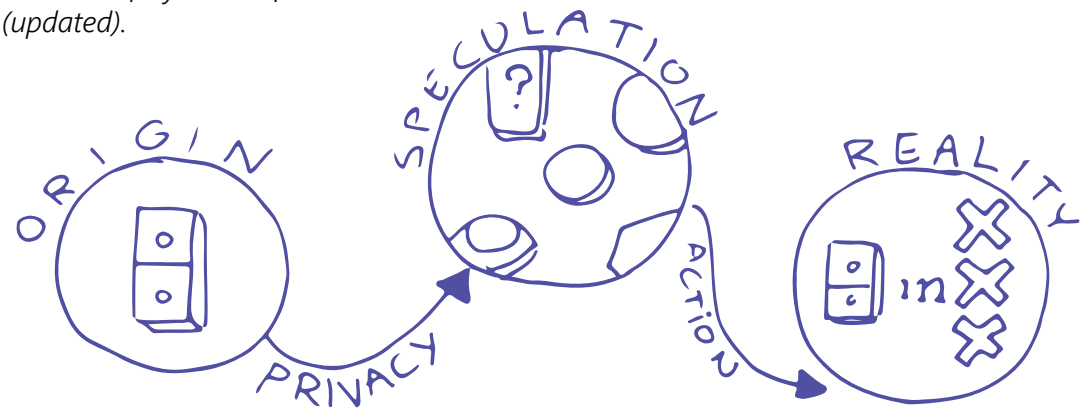
As mentioned before, this project aims to challenge the design of smart doorbells through a speculative design exhibition. The lifecycle of the imagination we want to create is described in illustration 16 (from Mitrovic et al. (2021, p. 27), updated from chapter 3 with the expanded notion of privacy.

We want the visitor to go through this imaginative journey with us at the exhibition. They need to experience all three steps to get to a point where they can imagine that reality can indeed look different.

But there are other elements we need to include to guide the visitor through this journey. In the paper from (Vervoort et al., 2015), the art of worldmaking is described as a framework and a tool to help give people the ability to imagine alternative futures. Worldmaking allows the participant to see that the future is constantly in the process of becoming and can be altered from what the present might indicate it will look like.

The planned exhibition on smart doorbells is a form of worldmaking. The future of the smart doorbell is imagined in worlds where different definitions of privacy are valued. To create engaging worldmaking, Vervoort et al. (2015) highlight the following elements as necessary:

Illustration 16. Lifecycle of imaginaries (updated).



Our origin is the increasing use of smart products in society. We extract the smart doorbell (A), and generate alternative doorbells as our speculation (B) based on privacy. We then allow the visitor to voice their opinion to influence how smart doorbells in Amsterdam is regulated (C).

Multiple, coexisting worlds.

Showcasing that there is no single, stable, objective reality but multiple coexisting worlds. (Vervoort et al. 2015). People understand the current reality differently, meaning we all perceive our view of the world as the real one, but in reality, we all live in different worlds. This is also true for the future. The future has yet to happen, and therefore multiple coexisting possible futures exist alongside each other.

To make people aware of this is to allow the visitor to start imagining the options of more possible futures, none of them more realistic or plausible than the other.

For the exhibition, this is ensured by offering not one but several possibilities (in our case, three possible smart doorbells) and presenting them as equally likeable and plausible. One is not given more weight than the other.

Furthermore, the exhibition also needs to allow the participants' own world to be present. If they feel their worldview cannot fit into the narrative, they might reject the suggested future worlds. Therefore, the exhibition should open the problem and context for interpretation, allowing each visitor to paint their values onto each doorbell. This also means my preference as the designer cannot be openly present or guide the visitor.

Letting the participant enter into the dialogue raised by the worldmaking.

As described by Vervoort et al. (2015), the imagination can become a bridge between the present and the future, showing the way to a world in which we would prefer to live. The imagination becomes the viewer's participation in the exhibition.

The exhibition should allow the viewer to voice their opinions and enter into a dialogue about what future they prefer, so they can have a chance to push the future a bit in their prefered direction.

This element is critical to incorporate into the exhibition to allow the participants to emerge and engage with the possible future of smart doorbells.

Learning from the exhibition

As part of the goal of challenging smart doorbells, it is not enough to help the visitor imagine that the future could be different. One must also ensure that the visitor's views and values are conveyed to people who might be able to implement that change. So part of the exhibition is to translate the individual's experience into general findings to help policymakers make better decisions. This way of using speculative design to gather knowledge on citizens' values as a way to guide urban decision making has been done before, e.g. the project Alternative Imaginaries (2021).

In this exhibition, these learnings will be gathered through a questionnaire, and the answers will be given to AMS and the municipality of Amsterdam.

Constructing our world

We can now begin to construct our world with our exhibition.

The architecture

Looking back at our lifecycle of imagination (from Mitrovic et al. (2021, p. 27)), we see that the visitor will go through three steps - origin, speculation and reality. Our speculation consists of three alternative smart doorbells. With the origin (context of smart doorbells) and reality (how people would like it to be), it leaves us with five elements as part of the exhibition.

Illustration 17, elements our exhibition.

As a starting point, a few constraints on the elements were set. The elements should be big enoug to allow the visitor to physically transition between them. This requires a certain size and height of the elements and the option of spacing. The elements should allow the visitor to experience the doorbells physically. The exhibition should also fit the location of the AMS institute in Amsterdam, which gave some limitations to size. It should also accommodate more than one person at a time if possible. This led to a few design ideas on how the elements could be set up in contrast to each other.

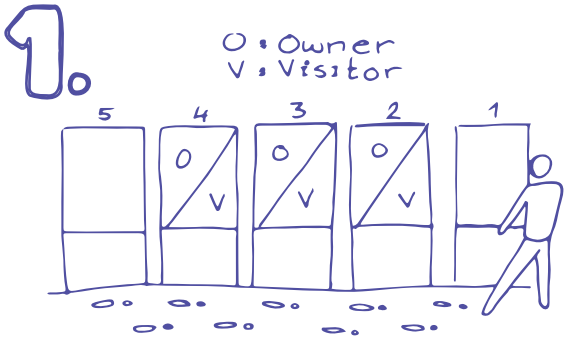


Illustration 18, possible exhibition setup no. 1

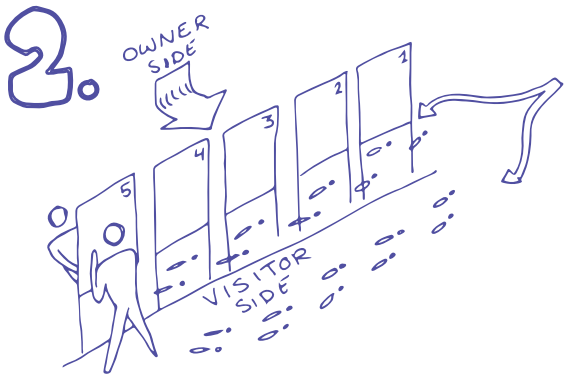
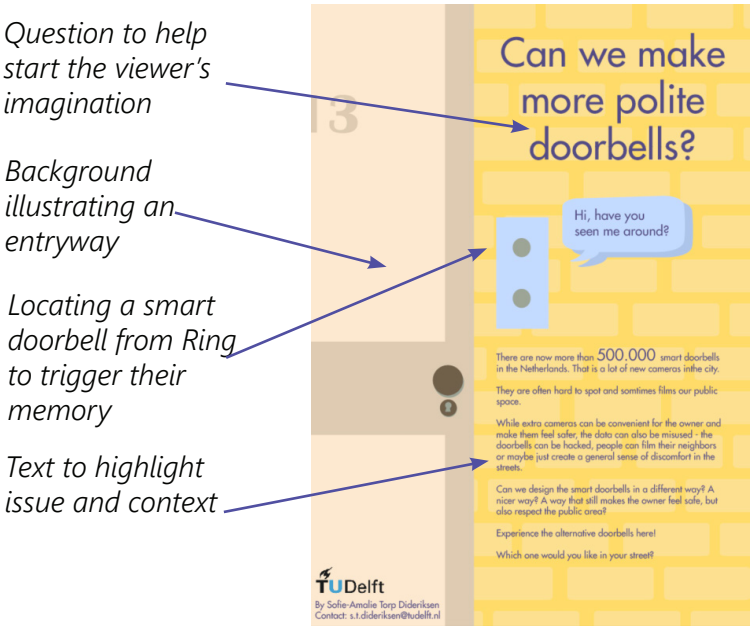


Illustration 19, possible exhibition setup no. 2

Setup no. 1 was chosen, because no. 2, with two sides of the exhibition might be too tricky to coordinate and would demand at least 2 people visiting at a time.

The elements

Now that the order of the elements was decided, the five individual elements could be created. As a broad base, each element would consist of a box, a poster and interactive elements. It was decided to have the main questions and first text in English since the questionnaire and facilitation would be done by me (a non-Dutch speaker), but with a second text done in Dutch. All poster backgrounds can be found in Appendix K.



The origin - introduction to the context of smart doorbells

The goal of the first element, the origin, is to introduce the visitor to the context of the smart doorbells as it is currently. It gives enough information about its challenge without asserting an already decided opinion.

The speculation - three alternative doorbells

Unlike the user test, the goal for the three alternative doorbells was to make actual functioning doorbells. This would give the visitor the whole experience without the facilitator having to play Wizard of Oz in the background. This meant creating three functioning prototypes.

Another element was to help the viewer understand how the different designs impacted the experience of a visitor and the owner. What did the owner see when the doorbell was activated? What does a visitor experience? The posters were divided into two halves to allow the viewer to experience both viewpoints.

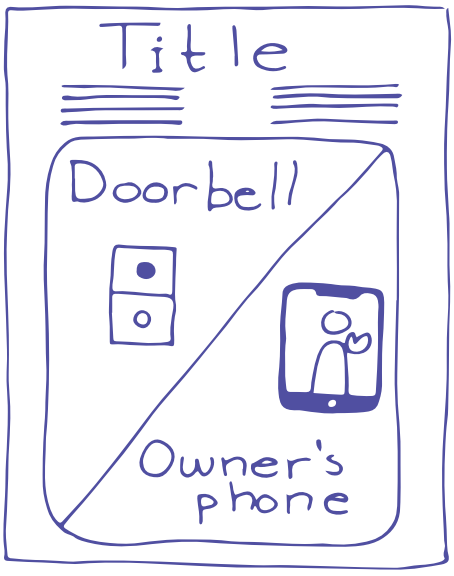


Illustration 20. Basis for the speculation element.

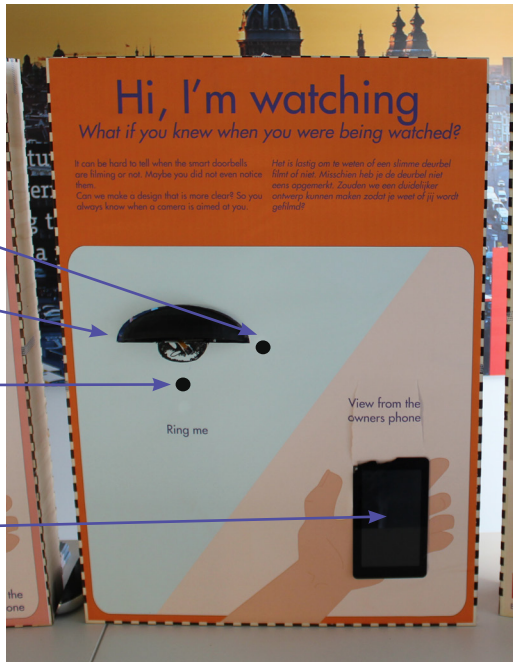
Hi, I'm watching (HIW)

The following construction was planned to build a functional HIW doorbell. The main change from the initial design of HIW from the user test to the exhibition was the removal of the eyelashes to make for a less creepy doorbell, as many people in the user test had expressed that they found it scary.

User test prototype

Exhibition prototype

The final prototype was constructed by adding a servo motor to the axis of the eye. The motor is activated by a PIR sensor. When passed by a person, the eye will rotate open and close.

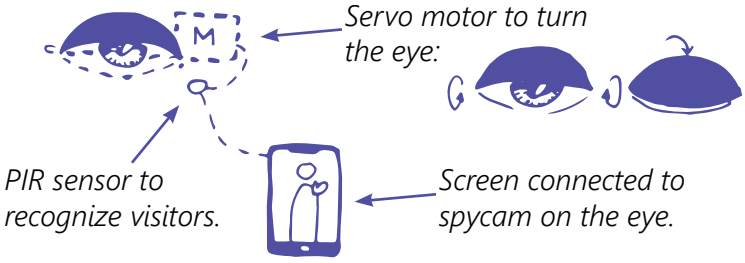


Location of PIR sensor.

Doorbell in shape of an eye.

Location of button to ring

The view from owners phone.



Servo motor to turn the eye:

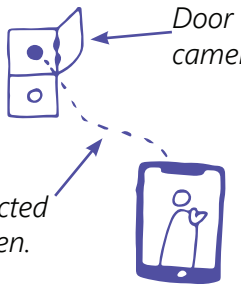
PIR sensor to recognize visitors.

Screen connected to spycam on the eye.

Illustration 21, Overview of how HIW works.

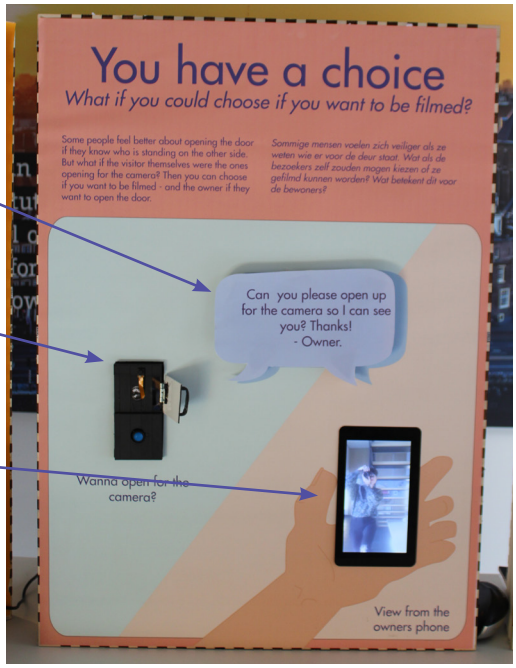
Please open the camera (POtC)

The construction of POtC was a bit more straightforward. This included fewer electronic elements:



Door to cover the camera with hinge.

Spycam connected directly to screen.



Speech bubble of owner asking to open the camera.

Doorbell, with door handle.

The view from owners phone.

Illustration 22, Overview of how POtC works.

Let me work freely (LMWF)

LMWF went through a more radical change from the initial design. Some of the comments from the user test had focused on how scary it might look if someone seemed to actively try and obstruct the video (see chapter 5.2). Therefore, a new design was created by taking inspiration from the doorbell concept no. 8: Anonymise.

Instead of a hat with a laser beam, the idea was that the camera, using machine learning, could identify when a visitor was from a delivery company based on their outfit. If a delivery person showed up on the video, the video would have a filter attached to it to anonymise the video.

Initially, the program SnapCamera (SnapCamera, 2019) was used. The goal was to apply filters used on social media to create anonymised, friendly-looking faces without making the visitor look like a criminal.

While the solution was not as smooth or interactive as a Snapchat filter, it offered the same functionality of anonymising the video enough that the video would be hard to manipulate. It did not cover so much that the owner would be scared to open the door since they could still glimpse the face of the delivery person.

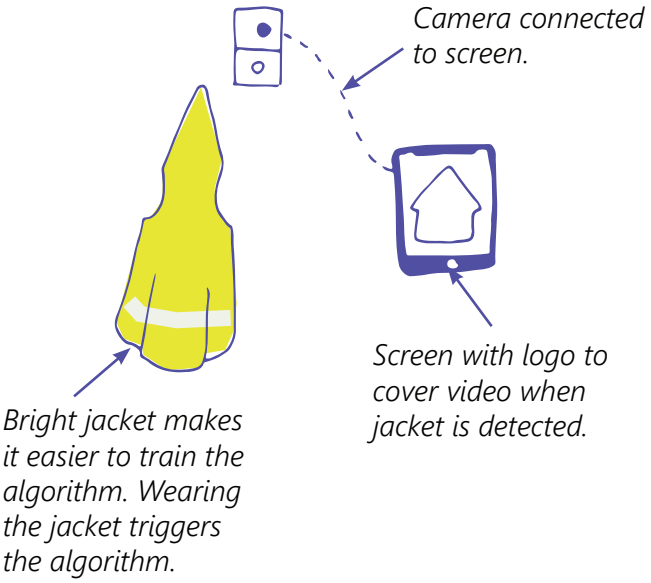
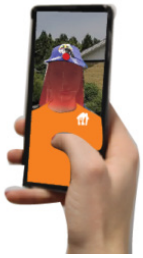
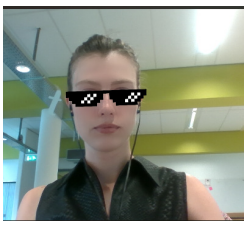


Illustration 23, Overview of how LMWF works.



Original concept

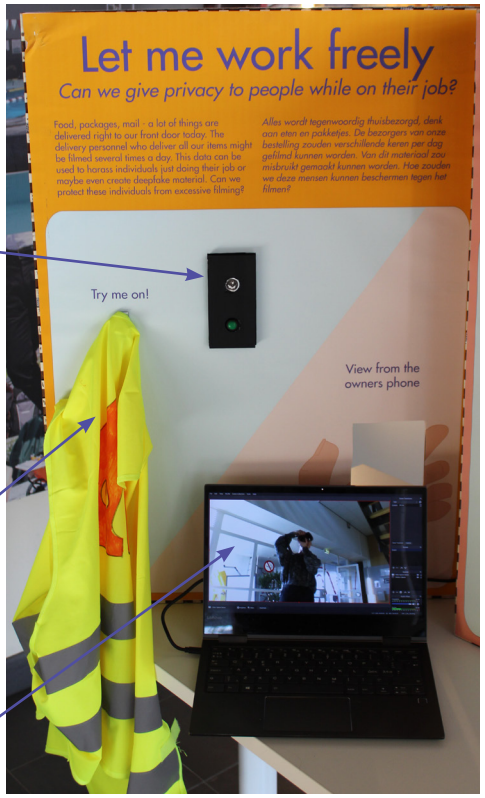


Two different snapfilters

SnapFilter offered an array of filters, many of them with a nice amount of realism. Unfortunately, I could not connect the snap filters to other machine learning programs. So instead, a simpler solution was chosen. Using the program Google Teachable Machines (Google Teachable Machines, 2018) in collaboration with P5.js (P5.Js, 2020), an algorithm was trained that could recognise a yellow "delivery" outfit and apply an image on top of the video.

Logo partly covers the delivery person

This resulted in the final set-up at the exhibition:



Smart doorbell with button

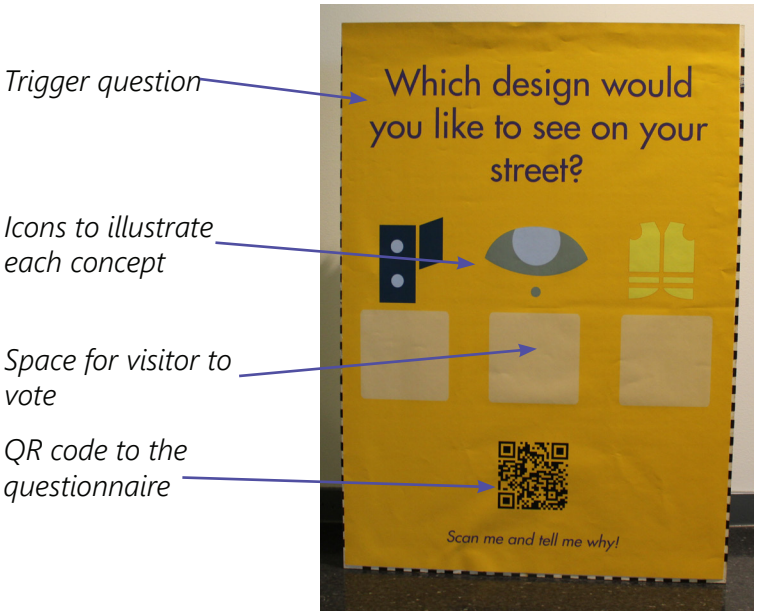
Delivery jacket for the visitor to put on

The screen showing the owners phone. (Unfortunatly only worked on computer)

The voice of the visitor

The final element of the exhibition posed a question to the visitor: "Which doorbell would you prefer to see on your street?" This formulation was chosen because it opened up the view of both the owner and the neighbour and asked the visitor to imagine a familiar setting meaningful to them - to move to a concrete level instead of the more abstract idea of somewhere in a city.

Then the visitors could mark which doorbell they preferred.



Gathering data

A QR code leads to a questionnaire for the visitor to answer at the final element. The questionnaire is about how visitors experienced the exhibition and their reflections on smart doorbells in their city.

The complete questionnaire can be found in the appendix L, but overall consisted of 3 parts:

Part 1 - comparing the three doorbells
The first question asks the visitor to compare the doorbells and explain their preference to:

- Their favourite doorbell
- Their least favourite doorbell
- The most owner-friendly
- The most visitor-friendly

Part 2 - the individual doorbell
The second part asks the viewer to review the visitor- and owner-friendliness of each doorbell.

Part 3 - ethnographic
The last part gathers demographic insights about the visitors.

The goal is to see if the exhibition can cause reflexivity in the viewer and if that knowledge can be translated into valuable insights for governmental bodies.

Reflections on building the exhibition

During the construction of the exhibition, I had several hard learnings and reflections.

It is always more tricky than you imagine

As someone with limited experience in prototyping physical, functional items, I underestimated the time it would take to make fully functional prototypes. And while I had three prototypes that all worked (at one point in time), I did not have the chance to make as many iterations and adjustments as I wanted. This meant that the doorbells only went through one iterations after the user test, and the look and shape of the doorbells were not as refined. But, alas, I did not have the time.

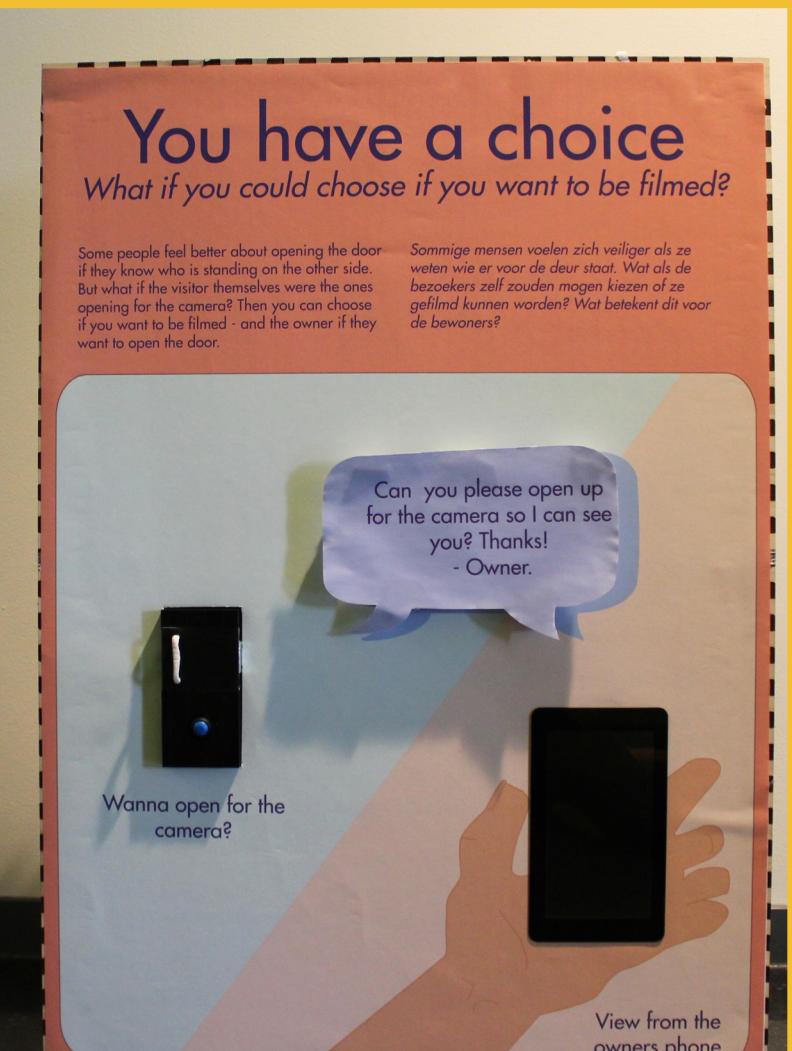
Get building quickly and show it to people!

While things might sound easy or simple on paper, several elements pop up when building starts - things and connections you have yet to consider, elements that physically do not go together, etc. Getting buildings quickly helps realise those missing pieces.

The same happens when you show your process to people. During the build, I occasionally showed it to fellow students, and it always gave a lot of good learning and feedback.

Image from when I prototyped during the course Interactive Technology Design and got feedback from the students

The final exhibtion materials!




Let me work freely
Can we give privacy to people while on their job?
Food, packages, mail - a lot of things are delivered right to our front door today. The delivery personnel who deliver all our items might be filmed several times a day. This data can be used to harass individuals just doing their job or maybe even create deepfake material. Can we protect these individuals from excessive filming?
Alles wordt tegenwoordig thuisbezorgd, denk aan eten en pakketjes. De bezorgers van onze bestelling zouden verschillende keren per dag gefilmd kunnen worden. Van dit materiaal zou misbruikt gemaakt kunnen worden. Hoe zouden we deze mensen kunnen beschermen tegen het filmen?
Try me on!
View from the owners phone


Let me work freely
Can we give privacy to people while on their job?
Food, packages, mail - a lot of things are delivered right to our front door today. The delivery personnel who deliver all our items might be filmed several times a day. This data can be used to harass individuals just doing their job or maybe even create deepfake material. Can we protect these individuals from excessive filming?
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Try me on!


Hi, I'm watching
What if you knew when you were being watched?
It can be hard to tell when the smart doorbells are filming or not. Maybe you did not even notice them.
Can we make a design that is more clear? So you always know when a camera is aimed at you.
Het is lastig om te weten of een slimme deurbel filmt of niet. Misschien heb je de deurbel niet eens opgemerkt. Zouden we een duidelijker ontwerp kunnen maken zodat je weet of jij wordt gefilmd?
Ring me
View from the owners phone


Which design would you like to see on your street?
Scan me and tell me why!

Ch. 7

THE EXHIBITION

What we can learn from the exhibition.

This chapter will go through how the exhibition went and what data was gathered during the exhibition. We then analyse the data to see what it can tell us about participants' values and preferences when it comes to the future of smart doorbells in the city of Amsterdam.

7.1 Learnings from the exhibition

The exhibition was held on the 10th and 14th of April, 2022, at the location of AMS in Amsterdam.

It was a great experience to show the work and talk to people at AMS and other passersby to hear many different opinions on smart doorbells. There was a visit from Amsterdam municipality, facilitated by Sam Smith, where I got to get an insight into the many views from the municipality. Around 40 people visited the exhibition over the two days.

It was not entirely smooth sailing to set up the exhibition. The doorbell HIW did not survive the transportation, but, luckily, still communicated well how it worked through its shape and form. The wind also decided to make for a few extra surprises.

This chapter will look at findings gathered during the exhibition, both from talking to visitors and from the distributed questionnaire (full questionnaire can be found in Appendix L).

Images from the exhibition

Broken exhibition pieces

Concept POtC

Concept LMWF

Concept HIW

Analysing the results of the questionnaire

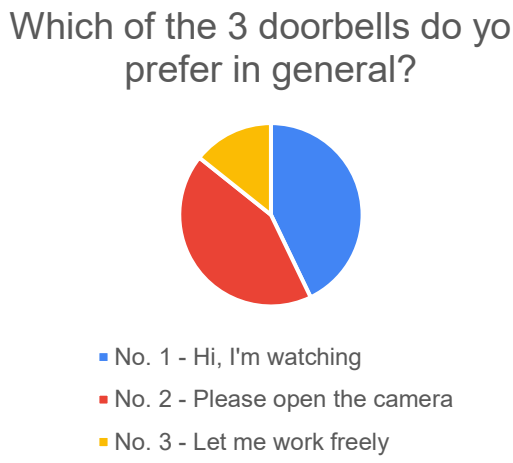
There were fifteen participants who answered the questionnaire at the exhibition.

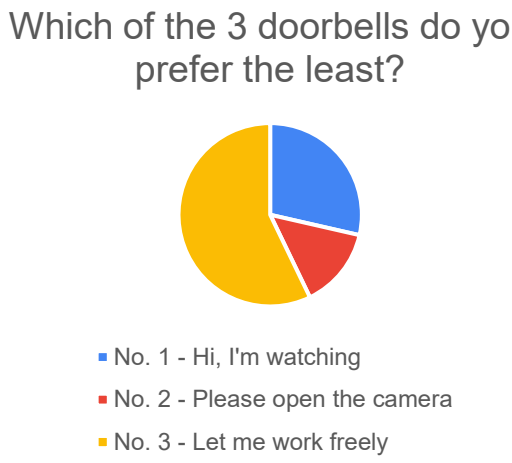
Two tools were used to analyse the findings from the exhibition. Quantitative data was analysed using statistical procedures and visualised as pie charts and box plots. Qualitative responses were derived from the questionnaire and discussions with participants during the exhibition. The results from both tools were triangulated with each other and resulted in the following findings.

Note that each participant was given a pseudonym, going from P1 to P15. When quotes from the qualitative responses are applied in the analysis, the pseudonym is indicated.

Comparing the three alternative doorbells - which people prefered

The first two questions asked which doorbell people preferred the most and the least.





Two main priorities - control vs clear

The first thing that appears is the overall preference for doorbell HIW and POtC, while doorbell LMWF is the least preferred. Looking into the qualitative answers, we see people argue their preferences focusing on either:

- Clear communication from the owner (doorbell HIW)
- The visitor being in control (doorbell POtC)

Both reasonings trace back to the two different views on privacy that inspired the two design. HIW was based on legal privacy: Informing people, they are being filmed. And POtC on privacy as a social foundation: The right to choose to be filmed. These two reasons also relate to people's least favourite choices. Some people choose doorbell LMWF as their least favourite because it does not communicate how it works and might film constantly. Others choose LMWF because it does not let them be in control.

Little empathy for delivery people

Examining the qualitative responses, in general, people seemed to make their choice based on how they would feel as an owner or a visitor, using first-person language:

- *"I have the choice to open it or not"* P10 (refers to doorbell POtC)
- *"I feel like I can use this doorbell, without constantly unwillingly filming visitors."* P15 (refers to doorbell POtC)
- *"It reminds public that your watching"* P4 (refers to doorbell HIW)
- *"Because I think I would use it in an ethical way haha"* P8 (refers to doorbell HIW)

However, when people talk about delivery people, which is the main focus of doorbell LMWF, they refer to the group in the third person:

- *"Because I'm of the opinion that it is a professional risk being filmed as a delivery person or similar."* P5
- *"...Those who have even less power, workers who do not have a or have a lesser choice to leave or not interact because they have to do their jobs, should be protected."* P15

It seems people do not have the same level of empathy (Kouprie & Visser, 2009) for the role of delivery people. They are referred to in the third person, and only three people refer to them. Moreover, of those three, only one tries to take the standpoint of a delivery person:

"Not sure delivery people experience this problem" P9.

Note that the use of the word empathy here is defined by Kouprie & Visser (2009) as the ability to understand and take the role of the other person's feelings (Kouprie & Visser, 2009, p. 442). It refers to imagining what it is like to be watched by a smart doorbell as a delivery person on the job, rather than just having an opinion from an outsider's perspective.

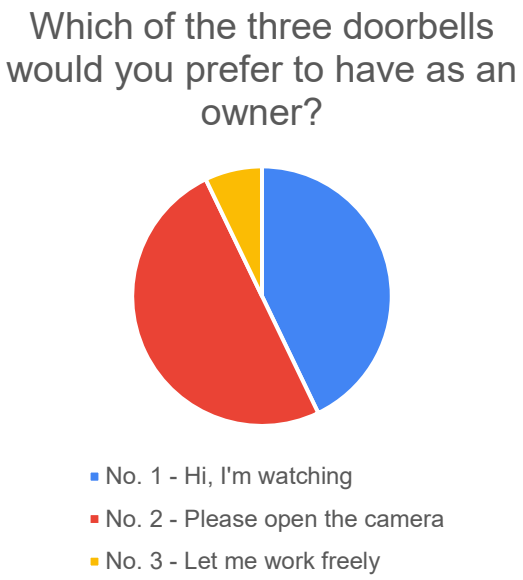
This is interesting considering the LMWF was designed for people to experience what it was like to be a delivery person by actively putting on the role by putting on the vest.

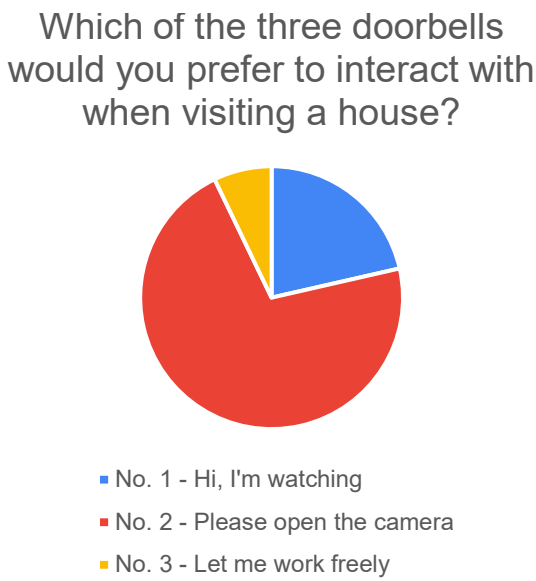
It is not possible to explain why there is this difference in levels of empathy. Some reasons could be:

- The participants, who many came from an academic background (see chart on p. 99), might have never imagined themselves in a job such as delivery, making it hard for them to empathsise with the role.
- People find it difficult in genreal to empathise with roles more foreign to them, in this case delivery people. It might be easier to view things from a more personal point of view. ("I want control"/"I want to watch")
- The questionnaire does not explicitly ask people to consider themselves as delivery people, and therefore people might have perceived it as not part of the scope. This would require redoing the questionnaire to see if a different line of questioning could evoke more empathy.

Comparing the three alternative doorbells - which people prefered to own vs visit

The following questions asked participants which doorbell they preferred to own versus visit.





Viewpoint and preferences

There is an apparent difference between which doorbell people would like to own and the one they would like to visit. While people had an almost equal preference to own doorbell HIW and doorbell POtC, there was a much bigger preference to visit doorbell POtC. As one participant said:

"Because then I would have the choice [to open the camera], but I would be make up scary scenarios if I were the owner." P8.

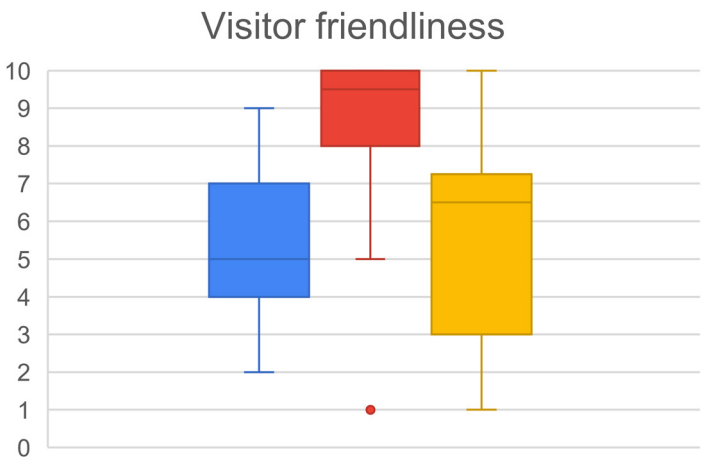
In the questionnaire, three people actively changed preferences regarding owning or visiting a doorbell. If people visit a house, they want to choose if they are getting filmed, but if they own the doorbell, they do not want to give the same privilege to others.

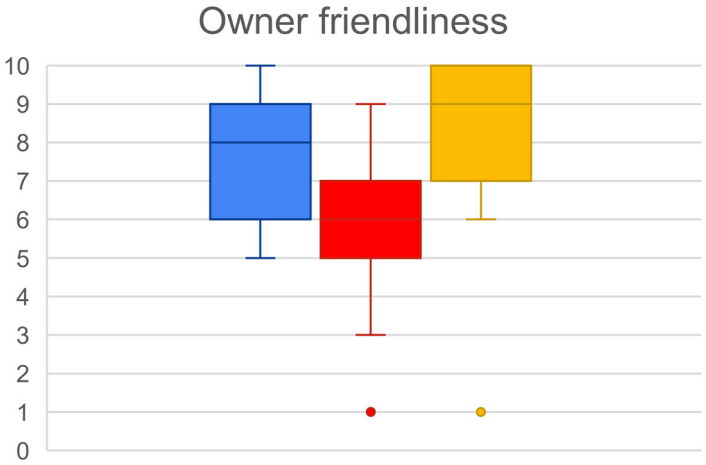
This shows that context and viewpoint are essential when looking at privacy - people's values can change depending on the situation and their position in the storyline.

Looking at levels of friendliness for owner and visitor

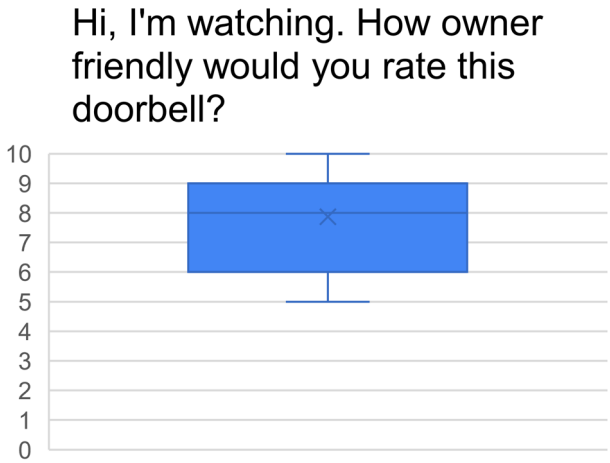
The second part of the questionnaire focused on the individual evaluation of each doorbell regarding owner friendliness and visitor friendliness.

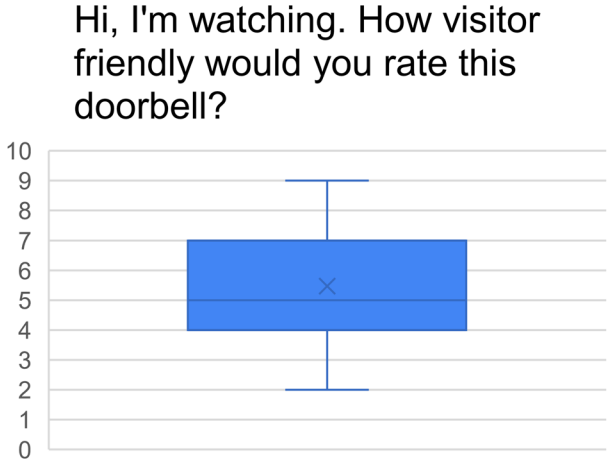
First of all, it is interesting to see that the range of responses is quite vast in all categories. Even when ignoring the outliers, the answers fall within at least a span of 5 points or more. It can indicate that people evaluate owner and visitor friendliness differently, potentially based on their values. We will go through the evaluation of owner and visitor friendliness for each doorbell.





Hi, I'm watching (HIW)



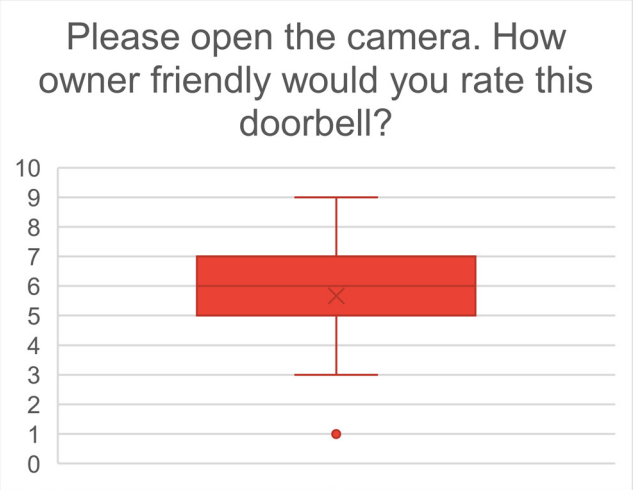


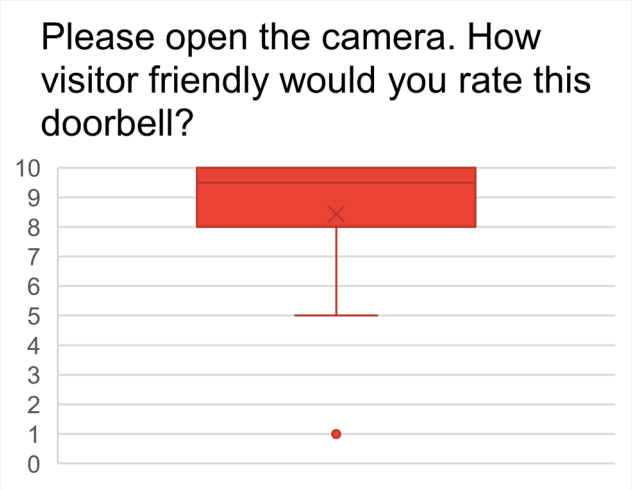
The medians show a three-point difference between owner friendliness (median of 8) and visitor friendliness (median of 5). Overall, the evaluation of owner friendliness of the doorbell falls only in the top 5 points, while the visitor friendliness spreads out between 2 to 9 points (with no indicated outliers).

Looking at the questionnaire responses, the high score for owner friendliness focuses on the fact that the doorbell does precisely as it does now, so the usage is the same for the owner. It is convenient. Some participants also point to clear communication as a bonus for the owner.

On the other hand, there is a much more divided opinion on visitor friendliness. The participants giving it a low score argue that it still films without consent and does not give the visitor a choice. As we move up the score, people emphasise the visibility and clarity that the design gives. As a visitor, you are aware that you are being filmed. This, again, ties back to the two main focuses on what people find important for a visitor - visibility or control.

Please open the camera (POtC)





Looking at doorbell POtC, it is the only one where the median is higher for visitor friendliness than owner friendliness.

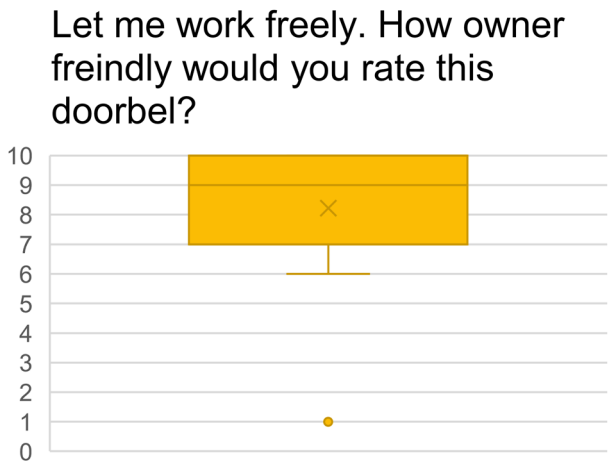
Looking at owner friendliness, we see a significant span between the answers - from 3 to 9 (from 1 to 9 if we count the outlier). Some of the concerns raised are (ordered from mentioned by lowest scores to higher score):

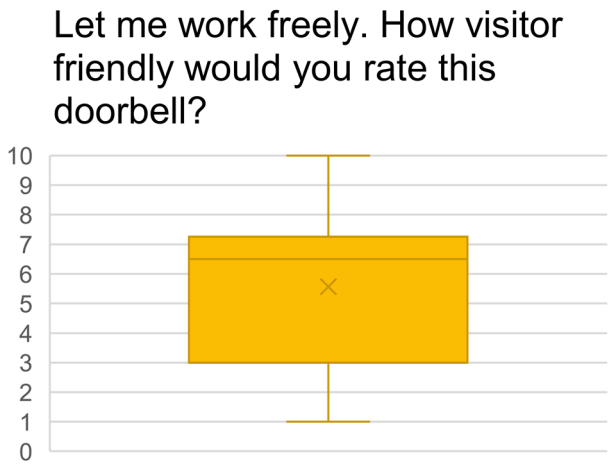
- It can be abused.
- It can be scary for the owner if the visitor does not open it.
- The owner is reliant on the visitor to open the camera.

It is not as convenient for the owner as they have to communicate with the visitor to see them. People are concerned that the loss of control for the owner can enhance paranoia, or the camera can be abused.

75 % of the participants rated visitor friendliness as eight or higher. People focused on the control the design gave to the visitor by having them choose whether they would like to be filmed or not. The one outlier who rated it 1 focused on not knowing what to do as a visitor based on the design.

Let me work freely (LMWF)





Other than a single outlier, the owner friendliness is the highest for doorbell LMWF out of all the doorbells. People focus on the fact that the owner can use the doorbell as they see fit without any challenges. The one outlier who rated it low on owner friendliness focuses on the chances of someone misusing the doorbell with sinister intention.

But it is interesting how high the owner friendliness is evaluated compared to the user test. As found in the user test in chapter 5.2, this concept initially got much negative feedback because it would be uncomfortable for the owner to not be able to see the face of the delivery person. The design changes implemented seem to have impacted people's perception of how the owner might appreciate the doorbell. It seems the use of a still logo on top of the video is not as uncomfortable as obscuring the delivery person's face.

Looking at visitor friendliness, the range falls in the full spectrum with no outliers. The main notion for the negative points here is, as with doorbell HIW, the lack of control from the person visiting

.

There is less explanation for the people giving it a high score (three out of the seven who gave it a rating of seven or higher have not indicated anything). Those who explained their preference focused either on the fact that the interaction is no different for the visitor than the initial experience or that it is helpful to people working with delivery.

People's perceptions

Certain narratives and opinions about society, and people emerged during the exhibition and questionnaire.

Outsiders will misuse the devices any chance they get

One recurring narrative was that any attempt to enhance privacy in the design could become a backdoor for people to abuse. Some of the comments in the questionnaire were:

- *"It is easy to trick if you have nefarious intentions"* P14 (regarding doorbell LMWF)
- *"There might be safety concerns if the owner cannot see who is at the front door"* P5 (regarding doorbell POtC)
- *"Seems very abusable and high maintenance"* P14 (regarding doorbell POtC)

This was also a recurring theme when talking to the visitors in person. People pointed out how you could steal a delivery jacket and then be partially hidden by the doorbell LMWF. Or, if you had ill intentions, the owner would not be able to see you with doorbell POtC.

The interesting thing is that even with the regular smart doorbell, people can still do something similar. Someone could wear a facemask and a cap and hide their face or steal a delivery jacket. All the bad scenarios imagined with the alternative doorbells were not necessarily prevented with the original doorbell.

One might say that people are paranoid. However, in comparison, no one talked about how the owner might have had ill intentions with the video. There seems to be a bigger fear of "outsiders" having ill intentions than owners.

Overall, this narrative fits what the companies promote: individuals need to protect their property from outsiders using surveillance (see chapter 3.2).

I don't want a smart doorbell!

In different places on the questionnaire, many people indicated that they did not want to have a smart doorbell. In response to the question about which doorbell they preferred to own, some people wrote:

- *"I actually wouldn't. The privacy concern for me comes from the usage of the data and who gets control of it and how long. It's a policy issue. The gathering of this kind of data in and of itself isn't a concern for me."* P14 (this participant did not even choose any doorbell in this question)
- *"If I have to make a choice it would be this one. But actually I don't prefer a doorbell with a camera at all."* P7
- *"None?"* P3
- *"I don't really need to see the person standing before my door. They can also just call me :)"* P2

So it is important to note that many participants did not want the smart doorbell at all. Many also pointed out that they did not like the cameras in general:

- *"The damage is already done by then, so you're only more aware"'* P6 (in response to doorbell HIW)
- *"Because you are always being watched/ filmed without knowing"* P10 (In response to doorbell HIW)
- *"...It's better than a 'normal' doorbell camera but still I do not really see the need for filming and storing." P13* (In response to doorbell LMWF)

So this questionnaire also showed that some people are not fans of private surveillance in society.

Oh, I don't think delivery people care

There is a common repetition that delivery people do not care about being filmed. It is a part of their job, and they do not deserve special treatment.

During a talk with a visitor, one even mentioned that maybe especially delivery people should be filmed to make sure they deliver and treat the packages fairly. They refeered to people working in delivery as people who should be watched or treated differently than others. They openly would disregard their right to privacy in a conversation.

This does seem to indicate a notion in society where people working in certain sectors, in this case, delivery people, are viewed as less deserving of protection. While it is hard to say general tendencies with such a low sample size, there seems to be open discrimination when talking about who deserves privacy and who does not.

I don't see a problem

One visitor voiced that he saw no problem with smart doorbells' current use and design. He did not say he owned one himself, but he could not see what the fuss was about. He even said that he would choose the original doorbell design as his favourite.

His view was the minority in the overall experience at the exhibition. However, it does show that some people are allright with the use of surveillance in private households. The reason this view was only encountered once might be related to the demographic of the visitors, many of whom worked with digitisation of cities and might already be biased against smart doorbells. Therefore, it is hard to tell if this view would be much more dominant in a broader exploration.

Inconsistencies and drawbacks of the analysis

Several things can have affected the result of the analysis. The location close to AMS allowed people from the institute to approach and view the exhibition and give their input easily. Considering it was a topic relevant to them, it gave a lot of interesting insights from many academically relevant fields. But the location was very secluded and did not attract as many other citizen groups. That meant that there were not as many people visiting, and those who did visit many were connected and from similar demographics - mainly students, people working at the muncipality or with high educational backgrounds. This gave a less diverse visitor group to gather data from and could have impacted the result.

Another disadvantage of locating myself at a workplace meant that people often only had 5 minutes to give before running off to another meeting. This gave less time to discuss and talk and meant fewer people had the time to fill out the questionnaire.

Also, only 15 people out of 40 answered the questionnaire. More people would have made for more solid research to confirm the findings

Finally, as mentioned earlier, the HIW did not function as intended but broke down in transit. This might have affected how well the design translated to people and their understanding of it. Overall, it did not seem to have had that much impact since most qualitative comments seem to have understood the concept and been able to relate to it.

Reflections

After the exhibition, there were several reflections made. They could roughly be divided into two categories: 1. Reflection on the usefulness of the exhibition format, and 2. Practical reflections on what to do better next time.

Reflection on if the exhibition reached its goals

In the questionnaire, we asked if the experience had changed people's opinions of smart doorbells, and 6 out of 15 answered that their opinions had changed. Some mentioned that they now felt a bigger need for legislation and could understand the concerns:

- *"I now think it is important to consider the collective risks of having a growing amount of unregulated privately owned cameras, from which the data is owned by commercial companies, in the public space."*
- *"Now I think it is a violation of privacy and people need to be in charge of them being filmed or not"*

Some people even reported to have changed their opinion to now imagine better alternatives in the future:

- *"Knowing that there are less privacy-invading designs possible makes me more against the current use of these doorbells."*
- *"There can be change!"*

This indicates that the exhibition format worked to create awareness and challenge people's perceptions. Considering that AMS is a place that focuses on responsible sensing, where people are possibly already aware of the issues with smart doorbells, the exhibition still managed to move many to change their perception.

Reflections on what to do differently next time

During the building as well as the two day exhibition, I had several learnings and things I would do differently next time:

Note-taking.
I took loose, unstructured notes during the exhibition after talking to visitors, which I now regret. I should have noted more things down like tone of voice, facial expressions etc. It might have given a more nuanced look back on my conversations.

Also, my notes were not as comprehensive as I wished because people tended to show up right after each other, giving me minimal time in between to note things. When I finally had time, some details might have slipped. Another time, it might be wise to record the conversation; on the other hand, that might affect the visitors and their experience. Ideally, two people, one talking, one taking notes, would be the best setup.

Testing and setting up in advance
Deciding to make an exhibition in Amsterdam, building it in Delft, and transporting it to AMS by train, was a bigger endeavour than I had imagined. It was especially challenging because I could not firmly attach the doorbells to the poster set up because I was scared they would break during transportation. This meant that I had to put everything together on the day of the exhibition and had not tested the whole setup together. This was partly one of the reasons prototype HIW did not function as expected. Another time, I should be better at constructing earlier and plan ahead.

Most vital conclusion to bring forward

The most vital findings from the exhibition can be boiled down to:

The most vital findings from the exhibition can be boiled down to four things.

1. Predominantly two views on privacy were present - privacy as the right to know what will happen (legal view on privacy) and privacy as the right to contest (privacy as a social foundation). But a wide range of opinions was present during the exhibition, from "No doorbells" to "No restriction of doorbells".

2. People's opinions and values on privacy cannot be answered by one singular question. Asking the same person if they mind being filmed in public might give a different impression of their opinion on privacy than asking people if it is okay to have private security cameras. Values are context-dependent.

3. It is impossible to design the perfect smart doorbell that would make everyone happy. People have different ideas of what is essential and true to them. Some accept surveillance as a logical part of protecting oneself in today's society, and some do not see the need for cameras in public spaces under any circumstance. Overall, the range of values and opinions would mean that designing one doorbell to accommodate everyone is impossible.

4. The exhibition format successfully allowed people to voice their complicated relationship to values and opinions when it came to a topic, which for some, was the first time they encountered.

Ch. 8

DISCUSSION AND CONCLUSSION

The final chapter

This chapter includes the final discussion and conclusions of the project and recommendations for how the municipality of Amsterdam can move forward when trying to find the right solution to deal with the presence of smart doorbells on the streets.

8.1 Conclussion and future recommendations

What have we learned from this project and what can AMS and the Amsterdam municipality take from it?

This project started with going through the anatomy of the smart doorbell and mapping out critiques and problem areas associated with the product. We followed up with an analysis of the power differences in the interaction with a smart doorbell, looking at how it has changed the negotiation at the front door. We then developed an exhibition using RtD and speculative design to create alternative smart doorbells that communicated different definitions of privacy. The exhibition was used to gather the visitors' opinions and values to learn what the citizens of Amsterdam thought of the current design of smart doorbells and what they would like to see in the future.

This project located itself in the following space of design methods/research:

So, in the end, what has this project shown us? At the finish line, two main learnings appear; one related to design methodology and one related to smart doorbells in Amsterdam.

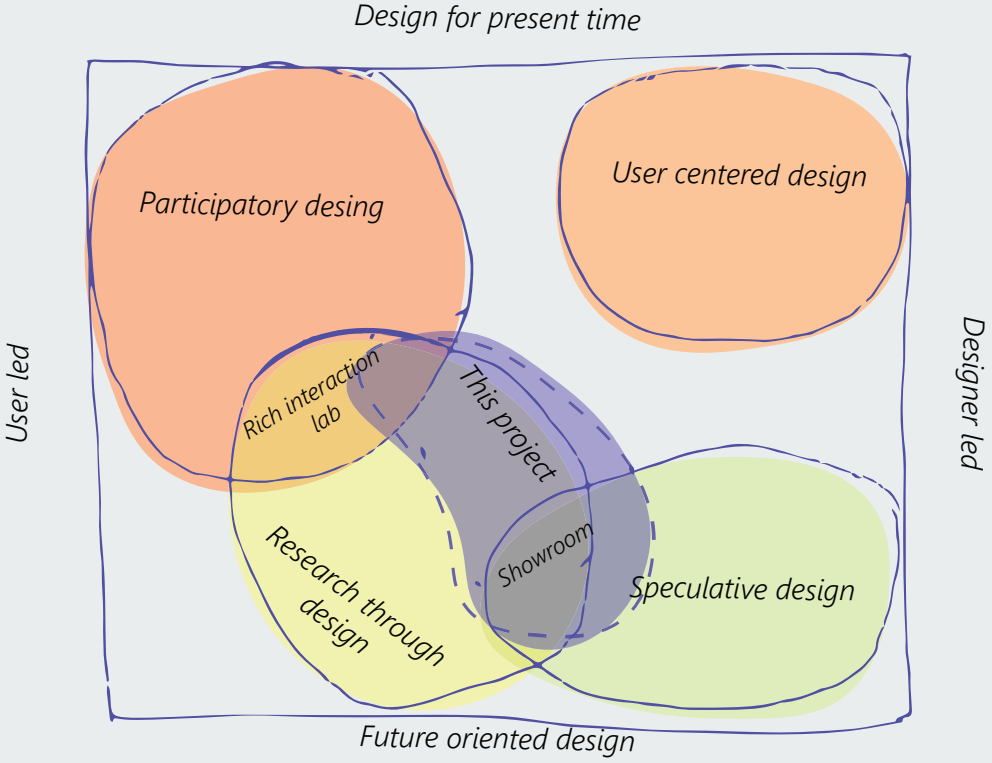


Illustration 24. Location of our research within design methodology.

Design methodology - uncovering values and opening up the solution space.

As shown in section 2.2, most smart doorbells look similar and function comparably. They are fundamentally privacy-invasive and designed to give the owner the upper hand in interacting with a visitor. The governing bodies in the Netherlands have, so far, not found a way to deal with these new cameras entering the public space, and the companies do not seem to prioritise privacy highly in their product development. It might have been hard to imagine how a smart doorbell could look more privacy-friendly while not loosing their functionality.

However, this project has shown that it is possible to open up the design space to more respectful cameras by taking a starting point in an ethical value. An array of alternative doorbells appeared by taking the starting point in three different definitions of privacy, each with different interpretations. The solution space opened up for the interventions implemented on several levels of the product (in hardware, software, legislation, external products) and for the negotiation to happen between different actors - between owner and visitor, between owner and municipality or owner and companies. We have seen plenty of options to create and expand the design of smart doorbells, and choosing the right one all depends on how we define privacy and where we want to locate the negotiation.

Talking about new technologies and their impact on society is a tricky discussion. It might be even more challenging because the data and functions are hidden from plain sight. Moreover, we have yet to see what effects they can have. Meanwhile, governmental bodies who want to act and restrict these new products, like the smart doorbells, can find it hard to find the right path in a democratic society of upholding privacy and allowing people to purchase home surveillance products. How do you make the process democratic, allowing citizens and stakeholders to give their input on how we should act and how strict we should be when the topic can be so hard to grasp? This project chose to tackle this challenge using speculative design. During the showcasing of the exhibition, I found that physical manifestations of alternative products were able to foster great discussion about the challenge of smart doorbells with citizens of Amsterdam. The prototypes allowed people to imagine things to be different and be very concrete in their comments on how they would like to tackle the challenge. People were able to point to concrete elements and verbally clarify what they thought a privacy friendly smart doorbell looked like. It succeeded in allowing people to voice their different opinions, and we experienced actual pluralism in the worldmaking by the participants ((Vervoort et al., 2015)).

Done right, speculative design can generate a discussion that both allows citizens to indicate their overarching views on values and principles and how they would prefer to tackle this problem by governmental bodies. This project, hopefully, showed that including citizens in discussions on how technology should be present in our society is possible when provided with the right tools and settings to take the conversation.

Recommendations - how can AMS and Amsterdam municipality use this in future work.

This project showed that speculative design could become a gateway to understanding citizens' values and preferences when it comes to topics like smart doorbells. But how can this exploration help decision-makers? How can this new knowledge help Amsterdam municipality move forward?

Working with values is not new to a municipality like Amsterdam. After each election, the city's political powers will create a set of values and directions for the city to work towards on different topics (City of Amsterdam, 2022c). This project has illustrated one way to move from abstract value to concrete solutions through the use of design. Speculative design allows one to find concepts within the given guidelines and helps clarify how to interpret values in the given context. It can allow citizens and stakeholder to give their input. The imaginary manifestations help move discussion towards an implementable level.

Now, it might not be realistic to ask Ring to change their complete doorbell design to a giant eye, nor might it be preferable to have a city full of eyes staring at all the tourists, blinking constantly. The alternative doorbells can seem too out there to implement, so how can they be translated into realistic actions? While it is true that the form of the speculations is more extreme to highlight the value they represent, they can become guidelines for future steps. In the case of our three doorbells, they could be translated into the following:

Hi, I'm watching:

If the HIW doorbell is what best represents the direction of the municipality, the most important thing to bring forward is making the smart doorbells and their function visible. This could happen by making it mandatory to put up a sticker clearly showing that filming was happening. Alternatively, companies could be obligated to make it visible in the design when the smart doorbell is filming or not.

Please open the camera:

If POtC best describes the municipality's approach to privacy, contestability needs to be built into the interaction. This can be done on a municipality level, making systems for citizens to inform and complain about doorbells on their streets. Or, in the interaction itself, by demanding all smart doorbells on the streets of Amsterdam to install a shutter ring (as designed by AMS) to allow citizens to contest the action of filming.

Let me work freely:

Finally, should the municipality wish to approach privacy as a right, as done in LMWF, they need to look into the inbuilt protection of citizens. This could be done on a citizen level, sending out instructions to all smart doorbell owners and making them aware of laws and regulations. Another option is to take it even one step further and make smart doorbells facing the public street illegally.

Each alternative doorbell provides to new designs and solutions on different levels. By taking a starting point in specific speculation, the solutions created are ensured to align with the desired values and intentions. The physical manifestations of the values and solution spaces allow for much more precise design suggestions for real-life solutions and limit the design space to fit within the wishes of citizens and municipalities.

Digital products and technologies are racing ahead of us. It can be challenging for decision making bodies to find suitable regulations and solutions to the new problems and products they face. It is even more challenging because citizens might have a hard time giving their input because the discussion on values and technologies can become too high-level and abstract for them to join. Speculative design can take the discussion to a more concrete level, opening up people's eyes to alternative futures and ways but by giving them physical manifestations they can relate to and comment on; letting them voice their values and preferences more easily.

So no, this project does not suggest the perfect solution for smart doorbells in Amsterdam. However, it has shown that design can provide a way to take one step closer to finding the right solution, one that better aligns with the values of the city.

Personal reflection

When I started my master's at TU Delft, I had never imagined that I would write my thesis on smart doorbells. I never felt like a very "techie" person and would shy away from things that seemed too technological. But, as luck would have it, I got dragged in a more technology-oriented direction and suddenly found myself interested in artificial intelligence, machine learning, IoT products, and how they affect our society.

New digital technologies are shaping our society in ways that are hard to grasp - data, algorithms and programs all touch our lives yet are invisible to the naked eye. I believe we need to help bring the invisible into the visible realm, allowing people to understand how it affects them. We need to give citizens a chance to voice how they would like the technology to be used in their society.

While some might argue that educating all types of citizens about something as complex as data-driven algorithms is not possible, I would respond by saying that the same could have been said about climate change. However, awareness has arisen in the last 10-15 years, and people can now connect how their everyday activity impacts the environment. Why should we believe we cannot reach the same awareness for digital technologies?

In this project, I got the chance to highlight some of the invisible issues connected to smart doorbells. It has been a delight to work on this thesis, and it has cemented my passion for ethical technology use and value-oriented research. I hope it has been inspiring to read and, potentially, made you question how you think we should apply technology in our society.

All the best,
Sofie

R

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APPENDIX

Overview of appendix:

Appendix A: Project Brief (not availble if thesis is found on openresearch. Amsterdam)

Appendix B: Overview of smart doorbells on the Dutch market

Appendix C: Research overview of why people have smart doorbells

Appendix D: Hegemonic domain analysis

Appendix E: Interpersonal domain analysis

Appendix F: Overview of other design projects

Appendix G: 16 smart doorbells concepts, overview

Appendix H: Usertest plan

Appendix I: Consent form

Appendix J: Sumup of usertest results

Appendix K: Background of posters

Appendix L: Questionnaire for exhibition

Appendix B: Overview of smart doorbells on the Dutch market

Here is a quick look at the top 5 doorbells in the Netherlands:

Name:	Ring (Amazon)	Google Nest Doorbell	Honeywell	Doorsafe	Doorbird
Image:					
Description:	Video doorbell	Video doorbell	Portable doorbell	Video doorbell	Video doorbell and intercom
Share of the market:	32 %	7 %	5 %	4 %	3 %
Video function:	Yes	Yes	No	Yes	Yes
Connectivity:	Yes	Yes	Yes	Yes	Yes
Cloud storage:	Yes	Yes	N/A	No (SD card)	Yes
Price range:	100 €	200 €	80 €	65 €	400+ €
Subscription:	Yes, 3 € montly	Yes, 5 € montly	No	No	Yes
Use of AI or ML for person or object recognition:	Yes	Yes	N/A	No	No
Option of more houses added:	No	No	No	No	Yes
Option to open the door through the doorbell:	No	No	No	No	Yes
Sources:	Ring Europe, (n.d.)	Google Store (n.d.-a), Google Store, (n.d.-c)	Honeywell home (n.d.), eSpares (n.d.)	Doorsafe (2022)	Doorbird (n.d.-a), Doorbird (n.d.-b)

It is noted that the Honeywell is not a video doorbell and therefore does not have a camera integrated (it is a portable doorbell to bring along with you in your home). So that one we will disregard further on.

The other four doorbells are all video doorbells with connectivity (able to access from the owners phone). Three of the four doorbells use cloud storage, allowing users to access video and images through their phones. The last doorbell from Doorsafe uses an SD card.

Only Ring and Nest uses artificial intelligence or machine learning to recognize objects.

Overall, the four doorbells include the camera and the doorbell, with only the Doorbird introducing more elements to the design (since it can be used for multiple households). They all function somewhat identical and are comparable in terms of interaction between owner and visitor.

Appendix C: Research overview of why people have smart doorbells

To gain an understanding of why people purchase a smart doorbell, 3 different activities was combined. In all 3, owners of smart doorbells had expressed why they had purchased a smart doorbell (different amount of participant and different type of research activity:

- Using existing research from AMS. AMS has already conducted research to understand why people have purchased smart doorbells. The research consisted of interviews with five residents.
- Interviewing a smart doorbell owner. The person did not reside in Amsterdam.
- Giving out questionnaires in Amsterdam. During a walk through the city, 40 questionnaires were delivered to houses with a smart doorbell. Only four people chose to answer, and no one was interested in a follow-up interview.

A total of 10 people gave their input to why they had a smart doorbell. Looking across the 10 participants, the following reasons were given:

<u>How this research is lacking:</u>

- First of all, the number of participants is deficient and gathered through 3 different research activities. The questionnaire specifically had a meagre output (only four out of 40 participants).
- Gender, age, social status etc., are only touched upon in the research from AMS, and it is not possible to know if it is representative.
- Finally, only one in-depth interview was conducted, and diving deeper into the participants' motivations.

How many people in each research responded with the following:				
Why they have a doorbell?	**Questionnaire in Amsterdam (total of 4 people)**	**Interview with 1 smart doorbell owner**	**AMS research in Amsterdam (total of 5 people)**	**Total**
Having a doorbell that is connected to my phone so I can hear it anywhere in my house/my property	2	1	3	**6**
So I can communicate with visitors when I'm not home	2	1	1	**4**
I want to try the latest tech	1	1	1	**3**
It makes me feel more safe at home	2		1	**3**
I can keep track of what is happening outside my house	1		2	**3**
I know when someone has visited me when I am not home	3			**3**
I can keep track of who enters and leaves the house (Kids, help etc.)	1	1		**2**
Keep track of pacages/theft of packages			1	**1**

Appendix D: Hegemonic domain analysis

To understand the different narratives in the hegemonic domain, three types of media were analysed:

- News articles. From both traditional news outlets like BBC to more tech-oriented news outlets.
- Reviews. From tech review articles to YouTube video reviews.
- Marketing materials. Looking at the websites of Arlo, Google Nest and Amazon Ring.

The focus of the analysis was on the narratives the different groups promoted and the role of the smart doorbell in each narrative. It is important to note that many of the sources in categories 1 and 2 came from English language sources and not Dutch sources. It was partly because it was hard to search for sources in Dutch as a non-native speaker, but also because there has been a more significant focus on smart doorbells in English speaking countries.

To analyse the discourse of different articles, the method was inspired by Kudina and Veerbeeks (2019) approach to value dynamic. Looking at how smart doorbells are discussed by (1) news articles, (2) reviews and (3) marketing material can show how the narratives and values are connected to the product and how different values are represented in different discourses pushed by different groups. In this section, we focused on the following in the discourses:

Overall themes and narratives of smart doorbells

- Choice of words
- Choice of imaginary (mainly applicable to group 3: marketing material).

News articles

Based on 15 news articles from 11 different sources, the general approach to smart doorbells was critical. Several issues with smart doorbells were raised in the articles, with little to no focus on any positive effects. Issues touched upon were:
Generally causing fear and paranoia for owners
Negatively impacting democratic values by undermining police integrity
Enhancing racial issues
Questioning the data ownership and general bad security practises
Questioning the actual effect on safety in communities with smart doorbells.

In general, the focus on the effects of smart doorbells was societal, with strong links to the companies behind the doorbell themselves.

Marketing materials

Looking at the three leading companies' websites (Amazon Ring, Arlo and Google Nest), the individual was again in focus. And just like in the review sites, safety and convenience were the dominant storylines.

Safety was divided into two categories: The feeling of being safe/having peace of mind and actual safety. Using videos of what looks like real life break-ins and weather challenges, the implied need for safety was enhanced on the website. This was also connected to practicalities such as having proof for insurance. The narrative of the convenience was much the same as the reviews - easy to use and ease of installation.

But the marketing also introduced a new narrative, that of the family-friendly product, present at birthdays and surprise visits from puppies. This was enhanced by fun imagery of smiling people and animals. This aspect of the product, made it seem as if filming non-criminal activity was a normal and fun part of any household.

Reviews

Looking at seven online reviews (three articles and four YouTube videos), the focus was on the individual experience with a strong notion of the owner of the doorbell.

Safety was a big topic, how the smart doorbells could help the owner feel safe and add to their actual level of safety. The safety was regarding minor crimes - package theft, deter burglars, and proof for insurance. Privacy issues were briefly touched upon, but usually regarding how to protect your privacy as an owner.

Secondly, convenience was a prominent narrative. The focus was on useful functions such as talking to visitors or the ease of installation or battery life.

In general, the narrative in these reviews was a need for people to protect themselves against outsiders through security tools such as a smart doorbell.

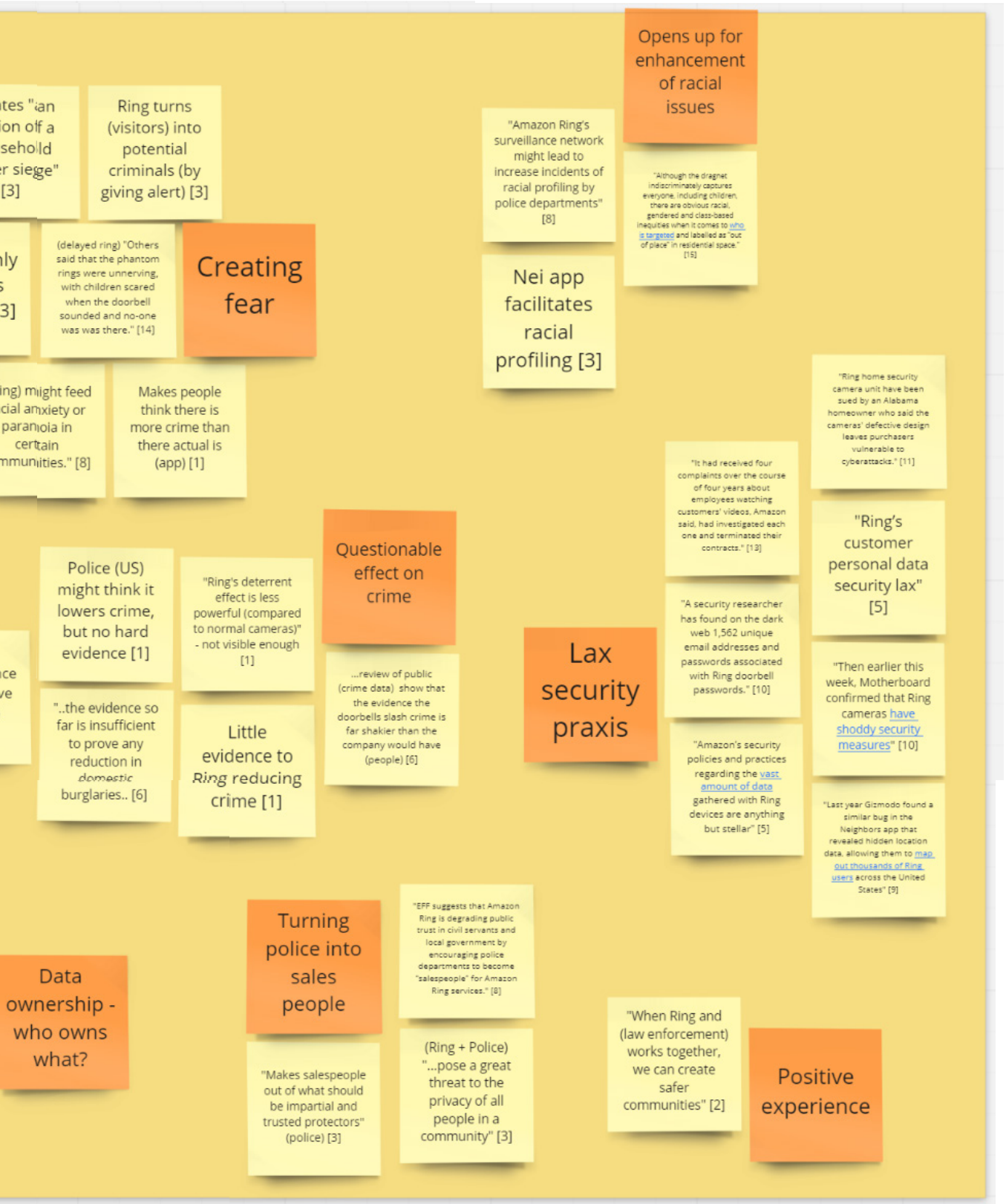
Summarising

Looking across the narratives showed the following tendencies:

- A strong individual focus is found in the reviews and marketing material. This makes it an individual choice to buy a smart doorbell. On the other hand, the News articles focus on the societal effect of the product.
- Safety and convenience are two values driven by both marketing and reviews.
- In regards to safety, there is a strong narrative that we as individuals need to protect ourselves and our property as if we are always in danger. The need for feeling safe/being safe is a given in this narrative and hard to counter.

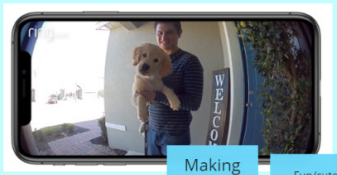
A critical approach is all but gone from marketing and is barely present in reviews. News articles focus mainly on the critical sides.
Only marketing materials seem to focus on the family-friendly image, which contrasts the dystopian imagery painted by News websites. The reviews keep themselves more neutral.

Analysis of news article related to smart doorbells, data clustering:


Opens up for enhancement of racial issues
"Amazon Ring's surveillance network might lead to increase incidents of racial profiling by police departments" [8]
"Although the dragnet indiscriminately captures everyone, including children, there are obvious racial, gendered and class-based inequities when it comes to who is targeted and labelled as "out of place" in residential space." [15]
Nei app facilitates racial profiling [3]
Ring turns (visitors) into potential criminals (by giving alert) [3]
(delayed ring) "Others said that the phantom rings were unnerving, with children scared when the doorbell sounded and no-one was was there." [14]
Creating fear
Makes people think there is more crime than there actual is (app) [1]
"Ring home security camera unit have been sued by an Alabama homeowner who said the cameras' defective design leaves purchasers vulnerable to cyberattacks." [11]
"It had received four complaints over the course of four years about employees watching customers' videos. Amazon said, had investigated each one and terminated their contracts." [13]
"Ring's customer personal data security lax" [5]
"A security researcher has found on the dark web 1,562 unique email addresses and passwords associated with Ring doorbell passwords." [10]
Lax security praxis
"Then earlier this week, Motherboard confirmed that Ring cameras have shoddy security measures" [10]
"Amazon's security policies and practices regarding the vast amount of data gathered with Ring devices are anything but stellar" [5]
"Last year Gizmodo found a similar bug in the Neighbors app that revealed hidden location data, allowing them to map out thousands of Ring users across the United States" [9]
Police (US) might think it lowers crime, but no hard evidence [1]
"Ring's deterrent effect is less powerful (compared to normal cameras)" - not visible enough [1]
Questionable effect on crime
...review of public (crime data) show that the evidence the doorbells slash crime is far shakier than the company would have (people) [6]
"..the evidence so far is insufficient to prove any reduction in domestic burglaries.. [6]
Little evidence to Ring reducing crime [1]
Turning police into sales people
"EFF suggests that Amazon Ring is degrading public trust in civil servants and local government by encouraging police departments to become "salespeople" for Amazon Ring services." [8]
"Makes salespeople out of what should be impartial and trusted protectors" (police) [3]
(Ring + Police) "...pose a great threat to the privacy of all people in a community" [3]
Data ownership - who owns what?
"When Ring and (law enforcement) works together, we can create safer communities" [2]
Positive experience

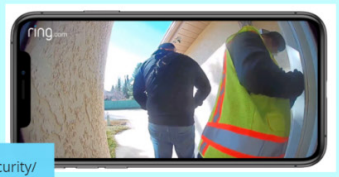
Analysis and images from company websites

Ring website



Making cameras less scary

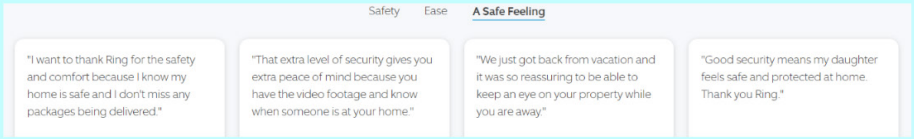
Fun/cute content - using camera as a for fun activity

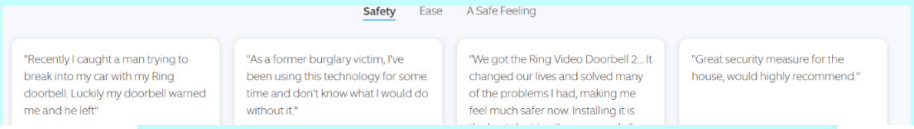


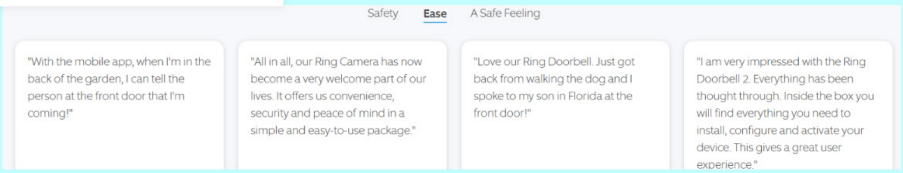
Security/ protection of property

Practical/ safety

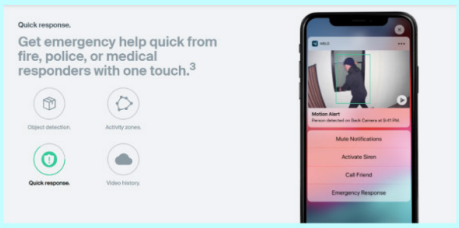
3 focuses on the website

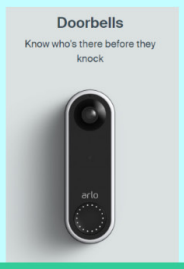






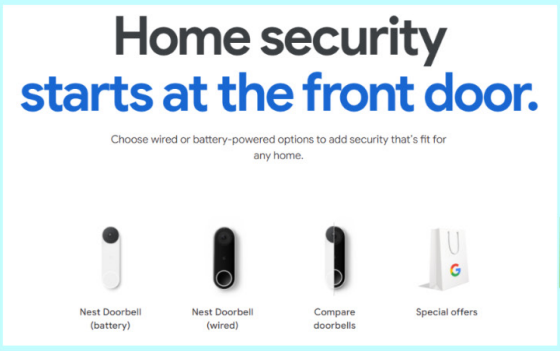
Arlo website





Security focus again

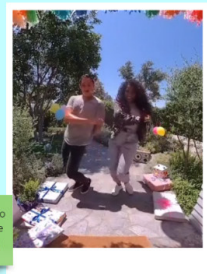
Google Nest



Ease of installation

Convenience - easy to answer without moving

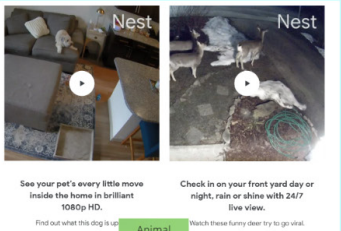
Good video (fun dance example)



Crisp HD video.

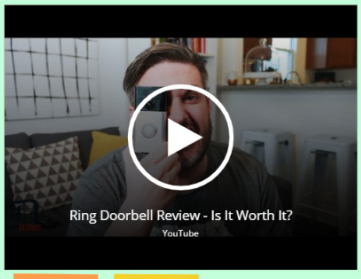
See details in bright and dim lighting, view visitors from head to toe, and see packages on the ground.

Protect privacy (of owner)



Animal videos as example of surveillance

Analysis from review websites and videos



Easy installation, hard to steal

"Do you like getting your packages stolen? I don't"

Many functionalities

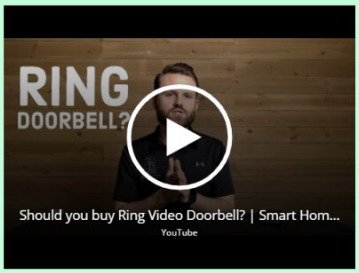
Good enough camera to recognize people

Battery power

Functionality of motion detection - avoiding irrelevant notifications

Having to have a paid subscription

Functionality and price focused



Not as secure because of cloud (easier to hack)

Does not film constantly (negative)

Don't have control of videos

"Great deterrent"

https://bestreviews.com/home/doorbells/best-ring-doorbells

Evaluation of Ring doorbells

Improved home security

Convenience (not having to get up)

Video storage - proof for police/insurance at vandalism/ theft

Delivery security of packages

Ease (instalment)

Works with other smart products

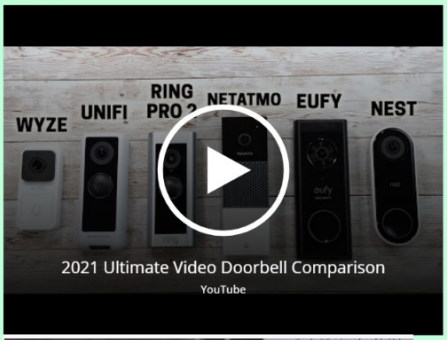
6 reasons to get a smart doorbell

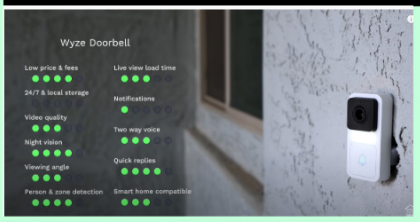
https://ideaing.com/ideas/6-reasons-need-smart-video-doorbell-now/

Safety - "It could be someone unscrupulous (standing outside the door)"

Convenience - (don't have to get up, communicate from distance)

Keeping an eye on things when away





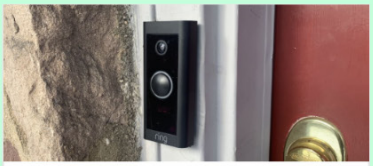
Only focus on functionality

Ease of installment

Comparing chimes

Battery hours (practicality)

Video/audio quality



www.tomsguide.com

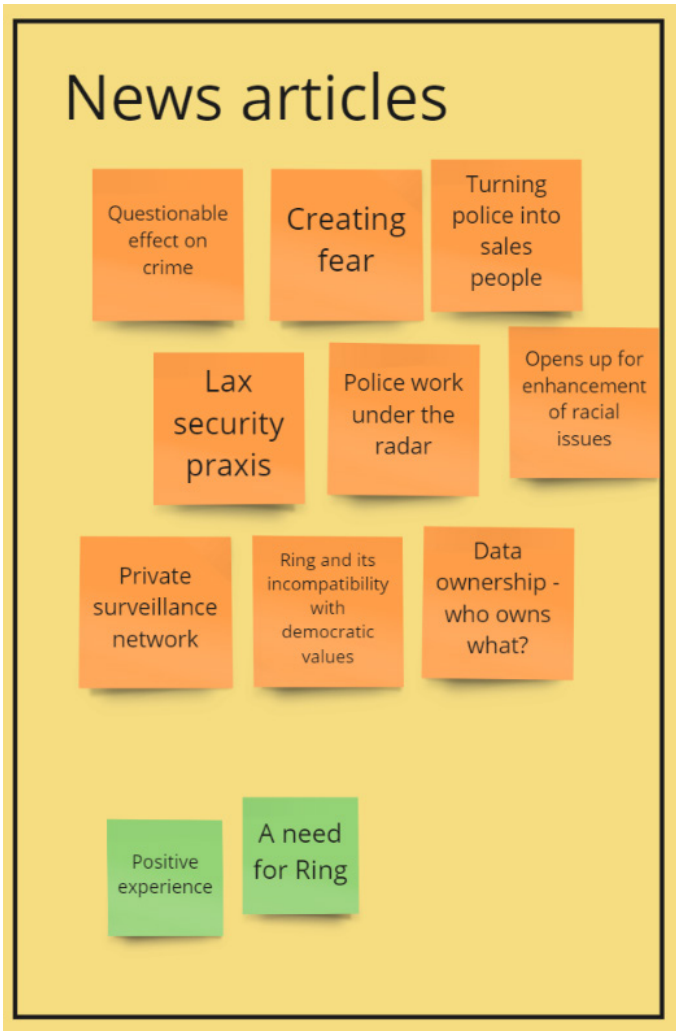
Buying a video doorbell? Here's 8 things you need to know

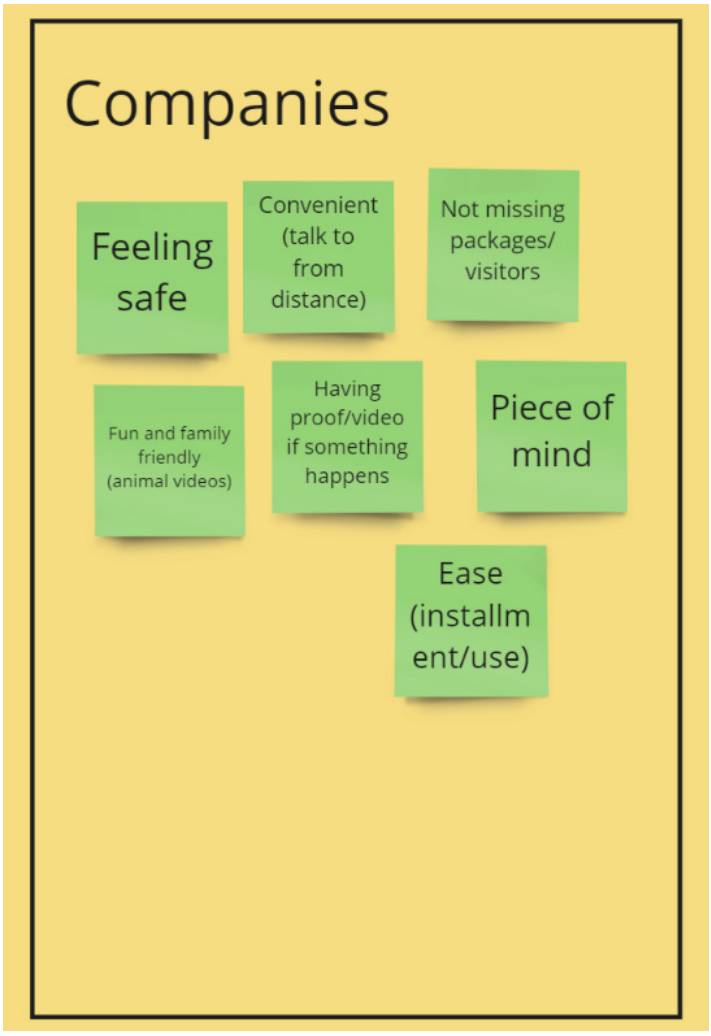
Video doorbells are one of the biggest smart home purchases, so it's important to ask questions before making a decision on which to buy. But what are the factors you should consider? Here are eight things you should know when shopping for a video doorb...

Facial recognition for ease (announcing visitors)

Camera that can cover everything

Sumup/overview





Sources for the analysis (full source in list of references):

News articles (numbers refers to numbers on miro board)

[1] Farivar, C. (2020, February 15). Cute videos, but little evidence: Police say Amazon Ring isn't much of a crime fighter. NBC News.
[2]Sawers, P. (2018, May 8). Amazon-owned Ring embraces neighborhood watch with home security networking app. VentureBeat.
[3] Guariglia, M. (2019, August 23). Amazon's Ring Is a Perfect Storm of Privacy Threats. Electronic Frontier Foundation. [4] Bloomberg Technology: https://www.bloomberg.com/news/articles/2021-09-28/amazon-s-ring-targets-pro-security-market-with-new-services
[5] Gyles, S. (2019, November 29). Amazon Ring Policies: "Open Door for Privacy and Civil Liberty Violations". VPNoverview.Com.
[6] Harris, M. (2020, April 2). Video doorbell firm Ring says its devices slash crime—but the evidence looks flimsy. MIT Technology Review.
[7] Whittaker, Z. (2021b, June 8). Ring refuses to say how many users had video footage obtained by police. Techcrunch
[8] Lindsey, N. (2020, April 13). The Dangerous Implications of Amazon Ring Creating a Nationwide Surveillance Network with Law Enforcement. CPO Magazine.
[9] Whittaker, Z. (2021a, January 14). Amazon's Ring Neighbors app exposed users' precise locations and home address'
[10] Whittaker, Z. (2019, December 19). Over 1,500 Ring passwords have been found on the dark web. Techcrunch.
[11] Stempel, J. (2019, December 27). Amazon's Ring cameras are vulnerable to hackers, lawsuit in U.S. claims. Reuters.
[12] Kelion, B. L. (2020, March 4). Amazon's Ring logs every doorbell press and app action. BBC News.
[13] BBC News. (2020a, January 9). Amazon Ring workers fired for accessing user video.
[14] BBC News. (2020b, October 1). Amazon Ring: Phantom smart doorbell chimes alarm owners.
[15] Bridges, L. (2021b, May 20). Amazon's Ring is the largest civilian surveillance network the US has ever seen. The Guardian.

Company websites

- Ring. (n.d.-e). [Screenshot from website]. Ring.Com.
- Google. (n.d.). [Screenshot from website]. Store.Google.Com.
- Arlo. (n.d.). [Screenshot from website]. Arlo.

Review websites:

- Kenney, B. (2020, April 18). 6 Reasons You Need a Smart Video Doorbell Now. Ideaing.
- Blair, J. (2022, April 5). Best Ring Doorbells. BestReviews.
- Prospero, M. (2021, July 17). Buying a video doorbell? Here's 8 things you need to know. Tom's Guide.

Youtube reviews:

- Detroit Tech. (2019, April 1). Ring Doorbell Review - Is It Worth It? [Video]. YouTube.
- Jordan Bellinger - Texas Real Estate. (2020, February 26). Should you buy Ring Video Doorbell? | Smart Home 101 [Video].
- Smart Home Solver. (2021, July 2). 2021 Ultimate Video Doorbell Comparison [Video].
- TED-Ed. (2014, November 4). How to understand power - Eric Liu [Video]. YouTube.
- The Gadget Show. (2021, March 16). The latest Smart Doorbells Reviewed | The Gadget Show [Video].

Appendix E: Interpersonal domain analysis

During the small user research conducted in Amsterdam, I decided to walk around the city to distribute pamphlets into the postboxes of houses with a smart doorbell. This resulted in a coincidental form of autobiographical design research.

Details
The walk happened on the 8th of November, from 16.00-19.00. During the walk I:

- Found 40 smart doorbells, all of them facing the road.
- 39/40 of the cameras pointed directly at the public street.
- Three of the houses looked like independent shops; the rest appeared to be residential houses.
- Two had stickers to indicate that they were filming.
- The route was approximately as indicated (screenshot from Google maps):

While this research was not planned or coordinated, the walk turned into a personal experience that gave a lot of interesting insights into how people can experience smart doorbells.

I had several reflection moments on the route. Most notes were written down on the train afterwards. This is the full entry:

Feeling uncomfortable
As someone who has before knocked on peoples doors regarding gathering money for charity, I am usually quite comfortable doing so. But this time, I felt bad. Walking up to a door with a smart doorbell, I felt like I was intruding on someone's property, as if I was not welcome.
I felt very uncomfortable the first 30 min, but the feeling lingered most of the 3 hours.

Feeling like I was at a disadvantage, unwelcome
I knew that 40 people now not only had my name, my email but potentially also a video of my face approaching their door. How many times had I been filmed? How many servers were my face on? This made me uncomfortable, and (somewhat) irrational fears of it backlashing came to me.

I also was scared someone was going to open the door and demand why I was there, notified by their smart doorbell. I assumed they would all look at the video with scepticism.

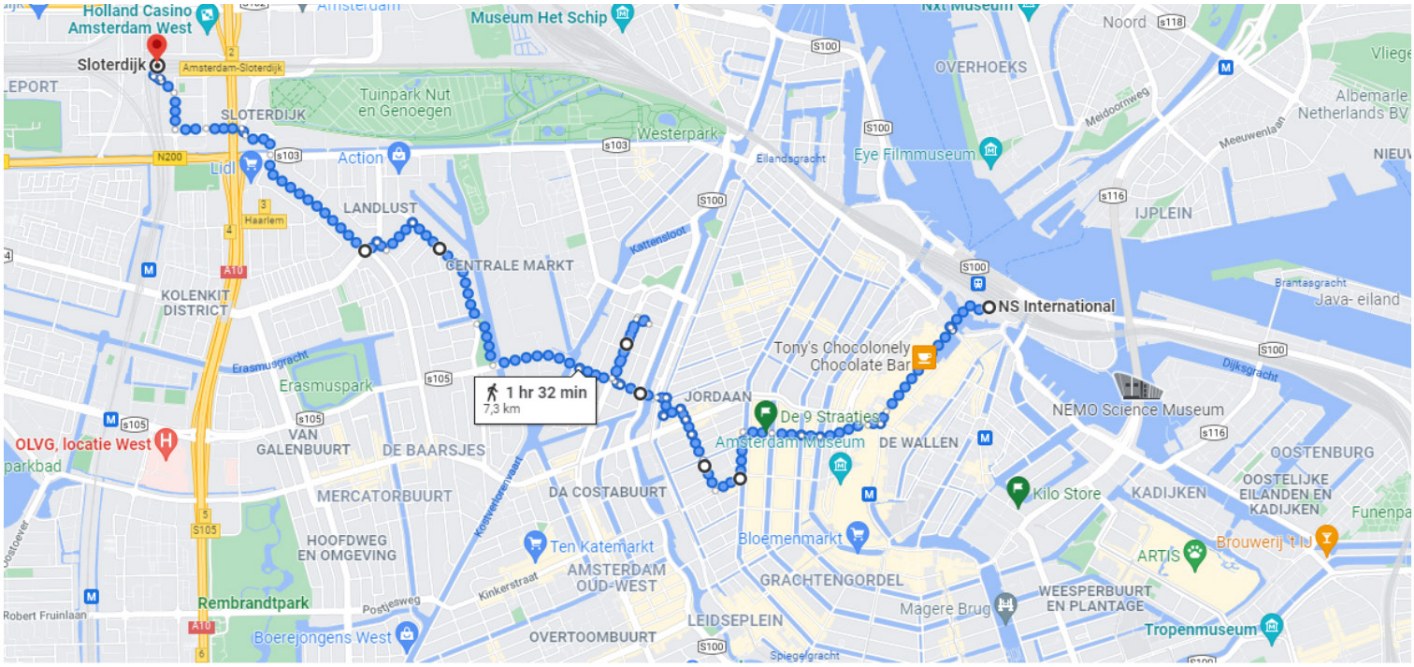
It was really bad at the houses that also had light sensors, that made me feel like I was unwelcome. Especially because I never knew when I was being filmed. Sometimes there was light on all the time, some had red lights go on. This might have been an indicator, but it only made me feel more uncomfortable.

The bad feeling slowly faded, but it never quite disappeared. I didn't dare knock and ask for a chat at any of the houses (this is usually never a problem).

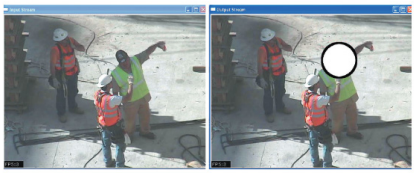
In hindsight
Looking back on the experience, for me it was proof that personally smart doorbells change how I behave in public space. It makes me feel like the private property of an owner is being extended to the street in front of them. A space I before felt was mine, has now been invaded by an unknown resident.

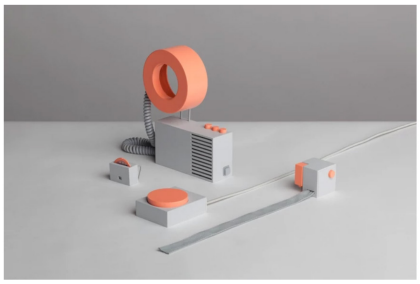
Comment after coach meeting the 10th of November:
As Nazli commented during the coach meeting: Considering that they were violating MY privacy, it is interesting that I felt like the one violating someone else's space.

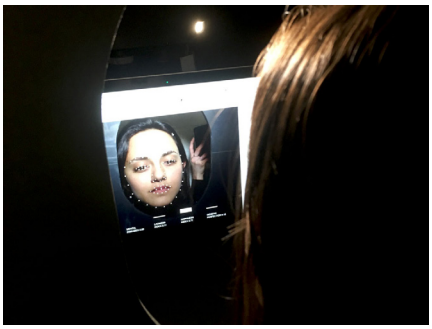
Approximately the walking route taken in Amsterdam:
(Mapped out with Google Maps)



Appendix F: Overview of other design projects

No.	Picture	Title, Author (year)	Description	Source
1		Dutch railway security cameras, Fabricque (2014)	More recognizable and friendly looking security cameras	https://designobserver.com/feature/a-security-camera-worth-looking-at/38335 designobserver.com/feature/a-security-camera-worth-looking-at/38335
2		Respectful cameras, Senior (2009)	Cameras that use object recognition to anonymize people in the view wearing certain colour jackets.	Senior, A. (2009). Protecting privacy in video surveillance. In Protecting Privacy in Video Surveillance. Springer London. https://doi.org/10.1007/978-1-84882-301-3
3		URME surveillance, Leonardo Selvaggi (2014)	Protecting user from facial recognition systems – in public and on video.	http://leoselvaggio.com/urmesurveillance
4		Surveillance exclusion, Jip van Leeuwenstein (2017)	Protecting user from facial recognition systems, while still allowing people to read the users facial expressions.	http://www.jipvanleeuwenstein.nl/#about
5		Anonymity scarf, Sanne Weekers (2017)	Protecting user from facial recognition systems.	http://sanneweekers.nl/big-brother-is-watching-you/

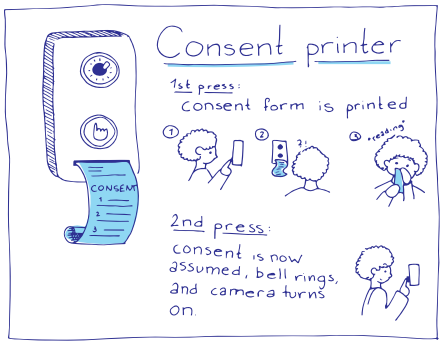
6		CV Dazzle, Adam Harvey (co-lab with Corana Museum of Art), (2010)	Makeup that protects user from facial recognition systems.	https://cvdazzle.com/
7		Wearable face projector, Jing-Cai Liu (2017)	Protecting user from facial recognition systems.	tp://jingcailiu.com/wearable-face-projector/
8		Accessories of the paranoid, Pia-Marie Stute and Katja Trinkwalder (2017)	Protecting personal data transmitted through house objects through a range of accessories.	https://www.katjatrinkwalder.com/accessoiries-for-the-paranoid
9		MegaPixels, Adam Harvey (2017)	A software that uses machine learning to search for peoples faces in a public facial recognition training database.	https://ahprojects.com/megapixels-glassroom/
10		Eyecam, Marc Teyssir (2021)	Webcam that looks like a real eye to help put focus on sensing devices	https://marcteyssier.com/
11		Shuttercam, AMS (2021)	Alternative shutter cameras that people can opt out of	https://www.ams-institute.org/urban-challenges/urban-data-intelligence/shuttercam-would-cameras-equipped-with-shutters-contribute-to-a-responsible-smart-city/

12		A B C, Shailee Advani, Byron Salas, Lea Lemaire (Copenhagen Institute of Interaction Design) (2019)		

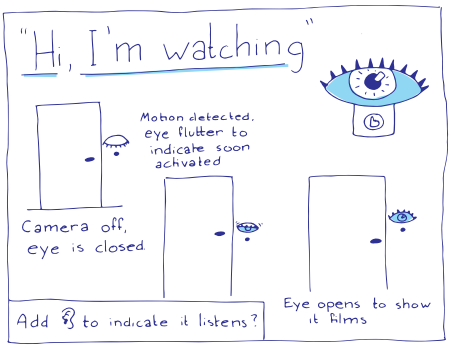
Appendix G:16 smart doorbell concepts, overview

The first initial 16 concepts of smart doorbells:

1



2



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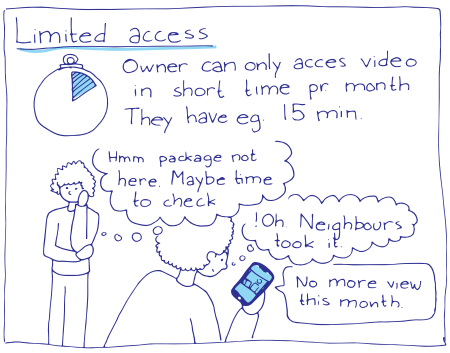

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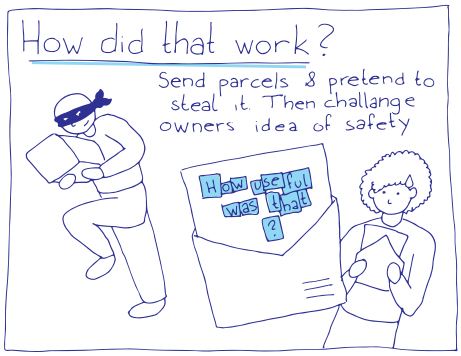

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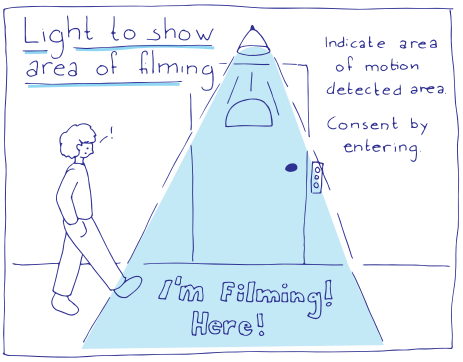

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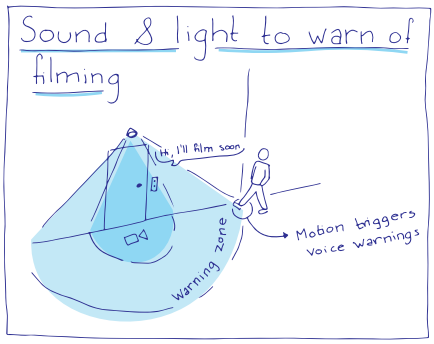

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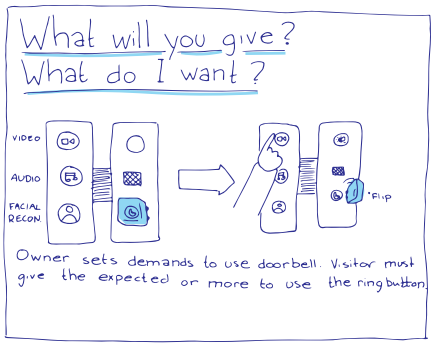

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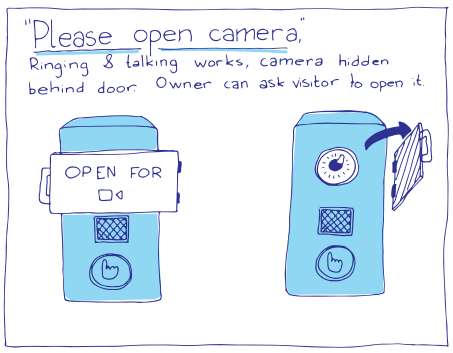
9



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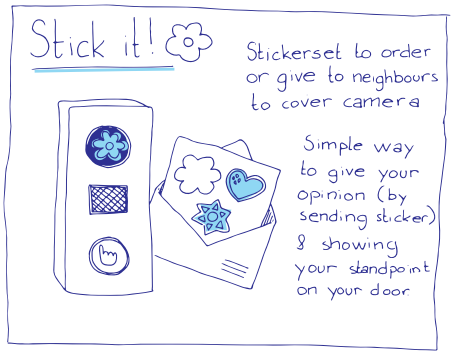

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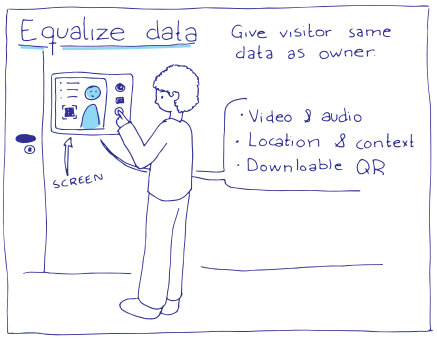

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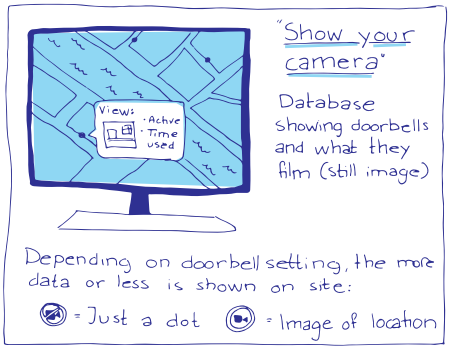

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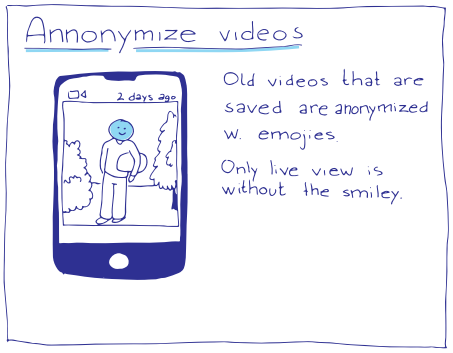

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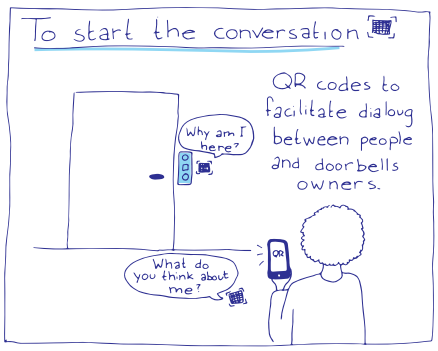

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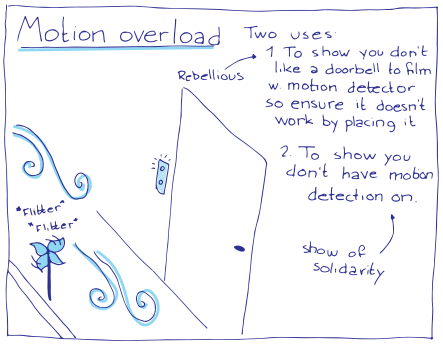
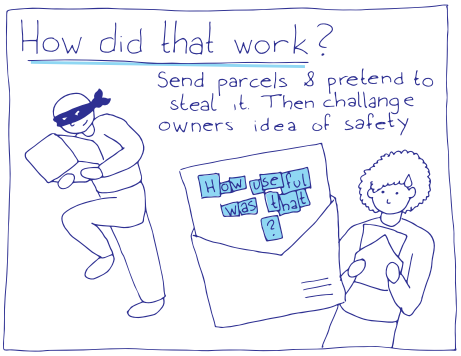


16

The 5 concepts not to continue with:

4



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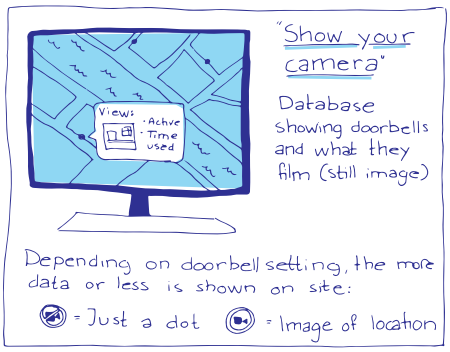
12



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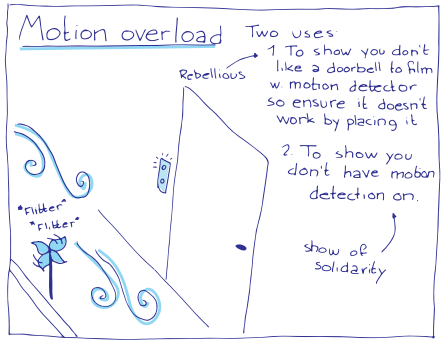
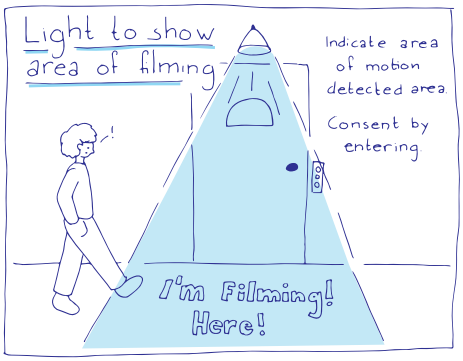


Concept 4. 8, 12 and 15 was not related to the actual doorbell, and therefore was removed.

5



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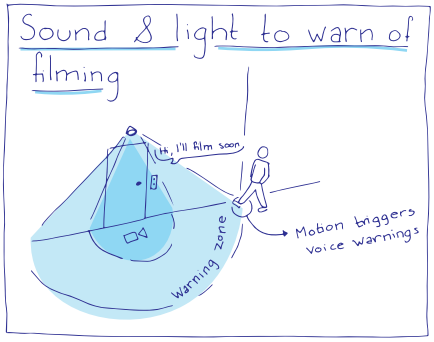


Concept 5 and 6 were merged into one.

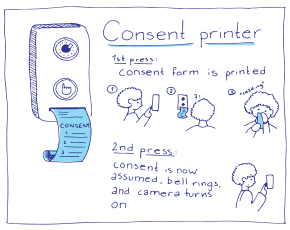
How the concepts divdes themselves over the different domain of the Matrix of domination.

The concepts spreads out over the Matrix of domination, but some concepts can of course be fitted into more than one box.

Structural domain:

Concepts that take starting point in laws, embeding the rules.

1



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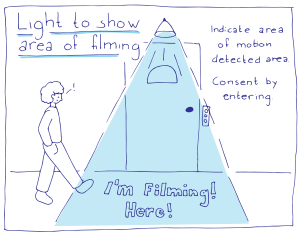
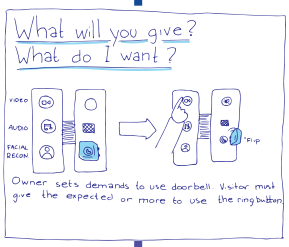


Disciplinary domain:

Concepts that focus on challenging the way the power is administered - use of app, camera etc.

7



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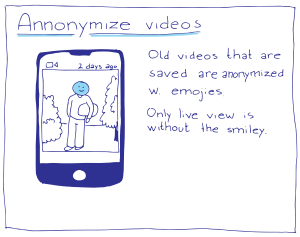

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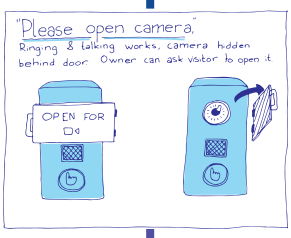


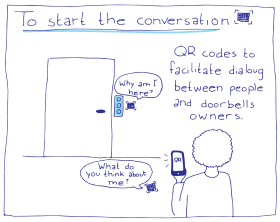
16

3

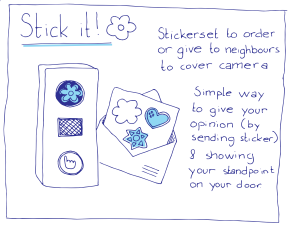
Hegemonic domain:

Concepts that challenge the narratives.

14



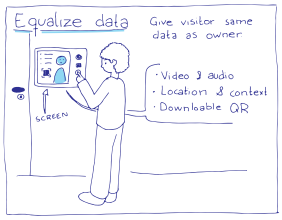
10



Interpersonal domain:

Concepts that affects the personal experience of the smart doorbell of owner or visitor.

11



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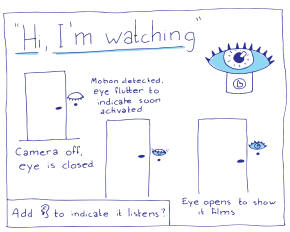
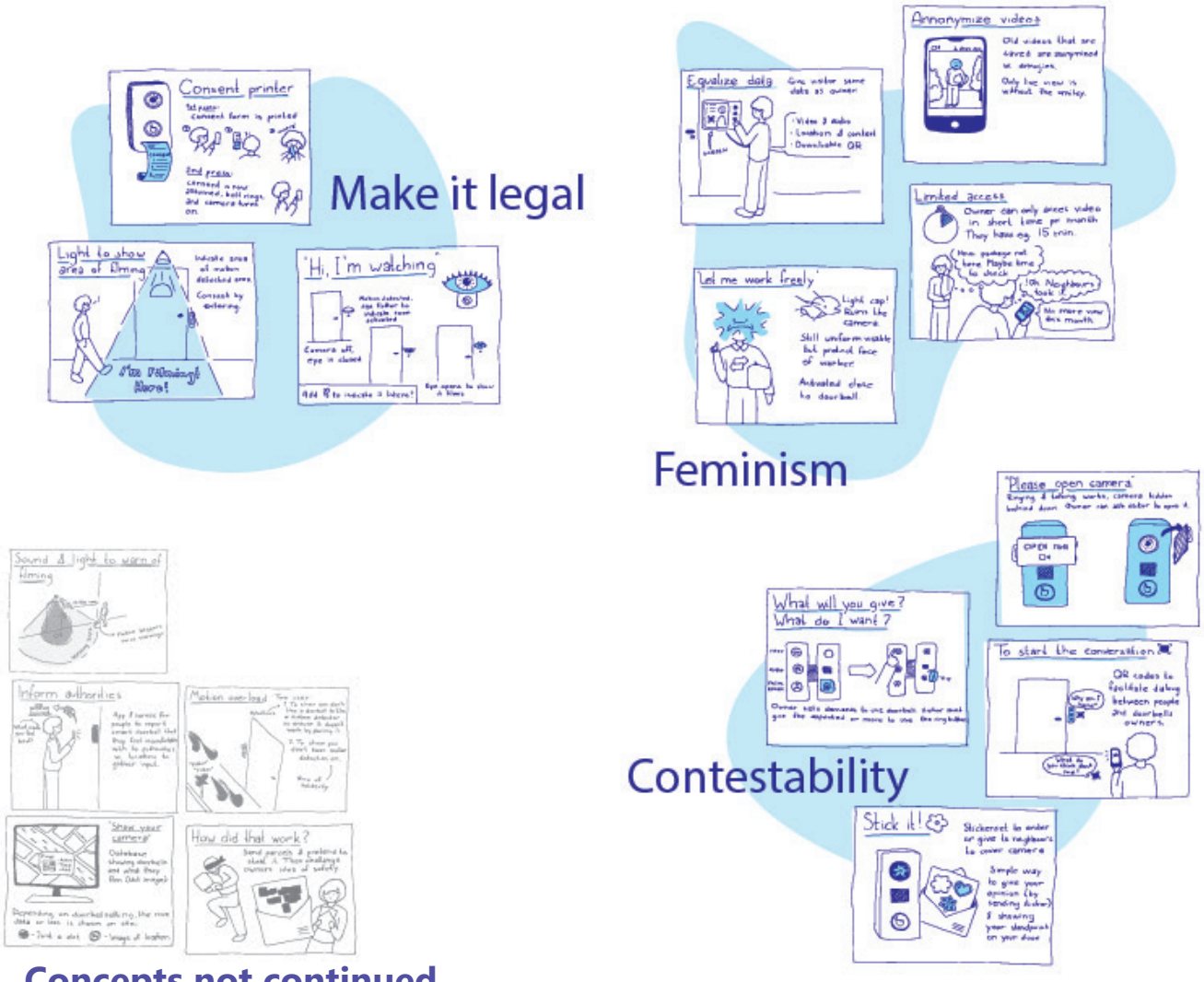


How the concepts divdes themselves over the different strategies:

How the concepts spread out over the different strategies/definitions of privacy (before sorting the concepts from 16 to 11):

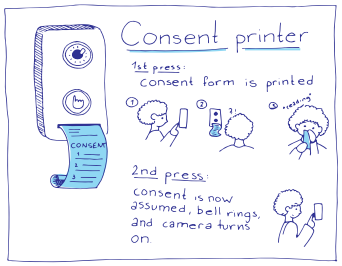


Where the negotiation is located in the alternative doorbells:

The negotiation is located in different places.

Doorbell and visitor:

1



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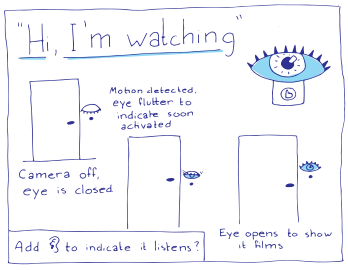

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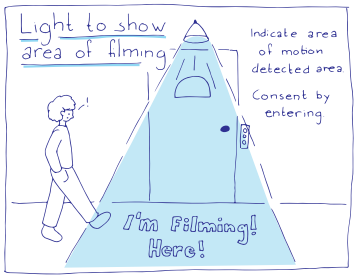

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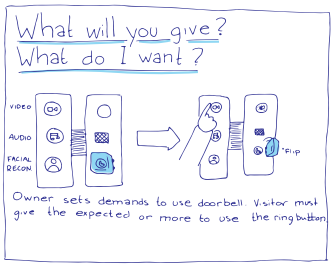
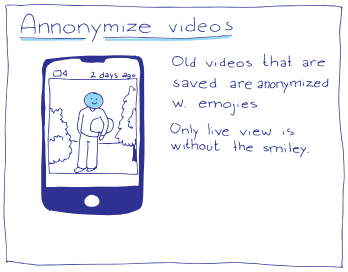


16

Owner and doorbell:

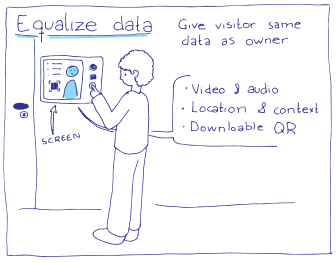
3

13



Owner and visitor:

11



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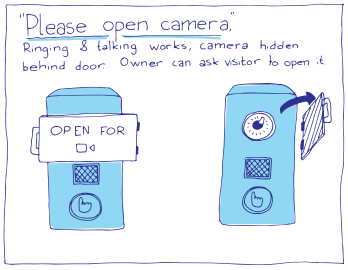

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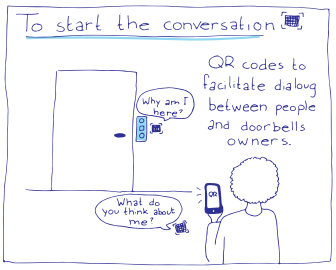

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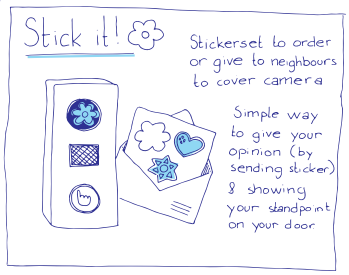


Appendix H: Usertest plan

User study plan

Date and time: 14-15 of December, from 9-18

Organisation:

- Each session will be scheduled to 45 min (with the option of a shorter session if the participants only have max 30 min).
- Each session will have space for 2-3 visitors (only 3 if they know each other/same household)
- People book a timeslot using this excel sheet: Smart doorbell userstudy - book a timeslot
- I will be present during the whole thing to guide through the study + act as Wizard of Oz
- The discussion and audio of the session will be recorded (for future notetaking)
- Participants will be asked to sign the following consent form: Informed consent for user study (still in progress)
- Ask people if they prefer we keep masks on beforehand + prepare hand sanitizer.

Session schedule:

Time	Activity	Questions:	Comments
5 min	Introduction. 1. What is smart doorbells 2. What is the plan 3. Consent form		I will have printed and prepared consent forms for signing, but I will also send the form beforehand (to save time).
35 min	Experience 11 prototypes (2-3 min pr. prototype). Pr. prototype:	After experiencing the prototype. 1. *What are your initial thoughts on this doorbell?*	I will have the PrEmo printed so they can easily cross out which
	• Let participants experience the prototype (1 person pr. prototype). See how they act. • Ask participants to say out loud what their thoughts were of the prototype. • Ask to indicate what emotions were triggered on PrEmo card	2. *What aspects did you find interesting? Why?* 3. *Any aspects that you do not like? Why?* 4. *Please indicate the emotions it triggered in you on the PrEmo.* 	emotions they sense are triggered.
5 min	End with wrap up questions. Ask them to fill out a quick questionnaire to answer: • Personal information: ○ Do they have a Ring Doorbell ○ Housing situation (rent/own) ○ Do they have a front door on a road ○ Age and profession Thank them for their participation	To wrap up the session: 1. *Which were your top 3 concepts and why?* 2. *Which were your 3 least favorite ones and why?*	Printed questionnaires to fill out.

Other

I plan to do a pre-run of the setup Monday the 13th to make sure it goes smoothly with some friends.

The online version of the user study will be just like the physical:

1. Show video of one concept
2. Ask the following:
    a. *What are your initial thoughts on this doorbell?*
    b. *What aspects did you find interesting/best?*
    c. *What aspect did you not like?*
    d. *Please indicate the emotions it triggered in you on the PrEmo.*
3. Wrap up with their favorite/least favourite ones

Appendix I: Consent form

Informed consent form template for research with human participants

Please tick the appropriate boxes	Yes	No
Taking part in the study I have understood the study information, 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.	O	O
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.	O	O
I understand that taking part in the study involves a user test that includes interacting with prototypes and follow up interviews. The audio will be recorded during the whole session. The audio will only be used by the graduation student (Sofie-Amalie Torp Dideriksen) to document the findings from the user study.	O	O
Use of the information in the study I understand that personal information collected about me (e.g. name and living situation) will be anonymised.	O	O
Future use and reuse of the information I give permission for the information and audio that I provide to be archived until the end of the project so it can be used for future research and learning.	O	O

Signatures

_____	_____	_____
Name of participant	Signature	Date

I have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands what they are freely consenting.

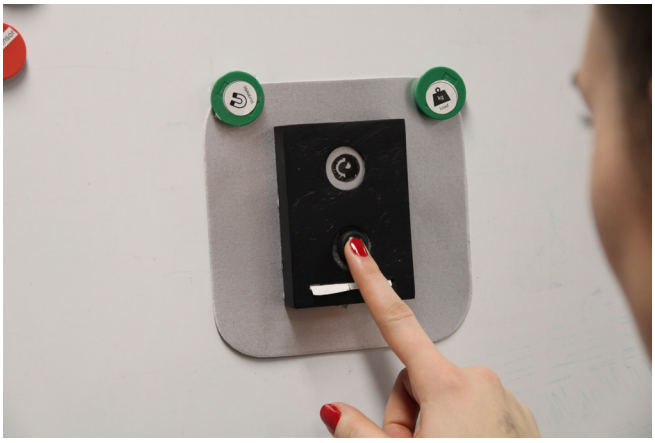
_____	_____	_____
Researcher name	Signature	Date

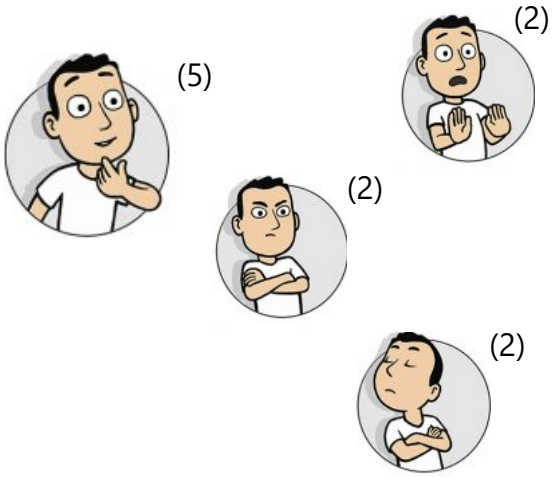
Study contact details for further questions: s.t.dideriksen@student.tudelft.nl

Appendix J: Sumup of user test result

A sum up of the result in the usertest. For each doorbell the most dominent PrEmo are noted down, as well as the positive, neutral and negative comments from participants. The numbers before the comments/next to the PrEmo indicates how many participants said it. Text in bold was mentioned more than 5 itmes.

No. 1 - Consent printer





(2) I like the paper receipt

(2) I like that I know I'm being recorded, very clear

(2) It gives you the option to do something else if you don't want to be recorded (e.g. whatsapp the person)

(2) Friendly that it asks for consent

(1) Intuitive

(1) It makes you think

(1) Maybe make it into a different text? The note could say that people can ask to have their data removed. Maybe it could be more of a reminder instead of asking for consent?

(1) It would be nice if the first press still rang, but only filmed at the second press.

(1) It would be nice if it was a receipt with my data

(3) There is little choice: Yes or walk away (forced consent)

(2) Scared that they would be filming anyway

(2) Scared that they would already have been filmed

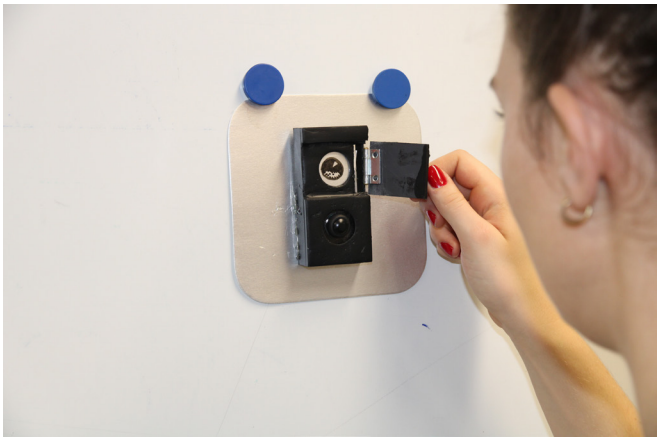
(1) Not safe, burglars can just not press again

(1) Confusion in how it works, that it does not ring the first time

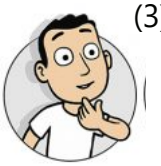
(1) Abelsist (assumes reading and English)

(1) Would like to use it, but not as an owner

No. 2 - Please open the camera



(6)



(3)

(2)

(3) Simple

(3) You can still ring the doorbell and talk even without the video

(3) Looks like a vault/fridge

(2) Really good solution

(2) You know it doesn't film

(1) As owner, helps me see in sketchy situations

(1) Feel involved/conversation with human

(1) Friendly interaction

(1) Negotiation

(1) I like the paper receipt

(2) Could work well with automatic door lock that you could open from a distance

(2) Add prerecorded voice message (to ask to open camera)

(1) If you have the voice, do you need the camera?

(1) Maybe triggers a more conscious use

(2) As owner, I don't want to repeat myself all the time

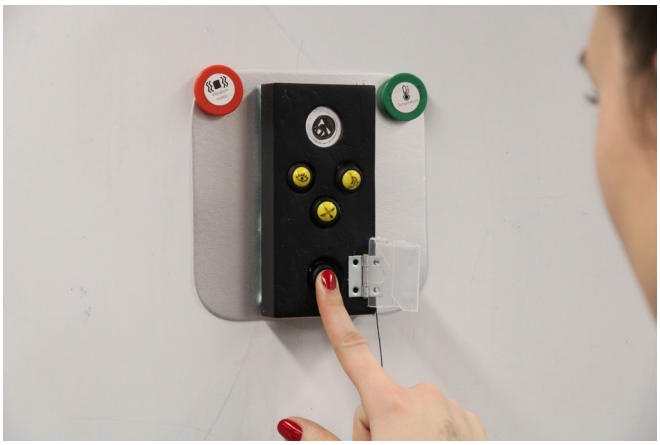
(1) Potential arguments between owner and delivery people

(1) Not entirely clear that it will film when opening door

(1) Wasn't entirely clear that it is a doorbell

(1) Removes the safety aspect

No. 3 - What will you give



(3)

(2)

(3)

(2)

(1) Nice to have a choice

(1) Like the tactile buttons

(3) Reads eye as camera, ear as sound (observation)

(1) Might be nice if you could order it with only the options you were interested in as an owner

(1) Would in most cases just give audio

(6) Too busy, too complicated

(4) Confusing

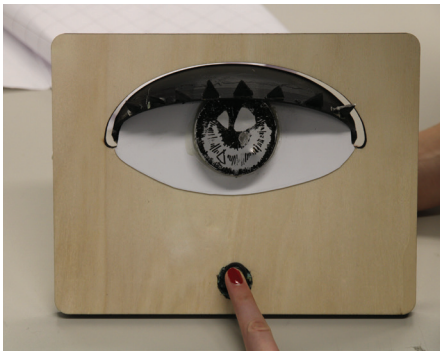
(2) Not sure if it is already recording?

(2) X means burning the house down?

(1) Did not assume that the owner is in charge of the settings

(1) Two step process is too long

No. 4 - Hi, I'm watching



(6)

(5)

(6)

(9) Clear that the camera is on, "it is honest"

(4) I feel watched

(3) Mechanical is nice

(2) Like the looks

(2) Allows me to challenge it

(2) Friendly (blinking)

(1) Playful

(1) You have a chance to walk away

(1) Less in your face (compared to no. 5)

(2) Organic, human shape

(2) Attributes agency to the house/eye is reacting

(1) If I really care for security, I would have more

(1) General suggestions to play with the eye shape

(5) It looks a bit scary

(2) Too human, disconcerting

(2) Doesn't help for security because of the cover

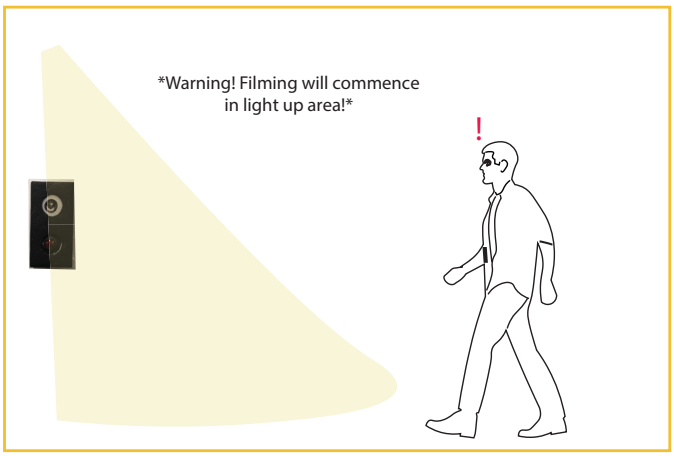
(1) Seems more like a gimmick

(1) Did not recognise eye as camera

(1) Not sure if you have to ring the doorbell since the eye is reacting to you

(1) Very disgusting shape

No. 5 - Light up area




(4)


(3)


(3)

(5) Likes the light sensor/change of surroundings

(4) Likes the indication/information

(2) Finds it playful

(2) I feel special

(1) Likes the warning

(1) Obvious

(1) Can give consent by walking

(5) People try to step around the recording zone to ring it (observation)

(1) There is the option to step in and out of light zone quickly

(1) Could be able to customise warning

(1) Nice for owner to know if people left because of it

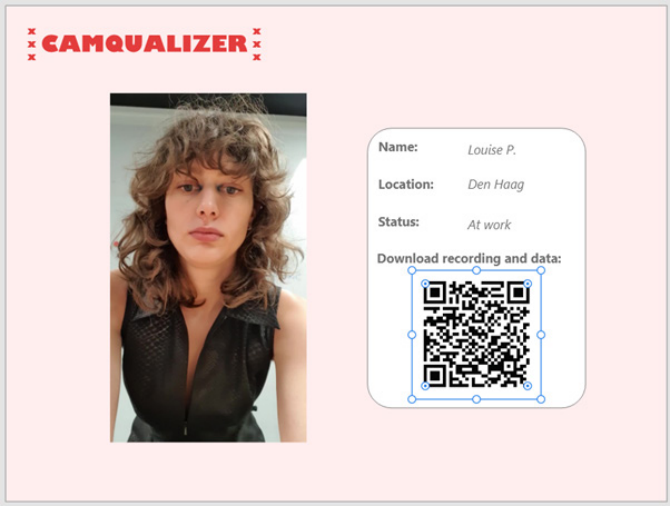
(1) Would like notifications for when it records

(2) Warning too much in your face

(2) Would be annoying to own as an owner who has to hear it all the time

(1) What if you miss the message (e.g. wearing headphones)

No 6 - Equaliser



(5)

(3)

(6)

(7) Likes the two way conversational element

(2) Practical way to give instructions to delivery people

(1) Glad to have the right to their own data

(1) Liked the data

(1) Equalises the interaction

(1) Maybe also allow people to type/send messages

(1) Maybe be able to answer without the video

(1) Convenient if you could also open the door

(5) Too much data sharing is uncomfortable

(4) As delivery people it is too time consuming

(3) Too time consuming for owner

(3) I want to see my side of the video as well

(2) As owner it is a bad solution

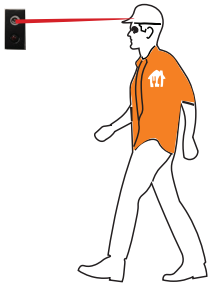
(2) Why is this data important to me?

(2) Vulnerable that others can download data afterwards (when visitor leaves)

(1) Did not realise filming was happening

(1) Feels worse because it is apparent that you are being filmed

No. 7 - Let me work freely



(5)

(5)

(4)

(4)

(6) Nice that you protect people's identity/privacy

(3) Maybe a filter to hide the face instead would be better/more playful?

(4) Safer, more trusting to see the persons face

(3) What if someone steals their hat and misuses it

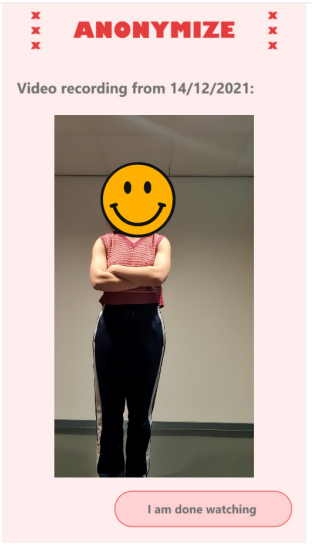
(3) Being filmed is part of being a delivery person

(2) Initially doesn't understand concept

(2) Would not open door without the face

(2) Becomes suspicious

No. 8 - Annonymise



(3)

(3)

(4)

(4)

(8) Nice to get anonymised (personal/a friend)

(3) Amazing if the police can decrypt anonymization if relevant

(2) Nice to see the relevant info in the moment (face), but upload is anonymised

(2) Cartoon faces are good! Better than pixelation, too police-ish

(2) You can probably still recognise a friend or the postman even with the face

(1) More respectable

(1) Clean functionality

(1) Maybe use AI to describe what is happening in the video?

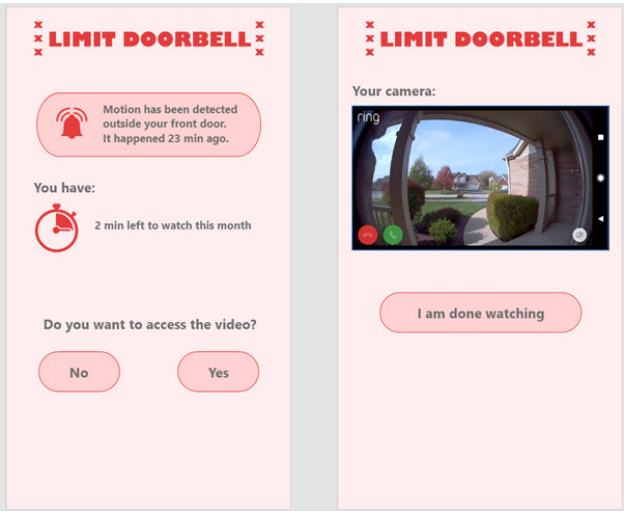
(5) I would be so mad if I see a bad person, but I don't know who it is because it is anonymised

(3) Do I care as a visitor that I am anonymised?

(1) Should anonymise more, full body

(1) How to know it is not a scammer?

No. 9 - Limit doorbell



(8)

(3)

(1) Nice to know as a visitor that the municipality is limiting the use

(2) Reaction might depend on whether you are home or not

(2) Limit creates scarcity effect

(1) Might help if an AI told me what was happening before I looked at the video

(8) I get very mad that my viewing is limited

(5) I assume it is a pay scheme where I need to pay more

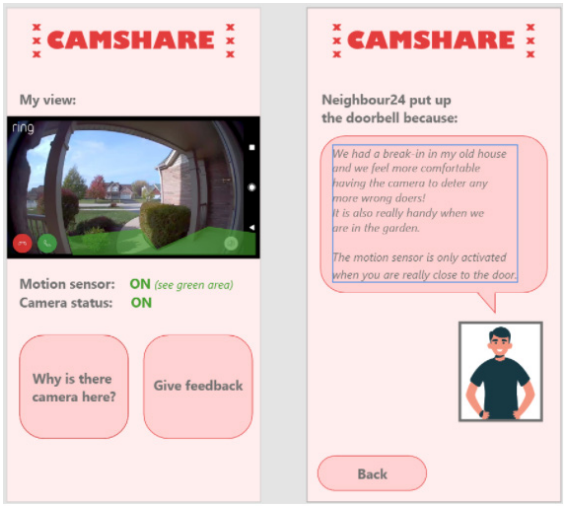
(4) Makes paranoia way worse

(4) Don't know as a visitor if you were filmed or not, so it does not matter

(1) Confusing

(1) Not clear that municipality is involved

No. 10 - Camshare



(4)

(3)

(3)

(5) Nice to know the info

(4) Nice and clear information

(3) Gives me agency to complain

(3) Nice to know neighbour might also record my house

(2) Opens up dialog about setting

(1) You feel included in system

(5) Feel bad/tricked because you have to go to doorbell to be viewed

(3) Wouldn't contract municipality through it (not make problems for others)

(3) Assumes it is showing video in real time

(3) Maybe info can be misused

(3) Would just talk to them

(1) Complicated

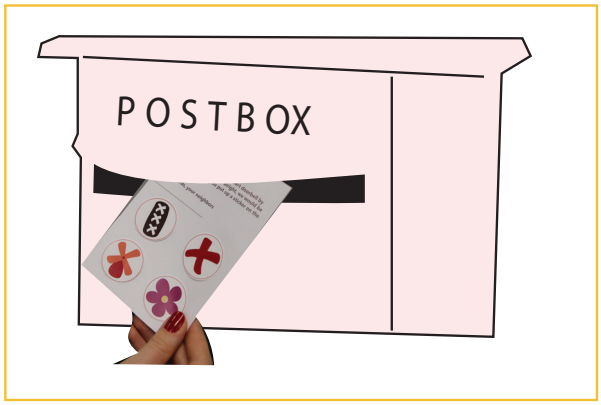
(1) Motivation feels a bit of an attack on the neighbourhood

(1) Not as explicit as the other ones

(1) Would not contact owner through it

(1) The feedback form would just be trolled

No. 11 - Stick it



(5)

(4)

(2) Likes the stickers look/tactility

(2) Feels a bit more confident

(1) Good suggestion if the owner does not use camera

(1) Assumes the different stickers have different meanings

(1) Very circumstantial

(5) Expects it to fail because owner put the camera there for a reason

(3) Understands others need for camera, so wouldn't ask this of them

(2) Feels like attacking/passive aggressive

(2) You should just go talk to them

(2) Could create tension

(1) Useless

(1) If municipality is sending this, they should fix it themselves

Appendix K: Background of posters

13

What does the future of smart doorbells look like?

There are now more than
500.000
smart doorbells in the Netherlands. That is a lot of new cameras inthe city. They are often hard to spot and somtimes films our public space.

While extra cameras can be convenient for the owner and make them feel safer, the data can also be misused - the doorbells can be hacked, people can film their neighbors or maybe just create a general sense of discomfort in the streets.

Can we design the smart doorbells in a different way? A nicer way? A way that still makes the owner feel safe, but also respect the public area?

Experience the alternative doorbells here! Which one would you like in your street?

Op dit moment zijn er meer dan
500.000
slimme deurbellen in Nederland. Dat betekent ook veel nieuwe camera's in steden. Deze nieuwe camera's zijn vaak moeilijk om waar te nemen en filmen soms publieke ruimtes.
De camera's zorgen voor gemak voor de bewoners en geeft een gevoel van veiligheid, de data van deze slimme deurbellen zou kunnen worden misbruikt - de deurbel kan worden gehackt, de buren kunnen worden gefilmd of zorgen voor een ongemakkelijk gevoel in de straat.

Zouden we de slimme deurbel anders kunnen ontwerpen? Zouden we een ontwerp kunnen vinden dat de eigenaren een gevoel van veiligheid geeft maar ook de publieke ruimte respecteerd?
Ervaar nu de alternatieve deurbellen hier!
Welke zou jij terug willen zien in jouw straat?

AMS AMSTERDAM INSTITUTE FOR ADVANCED METROPOLITAN SOLUTIONS
TU Delft

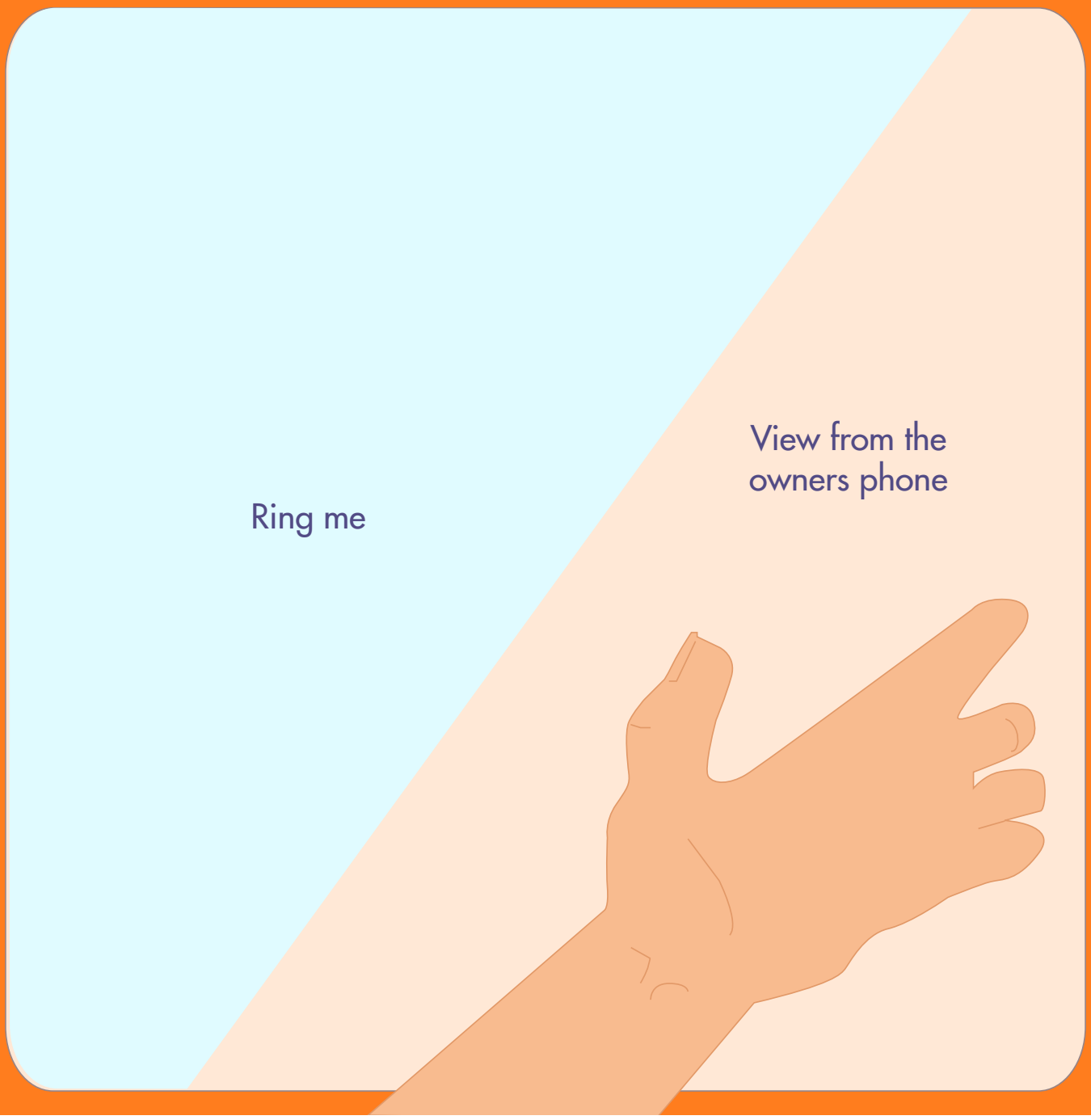
By Sofie-Amalie Torp Dideriksen

Hi, I'm watching

What if you knew when you were being watched?

It can be hard to tell when the smart doorbells are filming or not. Maybe you did not even notice them.
Can we make a design that is more clear? So you always know when a camera is aimed at you.

Het is lastig om te weten of een slimme deurbel filmt of niet. Misschien heb je de deurbel niet eens opgemerkt. Zouden we een duidelijker ontwerp kunnen maken zodat je weet of jij wordt gefilmd?

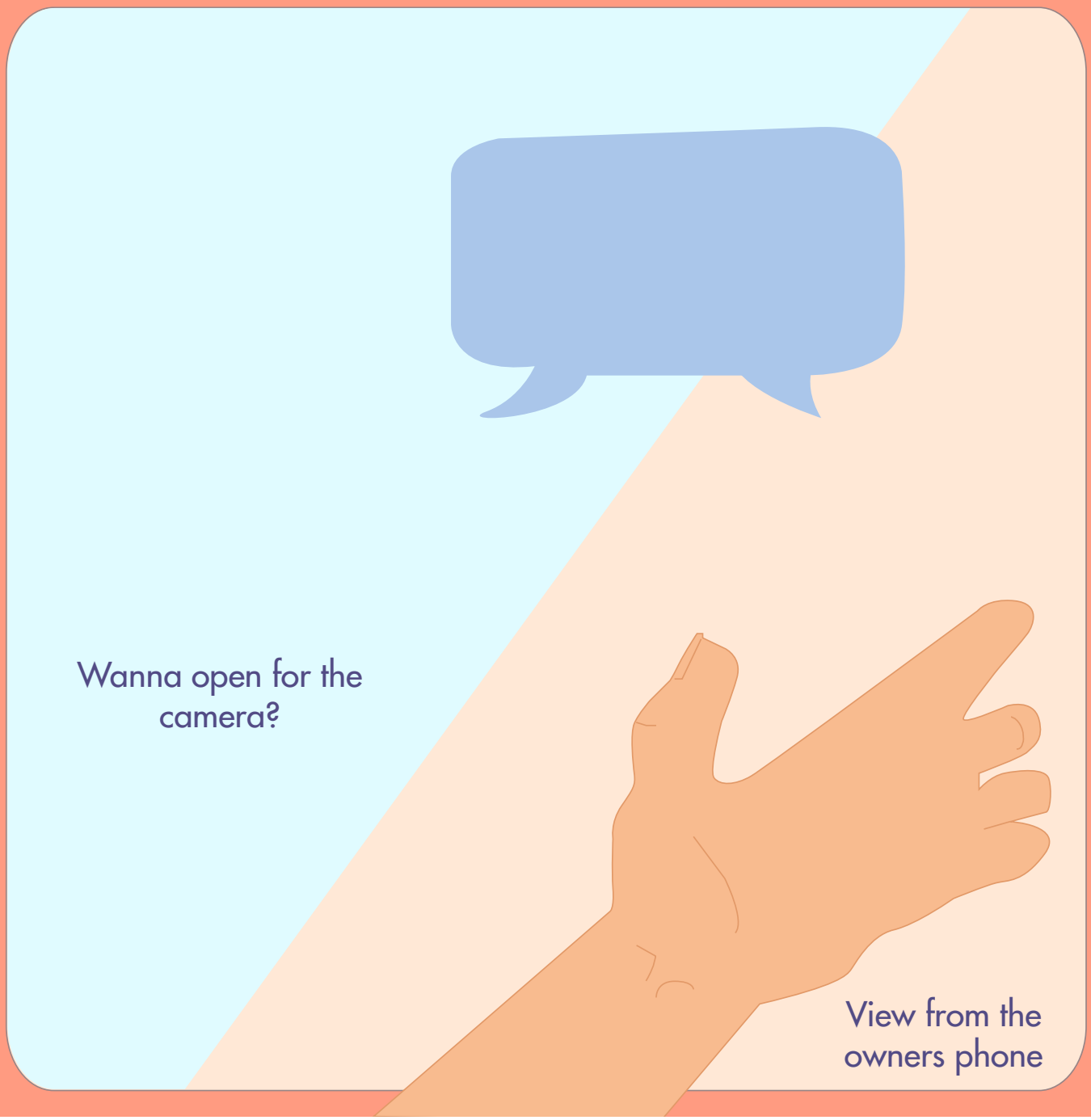


You have a choice

What if you could choose if you want to be filmed?

Some people feel better about opening the door if they know who is standing on the other side. But what if the visitor themselves were the ones opening for the camera? Then you can choose if you want to be filmed - and the owner if they want to open the door.

Sommige mensen voelen zich veiliger als ze weten wie er voor de deur staat. Wat als de bezoekers zelf zouden mogen kiezen of ze gefilmd kunnen worden? Wat betekent dit voor de bewoners?



Let me work freely

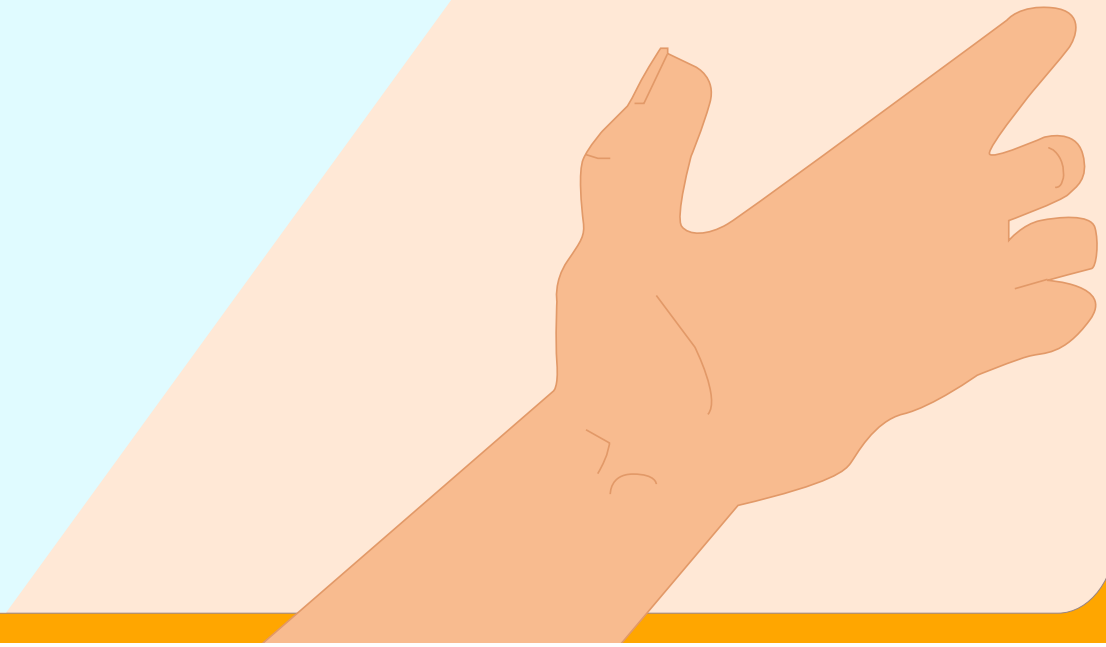
Can we give privacy to people while on their job?

Food, packages, mail - a lot of things are delivered right to our front door today. The delivery personnel who deliver all our items might be filmed several times a day. This data can be used to harass individuals just doing their job or maybe even create deepfake material. Can we protect these individuals from excessive filming?

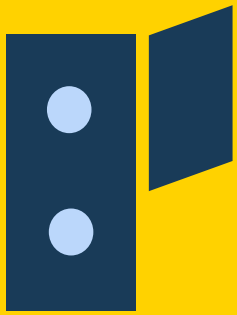
Alles wordt tegenwoordig thuisbezorgd, denk aan eten en pakketjes. De bezorgers van onze bestelling zouden verschillende keren per dag gefilmd kunnen worden. Van dit materiaal zou misbruikt gemaakt kunnen worden. Hoe zouden we deze mensen kunnen beschermen tegen het filmen?

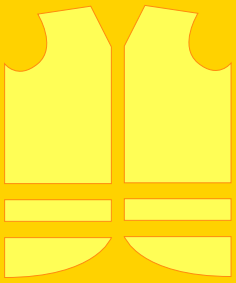
Try me on!

View from the owners phone



Which design would you like to see on your street?





Scan me and tell me why!

Appendix L: Questionnaire for the exhibition

Smart doorbells in Amsterdam - TU Delft graduation project

Dear participant,

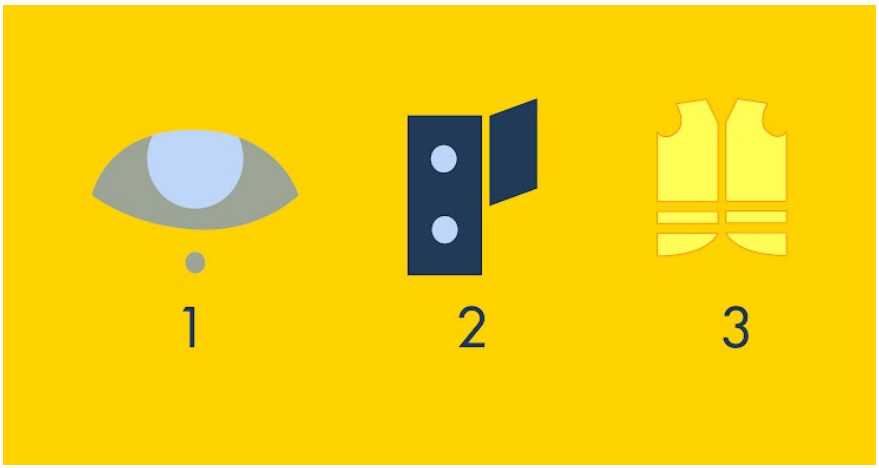
Thank you very much for your time and help in answering this questionnaire. This questionnaire is meant to be answered after you experienced the smart doorbell exhibition in front of AMS - if you have not yet experienced the doorbells, please wait with answering this questionnaire.

My name is Sofie Dideriksen, and I am a graduation student at the faculty of Industrial Design from the Technical University of Delft (TU Delft). The exhibition is the final part of my graduation project.

The questionnaire should not take longer than 5-10 min and is anonymous. I will not be gathering or storing any personal information about participants in any form. The insights from this questionnaire will be used as input to better understand people's perception of smart doorbells in the context of Amsterdam.

Thank you for your time.
Sofie-Amalie Torp Dideriksen

1. Which of the 3 doorbells do you prefer in general?

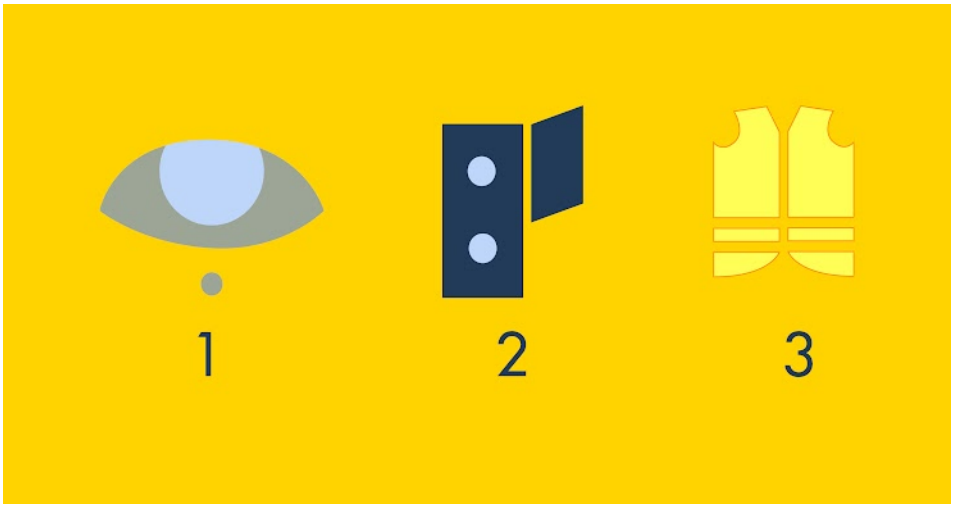


Mark only one oval.

- ◯ No. 1 - Hi, I'm watching
- ◯ No. 2 - Please open the camera
- ◯ No. 3 - Let me work freely

2. Why would you prefer to see that doorbell compared to the others?

3. Which of the 3 doorbells do you prefer the least?

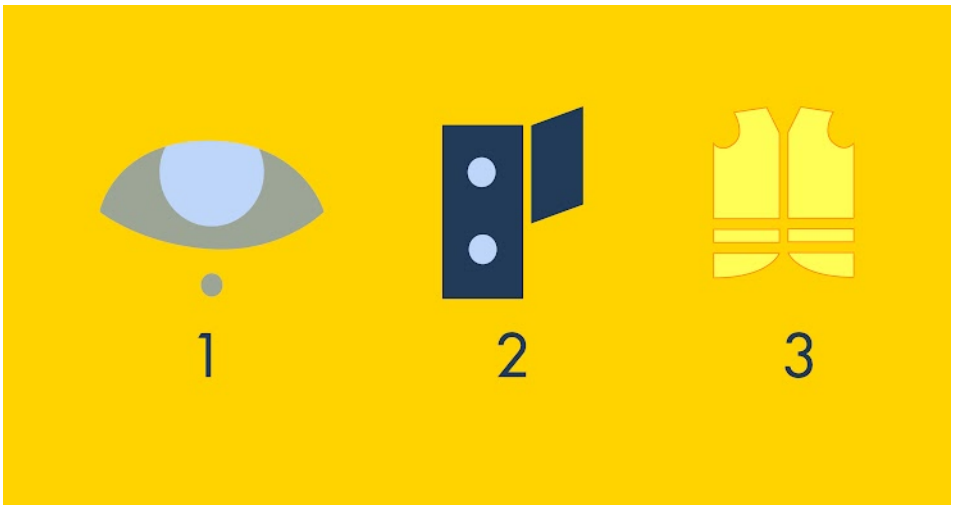


Mark only one oval.

- ◯ No. 1 - Hi, I'm watching
- ◯ No. 2 - Please open the camera
- ◯ No. 3 - Let me work freely

4. Why would you prefer this doorbell the least compared to the others?

5. Which of the three doorbells would you prefer to have as an owner?

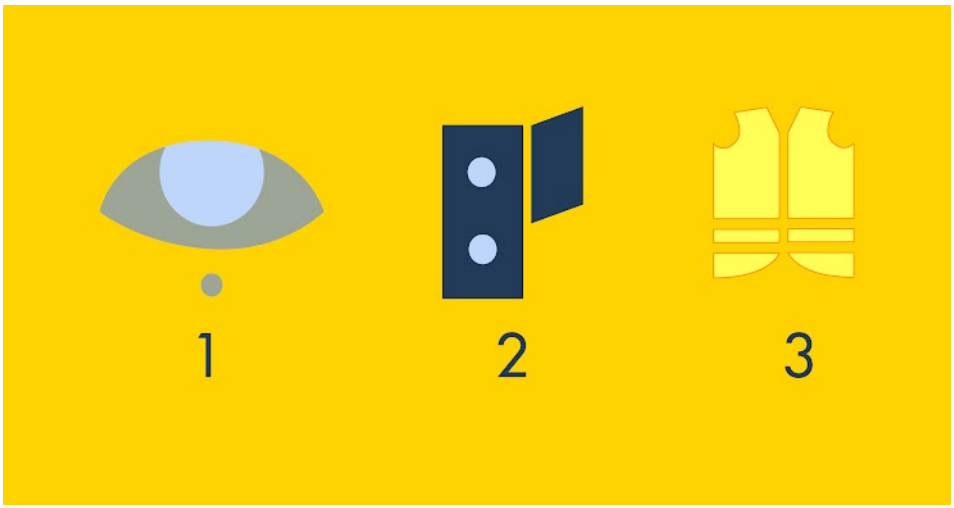


Mark only one oval.

- ◯ No. 1 - Hi, I'm watching
- ◯ No. 2 - Please open the camera
- ◯ No. 3 - Let me work freely

6. Why would you prefer to own this doorbell?

7. Which of the three doorbells would you prefer to interact with when visiting a house?



Mark only one oval.

- ◯ No. 1 - Hi, I'm watching
- ◯ No. 2 - Please open the camera
- ◯ No. 3 - Let me work freely

8. Why would you prefer to visit this doorbell?

9. Were you aware of smart doorbells being present in Amsterdam before the exhibition?

Mark only one oval.

- ◯ No, I never thought about it
- ◯ I have spotted one or two of them before
- ◯ I am very aware of their presence
- ◯ I have a smart doorbell myself

10. What was your opinion on smart doorbells before the exhibition? (if you did not have a previous opinion, please skip the question)

11. Did your opinions on smart doorbells change during the exhibition?

Mark only one oval.

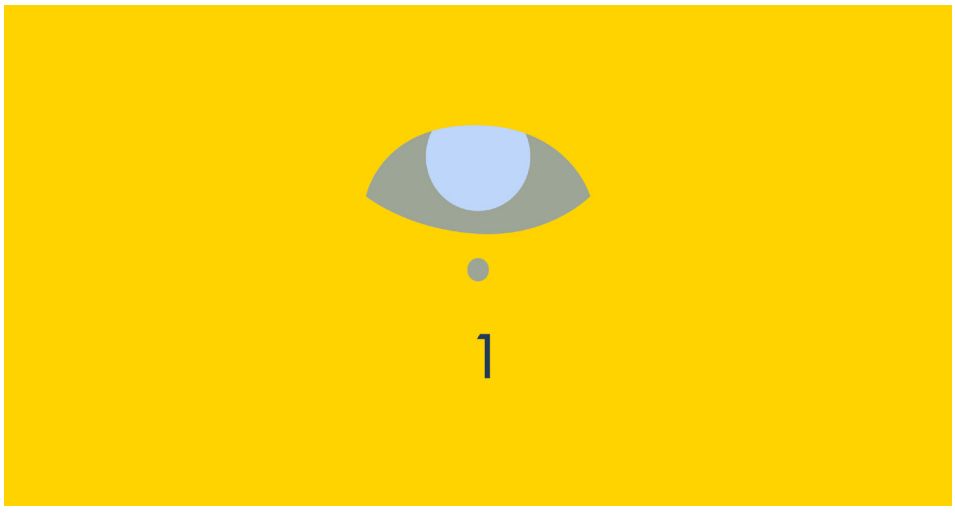
- ◯ No
- ◯ Yes
- ◯ I did not have a previous opinion

12. What is your opinion now

The individual doorbells

The following questions relates to the experience of the individual doorbells.

Doorbell no. 1: Hi, I'm watching



13. How owner friendly would you rate this doorbell? (in regards to user friendly, safety etc.? 1 being not at all owner friendly and 10 being very owner friendly)

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Not owner friendly	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very owner friendly

14. Why did you grade the owner friendliness with that number?

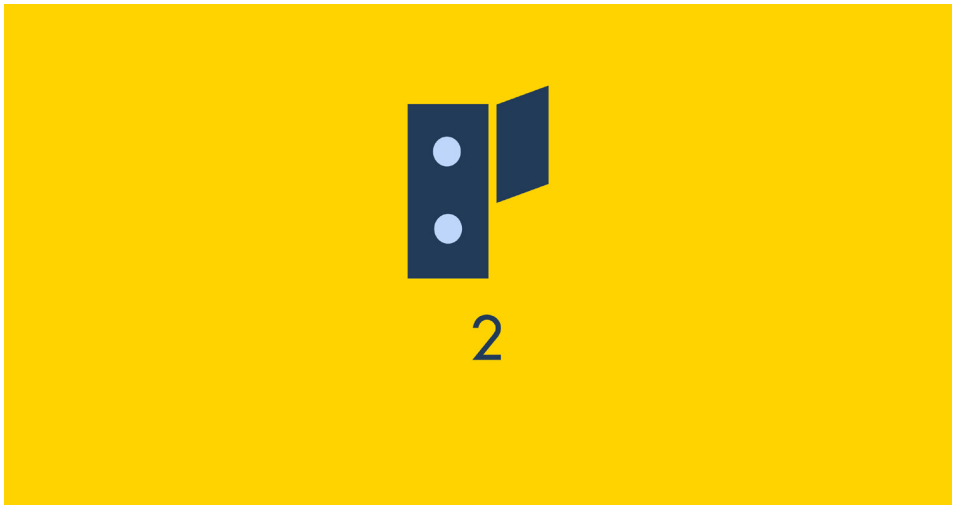
15. How visitor friendly would you rate this doorbell? (in regards to privacy friendly, safety etc.? 1 being not at all visitor friendly and 10 being very visitor friendly)

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Not owner friendly	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very owner friendly

16. Why did you grade the visitor friendliness with that number?

Doorbell no. 2: Please open the camera



17. How owner friendly would you rate this doorbell? (in regards to user friendly, safety etc.? 1 being not at all owner friendly and 10 being very owner friendly)

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Not owner friendly	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very owner friendly

18. Why did you grade the owner friendliness with that number?

19. How visitor friendly would you rate this doorbell? (in regards to privacy friendly, safety etc.? 1 being not at all visitor friendly and 10 being very visitor friendly)

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Not owner friendly	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very owner friendly

20. Why did you grade the visitor friendliness with that number?

Doorbell no. 3: Let me work freely

21. How owner friendly would you rate this doorbell? (in regards to user friendly, safety etc.? 1 being not at all owner friendly and 10 being very owner friendly)

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Not owner friendly	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very owner friendly

22. Why did you grade the owner friendliness with that number?

23. How visitor friendly would you rate this doorbell? (in regards to privacy friendly, safety etc.? 1 being not at all visitor friendly and 10 being very visitor friendly)

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Not owner friendly	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very owner friendly

24. Why did you grade the visitor friendliness with that number?

Ethnography

To end the questionnaire, there is a few demographic questions. All information will be treated as confidential and only used for statistical purposes.

25. What is your age?

Mark only one oval.

- ◯ 15-25
- ◯ 26-35
- ◯ 36-45
- ◯ 46-55
- ◯ 55+

26. What is your occupation?

27. What is your postal code? (This will be used to get an idea of what areas people who experienced the exhibition are from)

28. Do you have a front door facing the front road?

Mark only one oval.

- Yes
- No

29. Do you own a smart doorbell?

Mark only one oval.

- Yes
- No

Thanks a lot for your response!

I hope you enjoyed the exhibition and got to think a bit more about smart doorbells in the city of Amsterdam.

Again, thanks for your responses!
Kind regards
Sofie

30. Lastly, if you have any comments or questions you would like to send my way, feel free to add them here!