The Role of Imagined Sociotechnical Affordances in Shaping Experiences of Privacy in Smart Speakers

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Abstract *Smart speakers are heralded to make everyday life more convenient in households around the world. These voice-activated devices have become part of intimate domestic contexts in which users interact with platforms. This chapter presents a dual study investigating the privacy perceptions of smart speaker users and non-users. Data collected in in-depth interviews and focus groups with Dutch users and non-users show that they make sense of privacy risks through imagined sociotechnical affordances. Imagined affordances emerge with the interplay between user expectations, technologies, and designer intentions. Affordances like controllability, assistance, conversation, linkability, recordability, and locatability are associated with privacy considerations. Viewing this observation in the light of privacy calculus theory, we provide insights into how users' positive experiences of the control over and assistance in the home offered by smart speakers outweighs privacy concerns. On the contrary, non-users reject the devices because of fears that recordability and locatability would breach the privacy of their homes by tapping data to platform companies. Our findings emphasize the dynamic nature of privacy calculus considerations and how these interact with imagined affordances; establishing a contrast between rational and emotional responses relating to smart speaker use. Emotions play a pivotal role in adoption considerations whereby respondents balance fears of unknown malicious actors against trust in platform companies. This study paves the way for further research that examines how surveillance in the home is becoming increasingly normalized by smart technologies.*

1. Introduction

Intelligent personal assistants (IPAs), also known as digital assistants (DAs) or voice-activated personal assistants (VAPAs), have been around for more

than a decade. Such digital assistants have become embedded in different facets of life through different technologies – for instance, in smartphone use, voice assistants like Apple's Siri, Google Assistant, and Samsung's Bixby. IPAs also serve as the user interface of smart speakers, which are operated by direct user interaction through voice commands. Smart speakers have found a place in the intimate space of many homes and are connected to appliances, devices, and digital services (to control lights, curtains, TVs and other media devices, streaming services, thermostats, etc.). Smart speakers are purchased because they offer benefits like convenience, reduced consumption of time and energy, and entertainment (Gram-Hanssen and Darby 2018; Wilson et al. 2017). Smart speakers present opportunities for interaction and information once connected to other smart devices (Chang et al. 2020; Wilson et al. 2017). For instance, a smart speaker can be asked whether it will rain today, to shed light on a trivia question that pops up in a family conversation, or to close the curtains. Through these interactions, smart speakers collect, process, and communicate data, including data about the user (Batalla et al. 2017). Smart speakers thus allow for voice-activated interaction with smart elements of the home while simultaneously collecting potentially sensitive user data, like audio. To explore the societal significance of smart speakers, it is essential to view them as a part of the smart home system and to consider how the use of smart technologies contributes to the datafication of users, their homes, and their private lives (Lupton 2020).

Factors that limit the adoption of smart speakers are cost, privacy, and surveillance concerns (Balta-Ozkan et al. 2013; Wilson et al. 2017). More specifically, smart speakers potentially infringe upon privacy because, through built-in microphones and user profiles, they can collect data from the most private spheres of life (Jacobson 2019; Pridmore and Mols 2020; Wilson et al. 2017). This entails personal data, connected media accounts, linked devices, smartphone use data, internet traffic, use patterns, behavioral routines, environmental information, etc. Moreover, such data is collected on behalf of digital platforms like Amazon, Google, and Apple. Smart speakers are part of platform ecosystems that are increasingly embedded in everyday life. Smart speaker platforms' appetite for ever more personal data feeds into what has been termed the datafication of users, their homes, and their private lives (Lupton 2020).

The research presented in this chapter was conducted in the Netherlands, where the smart speaker market has grown steadily since their launch. Market researchers indicate that it reached the point of saturation in 2022, when 23%

of all households owned a smart speaker (Multiscope 2022, 2023). To provide insights into consumers' considerations, including privacy concerns, when deciding whether to install a smart speaker, our research investigated how users and non-users of smart speakers make sense of smart speaker features, their ongoing algorithmically driven changes, and the potential for data collection across platforms. We make use of the concept of affordances, which are defined as possibilities for action (Evans et al. 2017; Gibson 1979). More specifically, our interest lies in imagined sociotechnical affordances, which emerge in the interplay between user attitudes and expectations, technologies, and the intentions and perceptions of designers (Nagy and Neff 2015). This focus allows us to explore how technological features, user expectations, algorithms, and platform-based design all play a role in shaping adoption considerations and perceptions of privacy. The following question guided our research: **Which affordances play a role in privacy perceptions and adoption considerations of users and non-users of smart speakers?**

Research was conducted with focus groups of users and non-users (N=29) and interviews with family members (N=22), with the sample selected to include users with different financial standings and home contexts. We examined interlocutors' privacy considerations through a constructivist grounded theory analysis. Our study expands upon existing research by including the perceptions of users and non-users and by connecting privacy calculus theory to imagined sociotechnical affordances. This connection makes it possible to fully explore the rational, emotional, and imaginative aspects of privacy considerations.

Our results indicated that the most intense privacy concerns were expressed by non-users, while users seemed more willing to accept potential privacy and surveillance risks. For the latter group, the benefits of smart speaker use outweighed the risks. Emotions played a pivotal role in adoption considerations whereby respondents balanced fears of unknown malicious actors against trust in platform companies. Moreover, non-users' conceptualizations of the affordances of smart speakers were more speculative, as they had often not used the devices in practice, whereas users could draw on their embodied experiences of engaging with smart speakers and utilizing their affordances. Finally, our analysis suggests that the ongoing normalization of smart speaker use can further normalize commercial as well as interpersonal surveillance.

2. Theoretical Framework

Here, we present a review of current research on smart speakers in relation to privacy considerations and the privacy calculus. Subsequently, we explore the imagined sociotechnical affordances of smart speakers.

2.1 Privacy and smart speakers

Concerns about datafication revolve around privacy, a concept that can be traced back to Ancient Greece. Aristotle distinguished two aspects of privacy: *Oikos* and *Polis*. These can be defined as privacy within the social world (Polis) and privacy in the household (Oikos) (Swanson 2019). In this study, we were particularly interested in how individuals negotiate privacy in the Oikos. When using smart speakers, the Oikos becomes visible to external parties. Using smart speakers in the home is perceived to contribute to a potential diminishing or even dissolution of privacy in domestic contexts. Therefore, we conceptualize privacy around smart speakers as the right to exercise true invisibility within and around the household (inspired by Dinev and Hart 2006).

Privacy considerations are, in turn, interconnected with surveillance, with the Oikos becoming subject to commercial data collection through smart speakers. The notion of surveillance can be broken down into sur (from above) and veillance (to watch) (Galič et al. 2017). Surveillance encroaches upon the privacy of its subjects. In this case, it impacts smart speaker users who (partly unknowingly) disclose data about and from within their private homes. Haggerty and Ericson (2000) introduced the concept of the disappearance of disappearance and emphasized that, in the current societal and digital landscape, it is all but impossible to escape – or disappear – from the view of surveillance. This extends into the home; while the modern single-family home is often considered a haven of privacy, it becomes subject to increased visibility through smart speaker use. More than a decade ago, Deuze (2011) proclaimed that communication technologies have penetrated life to the extent that we no longer live with technology – instead, life is lived in technology. Deeply embedded and ever more pervasive, technology has become increasingly invisible (Deuze 2011). Smart speakers can be seen as impacting life in and around the home.

2.2 Smart speakers and the privacy calculus theory

The decision to adopt a smart speaker follows an evaluation of the perceived benefits, drawbacks, and risks (Kumar et al. 2020). Privacy, security, and surveillance concerns have been identified as aspects that inhibit smart speaker adoption (Kim et al. 2019). How people weigh the risks and benefits of technologies can be understood through the concept of the 'privacy calculus' (Dinev and Hart 2006; Kim et al. 2019), which elucidates the trade-off between affordances and privacy concerns or threats (Smith et al. 2011).

The privacy calculus concept was originally devised to analyze how users negotiate e-commerce (Dinev and Hart 2006). The theory also lends itself well to examining how users and non-users make sense of smart speakers' perceived affordances and privacy issues. In order to make use of smart speakers' capabilities and functionalities, users are obliged to share personal and behavioral data. The privacy calculus framework evaluates perceived privacy risks by assessing the extent to which it is believed that sharing personal information could lead to a negative outcome (Dinev et al. 2006). If levels of perceived trust in the companies that produce and sell smart speakers were to increase, users would perceive lower risk and greater benefit in providing personal information (Shin 2010). Kim et al. (2019) found that when it comes to IoT technologies like smart speakers, customization and personalization options were seen to significantly alleviate risk. Whereas privacy calculus theory has been widely applied to information systems, its application to IoT services has so far been limited, yet helpful (Kim et al. 2019). The privacy calculus theory starts from the assumption that individuals' actions are rational, and thus, that a correlation can be identified between benefits, risks, and actions. However, this is rarely the case, as individuals' purchasing decisions are notoriously at least as emotionally as they are rationally motivated (Kim et al. 2019). If we view such decisions as simply a rational evaluation of smart speakers' benefits versus their (privacy-related) drawbacks, we overlook emotions like the joy of using smart speakers for fun activities, feelings of unease when interacting with a device, or fear of someone eavesdropping on private conversations via smart speaker (Mols et al. 2022). Such emotions can impact privacy perceptions just as much as rational, informed ideas about functional benefits or drawbacks do. In this study, we employed privacy calculus theory in the context of smart speakers in order to distinguish between rational considerations and accompanying emotions.

2.3 Smart speaker affordances

Smart speakers enable users to 'do' everyday practices differently. The concept of affordances provides a means to understand such processes. Affordances are possibilities for action to occur in relations between humans, technologies, material features, and the situatedness of use (Evans et al. 2017, building on Gibson, 1979). This concept is often used in different contexts but is not always adequately defined (for a constructive critique, see, for instance, Evans et al. 2017). In this study we were concerned with sociotechnical "imagined affordances" (Nagy and Neff 2015, 1). Imagined sociotechnical affordances entail material, mediated, and emotional aspects of human–technology interaction whereby the relations between designers, users, and algorithms are formative. Nagy and Neff (2015) define imagined affordances as the features imagined by users based upon their perceptions and (emotional) experiences of technologies. Users form perceptions and conceptualizations of technologies partly through direct experiences and partly through indirect perceptions of how they function – in the case of smart speakers, this means internally as well as linked to internet connections, algorithms, data, and digital ecosystems. These perceived aspects of affordances are considered imagined.

Smart speakers are more than physical objects: they are embedded in digital platforms and invisibly connected to home appliances and digital services. Therefore, the concept of imagined affordances is useful because it takes the sociotechnical background of user perceptions into account. To explain, we tweak Nagy and Neff's (2015) example of Facebook news feeds to adapt it for a smart speaker context. When people ask their Google Home for their daily news updates, they might perceive this update as an objective account of news rather than an algorithmically generated selection of news sources shaped by the designers of the algorithms and the algorithms themselves. The ways users receive their news updates (e.g., via audio only or also on a screen) and the platform ecology that delivers them are the sociotechnical background that needs to be considered when studying an imagined affordance like objective news reporting.

Existing research about smart speakers already offers some insights into affordances. Brause and Blank (2020), for instance, identify "spatial affordances of SSAs [smart speaker assistants] to engage in spatially distributed uses" (p. 8). These include the affordances of potential ubiquity (ubiquitous connections with devices allow for seamless IPA use), controllability (controlling connected devices from one device) and linkability (connecting people

from a distance). Lutz and Newlands (2021) also set out from "an affordance perspective (Evans et al. 2017), whereby affordances are possibilities for action emerging from the relational structure between a technology and the user, intelligent assistants enable interactivity, searchability, and recordability" (Lutz and Newlands 2021: 148). The affordances interactivity, searchability, and recordability are perceived as enabling surveillance practices between family members (Lutz and Newlands 2021).

Earlier work by one of the authors (Mols et al. 2022) built on these studies by adopting recordability from Lutz and Newland (2021) and controllability and linkability from Brause and Blank (2020). In addition, Mols et al. (2022) introduced the smart speaker affordances assistance, conversation, and locatability, and explored how these affordances were related to potential users' privacy concerns. They found that security concerns were associated with locatability; the connectedness of smart speakers to homes and personal spaces was seen as a potential breach of privacy. Controllability offers control over devices and appliances and the assistance affordance allows for assistance with daily tasks (Mols et al. 2022). However, potential users feared that digital platforms could infringe upon their intellectual privacy and curtail their control over their personal information. Surveillance concerns revolved around conversation and recordability; these affordances inspired fear of third parties listening in (Mols et al. 2022).

Because of the current study's focus on emotional aspects of privacy calculus considerations, it is important to include social aspects of smart speaker use. The concept of connectedness provides a good basis from which to explore social dimensions (Lee et al. 2017). While Lee et al. do not describe connectedness as an affordance, it is closely associated with the affordances controllability and linkability. Lee et al. (2017) distinguish between inner social connectedness and outer social connectedness. Inner social connectedness refers to connections in a smart home environment made between the user and smart home devices (in the same vein as controllability). By contrast, outer social connectedness, similar to linkability, focuses on how smart home devices facilitate connections between smart home users and others (Lee et al. 2017). Smart speakers can facilitate perceived companionship by enabling connections with others and with technological entities (Lee et al. 2017). In this light, smart speakers can afford users with a means to combat loneliness by connecting individuals living in solitude, such as the elderly (Ehrenhard et al. 2014). In this chapter, we reflect on all of the abovementioned affordances

and social connectedness and show how they are perceived by users and non-users of smart speakers.

3. Methods

This study aimed to investigate the privacy perceptions of users and non-users of smart speakers through a dual-methods approach deploying interviews with parents and young teenagers in Dutch families (N=22) and focus groups with university students (N=29). Our data were collected in 2021.

3.1 Student focus groups

With the 29 university students, we conducted four focus groups of 5–8 interlocutors. The sessions lasted 60 minutes on average. Focus groups enable respondents to engage in meaning-making together and to generate rich and thick data (Peek and Fothergill 2009). The focus groups were moderated in a semi-structured manner and aimed to foster open discussions. Due to COVID-19 restrictions, the sessions were conducted online via Zoom. Stewart and Shamdasani (2017) observe that online focus groups generate better results than offline ones because respondents perceive the online setting to be more informal. In our research, we also experienced active and open engagement from all research participants in the online focus groups. The student participants, aged 18–26, were recruited by voluntary sampling. They were not obliged by their university or course to take part in the study, nor did they receive any academic credits or monetary rewards. The voluntary participants remarked that they were interested in discussing topics of privacy in relation to IPAs. Following recruitment, we filtered participants based on whether they were users or non-users of smart home technologies. Consequently, we held two focus groups with users only (FG 1+2), one with non-users only (FG 4) and one mixed session (FG 3). This approach was selected so that group sessions could focus on discussing participants' own experiences with smart home devices or on adoption considerations respectively. Furthermore, we were also interested in the exchange that a mixed group with both users and non-users would generate. Of the students, 14 were users and 15 non-users, as can be seen in Table 1. To instigate the group discussions, each session began with the screening of a video about the Google Home smart speaker (Peek of

the Net 2017). The subsequent discussion revolved around actual and potential uses, benefits and risks, and adoption considerations.

Table 1: Overview of focus group respondents

Pseudonym	Male/Female	Age	User/non-user
FG 1:			
Mike	M	18	User
Rutger	M	18	User
Ron	M	20	User
Renato	M	19	User
Ralf	M	22	User
Lotte	F	20	User
FG 2:			
Lex	M	24	User
Lance	M	22	User
Harold	M	24	User
Hans	M	20	User
Holly	F	19	User
Stan	M	20	User
Lars	M	22	User
FG 3:			
Sander	M	21	User
Sem	M	21	User
Mara	F	19	Non-user
Mario	M	19	Non-user
Mohammed	M	19	Non-user
Maria	F	19	Non-user
Mako	M	19	Non-user
Maarten	M	19	Non-user

Pseudonym	Male/Female	Age	User/non-user
FG 4:			
Mariana	F	19	Non-user
Rudolf	M	20	Non-user
Ryan	M	23	Non-user
Lara	F	24	Non-user
Harry	M	21	Non-user
Harriette	F	22	Non-user
Silvia	F	21	Non-user
Stefan	M	20	Non-user

3.2 Family interviews

We interviewed nine Dutch families (a total of 11 parents and 11 adolescents aged 11–15), as shown in Table 2. To maximize diversity in the sample (Patton 1990), families with different constellations (such as nuclear families, single-parent families, and a foster care family) were included. The families were recruited via (extended) personal networks and snowball sampling. Although we had prepared one interview framework for the parents and one for the youth, we adapted the interviews according to which family members were present, which varied between families. More specifically, some interviews were conducted with the parent(s) and youth separately, whereas other families preferred to be interviewed together. Above all, we aimed to interview family members in a situation that they felt comfortable in. Nine interviews were conducted in the family homes, and four via Zoom. The interviews focused on social media practices, parental monitoring, family interactions, COVID-19 lockdowns, and, most importantly, smart technology use.

All the respondents signed a consent form (the parents also officially approved their children's participation), and the research was conducted in accordance with the ethical guidelines set out by the Erasmus University Rotterdam. The focus groups' discussions and the interviews were transcribed verbatim. We pseudonymized the respondents and removed potentially identifiable information. Subsequently, the transcripts were analyzed in Atlas.ti through an inductive grounded theory approach consisting of (1) open coding, (2) ax-

ial coding, and (3) selective coding (Charmaz 2014). For this study, we filtered out the open codes related to smart speakers. We clustered the open codes of the focus groups and interviews into axial codes (the subthemes in the results section) and selective codes (benefits and risks inspired by privacy calculus theory). Through the triangulation of the findings of the focus groups and interviews, we were able to provide a thorough insight into privacy considerations around smart speakers.

Table 2: Overview of interview respondents

Family	Interview	Pseudonym	Role	Age	User/Non-user
1	1	Paul	Father	42	Users
	2	Parker	Son	13	
		Tim	Son	11	
2	3	Nadia	Mother	42	Users
	4	Ellie	Daughter	12	
3	5	Fiona	Mother	44	Non-users
		George	Father	42	
	6	Jill	Daughter	13	
4	7	Joel	Father	48	Non-users
	8	Scott	Son	14	
5	9	Greta	Mother	43	Non-users
		Jack	Son	13	
6	10	Abby	Mother	39	Non-users
		Naomi	Daughter	12	
7	11	Oscar	Father	49	Non-users
		Grace	Mother	43	
		Lucy	Daughter	15	
8	12	Camila	Mother	45	Users
		Jasmin	Daughter	13	
9	13	Lydia Eli Faith	Mother Son Daughter	45 12 11	Users

3.3 Methodological limitations

Despite the measures mentioned above taken to tackle methodological shortcomings and research bias, this research is not exempt from limitations. First, it is specific to the Dutch context, so its findings might not be applicable to other sociocultural contexts. The introduction of smart devices into private homes is, however, not unique to the Netherlands. By providing insights into experiences made in the Netherlands, we contribute to the growing global body of literature on privacy and smart speakers. Second, some of the research was conducted during the COVID-19 pandemic. This made it more difficult to recruit participants and meant that some of the research had to be conducted remotely, via Zoom. However, as described in the method section, we view this as a strength rather than a weakness, because online focus groups often enable respondents to feel more comfortable to share their experiences (Stewart and Shamdasani 2017). Combining data from online focus groups with interviews in family homes also enabled us to reflect on contextual factors in our interpretations of the transcripts. Finally, the research focuses on families and students, two groups that are of particular interest because young people and children are the customers of the (near) future, and their adoption considerations are therefore significant. However, future research should also consider older populations that may use smart home technologies for assistance or support. Their adoption considerations entail a need dimension not at play in the population under study in this chapter.

3.4 Connection to prior research

To allow insights into how privacy perceptions evolve during the processes of domestication of smart home technologies, this study refers back to prior research by one of the authors, which took place in 2018, before the introduction of smart speakers in the Netherlands, and was conducted with six focus groups comprised of university personnel (Mols et al. 2022). At the time of data collection of the study presented here (2021), smart speakers had meanwhile become widely available. Hence, it had become possible to study how interlocutors' privacy perceptions were shaped by experiences of actually using them, as well as exploring reasons for reluctance to use smart speakers. The study presented in this chapter thus provides updated insights into the imagined affordances identified in the 2018 study. In the conclusion, we reflect on the changes we observed in user perceptions and imagined affordances between the two studies.

4. Results

The analysis entailed the identification of several benefits and risks in accordance with privacy calculus theory. These benefits and risks revolve around specific imagined affordances, which form the sub-themes in this results section.

4.1 Controllability affordance

In relation to the affordance of controllability, participants reported various benefits as well as perceived risks of smart speakers in and around the home. The controllability affordance affords users the capability to control interconnected devices and appliances via one device (Brause and Blank 2020). Controllability was perceived by most users as a positive affordance: it was essentially the main reason why they had purchased a smart speaker. In the introductory round of one of the online focus groups, Renato (19, user) gave a live demonstration of the voice-activated lights in his room that were connected to his smart speaker, exemplifying controllability. When people use smart speakers to make their homes smart, they install interconnected devices that require transmission of personal information in order to be controllable. In the focus groups, respondents reflected on how controllability affords convenience for users in the home (supporting the findings of Chang et al., 2020; Gram-Hanssen and Darby, 2018). As Ron (20, user) put it: "The most important part is saving time and integrating these technologies in your life, making it very efficient and easy." Sander (21, user) illustrated the ease of use: "It removes a lot of hassle from daily things. For example, you do not have to open your computer or your phone to check flights, things are ready for you."

Some student users speculated that controllability would be even more useful for families. Stan (20, user) remarked: "For example, not right now, but if you have a family and busy lifestyle, then it [a smart home] is helpful, convenient and can save you a lot of time." The student focus groups with users and non-users brought together young adults who did not have their own children. Nevertheless, users perceived the increased controllability in the home as a great advantage of IPAs.

The family interviews provided insights into some families' habits of delegating household tasks and actions to smart speakers. Paul, father of two sons, described how smart speaker use was embedded into their everyday family life:

> We play music on different speakers, and sometimes we fool around with questions like 'imitate a dog'. And, well, actually, all of us use them [smart speakers] every day. We broadcast things, we turn the lights on or off. We never use switches or power outlets in the house anymore, we do all of that with those Google Homes. (Paul, 42, user)

While controllability was perceived by users as a beneficial affordance, a fear of losing control was expressed by non-users. "There's just information that's private and that's somehow used elsewhere. But, but just the feeling that you kind of have no control over it, that you don't know, that, that actually puts me off." (Joel, 48, non-user). Similar sentiments were voiced among students: "These kinds of things create an excessively big dependency, everything that the people are doing, they depend on this little machine." (Silvia, 21, non-user). Users spoke about control directly in terms of imagined affordances. In contrast, non-users seemed more concerned about a different aspect of control: in relation to the process whereby personal data is imagined to be collected, controlled, and manipulated in unknown ways by unknown agents. While greater control over the home (such as controlling energy consumption) was praised by users among our respondents, echoing the findings of prior research (Balta-Ozkan et al. 2013), it became clear that non-users often perceived the delegation of home control in the form of controllability as a daunting prospect. Hence, there are two dimensions of controllability at play. One dimension is experiencing a sense of having direct control over the home via a central device. The second is that the processes that enable this form of control are invisible to users and thus can only be imagined. This unseen back end is what creates a sense of lack of control, specifically, concerning the ways smart speakers use data.

Moreover, in debates about controllability as an imagined affordance, platform operators are often explicitly mentioned. For users as well as non-users, whether data collection is considered acceptable or not relates to perceived levels of (dis)trust in smart speaker providers like Google and Amazon. More specifically, concerns were raised by our participants about how collected data is handled, processed, and stored. As this remains a black box phenomenon for the vast majority of users and non-users alike, trust in the companies involved plays a crucial role in how the imagined affordance of controllability is weighed up. For instance, Ryan (23, non-user) expressed trust: "Google is responsible for the data… I would rather have trust in a company such as Google," while Sem (21, user) voiced distrust: "Google can collect information on what you're do-

ing, and what you like to do as well, which I think can be very scary." Trust is thus a significant component of the emotional aspects of this imagined affordance and is heavily dependent on the perceptions and experiences of the user or non-user. These perceptions crucially influence associated trust levels that shape interactions with smart speakers.

4.2 Assistance affordance

Many respondents described how smart speakers can increase convenience and make certain practices and household tasks easier. This is clearly illustrated in the examples discussed above in relation to the controllability affordance. Yet, there is a further dimension, which is about how smart speakers can assist people in their everyday lives. The assistance affordance (Mols et al. 2022) relates to how smart speakers assist with daily tasks and offer general user support. While controllability focuses on controlling the home environment, assistance provides support across a variety of tasks, stimulated by either human or technological input. Sander (21, user) described this: "It removes a lot of hassle from your daily tasks; for instance, you do not have to open the computer to check your flights; it [Google Home] does it for you." Ron (20, user) elaborated: "When you integrate these technologies into your daily life, it can make it a lot easier for you and save time." Smart speakers can function as personal assistants that makes the lives of users easier.

In a more negative light, non-users in the family interviews speculated that such assistance could have unwanted outcomes, which mainly revolved around users becoming too dependent or lazy. George (42, non-user) remarked: "I have colleagues who say, 'Hello Google' for everything, 'Google turn on the heating, the lights and play some music'." Fiona (family non-user) shared this view: "I think such practices where you become reliant on smart speakers to do certain actions for you can make you lazy." Therefore, while smart speakers offer users assistance in mundane tasks, such as switching on the lights, this was often perceived (by non-uses) as potentially making users lazy. Such considerations were also discussed in the focus groups with students. Harriette (20, non-user), for instance, commented that with assistance from smart speakers: "We would get so lazy and do nothing all day." Notably, the assistance affordance invoked stronger (negative) reactions among non-users than among users.

4.3 Conversation affordance

Smart speakers afford inner social connectedness by facilitating connections between users and their smart home devices (Lee et al., 2017). This conversation affordance provides benefits but is also accompanied by concerns about risks (Mols et al., 2022). Benefits are seen primarily in the aspect of saving time, as observed by users and non-users. Stan (20, user) believed that talking to technology can save time: "It also saves time since if you have a question, you can just ask instead of looking at your phone, and while asking, you can still do something else." Furthermore, in families, smart speakers are sometimes used to interact with family members. Paul (42, user) explained: "We sometimes broadcast through the Google Homes. So, then we don't have to scream upstairs, but then we can just ask 'Hey Google, broadcast…' and then it broadcasts to all devices, in all rooms, you will hear that."

Moreover, functionalities offering comfort and control through voice-activated interactions can simultaneously provide a means to combat loneliness. Verbally interacting with these smart home technologies could be an end in itself. Users of smart speakers perceived this to be a potential significant benefit in specific contexts: "I would see benefits for elderly who are alone at home" (Rutger, 18, user). Previous research on smart home technologies has shown that these technologies can offer particular benefits to users who are considered elderly and have physical limitations (Ehrenhard et al. 2014; Kim et al. 2019).

Some respondents, however, expressed ambivalence about the conversation affordance becoming integrated into family lives. Naomi (12, non-user) described her observation of how, when they become a medium for communication inside homes, smart speakers can significantly impact daily interactions.:

> I visited a family before and there they had everything. There, they said 'Good night, Google,' after which the lights in the hallway and the living room would turn off. They also use Google Home to broadcast to their children when dinner is being served. But I also know families that don't really want any part of that [smart speakers]. So, really, I see both. (Naomi, 12, non-user)

This example illustrates that smart speakers can become an integral part of sociotechnical systems in the home. Depending on how these smart speakers are

employed, they become increasingly involved in intimate contexts. Naomi was unsure whether this was an affordance that families should want, and in the further discussion she also expressed her concern about reliance on technology and the environmental impact of technology use.

While conversation is mainly perceived as a beneficial affordance by users, the interpersonal surveillance (also described as lateral surveillance, Andrejevic 2002) that it enables also evoked ambivalence. Just as Lutz and Newland (2020) warned about surveillance within families through smart speakers, families in our study also reported some negative impressions about interpersonal surveillance and conversation through devices. Jasmin (13, family user) shared an example: "Once me and my friend were watching Titanic at two a.m. Um, and at one point there was some scene that was really loud. That's when my mother heard us, and she activated sleepy music on the Google thing. So, I was like okay, stop, so I disconnected it."

4.4 Linkability affordance

Linkability affords smart speaker users connections with people across distance (Brause and Blank 2020), facilitating outer social connectedness between smart home users and others beyond the home (Lee et al. 2017). Connecting with other users is not a feature that is unique to smart speakers, but was seen as an attractive affordance by students who perceived it as beneficial for their age group (18–25). For example, Holly (19, user) remarked: "It is nice to connect with people of the same age through smart devices such as Google Home, to get the feeling your peers are there with you in the room." Like other communication technologies, smart speakers can connect homes to their users. Linkability enables smart speakers to represent people who are distant as if they are nearby. The value attributed to this by our participants might have been increased by the timing of the research – focus groups took place during the COVID-19 social distancing restrictions. Moreover, many other technologies also offer connections with others. Yet, Holly's quote indicates that when these connections are located in a smart speaker, it offers a sense of proximity which she apparently did not experience through other devices. This emotive experience could offer benefits to people who find themselves far away from friends or family. In other words, linkability can be understood as one of the emotional dimensions of the perceived benefits and risks that are weighed up by (potential) users, because smart speakers can offer a feeling of togetherness

with peers who are not bodily present. This was especially important for the university students who took part in the study during a global pandemic.

Linkability and conversation affordances come together when users broadcast through their smart speakers when they are not at home. Nadia (42, user) described a situation in which she broadcasted to her daughter from the gym:

> I used it to send a voice memo and then it would sound 'pling plong', and broadcast me saying 'I'll come home in a bit.' But she [her daughter] was completely shocked by it every time I did that. I thought it was very handy, because at that time she didn't look at her phone that much. So, I thought if you don't look at your phone, I'll broadcast it through the house. She didn't like that very much. (Nadia, 42, user)

This example demonstrates how certain users anticipate benefits from the linkability affordance, but in practice, other users may experience its effects in different ways. For Nadia's daughter, hearing her absent mother's disembodied voice emitted by the speaker was apparently more alarming than comforting. Thus, the imagined emotional affordance of linkability seems to be mostly appreciated in situations when physical presence is prevented.

4.5 Recordability affordance

Smart speakers that are operated by voice commands, such as the Google Home, work by processing audible requests and performing actions accordingly. To improve the technological functioning of these products, which are still in development, employees at smart speaker companies listen to recordings to evaluate the products' performance (Jacobson 2019). Some of our study participants were aware of this: "For artificial intelligence to work, it does have to have this feedback, it must hear from us, and then just continue learning more." (Holly, 19, user). Most respondents, however, perceived recordability (Lutz & Newland 2021) as an affordance associated with concerns and risks. For instance, Rutger (18, user) commented: "because it has to listen all the time and you don't know what will happen with your data." If users are aware of and express unease about the underlying mechanisms of data collection, this could discourage potential users from adopting the devices if companies do not adapt their practices in response to the concerns expressed. Our participants proposed several potential solutions; Lex (24, user) remarked that he would even be willing to pay extra for his data not to be used:

> These companies need lots of data to improve their products, but I think that they could do this in a better way like offering a product for free to people that want to participate and do not mind their data being used and offering the options for people to pay a little more to not share their data. (Lex, 24, user)

Now that smart speakers and their capabilities have become an increasingly familiar phenomenon in the Netherlands, both users and non-users have access to information about potential privacy issues. Yet, many users are not concerned and never use the mute function. For example, in the focus groups, a student explained: "Many people like me don't care about these privacy claims and that is why I think I never used the mute button." (Renato, 19, user). Camila (45, user) remarked in one of the family interviews: "Often, I don't even notice that it's there. To be honest, I didn't even know that you can mute it [smart speaker]?". The recordability affordance appears to be of little concern for some smart speaker users.

Responses from other interlocutors in the family interviews, however, indicated that some users evaluate what they know about data collection and potential recordability and ultimately decide that the benefits outweigh the risk. Paul (42, user) explained:

> It seems, but I'm not sure, that people could eavesdrop on a smart speaker because it is connected via the internet and it has speakers in it. So, if you really have something to hide, let's say you work for the police or whatever, well, it's best to turn off the microphone. But I never mute them. I don't have much to hide in that regard, but I don't have very sensitive information either, I am not interesting. What smart speakers can pick up, can't harm us. It's not like I'm going to mention what my PIN is, or how much I have in the bank, I'm not going to say that aloud. So, what could they be eavesdropping on me? (Paul, 42, user)

Concerns about recordability clearly carried more weight for non-users than users: "But if it's 'Hey Google', it listens in all day" observed Jack (13, non-user). His mother, Greta (43, non-user), added: "That's what dad says, isn't it? Yeah, um, my husband says that he wouldn't want a smart speaker for that reason. He has the idea that you are being eavesdropped on."

Recordability is thus an imagined affordance that is perceived as more problematic by non-users than by users. Privacy concerns are significant

enough to form an adoption barrier (Wilson et al. 2017). The imagined character of this affordance is crucial because recordability concerns an unreckonable process whereby data might or might not be processed and shared with third parties, and recordings might or might not be processed (to improve the accuracy of smart speakers or for malicious purposes). This uncertainty makes deciding whether the benefits of a smart speaker outweigh privacy concerns around recordability extremely complex. Thus, the privacy calculus inevitably lacks relevant information. For users, this unknowability may be alleviated by direct experiences of using smart speakers and feeling 'safe'.

While the user considerations around recordability share some resemblances with those around the controllability affordance, they differ in terms of which elements trigger privacy considerations and specific emotions. When it comes to controllability, it is in the context of the user controlling their home environment that some individuals experience a sense of lacking control over the hidden use of personal data. Considerations around control over personal data are fueled by (a lack of) trust in platform companies and are emphasized more strongly by non-users than users. For the recordability affordance, it is more specifically about the way this data is collected through voice recordings. This relates to the emotional experience of fearing eavesdropping by platforms. The idea of an external person or entity listening in on intimate conversations can incite unease among users as well as non-users. Unease is triggered by the feeling of being spied upon by an unknown entity. This imagined unease is not about personal data security but rather about the embodied personal experience of being subjected to invisible auditory surveillance.

4.6 Locatability affordance

In the family interviews, non-users expressed concerns about security. They feared that their privacy would be breached if a smart speaker was traceable to their home. As in our previous research findings about the locatability affordance (Mols et al. 2022), the risks raised mainly revolved around direct invasions of the private sphere by burglars and hackers. As George (42, non-user) put it: "You make it easier to break in, right? Yes, because if those smart speakers are connected to your network, that makes you more and more vulnerable for people to access." Concerns relating to hacking were also voiced by student users. Ralf (22, user) reflected:

> I am wondering what would happen if someone hacked into that speaker and could listen along and what they could do with that kind of information. It would be easy to find out that way, who your family members are, where you work or whom you have a relationship with. Even bank accounts if you use your Google Home to transfer money. (Ralf, 22, user)

The unreckonable threat of unknown interference clearly caused concern. Both non-users and users perceived unknown hackers as a greater threat than the platform owners that tap into vast amounts of data every day. The concerns raised express an imagined threat of malicious actors gaining access to one's home – digitally as well as physically. Imagining risks and threats involving malicious actors and their unreckonable potential actions evokes strong emotions.

5. Discussion: Adoption Considerations

The privacy calculus theory offers an insightful perspective on smart speaker adoption considerations by focusing on (potential) users' weighing up of perceived benefits against perceived risks. Users experience affordances such as controllability and assistance as beneficial. Although both users and non-users are cognizant of potential privacy risks, users have decided to adopt the devices nonetheless. In other words, affordances such as controllability and assistance appear to outweigh potential privacy risks for users. Whereas such risks lead to non-users' emotionally charged criticisms of smart speakers, users choose to accept the hidden ways their data is handled. As such, through the internalization of surveillance and the incorporation of these devices into their daily lives, users willingly allow personal data to be processed and further transmitted by their smart speakers in exchange for perceived and experienced benefits.

Conversely, many non-users feel that privacy risks outweigh the benefits, and therefore decide not to purchase smart speakers. Locatability and recordability are perceived in association with imagined threats of malicious entities breaching privacy, and controllability can instigate feelings of mistrust in platform companies. This indicates that emotional reactions to potential threats and invisible data collection play a vital role in privacy perceptions. The imagined, unreckonable character of these affordances seems to magnify some of these perceived risks.

When it comes to the affordances controllability and assistance, which users appreciate for their convenience, non-users perceive risks when they imagine intensive use scenarios. They fear that embedding such technology into their everyday (family) lives could lead to a form of technological dependency.

The considerations around the two remaining affordances seem to be less emotionally charged. Linkability is mainly seen as a beneficial way to connect with others. The conversation affordance is evaluated in mixed ways by users and non-users who see practical benefits but also identify reliability and interpersonal surveillance risks.

Notably, while non-users' concerns about privacy risks are often strong enough to limit their motivation to adopt smart speakers, some do not rule out acquiring such devices in the future. Student Rudolf (20, non-user) surmised: "I think that currently there is just too much risk compared to benefits. So, in time, it will improve, and I will consider buying smart home devices." The fundamental limitations of smart speakers were also mentioned in pragmatic evaluations. George (42, non-user) pointed out in one of the family interviews: "Even if you order a smart speaker to start your coffee machine, in the end, you still need to get your cup of coffee from the kitchen," to which his wife Fiona (44, non-user) added "You also need to drink it yourself." A general trend was observed that users and non-users were not always impressed by the current capabilities of smart speakers and what they offer. Yet, the readiness of some non-users to observe the ongoing development of smart speakers and perhaps consider adoption in the future indicates that smart speaker adoption considerations are open to change over time.

6. Conclusion

In this chapter we reported on our investigation into the privacy considerations surrounding imagined sociotechnical affordances of smart speakers. Deploying a dual-methods approach combining in-depth interviews and focus groups, we reflected on several imagined affordances: controllability, assistance, conversation, linkability, recordability, and locatability. These affordances were found to inform individuals' privacy calculus and informed how users and non-users evaluated privacy considerations for smart speakers. Although our findings were largely consistent with those of existing research and our prior study (Mols et al. 2022), we also identified that linkability affor-

dances were particularly highly appreciated during and since the COVID-19 pandemic and that perceived risks are often emotionally charged.

We identified three trends surrounding smart speaker use and adoption. This was based upon an evaluation of several studies conducted during a period of normalization of smart home speakers in the Netherlands. First, the most recent results display a marked normalization of smart speaker use and a relativization of concerns in contrast to our earlier study (Mols et al., 2022). In 2018, focus group participants had expressed more reluctance to speak to a device in their home and some had questioned whether smart speakers were even necessary, or perhaps offered a solution for a problem they did not have. In 2021, participants provided examples of smart speakers having been integrated into everyday (family) life. Users appreciated increased controllability and assistance in the home and expressed less concern about data collection in the private sphere. Non-users, however, continued to voice privacy concerns. This was most pronounced in relation to the controllability affordance: non-users were unwilling to accept the storage and processing of data by big platform companies whom they did not trust. Nonetheless, some non-users' statements indicated that there is scope for their attitudes to change if the technology and/or corporate practices develop in a favorable direction.

Second, discussions about the locatability and recordability affordances showed that perceptions of privacy risks are more influential when fear is involved, indicating that privacy considerations that are emotionally charged rather than rationally based have a more significant impact on adoption decisions. Fears seemed to be less prevalent among users. The privacy calculus theory is typically used to analyze rational evaluations that weigh perceived benefits against perceived risks (Balta-Ozkan et al., 2013). Our research illustrates how influential emotions are when people decide whether to adopt networked technological devices in their private and personal spaces. Privacy concerns intermingle with non-tangible imagined affordances. Yet, the relative importance attributed to benefits and risks can change as perceptions and emotions shift with changing circumstances, personal and societal. In other words, privacy considerations and adoption decisions are always dynamic and in flux.

Third, smart speakers are an example of smart home technologies that can be employed in many ways. Concerns relate to data collection and the processing of sensitive user data by smart speaker platforms. While the linkability affordance results from smart speakers' capacity to mediate human-to-human connections that are experienced positively, it also enables

human-to-human monitoring. Our study showed that the capacity to use smart speakers for interpersonal surveillance within the home also caused concern. With ongoing normalization, such concern may dissipate, setting a potentially harmful precedent that normalizes interpersonal surveillance in private contexts. Simultaneously, linkability increases the public visibility of hitherto private spaces. As these technologies and people's attitudes to them continue to develop, it is crucial that research continues to investigate the influence of smart speakers in the home and how they shape interactions. Future studies would do well to focus on the interactional aspects of smart devices and provide further insights into the situated use of smart devices.

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