

# Personal choices and situated data: Privacy negotiations and the acceptance of household Intelligent Personal Assistants

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## Abstract

The emergence of personal assistants in the form of smart speakers has begun to significantly alter people's everyday experiences with technology. The rate at which household Intelligent Personal Assistants such as Amazon's Echo and Google Home emerged in household spaces has been rapid. They have begun to move human–computer interaction from text-based to voice-activated input, offering a multiplicity of features through speech. The supporting infrastructure connects with artificial intelligence and the internet of things, allowing digital interfaces with domestic appliances, lighting systems, thermostats, media devices and more. Yet this also constitutes a significant new production of situated and sensitive data. This study focuses on how (potential) users negotiate and make choices about household Intelligent Personal Assistant use in connection with their data. This study is based on empirical research in Europe with early adopters in Germany and potential users in the Netherlands. This examination of users' early stage technology acceptance considerations highlights particular practices and choices of users to either preserve their privacy or determine what is acceptable use for their data. Drawing on a simplified version of Unified Theory of Acceptance and Use of Technology 2, a quantitative model for technology acceptance, we demonstrate how acceptance of a household Intelligent Personal Assistants does not imply access to all household data, how users see usefulness in relation to a proliferation of devices, and note the recognition by users regarding the efforts needed for full use and acceptance. The study highlights the complexity of data production at a household level and how these devices produce myopic views of users for platforms.

## Keywords

Smart speakers, household Intelligent Personal Assistants, Amazon Alexa, Google Home, Technology Acceptance Models, privacy, surveillance capitalism

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## Introduction

Negotiations regarding the personal production of data occur within everyday practices. Sometimes these negotiations are more explicit and purposeful and other times they are more subtle, hidden and routine. Choices to share certain information and make use of particular devices or technologies are subject to ongoing personal evaluations. Whilst the production of data across a broad spectrum of contexts, devices, and platforms

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provides new lines of insight into people's lives, these insights are often more myopic than anticipated. This results in the reification of only certain types of consumer behaviour becoming available for ongoing monitoring at both micro and macro levels.

In what follows, we argue that the relevance of everyday personal negotiations that affect the production of data are crucial to understanding platform based analytics drawn from micro level data production and capture activities. This is perhaps nowhere else as evident as in the recent move towards what we elsewhere have called the 'platformisation of the household' (Pridmore et al., 2019 drawing on Helmond, 2015) – specifically the deployment of voice activated intelligent personal assistants by major platforms in the form of smart speakers and screens, which we refer to as household Intelligent Personal Assistants (household IPAs). Three platforms dominate the market at present, Amazon (Echo devices), Google (Google Home), and Apple (HomePod), though the latter is currently a less prominent company in this space. These are supplemented by other companies such as Sonos, Lenovo or JBL that have Amazon or Google's smart assistant built into their devices (Segan, 2019).

Household IPAs have begun to move human-computer interaction from text-based to voice-activated input, supporting a multiplicity of features through speech. They connect other supporting Internet of Things (IoT) devices, acting as speech based interfaces for domestic appliances, lighting systems, thermostats, media devices and more. Though IPAs are a relatively new technology, the increasing use has begun to significantly alter users' everyday experiences with technology and their everyday routines (Schulz, 2019). Much like mobile devices, the growing rate at which IPAs are present in social spaces and settings like kitchens, living rooms, and bedrooms have been significant. With more than 50 million predicted shipments and expected market growth of 56.3 million US dollars worldwide in 2018, household IPAs are currently the fastest-growing consumer technology (Perez, 2018). However, along with these devices comes a significant production of potentially sensitive household data.

Whilst the proliferation of these devices in the United States is fairly significant, they have only recently been introduced in Europe. Given the differences in regulatory environments regarding privacy in Europe in comparison to the United States (where these IPA service providers originate), this study is based on empirical research with early adopters in Germany and potential users in the Netherlands. Evaluating recent and potential users in Europe shifts the focus from largely US centric research on the devices so far, and highlights the novelty of the devices

in these contexts, indicating a shift in cultural expectations and linguistic practices in the production of personal data. Further, the arrival of household IPAs in European contexts brings more into play the *interpretive flexibility* regarding what the use of such devices might be – that is, these devices do not yet have a predominant meaning and a predominant use (see Pinch and Bijker, 1984). Given their reliance on data, they also raise significant concerns about privacy and data protection in relation to their use. This article aims to provide an understanding of current and potential consumers' negotiations regarding household IPA use in connection with personal data. For us, following Oudshoorn and Pinch (2003), users *matter* significantly in the use of technology *and* in the production of data, often in ways that are overseen. This article examines the circumstances of household IPA use before the material equipment, data transmission and social habits become increasingly fixed in the coming years.

In what follows, we detail the emergence of household IPAs against the logic of divergent surveillance capitalism(s), draw on a framework of technology acceptance to interpret our empirical findings and use this to articulate key problematics and potentials of household IPA data production. Whilst users of these technologies invariably agree to the terms and conditions set out by the platform providers, our results suggest that users (will) employ a particular set of practices and choices to either preserve their privacy or determine what is acceptable use of their data.

## Household IPA devices and privacy debates

Up until recently, the everyday use of voice-activated services mainly entailed the use of IPAs on mobile phones. In 2014, smart speakers with integrated IPAs emerged with the first Amazon Echo. Aside from providing basic information on weather, news, sports and entertainment, these devices can be connected to other domestic appliances such as lights, thermostats, and other media devices to help people to control their homes through voice activated commands. With personalised verbal routines like 'Alexa, start my day' or 'Okay Google, good morning' users can combine various functionalities with just one command. Being placed in social spaces and settings in home environments, these devices bring human-computer interaction to a new level – not only regarding usability but also emotionally (Porcheron et al., 2017).

Currently, the most popular household IPAs are Amazon Echo, Google Home and Apple HomePod. These devices have been on sale in the United States since 2014, and Amazon Echo entered the European

market via Germany and the United Kingdom in September 2016 (Trenholm, 2016). Soon the Google Home followed in the UK in 2017 (Hern, 2017). Both Amazon and Google are quickly expanding the availability of their household IPAs throughout Europe, and Apple's HomePod was recently introduced in France and Germany. In the US, already 15.4% of the population owns an Amazon Echo and 7.7% a Google Home, compared to 5.9% and 1.2% in Germany (Brandt, 2018). According to the latest forecasts, an upward purchasing curve can be seen in Europe, particularly in Germany where household IPA purchases grew to 116% in the third quarter of 2018 as compared to the previous year (Tung, 2018).

Perhaps the most important feature of IPAs is that they are able to continually improve through increased use – they learn and adapt to habits and patterns of users, with the ability to self-learn through artificial intelligence (AI) and deep-learning algorithms (Kěpuska and Bohouta, 2018). These developments increase the ease-of-use and convenience, yet also serve to amplify the overall debate about privacy issues (Zeng et al., 2017). Amazon was recently at the centre of public attention as their Echo device unintentionally recorded a private conversation and sent it to a person within the contact list of the owner (Sacks, 2018). This followed an earlier incident in which Amazon devices started laughing suddenly without being activated with a voice command (Zeng et al., 2017). Household IPAs offer privacy settings and controls, yet these are often not aligned with user needs and customs (Lau et al., 2018).

### Platform logics and surveillance capitalism(s)

These incidents expose to some degree that IPAs are gathering and conveying *data* through speech. Smart, always-listening speakers and screens can be seen to exemplify the idea of 'surveillance capitalism' (Zuboff, 2015) by commodifying familial and social spaces and funnelling relevant data from these locations into corporate networks. Zuboff's depiction of a 'deeply intentional and highly consequential new logic of accumulation' which 'aims to predict and modify human behaviour as a means to produce revenue and market control' (2015: 75) is clearly a key motivation behind the push of platform technology companies into this market.

However, it is also clear that the motivations and goals driving the development of household devices vary, and so does the orientation towards the accumulation of data. Amazon appears focused on collecting user data to drive personalised sales across its shopping platform. Amazon's logic behind its Echo devices is to

bring 'frictionless shopping' ever more present to consumers, in connection with its other business practices towards an increasing the expectation of immediate results (Grosman, 2018). Google relies on its vast data-veillance infrastructure in attempting to capture 'micro moments' or intent-driven moments of decision-making and preferences that happen in the home (Ramasmwamy, 2015). The company wants to be present and responsive whenever a searchable query is envisaged no matter the location or context. Providing services in household spaces results in more consumer data for its AI driven advertising. Apple has the higher priced HomePod integrated into its entertainment and productivity devices and applications appealing to those already within its price premium ecosystem.

Although there are similarities in the logic of (data) accumulation and the platforms' attempts to predict and modify consumer behaviour, there is not a singular logic being employed by platforms in relation to households. More importantly, the struggle of users – as detailed below – to determine what these devices are really for, exposes the interpretive flexibility of household IPAs that as of yet have not solidified their purpose. Moreover, the distinctions in platform business models suggest several surveillance capitalisms rather than a singular capitalist logic of accumulation. Regardless of whether these differing orientations constitute a broadening of Zuboff's original concept of surveillance capitalism, or whether IPAs simply demonstrate a singular extension of data commodification into the household, some platforms see household IPAs as key to their future and have invested heavily in their development.

### Technology acceptance models

The empirical research in this study focuses on users' perceptions and experiences. Following the technology acceptance model (TAM) of Davis (1989), *ease of use* and *usefulness* are seen as the primary motivating factors behind technology acceptance processes. TAM provides a framework to comprehend user practices and behaviour, indicating that users are motivated by the promised functions of technology and by their usability to perform particular tasks. This process can be influenced by external factors like personality traits as well as by cognitive factors, technology design, resulting usability, and support options of technology suppliers (Davis, 1989). Technology acceptance factors have been further conceptualised in recent years and many TAM successors are integrated in the 'Unified Theory of Acceptance and Use of Technology 2' (UTAUT2, Venkatesh et al., 2012). UTAUT2 expands the original TAM as it reconfigures the perceived ease of use and usefulness by differentiating between expectations based on performances and effort, between

social, contextual, personal, facilitating, behavioural and practical influences (Venkatesh et al., 2012).

Whilst this TAM provides an important and useful framework to explore user motivations and behaviour, the UTAUT2 model has been predominantly used for quantitative research. However, the logic behind this model allows for both a helpful analysis of qualitative data in this study and the identification of key issues related to IPA data production. It contextualises the choices, experiences and practices of users and is indicative of areas in which users negotiate the potential usefulness and mitigating concerns of household IPAs, particularly in relation to the production of personal data in household contexts.

## Method

This article draws on three empirical studies conducted in the Spring of 2018 in Germany and the Netherlands as part of a broader project about IPAs. The interviews and focus groups were carried out by three different researchers whose work was centrally coordinated and formed a concerted effort to understand IPAs as a new phenomenon and to answer a variety of research questions. More specifically, the interview and focus group guides were created in close co-operation with all team researchers and the interview styles were thoroughly discussed in order to safeguard cohesion in research practices and results. For this publication the transcripts were cross-analysed to illustrate a richer understanding of current and potential consumers' attitudes towards IPA data collection and how these relate to specific negotiations in their (potential) technology acceptance decisions.

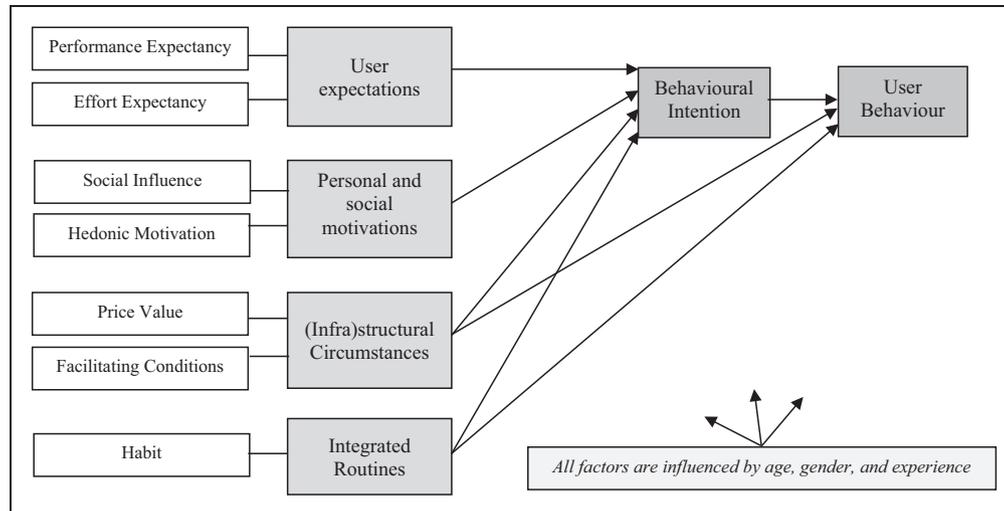
In Spring 2018, household IPAs were available on the German market but not yet sold in the Netherlands. Because smart speakers are still relatively new in Germany, our sample includes nine early adopters in Germany to provide insights in the actual everyday use of household IPAs. These persons were recruited via social media and snowball sampling. The criteria here were that they are German residents who own a household IPA. One-on-one in-depth interviews were the most suitable research method to get an insight into how these individuals used their IPAs on a daily basis as they explored participants' behaviour, attitudes and feelings (Legard et al., 2003). The interviews lasted 55 minutes on average and focused on connectivity and integration of the personal assistant, daily practices and routines, usability and experiences with the personal assistant, motivations, attitudes, emotions, and the future of household IPAs.

As household IPAs were not yet sold in the Netherlands, and to contrast experience following UTAUT2, we invited respondents to try out a

Google Home device and to discuss the potential use of household IPAs. Focus groups are useful for understanding perceptions and decision-making processes (Stewart et al., 2007). Participants are encouraged to engage in conversations, which is particularly helpful when it comes to discussing new technologies with which not all participants are familiar. The group dynamics in combination with stimulus in the form of a commercial and interacting with an actual household IPA (Google Home device) enabled us to fully explore the motivations, perceptions and concerns of the potential users. The focus group guides of both studies started with questions about personal affinity with new technologies, and perceptions and uses of IPAs on mobile phones. To familiarise respondents with household IPAs, a Google Home commercial was screened and discussed. Respondents then had the opportunity to try out a Google Home device (in English) with a list of example questions (e.g. *Turn on the lamp/Play Stranger Things on Netflix/Schedule a doctor's appointment*). After approximately 10 minutes of interaction and collecting the initial reactions, the moderator asked questions about potential future uses, benefits and drawbacks, and sharing personal data with the device. Finally, the discussion was targeted towards the future of household IPAs in light of the integration in everyday lives, IoT and predictive functions.

To maximise diversity with regard to age, occupation and background, study 2 focused on university personnel and study 3 on young adults (students and young professionals aged 20–30). University personnel was recruited via a university wide survey distributed via university email and the young adults were approached through snowball sampling. All focus group participants were living in the Netherlands, yet the sample also includes some international employees and multiple international students. These participants had varying degrees of familiarity with IPAs on phones and in household devices. A total of 57 respondents participated in 11 focus groups, which lasted approx. 60 minutes. See Appendix 1 for more details about the interview and focus group participants.

Household IPA routines	Trust towards platforms
Usefulness household IPA	Personal data indifference
Use conditions household IPA	Personal data concerns
Personal interactions with household IPA	Concerns about platforms
Fun household IPA	Privacy concerns
Technical issues	Privacy / security
Consequences integration daily life	Privacy protection
Control over household IPA	



**Figure 1.** Simplified and clustered UTAUT2 model.

Recordings of the interviews and focus groups were transcribed and anonymised (names indicated are pseudonyms) and this data was collated and analysed. This thematic analysis process (Braun and Clarke, 2006) helped us to determine particular key themes which we connected to our simplified UTAUT2 model in order to fully understand participant responses and key issues in (potential) household IPA acceptance and use. The key themes identified in the analysis are:

### Results: Contextual practices in the home

The seven influencing factors of technology adoption within UTAUT2 are described by Venkatesh et al. (2012) as performance expectations, effort expectations, social context, facilitating conditions, hedonic desires and needs, price value and habits. By clustering together several of these influencing factors, we can identify the negotiations and choices of (potential) household IPA users. Figure 1 presents our simplified and clustered model targeted towards qualitative analysis (an expanded and more quantitatively focused model is available in Venkatesh et al., 2012). In what follows, our empirical results indicate the complex relationship users have with these devices and the key issues this generates in terms of the data production.

#### *User expectations*

Technology use is preceded by user expectations about performance and effort. These are established on the basis of many factors, including peers, commercials, reviews, and previous experiences (Venkatesh et al., 2012). Whereas German interviewees were actively

using household IPAs, not all of the Dutch respondents had expectations about the technology. As noted, focus group participants were shown a Google Home commercial and tested a Google Home device to help establish expectations about the technology. In this section, we mainly focus on the expectations of the Dutch potential users.

Some of the potential users were certain that household IPAs have value. They expect that the use of a smart speaker will provide benefits in controlling household equipment and enabling multitasking:

I think it is hands-free and connectivity, because with this one device you can connect everything. Basically, you have full control of your home and what you want to do with your home, so that's one positive side. (Boni, potential user)

However, other interviewees were more sceptical about the added value Boni sees. For example, Leo (potential user) believed that household IPAs are 'handing me a solution while I don't have a problem.' These initial reactions to first interactions with a household IPA and the Google Home commercial showed that some potential users (about a fifth of the Dutch respondents) interpret household IPAs as useless and superfluous.

Expectations about the ease of use of a technology are a key factor in acceptance (Venkatesh et al., 2012), and many of the potential users were critical about the expected ease of use of household IPAs. Hannah expects that she will face a number of issues:

Those systems are not that well-adjusted. Yes, in a commercial like that, I understand that they make it

look so nice and smooth. But it makes you wonder what percentage of people have actually fine-tuned everything so that it is possible? (Hannah, potential user)

Hannah thinks that few people will make an effort to adjust and synchronise accounts and systems in order to control them with a household IPA. Moreover, Lucas also expects that the user has to work on their communication skills in order to use household IPAs efficiently:

Also, the way of communicating is ah... you have to keep an overview as a person. You can't... if we as humans communicate here, I can just give you a very complicated task or I can pose you a simple question with a lot of implicit information, and then you'll know exactly what you should do. And that is not the case with these devices. So a question has to be direct. (Lucas, potential user)

Respondents expected to work or train themselves to create ease of use. In order to interact with household IPAs via voice commands, users need to make sure their commands are tailored towards system requirements. These requirements constantly change because platforms use AI and deep-learning algorithms to optimise and adjust household IPA responses and interactions in real-time (Kěpuska and Bohouta, 2018). Potential users foresaw that labour is needed on their part in order to be able to effectively use household IPAs. These expectations align with the actual practices of multiple German respondents, who actively train themselves and put effort in their use. German interviewee Florian explains:

Well, the usability is quite bad. However, I do not expect that the product is already perfect because it is a new technology that is not fully developed. All people who are using voice assistants are still beta-testers, and you should be conscious of the fact that this is an unfinished system. (Florian, early adopter)

The experienced usability issues match Florian's expectations for new technologies. He is comfortable with being patient and inventive in his use of the device, aligning with an early adopter mentality of being motivated to try technology when the potential value is still uncertain. Other studies suggest that after the initial use, IPA engagement tends to diminish over time (Luger and Sellen, 2016). It is not yet clear how many users would be willing to invest time and energy in setting up these household IPAs if they do not yet see a clear use.

### *(Infra)structural circumstances*

The acceptance of new technology is mitigated by many factors, but a crucial influencer is price consideration. Potential users weigh the perceived benefits of the technology against its monetary costs (Venkatesh et al., 2012). In early 2019, standalone smart speaker prices ranged from €29.99 (Amazon Echo Dot) to €349 (Apple HomePod; Segan, 2019). Many interviewees considered smart speakers to be affordable, and for them the perceived benefits seem to outweigh the monetary costs at the lower price range. However, some potential users were concerned that one standalone smart speaker does not create convincing benefits on itself. Mark was concerned that you need at least three speakers to be able to use the household IPA effectively:

You need more points to be able to easily talk to it [the household IPA] and that can get pretty expensive... If you need three devices, for the living room, the kitchen and possibly the hallway or bedroom, that will cost you quite a lot of money. (Mark, potential user)

That this expectation is more widespread is visible in the fact that seven out of nine German respondents used more than one household IPA and installed these in different rooms in their house.

In order to fully make use of effortless integration of voice-operated household IPAs, users not only need to install multiple devices, but these also need to be connected to a myriad of household appliances. Potential users expect their household IPA to be connected with lamps, smart TVs, curtain rods and coffee machines. As Kim notes, the connective nature of the device brings additional costs:

But for me it is not really attractive because you have to put a lot of money into it to buy the specific lamps that also work with it and then for example curtains or something... I think, yes, it all sounds very fancy and fun but if I want to put the energy, time and money into it, that is something else. (Kim, potential user)

In order to facilitate more interconnected use of a smart speaker, users need 'connectable' home appliances (thermostats, lights) and services (Netflix, Spotify). As Kim describes, these bring additional costs, but also require time and energy to set up. Users need to invest energy in installing different devices and connecting them to appliances and services.

Although not normally seen as a key structural consideration in TAMs, data collection processes raised another type of 'cost' concern for users. IPAs listen for their trigger words, after which they record requests and

collect user data. This data is used to optimise the IPA functions in general (Kěpuska and Bohouta, 2018) and allows for more personally tailored functionality. The data is also used for commercial goals (creating consumer profiles, targeted advertising, etc.), and the data collection and personalisation processes were perceived as opaque, creating particular concerns for (potential) users. Interviewees worried that household IPAs record conversations, noises and sounds when the trigger word is not used. Dutch potential users expressed the fear of the platforms listening in and mainly based their concerns on these types of stories. Babette and Rick (potential users) shared examples of friends that received specific ads about robot vacuum cleaners and snorkelling after discussing them in private.

For some potential users the fear of devices listening is a reason not to trust or want to buy the device – e.g. Olly (potential user) states: ‘If I want to protect privacy in my house, I need to get this out of my house, whichever room I put it in I will still feel that this thing is here listening to me.’ Interestingly, most German early adopters already have come to terms with these concerns. Even though they believe that the device is just listening when the keyword is being said, most of them could imagine that abuses might happen. However as they have not experienced any consequences from these potential abuses, they have as of yet had no motivation to change anything. Emily, for instance, spends the most time in her apartment by herself. For this reason she expressed no concern about the device collecting sensitive data about her:

I live alone here. This is the reason why I do not have any intimate conversations at home. Sometimes I call someone, but I don’t know if I would leave the room for private conversations. In my daily life, I do not see any problems with someone listening to what I watch on television. (Emily, early adopter)

Whereas many interviewees are aware of the data collection practices of the household IPA platforms, their concerns are divergent. Adrina (potential user) makes a distinction between the collection of data that she is concerned about and data that she is willing to share with IPA platforms: ‘For example, I only use the internet to browse for fashion and make-up and food, stuff like that, that’s okay. But then if it’s about the personal things then I don’t [want to share].’ Concerns about data collection and data use via household IPAs are widespread and are perceived as risks or drawbacks. For some this is a reason to reject household IPA technologies, whilst others decided that the expected benefits outweigh their detractions. Privacy concerns in relation to household IPAs are nuanced (Lau et al., 2018), and when users decide to install household

IPAs in their homes, this does not mean that they fail to protect their privacy. As noted below, users actively negotiate privacy protection whilst using household IPAs on a daily basis.

Interestingly, the Dutch focus group participants and to a lesser degree the German interviewees demonstrated an awareness of the different logics behind household IPA platforms. Catarina (potential user), for instance, is specifically worried about Google, and her concerns proliferate when she thinks about the use of a household IPA:

For Google, I think, I always feel like they are spying on me all the time because they know everything about you and if you have this device at home, it’s even worse because they will hear everything, know everything, they will track everything basically. (Catarina, potential user)

Amazon’s intentions in motivating users to buy via Amazon were also seen as problematic, as well as concerns about commercially driven third parties that use consumer data to create consumer profiles. But beyond this, concerns about the involvement of governments in data collection through household IPAs were voiced. Leo (potential user) stated: ‘I think the state deserves as little trust as huge data firms’ whilst Florian (German user) noted that he cares ‘about data protection but not because I am afraid of Google, Amazon or Apple. I am afraid that the state forces private companies to give them the data.’

### *Personal and social motivations*

As described in other technology acceptance based research, our respondents reiterated that social context and personal motivations influence technology acceptance. Personal motivations focus on the fun or pleasure technology offers (Venkatesh et al., 2012). Household IPAs provide entertainment in social situations for many interviewees, they show friends and family the functionalities of the devices. Daniela (early adopter) plays around with her Amazon Echo when she has friends over: ‘Mostly, they are impressed, laugh and think it is fun to explore different functionalities and games with us.’ Moreover, for some early adopters, the opportunity to experiment with the technology provides joy:

I think the technology is still great and I love to play around with it. It is so much fun to test new things with the personal assistants and to shorten daily tasks. However, I do not know if I would recommend buying them if you are not that technical affine and

don't want to test different functionalities. (Pascal, early adopter)

Pascal's orientation to these devices differs from Mathilde, who initially enjoyed playing around with her Amazon Echo: 'In the beginning, I did many things with Alexa. I downloaded different skills and spent much time exploring new functionalities.' After a whilst her curiosity waned and she stopped experimenting, 'I am beyond this point of initial curiosity. I have no desire to get used to new functionalities' (Mathilde, early adopter). Like Mathilde, many active early adopters experience a turning point when most functionalities were explored and changed into a more sceptical attitude resulting in use of just the basic functions instead of figuring out new ways of integration. This is in line with other technology acceptance research that demonstrates a shift in technology use (Hackbarth et al., 2003) and more specifically that IPA engagement tends to diminish over time (Luger and Sellen, 2016). In the process, less relevant data is transmitted to the platform by most users. However, active users who find a match between expectations and benefits serve to normalise understandings of household IPA use despite not necessarily being representative of most consumers.

### *Integrated routines*

With varying degrees of active use, these platform-based devices have become part of the everyday life of users. Habits form the final influencing factor in technology acceptance processes. In this case, users incorporate the IPA into their daily habits, and this integration is a key factor in technology acceptance (Venkatesh et al., 2012). Besides using household IPAs for fun, the most common functionalities interviewees identified were listening to music, setting a timer or alarm, checking the news and controlling the lights. The interviews with German users provide clear examples of the integration of household IPAs into their daily lives:

Alexa is really integrated into our everyday routines. [...] I always listen to the 100 seconds of daily news summary, [...], I always ask for the weather forecast in the morning and I always open Spotify in the morning, [...] and every day I say "Alexa, put this on my grocery shopping list." [...] In the evening you will always hear that Derek [her partner] says "Good night" to activate the scene for the light control. So I would say that the assistant is very much integrated into our routines. (Sandra, early adopter)

Many of those functionalities are easy to conduct actions that can be embedded in fixed and repetitive routines.

Derek describes similar habits and adds that he perceives personal assistants as particularly suitable for recurring tasks: 'Especially for daily routines, Alexa is most useful' (Derek, early adopter). Robert sees his household IPA as a useful tool in making his life more convenient:

The most helpful tasks are the ones where I can shorten processes, like writing a grocery shopping list. In the past, you wrote the list on a board, took a photo from it and looked at the photo when you are at the store. Now you just have to say one sentence and the list is on your smartphone. This is very efficient as the input speed is three to five times faster than with the keyboard. (Robert, potential user)

Other early adopters provided examples of how their lives became more convenient and their appreciation for this. In contrast, a recurring concern voiced in the Dutch focus groups is the fear that the integration of a household IPA into daily routines will make users dependent: 'That concerns me, yes, that when you put this [smart speaker] in your house, that you will not think about what is on the agenda for tomorrow, but that you'll ask that thing.' (Karen, potential user). Other potential users are concerned that the use of a household IPA allows Google, Amazon or Apple to control their lives. Jessie notes that she is reluctant towards IPAs because of predictive algorithms aim to steer behaviour: 'Things like: "You have to leave because there will be a traffic jam". That makes me think, won't we serve technology that way in the end?' (Jessie, potential user). Whereas early adopters experience the benefits in their daily routines, potential users seem to interpret the convenience that household IPAs can offer in everyday life as a risk to lose autonomy and to become dependent on technology platforms.

Moreover, some of the potential users were also concerned about data collection when household IPAs are integrated into daily routines. Bjorn for example fears that the devices can reveal recurring daily user schedules: 'There will be a point in time where they [household IPAs] will be hacked. Ehm, without a doubt. And on the moment that that information comes out you'll have, you can easily map when someone is home or not. So that is really interesting for burglars.' (Bjorn, potential user). This risk is acknowledged in research about the security of smart devices (Apthorpe et al., 2017).

Whereas for potential users Bjorn, Karen and Jessie, their concerns currently seem justifiable as reasons for not adopting household IPAs, interviews with the German early adopters show that users adjust their behaviour in response to their concerns whilst using household IPAs. Mathilde actively negotiates the

incorporation of her household IPA into her daily life, whilst still having privacy concerns:

I am trying to balance privacy and utility. In the kitchen, I am giving the personal assistant a more significant weight for usefulness than privacy concerns because I am primarily doing stuff there instead of having intimate conversations and moments. However, when I am sitting in the living room with my friends to drink a glass of wine or whatever the usefulness does not balance against privacy... (Mathilde, early adopter)

Mathilde's balancing between usefulness and privacy concerns is indicative of how concerns about platforms listening in also inform the daily negotiations of other active users. Household IPA users develop protective routines, Pascal uses the 'mute' button of his household IPA when he feels Google Assistant interferes with his private conversations: 'Sometimes I feel observed when I have a personal conversation, and the Google Assistant is interrupting me a second time. This is a moment when I feel uncomfortable in my own house and turn the microphone off.' (Pascal, early adopter).

The actual practices of early adopters show that even though they accept the terms of service and install (multiple) household IPAs, this does not automatically mean that they do not care about their privacy. Instead, these users actively sculpt boundaries in their intimate home setting. Some use the device only in spaces that are seen as less intimate and privacy sensitive, whilst others physically mute the device. These findings exemplify the conclusions of Lau et al. (2018), who found that Alexa users struggle in balancing the benefits of using new technologies against protecting their privacy.

## Discussion and conclusion

The arrival of household IPAs represents a further colonisation of platforms into everyday life (Helmond, 2015). Yet at the moment, there remains significant interpretive flexibility in their use. The devices are tethered to particular large-scale platform investments to increase platform data gathering capacities within the intimate sphere of people's homes – a context that is potentially the most socially intimate space for data gathering (perhaps second only to medical devices). Yet, the expectations and lived experiences of (potential) household IPA users show fragmentation and inconsistencies in user acceptance and responses to these data gathering devices.

Our simplified UTAUT2 model represents a logical way of understanding responses within our research and points to several key issues related to integration

of IPAs in the home. We believe the connections made between the empirical perceptions and choices of early adopters and potential users demonstrate three key points for further reflection and analysis that have specific conceptual implications. *First*, the focus on user expectations and integrated routines demonstrate that *acceptance of the devices does not indicate full access by platforms to all data* that could be produced in a home environment. We must not perceive the surveillance capabilities of household devices as uniform and need to be wary of claims either on the part of platforms or their critics that through these devices companies have a full or complete view of consumers in the home. To do so would be to both risk reifying potential advertising or corporate claims about these devices and underplaying the agency of users to make effective decisions about their own relationship with these data capturing machines. Whilst these devices continue to make the household 'platform ready', this happens in ways that both will and will not be mitigated by everyday practices of users. Users can and will shape opportunities and problems for household IPAs and can prompt action on a broader scale (Oudshoorn and Pinch, 2003).

*Second*, in relation to user expectations and motivations, the acceptance of household IPAs hinges not on the devices themselves but on *the need for more platform connectivity, an increased number of devices, and connection with other household devices to demonstrate their usefulness*. Whether active users or potential users, our respondents believe that more effective use is increased by relying on one specific platform, potentially having multiple devices, and connecting this with other household devices and appliances. Two points are critical here. In these discussions, our European based respondents demonstrated a clear awareness of and concern about the platforms' push for more presence in their lives. This has not yet been described in US based research (see also Pridmore et al., 2019). They see and respond differently to platforms' apparent intentions in terms of data production with these devices. Whilst this is the case, there is also little recognition that the connection of IPAs to other IoT devices in the home extends the knowledge these platforms have about users beyond their own platform-based data streams. Both an understanding of the wariness towards American based platforms and the limited awareness of how platform data production is extended through connection with other devices warrant further examination, something beyond the scope of this current text.

*Third*, by evaluating the expectations of potential users and the acceptance process of early adopters, it becomes clear that *the labour of users needs to be seen in relation to processes of normalisation which affect data*

*production.* Technology acceptance is a process, and at this point in the European context, whilst current users may train themselves to be effective users, others await the more widespread acceptance that is anticipated. In this, our simplified UTAUT2 model focuses attention on user efforts and choices in relation to data production, revealing that data being produced in home contexts is and will be somewhat myopic. Users intentionally include household IPAs in particular routines, whilst actively keeping them out of others (muting or unplugging the device; limiting IPAs to specific areas). Additionally, more active or playful initial use recedes quickly leaving only certain key integrated routines. This limits data collection to specific activities likely with limited economic value at an individual level, but may represent more significance at platform levels. However, this points to another issue: early adopters and their interaction patterns are likely to be seen as normal use, producing patterns of action and acceptance of household IPAs in potentially problematic ways. That is, these subjects may underrepresent the lives and experiences of those with limited choice in technology implementations in the home – the surveillance capacities of household IPAs may increase disparities between, for instance, technology savvy household members and those less savvy (see for instance Bowles, 2018).

These points demonstrate that concerns about data use can be held in tandem with a desire for, acceptance of, or even resignation towards (corporate) data gathering practices at an individual level. Tensions between user choices and agency (Oudshoorn and Pinch, 2003) against (divergent) logics of accumulation intended to predict and modify human behaviour (Zuboff, 2015) become more salient within these empirically demonstrated responses. Whilst a significant amount of data may be produced by household IPAs, at least given our European based responses, it would seem that this data is scattered and inconsistent at present. Platforms may have increased presence in the home through these devices, but the data produced remains myopic and certainly overemphasises types of users that – as early adopters – we show have a nuanced relationship with the data produced by household IPAs. However, it is the case that most (potential) users are unaware of the security and privacy risks or the platform dataveillance capacities that these connections potentially bring (as noted by Lau et al., 2018; Zeng et al., 2017). Despite the potential for providing new lines of insight into an intimate sphere of everyday life, it is clear that a platform's knowledge of users in this context is still cloudy at best. It suggests that platform data collection efforts in household spaces remain experimental, allowing for and requiring continued critique and engagement in both future research and policy decisions.

As household IPAs make their way into more European and global homes, their anticipated data production value continues to face barriers by (potential) users. This raises a critical point about this study as it extends an implicit Western bias. Whilst examining European rather than US based experiences, it does not take a more global view. Chinese vendors Alibaba, Xiaomi and Baidu all have developed household IPAs focused on the Chinese market, and these further complicate narratives about corporate orientations to household data collection and the platformisation of the home. Additionally, the critical concerns about data production and the insights that household IPAs may give about the intimate sphere of the home should be seen in light of the benefits these technologies provide for those with physical impairments or mobility issues (see Pradhan et al., 2018). For some people, household IPAs are more than a novelty: They have drastically reduced the burdens of everyday barriers within the home. This is something that deserves further exploration.

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## Appendix I. Respondent overview

Name	Male/ female	Age group	Profession
Study 1: Early adopters: Interviews Germany			
Daniela	F	20–30	PhD student
Ralph	M		Engineer
Mathilde	F		Partnership Manager
Emily	F		Marketing Manager
Florian	M		Engineer
Pascal	M		Programmer
Daniel	M		Student
Natalie	F		Student
Oliver	M	40–50	CEO
Study 2: Potential users: Focus groups university personnel Netherlands			
FG1			
Jessica	F	20–30	Marketing
Kim	F		PhD candidate
Peggy	F	30–40	Education support
Susan	F		Communication
Henry	M	40–50	IT
Charlie	M	50–60	Professor
FG2			
Bjorn	M	20–30	PhD candidate
Kathryn	F		PhD candidate
Julia	F		PhD candidate
Lucas	M	30–40	Researcher
Andreas	M		PhD candidate
Alex	M	40–50	IT
Marcus	M		IT
FG3			
Mark	M	20–30	Education support
Hannah	F	30–40	Education support
Anna	F		Logistics
Leah	F		Support
Jay	M	40–50	Communication
FG4			
Babette	F	20–30	Research and teaching support staff
Marian	F		PhD candidate
Jessie	F	30–40	Health support
Karen	F		Professor
Robert	M	40–50	IT
Peter	M		IT
Leo	M	50–60	Professor
FG5			
Claire	F	30–40	IT
Linda	F		Professor
Michelle	F		PhD candidate
Dennis	M	40–50	IT
Louis	M		Library support
FG6			
Mona	F	20–30	PhD Candidate (Chinese)
Evy	F		PhD Candidate (Chinese)
Jack	M	30–40	PhD Candidate (Latvian)
Monica	F		Communication
Rick	M		PhD Candidate (German)

(continued)

**Appendix I.** Continued.

Name	Male/ female	Age group	Profession
Study 3 Potential Users: Focus groups Young Adults Netherlands			
FG7			
Boni	M	20–30	Just graduated (Indonesian)
Stella	F		International student (Polish)
Adrina	F		International student (Indonesian)
Violet	F		International student (Chinese)
Catarina	F		Student / journalist (Portugese)
FG8			
Riley	F	20–30	International student (Chinese)
Laura	F		Student
Aurora	F		International student (Indonesian)
Nora	F		Student
FG9			
Clara	F	20–30	International student (Serbian)
Irina	F		International student (Ukranian)
Olly	M		International student (Korean)
Aubrey	F		International student (Ukranian)
Ilena	F		International student (Greek)
FG10			
Vera	F	20–30	International student (German)
Dina	F		International student (Indonesian)
Maria	F		International student (Italian)
Aliyah	F		International student (Indonesian)
FG11			
Sebastian	M	20–30	Student
Delilah	F		Product developer
Leonore	F		R&D specialist
Antonia	F		International student (Bulgarian)