

Shutting the door before undressing and not sharing one's data online: can we develop one privacy as a value measurement that explains various different privacy concerns and behaviours?

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Abstract

Privacy is a steady constant in our life, no matter if it relates to how we can protect it in order to react to privacy threats or to use it to gain autonomy about our own private sphere.

However, privacy is not considered to be a universal human value even though indicators exist that it fits well to be considered as one. For this survey study (N=251) the aim was to develop a set of items to measure privacy as a value, which fit to the idea of value questionnaire developed by Schwartz et al. (2017). Another goal was to test if privacy can be considered a multidimensional construct, as was proposed by Burgoon (1982). Results found support for privacy being distinguishable as three dimensions, namely “Control over interactions and monitoring”, “Social and psychological privacy”, as well as “Informational and online privacy”. This study therefore found conceptually different dimensions from Burgoon (1982). Some of the privacy as a value items significantly showed that they can predict individual privacy-related behaviours since they showed positive correlations. Furthermore, gender effects for privacy as a value were tested and suggested that women display significantly higher privacy concerns than men for the dimensions “Control over interactions and monitoring” and “Social and psychological privacy”. Overall, this study led to an alternative idea on how to conceptualize privacy and can provide insight into the predictability of behaviour based on privacy as a value.

Introduction

As human beings we have the tendency to disclose personal information about us every day. Whether that is with close friends, colleagues or in any other social interaction, we naturally decide for ourselves if the situation allows us to share private thoughts and details. While this emotional release is something we can even enjoy in certain contexts, we steadily aim to maintain a comfortable state, without feeling too vulnerable or exposed (Masur, 2018). This issue is part of the spectrum of privacy, which even though considered a universal human right by the United Nations, is seen as difficult to define since it has various dimensions and is also dependent on societal, cultural, and economic environments (Nissim & Wood, 2018).

One of the earliest definitions describes privacy very broadly as “the right to be let alone” (Brandeis & Warren, 1890), while others add the characteristics of having control over personal information and the autonomy to decide if we want to share it with others (Lukács, 2016). This can relate to simply not being listened to by strangers while we have a private conversation, as well as not having our locations and homes monitored.

Especially nowadays, privacy gains a new importance through steadily evolving technology and novice ways of digital communication. Now more than ever, the possibilities we have allow us to build personal relations online and practice self-disclosure to gain intimacy and appraisal (Oh & Syn, 2015). At the same time, digitalization comes with the sharing, distribution, and storing of personal information in an immense and uncontrollable manner. Once a picture, message or private information is uploaded, it is often hard to follow the trail on how it is spread and mostly even difficult to completely erase. The growing risks and threats that come with technological data sharing is something that people need to adapt to, in order to protect their identity online. In line with this, research has shown that digital media users report an increasing feeling of uncertainty and privacy concerns (Masur, 2018). Furthermore, the overall risk perception has shifted and has let people experience novice ways

of physical privacy threats, such as surveillance cameras and facial recognition systems, that substantially monitor people's activities (Westerlund et al., 2021). We therefore not only talk about the individual need for physical privacy relating to public behaviour and security, but also about the crucial role of online privacy. Hence it can be argued that privacy is made up of multiple constructs since it concerns multiple different aspects of our lives.

Burgoon's theoretical approach (1982) is to describe privacy as four different dimensions, namely physical privacy, social privacy, psychological privacy, and informational privacy. The dimension of physical privacy describes the extent to how much control one has over their personal space, for example, who has access to it and that personal space invasion is prevented. Burgoon (1982) noted that keeping one's physical privacy ensures physical comfort and can help to ensure well-being. Next, social privacy involves controlling all kinds of interactions and interpersonal relations. It is described as a freedom over communicating and interacting with others and being able to keep a level of anonymity and intimacy when desired. Psychological privacy is related to social privacy, but concerns as a difference more our inner and private life. It is especially important for the control over our thoughts, beliefs and emotions, the ability to form them independently and protect them from others. Lastly, informational privacy is described as managing the use and distribution of any personal data, which includes the content, amount, and whom to share it with. Burgoon's work (1982) has shaped the conceptualization of privacy, as it has been used by other scholars as a theoretical background for their own research (e.g., Dienlin, 2014; Teutsch et al., 2018). Even though by now alternative privacy models have been developed, which focus on different viewpoints such as developments in the digital age (e.g., Finn et al., 2013; Petronio, 2002), Burgoon's theory (1982) remains popular to mention when trying to understand the concept of privacy. Nonetheless, her dimensions have not yet been tested empirically nor confirmed that they actually exist, which will be the aim for this research study.

Besides different approaches to understand the concept of privacy, research also suggests that individuals show differences when it comes to personal privacy concerns. Westin (2000) has developed a typology to categorize people into one of three groups describing different privacy attitudes, namely fundamentalists, pragmatics and unconcerned. The fundamentalists are the most concerned about their privacy, do not feel safe sharing private information with organisations and businesses, and perceive a lot of privacy threats. Secondly, the pragmatics, which form the biggest group in most societies, tend to assess the privacy risks and if feeling comfortable enough, share with trusted second parties. The unconcerned individuals are generally willing to share any information and believe that it is safe without thinking about privacy invasion and abuse at all (Westin, 2000). These three groups of privacy types are suggested to behave very differently when it comes to making choices related to online related behaviour, security measurements and privacy strategies. Comparing differences in genders, studies show that women report more privacy concerns and also tend to be more likely to adopt privacy-security measurements than men (Tifferet, 2019). Dehlinger & Rowan (2014) found similar results in their study, confirming that women are especially more concerned about protecting personal information.

Even though privacy protection has become a prominent topic, reinforced by the immense developments in technology, privacy as a universal value has not yet received great attention in studies within the domain of psychology (Stuart et al., 2019). Especially since privacy is connected to fundamental human rights and plays a big part in people's autonomy, the importance of privacy becomes clear. However, privacy is not listed among the dominant approach of universal psychological values, which are important to study and understand basic needs, behaviour, and societies (e.g., Giménez & Tamajón, 2019). which are defined as "desirable transsituational goals, varying in importance, that serve as guiding principles in the life of a person or other social entity" (Schwartz, 1994). Originally, Schwartz developed a scale of ten values in 1992 of which he said they are distinguished by different motivational

goals and all follow universal requirements for humans to function and survive in a society. Later in 2017, he revised and extended the values to a total number of 19, to describe the values more narrowly and potentially make them more applicable to human needs in modern times (Schwartz et al., 2017). Even though Schwartz and Fischer (2006) did introduce in an earlier study one item for privacy, it has since been excluded from their value questionnaires and not been mentioned anymore. Although the authors do not clearly state why privacy was not kept, the concept they used for privacy, namely “the right to have a private sphere” (Fischer & Schwartz, 2011), did not seem to be valuable in their study for universal importance and understanding. It can be argued that if privacy is indeed a multidimensional construct, it is required by researchers to design a new measure with multiple items that are able to grasp privacy as a whole.

Privacy can be suggested to be added as an additional value to Schwartz’s value continuum, since it fulfils the criteria to be a universal human value, which were defined as: “Values (1) are concepts or beliefs, (2) pertain to desirable end states or behaviors, (3) transcend specific situations, (4) guide selection or evaluation of behavior and events, and (5) are ordered by relative importance.” (Schwartz, 1992, p.4). Since privacy does follow unique goals of self-protection and striving for autonomy, which appear in a variety of situations, as well as cross-cultural, it can be argued to be a unique value, accounting for individual differences (Lukács, 2016; Trepte, et al., 2017).

If established as a new value, research could benefit from gaining a deeper insight into people’s motivations and being able to explore the relationship of privacy with other human values. It can also be explored if privacy is indeed a multi-dimensional value with multiple distinguishable constructs. Valuable for research might also be the insight on how privacy as a value influences privacy protective behaviour. This would in turn help to make predictions about people’s behaviour, specifically if each dimension of privacy as a value is able to explain behaviour of the same dimension.

The Current Research

Therefore, the goal of this research will be to develop items that can measure privacy as a value and investigate if we can find the four different privacy dimensions suggested by Burgoon (1982) or if we instead find other dimensions. Additionally, the aim is to test if privacy as a human value is able to explain privacy-protective behaviours and if it is possible to find differences between genders in valuing their privacy. This will be done with an online survey, where a questionnaire to measure privacy as a value will be tested and explored.

RQ1: Can we find different dimensions to categorize privacy as value?

RQ2: Does each privacy as a value dimension explain privacy-protective behaviours of the same dimension?

RQ3: Do men and women value their privacy differently?

H1: It is expected to find four dimensions of privacy, namely psychological, social, physical, and informational.

H2: The higher a person values a dimension of privacy, the more privacy-protective measurements relating to the same dimension will be adopted.

H3: Women value their privacy higher as a value and therefore show more privacy concerns than men for all privacy dimensions.

Methods

Participants

Participants were recruited with a non-probability sampling via Prolific Academic, which is a data-collection platform to publish research surveys and gather a sample from a pool of participants in the UK. Each participant received a compensation of 1,99£/2,32€ for their time and participation via the Prolific Academic platform. Prior to data collection, the survey has been ethically approved by the University of Twente Ethics Committee (registration number: 230508).

Of the initial 263 participants who finished the online survey, 3 did not sign the informed consent and hence had to be excluded. 9 participants had to be omitted because they either did not meet the inclusion criteria due to being younger than 18 years old or did not pass the attention check question. The final group of 251 participants consisted of 122 males between the ages of 18 and 73 with an age mean of 38.6 years and 125 females between 19 and 73 years old with an age mean of 40. Four participants preferred not to say or identified as non-binary/ third gender.

Materials

The first presented set of items the participants received contained 24 questions regarding the intention and attitude towards using certain technologies. Those did not relate to the research questions of this thesis but are included in the survey since it is a collaboration with another researcher (Appendix D). Secondly, demographic questions were asked about the gender, age, and education of the participant.

Schwartz Value Survey

Afterwards, the questionnaire that was administered is the Schwartz Value Survey (PVQ-RR) (Appendix A), which is used to measure 19 values that are considered as universal human values. The questionnaire includes a total of 57 items which were answered on a 7-point scale (1 = “Not like me at all”, 2 = “Not like me”, 3 = “A little like me”, 4 = “Moderately like me”, 5 = “Like me”, 6 = “Very much like me”, 7 = “Does not apply”). The Schwartz Value Survey was included to present the participants a comprehensive survey of human values while forming the basis for the following Survey.

Privacy Value Survey

To these preceding 57 items, another 26 items were presented as a new set of questions that aim to measure privacy as a universal human value to serve as a possible addition to the Schwartz Value Survey (Appendix B). Even though Schwartz only uses three items per value for his questionnaire, a high number of possible privacy items were developed

for this study to be able to later narrow down the items. Several researchers with research experience on the topic of privacy, designed this privacy scale for the study and improved the formulation of the items with feedback and expertise. The privacy statements are split into five different subscales, which reflect the different dimensions of privacy. The specific items aiming to measure each dimension were developed based on Burgoon's conceptualization of the privacy dimensions. The measurement of those items can be found in Table 1. The first subscale, general privacy, includes items that cover more than one dimension of privacy, e.g. "It is important to him/her to control what other people get to know about him/her". The other four subscales relate to the dimensions of privacy developed by Burgoon, namely informational, physical, social, and psychological. An example of an item that belongs to the informational privacy dimension is "It is important to him/her to actively protect his/her online data" and for the physical privacy dimension e.g. "It is important to him/her to have a space that is exclusively his/hers". For the social privacy dimension, an item used is e.g. "It is important to her to choose under what circumstances he/she interacts with others", while for the psychological privacy dimensions an example is "It is important to him/her to keep personal matters to himself/herself". Those statements were also answered on the same 7-point scale as mentioned before, to fit the structure of the Schwartz Value Survey.

Behaviour Survey

Lastly, a questionnaire containing 20 behavioural items was used to assess how frequently privacy behaviour is acted out (Appendix C). Eight of these items describe informational privacy behaviour, while for social, psychological, and physical privacy there are four different behaviours for each dimension. This privacy behaviour survey was answered on a 6-point scale (1 = "Never", 2 = "Rarely", 3 = "Sometimes", 4 = "Often", 5 = "Always", 6 = "Does not apply"). An example of an item of the subscale of informational privacy is "I generally try to change my passwords", for physical privacy "I generally try to avoid sitting close to strangers in a crowded bus", for social privacy "I like to have private

conversations with work colleagues” and for psychological “I generally hide my personal notes from others”.

Design and Procedure

This study was conducted as an online survey with a cross-sectional study design. After opening the link to the study called “Values, behaviour and technologies”, participants first had to fill out an informed consent form, a necessary prerequisite to meet ethical standards. After filling in their Prolific ID, they were able to start the actual survey and were instructed to fill out a self-administered online questionnaire within Qualtrics. They were first presented with the attitude towards technology items, secondly the Schwartz Value Survey, followed by the privacy as a value items and lastly the privacy behaviour items. Afterwards they were redirected to the Prolific site and automatically registered their submission. The complete survey took the participants approximately 10-15 minutes to complete.

Data Analysis

The gathered data was analysed with the statistical software program RStudio 2023.03.0+386. The analysis used the packages haven (Wickham & Miller, 2020), magrittr (Bache & Wickham, 2022), readr (Wickham & Hester, 2020), tidyverse (Wickham et al., 2019), lavaan (Rosseel, 2012), psych (Revelle, 2023), dplyr and janitor (Firke, 2021). The used script can be found in Appendix F.

The first step of the analysis was to screen the final sample data, which was done by eliminating data of participants who either did not fill in the informed consent or who did not meet the inclusion criteria. Additionally, all participants were excluded who failed the attention check questions. The answer option for “Does not apply” was excluded from the analysis, by filtering the single answers out. The next step was to perform a factor analysis on the privacy items to explore the underlying dimensions and determine factor loadings. After screening those factor loadings, an alternative factor analysis was computed by excluding the items that did not adhere to the .40–.30–.20 rule, which recommends only including items that

“load onto their primary factor above 0.40, (b) load onto alternative factors below 0.30, and (c) demonstrate a difference of 0.20 between their primary and alternative factor loadings” (Howard, 2016, p. 55). To test for the effect of the different dimensions of privacy as a value on privacy-protective behaviour, a factor analysis was also performed on the behaviour items to explore if the same factors can be found in both questionnaires. Additionally, the correlations were calculated between the behaviour items and the privacy factors that were found in the earlier factor analysis. Lastly, a t-test was performed to explore gender differences.

Results

Dimensions of Privacy as a Value Survey

An examination of the Kaiser-Meyer Olkin measure of sampling adequacy suggested that the sample was factorable ($KMO=.92$). Bartlett’s test of sphericity demonstrated that correlations between the items were large enough for a Factor Analysis ($\chi^2(325) = 4127.06, p < .001$).

The exploratory factor analysis of the privacy as a value questionnaire was conducted with the oblique rotation method being Oblimin, since it is likely that the factors are not independent, but conceptually related. A parallel analysis suggested that the number of factors is equal to five, however, the first factor showed no significant factor loadings and an Eigenvalue below 1. The factor loadings from the pattern matrix, including the variance and eigenvalues of the three-factor solution can be found in Table 1, sorted by the original behaviour dimensions. The alternatives with the four- and five-factor solution can be found in Appendix E. While comparing three- and four-factor solutions, it was decided to continue with three factors, based on statistical and theoretical indications. For one, the four factors showed one factor with a low explained variance (7%), which only 3 items significantly loaded onto, while two factors also showed conceptually very close themes and were therefore harder to conceptually interpret. When using three factors, the explained variance

and proportion of each factor were far more acceptable and each factor was well distinguishable, covering its own theoretical dimension. As can be seen in the results, the three factors onto which items were loading explain 53.0% of the total variance.

Next, the factor loadings were screened and a reduced set of 16 items was used, where the items only significantly loaded onto one factor and showed not too strong cross-loadings. That output showed one other item to be excluded, which led to a final cleaned-up set containing 15 items. The factor loading for this second approach with reduced items can be found in Table 2, where the privacy items are sorted by the new privacy dimensions. The explained variance is slightly higher for the cleaned-up option of items with 58.0%. For the next steps, the results for both approaches will be included to demonstrate two different options of item sets and compare them with each other.

Factor 1 Control over Interactions and Monitoring

Factor 1 includes 8 items and can be conceptualized as a dimension that includes the control one has over keeping information to themselves and excluding uninvolved third parties from interactions, as well as not being monitored. An example for this factor is “It is important to him to communicate with others without being overheard”.

With the reduced number of items, 4 items were left that show significantly high factor loadings on this factor between .62 and .82.

Factor 2 Informational and Online Privacy

The second factor included 9 items and can be labeled as informational and online privacy. Items 1 and 3 have especially high factor loadings (“It is important to him to control which personal information is collected about him”, “It is important to him to be aware of which data are collected about him while using the internet”). This factor includes a lot of the items that were originally developed to be part of the dimension of general privacy, which did have a lot of information-related items.

The cleaned-up set contained only 3 factors which loaded significantly onto this factor and show factor loadings between .59 and .97.

Factor 3 Social and Psychological Privacy

The third factor also has 9 items. This factor can be described as deciding under what circumstances to interact with others, specifically managing those interactions. Compared to factor 1, this factor is rather about intimate thoughts and feelings and the control over close relationships. Examples of items describing this factor are “It is important to him/her to control how he/she interacts with others to meet his/her own needs” and “It is important to him/her to choose under what circumstances he/she interacts with others”.

After reducing the number of items, this factor still contains 6 items with relatively high factor loadings between .54 and .71.

Table 1

Factor Loadings for Exploratory Factor Analysis of Privacy as a Value Questionnaire.

| Item No. | Items | Factor | | |
|-----------------------|---|------------|------------|------------|
| | | 1 | 2 | 3 |
| <i>General:</i> | | | | |
| 1 | It is important to him/her to control which personal information is collected about him/her. | .06 | .82 | -.01 |
| 4 | It is important to him/her to withhold personal information from specific others. | -.03 | .46 | .40 |
| 7 | It is important to him/her to decide who can see him/her in a vulnerable state. | .12 | -.05 | .63 |
| 11 | It is important to him/her to control what other people get to know about him/her. | .37 | .07 | .39 |
| 14 | It is important to him/her to communicate with others without being overheard. | .68 | .09 | .12 |
| 20 | It is important to him/her to be able to trust that his/her personal information will be kept confidential and not be shared. | .35 | .38 | .22 |
| 25 | It is important to him/her to control who has access to his/her personal information. | .28 | .49 | .17 |
| <i>Informational:</i> | | | | |
| 3 | It is important to him/her to be aware of which data are collected about him/her while using the internet. | -.13 | .96 | .04 |

| | | | | |
|----------|---|------------|------------|------------|
| 8 | It is important to him/her to know who can access information about his/her location. | .14 | .47 | .25 |
| 13 | It is important to him/her to know who can access his/her medical data. | .48 | .30 | .09 |
| 16 | It is important to him/her to occasionally disconnect from technology to limit the tracking of his/her online activity. | .24 | .31 | .01 |
| 19 | It is important to him/her to actively protect his/her online data. | .39 | .63 | -.10 |
| 23 | It is important to him/her to control which information his/her devices store online about him/her. | .15 | .72 | .06 |
| 26 | It is important to him/her to not be monitored. | .75 | .20 | -.10 |
| | <i>Physical</i> | | | |
| 5 | It is important to him/her to control who can be physically close to him/her. | -.11 | .07 | .71 |
| 10 | It is important to him/her to control who can observe him/her in his/her home environment. | .45 | -.09 | .38 |
| 17 | It is important to him/her to know who is able to see and hear what he/she is doing. | .49 | .29 | .08 |
| 22 | It is important to him/her to have a space that is exclusively his/hers. | .20 | -.03 | .42 |
| | <i>Social</i> | | | |
| 2 | It is important to him/her to control who he/she interacts with at specific times. | -.17 | .24 | .62 |
| 9 | It is important to him/her to control how he/she interacts with others to meet his/her own needs. | .07 | .04 | .67 |
| 15 | It is important to him/her to decide when to be by himself/herself without any social interaction. | .58 | -.14 | .28 |
| 21 | It is important to him/her to choose under what circumstances he/she interacts with others. | .09 | -.05 | .70 |
| | <i>Psychological</i> | | | |
| 6 | It is important to him/her to be able to trust others that they will keep personal conversations to themselves. | .03 | .16 | .52 |
| 12 | It is important to him/her to keep personal matters to himself/herself. | .52 | -.02 | .30 |
| 18 | It is important to him/her to control who has access to his/her personal thoughts. | .31 | .01 | .41 |
| 24 | It is important to him/her that others do not hear what he/she discusses with his/her best friend. | .36 | .11 | .34 |
| Factor 1 | | | .52 | .53 |

| | | | | |
|----------------------|--|------|------|------|
| Factor 2 | | | | .44 |
| Eigenvalues | | 4.42 | 4.65 | 4.73 |
| % of Variance | | 17 | 18 | 18 |

Table 2

Factor Loadings for Exploratory Factor Analysis after Item Deduction

| Item No. | Items | Factor | | |
|----------|---|------------|------------|------------|
| | | 1 | 2 | 3 |
| 14 | It is important to him/her to communicate with others without being overheard. | .82 | .00 | .06 |
| 26 | It is important to him/her to not be monitored. | .76 | .13 | -.09 |
| 15 | It is important to him/her to decide when to be by himself/herself without any social interaction. | .62 | -.16 | .23 |
| 17 | It is important to him/her to know who is able to see and hear what he/she is doing. | .62 | .20 | .04 |
| 3 | It is important to him/her to be aware of which data are collected about him/her while using the internet. | -.06 | .97 | .04 |
| 1 | It is important to him/her to control which personal information is collected about him/her. | .16 | .77 | .00 |
| 23 | It is important to him/her to control which information his/her devices store online about him/her. | .24 | .59 | .07 |
| 7 | It is important to him/her to decide who can see him/her in a vulnerable state. | -.02 | -.02 | .71 |
| 9 | It is important to him/her to control how he/she interacts with others to meet his/her own needs. | .06 | .01 | .70 |
| 5 | It is important to him/her to control who can be physically close to him/her. | -.05 | .06 | .67 |
| 21 | It is important to him/her to choose under what circumstances he/she interacts with others. | .18 | -.11 | .66 |
| 6 | It is important to him/her to be able to trust others that they will keep personal conversations to themselves. | -.08 | .15 | .63 |
| 2 | It is important to him/her to control who he/she interacts with at specific times. | -.01 | .19 | .54 |
| Factor 1 | | | .59 | .56 |

| | | | |
|----------------------|------|------|------|
| Factor 2 | | | .48 |
| Eigenvalues | 2.85 | 2.43 | 2.28 |
| % of Variance | 22 | 19 | 18 |

Privacy Protective Behaviour

To test the second hypothesis the first step was to perform a factor analysis on the behaviour items to see if similar factors can be found as in the privacy as a value factors. Cronbach's alpha for reliability testing showed a score of .75. Even though Bartlett's test of sphericity and Kaiser-Meyer-Olkin measures both showed satisfactory results, the suggested number of five factors of a parallel analysis did not result in a favourable factor analysis. With all reasonable numbers of factors 1, 2, 3, 4 and 5, the factor loadings were mostly small and closer to 0 and a lot of double-loadings on one or more factors occurred. Reducing the number of factors lead also to less significant factor loadings. This suggested that for this study, the behaviours are too diverse from each other, which is why they do not relate much with each other and were not able to be reduced to dimensions.

Consequently, the decision was made to individually use each of the behaviour items in the further analyses. A correlation analysis was performed to look at the relation between the individual behaviour items and the privacy factors that were found in the earlier analysis. The values for the privacy factors were established by assigning the mean value of the items of each factor to represent the privacy factor for the correlation analysis. This was done by assigning the mean value of the items to each of the four factors and then using that value to represent the privacy factor. The correlations can be found in Table 3 and range from -.03 to .53.

As the results show, a few items did not produce any significant correlations with any factor, namely Item 3, 9, 14, 18 and 19. This suggests that people might not associate those behaviours with privacy in their daily life. However, the rest of the behaviour did produce

some moderate to high correlations, demonstrating that they are explained well by privacy as a value. The highest positive significant correlations that were found for the behavioural items also relate to the same content of the privacy factors.

Control over interactions and monitoring shows a lot of moderate correlations but shows the highest positive correlations with “I generally check and manage the settings of my personal devices”, “I generally try to keep people from watching into my home” and “I generally hide my personal notes from others”. These high-loading items were originally assumed to be part of very different dimensions, which reinforces the idea that the items were too complex to simply fit to one dimension.

The second factor, informational and online privacy, shows especially high correlations with “I actively select which cookies I accept on the internet” and other items that were selected for the original informational privacy dimension. Therefore, the data suggests that the information and online privacy dimension as a value, is well able to predict some specific privacy protective measurements that relate to the same dimension.

For the third factor of social and psychological privacy, it shows the highest positive correlations with “I generally try to make sure that bystanders are not able to see chat conversations on my phone”, “I hold private conversations only when no one else can listen to them” and other items of the same content-related dimension, namely psychological and social privacy. Therefore it can be said that for this factor too, a few behavioural items among the psychological and social privacy dimension are able to be predicted well.

The same correlation analysis was done for the earlier reduced set of items that resulted in the three privacy factors. Those results are displayed in Table 4 and the correlations range from $-.09$ to $.55$. Some of the correlations show slightly smaller relations than before, however, the effect is still the same and it becomes visible over both item options, which behaviours serve as good predictions.

Table 3

Correlations of Behaviour Items and Privacy Factors

| Item No. | Behaviour Item | Factor 1 | Factor 2 | Factor 3 |
|-----------------------|---|--|--------------------------------|----------------------------------|
| | | Control over interactions and monitoring | Information and online privacy | Social and psychological privacy |
| <i>Informational:</i> | | | | |
| 1 | I generally avoid publishing pictures of myself on the internet. | .27 (.000) | .22 (.000) | .14 (.023) |
| 4 | I generally try to change my passwords. | .25 (.000) | .32 (.000) | .09 (.145) |
| 7 | I generally keep my virus protection software on my computer updated. | .32 (.000) | .39 (.000) | .30 (.000) |
| 10 | I actively select which cookies I accept on the internet. | .39 (.000) | .53 (.000) | .27 (.000) |
| 13 | I generally check and manage the settings of my personal devices | .48 (.000) | .52 (.000) | .31 (.000) |
| 14 | I use my full name on social media. | .03 (.695) | .03 (.642) | -.03 (.621) |
| 17 | I turn off personal targeted advertisements online. | .40 (.000) | .52 (.000) | .38 (.000) |
| 20 | Whenever I can I use cash over credit or debit cards to prevent information tracking. | .28 (.000) | .35 (.000) | .20 (.001) |
| <i>Social:</i> | | | | |
| 3 | I like to have private conversations with work colleagues. | -.03 (.618) | -.03 (.617) | .02 (.775) |
| 8 | I like to withdraw myself from any social interaction and spend some time alone. | .24 (.000) | .13 (.361) | .20 (.001) |
| 12 | I hold private conversations only when no one else can listen to them. | .41 (.000) | .29 (.000) | .44 (.000) |

| | | | | |
|-----------------------|--|------------|-------------|------------|
| 16 | I generally try to make sure that bystanders are not able to see chat conversations on my phone. | .37 (.000) | .41 (.000) | .47 (.000) |
| <i>Physical:</i> | | | | |
| 2 | I generally try to avoid sitting close to strangers in a crowded bus. | .14 (.027) | .03 (.686) | .17 (.006) |
| 6 | I generally try to keep people from watching into my home. | .44 (.000) | .35 (.000) | .33 (.000) |
| 11 | I generally try to avoid eye-contact with strangers. | .22 (.000) | .04 (.488) | .26 (.000) |
| 19 | I generally can comfortably change my clothes in public changing rooms. | .28 (.174) | -.01 (.886) | .14 (.027) |
| <i>Psychological:</i> | | | | |
| 5 | I generally hide my personal notes from others. | .44 (.000) | .40 (.000) | .40 (.000) |
| 9 | I generally enjoy sharing my personal beliefs and goals with others. | .06 (.357) | -.01 (.827) | .01 (.839) |
| 15 | I generally try to avoid being judged by others when feeling vulnerable | .38 (.000) | .29 (.000) | .43 (.000) |
| 18 | I generally like to ask for advice about personal matters and feelings | .04 (.566) | .03 (.618) | .03 (.643) |

Note. The table displays the correlations followed by the p-values in brackets.

Table 4

Correlations of Behaviour Items and Privacy Factors with Reduced Number of Items

| Item No. | Behaviour Item | Factor 1 | Factor 2 | Factor 3 |
|-----------------------|----------------|--|--------------------------------|----------------------------------|
| | | Control over interactions and monitoring | Information and online privacy | Social and psychological privacy |
| <i>Informational:</i> | | | | |

| | | | | |
|------------------|--|-------------|-------------|-------------|
| 1 | I generally avoid publishing pictures of myself on the internet. | .24 (.000) | .19 (.003) | .09 (.147) |
| 4 | I generally try to change my passwords. | .24 (.000) | .33 (.000) | .09 (.145) |
| 7 | I generally keep my virus protection software on my computer updated. | .29 (.000) | .35 (.000) | .29 (.000) |
| 10 | I actively select which cookies I accept on the internet. | .39 (.000) | .55 (.000) | .24 (.000) |
| 13 | I generally check and manage the settings of my personal devices | .45 (.000) | .52 (.000) | .26 (.000) |
| 14 | I use my full name on social media. | .03 (.616) | .02 (.717) | -.02 (.721) |
| 17 | I turn off personal targeted advertisements online. | .32 (.000) | .52 (.000) | .35 (.000) |
| 20 | Whenever I can I use cash over credit or debit cards to prevent information tracking. | .27 (.000) | .33 (.000) | .20 (.001) |
| <i>Social:</i> | | | | |
| 3 | I like to have private conversations with work colleagues. | -.07 (.242) | -.09 (.165) | .05 (.421) |
| 8 | I like to withdraw myself from any social interaction and spend some time alone. | .26 (.000) | .10 (.116) | .17 (.006) |
| 12 | I hold private conversations only when no one else can listen to them. | .40 (.000) | .23 (.000) | .44 (.000) |
| 16 | I generally try to make sure that bystanders are not able to see chat conversations on my phone. | .32 (.000) | .35 (.000) | .47 (.000) |
| <i>Physical:</i> | | | | |
| 2 | I generally try to avoid sitting close to strangers in a crowded bus. | .12 (.068) | -.01 (.847) | .15 (.021) |
| 6 | I generally try to keep people from watching into my home. | .39 (.000) | .30 (.000) | .43 (.000) |

| | | | | |
|-----------------------|---|------------|-------------|------------|
| 11 | I generally try to avoid eye-contact with strangers. | .24 (.000) | .01 (.833) | .25 (.000) |
| 19 | I generally can comfortably change my clothes in public changing rooms. | .05 (.417) | -.04 (.556) | .16 (.010) |
| <i>Psychological:</i> | | | | |
| 5 | I generally hide my personal notes from others. | .43 (.000) | .31 (.000) | .36 (.000) |
| 9 | I generally enjoy sharing my personal beliefs and goals with others. | .04 (.495) | -.01 (.826) | .02 (.780) |
| 15 | I generally try to avoid being judged by others when feeling vulnerable | .35 (.000) | .20 (.002) | .42 (.000) |
| 18 | I generally like to ask for advice about personal matters and feelings. | .01 (.872) | -.01 (.936) | .03 (.610) |

Note. The table displays the correlations followed by the p-values in brackets.

Gender Effects

An unpaired t-test was performed to compare differences in men and women when it comes to privacy as a value. The results can be found in Table 5. It was found that women score significantly higher on control over interactions and monitoring, as well as social and psychological privacy. This suggests that women value these privacy dimensions as more important than men. No significant differences between the genders were found for informational and online privacy, even though the women scored also on average somewhat higher on this dimension.

When testing for gender effects with the reduced number of privacy items, the only significant effect that was found was for women scoring higher on social and psychological privacy ($t(250) = 2.58, p = .028$)

Table 5

Descriptive Statistics and T-test Results

| | Men | | Women | | <i>df</i> | <i>p-value</i> |
|--|----------|-----------|----------|-----------|-----------|----------------|
| | <i>M</i> | <i>SD</i> | <i>M</i> | <i>SD</i> | | |
| Control over Interactions and Monitoring | 4.82 | .18 | 5.12 | .18 | 14 | .005 |
| Informational and Online Privacy | 4.52 | .41 | 4.78 | .41 | 16 | .188 |
| Social and Psychological Privacy | 4.72 | .33 | 5.08 | .25 | 16 | .019 |

Note. The table displays the three-factor solution.

Discussion

This study aimed to design privacy items that can be measured as a universal human value and test if privacy can be conceptually distinguished as different dimensions. According to prior theoretical conceptualization of privacy from Burgoon (1982), it was hypothesized to find four different dimensions of privacy, namely psychological privacy, physical privacy, social privacy, and informational privacy. Differently than expected, we were not able to find the same four dimensions, but instead, three dimensions were discovered that are conceptually well distinguishable. It was not completely clear if three or four factors were more suitable based on the outcome of the analyses, but they differed from Burgoon's dimension labels either way to a certain degree. As a difference to Burgoon (1982), the data introduced controlling interactions and monitoring as a new dimension, while informational and online privacy built the second dimension. The third dimension found was psychological and social privacy and interestingly thus combined both of Burgoon's dimensions into one, which were found to have an overarching theme and being often interrelated. This could be explained due to the fact that a lot of social interactions include psychological mechanisms and effects, and it is therefore hard to strictly divide them from one another.

Overall, it can be said that even though the exact same dimensions that Burgoon (1982) proposed were not replicated in this study, the findings did support the idea of a multidimensional concept of privacy. This suggests that there are different approaches to conceptualize privacy from multiple viewpoints, for example by focusing more on different

social aspects of privacy or modern developments that influence privacy (e.g. Pedersen, 1979; Roessler, 2018).

For the second research hypothesis, relevant findings were found to explain the influence of privacy as a value on behaviour. Against expectations, it was not possible to find common dimensions for the behavioural items since the behaviours seemed to be too unrelated to each other, but there were still positive significant correlations found between the privacy factors and the individual behavioural items. This means that some privacy-protective behaviours can be predicted by privacy as a value, just that inferences about the behavioural dimension were not possible for this study. Some of the correlations even showed very promising correlations and seemed to be strong predictors. For other relations that ranged from low to moderate effects, it should also be noted that behaviours are influenced by a lot of different values and characteristics, which is why it is better to assume that privacy as a value is only partly responsible for behaviour measurements. Sagiv et al. (2017) support the idea that for a single behaviour, the whole spectrum of values needs to be observed in order to understand someone's motivation. The results can still be insightful as to which behaviours can be predicted by privacy as a value.

In line with expectations, especially high correlations were found when the content of the behavioural items matched with the privacy factors, as it was found for example in the case of informational and online privacy. This suggests that people who value their privacy also associate a certain privacy-protective behaviour with it. However, as a new insight, it can also be noted that privacy as a value seems to also predict behaviour that we thought would have privacy implications apart from the dimensions since there were a lot of positive correlations found for items with different dimensions.

For the last part of the analyses, gender differences were observed and confirmed the expectations for some of the dimensions. Using the full set of items, the hypothesis of women being more concerned over privacy-related issues was partly met since they did indeed show

higher concerns when it comes to controlling interactions and monitoring, as well as social and psychological privacy. The only dimension where no difference was found was for informational and online privacy, which seems to suggest that men and women carry similar attitudes and that they are equally aware of the online and informational risks.

The alternative option with the reduced set of privacy items only supported the significant findings of social and psychological privacy, which suggests considering that dimension as the most different between genders. Therefore, we can also confirm prior research, that women seem to be more cautious about their social and private lives as they report more personal value for those dimensions (Tifferet, 2019). According to Westin's privacy typology (2000), it could therefore be assumed that more women tend to rather be a part of the fundamentalist group of people, which are said to be more concerned about their privacy. According to Westin (2000) those insights can help to see how people react to or think about privacy threats, which could provide interesting hints on behavioural studies.

Strengths and Limitations

As two strengths of this research, the large sample group for a higher statistical power can be highlighted, as well as the team of researchers that worked on the development of the surveys. At the same time, it can be noted that a limitation could be that only Burgoon's theory was used to develop the items based on her ideas, instead of considering other papers that exist on privacy. Nonetheless, the research team did use a high expertise and developed the items in their best possible way with a lot of consideration.

Suggestions for Further Research

For future studies, it could be recommended to continue using the set with the reduced number of privacy items, which describe the privacy factors in the most promising way. A next study could consist of adding privacy to the Schwartz Value Survey and including three items that capture privacy that were found in this study. As a recommendation, I would propose the highest scoring item of each dimension to measure privacy as a value and

therefore use the items “It is important to him/her to communicate with others without being overheard”, “It is important to him/her to be aware of which data are collected about him/her while using the internet” and “It is important for him/her to decide who can see him/her in a vulnerable state”.

Additionally, since it was not possible to completely support Burgoon’s theory (1982), it would be interesting to design a new survey to test the three privacy dimensions that were developed in this study and to research privacy from a psychological standpoint more in the future. Especially evolving privacy threats are a reason to consistently review the importance of privacy on an individual and societal level, as it can change how people value and view their privacy. As a real-life impact, it can be helpful to consider how people value their privacy when implementing e.g. new security measurements, where an assessment can help to predict the adaptation and reaction to privacy threats.

Conclusion

This research on privacy within the domain of psychology was able to develop a few potential items to measure privacy as a human value. However, more insight is still missing if it can reliably be added within the Schwartz Value Survey among the other universal values. It can be highlighted that this study was able to set a foundation by confirming the existence of a multidimensional construct, showing that there are some favourable items to measure privacy as a value. The predictability of privacy-related behaviour was also supported, which can be used for behavioural studies and implementations when trying to understand individual differences. However, it should be noted that privacy is a complex construct and that there still needs to be much more extensive research in order to really grasp the significance of privacy in our society.

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Appendix A

Schwartz Value Survey (PVQ-RR)

Here we briefly describe different people. Please read each description and think about how much that person is or is not like you. Put a checkmark in one of the boxes to the right of each question to indicate how much the person described is like you.

How much like you is this person?

- Not like me at all
- Not like me
- A little like me
- Moderately like me
- Like me
- Very much like me
- Does not apply

PVQ-RR male

1. It is important to him to form his views independently.
2. It is important to him that his country is secure and stable.
3. It is important to him to have a good time.
4. It is important to him to avoid upsetting other people.
5. It is important to him that the weak and vulnerable in society be protected.
6. It is important to him that people do what he says they should.
7. It is important to him never to think he deserves more than other people.
8. It is important to him to care for nature.
9. It is important to him that no one should ever shame him.
10. It is important to him always to look for different things to do.
11. It is important to him to take care of people he is close to.
12. It is important to him to have the power that money can bring.
13. It is very important to him to avoid disease and protect his health.
14. It is important to him to be tolerant toward all kinds of people and groups.
15. It is important to him never to violate rules or regulations.
16. It is important to him to make his own decisions about his life.
17. It is important to him to have ambitions in life.
18. It is important to him to maintain traditional values and ways of thinking.
19. It is important to him that people he knows have full confidence in him.
20. It is important to him to be wealthy.
21. It is important to him to take part in activities to defend nature.
22. It is important to him never to annoy anyone.
23. It is important to him to develop his own opinions.
24. It is important to him to protect his public image.
25. It is very important to him to help the people dear to him.
26. It is important to him to be personally safe and secure.

27. It is important to him to be a dependable and trustworthy friend.
28. It is important to him to take risks that make life exciting.
29. It is important to him to have the power to make people do what he wants.
30. It is important to him to plan his activities independently.
31. It is important to him to follow rules even when no-one is watching.
32. It is important to him to be very successful.
33. It is important to him to follow his family's customs or the customs of a religion.
34. It is important to him to listen to and understand people who are different from him.
35. It is important to him to have a strong state that can defend its citizens.
36. It is important to him to enjoy life's pleasures.
37. It is important to him that every person in the world has equal opportunities in life.
38. It is important to him to be humble.
39. It is important to him to figure things out himself.
40. It is important to him to honour the traditional practices of his culture.
41. It is important to him to be the one who tells others what to do.
42. It is important to him to obey all the laws.
43. It is important to him to have all sorts of new experiences.
44. It is important to him to own expensive things that show his wealth.
45. It is important to him to protect the natural environment from destruction or pollution.
46. It is important to him to take advantage of every opportunity to have fun.
47. It is important to him to concern himself with every need of his dear ones.
48. It is important to him that people recognize what he achieves.
49. It is important to him never to be humiliated.
50. It is important to him that his country protect itself against all threats.
51. It is important to him never to make other people angry.
52. It is important to him that everyone be treated justly, even people he doesn't know.
53. It is important to him to avoid anything dangerous.
54. It is important to him to be satisfied with what he has and not ask for more.
55. It is important to him that all his friends and family can rely on him completely.
56. It is important to him to be free to choose what he does by himself.
57. It is important to him to accept people even when he disagrees with them.

PVQ-RR female

1. It is important to her to form her views independently.
2. It is important to her that her country is secure and stable.
3. It is important to her to have a good time.
4. It is important to her to avoid upsetting other people.
5. It is important to her that the weak and vulnerable in society be protected.
6. It is important to her that people do what she says they should.
7. It is important to her never to think she deserves more than other people.

8. It is important to her to care for nature.
9. It is important to her that no one should ever shame her.
10. It is important to her always to look for different things to do.
11. It is important to her to take care of people she is close to.
12. It is important to her to have the power that money can bring.
13. It is very important to her to avoid disease and protect her health.
14. It is important to her to be tolerant toward all kinds of people and groups.
15. It is important to her never to violate rules or regulations.
16. It is important to her to make her own decisions about her life.
17. It is important to her to have ambitions in life.
18. It is important to her to maintain traditional values and ways of thinking.
19. It is important to her that people she knows have full confidence in her.
20. It is important to her to be wealthy.
21. It is important to her to take part in activities to defend nature.
22. It is important to her never to annoy anyone.
23. It is important to her to develop her own opinions.
24. It is important to her to protect her public image.
25. It is very important to her to help the people dear to her.
26. It is important to her to be personally safe and secure.
27. It is important to her to be a dependable and trustworthy friend.
28. It is important to her to take risks that make life exciting.
29. It is important to her to have the power to make people do what she wants.
30. It is important to her to plan her activities independently.
31. It is important to her to follow rules even when no-one is watching.
32. It is important to her to be very successful.
33. It is important to her to follow her family's customs or the customs of a religion.
34. It is important to her to listen to and understand people who are different from her.
35. It is important to her to have a strong state that can defend its citizens.
36. It is important to her to enjoy life's pleasures.
37. It is important to her that every person in the world has equal opportunities in life.
38. It is important to her to be humble.
39. It is important to her to figure things out herself.
40. It is important to her to honour the traditional practices of her culture.
41. It is important to her to be the one who tells others what to do.
42. It is important to her to obey all the laws.
43. It is important to her to have all sorts of new experiences.
44. It is important to her to own expensive things that show her wealth.
45. It is important to her to protect the natural environment from destruction or pollution.
46. It is important to her to take advantage of every opportunity to have fun.
47. It is important to her to concern herself with every need of her dear ones.
48. It is important to her that people recognize what she achieves.

49. It is important to her never to be humiliated.
50. It is important to her that her country protect itself against all threats.
51. It is important to her never to make other people angry.
52. It is important to her that everyone be treated justly, even people she doesn't know.
53. It is important to her to avoid anything dangerous.
54. It is important to her to be satisfied with what she has and not ask for more.
55. It is important to her that all her friends and family can rely on her completely.
56. It is important to her to be free to choose what she does by herself.
57. It is important to her to accept people even when she disagrees with them.

Appendix B

Privacy Value Survey

Here we briefly describe different people. Please read each description and think about how much that person is or is not like you. Put a checkmark in one of the boxes to the right of each question to indicate how much the person described is like you.

How much like you is this person?

- Not like me at all
- Not like me
- A little like me
- Moderately like me
- Like me
- Very much like me
- Does not apply

privacy value questionnaire male

1. It is important to him to control which personal information is collected about him.
2. It is important to him to control who he interacts with at specific times.
3. It is important to him to be aware of which data are collected about him while using the internet.
4. It is important to him to withhold personal information from specific others.
5. It is important to him to control who can be physically close to him.
6. It is important to him to be able to trust others that they will keep personal conversations to themselves.
7. It is important to him to decide who can see him in a vulnerable state.
8. It is important to him to know who can access information about his location.
9. It is important to him to control how he interacts with others to meet his own needs.
10. It is important to him to control who can observe him in his home environment.
11. It is important to him to control what other people get to know about him.
12. It is important to him to keep personal matters to himself.
13. It is important to him to know who can access his medical data.
14. It is important to him to communicate with others without being overheard.
15. It is important to him to decide when to be by himself without any social interaction.
16. It is important to him to occasionally disconnect from technology to limit the tracking of his online activity.
17. It is important to him to know who is able to see and hear what he is doing.
18. It is important to him to control who has access to his personal thoughts.
19. It is important to him to actively protect his online data.
20. It is important to him to be able to trust that his personal information will be kept confidential and not be shared.
21. It is important to him to choose under what circumstances he interacts with others.
22. It is important to him to have a space that is exclusively his.
23. It is important to him to control which information his devices store online about him.
24. It is important to him that others do not hear what he discusses with his best friend.

25. It is important to him to control who has access to his personal information.
26. It is important to him to not be monitored.

privacy value questionnaire female

1. It is important to her to control which personal information is collected about her.
2. It is important to her to control who she interacts with at specific times.
3. It is important to her to be aware of which data are collected about her while using the internet.
4. It is important to her to withhold personal information from specific others.
5. It is important to her to control who can be physically close to her.
6. It is important to her to be able to trust others that they will keep personal conversations to themselves.
7. It is important to her to decide who can see her in a vulnerable state.
8. It is important to her to know who can access information about her location.
9. It is important to her to control how she interacts with others to meet her own needs.
10. It is important to her to control who can observe her in her home environment.
11. It is important to her to control what other people get to know about her.
12. It is important to her to keep personal matters to herself.
13. It is important to her to know who can access her medical data.
14. It is important to her to communicate with others without being overheard.
15. It is important to her to decide when to be by herself without any social interaction.
16. It is important to her to occasionally disconnect from technology to limit the tracking of her online activity.
17. It is important to her to know who is able to see and hear what she is doing.
18. It is important to her to control who has access to her personal thoughts.
19. It is important to her to actively protect her online data.
20. It is important to her to be able to trust that her personal information will be kept confidential and not be shared.
21. It is important to her to choose under what circumstances she interacts with others.
22. It is important to her to have a space that is exclusively hers.
23. It is important to her to control which information her devices store online about her.
24. It is important to her that others do not hear what she discusses with her best friend.
25. It is important to her to control who has access to her personal information.
26. It is important to her to not be monitored.

Appendix C

Behaviour Survey

Here we describe different behaviours. Please read the statements and indicate how much you generally act out each behaviour.

- Never
- Rarely
- Regularly
- Often
- Always/Very often
- Does not apply

1. I generally avoid publishing pictures of myself on the internet.
2. I generally try to avoid sitting close to strangers in a crowded bus.
3. I like to have private conversations with work colleagues.
4. I generally try to change my passwords.
5. I generally hide my personal notes from others.
6. I generally try to keep people from watching into my home.
7. I generally keep my virus protection software on my computer updated.
8. I like to withdraw myself from any social interaction and spend some time alone.
9. I generally enjoy sharing my personal beliefs and goals with others.
10. I actively select which cookies I accept on the internet.
11. I generally try to avoid eye-contact with strangers.
12. I hold private conversations only when no one else can listen to them.
13. I generally check and manage the settings of my personal devices.
14. I use my full name on social media.
15. I generally try to avoid being judged by others when feeling vulnerable.
16. I generally try to make sure that bystanders are not able to see chat conversations on my phone.
17. I turn off personal targeted advertisements online.
18. I generally like to ask for advice about personal matters and feelings.
19. I generally can comfortably change my clothes in public changing rooms.
20. Whenever I can I use cash over credit or debit cards to prevent information tracking.

Appendix D

Attitude towards Technology Survey

Here we compare different types of technologies to each other. Please assume that money is no issue when you read each question. Put a checkmark in one of the boxes to indicate how you generally feel towards these technologies.

open floor plan offices vs. closed floor plan offices

1. Do you feel more positively towards open floor plan offices or towards closed floor plan offices?
 - Much more positive towards open floor plan offices
 - Somewhat more positive towards open floor plan offices
 - No difference
 - Somewhat more positive towards closed floor plan offices
 - Much more positive towards closed floor plan offices
 - Do not know

0. Do you feel more comfortable to work in open floor plan offices or in closed floor plan offices?
 - Much more comfortable to work in open floor plan offices
 - Somewhat more comfortable to work in open floor plan offices
 - No difference
 - Somewhat more comfortable to work in closed floor plan offices
 - Much more comfortable to work in closed floor plan offices

0. Do you prefer to work in open floor plan offices or in closed floor plan offices?
 - Strongly prefer to work in open floor plan offices
 - Somewhat prefer to work in open floor plan offices
 - No preference
 - Somewhat prefer to work in closed floor plan offices
 - Strongly prefer to work in closed floor plan offices
 - Do not know

smart video doorbell vs. regular doorbell

1. Do you feel more positively towards owning a smart video doorbell or towards owning a regular doorbell?
 - Much more positive towards owning a smart video doorbell
 - Somewhat more positive towards owning a smart video doorbell
 - No difference

- Somewhat more positive towards owning a regular doorbell
- Much more positive towards owning a regular doorbell
- Do not know

0. Do you feel more comfortable to own a smart video doorbell or a regular doorbell?

- Much more comfortable to own a smart video doorbell
- Somewhat more comfortable to own a smart video doorbell
- No difference
- Somewhat more comfortable to own a regular doorbell
- Much more comfortable to own a regular doorbell
- Do not know

0. Do you prefer to own a smart video doorbell or a regular doorbell?

- Strongly prefer to own a smart video doorbell
- Somewhat prefer to own a smart video doorbell
- No preference
- Somewhat prefer to own a regular doorbell
- Strongly prefer to own a regular doorbell
- Do not know

carpooling vs. driving alone

1. Do you feel more positively towards carpooling or towards driving alone?

- Much more positive towards carpooling
- Somewhat more positive towards carpooling
- No difference
- Somewhat more positive towards driving alone
- Much more positive towards driving alone
- Do not know

0. Do you feel more comfortable to carpool or to drive alone?

- Much more comfortable to carpool
- Somewhat more comfortable to carpool
- No difference
- Somewhat more comfortable to drive alone
- Much more comfortable to drive alone
- Do not know

0. Do you prefer to carpool or to drive alone?

- Strongly prefer to carpool

- Somewhat prefer to carpool
- No preference
- Somewhat prefer to drive alone
- Strongly prefer to drive alone
- Do not know

smart watch vs. regular watch

1. Do you feel more positively towards using a smartwatch or towards using a regular watch?
 - Much more positive towards using a smartwatch
 - Somewhat more positive towards using a smartwatch
 - No difference
 - Somewhat more positive towards using a regular watch
 - Much more positive towards using a regular watch
 - Do not know

0. Do you feel more comfortable to use a smartwatch or a regular watch?
 - Much more comfortable to use a smartwatch
 - Somewhat more comfortable to use a smartwatch
 - No difference
 - Somewhat more comfortable to use a regular watch
 - Much more comfortable to use a regular watch
 - Do not know

0. Do you prefer to use a smartwatch or a regular watch?
 - Strongly prefer to use a smartwatch
 - Somewhat prefer to use a smartwatch
 - No preference
 - Somewhat prefer to use a regular watch
 - Strongly prefer to use a regular watch
 - Do not know

bottom floor apartment vs. top floor apartment

1. Do you feel more positively towards living in the bottom floor apartment or towards living in the top floor apartment?
 - Much more positive towards living in the bottom floor apartment
 - Somewhat more positive towards living in the bottom floor apartment
 - No difference
 - Somewhat more positive towards living in the top floor apartment
 - Much more positive towards living in the top floor apartment

- Do not know

0. Do you feel more comfortable to live in the bottom floor apartment or in the top floor apartment?

- Much more comfortable to live in the bottom floor apartment
- Somewhat more comfortable to live in the bottom floor apartment
- No difference
- Somewhat more comfortable to live in the top floor apartment
- Much more comfortable to live in the top floor apartment
- Do not know

0. Do you prefer to live in the bottom floor apartment or in the top floor apartment?

- Strongly prefer to live in the bottom floor apartment
- Somewhat prefer to live in the bottom floor apartment
- No preference
- Somewhat prefer to live in the top floor apartment
- Strongly prefer to live in the top floor apartment
- Do not know

smart lights vs. regular lights

1. Do you feel more positively towards using smart lights or towards using regular lights?

- Much more positive towards using smart lights
- Somewhat more positive towards using smart lights
- No difference
- Somewhat more positive towards using regular lights
- Much more positive towards using regular lights
- Do not know

0. Do you feel more comfortable to use smart lights or regular lights?

- Much more comfortable to use smart lights
- Somewhat more comfortable to use smart lights
- No difference
- Somewhat more comfortable to use regular lights
- Much more comfortable to use regular lights
- Do not know

0. Do you prefer to use smart lights or regular lights?

- Strongly prefer to use smart lights

- Somewhat prefer to use smart lights
- No preference
- Somewhat prefer to use regular lights
- Strongly prefer to use regular lights
- Do not know

street-facing balcony vs. back-facing balcony

1. Do you feel more positively towards having a balcony that faces the street or towards having a balcony that faces the back?
 - Much more positive towards having a balcony that faces the street
 - Somewhat more positive towards having a balcony that faces the street
 - No difference
 - Somewhat more positive towards having a balcony that faces the back
 - Much more positive towards having a balcony that faces the back
 - Do not know

0. Do you feel more comfortable to have a balcony that faces the street or a balcony that faces the back?
 - Much more comfortable to have a balcony that faces the street
 - Somewhat more comfortable to have a balcony that faces the street
 - No difference
 - Somewhat more comfortable to have a balcony that faces the back
 - Much more comfortable to have a balcony that faces the back
 - Do not know

0. Do you prefer to have a balcony that faces the street or a balcony that faces the back?
 - Strongly prefer to have a balcony that faces the street
 - Somewhat prefer to have a balcony that faces the street
 - No preference
 - Somewhat prefer to have a balcony that faces the back
 - Strongly prefer to have a balcony that faces the back
 - Do not know

smart television vs. regular television

1. Do you feel more positively towards using a smart television or towards using a regular television?
 - Much more positive towards using a smart television
 - Somewhat more positive towards using a smart television
 - No difference
 - Somewhat more positive towards using a regular television
 - Much more positive towards using a regular television

- Do not know
0. Do you feel more comfortable to use a smart television or a regular television?
- Much more comfortable to use a smart television
 - Somewhat more comfortable to use a smart television
 - No difference
 - Somewhat more comfortable to use a regular television
 - Much more comfortable to use a regular television
 - Do not know
0. Do you prefer to use a smart television or a regular television?
- Strongly prefer to use a smart television
 - Somewhat prefer to use a smart television
 - No preference
 - Somewhat prefer to use a regular television
 - Strongly prefer to use a regular television
 - Do not know

Appendix E

Factor Loadings

Table E1 with 4 Factors.

| Item No. | Items | Factor | | | |
|-----------------------|---|------------|------|------------|------------|
| | | 1 | 2 | 3 | 4 |
| <i>General:</i> | | | | | |
| 1 | It is important to him/her to control which personal information is collected about him/her. | .84 | .07 | .08 | -.09 |
| 4 | It is important to him/her to withhold personal information from specific others. | .49 | .35 | .08 | .05 |
| 7 | It is important to him/her to decide who can see him/her in a vulnerable state. | -.10 | .10 | .01 | .79 |
| 11 | It is important to him/her to control what other people get to know about him/her. | .07 | .12 | .38 | .32 |
| 14 | It is important to him/her to communicate with others without being overheard. | .10 | .03 | .73 | .73 |
| 20 | It is important to him/her to be able to trust that his/her personal information will be kept confidential and not be shared. | .35 | -.08 | .25 | .40 |
| 25 | It is important to him/her to control who has access to his/her personal information. | .48 | -.01 | .24 | .23 |
| <i>Informational:</i> | | | | | |
| 3 | It is important to him/her to be aware of which data are collected about him/her while using the internet. | .96 | .07 | -.13 | .00 |
| 8 | It is important to him/her to know who can access information about his/her location. | .46 | .07 | .12 | .24 |
| 13 | It is important to him/her to know who can access his/her medical data. | .29 | -.09 | .42 | .22 |
| 16 | It is important to him/her to occasionally disconnect from technology to limit the tracking of his/her online activity. | .32 | .00 | .24 | .00 |
| 19 | It is important to him/her to actively protect his/her online data. | .62 | -.18 | .31 | .10 |
| 23 | It is important to him/her to control which information his/her devices store online about him/her. | .71 | -.03 | .10 | .13 |
| 26 | It is important to him/her to not be monitored. | .19 | -.19 | .71 | .05 |
| <i>Physical</i> | | | | | |

| | | | | | |
|----------------------|---|------|------------|------------|------------|
| 5 | It is important to him/her to control who can be physically close to him/her. | .12 | .58 | .06 | .16 |
| 10 | It is important to him/her to control who can observe him/her in his/her home environment. | -.08 | .18 | .51 | .20 |
| 17 | It is important to him/her to know who is able to see and hear what he/she is doing. | .31 | .09 | .56 | -.08 |
| 22 | It is important to him/her to have a space that is exclusively his/hers. | .00 | .36 | .35 | .01 |
| <i>Social</i> | | | | | |
| 2 | It is important to him/her to control who he/she interacts with at specific times. | .29 | .57 | .00 | .06 |
| 9 | It is important to him/her to control how he/she interacts with others to meet his/her own needs. | .05 | .33 | .13 | .41 |
| 15 | It is important to him/her to decide when to be by himself/herself without any social interaction. | -.13 | .22 | .73 | -.03 |
| 21 | It is important to him/her to choose under what circumstances he/she interacts with others. | -.02 | .48 | .25 | .23 |
| <i>Psychological</i> | | | | | |
| 6 | It is important to him/her to be able to trust others that they will keep personal conversations to themselves. | .11 | .02 | -.14 | .77 |
| 12 | It is important to him/her to keep personal matters to himself/herself. | -.01 | .14 | .58 | .14 |
| 18 | It is important to him/her to control who has access to his/her personal thoughts. | .00 | .09 | .28 | .41 |
| 24 | It is important to him/her that others do not hear what he/she discusses with his/her best friend. | .07 | -.06 | .26 | .53 |
| Eigenvalues | | 4.66 | 1.91 | 4.67 | 3.40 |
| % of Variance | | 18 | 7 | 18 | 13 |

Table E2 with 5 Factors.

| Item No. | Items | Factor | | | | |
|-----------------|--|--------|-----|------------|------|-----|
| | | 1 | 2 | 3 | 4 | 5 |
| <i>General:</i> | | | | | | |
| 1 | It is important to him/her to control which personal information is collected about him/her. | -.02 | .04 | .85 | -.07 | .09 |

| | | | | | | |
|-----------------------|---|------|------------|------------|------------|------------|
| 4 | It is important to him/her to withhold personal information from specific others. | -.12 | .31 | .51 | .07 | .07 |
| 7 | It is important to him/her to decide who can see him/her in a vulnerable state. | .00 | .10 | -.12 | .79 | .00 |
| 11 | It is important to him/her to control what other people get to know about him/her. | -.31 | -.01 | .16 | .39 | .43 |
| 14 | It is important to him/her to communicate with others without being overheard. | .07 | .08 | .11 | .04 | .68 |
| 20 | It is important to him/her to be able to trust that his/her personal information will be kept confidential and not be shared. | .38 | .05 | .23 | .40 | .18 |
| 25 | It is important to him/her to control who has access to his/her personal information. | .36 | .13 | .37 | .21 | .17 |
| <i>Informational:</i> | | | | | | |
| 3 | It is important to him/her to be aware of which data are collected about him/her while using the internet. | -.71 | .04 | .95 | .01 | -.11 |
| 8 | It is important to him/her to know who can access information about his/her location. | .17 | .14 | .40 | .24 | .09 |
| 13 | It is important to him/her to know who can access his/her medical data. | .01 | -.10 | .30 | .24 | .42 |
| 16 | It is important to him/her to occasionally disconnect from technology to limit the tracking of his/her online activity. | -.13 | -.06 | .37 | .02 | .28 |
| 19 | It is important to him/her to actively protect his/her online data. | .07 | -.17 | .61 | .12 | .32 |
| 23 | It is important to him/her to control which information his/her devices store online about him/her. | .29 | .06 | .61 | .12 | .06 |
| 26 | It is important to him/her to not be monitored. | .29 | -.08 | .12 | .04 | .66 |
| <i>Physical</i> | | | | | | |
| 5 | It is important to him/her to control who can be physically close to him/her. | -.22 | .53 | .16 | .17 | .04 |
| 10 | It is important to him/her to control who can observe him/her in his/her home environment. | -.17 | .13 | -.02 | .22 | .51 |
| 17 | It is important to him/her to know who is able to see and hear what he/she is doing. | .02 | .12 | .32 | -.07 | .53 |
| 22 | It is important to him/her to have a space that is exclusively his/hers. | .15 | .49 | -.07 | -.03 | .27 |

| | | | | | | |
|----------------------|---|------|------------|------|------------|------------|
| <i>Social</i> | | | | | | |
| 2 | It is important to him/her to control who he/she interacts with at specific times. | .03 | .63 | .25 | .04 | -.07 |
| 9 | It is important to him/her to control how he/she interacts with others to meet his/her own needs. | -.08 | .32 | .06 | .42 | .11 |
| 15 | It is important to him/her to decide when to be by himself/herself without any social interaction. | .05 | .29 | -.13 | -.04 | .66 |
| 21 | It is important to him/her to choose under what circumstances he/she interacts with others. | .08 | .58 | -.08 | .21 | .17 |
| <i>Psychological</i> | | | | | | |
| 6 | It is important to him/her to be able to trust others that they will keep personal conversations to themselves. | .02 | .02 | .09 | .77 | -.14 |
| 12 | It is important to him/her to keep personal matters to himself/herself. | -.13 | .10 | .04 | .16 | .58 |
| 18 | It is important to him/her to control who has access to his/her personal thoughts. | .07 | .13 | -.03 | .41 | .25 |
| 24 | It is important to him/her that others do not hear what he/she discusses with his/her best friend. | .08 | -.03 | .05 | .53 | .25 |
| Eigenvalues | | .90 | 2.31 | 4.38 | 3.47 | 4.24 |
| % of Variance | | 3 | 9 | 17 | 13 | 16 |

Appendix F

R Code

```

install.packages("haven")
install.packages("magrittr")
install.packages("readr")
install.packages("tidyverse")
install.packages("lavaan")
install.packages("psych")
install.packages("dplyr")
install.packages("janitor")
library(psych)
library(magrittr)
library(dplyr)
library(tidyverse)
library(haven)
library(janitor)
library(readr)
library(lavaan)

data1 <- rename(data1, consent = X.,
                age = X..7, gender = X..6)
data1 <- data1 %>% filter(consent == 1)
data1 <- data1 %>% filter(age >= "17")
data1[data1 == '7'] <- 'NA'

#filter failed attention checks
data2 <- subset(data1, Q52_4!=1 & Q52_4!=2 & Q52_4!=3 & Q52_4!=4 & Q52_4!=5 & Q52_4!=7)
data3 <- subset(data2, Q67_3!=1 & Q67_3!=2 & Q67_3!=3 & Q67_3!=5 & Q67_3!=6 & Q67_3!=7)
data4 <- subset(data3, Q62_4!=1 & Q62_4!=2 & Q62_4!=3 & Q62_4!=4 & Q62_4!=5 & Q62_4!=7)
data5 <- subset(data4, Q71_3!=1 & Q71_3!=2 & Q71_3!=3 & Q71_3!=5 & Q71_3!=6 & Q71_3!=7)
mydata <- data5 %>% select(1:17, 19:26)
mydata <- mydata %>% mutate_if(is.character,as.numeric)

bart_spher(mydata)
KMO(mydata)

# Parallel Analysis
mydata[,1:25] %>% fa.parallel()

#exploratory factor analysis
fa(mydata, nfactors = 5, rotate = "oblimin")

```

```

fa(mydata, nfactors = 4, rotate = "oblimin")
fa(mydata, nfactors = 3, rotate = "oblimin")

M1<-fa(mydata, nfactors = 3, rotate = "oblimin")
fa.diagram(M1,main="mydata")

results <- mydata %>%
  as.matrix() %>%
  itemAnalysis()

# PCA
results <- prcomp(mydata, scale = TRUE)
var_explained = results$sdev^2 / sum(results$sdev^2)
print(var_explained)

#behaviour items

#filter participants
data1 <- data1 %>% filter(consent == 1)
data1 <- data1 %>% filter(age >= "17")
behaviouritems[behaviouritems == '6'] <- 'NA'

#filter failed attention checks
data2 <- subset(data1, Q52_4!=1 & Q52_4!=2 & Q52_4!=3 & Q52_4!=4 & Q52_4!=5 & Q52_4!=7)
data3 <- subset(data2, Q67_3!=1 & Q67_3!=2 & Q67_3!=3 & Q67_3!=5 & Q67_3!=6 & Q67_3!=7)
data4 <- subset(data3, Q62_4!=1 & Q62_4!=2 & Q62_4!=3 & Q62_4!=4 & Q62_4!=5 & Q62_4!=7)
data5 <- subset(data4, Q71_3!=1 & Q71_3!=2 & Q71_3!=3 & Q71_3!=5 & Q71_3!=6 & Q71_3!=7)

behaviouritems <- data5 %>% select(211:230)
behaviour2 <- behaviouritems %>% select(1:20)

#change answer scale
behaviour2$X._3.4[behaviour2$X._3.4 == '1'] <- '6'
behaviour2$X._3.4[behaviour2$X._3.4 == '2'] <- '7'
behaviour2$X._3.4[behaviour2$X._3.4 == '5'] <- '1'
behaviour2$X._3.4[behaviour2$X._3.4 == '4'] <- '2'
behaviour2$X._3.4[behaviour2$X._3.4 == '6'] <- '5'
behaviour2$X._3.4[behaviour2$X._3.4 == '7'] <- '4'
behaviour2$X._9[behaviour2$X._9 == '1'] <- '6'
behaviour2$X._9[behaviour2$X._9 == '2'] <- '7'
behaviour2$X._9[behaviour2$X._9 == '5'] <- '1'

```

```

behaviour2$X._9[behaviour2$X._9 == '4'] <- '2'
behaviour2$X._9[behaviour2$X._9 == '6'] <- '5'
behaviour2$X._9[behaviour2$X._9 == '7'] <- '4'
behaviour2$X._14[behaviour2$X._14 == '1'] <- '6'
behaviour2$X._14[behaviour2$X._14 == '2'] <- '7'
behaviour2$X._14[behaviour2$X._14 == '5'] <- '1'
behaviour2$X._14[behaviour2$X._14 == '4'] <- '2'
behaviour2$X._14[behaviour2$X._14 == '6'] <- '5'
behaviour2$X._14[behaviour2$X._14 == '7'] <- '4'
behaviour2$X._18[behaviour2$X._18 == '1'] <- '6'
behaviour2$X._18[behaviour2$X._18 == '2'] <- '7'
behaviour2$X._18[behaviour2$X._18 == '5'] <- '1'
behaviour2$X._18[behaviour2$X._18 == '4'] <- '2'
behaviour2$X._18[behaviour2$X._18 == '6'] <- '5'
behaviour2$X._18[behaviour2$X._18 == '7'] <- '4'
behaviour2$X._19[behaviour2$X._19 == '1'] <- '6'
behaviour2$X._19[behaviour2$X._19 == '2'] <- '7'
behaviour2$X._19[behaviour2$X._19 == '5'] <- '1'
behaviour2$X._19[behaviour2$X._19 == '4'] <- '2'
behaviour2$X._19[behaviour2$X._19 == '6'] <- '5'
behaviour2$X._19[behaviour2$X._19 == '7'] <- '4'

```

```
behaviour2 <- behaviour2 %>% mutate_if(is.character,as.numeric)
```

```
bart_spher(behaviour2)
```

```
KMO(behaviour2)
```

```
# Parallel Analysis
```

```
behaviour2[,1:20] %>% fa.parallel()
```

```
#factor analysis
```

```
fa(behaviour2, nfactors = 5, rotate = "oblimin")
```

```
fa(behaviour2, nfactors = 4, rotate = "oblimin")
```

```
fa(behaviour2, nfactors = 3, rotate = "oblimin")
```

```
fa(behaviour2, nfactors = 2, rotate = "oblimin")
```

```
fa(behaviour2, nfactors = 1, rotate = "oblimin")
```

```
#corellation between behaviour and privacy
```

```
factor1 <- factor1 %>%
```

```
mutate(Factor1 = ('item 10' + `item 12` + `item 13` + `item 14` + `item 15` + `item 17` + `item 24` + `item 26` +
`item 25`)/8)
```



```

+ repeat for factor2&3

Factor1_column <- factor1$Factor1
Factor2_column <- factor2$Factor3
Factor3_column <- factor2$Factor3

behaviour2 <- behaviour2 %>%
mutate(Factor1 = Factor1_column)
mutate(Factor2 = Factor2_column)
mutate(Factor3 = Factor3_column)

#compute the correlations
correlations <- cor_mat(behaviour2)
#computes only p-values of correlations a
p_values2Test <- cor_pmat(behaviour2)

#genderdifferences
privacygender <- valueitems %>% select(2:28)
privacygender <- privacygender %>% mutate_if(is.character, as.numeric)
maleprivacy <- privacygender %>% filter(gender == "1")
femaleprivacy <- privacygender %>% filter(gender == "2")

summary(maleprivacy)
summary(femaleprivacy)

# compute t-test
t.test(maleprivacy ~ femaleprivacy)

#new data set excluding the low loading items
dfnew <- mydata %>% dplyr::select(1,2,3,5,6,7,8,9,14,15,17,21,22,23,25,26)

bart_spher(dfnew)
KMO(dfnew)

# Parallel Analysis
dfnew[,1:16] %>% fa.parallel()

#factor analysis
fa(dfnew, nfactors = 3, rotate = "oblimin")

M1 <- fa(dfnew, nfactors = 4, rotate = "oblimin")
fa.diagram(M1, main = "factor analysis")

```

```

results <- dfnew %>%
  as.matrix() %>%
  itemAnalysis()

#filter more items
dfnew3 <- mydata %>% dplyr::select(1,2,3,5,6,7,9,14,15,17,21,23,26)

bart_spher(dfnew3)
KMO(dfnew3)

#factor analysis
fa(dfnew3, nfactors = 3, rotate = "oblimin")

M1<-fa(dfnew3, nfactors = 3, rotate = "oblimin")
fa.diagram(M1,main="factor analysis")

#merge factors for correlation
f1 <- dfnew3 %>% dplyr::select(8,13,10,9)
f2 <- dfnew3 %>% dplyr::select(3,1,12)
f3 <- dfnew3 %>% dplyr::select(6,7,4,11,5,2)

f1 <- f1 %>%
  mutate(Factor1 = (`item 14` + `item 15` + `item 17` + `item 26`)/4)
f2 <- f2 %>%
  mutate(Factor2 = (`item 1` + `item 3` + `item 23`)/3)
f3 <- f3 %>%
  mutate(Factor3 = (`item 2` + `item 5` + `item 6` + `item 7` + `item 9` + `item 21`)/6)

behavingnew <- behaviour2 %>% dplyr::select(1:20)

Factor1_column <- f1$Factor1
behavingnew <- behavingnew %>%
  mutate(Factor1 = Factor1_column)
Factor2_column <- f2$Factor2
behavingnew <- behavingnew %>%
  mutate(Factor2 = Factor2_column)
Factor3_column <- f3$Factor3
behavingnew <- behavingnew %>%
  mutate(Factor3 = Factor3_column)

#compute correlations

```

```
newcorrelations <- cor_mat(behavingnew)
```

```
#compute only p values
```

```
newpvalues <- cor_pmat(behavingnew)
```