1 Analyzing the Privacy Paradox Using a Nationally Representative Three-Wave Panel Study

Abstract

The privacy paradox states that people's concerns about online privacy are unrelated to their online sharing of personal information. On the basis of a representative sample of the German population, which includes 1403 respondents who were interviewed at three waves separated by 6 months, we investigate the privacy paradox from a longitudinal perspective. Using a cross-lagged panel model with random intercepts, we differentiate between-person relations from within-person effects. Results revealed that people who were more concerned about their online privacy than others also shared slightly less personal information and had substantially more negative attitudes toward information sharing (between-person level). People who were more concerned than usual also shared slightly less information than usual (within-person level). We found no long-term effects of privacy concerns on information sharing or attitudes 6 months later. The results provide further evidence against the privacy paradox, but more research is needed to better understand the variables' potential causal relations.

Keywords: privacy paradox, privacy concerns, information sharing, longitudinal analysis, structural equation modeling

Word count: 6459

Analyzing the Privacy Paradox Using a Nationally Representative Three-Wave Panel Study

The privacy paradox states that the information disclosure of Internet users is problematic: Although many people are concerned about their privacy online, they still share plenty of personal information on the web (e.g., Acquisti & Grossklags, 2003). The privacy paradox is of considerable interest to society—it is discussed in newspapers (Frean, 2017), Wikipedia entries (Wikipedia, 2018), designated websites (New York Public Radio, 2018), books (Trepte & Reinecke, 2011), and top-tier academic journals (Acquisti, Brandimarte, & Loewenstein, 2015). If the privacy paradox really exists, it should inspire worry: It would suggest that online behavior is irrational and that people are revealing too much of their personal information, which can cause various problems (e.g., Sevignani, 2016). Understanding why people disclose information online and whether or not this is paradoxical therefore represents an important challenge.

However, current research on the privacy paradox has one major limitation. To the best of our knowledge, most empirical studies conducted so far have investigated the privacy paradox from a between-person perspective. By employing empirical tests of relations between people (e.g., cross-sectional questionnaires analyzed with multiple regression or Pearson correlations), studies have analyzed whether people who are more concerned than *others* also share less personal information than *others*. Although such a perspective is interesting and represents a viable first step, it cannot make informed claims regarding causality. The privacy paradox, however, implies a causal perspective: Does a person, if *he or she* becomes more concerned about online privacy, then also share less personal information? This mismatch is problematic because although between-person relations are, except for some special cases, a *necessary* condition for causal within-person effects, they are by no means a *sufficient* one. For example, it could be that the between-person relation is determined other third variables. Hence, as the next step in investigating the privacy paradox and to better understand the causal relation between privacy concerns and information sharing, it is necessary to conduct studies with

within-person designs.

With this study we aim to answer four major questions. First, on a between-person level, how are concerns about online privacy related to the online sharing of personal information? Second, on a within-person level, does information sharing decrease when concerns increase? Third, what are the potential long-term effects? Are changes in concerns related to changes in information sharing 6 months later and/or vice versa? Fourth, what is the role of privacy attitudes, do they mediate the relation between privacy concerns and information sharing? To best answer and contextualize these questions, we first provide an in-depth theoretical analysis of the privacy paradox, after which we present the empirical results of a longitudinal panel study, which is representative of the German population.

A Brief History of the Privacy Paradox

Acquisti and Grossklags (2003) were among the first to argue that the online disclosure of personal information is paradoxical. "Experiments reveal that very few individuals actually take any action to protect their personal information, even when doing so involves limited costs" (p.1). Three years later, Barnes (2006) discussed the behavior of young people on SNSs, popularizing the term *privacy paradox*. Barnes listed six aspects of online behavior that she considered to be particularly paradoxical: (a) illusion of privacy, (b) high quantity of information sharing, (c) attitude behavior discrepancy, (d) lack of privacy concerns, (e) lack of privacy literacy, and (f) fabrication of false information. Norberg, Horne, and Horne (2007) were one of the first to empirically analyze the privacy paradox explicitly. The study found a mismatch between concerns and behavior, which is aligned with several other experimental studies conducted at the time (Beresford, Kübler, & Preibusch, 2012; Hann, Hui, Lee, & Png, 2007; Huberman, Adar, & Fine, 2005).

While there are various understandings and operationalizations of the privacy paradox (Kokolakis, 2017), subsequent research focused on Barnes's third tenet, the attitude-behavior discrepancy. Whereas some studies reported that privacy concerns were

72 not significantly related to the disclosure of personal information (e.g., Gross & Acquisti,

73 2005; Taddicken, 2014; Tufekci, 2008), which lends credence to the privacy paradox, a

74 different set of studies showed significant relations (e.g., Dienlin & Trepte, 2015; Heirman,

75 Walrave, & Ponnet, 2013; Walrave, Vanwesenbeeck, & Heirman, 2012), which refutes the

76 privacy paradox.

77   Notably, in a parallel line of research other studies have also analyzed the relation

78 between privacy concerns and information sharing. However, the term privacy paradox was

79 often not used explicitly. Instead, studies have referred to the so-called *privacy calculus*,

80 which states that the sharing of personal information online is affected by both the

81 respective costs and the anticipated benefits (Culnan & Armstrong, 1999). By now, several

82 studies have found empirical support for the privacy calculus in various online contexts

83 (e.g., Bol et al., 2018; Dienlin & Metzger, 2016; Krasnova, Spiekermann, Koroleva, &

84 Hildebrand, 2010).

85   Baruh, Secinti, and Cemalcilar (2017) published the first empirical meta-analysis on

86 the relations between privacy concerns and various forms of social media use (e.g.,

87 information sharing or SNS usage). On the basis of 37 studies, Baruh et al. (2017) found a

88 small and significant statistical relation between concerns about online privacy and online

89 information sharing ($r = -.13$, 95% CI [-.07, -.18]). Another more recent meta analysis by

90 Yu, Li, He, Wang, and Jiao (2020) also finds a significant bivariate relation between

91 privacy concerns and information sharing, albeit smaller ($r = -.06$, 95% CI [-.01, -.12]]).

92 There also exist several systematic literature reviews on the privacy paradox (Barth &

93 Jong, 2017; Gerber, Gerber, & Volkamer, 2018; Kokolakis, 2017). Kokolakis (2017) come to

94 the conclusion that "the dichotomy between privacy attitude and behaviour should not be

95 considered a paradox anymore." (p. 130) However, the authors also note that the privacy

96 paradox is a "complex phenomenon that has not been fully explained yet". Barth and Jong

97 (2017) are more skeptical, and argue that "attempts to theoretically explain and practically

98 solve the problem of the privacy paradox are still scarce and we feel the subject deserves

99 far more research attention" (p. 1052).

Defining Privacy Concerns and Information Sharing

101   Privacy is defined as the "[. . .] voluntary and temporary withdrawal of a person from
102 the general society through physical or psychological means [. . .]" (Westin, 1967, p. 7).
103 Privacy captures aspects of both volitional *control* and social *separateness* (Bräunlich et
104 al., 2020; Marwick & boyd, 2014). Several dimensions of privacy have been proposed. For
105 example, it is possible to distinguish a vertical and a horizontal level (Masur, 2018).
106 Whereas the vertical level captures privacy from authorities, institutions, or companies,
107 horizontal privacy addresses privacy from peers, colleagues, or other people. When it comes
108 to concerns in general, interestingly they do not seem to be established as a stand-alone
109 theoretical concept in psychology (Colman, 2015). Lexically, concerns are defined as a
110 "marked interest or regard usually arising through a personal tie or relationship" that also
111 reflect an "uneasy state of blended interest, uncertainty, and apprehension"
112 (Merriam-Webster, 2018). Concerns therefore represent both a latent *motivation* (or
113 increased attention), a negatively valenced *emotion* (or affective condition), and are mostly
114 implicit. As a theoretical construct, privacy concerns can hence be categorized as an
115 affective motivational disposition. As such, there are many similarities with other concepts,
116 including emotions (e.g., fear, anxiety), moods (e.g., dismay, fatigue), attitudes (risk
117 perception, approval), values (e.g., autonomy, freedom), personality traits (e.g.,
118 introversion, risk avoidance), and even physiological activation (e.g., attention, arousal).
119 Taken together, concerns about online privacy represent how much an individual is
120 motivated to focus on his or her control over a voluntary withdrawal from other people or
121 societal institutions on the Internet, accompanied by an uneasy feeling that his or her
122 privacy might be threatened.

123   The online sharing of personal information, on the other hand, captures how much
124 person-related information people share when they use the Internet, including information

about their age, sex, name, address, health, and finances. Information sharing can be differentiated from communication and self-disclosure. Communication is broad, because it comprises all verbal and nonverbal information that is emitted (e.g., Watzlawick, Bavelas, Jackson, & O'Hanlon, 2011). Self-disclosure is narrow, because it focuses on deliberate revelations about the true self to others (e.g., Jourard, 1964). Information sharing is even more specific, because it addresses only person-related information but ignores other types of self-disclosure such as personal fears, values, or plans.

The Relation Between Privacy Concerns and Information Sharing

Currently, there is a lack of studies that explicitly analyze how behavior is affected by *concerns* in general. Fortunately, however, we know much about the behavioral effects of related concepts such as attitudes or fears, which all can affect behavior, sometimes profoundly (Fishbein & Ajzen, 2010; Rogers, 1983). Emotions, perhaps the concept most closely related to concerns, have a particularly strong effect on behavior. By causing fight, flight, or freeze reactions, they are a primordial trigger of behavior and are considered to be an adaptive mechanism of evolved species (Dolan, 2002).

Also empirically, concerns have been shown to affect behavior. People more concerned about the environment show more environment-related behaviors (Bamberg, 2003). People more concerned about their appearance consume fewer calories (Hayes & Ross, 1987). People more concerned about their bodies engage in more physical exercise (Reel et al., 2007). Taken together, it is reasonable to expect that also concerns about online privacy should somehow reflect in the online sharing of personal information.

At the same time, there are some factors that likely diminish the relation. Most prominently, there is the so-called *attitude behavior gap* (Fishbein & Ajzen, 2010), which states that people sometimes act against their own attitudes. Evidently, not everyone concerned about their physical health exercises regularly. The explanation is simple: Other factors such as subjective norms and perceived behavioral control also determine behavior

(Ajzen, 1985), which automatically reduces the impact of attitudes or concerns.

Specifically, two of the most influential factors that affect online information sharing are

(a) strong subjective norms (Heirman et al., 2013) and (b) expected benefits (Krasnova et

al., 2010). In other words, users often prioritize social support, special offers, or improved

services, accepting that their privacy will be diminished. Trepte, Dienlin, and Reinecke

(2014) listed several factors that can additionally attenuate the relation: lack of strength of

concerns, absence of negative personal experiences, or situational constraints due to social

desirability. In conclusion, also in the context of the privacy paradox it *not* reasonable to

expect a *perfect* relation between attitudes and behaviors. However, we should still expect

to find a relation that is *small* or *moderate.*

There are also some methodological explanations as to why some studies did not

detect statistically significant relations. Researchers are always confronted with the

so-called *Duhem-Quine problem*, according to which it is impossible to test theories in

isolation, because empirical tests always rely on auxiliary assumptions (Dienes, 2008). In

other words, if a psychological experiment fails, we do not know whether the theory is

wrong or the questionnaire subpar. This tenet is particularly relevant for the privacy

paradox: Detecting statistical significance for small effects—and, again, we should expect

to find small effects—is more challenging because it means that large samples are necessary

to guarantee sufficient statistical power.[1] Precisely, in order to be capable of detecting a

correlation between privacy concerns and information sharing in 95% of all cases, which

Baruh et al. (2017) estimated to be $r = -.13$, we need a sample of $N = 762$ people. The

reality, however, looks different: In their meta-analysis, Baruh et al. (2017) reported a

median sample size of $N = 300$, which can explain why several studies did not find

significant effects.

In conclusion, in line with prior research and the within-person rationales presented

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[1] Statistical power describes the probability of statistically detecting an effect that exists empirically. Only
with high statistical power is it possible to make valid claims about an effect's existence (Cohen, 1992).

above, we expect to find a small significant relation between privacy concerns and

information sharing, both on the between-person level and the within-person level.

Hypothesis 1: People who are more concerned about their online privacy than others

will also be less likely to share personal information online than others.

Hypothesis 2: People who are more concerned about their online privacy than they

usually are will also share less personal information online than they usually do.

Long-Term Perspective

Although short-term effects are likely, it is still unclear whether long-term effects

exist as well. First, when analyzing potential long-term effects, it is important to choose an

interval that is both plausible and relevant. (It makes a large difference whether the effects

of alcohol consumption on driving performance are tested after say 1 minute, 1 hour, or 1

day.) One factor that determines an interval's optimal length is the stability of the

variables (Dormann & Griffin, 2015). Privacy concerns and privacy attitudes are

predominantly trait-like constructs with high stabilities, which is why they necessitate

longer intervals. Other studies with comparable research questions have therefore used an

interval of 6 months (e.g., Valkenburg & Peter, 2009), which we adopt also in this study.

In general, we believe that it should be possible to find long-term effects. It has been

argued that privacy concerns affect privacy behavior in the long run (e.g., Heirman et al.,

2013). The underlying theoretical mechanism could be that the emotional part of privacy

concerns causes (a) motivated information selection and (b) motivated information

processing, which is likely to change actual behavior (Nabi, 1999). Specifically, when

privacy concerns increase (e.g., because of experienced or witnessed privacy infringements),

people might begin reading more media articles on privacy issues and might also consume

these articles more carefully, which could prompt information sharing practices that are

more cautious. Also empirically, a study with 290 participants found small negative

longitudinal (between-person) relations between privacy concerns and self-disclosure

₂₀₂ (Koohikamali, French, & Kim, 2019).

₂₀₃   At the same time, the adverse effect seems plausible as well, with two potential

₂₀₄ outcomes. On the one hand, the long-term relation could be positive: If people start to

₂₀₅ share more information online, they might become increasingly aware that their privacy is

₂₀₆ at risk, thereby stirring concern (Tsay-Vogel, Shanahan, & Signorielli, 2018). On the other

₂₀₇ hand, the long-term relation might also be negative: When people share more personal

₂₀₈ information online they might become accustomed to doing so, which potentially reduces

₂₀₉ concern (for example, due to the mere exposure effect; Zajonc, 1968). Finally, there could

₂₁₀ also be no long-term relation at all: People might have already become used to sharing

₂₁₁ information online, which stifles further cognitive or emotional processing. This rationale is

₂₁₂ central to so-called *privacy cynicism* (e.g., Hoffmann, Lutz, & Ranzini, 2016).

₂₁₃   Research Question 1.1: Do changes in concerns about online privacy affect the online

₂₁₄ sharing of personal information 6 months later?

₂₁₅   Research Question 1.2: Do changes in the online sharing of personal information

₂₁₆ affect concerns about online privacy 6 months later?

The Role of Attitudes

₂₁₈   It has been argued that privacy attitudes could bridge the gap between concerns and

₂₁₉ information sharing (e.g., Dienlin & Trepte, 2015). In contrast to privacy concerns, privacy

₂₂₀ attitudes capture a more explicit, fluctuating cognitive appraisal (Tsay-Vogel et al., 2018).

₂₂₁ Although both variables are related to information disclosure, attitudes are likely the

₂₂₂ better predictor. This reasoning follows the rational choice paradigm (Simon, 1955), which

₂₂₃ maintains that behavior is always at least partially influenced by convictions, attitudes,

₂₂₄ and cost-benefit analyses. Also empirically, a study of 1,042 youths from Belgium found

₂₂₅ that the relation between privacy attitudes and disclosure of personal information was

₂₂₆ strong ($r = .56$), whereas the relation between privacy concerns and disclosure was only

₂₂₇ moderate ($r = -.29$; Heirman et al., 2013).

Hypothesis 3.1: People who are more concerned about their online privacy than others will also hold a less positive attitude toward the online sharing of personal information than others.

Hypothesis 3.2: People with a more positive attitude toward the online sharing of personal information than others will also share more information online than others.

Hypothesis 4.1: People who are more concerned about their online privacy than they usually are will also hold a less positive attitude toward the online sharing of personal information than they usually do.

Hypothesis 4.2: People with a more positive attitude toward the online sharing of personal information than they usually have will also share more information online than they usually do.

Concerning the potential long-term relations of privacy attitudes, we are confronted with the same situation mentioned above. Because we are not aware of research on long-term relations, several scenarios seem plausible. Attitudes could either have long-term relations or not, and information sharing could either foster privacy attitudes or diminish them.

Research Question 2.1: Do changes in concerns about online privacy affect attitudes toward the online sharing of personal information 6 months later?

Research Question 2.2: Do changes in attitudes toward the online sharing of personal information affect concerns about online privacy 6 months later?

Research Question 3.1: Do changes in attitudes toward the online sharing of personal information affect the online sharing of personal information 6 months later?

Research Question 3.2: Do changes in the online sharing of personal information affect attitudes toward the online sharing of personal information 6 months later?

₂₅₂   **Method**

₂₅₃ **Statistics**

₂₅₄   We follow the recommendation by Lakens, Adolfi, et al. (2018) and first justify the

₂₅₅ choice of our alpha level. We determined adequate error margins by considering the

₂₅₆ potential implications of both false positive and false negative findings (i.e., alpha and beta

₂₅₇ errors): On the one hand, if we committed an alpha error, we would wrongfully conclude

₂₅₈ that people's concerns and behaviors are consistent. Communicating such a false result to

₂₅₉ the public might unjustly reassure people when they should be more alert. On the other

₂₆₀ hand, if we committed a beta error, we would wrongfully conclude that individuals behave

₂₆₁ paradoxically. Communicating such a false result would unjustly accuse people of

₂₆₂ implausible behavior, potentially causing unnecessary distress or reactance. We consider

₂₆₃ both errors to be equally detrimental. Hence, we chose balanced error rates, setting a

₂₆₄ maximum error rate of 5% for both alpha and beta. As the smallest effect size of interest

₂₆₅ (SESOI; Lakens et al., 2018), we chose to consider effects that are at least small (i.e.,

₂₆₆ standardized coefficients above $\beta = .10$; Cohen, 1992) as able to offer empirical support for

₂₆₇ our theoretical hypotheses. Significantly smaller effects were not considered able to offer

₂₆₈ support. The six hypotheses were tested with a one-tailed approach and the six research

₂₆₉ questions with a two-tailed approach. On the basis of the balanced alpha-beta approach

₂₇₀ with a maximum error probability of 5%, a desired power of 95%, and an SESOI of $\beta =$

₂₇₁ .10, we calculated a minimum sample size of 1,293 respondents. Given the final sample size

₂₇₂ of 1,403 respondents (see below), alpha and beta errors were balanced for our hypotheses

₂₇₃ (research questions) when we used a critical alpha of 3% (4.20%), resulting in a power of

₂₇₄ 97% (95.80%) to detect small effects.

₂₇₅   The data were analyzed using of a random-intercept cross-lagged panel model

₂₇₆ (RI-CLPM, Hamaker, Kuiper, & Grasman, 2015). For a visualization, see Figure 1. Note

₂₇₇ that in contrast to regular cross-lagged panel models (CLPMs), RI-CLPMs can separate

₂₇₈ between-person variance from within-person variance. We used factor scores as observed
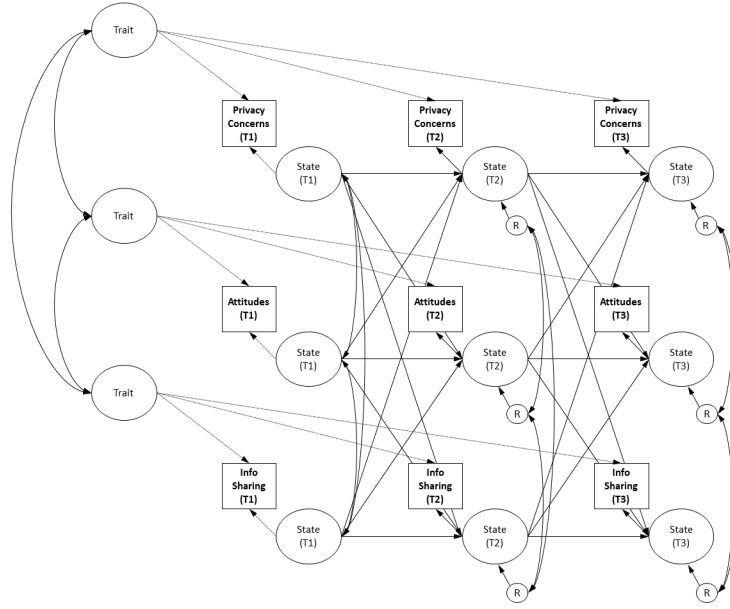
Figure 1. Visual representation of the estimated random-intercept cross-lagged panel model (RI-CLPM).

279   variables to represent the variables' latent structure more closely. We tested H1, H3.1, and

280   H3.2 by correlating the random intercepts, which represent the respondents' individual

281   mean scores across all three waves. We tested H2, H4.1, and H4.2 by correlating the

282   respondents' within-person variance at T1, which captures their specific deviation at T1

283   from their overall score. We tested all research questions by regressing variables on all

284   other measures obtained 6 months earlier. Given that we had three points of measurement,

285   this resulted in two estimates for each research question. As we did not assume

286   longitudinal effects to differ across time, they were constrained to be equal across all waves,

287   which produces one single general measure of each effect instead of two time-specific ones.

288   (We later tested this assumption empirically. As expected, the model with constrained

289   effects did not show significantly reduced model fit, $\chi^2(9) = .114$, $p = 14.25$, which

290   supports that effects did not change over time.) Fit was assessed according to the common

291   criteria as described by Kline (2016). The final model fit the data well, $\chi^2(15) = 25.18$, $p =$

292   .048, cfi $= 1.00$, rmsea $= .02$, 90% CI $[< .01, .04]$, srmr $= .01$.

293   For the analyses, we used R (Version 3.6.1; R Core Team, 2018) and the R-packages

294   *GGally* (Version 1.4.0; Schloerke et al., 2018), *ggplot2* (Version 3.2.1; Wickham, 2016),

295   *lavaan* (Version 0.6.5; Rosseel, 2012), *MissMech* (Version 1.0.2; Jamshidian, Jalal, &

296   Jansen, 2014), *MVN* (Version 5.8; Korkmaz, Goksuluk, & Zararsiz, 2014), *psych* (Version

297   1.9.12.31; Revelle, 2018), *pwr* (Version 1.2.2; Champely, 2018), *semTools* (Version 0.5.2;

298   Jorgensen et al., 2018), and *sjstats* (Version 0.17.9; Lüdecke, 2019). The code, additional

299   analyses, and a reproducible version of this manuscript can be found on the manuscript's

300   companion website at https://XMtRa.github.io/privacy-paradox.

Procedure and Respondents

302   This study is part of a large-scale project which investigates the development of

303   privacy and self-disclosure, including several other variables. Other publications linked to

304   the project can be accessed at [link blinded during review]. The data come from a

305   longitudinal paper-and-pencil questionnaire study, in which a representative sample of the

306   German population (16 years and older) was surveyed on overall five occasions. The data

307   can be downloaded from [link blinded during review].

308   The first three waves were collected from May 2014 to May 2015, with intervals of 6

309   months each. The last two waves were collected on May 2016 and May 2017, and had an

310   interval of one year. Because we hypothesized the effects to take place across half a year,

311   the last two waves were not included in the analyses presented here. First, a sample of

312   14,714 potential respondents was drawn from a representative omnibus survey in Germany

313   (ADM master sample), using a random last-two-digit dialing procedure. In this CATI

314   screening, 5,286 respondents agreed to participate in all following waves. Wave 1 was

315   completed by 3,278 respondents (response rate: 38%), Wave 2 by 2,448 respondents

316   (attrition rate: 25%), and Wave 3 by 2,021 respondents (attrition rate: 17%). We filtered

317   respondents who never used the Internet at all waves, answered fewer than 50% of the

318   items in each scale for at least one wave, provided inconsistent birth-dates across

319   measurements, or did not report sociodemographic variables. The final sample consisted of

320   $n = 1{,}403$ respondents.

321   In the final sample, the rate of missing data was 5.40%. Visual inspection of the

322   missing value patterns as well as the non-parametric test by Jamshidian et al. (2014)

323   suggested that all missing values could be considered missing at random ($p = .514$).

324   Therefore, Full Information Maximum Likelihood estimation was conducted using all

325   available data. The average age was 54 years ($SD = 15$ years), and 49% were male. About

326   39% reported that they had graduated from college.

Measures

328   We tested the factorial validity of all measures using confirmatory factor analysis

329   (CFA). Each CFA included the items from all three waves. For each item, factor loadings

330   were constrained to be equal across waves. Constrained and unconstrained models were

331   compared using χ^2 differences tests. All results were nonsignificant, suggesting longitudinal

332   factorial invariance. The measures showed good composite reliability in all three waves.

333   Graphical displays of the variables' distributions showed that privacy concerns were skewed

334   to the left, privacy attitudes were normally distributed, and information sharing was

335   skewed to the right (Figure 2, diagonal). We calculated intra-class correlation coefficients

336   to quantify how much variance in the variables' factor scores could be attributed to

337   between-person differences. An English translation of the original German items can be

338   found in the OSM.

339   **Concerns about online privacy.**   Privacy concerns were measured as a

340   second-order factor. Three items captured the vertical dimension (e.g., "How concerned are

341   you that institutions or intelligence services collect and analyze data that you disclosed on

342   the Internet?"), and three items captured the horizontal dimension (e.g., "How concerned

343   are you that people that you do not know might obtain information about you because of

344   you online activities?"). Respondents rated all items on a 5-point scale ranging from 1 (*not*

at all concerned) to 5 (*very concerned*). The means were $M_{t1} = 3.67$, $M_{t2} = 3.62$, $M_{t3} =$ 3.59, and the standard deviations $SD_{t1} = 0.88$, $SD_{t2} = 0.89$, and $SD_{t3} = 0.90$. The two-dimensional model fit the data well, $\chi^2(118) = 661.17$, $p < .001$, cfi = .97, rmsea = .06, 90% CI [.05, .06], srmr = .04. The reliability was high ($\omega_{t1} = .95$, $\omega_{t2} = .96$, $\omega_{t3} = .97$). Overall, 73.85% of the measure's variance was explained by differences between persons.

The online sharing of personal information. To measure respondent's level of information disclosure, they were asked how often they disclosed 10 different pieces of information on the Internet. The exact question was: "How often do you disclose the following pieces of information online (i.e., on the Internet)?" Each item was answered on a 5-point scale ranging from 1 (*never*) to 5 (*daily*). Factor analyses suggested a second-order factor structure with five first-order factors of two items each. The first first-order factor subsumed financial and medical information, the second first and last name, the third place of residence and street (including house number), the fourth email address and phone number, and the fifth information about education and current job. The means were $M_{t1} = 2.12$, $M_{t2} = 2.13$, $M_{t3} = 2.10$, and the standard deviations $SD_{t1} = 0.66$, $SD_{t2} = 0.64$, and $SD_{t3} = 0.61$. The model fit the data adequately, $\chi^2(375) = 2527.69$, $p < .001$, cfi = .95, rmsea = .06, 90% CI [.06, .07], srmr = .06. The reliability was high ($\omega_{t1} = .91$, $\omega_{t2} = .92$, $\omega_{t3} = .91$). Overall, 64.29% of the measure's variance was explained by differences between persons.

Attitudes toward the online sharing of personal information. Respondents' attitudes toward disclosing personal information online were captured with 10 items that measured the general appraisal of disclosing the same 10 pieces of information. Adhering to the principle of compatibility (Fishbein & Ajzen, 2010), the items were parallel to those of the actual disclosure scale. Specifically, we asked: "Do you think that it is sensible to disclose the following pieces of information online (i.e., on the Internet)?" The scale ranged from 1 (*not at all sensible*) to 5 (*very sensible*). The means were $M_{t1} = 3.67$, $M_{t2} = 3.62$, $M_{t3} = 3.59$, and the standard deviations $SD_{t1} = 0.88$, $SD_{t2} = 0.89$, and $SD_{t3} = 0.90$. The

372   second-order model with five first-order factors showed an adequate model fit, $\chi^2(375) =$

373   2683.43, $p < .001$, cfi $= .93$, rmsea $= .07$, 90% CI [.06, .07], srmr $= .08$. The reliability was

374   high ($\omega_{t1} = .88$, $\omega_{t2} = .89$, $\omega_{t3} = .87$). Overall, 59.19% of the measure's variance was

375   explained by differences between persons.

Results

377   In a first descriptive step, we analyzed the variables' bivariate relations. All variables

378   associated with the hypotheses showed correlations that were in line with our theoretical

379   rationales (Figure 2, above the diagonal).

380   Hypothesis 1 predicted that people reporting higher concerns about online privacy

381   than others would also be less likely to share personal information online than others.

382   Results revealed that the random intercepts of the two variables were significantly

383   correlated ($\beta = $ -.09, $b = $ -0.03, 95% CI [-0.05, -0.01], $z = $ -2.57, $p = .005$). Hence,

384   respondents who—on average across all three waves—were more concerned about their

385   privacy than others also shared slightly less personal information online. The effect was

386   small. When looking at the standardized effect's confidence interval (i.e., $\beta = $ -.09, 95% CI

387   [-.15, -.02]), it was not significantly smaller than our SESOI of $beta = .10$. Thus,

388   Hypothesis 1 was supported.

389   Hypothesis 2 proposed that if people perceived more concerns about their online

390   privacy than they usually do, they would also share less personal information online than

391   they usually do. Results revealed a small significant correlation ($\beta = $ -.10, $b = $ -0.02, 95%

392   CI [-0.03, $>$ -0.01], $z = $ -2.37, $p = .009$), suggesting that if respondents were more

393   concerned about their online privacy at T1 than usual, they also shared less personal

394   information online at T1 than usual. In conclusion, the results supported Hypothesis 2.

395   With Research Question 1.1, we analyzed the longitudinal relation of concerns about

396   online privacy and the online sharing of personal information 6 months later. No significant

397   lagged effect across 6 months was found ($\beta = .01$, $b = 0.01$, 95% CI [-0.05, 0.07], $z = 0.41$,
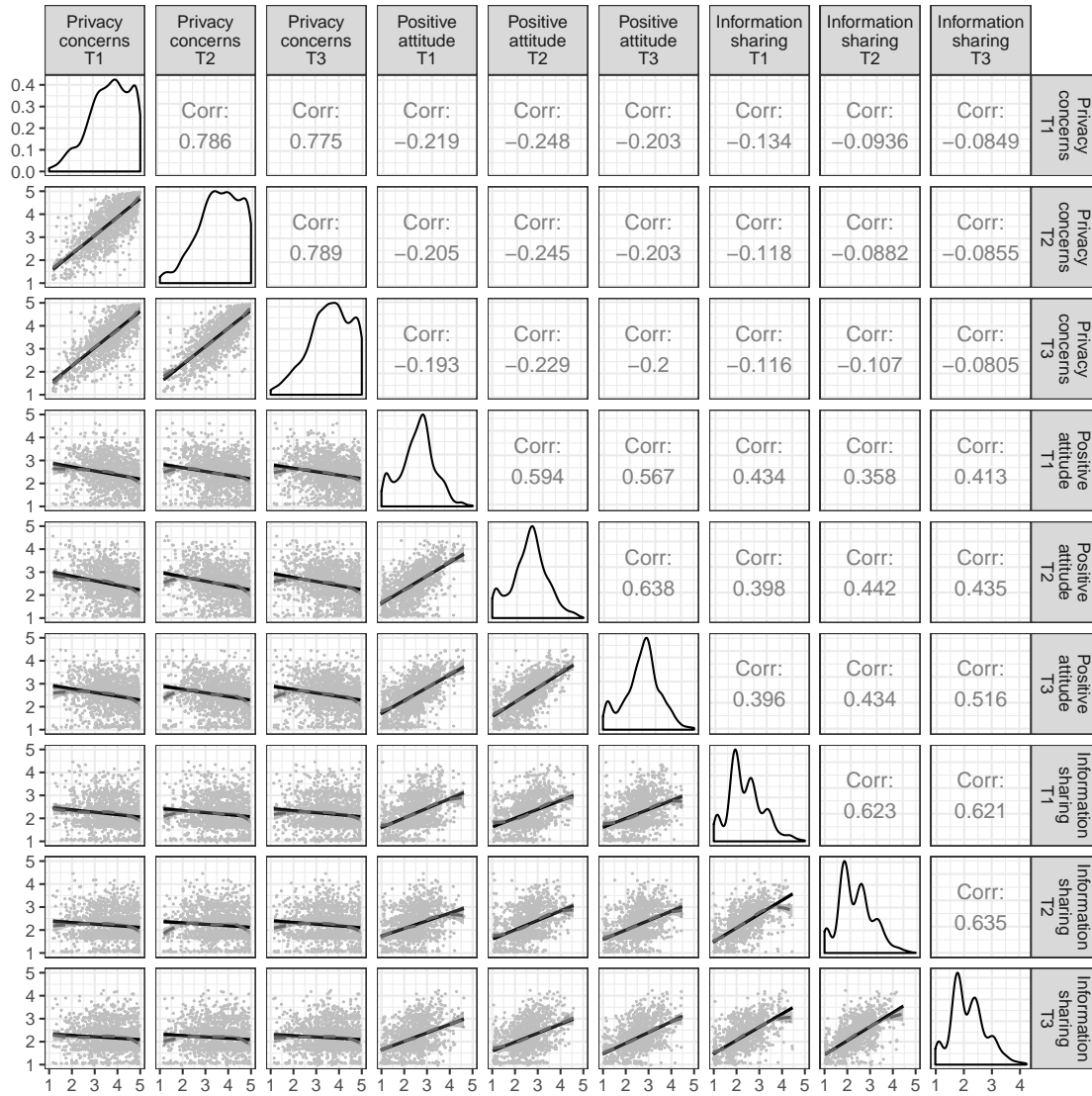
Figure 2. Results of the bivariate relations. Above the diagonal: zero-order correlation matrix; diagonal: density plots for each variable; below the diagonal: bivariate scatter plots for zero-order correlations. Solid regression lines represent linear regressions, dashed regression lines represent quadratic regressions. Calculated with the variables' latent factor scores.

398 $p = .683$). With Research Question 1.2, we investigated the longitudinal relation of the

399 online sharing of personal information and concerns about online privacy 6 months later,

400 again revealing no significant effect ($\beta = $ -.03, $b = $ -0.03, 95% CI [-0.09, 0.04], $z = $ -0.80, p

= .422).

Hypothesis 3.1 predicted that people who perceived more privacy concerns than others would also hold more negative attitudes toward the online sharing of personal information than others. The results revealed a medium-sized negative correlation between the two variables on the between-person level (β = -.31, b = -0.11, 95% CI [-0.14, -0.08], z = -8.46, p < .001). Thus, people who—on average across all three waves—reported being more concerned about their online privacy relative to the rest of the sample, were also substantially more likely to hold a more negative attitude toward the online sharing of personal information. The results therefore supported Hypothesis 3.1. Hypothesis 3.2 stated that people who held more positive attitudes toward the online sharing of personal information than others would also share more personal information online than others. Results showed a very strong between-person correlation between the two variables (β = .66, b = 0.15, 95% CI [0.13, 0.17], z = 15.12, p < .001). In other words, when averaged across all three waves, if people had more positive attitudes toward the online sharing of personal information than others, they were much more likely to actually share personal information online. In conclusion, the results supported Hypothesis 3.2.

Hypothesis 4.1 proposed that people who perceived more privacy concerns than usual would also hold more negative attitudes toward the online sharing of personal information than usual. The results did not reveal a significant effect (β = -.06, b = -0.01, 95% CI [-0.03, < 0.01], z = -1.38, p = .084). Hypothesis 4.2 proposed that people who held more positive attitudes toward the online sharing of personal information than usual would also share more personal information online than usual. Results showed a moderate within-person correlation between the two variables (β = .15, b = 0.03, 95% CI [0.02, 0.05], z = 4.01, p < .001), which indicates that when respondents had more positive attitudes at T1 than usual, they also shared more personal information than usual. In conclusion, the results supported Hypothesis 4.2.

With Research Question 2.1, we analyzed the longitudinal relations of concerns about

428 online privacy and positive attitudes toward the online sharing of personal information. No

429 significant effect was found (β = -.02, b = -0.02, 95% CI [-0.09, 0.06], z = -0.47, p = .641).

430 Regarding Research Question 2.2, again no significant longitudinal relations emerged

431 between privacy attitudes and privacy concerns 6 months later ($\beta < .01$, $b < 0.01$, 95% CI

432 [-0.06, 0.06], z = 0.06, p = .951).

433   Research Question 3.1 asked whether changes in attitudes toward the online sharing

434 of personal information would affect changes in personal information sharing 6 months

435 later. No significant effect was found ($\beta > -.01$, $b > -0.01$, 95% CI [-0.06, 0.05], z = -0.07, p

436 = .947). Next, Research Question 3.2 asked whether changes in the online sharing of

437 personal information would affect attitudes toward the online sharing of personal

438 information 6 months later. Again, no significant effect was found (β = .04, b = 0.04, 95%

439 CI [-0.03, 0.11], z = 1.15, p = .249).

440   Table 1 presents an overview of all results.

441   **Discussion**

442   Most research on the privacy paradox suggests a significant small effect of privacy

443 concerns on the online sharing of personal information (e.g., Baruh et al., 2017). However,

444 whereas the theoretical premise of the privacy paradox addresses a within-person *effect*,

445 most empirical studies have analyzed only between-person *relations*. On the basis of a

446 representative sample of the German population, from which three waves of data separated

447 by 6 months were collected, we hence analyzed the privacy paradox by differentiating

448 general between-person relations, short-term within-person relations, as well as long-term

449 within-person effects. Together, this approach allows for informed inferences about the

450 variables' causal relationship.

451   The results of the between-person analyses showed that people who were more

452 concerned about their privacy than others were slightly less likely to share personal

453 information. In addition, people who were more concerned about their privacy than others

Table 1

Parameter Estimates Obtained in the Random-Intercept Cross-Lagged Panel Model

		95% CI			
Effect	b	ll	ul	beta	p
Between-person correlations across all waves					
Privacy concern <-> information sharing	-0.03	-0.05	-0.01	-.09	.005
Privacy concern <-> positive attitude	-0.11	-0.14	-0.08	-.31	< .001
Positive attitude <-> information sharing	0.15	0.13	0.17	.66	< .001
Within-person correlations at T1					
Privacy concern <-> information sharing	-0.02	-0.03	> -0.01	-.10	.009
Privacy concern <-> positive attitude	-0.01	-0.03	< 0.01	-.06	.084
Positive attitude <-> information sharing	0.03	0.02	0.05	.15	< .001
Within-person effects across 6 months					
Privacy concern -> information sharing	0.01	-0.05	0.07	.01	.683
Information sharing -> privacy concern	-0.03	-0.09	0.04	-.03	.422
Privacy concern -> positive attitude	-0.02	-0.09	0.06	-.02	.641
Positive attitude -> privacy concern	< 0.01	-0.06	0.06	< .01	.951
Positive attitude -> information sharing	> -0.01	-0.06	0.05	> -.01	.947
Information sharing -> positive attitude	0.04	-0.03	0.11	.04	.249

Note. The between-person correlations represent interpersonal relations. For example, results showed that people who were more concerned than others, averaged across all three waves, also shared less information than others. The within-person parameters reflect how intrapersonal changes in one variable are related to intra-personal changes in another. For example, results showed that if a person was more concerned at T1 than usual, they also shared less information than usual.

454 also held substantially more negative attitudes toward disclosing personal information

455 online. Notably, we found a very strong between-person correlation between attitudes

456 toward information sharing and actual information sharing, which shows that typical

457 online disclosure can be predicted precisely by a person's attitude. Taken together, the

458 cross-sectional results are in line with the extant literature: The between-person correlation

459 of privacy concerns and information sharing found in this study (i.e., β = -.08) fall within

460 the 95% confidence interval of the effect reported by Baruh et al. (2017) (i.e., r = -.13,

461 95% CI [-.07, -.18]). Note that the between-person correlations reported here represent

462 averaged measurements across three waves, which makes the findings more robust than

463 typical one-shot measures.

464   In conclusion, this study suggests that the privacy paradox does not exist on a

465 between-person level. The differences between people with regard to their online

466 information sharing behavior can be explained by differences in their privacy concerns to a

467 small extent, and by differences in their privacy attitudes to a large extent. The more

468 specific we become, the better we can explain online behavior: Whereas privacy concerns

469 are related only weakly to online information sharing (e.g., Baruh et al., 2017), more

470 specific risks perceptions are related to behavior more closely (e.g., Bol et al., 2018; Yu et

471 al., 2020), whereas behavioral attitudes are the best predictors (Dienlin & Trepte, 2015).

472   The within-person results showed that when a person's privacy concerns increased,

473 the same person also shared slightly less information online than usual. Moreover, people

474 who developed more positive attitudes toward the online sharing of personal information

475 than usual, also shared substantially more personal information online. Together, changes

476 in concerns and attitudes are therefore related to changes in behavior, which speaks against

477 the privacy paradox also on the within-person level.

478   We did not find any long-term effects, however. Changes in both privacy concerns

479 and attitudes toward the online sharing of personal information were not related to any

480 meaningful changes in the online sharing of personal information 6 months later (and vice

versa). As an explanation, it might be the case that changes in privacy concern affect

information sharing more immediately. To test this assumption, we would need studies

with shorter intervals (Keijsers, 2016). Moreover, given that the directions of most

longitudinal relations were in line with the between-person and within-person relations,

longitudinal effects might indeed take place, but only that they are very small. Of course,

it could also be that longterm longitudinal effects do not exist.

Limitations

Some of the effect sizes reported in this study are potentially not large enough to

refute the privacy paradox completely. On the one hand, they could be a manifestation of

the so-called "crud factor" (Meehl, 1990, p. 204), which states that all psychosocial

measures are related to one another to some extent. On the other hand, other factors such

as expected benefits might play a more important role (Dienlin & Metzger, 2016). In

conclusion, although our results suggest that privacy concerns and privacy attitudes are

correlated with information sharing, the importance of privacy concerns should not be

exaggerated. The effects could be larger, and other variables play a role as well.

In this study we measured information sharing using self-reports. However,

self-reports of frequent and routine behaviors are often imprecise and unreliable (Scharkow,

2016). This represents a profound limitation of our study. Whenever possible, future

studies should aim to collect objective observations of behavior.

Finally, please note that the hypotheses presented in this study were not formally

preregistered. At the time when the study was conceived in 2014, we were not yet aware of

the importance of preregistration.

Future Research

Evidence of within-person longitudinal effects is still missing. Although we found

significant within-person correlations at T1, they were absent across the 6-month intervals.

Together, this suggests that longitudinal effects might exist, but that they take place on a

different time interval. Future research could hence probe different intervals. For

theoretical reasons (e.g., due to availability heuristics), it is plausible to use short intervals;

for statistical reasons (e.g., because of the high stability of privacy concerns), it would also

make sense to test longer intervals (Dormann & Griffin, 2015).

Although we argue that in most circumstances privacy concerns and behavior should

correlate modestly, the exact extent depends on a many boundary conditions. Future

research should hence explicitly analyze different contexts and situations. Building on

Kokolakis (2017), we suggest to analyze the following boundary conditions:

- Context (e.g., professional, social, commercial, or health-related);
- Situation (e.g., new, habitualized, or unexpected);
- Mood (e.g., positive vs. negative);
- Extent of control (high vs. low);
- Type of information processing applied (implicit, heuristic, or peripheral vs. explicit, analytic, or central);
- Existence of bias (e.g., overconfidence, optimism, comparative optimism, or hyperbolic discounting);
- Type of information (e.g., sensitive vs. superficial, biographic, or person-related);
- Benefit immediacy and risk diffusion (high vs. low).

Specifically, we encourage analyzing privacy behaviors also from a situational

perspective, accounting for temporal needs, interpersonal perceptions, contextual cues, or

characteristics of communication channels (Masur, 2018). For example, whereas general

levels of information sharing are likely best explained by using privacy *concerns*, situational

information sharing might be best explained by using privacy *heuristics* (Sundar, Kang,

Wu, Gu, & Zhang, 2013).

Next to these theory-related boundary conditions there are also methodological ones:

- Analysis design (e.g., theoretical, experimental, questionnaire-based, interview-based,

533   or anecdotal);

534 • Quality of measurement (high vs. low; low quality less likely to detect statistical

535   significance);

536 • Sample size (small vs. large; small samples less likely to detect statistical significance);

537 • Statistical analysis (e.g., SEM vs. Regression; analyses without error control less

538   likely to find statistical significance);

539 • Operationalization (e.g., concerns vs. risk perceptions vs. behavioral attitudes; the

540   more specific, the stronger the relation).

541   We emphasize that when analyzing the privacy paradox we are likely dealing with

542 small effects (Baruh et al., 2017). Hence, to detect these small effects reliably we need large

543 samples. This is often not the case (Baruh et al., 2017). In conclusion, it is crucial to use

544 statistical designs that allow for sufficient statistical power.

545 **Conclusion**

546   Being able to show that online behaviors are not paradoxical can be socially relevant.

547 Consider the similar case of fear appeals and protective behavior, where there is also only a

548 small correlation (Witte & Allen, 2000). However, fear appeals are used in public

549 campaigns nonetheless, oftentimes to much success (Wakefield, Loken, & Hornik, 2010).

550 Likewise, proclaiming that the online sharing of personal information is not paradoxical

551 and that concerns about online privacy matter, could lead to more cautious and reflective

552 behavior. It is probably no coincidence that the General Data Protection Regulation,

553 which strengthens the privacy rights of consumers, was passed in Europe, where privacy

554 concerns are particularly pronounced (European Commission, 2015).

555   In sum, this study showed that when people were more concerned about their

556 privacy, they also shared a little less personal information about themselves online. If

557 respondents considered sharing personal information to be insensible, they disclosed

558 substantially less information. Together, these findings do not support the existence of a

privacy paradox, at least in this particular context and operationalization. No evidence of long-term effects was found, however. Further research is needed to understand the potential causal interplay of concerns, attitudes, and behavior.

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