Der Einfluss von Gewinnspielen auf die Bereitschaft Nutzungsverhalten des öffentlichen Nahverkehrs zu teilen

The Impact of Lottery Incentives on Willingness to Share Public Transport Usage Behavior

Bachelorarbeit

im Bachelorstudiengang

Psychologie

der Otto-Friedrich-Universität Bamberg

Verfasser: Pascal Philipp Brückner

Prüfer: Dr. Johannes Leder

Bamberg, 2022

URN: urn:nbn:de:bvb:473-irb-561222
DOI: https://doi.org/10.20378/irb-56122

Abstract

The present study investigates the effects of a lottery incentive and trust on the willingness of local public transport users (N =169) to disclose their personal data for the improvement of the local public infrastructure. A positive effect for the lottery incentive was expected, as well as differences between the three trust conditions, with trust positively affecting personal data disclosure. In the quasi-experimental field study conducted, posters were put up in 63 buses driving in Bamberg, whose originator was varied between Stadtwerke Bamberg, University of Bamberg, and BeeInnovation, which were assumed to elicit different levels of trust. Each poster was designed in two versions, with and without notice of the possibility of winning vouchers in a lottery when completing the survey. By scanning the QR code of the posters, participants were directed to a website where they were asked to submit demographic and location data and to allow linking their survey responses with possible future responses. The hypothesis tests with a chi-square test of independence showed no significant effects of the poster conditions on personal data disclosure. The varying number of QR code scans between the quasi-experimental conditions indicated that there might have been an effect on willingness to scan the QR-codes instead. Implications of these results were discussed, and recommendations for further research were given to clarify the role of lottery incentives and trust in personal data disclosure.

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Whether it's signing up to receive a 10% discount, leaving the email address for a free trial month, or registering for faster checkout on the next purchase: companies use various strategies to obtain personal data from customers when they purchase products on their websites. But along with the proceeding collection and analysis of personal data on the internet, users' concerns about privacy have been growing in recent years (Alfnes & Wasenden, 2022). Thus, great research interest has arisen on the question of the determinants of personal data disclosure. As the interdisciplinary review of the privacy literature by Smith et al. (2011) shows, there have been two major streams of research: (a) Research on *privacy concerns*, which are rather invariant beliefs, attitudes, and perceptions towards information disclosure in general, (b) Research on the *privacy calculus*, which is the dynamic trade-off between perceived risks and perceived benefits that individuals perform when deciding whether to disclose personal data (Kim et al., 2008).

The study at hand arises from the project *Determinants of Decisions to Disclose Own Mobility Behavior* (DEMo) by the Smart City Research Lab of the University of Bamberg. Working towards the superordinate goal of improving the public bus infrastructure in the city of Bamberg, the purpose of the study is to find out possible enhancing determinants on the willingness of public transport users to submit personal data. These personal data are essential for implementing a smarter bus infrastructure since they give information about who is using the public bus transport in Bamberg and how it is being used.

The Research Questions of this study are derived from the privacy calculus model by Kim et al. (2008), which finds two factors to have a direct positive effect on the willingness to disclose personal data: perceived benefits and trust. Applied to the context of public transport usage, the present study aims to address the research questions: (a) Does a lottery incentive increase the willingness to disclose personal data? (b) Does trust increase

the willingness to disclose personal data? To answer these questions, a quasi-experimental field study in a 3x2 between-subject design has been conducted.

The following work starts with the most relevant theories behind the privacy calculus in the theory section and reports empirical findings on the positive effects of financial incentives and trust on information disclosure. After describing the sample and procedure in the method section, the results section presents the relevant findings, to then be complemented by the theoretical and practical implications in the discussion section.

2. Theory

2.1 Theoretical Framework

Information privacy is the ability to control at what time, in which way, and to what extent personal data is being shared with others, according to the definition by Westin (1967). The study at hand wants to gain further understanding of two possible determinants of the decision to disclose personal data: Trust and financial incentives. To understand if trust and financial incentives can lead to a higher willingness to disclose personal data, the cognitive mechanisms behind the decision over information disclosure must be understood in more detail.

A framework of decision-making that has been applied to information disclosure by several studies is the *theory of reasoned action,* in short, TRA (Ajzen & Fishbein, 1980; Y. Li, 2012). According to this theory, individuals have to choose between different behaviors when making decisions (Ajzen & Fishbein, 1980). In the case of information disclosure, this means the decision of whether personal data should be disclosed to a certain organization. The behavioral choice is predicted by the intention towards the behavior in the model. Intention, in turn, is determined by two factors: The *attitude* towards the behavior and the *subjective norms* regarding the behavior. Attitudes are formed out of generally expected outcomes, which are the anticipated consequences of an individual towards a certain behavior. Depending on the subjective evaluation, attitudes can be positive or negative.

Subjective norms are the subject's perception of the current social norm concerning the behavior in question. Depending on the personal importance of the social norm, this factor's influence on behavioral intention can vary.

Dinev and Hart (2006) have applied the TRA to the context of information disclosure in e-commerce transactions. In their e*xtended privacy calculus model,* they adopt the basic assumption of the TRA that intention, in this case, the *willingness to provide personal information to transact on the internet (PPIT)*, is the sole predictor of information disclosure. According to the model, PPIT is predicted by two factors, *risk beliefs* and *confidence and enticement beliefs*, which are weighed against each other. The individual calculates behavior-avoidant risk beliefs, namely the beliefs that assume that negative outcomes will follow information disclosure, with the behavior-advocating confidence and enticement beliefs, which assume that possible negative outcomes can be controlled, to form an intention towards information disclosure.

The extended privacy calculus model suggests two subfactors for each factor. For risk beliefs, these subfactors are: (a) *Perceived internet privacy risk*, (b) *Internet privacy concerns*. The first regards to possible negative outcomes of submitting personal data on the internet in general, the latter to the possible negative outcomes the respondent, in particular, has to expect (Dinev & Hart, 2006).

Confidence and enticement beliefs are, according to the scholars, determined by Internet trust, which is the belief that submitted data will be handled competently, reliably, and safely, and perceived internet interest, which is the cognitive attraction to the internet in general (Dinev & Hart, 2006). What all four subfactors have in common is they are relatively fixed by the learning history of the individual and do not vary across different internet privacy situations (Dinev & Hart, 2006).

That the privacy calculus can vary in different situations has been shown by Norberg et al. (2007), who discovered the *privacy paradox*. It describes the phenomenon that

individuals disclose more personal data in actual data submission situations than they claim to be willing to disclose when asked in a hypothetical situation. In this study, respondents had to specify which personal data they would share in a hypothetical scenario with a large bank. In the scenario, the bank introduced a graduate student credit card, and participants would receive a financial incentive of $20 to sign up for it. 12 weeks later, the same subjects should provide the actual data to an actual bank representative – and provided much more personal data than they had claimed in the first sitting (Norberg et al., 2007). If the privacy calculus, and therefore the intention to disclose personal data, is solely dependent on invariable factors like in the model by Dinev and Hart (2006), these results are difficult to explain since changes must have occurred within 12 weeks between the two measurement points (Norberg et al., 2007).

However, this model by Dinev and Hart (2006) is not the only one that constructed a privacy calculus to predict the decision to disclose personal data. Laufer and Wolfe (1977) have formulated the *calculus of behavior* for the first time in the privacy context and described it as the anticipation of possible future consequences if engaging in a particular behavior. Since then, privacy calculus has become the most researched model in the privacy literature (Yun et al., 2019).

Kim et al. (2008) propose a privacy calculus model which includes more variable, situation-specific factors. This model will be adapted to form the conceptual framework of the study at hand. Therefore, the components of the model, their effects on information disclosure, and their interactions will be described in more detail in Chapter 2.2.

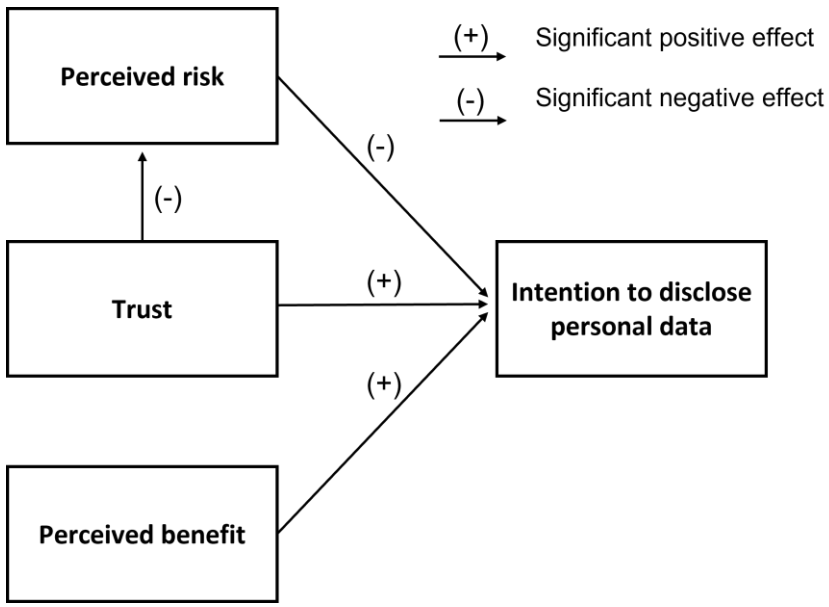
2.2 Conceptual Framework

The privacy calculus model by Kim et al. (2008) is based on a study conducted in the context of e-commerce, namely the purchase of products online. This context is also relevant to information disclosure since customers must leave sensitive information on the website to execute the transaction. Thereby, e-commerce transactions usually have a first and a second exchange: The *first exchange* concerns the trade of money and the product,

and the *second exchange* is the trade of personal data and the product (Culnan & Bies, 2003). To validate the privacy calculus model by Kim et al. (2008), a group of 512 students was observed while going through an online buying process. The scholars let participants freely choose two websites to buy an arbitrary product from and were only stopped right before the payment. At this point, scholars asked the students which website they were more likely to buy the product from. Several determinants of the participants' decisions were analyzed using a structural equation modeling technique. The resulting model takes over intention from the TRA as the sole predictor of purchasing the product on the chosen website. According to the model pictured in Figure 1, intention to disclose personal data is directly affected by three factors: Risk and benefit, which together form the privacy calculus in this model, and trust. In the following, these three factors will be defined, interactional relationships between the factors described and empirical evidence for their influence of financial incentives and trust on information disclosure presented.

Figure 1

Determinants of Intention to Disclose Personal Data Following the Model of Kim et al. (2008)



Note. The figure displays a simplified version of the model by Kim et al. (2008)

2.2.1 The Effect of a Financial Incentive on Intention to Disclose Personal Data

While in the model by Dinev and Hart (2006), the privacy calculus consists of risk beliefs and confidence and enticement beliefs, the factors establishing it in the model by Kim et al. (2008) are *perceived risks* and *perceived benefits*. Perceived risks are the individual's belief about the possible negative outcomes of information disclosure and negatively affect the intention to disclose personal data (Kim et al., 2008). Perceived benefits, in turn, are the individual's beliefs about possible advantages that could come from information disclosure and positively affect the intention to disclose personal data (Kim et al., 2008). Perceived benefits can have various forms, such as financial reward, personalization, convenience, or fun (Kim et al., 2008). For the purpose of this study, it will be focused on empirical evidence for the positive effect of financial incentives on the willingness to disclose personal data. When the calculation of perceived benefits exceeds the perceived risks, the intention to disclose personal data is positive (Kim et al., 2008).

Hann et al. (2002) applied a conjoint analysis approach to measure the importance of financial incentives on the privacy calculus. They analyzed ranking responses by 184 undergraduate students on different combinations of financial incentives and privacy policies, claiming under which conditions they would most likely disclose their personal data. The scholars presented three conditions of financial incentives: $5, $10, and $20. Only the $20 condition significantly positively affected the intention to disclose personal data (Hann et al., 2002). This finding supports the general assumption that a financial incentive increases the intention to disclose personal data, but only above a threshold that is perceived high enough to outweigh the perceived risks of disclosure (Hann et al., 2002).

In a field-experimental setting by Hui et al. (2007), researchers contacted 600 Singaporean business students via email and invited them to participate in a market research survey about mobile computing products. The survey varied between four and 23 items that were mandatory to respond to. In the base treatment, participants were asked for

their name, email address, postal address, and citizenship. Respondents had the option to withdraw from the survey if they were unwilling to respond. Next to the quantity and sensitivity of requested data, scholars manipulated three levels of privacy assurance and the financial incentive, between one and nine Singaporean Dollars ($0.60 to $5.40). They found a positive effect of the financial incentive on information disclosure. Other than that, the authors conceded that the sample selection might have been too one-sided since Singaporeans, a collectivistic population, generally have fewer privacy concerns. This low level of privacy concerns could have led to the high disclosure probability in the baseline condition without privacy assurance or financial incentive of 90.33% and might have led to the effect of a relatively low financial incentive.

Alfnes and Wasenden (2022) studied a cross-cultural sample, including participants from Norway, Serbia, Malaysia, and Pakistan. The sample consisted of 16 to 35-year-old subjects with access to the internet via mobile phones. The participants had to respond to a hypothetical survey on how likely they would accept a specific personalized ad service by their mobile phone internet provider. In every condition, the participants would receive up to 10 personalized ads via text messages on their mobile phones per month. The scholars manipulated the content of the ad messages in three ways: Either the messages were based only on the geolocation data, or on the geolocation data in combination with the browser history, or the geolocation data in combination with the browser history and the transfer of the information to a third-party store. In exchange for the personal data, respondents either received a 10% discount on their mobile phone subscription or no financial incentive in the control condition. The positive association between the offer of a financial incentive and the willingness to accept the service was generally supported. For the participants from Norway and Serbia, the scholars found small significant effect sizes, while the effect for Pakistani participants was large. The difference might be due to the poorer economic conditions in Pakistan, leading to a higher value of the financial benefit. Notably, there was no effect for participants from Malaysia. The experimental controls might offer an explanation for this

inconsistent finding, since the participants from Malaysia scored lowest on trust in their mobile operator. It is assumable that the low trust might have negatively affected the situational privacy calculus. The relationship between trust and privacy calculus will be outlined in Chapter 2.2.2.

Although these studies deliver evidence for the positive effect of financial incentives on the intention to share personal data, the question about what the calculation that individuals perform when trading off perceived risks with perceived benefits looks like remains. Hann et al. (2007) propose an answer by applying the classical e*xpectancy theory of motivation*, for the first time introduced by Vroom (1964), to the privacy calculus. According to Hann et al. (2007), every privacy calculus consists of three components: *expectancy*, which is the perceived probability that a certain effort leads to a specific performance. I*nstrumentality,* which is the level of belief that a certain performance will lead to a specific outcome. Finally, *valence* places the perceived value of the outcome, which can be positive or negative. The individual multiplies expectancy, instrumentality, and valence values for all the perceived risks and benefits to calculate a total motivational score. The algebraic sign of the motivational score indicates if the intention to disclose personal data is positive or negative; the value of the total motivational score determines the intention's strength. Another theory to describe the mechanism behind the situational privacy calculus is the *multi-attribute-utility-theory* (MAUT), which calculates a utility score instead of a motivational score (Zhu et al., 2017). For the context of this study, the idea of motivation to submit personal data, as described by Hann et al. (2007), seems more fitting than utility. However, despite partially using different terms to explain the calculus mechanism, no fundamental differences between both theories were found (Y. Li, 2012).

2.2.2 The Effect of Trust on Intention to Disclose Personal Data

Also, the model of Dinev and Hart (2006) included trust as an antecedent of intention to disclose personal data, more specifically, internet trust. This must be separated from the understanding of trust in the model by Kim et al. (2008), who defined trust as the subjective

belief that the data-demanding organization "will fulfill its transactional obligations as the consumer understands them" (Kim et al., 2008). Potential transactional obligations which could be violated by the data-demanding organization have been discovered by Smith et al. (1996) in their research on privacy concerns: (a) *Collection*, which applies to the concern that extensive amounts of personal data are stored, (b) *Errors*, the concern that accidental mistakes occur in the handling of the data (c) *Unauthorized secondary use*, the concern that the data holder shares personal data with external parties for other than the intended purposes (d) *Improper access*, that people can access the data that are not authorized for it (Smith et al., 1996). In other words, trust is the subjective belief that none of the four privacy concern dimensions by Smith et al. (1996) will occur when the concerned organization handles personal data. This definition shows that trust in the model by Kim et al. (2008) is more organization-dependent than in the model by Dinev and Hart (2006). Organizational trust in the model by Kim et al. (2008) is dependent on the familiarity, positive reputation, and implemented privacy practices of the data-demanding organization. The positive effect of trust on the intention to disclose personal information will be supported by further empirical evidence.

In the original study by Kim et al. (2008), participants' trust in the vendor, perceived risks, benefits, and purchase intention for each website were captured. Trust showed an impact on purchase intention and, therefore, the willingness to share personal data on the website in two ways: (a) Trust had a direct positive effect on purchase intention. (b) Trust had a negative effect on perceived risks and, therefore, an indirect positive effect on purchase intention (Kim et al., 2008).

Kim et al. (2008) infer from these findings that organizational trust and financial incentives are not independent. Instead, higher organizational trust leads to lower perceived risks, which ultimately leads to a higher impact of a financial incentive on the intention to disclose personal information.

This link between organizational trust and financial incentives could explain the incoherent results from the study by Alfnes and Wasenden (2022). As described in Chapter 2.2.1, scholars found a positive effect on the willingness to disclose personal data for all subgroups except Malaysian participants. Simultaneously, the Malaysian subgroup exhibited significantly lower trust in the mobile phone provider than the other nationalities. Assumably the subgroup's lower organizational trust could have led to a direct negative effect on the willingness to disclose personal data. Furthermore, the lower organizational trust might have increased perceived risks and consequently led to a negative result of the situational privacy calculus performed between perceived risks and the 10% discount financial benefit offered. Summed up, the effect of the financial benefit on the willingness to share personal data for the Malaysian subgroup might not have been significant because of the effects of lower organizational trust.

D'Annunzio and Menichelli (2022) tried to gain insights into consumers' attitudes towards privacy. In contrast to prior studies, their sample of 522 respondents was age- and gender- representative of the Norwegian population. In a web-based survey, participants should rate the likelihood of them using certain apps or services on their mobile devices for a financial discount. The apps or services captured different types of personal data, ranging from demographic information over geolocation to bank details. Participants rated demographic information as least sensitive, followed by geolocation and bank details. Finally, trust levels for different kinds of organizations were registered. Organizational trust was highest for financial institutions and lowest for social network sites (D'Annunzio & Menichelli, 2022). Results showed that trust differences between organizations had a significant positive influence on information disclosure intention for more sensitive data like credit card numbers or login information. For less sensitive information like demographic information, an overall positive effect of general trust showed up, but no differences between organizations were found (D'Annunzio & Menichelli, 2022). Therefore, the impact of

organizational trust on the influence of financial incentives might be especially relevant for more sensitive personal data.

But not only could trust affect the influence of a financial incentive but also the financial incentive could affect trust. According to the *self-determination theory* by Deci (1971), extrinsic motivation can undermine intrinsic motivation. Applying this to the privacy calculus, financial incentives could undermine the trust-based motivation to share personal data since accepting money for personal data might be perceived as "bribery." This potential conflict between trust and financial incentives is at the center of the work by Culnan and Armstrong (1999). They discovered *perceived procedural fairness* as another decisive determinant for information disclosure (Culnan & Armstrong, 1999). Perceived procedural fairness is in place when implicit norms of the individual are not violated when exchanging personal information. Among these violations of procedural fairness are, e.g., collecting information that seem irrelevant to the purpose of the transaction or not providing an opt-out option when collecting information (H. Li et al., 2010). H. Li et al. (2010) showed that the perceived relevance of the information moderates the relationship between financial incentives and the intention to disclose personal data for a transaction's purpose. Hence, financial incentives do not necessarily undermine trust. However, they could have such an effect on information disclosure if the organization does not follow the individual's principles of perceived procedural fairness.

2.3 Summary and Goals of the Study

This section has presented empirical evidence for the positive effect of financial benefits and organizational trust on information disclosure. For this study, a simplified version of the model by Kim et al. (2008) will be used as a research model. The conceptual model of the study at hand focuses on the direct effects of two factors on intention: Perceived benefits and trust. Perceived benefits will be operationalized via a lottery incentive. Trust has been operationalized by three data-demanding organizations, which are expected to have different trust levels. The three organizations are the *Stadtwerke Bamberg*

(stwb), a local company in Bamberg that manages, amongst others, the public bus transport in Bamberg, the *University of Bamberg* (uniba), and *BeeInnovation* (beeinno), an unknown start-up made up for the purpose of the study. Assumptions of the trust levels of the three organizations have been made in accordance with the antecedents of trust in the model by Kim et al. (2008), familiarity, positive reputation, and implemented privacy practices. The following trust levels were expected: The academic organization University of Bamberg will have the highest trust, followed by the local company Stadtwerke Bamberg and finally, the unknown start-up BeeInnovation.

Hypotheses have been tested for three types of personal data: General data, comprising variables like age, gender, or job; location data, asking for the current GPS location of the user and granted linkages, asking for allowance to link survey results with future survey results. The hypotheses testing the effects of the lottery incentive are:

H1a: The lottery incentive condition increases the amount of general data submitted.

H1b: The lottery incentive condition increases the amount of location data submitted.

H1c: The lottery incentive condition increases the number of linkages granted.

The hypotheses for the effect of trust on personal data disclosure are:

H2a: The uniba condition receives more general data than the stwb condition, which in turn receives more general data than the beeinno condition.

H2b: The uniba condition receives more location data than the stwb condition, which in turn receives more location data than the beeinno condition.

H2c: The uniba condition receives more linkage allowances than the stwb condition, which in turn receives more linkage allowances than the beeinno condition.

3. Method

3.1 Participants

The final data set comprised 169 participants, of which 88 (52.1%) were male, 70 (41.4%) female, and four (2.4%) diverse. Seven (4.1%) participants did not disclose their gender. The respondents' age ranged from 18 to 71 years (M = 28.7, SD = 12.4). 11 (6.5%) participants did not reveal their age. Participants had to be at least 18 years old to take part in the survey, which was noted on the posters. 69 (40.8%) participants were students, 42 (24.9%) employees, 17 (10.1%) pupils, 16 (9.5%) trainees, six (3.6%) were self-employed, five (3.0%) worked in the public sector, four (2.4%) were in pension and three (1.8%) were job-seeking. Seven (4.1%) participants did not disclose their current occupation. Furthermore, 65 (38.5%) respondents stated to use public transport in Bamberg three to five times a week, 64 (37.9%) were daily users, 22 (13.0%) used it one to two times a week, six (3.5%) less than once per week and four (2.4%) less than once per month. Eight (4.7%) participants did not indicate how often they use public transport.

3.2 Materials

To recruit participants, 78 posters in DINA3 format were created. The six different poster designs can be seen in the Appendix. On all posters was written in German: "We want to make the local public transport in Bamberg smarter. For that, share with us how you use it!" The slogan was written in a neutral, non-petitionary tone to make sure participants responded because of the quasi-experimental manipulations of trust and lottery incentive, not out of other motives like altruism. To implement the three conditions of trust, three types of poster designs in the style of the University of Bamberg, the Stadtwerke Bamberg, and BeeInnovation have been created. All three poster designs showed a woman with a smartphone to avoid a confounding effect of the poster motives on information disclosure. However, the shapes and colors of the three poster designs have been varied to make the poster designs seem like they stem from three independent surveys. To include the effect of a lottery incentive, two versions of each poster design were created. One version had a note

on it that for participation, either one of 50 vouchers in the value of 15€ could be won, or one voucher in the value of 200€. The design of the lottery was based on previous findings about the attractiveness of lotteries, which showed that lotteries with a high first prize and many smaller prizes are most appealing to participants (Quiggin, 1991; zur Shapira & Venezia, 1992). The second version of each poster design had no note of a lottery incentive on it. Thus, a total number of six poster designs resulted from that. Each poster design had a distinct QR code on it to trace back which poster condition each participant came from. Also, there was simple instruction on the next steps after scanning the QR Code. This was expected to improve the general participation rate across all poster designs.

3.3 Procedure

3.3.1 Data Collection

Ethical approval was obtained before the recruitment of participants began. 78 posters were put up in 63 buses of the Stadtwerke Bamberg in the period from 11.05.22 – 25.05.22. The posters were all put up in the same period of time to minimize sequence effects, meaning that participants could see two different poster designs during the period of data collection. The 63 buses of the Stadtwerke Bamberg were each not assigned to a specific route. Rather each bus ran all routes in the entire city area. This allowed effects from specific locations or neighborhoods to be excluded.

After scanning the QR code, participants were taken to a website built especially for the survey. Each question was presented on an extra page. After agreeing to the privacy statement, participants were directed to the main survey on the website. For each item of the survey, there was the option to refuse to answer. The reasons for refusal were collected immediately afterward. This process includes two clicks and a choice or free answer. By that, refusing to answer was no simpler and faster than answering the survey question. This was implemented to ensure participants did not skip through the questions for the reason of lower effort. After answering the survey questions, participants had to submit the answers for them to be saved in the final data set. After that, it was asked for permission to store a

cookie on the smartphone to link the participant's survey responses with possible future responses. In the following, participants were asked if they had participated in a similar study before, as another safety question, to check if multiple participation had occurred. In the next step, all participants were thanked for their participation, and the respondents of the lottery incentive condition could sign up to take part in the lottery. Finally, each participant was clued up about the actual purpose of the study and that the different poster designs belonged to one study. They were asked not to spread the real purpose of the study during the time of data collection to not confound the results and were informed that on this website, study results would be presented after completion of the study. The winners of the lottery were contacted after the data collection via the email address they had indicated when signing up for the lottery.

3.3.2 Research Design

Given the limitation of a field experiment, a quasi-experimental 3x2 between-subjects design was used. The first independent variable was trust, operationalized by the three poster designs of the University of Bamberg, Stadtwerke Bamberg, and BeeInnovation. The second independent variable was perceived benefit, operationalized by the posters with and without notice of a lottery incentive.

Three dependent variables were used to operationalize the willingness to disclose personal data: The amount of general data submitted, the amount of location data submitted, and the number of linkages granted. The general data variable comprised seven survey questions with age, gender, job, usage frequency, current bus line, starting stop, and destination stop. These data were grouped into one because they were all estimated as less sensitive and privacy-invasive. As can be seen in Table 1, there were no notable differences between the response rates of the seven survey questions. Therefore, they were artificially dichotomized: The participants who answered all seven survey questions were counted under "general data submitted: Yes." If one or more survey questions were skipped, participants were categorized into "general data submitted: No."

Table 1

Response Rates of General Data Survey Questions (N = 169)

	Data submitted			
	Yes		No	
	n	*%*	*n*	*%*
Age	158	93.49	11	6.51
Gender	162	95.85	7	4.14
Job	162	95.85	7	4.14
Usage frequency	161	95.27	8	4.73
Bus line	164	97.04	5	2.95
Starting stop	162	95.86	7	4.14
Destination stop	163	96.45	6	3.55

The second variable, location data, which referred to the question about the exact GPS location, was examined individually because it might be perceived as more sensitive, and differences in the respondents' behavior between general data submission and location data were conceivable.

Third, linkages granted were examined individually because they were expected to be perceived as more sensitive since the claimed idea of the linkage was that future data submissions could be connected with prior ones and therefore reveal more information about the individual mobility behavior of the respondent. Since the reason for the sensitivity of granted linkages was different from the reason for the sensitivity of the location data, this variable was examined individually as well.

3.3.3 Data Analysis

All analyses to test the hypotheses have been done with the statistic software *R Studio*. To find an answer to research question (a): “Does a lottery incentive increase the willingness to disclose personal data?”, *H1a, H1b,* and *H1c* have been tested with a chi-square test of independence. Significance levels have been set to $p < .05$. Research Question (b) was: "Does trust increase the willingness to disclose personal data?" To

answer this question, *H2a, H2b,* and *H2c* have been tested with a chi-square test of independence.

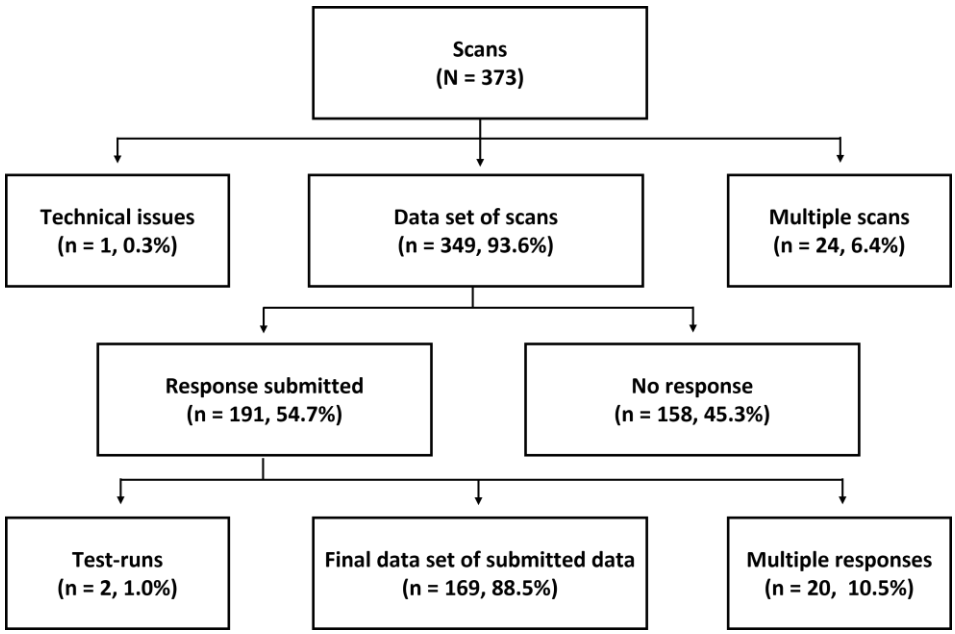
4. Results

4.1 Participant Flow

The period of recruitment in which the posters were put up was from 11.05.22 – 25.05.22. In these 14 days, the QR code was scanned 373 times. Figure 2 shows the flow of scans and survey submissions. In the case of multiple scans, the first participation was kept, and all further participations were eliminated from the data set. This was done to make sure every scan belonged to one participant. In total, 24 (6.4%) cases were excluded because of multiple scanning. One (0.3%) scan was removed because of a technical issue, due to which its experimental condition couldn't be determined. This led to a remaining number of 349 scans. After answering the survey questions, participants had to submit their responses for them to be registered. 191 responses were registered, of which 20 (10,5%) were eliminated because of multiple responses, with the identical procedure as for multiple scans. Two (1,0%) responses were removed because they were test-runs by the scholars. For the final data set, 169 responses remained.

Figure 2

Participant Flow From QR-Code Scans to Final Data set



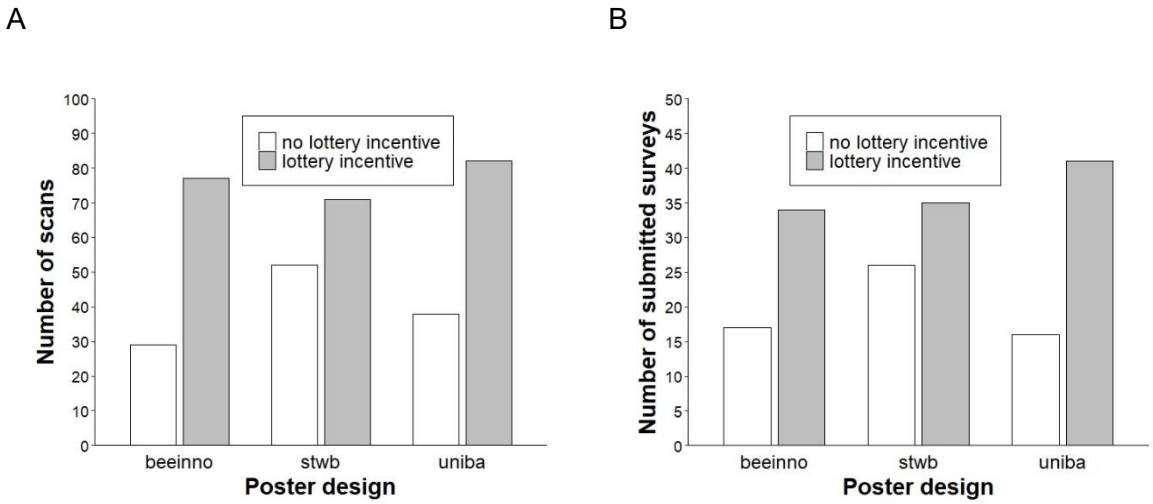
4.2 Descriptive Statistics

As can be seen in Figure 3, the number of scans and the number of responses varied between the experimental conditions. Figure 3A shows that the University of Bamberg poster with lottery incentive received the most scans (n = 82, 23,5%), followed by the BeeInnovation poster with lottery incentive (n = 77, 22.1%). The least scans received the poster by BeeInnovation without lottery incentive (n = 29, 8.3%).

Looking at the number of submitted surveys in Figure 3B, the majority came from the University of Bamberg condition with lottery incentive (n = 41, 24.3%), followed by the poster of the Stadtwerke Bamberg poster with lottery incentive (n = 35, 20.7%). The least responses came from the University of Bamberg poster without lottery incentive (n = 16, 9.5%).

Figure 3

Number of scans (Panel A) and Number of Submitted Surveys (Panel B) per Poster Design



Note. Beeinno refers to the start-up BeeInnovation, *stwb* to the local company Stadtwerke Bamberg and *uniba* to the University of Bamberg.

The amount of submitted personal information varied across the experimental conditions. Table 2 shows that more data was submitted from posters with the lottery incentive on them than from posters without lottery incentive. This applied to the submission of general data, location data, and the number of linkages granted.

Table 3 indicates that most data were submitted via posters in the University of Bamberg design, followed by the Stadtwerke Bamberg design and then the BeeInnovation design. This order applied to all three operationalizations, general data, location data, and the number of granted linkages.

Table 2

Results of the Chi-Square Test of Independence for H1a, H1b, and H1c (N = 169)

Information disclosure	Lottery incentive				$\chi^2(1)$
	No		Yes		
	n	%	*n*	%	
General data submitted					
No	6	40.00	9	60.00	.02
Yes	53	34.42	101	65.58	
Location data submitted					
No	26	40.00	39	60.00	.87
Yes	33	31.73	71	68.27	
Linkage granted					
No	19	31.67	41	68.33	.24
Yes	40	36.70	69	63.30	

**p < .05*

Table 3

Results of the Chi-Square Test of Independence for H2a, H2b, and H2c (N = 169)

Information disclosure	Poster conditions						$\chi^2(2)$
	beeinno		stwb		uniba		
	n	%	*n*	%	*n*	%	
General data submitted							
No	6	40.00	7	46.67	2	13.33	3.07
Yes	45	29.22	54	35.06	55	35.71	
Location data submitted							
No	24	36.92	25	38.46	16	24.62	4.36
Yes	27	25.96	36	34.62	41	39.42	
Linkage granted							
No	20	33.33	25	41.67	15	25.00	3.21
Yes	31	28.44	36	33.03	42	38.53	

Note. Beeinno refers to the start-up BeeInnovation, *stwb* to the local company Stadtwerke Bamberg and *uniba* to the University of Bamberg.

**p < .05*

4.3 Inferential Statistics

H1a was the first hypothesis tested. No significant association between the lottery incentive condition and the amount of general data submitted was found, $X^2(1) = .02$, $p = .881$.

The second hypothesis, *H1b,* wasn't supported by the results of the chi-square test of independence. No significant association between the lottery incentive condition and the amount of location data has been shown, $X^2(1) = .87$, $p = .352$.

The third hypothesis, *H1c,* was not confirmed. It showed no significant association between the lottery incentive condition and the number of granted linkages, $X^2(1) = .24$, $p = .626$.

Hypothesis *H2a* has not been confirmed in the analysis. No significant association between the poster conditions of the University of Bamberg, Stadtwerke Bamberg, or BeeInnovation and the amount of general data submission has been found, $X^2(2) = 3.07$, $p = .216$.

Hypothesis *H2b* has not been supported by the data. The chi-square test of independence showed no significant association between the three poster conditions and the amount of location data submitted, $X^2(2) = 4.36$, $p = .113$.

Hypothesis *H2c* could not be supported in the analysis as well. No significant association was revealed between the three poster conditions and the number of linkages granted, $X^2(2) = 3.21$, $p = .201$.

5. Discussion

The purpose of this study was to gain a better understanding of how the willingness of local public transport users to share their personal data can be increased. For this, two research questions were posed: (a) Does a lottery incentive increase the willingness to disclose personal data? (b) Does trust increase the willingness to disclose personal data? Both research questions have been tested with three hypotheses to test for three different

types of personal data: general data, location data, and granted linkages. Of the resulting six hypotheses, *H1a, H1b, H1c, H2a, H2b,* and *H2c*, none could be confirmed in the analysis with the chi-square test of independence.

It must be acknowledged that these findings are not in line with the findings by Hann et al. (2002), Hui et al. (2007), and Alfnes and Wasenden (2022), who found an effect of a financial incentive on the willingness to disclose personal data. Neither do they confirm the findings by Kim et al. (2008) and D'Annunzio and Menichelli (2022), who found a significant association between trust and willingness to disclose personal data.

However, the occurred patterns in Figure 3 could lead to a more specific explanation of some of the divergences from the expected outcomes. Figure 3A shows that the number of scans varied between the experimental conditions. The posters of the lottery incentive attracted more scans in all three poster design conditions, and when no lottery incentive was announced, the Stadtwerke Bamberg poster design attracted the most scans, followed by the University of Bamberg and the BeeInnovation poster design. Partly, these patterns follow the direction of the assumed effects of the lottery incentive and trust on information disclosure. It could be assumed that these experimental variations might not have had an effect on data disclosure as intended, but instead could have affected the motivation to scan the QR Code on the posters only. The distribution in Figure 3B, which represents the number of submitted surveys, is quite analog to the one in Figure 3A since more submitted surveys stemmed from the lottery incentive condition on all three poster designs, and among the posters without lottery incentive, the Stadtwerke Bamberg poster was the one where most responded surveys came from. Thus, the frequency differences between the experimental groups might have been determined by the scanning phase only.

A partial explanation of why no effect of lottery incentive and trust on information disclosure could be found might be the general high data submission rates across all experimental conditions. Table 1 shows that the willingness to share general data was for each of the seven survey questions above 90%. It could be concluded from this that people

might have taken the decision to share their personal data already before scanning the QR-Code and did not evaluate every survey question that asked for general data individually. Such a transition from contemplating a behavior to engaging in it can be found in the *Rubicon model* by Heckhausen and Gollwitzer (1987). The authors separate rational behavior into two phases: A *predecisional phase*, where the outcomes of behavioral alternatives are weighed, and a *postdecisional phase*, where the focus is on the implementation of the already decided behavior. In the postdecisional phase after the metaphorical "Rubicon," the focus is on action rather than on re-evaluation of every step towards the intended goal. It would be conceivable that the decision of participants to disclose general data was made in the predecisonal phase before scanning the QR-Code, which led to the overall high submission rates of the seven survey questions in the postdecisional phase.

Still, as Tables 2 and 3 show, there have been considerable dropout rates for location data and granted linkages, which cannot be explained with a possible postdecisional phase. These data might only have been submitted by each participant after rational evaluation, but as the insignificant results show, they are independent of the lottery incentive and poster design.

In summary, the quasi-experimental conditions, if they had any effect, they could have had it only on the willingness to scan the QR code but did not carry on to the willingness to share personal data. What separates these two phases of data disclosure is the time they take to complete. While a QR code can be scanned within seconds on a smartphone, the completion of the survey took up to a minute. It could be assumed that the effect of financial incentives and trust is restricted to a relatively short period of time. Kehr et al. (2015) demonstrated that heuristics like *momentary affective states* can influence information disclosure. In their study positive affect led to a higher willingness to disclose personal information by underestimating perceived risks and overestimating perceived benefits. Applied to this research, the announced lottery and the poster design of the

Stadtwerke Bamberg could have elicited a momentary positive affect. This positive affect might have led to a higher motivation to scan the QR codes on the trustworthy and potentially rewarding posters. Because the effect described by Kehr et al. (2015) is quite immediate, this could be the reason why no effect of the experimental conditions on data disclosure was found. In addition to this, Tsai et al. (2011) discovered that the salience of a privacy decision negatively affects the influence of heuristics. Since privacy salience was lower for the scanning phase, this might have contributed to the reason why variations in the number of scans between the poster designs were found, but no association between the quasi-experimental conditions and data submission.

5.1 Theoretical Implications

The results indicate that the conceptual framework by Kim et al. (2008), which has been adapted for this work, might not be boundlessly transferable to the context of data submission within a local public transport project. First, the model by Kim et al. (2008) has been validated in the context of e-commerce, where the disclosure of personal data is only the second exchange after the purchase of the wanted product. This context differs from the context of the study at hand, which had the submission of personal data clearly as the primary focus of the transaction. Second, the goals of the participants in the study by Kim et al. (2008) were different from the goals of the study at hand. In the e-commerce-based model, participants pursue the goal of purchasing a product. They have no personal connection to the vendor and seek to maximize their personal benefit. Ultimately, this economic approach might be the root of the privacy calculus. In contrast, participants in this study act towards a common goal, the improvement of local public transport. Additionally, it can be assumed that the participants of the study were predominantly residents of the city of Bamberg. From both facts could be concluded that participants did not only seek to maximize their benefits but were also influenced by altruistic motives. It is conceivable that because of these deviant characteristics of our study, the hypotheses derived from the privacy calculus model by Kim et al. (2008) could not be supported.

Overall, the findings of this study add an interesting contribution to the literature by opening a new area of application to the privacy calculus since the majority of studies have been conducted in the context of e-commerce transactions. It indicates that the relations found in the models of Dinev and Hart (2006) or Kim et al. (2008) might not be generalizable for every context of personal data disclosure. Also, they have been tested in laboratory settings. In this field study, however, many more confounding variables are included: lack of attention, distraction, or time pressure could be conditions that might have affected the behavior of participants. Such studies help develop a decision model which is as close as possible to the user's reality. Another contribution has been made through the particular setup of the study, with two decision stages, (a) when deciding to scan the QR code and (b) when deciding to submit personal data. The reported studies by Hui et al. (2007), Hann et al. (2002), Alfnes and Wasenden (2022), and D'Annunzio & Menichelli (2022) have, conditioned by their different research design, focused exclusively on the second stage. Signs were found, though, that these two stages might not be processed equally. The possibility was discussed that the lottery incentive and the organizational trust might only have had a short-term effect on the first stage via the momentary positive affect they elicited. More research must be done to support this claim, but an extension of the model by Kim et al. (2008) to a two-stage model with (a) the willingness to visit a website that asks for personal data and (b) the willingness to disclose personal data could be suggested. This extended model could include the influence of momentary affective states by Kehr et al. (2015) and clarify to what extent the effect of financial benefits and trust might be mediated by the positive affect they elicit.

5.2 Practical Implications

The Stadtwerke Bamberg can draw several implications from this study. First, a collaboration with the University of Bamberg would probably not lead to a higher willingness of participants to disclose their personal data. The number of scans without lottery incentive even indicates that posters held in the corporate design of the Stadtwerke Bamberg could

attract most users to scan the QR code. Second, the lottery incentive did not improve the willingness to disclose personal information. Neither did the lottery incentive lead to a significant negative "trust-undermining" effect on information disclosure. However, the number of scans indicates that a lottery incentive could be helpful to attract more users to the website, where the data can be submitted. Third, the data collection via QR-code scans that led to a mobile website attracted mostly younger participants, as the age mean of 28.7 and the 40.8% of students in the sample illustrate. Other, less digitalized ways of data collection might be useful to collect data from older target groups. More research on the determinants of the scanning decision should be done to confirm the assumptions of this study that a lottery incentive could have a positive effect on the willingness to scan the QR code on the poster via the positive affect it could elicit. Furthermore, research within this project should be done on other factors that remained unnoticed in this study, like the effect of effort and completion time on the willingness to disclose personal data in the survey. For this purpose, different survey lengths and their effect on information disclosure could be compared.

5.3 Limitations

Several limitations must be considered when generalizing the results of this study. The sample of the study might have been biased because of the two-stage design of the study: Therefore, the final sample of respondents has only been participants who were willing to scan the QR code before. It would have been interesting to register the number of participants who saw and perceived the posters but decided not to scan the QR code. Indeed, the field-experimental character of the study made it impossible to ask participants after the bus drive if they had perceived the poster and, if yes, whether they decided to scan the QR code on it. As described in theoretical implications, the examination in the field was more prone to confounding variables than a laboratory study. Hence, participants could have been distracted by other guests while completing the survey, were under time pressure, or merely not as concentrated to make a rational decision as they would have been in an

experimental setting. Looking at the insignificant effect of the lottery incentive, the question of the applicability of the lottery incentive to operationalize the financial incentive arises. Participants might have estimated their chances of winning as too low and, therefore, might not have been motivated enough to take part in the survey. Finally, the high dropout rate shown in Figure 2 between the data set of scans and the final data set of submitted data of 45.3% indicates that the skip option might not have been used as previously intended for skipping unwanted survey questions. Instead, it might be that participants, when reaching an unwanted survey question, did not skip it and went on with the survey but just stopped the survey and closed the website. These possible biases must be taken into account when interpreting the study results.

6. Conclusion

The present research by the Smart City Research Lab of the University of Bamberg aimed to find out if a lottery incentive or trust can increase the willingness of local public transport users to disclose personal data. A field-experimental approach was chosen to test the conceptual model adapted from Kim et al. (2008) in a setting as natural as possible. Derived from the conceptual model, positive effects for the lottery incentive and trust have been hypothesized. These expectations could not be confirmed in the analysis since no significant effects of both factors were found. The study shows that the generalizability of the model by Kim et al. (2008), which stems from an e-commerce context, might be bounded to other contexts. Indications have been found that the effect of trust and financial incentives might have been short-term in the study at hand. Based on these indications, a suggestion for an extended version of the model by Kim et al. (2008), which includes two stages of data disclosure, could be made. Practical implications for the Stadtwerke Bamberg were given. To confirm the indications of this study, more research on the first stage of scanning the QR codes has been recommended.

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8. Appendix

The Poster Designs of the Study to Manipulate Trust and Lottery Incentive

Figure A1

Figure A2

Figure A3

Figure A4

Figure A5

Figure A6

Note. Figures A1, A3, and A5 are the poster designs without lottery incentive. Figures A2, A4, and A6 show the poster designs with lottery incentive.