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Theory-Motivated Design for Developing Privacy Nudges

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Abstract. Using digital technologies, various data traces are left behind for collection, storage and analysis. Potential risks that the availability of personal information entails, like the vulnerability to discrimination, commercial exploitation and unwanted monitoring, is ubiquitous. Hence, modern IT systems are needed that ensure employees' privacy and informational self-determination. One mechanism to achieve this is the implementation of privacy nudges in modern working systems. Nudging is a mechanism to influence decisions in a predictable way. In this context, privacy nudging concepts should influence employees' behavior in digital working environments in such a way that they make more data protection-friendly decisions. In this research project I am focusing on building an integrative understanding of effective nudging in privacy-related decisions. From this, design knowledge for better privacy nudges in digital work systems should be derived, which can pave the way for more privacy-sensitive IT systems. Successfully implemented privacy nudges can increase acceptance, trust and usage of modern IT-systems. Privacy sensitive IT-systems can then constitute a competitive advantage for the company. On the side of society, informational self-determination can be ensured and the potential risks that the availability of personal information entails can be reduced.

Keywords: Privacy Nudging, Information Privacy, Design Science Research.

1 Background and Purpose

Digital work environments are ubiquitous nowadays and the possibility to electronically acquire information about work activities as well as personal sensitive data has dramatically increased (Backhaus 2019). Companies use more forms of digital work systems and implement advanced instruments such as big data analytics or artificial intelligence. With this, data can be collected, aggregated, and analyzed at a faster pace and in larger volume than ever before (Malhotra et al. 2004). Furthermore, data can be collected without individuals' awareness (Bélanger und Crossler 2011). On one side, widespread analysis of personal data yields substantial innovation potential, economic value as well as more efficient working models (Erevelles et al. 2016). On the other side, the vulnerability to discrimination, commercial exploitation and unwanted monitoring is ubiquitous. Thus, the acceptance and adoption of modern IT systems is hindered. This conflict of interests is assumed to intensify in future years, as companies benefit from the advancing digitalization. It is assumed that by 2022, 60% of the global gross domestic product is estimated to come from digital technologies (O'Halloran und Winston Griffin 2019).

The issue arising is that people value their privacy while they do not always protect it; this phenomenon is known as the Privacy Paradox (Barth und Jong 2017). As privacy is a critical antecedent for the acceptance of future work systems innovative solutions for information systems (IS) are needed that mitigate privacy risks and foster information privacy. A possible solution would embody privacy-by-design systems which are privacy enhancing technology components (Spiekermann 2016).

One mechanism to achieve this is the implementation of privacy nudges. Nudges are described as "any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options, or significantly changing their economic incentives" (Thaler und Sunstein 2008). Thus, privacy nudges should help users to make better privacy decisions (Acquisti et al. 2017). However, their effectiveness varies (Sunstein 2015). Some nudges emerge to have little or no impact on actual behavior (Sunstein 2017). Hence, in my project I am deriving evidence-based design principles that support decision architects to design privacy friendly digital work systems. Our developed artifact should then answer the following research goal:

- *How to design privacy friendly digital work systems fostering information privacy of users?*

To achieve this research goal, three research questions (RQ) are proposed:

- *RQ1: Which nudges are suitable for the cognitive decision-making process and behavior to protect privacy in digital work systems?*
- *RQ2: What influences and mechanisms underlie the identified privacy nudges and to what extent?*
- *RQ3: What practical implications and design principles can be derived from the results for IS research and practice?*

2 Related Work

2.1 Nudging and Privacy Nudging

Nudging is present in offline as well as in online areas. Nudging in the offline area can involve a variety of approaches to influence decisions. What is chosen often depends on the way the decisions are presented (Weinmann et al. 2016). Thus, nudging is based on the principle of libertarian paternalism in order to influence decisions. This means that an individual can, at any time, freely choose a decision option (liberalism component). The individual's freedom of choice is not restricted since none of the options are prohibited and the economic incentive of the alternatives is not significantly changed. However, the individual is nudged towards a decision option that represents the supposedly greatest benefit for them (paternalism component) (Thaler und Sunstein 2008).

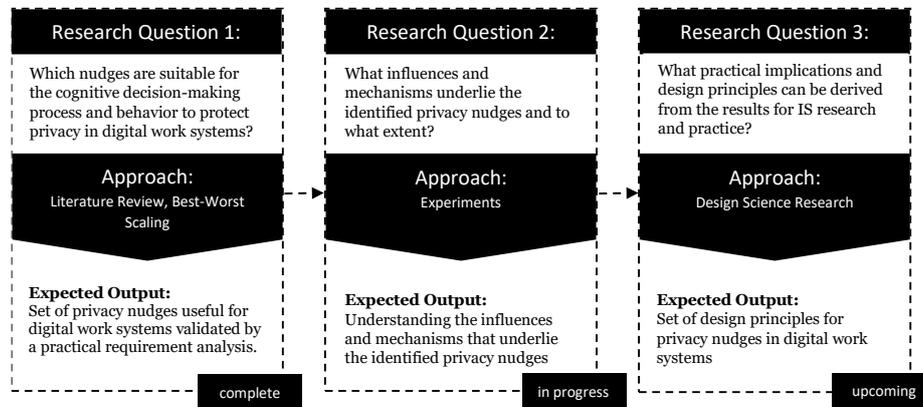
In digital nudging, this concept is transferred to the digital space and corresponding design elements on the user interface are used to control behavior in digital decision environments (Almuhimedi et al. 2015). Digital decision environments are user interfaces that require people to make judgements or decisions (Weinmann et al. 2016). As in offline environments, online environments offer no neutral way of presenting choices. Any user interface, from organizational websites to mobile apps, can thus be viewed as a digital choice environment (Weinmann et al. 2016).

Digital choice environments nudge people by deliberately presenting choices or organizing workflows, making digital nudging "the use of user-interface design elements to guide people's behavior in digital choice environments" (Thaler und Sunstein 2008). For example, the mobile payment app Square presents the "tipping" option as default, so users must select the "no-tipping" option if they choose not to give a tip; this modification is likely an attempt to nudge people into giving tips, raising tips even where tipping is uncommon (Weinmann et al. 2016).

Privacy nudges are a subset of digital nudges. Privacy nudging describes a targeted influence on the decision-making process in order to push people towards "better" decisions regarding their privacy and at the same time take their informational self-determination into account (Acquisti et al. 2017).

3 Approach and Methodology

This project takes an interdisciplinary approach to develop an artifact representing a set of evidence-based design principles that support decision architects to design and implement effective privacy nudges. Privacy nudges are effective when ensuring individual's informational self-determination and lead users to a more privacy sensitive behavior. My approach focuses on working out components of effective privacy nudges. In the next step, to provide concrete guidance for nudge architects, we deduct specific design principles. Evaluating these principles in lab and real-world contexts, we generate fine granular evidence-based design principles for privacy nudges.



3.1 Research Question 1

Input: This question was tackled by conducting a systematic literature review (Jan vom Brocke, Alexander Simons, Kai Riemer, Bjoern Niehaves, Ralf Plattfaut, and Anne Cleven; Webster und Watson 2002). I analyzed 111 paper to craft a classification of potential privacy nudges. Following, we performed a Best-Worst Scaling of the identified nudges. In this analysis we tested which privacy nudges were most comfortable and uncomfortable for users to get in touch with. Having a set of potential privacy nudges as well as scenarios (Schomberg et al. 2019), I conducted field studies and interviews to validate our results and to derive a practical requirement analysis for implementation.

Output: From this approach I received a set of privacy nudges useful for the implementation in digital work systems and validated by a practical requirement analysis.

3.2 Research Question 2

Input: Based on the findings of research question 1, I will conduct several experiments to test and evaluate the underlying influences and mechanisms that determine privacy nudge effectiveness. At this stage, privacy nudges can be designed and implemented in controlled lab experiments to gain theoretical insights. I am therefore planning to extend theories, use-cases and several best-case examples from related disciplines and extract knowledge for digital work systems. Specifically, in several lab experiments, I want to look at individual differences such as personality related factors and emotions that alter nudge effectiveness, but at the same time ensuring ethical dimensions of nudging. This is important as nudges spark different reactions from one person to another (Sunstein 2015).

Output: I am expecting to gain a better understanding of the general influences and mechanisms that underlie the identified privacy nudges.

3.3 Research Question 3

Input: Based on the findings of the second research questions, I will use a field setting to derive practical implications and design principles by merging the extracted knowledge. To do so I want to adopt a Design Science Research (DSR) approach (Peppers et al. 2007). With DSR I want to analyze the continuing adaptation of the artifact and the local practices of its use. This is important because the crafted technological artifact typically exhibits emergent properties that are unanticipated during the design (Iivari 2003). Therefore, I plan

to implement and evaluate privacy nudges on a digital work platform and freelancer hub, thus, extending the body of knowledge of privacy nudges for the domain of social networks in a professional work context. The crafted artifacts should then be developed in an iterative way together with practitioners, but also incorporating user evaluations in field A/B-test settings.

Output: I am expecting to receive design knowledge and craft design principles for privacy nudges in digital work systems with a high ecological validity through field settings.

4 Preliminary Results

From our literature review we worked out six promising privacy nudges. Following they are introduced representing their underlying nudge mechanism: Defaults, Presentation, Information, Feedback, Error, Social Influence.

| Privacy Nudge | Description |
|------------------|---|
| Defaults | Preselected options are set as defaults predetermining the extent to which private data is shared (Acquisti et al. 2017) |
| Presentation | Provide contextual cues to convey the expected risk (Turland et al. 2015) |
| Information | Providing additional information in decision-making situations to enable a realistic perspective on risks (Wang et al. 2014) |
| Feedback | Feedback is provided alongside and after the process to inform the user on the consequences of his actions (Acquisti et al. 2017) |
| Error Resiliency | Expecting users to make errors and allow them to recover from them (Wang et al. 2014) |
| Social Influence | Indication of popularity of an alternative. The individual derives from the behavior of his fellow individuals to what extent it is appropriate to select this option (Zhang und Xu 2016) |

Table 2. Privacy Nudge Mechanisms adapted from Acquisti et al. 2017

4.1 Underlying Mechanisms of Nudging

Particularly in the context of decisions relating to privacy, human decision-making is often imperfect, and decisions are made that often do not correspond to the desired objectives. Studies have shown that especially users of digital systems often act irrationally due to cognitive, emotional and social factors (Acquisti et al. 2017; Thaler und Sunstein 2008).

This can be explained with the dual-process theory, which states that users use two systems of thought (Kahneman 2003). Two systems are therefore necessary to better evaluate the abundance of information in today's (digital) world and to make targeted decisions. System 1 represents our intuitions or our unconscious autopilot. System 2, on the other hand, expresses itself through our conscious planning and control.

However, system 2 requires significantly more mental effort and time. Both systems are active at the same time and usually work together smoothly (Kahneman 2003). In everyday life, however, users rarely have enough time and information to fully evaluate all alternatives. Instead of exercising a systematic decision-making process, users tend to resort to so-called heuristics (mental abbreviations) (Hertwig und Grüne-Yanoff 2017). Heuristics are informal rules of thumb that reduce the complexity of decision-making and thus represent abbreviations in decision-making. Although heuristics are an efficient way to solve recurring problems, they can lead to systematic errors such as biases in information evaluation (Tversky und Kahneman 1974). For example, personal data are often disclosed carelessly because the risk of unwanted monitoring is less present mentally (availability heuristics). These false conclusions do not mean that the behavior of users is unpredictable and irrational. Rather, it is a systematic and thus predictable deviation from rational behavior. This is where privacy nudges come into play. Privacy nudges can influence both systems of thought by exploiting heuristics or counteracting them in order to guide users to their informational self-determination. Interestingly, the perceived aspect in the choice environment guiding users' behavior, for instance, a colored element or given information, can be processed differently by users. Some stimuli may be perceived as pleasant while others may be perceived as unpleasant. The initial stimuli may therefore be crucial for the nudge effectiveness and is worth further investigation. It is worth exploring how users perceive specific nudges (Sunstein 2014).

Specifically, to elaborate on the underlying mechanisms that enable each privacy nudge, we will introduce each nudge separately in the following paragraphs. For the sake of brevity of this short paper, we will focus on the main mechanisms that are affected.

Default privacy nudges are very effective since individuals often do not adapt privacy settings to their needs, the default option (the status-quo) remains overly preferred and mostly unchanged (status-quo bias) (Acquisti et al. 2017; Thaler und Sunstein 2008). In addition, the default option is used as a reference point for weighing decision options. This "anchor" is perceived unconsciously by individuals. Each decision option is now weighed against this alternative, and the decision behavior is influenced in this direction (Tversky und Kahneman 1974). Literature suggests that defaults are strong privacy nudges as predetermining the extent to which private data is shared.

Research concerning *presentation nudges* focuses mainly on framing effects. Framing effects exist, when two identical alternatives influence the consumer's decision-making behavior differently due to their different presentation. For example, colored fonts draw attention to selected elements in order to emphasize certain decision alternatives.

Regarding *information privacy nudges*, the probability of privacy violations is often incomprehensible for individuals and underestimated. Individuals then tend to make risky decisions regarding the protection of their privacy. Beyond others, this can be attributed to representation heuristic, which states that individuals tend to incorrectly associate the frequency of observations of an event with its probability of occurrence. In this context, research in the privacy nudge literature also discussed the availability heuristic, which is assumed to play an important role here. It suggests, that decisions are based on information that is mentally easy accessible (Tversky und Kahneman 1974; Acquisti et al. 2017). In order to counteract these heuristics, it is suggested that nudges inform individuals about the risks and consequences of the actions. Based on this information nudge, the individual can make a well-founded decision about his or her own privacy (Acquisti et al. 2017).

A further *privacy nudge* is the provision of *feedback*, which indicates the previous usage behavior of a person. This nudge creates awareness of individual's previous and current decisions and their consequences (Acquisti et al. 2017). Research, which analyses the feedback privacy nudge covers mainly framing effects, hyperbolic discounting and in large parts the state of incomplete information. It assumes that the feedback nudge is enabled as individual's have not sufficient knowledge to make decisions in line with their motivations.

Error resiliency privacy nudges can assist consumers, as decisions on privacy often favor risky and ill thought through decisions without taking possible long-term consequences into account. This is based on so-called hyperbolic discounting, in which the immediate benefit is overestimated, and costs incurred later are underestimated by individuals (Acquisti et al. 2017). To counteract this, a time delay can be used as a privacy nudge (Wang et al. 2014). In this way, the individual should be persuaded to act less impulsively and to rethink the message and possible negative consequences (Acquisti et al. 2017). To better understand this privacy nudge much of the current research is devoted to analyze hyperbolic discounting, loss aversion effects and the state of incomplete information.

The effect of *social influence privacy nudge* is based on the principle of social norms. The individual derives from the behavior of his fellow individuals to what extent it is appropriate to share personal information (Chang et al. 2016; Coventry et al. 2016). The majority's decision influences perception and behavior of individuals in a way (Zhang & Xu, 2016) that others get the feeling of trying to imitate the behavior of the majority (Coventry, Jeske, Blythe, Turland, & Briggs, 2016). The more people have the same opinion on a particular topic, the more likely it is to elicit the same opinion in others (Wang & Chang, 2013) because behavior of like-minded people leads to individual behavior (Bakshy, Eckles, Yan, & Rosenn, 2012). Besides cognitive effects, research analyses the influence of personality traits that determine the effectiveness of this nudge. Research suggests that personality traits such as impulsivity, sociability and risk-taking are enabling the effectiveness of this nudge varyingly strong.

4.2 Future Research for Improving Nudge Design

It is already evident that in the area of privacy nudges many authors have investigated the relationships between cognitive characteristics and effective privacy nudges. However, it must be said that it would be necessary to work out which cognitive effects are exploited, and which are mitigated. In addition, the objective for further objective could be how strong specific cognitive function in relation to each other and how strong they affect privacy nudging. An empirical validation could be a valuable research topic. In the area of personality traits significantly less research has been conducted. In order to design more effective privacy nudges and derive privacy nudge design knowledge, this might represent an interesting research gap that might be worth exploring. As the "big 5 model" seems only as a weak leverage point for privacy nudges, we suggest focusing on other personality traits such as impulsivity, risk-taking and sociability. Little research has already been conducted but needs to be objective for further elaboration. Therefore, we propose the first proposition that also contributes to the design of better privacy nudges:

Proposition 1: The consideration of intrapersonal factors improves the effectiveness of privacy nudging.

Emotions are generally considered as strong influencers in decisions making (Ho und Lim 2018). Specifically, in the privacy nudge literature fear and creepiness are considered to influence privacy-related decisions. However, due to this point, predominantly social influence and information nudges are analyzed

to make use of these emotions. Future research could therefore explore how other privacy nudges could address states of emotions as well. We formulate the second proposition as follows:

Proposition 2: Adapting privacy nudges to emotionally loaded individuals improves the effectiveness.

My review results suggest that targeted privacy nudges can improve privacy-related decision making. As most of the analyzed intrapersonal characteristics are unconscious factors, effective personalized nudges should focus on system 1 thinking. Nonetheless, we highlight that privacy-decisions might also be related to be educative in some way, thus, making nudging the reflexive system 2 necessary. However, these theoretical linkages are not covered up until now from research. We therefore formulate the third proposition as follows:

Proposition 3: Address system 1 thinking with adaptive privacy nudges directly improves privacy-decisions while addressing system 2 thinking improves learning behavior and indirectly improves privacy decisions.

4.3 Nascent Artifact

Finally, I am developing an artifact representing a set of evidence-based design principles that support decision architects to design and implement effective privacy nudges. Privacy nudges are effective when ensuring individual's informational self-determination and lead users to a more privacy sensitive behavior. My approach focuses on working out components of effective privacy nudges. In the next step, to provide concrete guidance for nudge architects, I deduct specific design principles. Evaluating these principles in lab and real-world contexts, I generate fine granular evidence-based design principles for privacy nudges.

5 Theoretical and Practical Implications

With the artifact representing evidence-based design principles for privacy nudges, my contribution will be twofold. From a theoretical perspective, my nascent design theory contributes to the discussion of what drives privacy sensitive behavior. I will extend existing generic models, making them applicable in the context of data disclosure. For practitioners, I offer evaluated and specific design-directives-crafting privacy nudges. Importantly, the artifact is abstracted ensuring the adoption of my design principles to all types of privacy nudges.

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