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Ethics of digital, data-based nudges: The need for responsible innovation

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Abstract: Digital, data-based nudging is seen as an innovative method for influencing behaviour without threat or banning options. However, concerns have been expressed that it is a paternalistic way of manipulating people into behaviour that even taps into subconscious and automatic decision-making. In light of tailoring nudges with big data for personalisation for added effectiveness, ethical problems about privacy of personal data arise. In our contribution, we address these challenges within the framework of responsible innovation. For the field of sustainable mobility, we demonstrate how responsible digital nudges can be designed by incorporating reflexivity and inclusion. We discuss how ethical implications as well as issues of data privacy and use of personal data can be reflected in the design process of data-based nudges, and present results from co-creation workshops that were used to get feedback, improvement and new ideas for nudges. Finally, we give recommendations for designing responsible digital, data-based nudges.

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1 Nudging for behaviour change

Nudging describes a method for influencing and changing behaviour without taking individuals the freedom to choose. Nudging in this sense does not operate with threat, forbidding or severe economic consequences (Ly and Soman 2013; Thaler and Sunstein 2008). Rather, nudging tries to change the way that options and important factors for decisions are presented within the environment in which we make these decisions (the so-called 'choice architecture'), usually by reframing, rearranging cues, adding new information, or by providing social feedback. Thaler and Sunstein (2008, p.6) give a short description of nudging as an intervention method as

> "(...)any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic consequences. To count as a mere nudge, the intervention must be easy and cheap to avoid. Nudges are not mandates. Putting fruit at eye level counts as a nudge. Banning junk food does not. In short: a nudge is a subtle shift in the way options are presented (...)."

Nudge theory draws insights from dual process theory (Kahneman 2012; Thaler and Sunstein 2008) that postulates two different systems of cognitive processes:

1. System 1 ('automatic') is processing information fast and effortlessly in a quasi-automatic way. It guides many of our decisions, leading us through everyday life (e.g. driving to the office daily), operates out of habits and shortcuts, but it is also susceptible to errors and biases.
2. System 2 ('reflective') is much slower in processing, is consciously controlled and it requires more cognitive effort, therefore, it is used not as often (e.g. when encountering an obstacle on the road that we have to navigate around).

Nudging takes this division of cognitive systems into account, for instance, by guiding our automatic system 1 with cues within our 'choice architecture' to influence decisions. A famous method of nudging is the default option: Most people will not opt-out of the default, and this can be used to influence behaviour in an intended way. For example, double-sided printing is set as office default in order to save paper, or switching the default in financial savings and retirement plans from non-participation to participation is used to achieve bigger contributions (Beshears and Kosowsky 2020; Thaler 1994).

The use of digital tools like smartphones or tablets allows for digital nudges to change behaviour in the analogue environment (Lembcke et al. 2019), such as a notification via an app that reminds a person to schedule an appointment for an important cancer screening with their doctor. Digital nudges have seen an uprise since 2016 and are estimated to be as effective as regular nudges (Hummel and Maedche 2019). As digital tools also allow for collection of data about users, personalised nudges became possible: Research has shown

that the one-size-fits-all approach to nudging (i.e. everyone gets the same intervention at the same time) is not the most effective. Rather, personalising a nudge to a person's current situation and to individual factors improves the effectiveness (Mills 2020; Peer et al. 2020). Data can concern information about the person (e.g. gender, age), a current situation (e.g. location) or past behaviour (e.g. consumer preferences).

With nudging as a method to influence people's behaviour with relatively cheap and easy to implement approaches, nudging has evolved from its original use of enhancing policy effectiveness into a method to promote behaviour that has been deemed beneficial for individuals (e.g. healthier eating) or the society (e.g. taking action against climate change) and is also used by non-profit or for-profit institutions and organisations (Sunstein 2014), especially in public health (Hummel and Maedche 2019). In addition, it has been shown that nudges that influence the choice architecture do have a small to moderate effect size, which is remarkable when the cost and effort of nudging is compared to other interventions, such as laws or regulations (Mertens et al. 2022). However, several ethical challenges with digital nudging have been identified, and within this contribution, we discuss how the framework of responsible innovation (Stilgoe et al. 2013) can be used to help address and solve these issues. In addition, we provide examples from a research project in which digital nudges for sustainable mobility were designed, show results from co-creation workshops and demonstrate how we have put the framework of responsible innovation into practice.

2 Ethical concerns with nudging

Despite the impression that nudging as a method for behaviour change is perfectly suitable for policy maker's and organisation's toolboxes, since its introduction, concerns have been expressed that nudging means manipulating people into behaviour that taps into subconscious and automatic decision-making (Hansen 2016). Many critical voices have uttered concerns that some forms of nudging might still threaten freedom of choice and values of a democratic society—despite the fact that proponents of nudging are claiming that people can still choose as they wish. Nudging as a policy instrument has been dubbed as a paternalistic way of policy makers deciding what is best for people based on their own judgement. However, processing information within our automatic system 1 often operates on heuristics, biases and erroneous assumptions, and policy makers are not immune to these errors that system 1 produces. Therefore, their decisions are also prone to this 'bounded rationality' (Lodge and Wegrich 2016): Policy makers run the risk of falling short of their own decision-making. Even worse, critics have voiced concerns that nudging equips policy makers with instruments for manipulating people into behaviours that a government deems as 'ideal', especially when intentions and means of nudges are not clear to the receiving person (Ivanković and Engelen 2019). Usually, the nudged people (e.g. citizens) are rarely included in the design process of nudges, as this has been deemed as two opposite ends of the spectrum (top down vs. bottom up) (Einfeld and Blomkamp 2021).

In light of tailoring nudges with big data, additional ethical problems about privacy of personal data arise. This poses a problem for the widespread implementation of nudging; if digital nudges are not accepted, this also jeopardises the intended behaviour change.

The integration of personal data to public digital ecosystems requires conscientious efforts to anticipate and prevent potential data privacy concerns. There is currently a lack of user

transparency on the datafication process of user activity within most digital platforms. Mayer-Schonberger and Cukier (2013) (as cited in Pierson 2022) define datafication as the "ability of online platforms to convert online and offline interactions and activities into data" (p.7). This process of datafication is almost imperceptible by nature as individuals come to depend on smart devices and digital ecosystems to aid them in their daily activities. While users technically must provide consent for digital devices to capture data, the lack of transparency on subsequent treatment of user data leaves them ill-informed on the process of developing their user profiles and how their digital footprints affect the design process of the digital nudges presented to them by the system.

Another major ethical dilemma digital nudges present is the loss of human autonomy. In the literature review done by Vugts and colleagues (2020) on the different cases of loss of autonomy in relation to nudging, 'freedom of choice', 'agency' and 'self-constitution' emerged as the three general categories that can be attributed as loss of human autonomy due to nudging. "Autonomy is a complex notion that can be understood in different ways. Autonomy can, among others, be understood as self-government, independence, free will or self-rule" (Vugts et al. 2020, p. 110) In an increasingly datafied society, people feel "controlled" by the technology they use. An example of loss of autonomy is the likely case of personalised digital nudges resulting to predisposed reliance of users on algorithmic recommendations. de Vries (2010) labels this as outsourced anticipation, where individuals start to become too dependent on recommender systems and consequently, thinking is outsourced to the smart environment. These issues, regarding the protection of data privacy and autonomy, and consent to the use of data, need to be addressed when designing digital nudges.

3 Designing responsible nudges for sustainable mobility

While nudging seems like an appropriate method to motivate behaviour change that benefits society as a whole (e.g. taking action against climate change), the question remains how nudges can be designed in face of these aforementioned ethical challenges regarding their very nature (paternalism, transparency) and challenges in using data for their effectiveness. For this, we suggest turning to the framework of responsible innovation (Stilgoe, Owen and Macnaghten 2013). The authors define the concept as: "Responsible innovation means taking care of the future through collective stewardship of science and innovation in the present" (p. 1570). Within this framework, four different dimensions are described (anticipation, reflexivity, inclusion, responsiveness), derived from common questions that the public usually asks of scientists and researchers, and that the public would like that scientist and researchers ask themselves. The dimensions are meant to reflect societal concerns, norms, values and ideas, and help address these aspects. The framework can provide a heuristic for more responsible innovation. Nudging, and especially digital nudging, can certainly be seen as an innovative method to change behaviour that would benefit from a responsible design. Despite its ethical challenges, the public seems to be in favour of nudging, at least if the nudge fits with the interests and values of the majority of people (e.g. for environmental protection) (Reisch and Sunstein 2016). Therefore, as the public seems to be approving and interested in this technique, it is a priority to design and use (digital) nudging as an innovative method in a responsible way. Especially the two dimensions of inclusion and reflexivity are well suited for the design process. Public acceptance of nudges has been analysed a posteriori (Einfeld and

Blomkamp 2021), but there have been no efforts to design nudges under the viewpoint of responsible innovation.

In the following section, we describe the design process of digital, data-based nudges within a European research project to encourage sustainable mobility (however, our approach can be transferred to other fields). We wanted to follow an approach of responsible innovation for the resulting digital, data-based nudges, and show how nudging can benefit from this framework. We will use the dimensions of reflexivity and inclusion to address the most pressing ethical concerns about nudging and propose adequate solutions for each of them: Eliciting behaviour that is not intended by the individual through manipulation, improving effectiveness of nudges by collecting personal data for profiling, and nudging as paternalistic instrument for policy-making that excludes citizens. We will give an overview of the role of responsible innovation and how reflexivity and inclusion were put into practice within our research.

Within the European research project DyMoN[1], the goal is to design digital, data-based nudges to encourage more sustainable mobility (i.e. switching from individual car use to more sustainable modes such as bicycling or walking). People are reached via a smartphone app, where nudges are implemented as text-based notifications or as app features. Nudges take into account the situational context, which is known to be fundamental for mobility behaviour. The immediate environment of users defines a situation. Any information about the environment is derived from the user's current location by overlaying multiple data sources. In the context of this project, we are considering the design of the road space (such as the existence and quality of infrastructure that is dedicated to pedestrians and cyclists), the proximity to public transport stops and their accessibility, current traffic conditions, or real-time weather information and forecast. Against the backdrop of a large evidence base that describes the relation of environmental factors and mobility behaviour, nudges can be adapted and triggered in a situation-aware way. We hypothesise that this contributes to an increase of effectiveness, while minimising the demand for personal data (profiling).

The nudges (behaviour change techniques) were developed by using the COM-B model (Michie, van Stralen and West 2011) and the related behaviour change technique taxonomy (Michie et al. 2013) that gives a practical guide to designing behavioural interventions and nudges. After the initial design phase where ideas for appropriate nudges were laid out, we went through the phases of reflexivity and inclusion in the design process.

4 Reflexivity

In the framework of responsible innovation, this aspect is described as "Reflexivity, at the level of institutional practice, means holding a mirror up to one's own activities, commitments and assumptions, being aware of the limits of knowledge and being mindful that a particular framing of an issue may not be universally held" (Stilgoe, Owen and Macnaghten 2013, p. 1571). Reflexivity also includes moral responsibility of researchers and institutions. By this definition of reflexivity, it becomes clear that this very much relates to the apprehended use of and concerns about nudging, that is, nudges as a tool for

[1] https://www.dymon.eu

manipulating people's behaviour and decision making and further, using data to personalise these nudges.

4.1 Transparency of nudges

The assumption that people are manipulated into behaviour they might not choose for themselves can also be reflected in the transparency of the nudge, referring to the intention of the nudge and the means that are used for behavioural change (Hansen and Jespersen 2013; Ivanković and Engelen 2019). A nudge is transparent if the person that is to nudged is able to identify the intention of the nudge and the means by which the behaviour change is pursued (e.g. double-sided printing in offices). A nudge is non-transparent, however, if it is working in a way that the person can no longer easily identify the intention of the nudge or the means of behavioural change (e.g. switching to smaller plates in cafeterias in order to reduce caloric intake).

Hansen and Jespersen (2013) have combined the two dimensions of system 1 (automatic system) vs. system 2 (reflective system) and transparent vs. non-transparent decision making into a matrix that can be helpful to judge which nudges could be used. Non-transparent nudges are especially critical when it comes to an ethical use of these nudges (i.e. the intention and means are not inherently clear). Non-transparent nudges that are built on the automatic system 1 can be used, but people need to be made aware of these nudges or consent should be given, as system 1 operates quasi-automatic and often unnoticed. However, non-transparent nudges that utilise the reflective system 2 practically can be considered manipulation and should not be used at all (e.g. framing of risk of medical procedure to get patients to consider a specific treatment).

For designing the nudges for sustainable mobility, we used this matrix as the guideline for reflection on ethical issues. Mainly transparent nudges for encouraging sustainable mobility were designed, as this helps with acceptance (see results of workshops below). Studies suggest that disclosing the intention of the nudge does not necessarily diminish its effectiveness (Ivanković and Engelen 2019). However, not all means of nudges are necessarily transparent, as sometimes additional psychological knowledge is needed to understand the workings of a nudge, for example, when a nudge uses social comparison. Social comparison theory (Festinger 1954) proposes a general human tendency to evaluate opinions and abilities (and further, behaviour) by comparing them to that of other people. This tendency has been also used to promote behaviour change: A meta-analysis (Abrahamse and Steg 2013) showed that social influences can be beneficial in promoting individual changes towards more sustainable behaviour. For nudging, following social comparison theory, one way to influence people's behaviour is to provide them with some information that their relevant social group is displaying a particular behaviour already, and this method has shown promising results already for getting people to use their bicycle more often (Luger-Bazinger and Hornung-Prähauser 2021). While this is promising for sustainable mobility, it is not necessarily transparent, as a layperson does not immediately realise that information about the mobility behaviour of their friends and family is used to motivate them. While the means of the nudge (i.e. social comparison) are not transparent, however, the intention behind receiving such information is (i.e. it is clear that the nudge wants to motivate more sustainable mobility behaviour). Therefore, in terms of

transparency, this can be regarded as acceptable and in line with Hansen and Jespersen's (2013) assessment.

4.2 Use of data for personalization

With the increasing use of personal data and user activity in digital environments, privacy scholars advocate designing systems that can alleviate data security risks, increase data flow transparency, and incorporate user empowerment tools to gain user trust and increase user participation. Kroll and Stieglitz (2021) identified three factors that affect the level of trust of users: (1) perceived control of data, (2) trust in provider and (3) perceived privacy risk. Trust in the provider must be well-established in smart technologies that stores participatory sensing data. In this type of technology, the user voluntarily provides the system unrestricted access to a multitude of sensitive information (Kounadi & Resch 2018). Tackling privacy risks of participatory sensing technologies entails profound contemplation on the part of the system architects. It involves careful reflection of the intended and unintended impact of the technology on users. Empowering users by implementing a participatory design approach (also related to the aspect of inclusion, see below) is necessary to address the privacy risks of this specific type of smart technology.

Conceptualising privacy in the era of smart information systems requires having a broad understanding of the potential privacy risks users will be exposed to. Regulation (EU) 2016/679 General Data Protection Regulation (EU, 2016) maintains that anonymization or pseudonymization must be applied to any gathered and stored personal data. In the study done by Kounadi and Resch (2018) on geo-privacy by design for technologies that utilises participatory-sensing data, the authors highlight the importance of introducing appropriate anonymization and pseudonymization methods, such as 'geo-masking technique', 'spatial-point aggregation', and 'unlinked pseudonyms method' in collected spatial datasets. While these techniques are still in an early stage of development, privacy advocates encourage system designers and researchers to increase their efforts on incorporating such techniques in collected datasets.

In our research project DyMoN, nudges for sustainable mobility will be delivered via a smartphone app as notifications and will also be built in a smartphone feature. The smartphone app will also be used for collecting data about the user where necessary, but will not send this to a central server. Instead, personal data is exclusively stored on users' devices. The current location of users is the only information that is sent to the server, in order to retrieve situation-aware nudges. Location information is packed into the request URL and not stored server-side. However, this design makes self-learning systems and profiling impossible, as every request is treated uniquely. The consent for this privacy design is given by individual app users.

5 Inclusion

Inclusion describes the "waning of the authority of expert, top-down policy-making" (Stilgoe, Owen and Macnaghten 2013, p. 1571) and seems to be an obvious solution to the paternalistic prejudice against nudging. After all, if nudging is to serve a greater benefit, it should not only be decided by policy makers, but the people targeted must be involved. Surprisingly, however, the acceptance of nudges has been analysed a posteriori, but there have not been many efforts to design nudges under the viewpoint of inclusion. On the

contrary, there have been doubts that methods for inclusion such as co-creation could even be suitable for designing nudges: Some have argued that co-creation and nudging pose two different ends of a spectrum—co-creation can be regarded as a bottom-up and nudging as a policy tool as a top-down approach, and the two are contradictory positions (Einfeld and Blomkamp 2021). Others, however, have argued that including people in the design process of nudges can support better understanding and awareness of motivators, barriers and personal context of the people to be nudged, and help uncover a mismatch between policies and actual system functioning in order to have more effective interventions (Schmidt 2022). A comparison of policy makers' or institutions' ideas for nudges with those of the addressed, to be nudged people could also help in limiting errors and biases on the side of those who design nudges. Therefore, we used co-creation for designing and validating the nudges for our project.

5.1. Co-creation Workshops

5.1.1. Method

Workshops were conducted in January and February 2022. An online format for workshops via Zoom was chosen, due to the ongoing COVID-19 pandemic and as an easier access to participants from various countries. The goal of the workshop was to gather feedback on nudges for sustainable mobility (i.e. motivating people to walk, bicycle or use public transport instead of individual car use) that were already designed within our research project (see above) and to co-create improvements or requirements for their implementation. For this, two online workshops were conducted that were similar in setting and methods, however, the first workshop had both male and female participants (N = 7), the second workshop had only female participants (N = 4), as mobility needs and mobility behaviours between genders can be different (CIVITAS 2020). Participants were recruited online via newsletters (from research partners in DyMoN).

To ensure a high level of transparency in the co-creation process and therefore following the framework of responsible innovation, participants of the mixed-gender and female-only workshops received an introduction to the research project and to the idea of nudging. As a first exercise, participants were invited to mimic each other's gestures and behaviours in order to facilitate co-creation. People that positively mimic each other's behaviour are more likely to have a higher bond to each other (Chartrand and Lakin 2013), and in our previous experience, mimicking in addition to a personal introduction to each other was found to facilitate group dynamics and co-creation. Then, participants were presented with four different examples of nudges for sustainable mobility behaviour and were asked to think about adaptations of their own ideas by answering the following questions.[2]

- What kind of specific information would help you to decide for more sustainable means of transportation?
- After walking, cycling or taking public transport, how do you feel? What benefits (emotional, health) does this have for you?
- Has someone ever inspired you to make healthier or more sustainable choices? If so, how?
- When would you personally like to get reminders to use more sustainable transport?

[2] These questions represent categories within the behaviour change techniques taxonomy (Michie et al. 2013) that was used for designing the nudges

Participants were asked to brainstorm individually and to discuss their own ideas for nudges. Ideas were noted on virtual post-its in a shared presentation and facilitators were also taking notes. In order to not only gather ideas, but to also ensure the understanding of the concept of nudging, virtual post-its and discussions were closely monitored by the facilitators, who also attended the break-out-session to answer emerging questions. After the break-out sessions, participants had the opportunity to read through virtual post-its and comment on and respond to each other's ideas. After a short break, participants were activated again by asking them to help the facilitators sort their previous ideas into categories, visualised in an online presentation. Following the sorting process, participants were educated about the potential ethical issues of nudging, including some pointers from the literature on how to nudge responsibly. Then participants were asked to mark their favourite nudges as well as the most responsible nudges. The most popular nudges were then selected for a deeper feedback and improvement round.

5.1.2. Results

Participants in the mixed-gender workshop expressed the need to receive information about the following categories which would motivate and support them in choosing more sustainable forms of mobility instead of the car: Information about infrastructure availability (e.g. bike lanes, safe parking, bike pumps), personal benefits of sustainable transportation (e.g. exercise and mental health), information about current traffic conditions (e.g. public transport availability, traffic jams). In the further prioritisation step, three nudging ideas were favoured by most participants:

- Information about the quality, safety, and availability of bike lanes,
- information of congestion on public transport and
- push notifications about good weather and local traffic conditions.

For the female-only workshop, safety was especially important for participants. Although being safe in traffic and from adverse weather conditions was also discussed in the mixed-gender workshop, in the female-only workshop, this included the safety from other travellers (i.e. in public transport). The participating women reported a need to know about the locations of staff, or who to report issues to when feeling unsafe. In the female-only workshop, participants discussed that they would like information on the following categories that would motivate them to forego individual car use:

- Weather information and forecasts (e.g. reminders to take jackets),
- safety-related information (e.g. surveillance system locations, movements of local law enforcement, that the counters at train stations have personnel still working, or that controllers are in the trains and actively looking out for single travellers) and
- congestion related information (e.g. live maps for passenger numbers on public transport)—female participants expressed a preference for higher density of passengers in the evenings for safety reasons: they would prefer a busy bus over an empty train.

Further discussion showed that all of the three categories mentioned were equally important to the participating women. In addition, in the female-only workshop, discussions were visibly more open and diverse, with participants giving more space to each idea.

For both workshops, not many participants were worried about being manipulated by nudges, even after being informed that this was a typical concern. Instead, the main topic

discussed in terms of ethics was data privacy; specifically their location information, how this information was stored, and whether it would be shared with third parties. Among the possible solutions co-created in the workshops were ideas for a holistic control of data and a transparent and inclusive education of the usage of the data.

5.2. Outlook

Following the workshops and for further inclusion of relevant stakeholders, in a next step, a focus group discussion will be organized to get the critical insights. Participants will be asked to share their concerns regarding data privacy and ethical considerations related to personalized digital nudges. The utilization of user data and user behaviour manipulation will be tackled in a guided discussion to identify and anticipate various concerns of future users. The goal of this open discussion is to assess the privacy and ethical concerns from the viewpoints of relevant stakeholders and collectively develop practical solutions that can be integrated into the design of the system to effectively address privacy concerns of future users.

6 Conclusion and Recommendations

While digital nudging as an innovative method is certainly promising and has great potential for motivating behaviour change within a society for the greater good (i.e. achieving a result that most people can profit from, like taking action against climate change), it certainly comes along with potential frictions. It is important to use nudges in a way that the targeted people feel included, comfortable and secure. This relates both to the very nature of nudging as well as to additional data that might be used for personalization and profiling. In this contribution, we discussed an approach of designing digital nudges with the framework of responsible innovation. We show how digital nudges for encouraging sustainable mobility were designed within a research project by incorporating reflexivity and inclusion. We first reflected on the ethical implications of the designed nudges as well as on data privacy issues, and then used co-creation methods to get additional feedback, improvements and new ideas for nudges. The results of both steps now determine the nudges that will be used and tested within a field trial. Our approach is not limited to sustainable mobility, but can be transferred to other fields as well. In particular, we recommend taking the following steps for designing responsible digital data-based nudges:

- Using the matrix by Hansen and Jespersen (2013) as a guide to judge and to reflect on whether a nudge should be used or not (e.g. non-transparent, reflective nudges can be considered as problematic in general).
- Considering transparency also when it comes to using data for personalising nudges; encouraging user empowerment is a necessary step for responsible innovation.
- Informing nudged persons on the ways personal information is used to generate nudges.
- When using personal data for personalisation of nudges, not storing this information on a server (e.g. user location for sustainable mobility).
- Using interactive elements within (online) co-creation workshops to ensure a sense of togetherness and team building of participants.

- Taking time to explain the concept of nudging and having examples available for participants' understanding.
- Considering needs, apprehensions and barriers of target groups when designing nudges and getting feedback from the target group.
- Having separate workshops for diverse target groups to focus on different perspectives and needs (e.g. female-only workshop).

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