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ORIGINAL PAPER

A Comparative Analysis of Two Data-Driven Mechanisms for Behavioral Change: Nudging and the Chinese Social Credit System

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Abstract

Nudging and the Chinese social credit system (SCS) are two widely discussed measures that utilize digital technology and behavioral science to shape and modify people's behavior. But these two approaches differ in many perspectives. Nudging is envisioned to address challenging policy issues and lauded for its effectiveness. In contrast, the SCS is seen as highly controversial and regarded as an instance of social surveillance. With reference to the Fogg Behavior Model (FBM), this paper aims to examine how nudging and the SCS are strategically designed in different ways to influence individuals' behavior in the public sector. Our analysis draws upon comprehensive interviews conducted with a sample of 30 university students and researchers from Germany and China. We employed a scenario-based approach involving digital nudges and SCS measures in domains of law enforcement and prosocial conduct. Our interviews reveal how people think conceptually about these two data-driven intervention methods. For Chinese citizens, who are supposed to be more familiar with the SCS, we also explore whether they see a difference between the two approaches and how they understand the fundamental differences. The application of the FBM analysis uncovers disparities in behavioral influence mechanisms between these two approaches for behavioral change.

Keywords Nudging · Chinese social credit system · Digital technology · Fogg behavior model · Behavioral change · Ethical concerns

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1 Introduction

Individuals' behavior can be influenced in various ways. In addition to traditional law enforcement efforts, public policymakers are developing alternative mechanisms to impact people's behavior. This trend is further enhanced through the integration of digital technologies. Two representative but nonetheless different cases of such alternative mechanisms are nudging and the Chinese social credit system (SCS).

A nudge, according to Thaler and Sunstein (2009, p. 6), "is 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". Nudges are increasingly applied to intractable policy problems in different fields such as public health and environmental protection, and are considered particularly useful when conventional policy tools based on hard economic incentives and strict legal requirements have failed. The most famous case is increased volunteering for organ donations caused by changes in defaults (Johnson & Goldstein, 2003). Meanwhile, nudging is increasingly combined with digital technology and data science to develop more accurate predictive models that can identify citizens' most common biases and behavioral inclinations on an individual level, thereby systematically nudging them to choose more wisely (Yeung, 2017). For example, Facebook has teamed up with the public sector in different countries to launch a "blood donations" feature. Using artificial intelligence (AI) and geo-location data, Facebook notifies its users who have signed up as blood donors when blood banks in their area are in need of donations. Taken together, on the one hand, the implementation of nudges is criticized for harming people's autonomy (Barton & Grüne-Yanoff, 2015; Bovens, 2009); on the other hand, (digital) nudging is playing an increasingly important role in evoking behavioral change. Since the establishment of the UK Behavioral Insights Team (BIT) in 2010, many countries have founded nudge units to support their policies and programs. By now, there are over 200 nudge units that exist both inside and outside government institutions, and may even be multinational.[1]

The SCS is widely considered as a reputation mechanism (Dai, 2018; Langer, 2020). Launched in 2014, the SCS relies on digital technologies to assess, educate, and seek to change the social and economic behavior of almost all types of social entities, including individuals, social organizations, judicial organs, and governmental authorities (Chen et al., 2021; State Council, 2014). The SCS is thus regarded as a new form of governance that changes the essence of the political role of the state (Orgad & Reijers, 2021). Different from reputation systems used by online platforms such as eBay, Airbnb and Uber that collect, distribute and aggregate feedback about participants' past behavior to foster trustworthy behavior among strangers (Resnick et al., 2000), the SCS is a government-led, nationwide system, purportedly focusing on building trust within Chinese society (State Council, 2014). More specifically, it employs digital blacklisting and redlisting, rating, and scoring mechanisms to shape and change behavior according to state-defined principles (Dai, 2018; Engelmann et al., 2021). For instance, the digitally facilitated blacklist and redlist records showcase untrustworthy and trustworthy behaviors, respectively, revealing personal informa-

[1] OECD. Behavioral Insights. https://www.oecd.org/gov/regulatory-policy/behavioural-insights.htm.

tion with public access, such as names and partially anonymized ID numbers (or the full Unified Social Credit Identifier for companies and organizations). These lists are developed by various government agencies and publically made available online and offline for the purpose of public shaming and praising (Engelmann et al., 2019), leading to concerns regarding privacy and surveillance (Chen & Grossklags, 2020; Wong & Dobson, 2019).

Previous research has examined the SCS alongside nudges as forms of behavioral change mechanisms, or even considered it as a type of nudge, both aimed at influencing individual and collective behaviors on a large scale. For instance, Keane and Su (2019) explore how the Chinese state uses the SCS and digital tools to guide citizens' decisions, framing it as a way to nudge behavior in the direction of compliance and social order (Keane & Su, 2019). Similarly, Wong and Dobson (2019) drew parallels between the SCS and digital reputation systems in the West, suggesting that both systems use data-driven mechanisms to nudge users toward desirable behaviors, though with distinct cultural and political motivations (Wong & Dobson, 2019). Meanwhile, Langer (2020) delved into the evolution of the SCS, noting its nudge-like functions in incentivizing trustworthiness and compliance (Langer, 2020).

However, while these studies align the SCS with nudging practices, they fall short of explicitly comparing or contrasting the two systems in a systematic way. This gap is where our research steps in—to investigate *how nudging and the SCS are strategically designed as behavioral change tools, but also to explore the distinct mechanisms and implications each system holds in shaping individuals' behavior in the public sector*. A comparative study of the SCS and nudging is particularly needed because, while both systems aim to influence behaviors, they diverge in their underlying mechanisms, implementations, and broader societal implications.

Our analysis is situated within the framework of the Fogg Behavior Model (FBM), examining the strategic design of the two systems across the dimensions of motivation, ability, and trigger effectiveness. By directly contrasting the SCS, with its state-controlled, data-driven enforcement mechanisms, and nudging, which often relies on subtle behavioral cues and individual autonomy, this study aims to reveal important insights into how public sector interventions influence societal outcomes. Specifically, using data collected from 30 in-depth interviews, this paper explores participants' perceptions regarding scenarios using nudging and the SCS from the perspective of behavioral engineering under the FBM and how they really perceive the two approaches conceptually. In particular, since public opinions can impact public policy (Burstein, 2003), we also investigate public attitudes and the perceived effectiveness of the two data-driven approaches. Understanding these differences is crucial for policymakers and scholars alike, especially as discussions on data privacy, autonomy, and ethical governance become more pressing in both democratic and authoritarian contexts.

Our study can be contextualized in the domain of public policy, contributing to two different, pervasively applied design and influence approaches—nudging and the SCS—as well as the socio-technical challenges involved in designing technology for behavior change. In particular, our work helps to understand perceptions regarding each of the two critically viewed approaches to facilitate behavioral change. Further, using a multi-national sample helps to overcome limitations regarding the perceptions

of one particular subject population, which would reduce the diversity of viewpoints regarding cultural, social, political, economic, and technology-related concerns.

2 Key Concepts

2.1 Fogg Behavior Model

The Fogg Behavior Model (FBM) provides a useful framework to understand people's behavior. According to the FBM, behavior is a product of three factors: motivation, ability, and triggers/prompts (Fogg, 2009). That is, to perform a target behavior, a person must have sufficient motivation, sufficient ability, and an effective trigger. To paraphrase, the higher an individual's motivation is, the more likely (s)he is to act; and the easier the task is, the more likely the individual is to do it. Finally, an individual can be triggered to initiate a target behavior. Fogg further categorizes motivators into pleasure/pain, hope/fear, and social acceptance/rejection, while ability relates to task simplicity and the design of interventions to lower barriers. Triggers are conceptualized as three types: signals to remind, sparks to inspire motivation, and facilitators to simplify tasks (Fogg, 2009). Given its simplicity and effectiveness, the FBM is widely employed for the analysis of online persuasive technologies as well as some compliance behaviors such as following traffic rules (e.g., Boston's Safest Driver App), social distancing during the pandemic (e.g., floor marking), and COVID-19 vaccinations (Dai et al., 2021).

Ethical concerns emerge when FBM-driven interventions undermine individual autonomy by subtly influencing behavior without full awareness or consent, exploiting cognitive biases to maximize compliance or engagement (Rossi et al., 2024). In particular, when the FBM is applied to nudges embedded in digital platforms, it often depends on opaque algorithms (Hoven, 2021). These challenges necessitate frameworks that promote transparency, accountability, and equity. As interventions increasingly span socio-political contexts, adaptations must align with cultural norms, institutional structures, and societal values, underscoring the need for comparative governance studies.

In this paper, our analysis of the implementation of nudging and the SCS was developed along the three factors, focusing on the difficulty of the target behavior (capability), initial motivation to perform (motivation), and the facilitating and motivating effects of the intervention (triggers). This approach examines how these factors vary across socio-political contexts such as Germany and China, where governance frameworks shape the design and impact of behavior-influencing interventions.

2.2 Nudging

At least since the publication of *Nudge: Improving Decisions about Health, Wealth, and Happiness* by Thaler and Sunstein (2009), nudging has become an increasingly influential concept of behavioral economics. It operates within the framework of voluntary compliance by structuring choice architectures without removing options or imposing penalties. This reliance on non-coercive measures differentiates nudging

from other governance mechanisms. Nudging spans both offline and digital applications, with digital nudging gaining prominence due to advancements in data collection and algorithmic precision. In interface design, digital nudges leverage user interaction patterns to guide behavior subtly and effectively (Bhuiyan et al., 2018; Schneider et al., 2018).

Empirical evidence demonstrates the cost-effectiveness of nudges in addressing policy challenges (Benartzi et al., 2017; Hummel & Maedche, 2019). However, their increasing reliance on digital platforms introduces governance challenges, particularly regarding privacy, surveillance, and power imbalances between institutions and individuals (Yeung, 2017). This has sparked debates about the boundaries of ethical governance in behavioral interventions and the responsibilities of policymakers to prevent manipulative practices (Furedi, 2011; Helbing et al., 2019; Wilkinson, 2013). Regulatory approaches to nudging vary significantly across countries. In Germany, for instance, under the General Data Protection Regulation (GDPR), digital nudges must comply with strict data protection standards like explicit consent and data minimization (Yeung, 2017). In contrast, China's digital governance mechanisms tend to facilitate the large-scale deployment of nudges. Although China has enacted regulations such as the Personal Information Protection Law (PIPL), these primarily regulate corporate data collection and usage practices, and only place limited restrictions on state activities (Krause et al., 2023).

Public perception of nudging reveals cultural and systemic variations. Worldwide surveys indicate general approval of nudges, yet acceptance rates differ significantly across countries, reflecting the influence of governance systems and societal values (Jung & Mellers, 2016; Reisch & Sunstein, 2016; Sunstein et al., 2018). For example, Germany exhibits lower support for nudging compared to China, where governance mechanisms may normalize state intervention in individual choices. Existent empirical studies largely concentrated on offline nudging. Our research bridges this gap by comparing online and offline nudging, incorporating FBM analysis, and investigating public perceptions across diverse governance contexts.

2.3 The Chinese Social Credit System

The SCS represents a governance innovation, facilitating behavioral compliance with state-defined mechanisms using reputational and material incentives. Developed at national, provincial, and municipal levels, the SCS leverages big data technologies for oversight and enforcement. The construction of the system is led by the National Development and Reform Commission and the People's Bank of China, and its implementation draws on a wide range of government departments. The critical SCS mechanisms—digital blacklists and redlists—are associated with the joint punishment and reward mechanism, which is based on Memorandum of Understanding (MoU) documents signed jointly by different government authorities.[2] Joint punishment and reward imply that behaviors that are deemed untrustworthy or trustworthy in one context lead to punishments or rewards in a wide variety of contexts. The most reported case is that people who failed to repay debt were included in the SCS

[2] There are now over 50 relevant MoUs.

blacklist of *Dishonest Persons Subject to Enforcement* and were thus banned from taking flights and high-speed trains. Furthermore, some cities, such as Hangzhou and Xiamen, have developed credit scoring systems (in different ways) to score their own residents. But there is not (yet) a unified scoring system at the national level at the current stage. According to the 13th five-year plan (2016–2020), the SCS would go hand in hand with a series of social and economic initiatives using big data technologies, including a national big data strategy focusing on opening up and sharing data resources. This aims to ensure that the SCS is constructed and implemented on the basis of big data collection and analysis. The intertwining of individual behavior with material and reputational rewards or punishments reflects a form of mandatory participation, enforced through systemic integration and oversight.

The SCS has ignited extensive debates in the realms of digital ethics and governance. Its mandatory nature, coupled with its reliance on big data, amplifies concerns about consent, fairness, and the ethical limits of governance in a digitally driven society. Critics highlight its surveillance implications, threats to privacy, susceptibility to algorithmic bias, and the stark power imbalances it creates between the state and individuals (Chen et al., 2023; Chen & Grossklags, 2020; Liang et al., 2018; Maurtvedt, 2017; Wong & Dobson, 2019).

A few empirical works have concentrated on Chinese citizens' perceptions towards the SCS via online surveys (Kostka, 2019; Liu, 2022; Rieger et al., 2020). These studies claim an overall positive attitude towards the system, but with different approval rates. However, it is questionable whether such survey data can be collected in an unbiased manner. To address this shortcoming, our research designed different scenarios and conducted relatively comprehensive interviews to gain a more in-depth understanding of participants' perceptions. In particular, since the Chinese are more directly affected by the SCS and, according to the above mentioned research, tend to have positive attitudes towards the system, we examine how the Chinese participants conceptualize differences between nudging and the SCS.

As stated at the beginning of this paper, previous studies commonly framed the SCS as a type of nudge (Keane & Su, 2019; Langer, 2020; Wong & Dobson, 2019). However, our conceptual discussion in Sects. 2.2 and 2.3 revealed fundamental differences between the two approaches: Nudging manipulates choice architectures in a way that does not entail overt punishment. In contrast, the SCS is a mandatory mechanism, which intertwines individual actions with the broader state apparatus and governance structures. This conceptual distinction underscores the need for a comparative study to gain deeper insights into how these two systems operate differently and how they are perceived by the public from various theoretical and practical perspectives.

3 Method

In this study, we recruited German and Chinese participants due to the significant and contrasting dynamics between the two nations in economic, cultural, and governance contexts. As two of the largest economies, Germany and China share robust

economic relations, with China being German's top trading partner[3] and Germany playing a vital role in China's European market.[4] This close economic relationship underscores the global relevance of comparing behavioral change mechanisms within these countries. Additionally, there is a substantial presence of Chinese nationals in Germany[5] and vice versa[6], facilitating a rich exchange of social and cultural practices, which further justifies this comparative analysis. Finally, the distinct political systems present a good opportunity to examine how the systems are developed and applied in different political and societal landscapes. More specifically, participants were selected based on their higher educational backgrounds, as we aimed to gather insights from individuals who are more likely to be informed about nudging and the SCS. This selection criterion was intended to ensure that the feedback received would be substantive and relevant.

3.1 Data Collection and Analysis

Between October 16 and November 26, 2021, one researcher conducted 30 interviews with students and researchers from large universities in a European metropolitan area. Having one person conduct interviews can introduce bias into the results. The potential for bias was mitigated through the collaborative nature of both the study design and the analysis process. All three authors were actively involved in the development of the interview questions, the design of fixed scenarios for consistency, and the coding methodology, ensuring a comprehensive and balanced approach. By using fixed scenarios across all interviews, designed collectively by the authors, interviewer bias was minimized. Additionally, all interviews were audio-taped after having obtained the permission of each participant, allowing for post-interview review and cross-checking of the coding and interpretation by all three authors. This rigorous process ensured that the interpretations were aligned, unbiased, and enhanced the overall reliability and validity of the study.

Prior work on qualitative research methods is showing that a common sample size for interview studies is typically between 20 and 30 or between 20 and 40 participants (Creswell, 2013; Hagaman & Wutich, 2017). According to review work by Marshall et al. (2013), 35% of the information system (IS) studies using grounded theory were conducted with less than 20 interviews. Therefore, our sample size appears to be in line with many other studies; typically conducted in considerably less sensitive contexts. More specifically, the interviews covered two groups of 15 individuals each: One group included German participants who were born and raised in Germany; the other group was comprised of Chinese participants who were brought up in China but were living in Germany at the time of the interviews. Both groups were balanced

[3] See https://www.destatis.de/EN/Press/2024/02/PE24_056_51.html.

[4] See https://china.diplo.de/cn-de/willkommen-in-china/wirtschaft/wirtschaft-bilateral.

[5] There were 155,955 Chinese living in Germany by Dec 31, 2023. See https://www.destatis.de/EN/Themes/Society-Environment/Population/Migration-Integration/Tables/foreigner-place-of-birth.html.

[6] Germans ranked among the top 10 nationalities of foreigners residing in China (see https://www.stats.gov.cn/sj/tjgb/rkpcgb/qgrkpcgb/202302/t20230206_1901999.html). However, the exact number of Germans was not disclosed in the most recent national population census (see https://www.stats.gov.cn/sj/tjgb/rkpcgb/qgrkpcgb/202302/t20230206_1902008.html).

Table 1 Sociodemographic characteristics of interviewees

	Age (Mean)	Gender (Female: Male)	Education Background (Bachelor; Master; PhD)
German	23.5	7: 8	7; 8; 0
Chinese	24.5	8: 7	1; 11; 3

Table 2 Scenarios included in the interviews

	Scenario	Type of Nudge	Scenario	SCS Mechanism
Law Enforcement	Following traffic rules (Safe-driving app)	- Feedback - Reminder - Entertainment	Following traffic rules (Driving surveillance & blacklisting)	- Blacklisting
	Filing income taxes (Tax filing software)	- Default option	Repaying debt (Debtor shaming before phone calls)	- Blacklisting - Spreading via telephone
Environment Protection	Buying energy-sorting electronic devices (Energy labels)	- Information	Sorting waste (Social credit scores & blacklisting)	- Reduction of social credit score - Blacklisting
Societal Welfare	Donating money to charities (Online charity donation form)	- Default option	Treating others respectfully on the Internet (Social credit scores & online blacklisting)	- Reduction of social credit score - Blacklisting

regarding the gender ratio (see Table 1). We also aimed to include participants from a wide variety of study backgrounds. As a result, our participants majored in 23 different areas, ranging from arts to natural science. The length of the interviews was between 35 and 70 min. Each interviewee was offered a reward of 20 Euros for their participation in the interviews.

We chose a semi-structured interview approach, posing fixed as well as supplementary questions and providing explanations where necessary. Interviews with German individuals were all conducted in German, whereas interviews with those from China were held in English, except for one in German. While our institution did not specifically require approval for survey or interview studies that focus on non-medical issues, we ensured adherence to recommended academic ethical practices. We followed a rigorous ethical framework, including obtaining informed consent from all participants. We clearly communicated the study goals to participants and informed them of their rights to withdraw from the interview at any time and to choose not to answer any questions. Furthermore, we provided transparency regarding our data handling practices, assuring participants that their responses would be anonymized, while also clarifying that the insights derived from the interviews would be used for the purpose of academic research publications. All interviews were then transcribed manually for the subsequent content analysis. The data that support the findings of this study are available from the corresponding author upon request.

There were four main parts associated with each interview, including four different *real-world* examples of nudges and SCS measures, respectively. The selected example cases for the two systems may differ due to the challenge of finding identical cases for both. Nonetheless, they target shared focal areas for both nudging and the SCS, covering online and offline behaviors. The scenarios, depicted in Table 2,

encompass a spectrum from promoting prosocial conduct to law enforcement contexts. Prosocial behavior includes environmental protection and societal welfare, and law enforcement activities include economic behavior and non-financial behavior. Based on the FBM, participants were first asked about their ability and motivation, respectively, for a specific target behavior. They were required to rate the two factors on a scale between 1 and 10 points, in which a higher score indicates higher difficulty and higher motivation, respectively.

After participants rated their ability and motivation regarding the target behavior, we introduced the nudging or SCS-related intervention scenario. In each of the scenarios, we provided a strategy using one or more types of nudges or aspects of the SCS mechanisms. After describing a scenario, participants were asked to explain whether they perceived the presented nudging or SCS strategy as facilitating or motivating. "Signal" was not explicitly and separately tested in the questions to the participants as it is usually combined with the other two types of interventions. But participants' answers would indicate the role of signaling in the designed intervention. Throughout the interviews, participants were encouraged to express their opinions about the nudging/SCS strategy from any perspective. Before the end of the interview, we included open-ended questions focusing on participants' previous knowledge and attitudes about nudging and the SCS to further situate our research in the context of prior empirical research in this topic space (e.g., Rieger et al. 2020).

We used the conventional approach for content analysis as there was no coding scheme for comparative analysis of nudging and the SCS. The analysis consisted of four steps: meaning units extraction, condensed meaning units summary, code assignment, and category development. We generated two separate coding tables encompassing interviews in English and German, respectively. When coding German interviews, we listed the meaning units in German and translated the condensed meaning units, codes, and categories into English. Three weeks after the first coding cycle, the transcripts were coded again. Different coding results between the two rounds of analysis were reconsidered. The final categories were divided into two parts: those pertaining to nudging and those associated with the SCS.

4 Findings

Following the FBM framework, we report findings along five dimensions: difficulty and motivation of the target behavior, motivating and facilitating effects of the intervention, and concerns raised by the intervention. Finally, we provide insights regarding the participants' knowledge and attitudes on nudging and the SCS, respectively.

4.1 Nudging Scenarios

Scenario 1—Following traffic rules (Safe-driving app): Following traffic rules was considered relatively easy. Chinese participants presented a somewhat higher difficulty score (4.67) than the German peers (3.47) (see Fig. 1). Participants from both groups exhibited a high motivation to follow traffic rules (average score of 8.57).

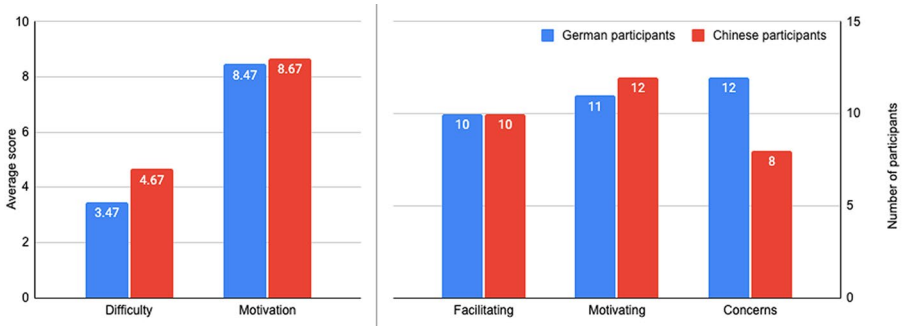


Fig. 1 Compliance with Traffic Regulations (with nudging regulation). Both participant groups demonstrated high levels of motivation to follow traffic rules. However, Chinese participants appeared to encounter comparatively greater challenges. Intervention via an app was generally perceived as both facilitating and motivating. German participants were more inclined to express concerns regarding privacy.

Based on Boston's Safest Driver Competition[7], we described an app that tracked the user's car trips, gave feedback on how to improve in the future, and also included a safe driving competition between app users. Two thirds of participants (10 from each group) regarded this intervention as facilitating by reducing users' mental efforts. In contrast, 2 Chinese participants, who disagreed with the facilitating effect, argued that the app could even complicate the case as the notifications would distract or create mental pressure. Most participants (11 German and 12 Chinese) thought the app could motivate them to follow traffic rules, especially with the feedback function. Two thirds of participants (12 German and 8 Chinese) raised privacy concerns due to personal data collection and worries about the potential increase in insurance cost due to data flow to third parties.

Scenario 2—Filing income taxes (Tax filing software): Filing an income tax return in Germany was rated as very difficult by Chinese participants (average score: 7.43 Chinese vs. 4.77 German), who were not familiar with German tax law and also had a language barrier. However, Chinese participants also expressed a somewhat higher motivation to hand in their income tax return (average score: 8.83 vs. 7.80 for Germans). German participants were mainly motivated by financial gains, while Chinese participants were primarily driven by social motives. We described a pre-filled tax return form with (editable) basic financial information, which is provided by tax offices in many other countries to make it easier for taxpayers to meet their obligations. Most interviewees (26 out of 30) associated facilitating effects with the pre-filled form, and half of the participants perceived the intervention as motivating. Two thirds of participants (9 German and 11 Chinese) expressed concerns related to (financial) data collection, storage, and sharing with a third party.

Scenario 3—Buying energy-saving electronic devices (Energy labels): The difficulty level of buying energy-saving electronic devices was rated as medium with an average score of 4.82. Half the participants (5 German and 10 Chinese) referred to the higher purchasing cost (compared to non-energy saving devices) as the main impedi-

[7] See https://www.boston.gov/departments/new-urban-mechanics/bostons-safest-driver-competition.

ment, and 6 participants (3 from each group) mentioned mental efforts as deterrence since they lacked knowledge about the energy consumption of different devices. The motivation to buy an energy-saving electronic device is relatively high (average scores, German: 7.5; Chinese: 6.93), being driven by environmental protection and long-term cost savings. We described widely used energy consumption labels as a nudge to interviewees. All participants perceived it as facilitating by providing useful information. About two thirds of participants from each group (9 German and 10 Chinese) reported to be more motivated to buy energy-saving devices due to such labels. 2 German interviewees, who would not be more motivated by the labels, explained that they already had a very high level of motivation. Different from other scenarios, the energy consumption label did not raise many concerns.

Scenario 4—Donating money to charities (Online charity donation form): Donating online was rated as the most difficult across all scenarios (average score: 6.35). Extra financial expenditure was referred to as the major impediment, which can be explained by the income status of the student participants. The motivation to perform online donations was relatively high (average score 6.42). On the one hand, participants wanted to help the poor or to protect the environment; on the other hand, they were not convinced about the appropriate use of the funds by charities. Based on the interface design of popular online donation platforms (e.g., JustGiving and National Geographic), we introduced a donation webpage designed with a default option granting a certain amount of money to the charity. Users could also select other monetary amount options or enter a custom amount manually. This nudge design was considered as facilitating by most participants (10 German and 13 Chinese) as it saves mental effort to figure out an appropriate amount. Less than half of the participants (5 German and 8 Chinese) would be motivated to donate due to this default option design. Twice the number of Chinese (8) as German (4) participants expressed concerns about the safety of personal and financial data.

4.2 SCS Scenarios

Scenario 1—Following traffic rules (Driving surveillance & blacklisting): Focusing on safe driving, we described a different approach to address violations based on SCS mechanisms: digital technology helps to identify violators and fines them automatically. Meanwhile, violators' misbehavior would be published on SCS blacklists with public access. More than two thirds of the participants (12 German and 9 Chinese) disagreed with a facilitating effect as associated surveillance measures and impending punishment would result in further stress and mental load. The other 9 participants, who argued for a facilitating function, believed that the SCS intervention could bring about a more driving-friendly environment as everyone would be careful to meticulously follow the rules. 12 participants from each group indicated that they would be motivated to drive responsibly by the SCS measures due to the fear of shaming or financial punishments. All participants, except one from China, expressed concerns about privacy infringement and pervasive camera surveillance.

Scenario 2—Repaying debt (Debtor shaming before phone calls): Repaying debt was rated as a very easy task by our interviewees, with an average difficulty score of 2.3. Participants expressed different motivations to repay debt: they considered

trustworthiness as a key component in society, they would not want to experience the guilt of being indebted, and they were worried about potential negative impacts on their reputation. We then provided a scenario based on SCS measures: If you do not repay your debt, anyone who gives you a call will first be informed that you are blacklisted and be asked to persuade you to repay debts before the line is connected. 8 participants agreed that this measure would make debt repayment easier, referring to it as a reminder. 20 participants (8 German and 12 Chinese) perceived this measure as motivating, considering the telephone message as a warning or fearing being blacklisted. All German participants and 11 Chinese participants expressed concerns, believing the financial situation was an issue between debtor and creditor and should not be revealed to third parties.

Scenario 3—Sorting waste (Social credit scores & Blacklisting): Our interviewees expressed a high motivation to live an environmentally-friendly life (average score 8.28), which was also considered relatively easy (average score 3.72). Regarding sorting of waste, our participants considered as a main impediment the tedious process of separating every piece of garbage, the mental efforts of sorting the garbage correctly, and a lack of infrastructure for waste sorting. About two thirds of participants highlighted benefits for the environment, humans, and animals. Social norms were also mentioned as a main motivation by 2 participants from each group, who wanted to avoid criticism from neighbors. Low motivation was associated with the beliefs that sorting waste was mainly the responsibility of big companies or that garbage would be mixed afterward anyway. Based on existing SCS measures in some Chinese cities (e.g., Xiamen and Shanghai), participants were informed that people who fail to sort waste properly would face reduced credit scores and be included in SCS blacklists. Merely 3 German and 4 Chinese interviewees perceived this measure as facilitating. Most participants (23 in total) attributed motivating effects to the blacklisting mechanism. All participants (except one Chinese) voiced concerns regarding the SCS blacklist, centering on privacy worries.

Scenario 4—Treating others respectfully on the Internet (Social credit scores & blacklisting): Treating others respectfully online was considered a very easy task for our interviewees, but was regarded as more difficult by Chinese participants (average score 3.13 vs. 1.13 by German) (see Fig. 2). In particular, 3 Chinese participants gave a difficulty score of over 7 points, believing people tend to have less self-control and are more likely to say something against others when they consider themselves to be anonymous online. All interviewees showed a high motivation for respectful online behavior (average scores 7.83 for German and 8.67 for Chinese), being driven by the desire for social acceptance. An SCS regulation scenario was then described to the participants: certain online behaviors such as spreading rumors may result in a reduction of the credit score and to be blacklisted.[8] Two thirds of the participants from each group regarded this measure as facilitating and effective for fewer online conflicts and a better online environment. 24 participants (10 German and 14 Chinese) thought the fear of punishment was the key motivation. However, according

[8] This is based on the *Management Rules for Credit Information of Gravely Untrustworthy Subjects in Internet Information Services (Opinion-seeking Draft)* at http://www.cac.gov.cn/2019-07/22/c_1124782573.htm.

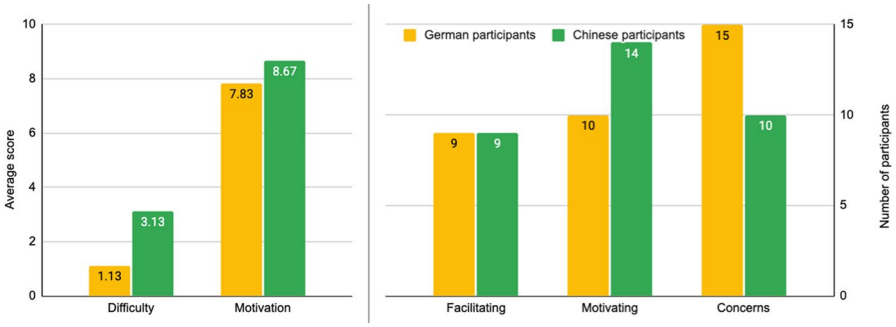


Fig. 2 Online behavior (with the SCS regulation). Both participant groups found this task manageable. However, Chinese participants perceived it as notably more challenging, despite expressing stronger motivation to uphold respectful behavior. The SCS regulation was generally found to be motivating, especially among Chinese participants. While concerns about this scenario were widespread among all participants, the figure highlights a more pronounced emphasis on these concerns by the German participants.

Table 3 Perceptions towards the two systems

		Positive	Neutral	Negative
Nudging	German	4	10	1
	Chinese	11	3	1
SCS	German	0	3	12
	Chinese	4	6	5

to 5 German participants, who denied a motivating effect, such mechanisms could trigger a kind of resistance or even anger. All German participants and two thirds of Chinese participants expressed concerns about privacy and surveillance problems. In addition, 7 German and 6 Chinese participants also voiced concerns related to the loss of freedom of opinion and expression, especially in a political context.

4.3 Knowledge and Attitudes on Nudging and the SCS

We noted varying levels of familiarity with the concept of nudging among participants. About half of the German interviewees were familiar with the concept of nudging prior to the interview; 2 participants even claimed to have a comprehensive understanding of nudging. In contrast, nudging was an unfamiliar concept to Chinese participants. Only 1 of them had a good understanding of the concept due to his work experience. Since our focus was on students and scholars, the limited knowledge observed among Chinese participants underscores the broader issue of varying awareness. This suggests that less informed groups in China may possess an even lower level of understanding. The overall attitude toward implementing nudges in public policy was relatively positive, with half of the participants approving it and a disapproval rate of 6.7% (see Table 3). Chinese participants reported a particularly high approval rate (73.3% vs. 66.7% for German). Negative attitudes were mainly associated with the potential for manipulation and privacy infringement.

When comparing online and offline nudges, two thirds (12 German and 8 Chinese) of the participants indicated that they would feel more comfortable about offline nudges that, according to the participants, typically involve less data collection. In contrast, 3 German and 6 Chinese participants would prefer online nudging. They thought that digital nudging guaranteed a greater degree of privacy as they could decide which data to share or simply turn off their devices. Online nudging was regarded as more effective by about half of the participants who assumed that people were more easily distracted online and would fall more readily into the "trap" of an influencing mechanism. On the contrary, those who believed offline nudges to be more effective gave two key reasons. They argued that, first, there are usually more opportunities to influence people's behavior in an offline situation; and second, people usually face more social pressure offline than in front of the screen.

Compared to nudging, the SCS was better known among the participants from both groups. About half of them (6 German and 8 Chinese) knew the system quite well, gaining information about the SCS through media, work, or studies and research about related topics. They also learned about the topic from personal contacts including roommates and family members. Another third of the participants (6 German and 4 Chinese) had some basic knowledge about the SCS, and 3 participants from each group (20%) had not heard of the SCS prior to our interview. The SCS was associated with a higher percentage of negative attitudes, with a disapproval rate of 56.7% (vs. an approval rate of 13.3%). German and Chinese participants differed substantially regarding their attitudes towards the SCS (see Table 3). No German participant supported the SCS as a whole (vs. 26.7% for Chinese). Rather, 80% of them reported negative attitudes toward the system (vs. 33.3% for Chinese). More specifically, the majority of both German and Chinese participants challenged SCS-based interventions as they did not believe that the SCS's rating and scoring criteria could adequately evaluate an individual's trustworthiness due to the concept's complexity. 30% of the participants (3 German and 6 Chinese) partly supported the SCS rating/scoring mechanism as they believed that technology would help to improve the system continuously. Problems of mass surveillance and privacy invasion, which have been discussed in both academic papers and media reports, were also raised in our interviews. Participants also highlighted fairness problems associated with the system and the system's damage to interpersonal relationships in society. Despite the lack of approval for the SCS, participants attributed a general effectiveness to the system in terms of changing people's behavior.

5 Analysis

5.1 The FBM Analysis

Participants generally stated a very high motivation for all target behaviors (except regarding online donations, average score 6.42), but revealed different levels of capacity. As pointed out by Fogg (2009), different groups of people have different resources in terms of time and money and thus, what is difficult for one person is not always difficult for another. The income tax reporting scenario best supports this

argument, presenting differences between the two groups of participants. Also, making online donations was perceived as the most difficult target behavior among the eight scenarios, which is associated with the economic status of our participants. Therefore, as FBM highlights, the design of an effective behavior intervention (a trigger) must be customized to the characteristics of the target users.

Interventions discussed in our interviews are based on real cases for a general purpose, without labeling a target group of people. Some of them do not match the features of our participants who are university students and early-career researchers. For instance, in the case of online donations, our interviews indicated that the difficulty of taking action primarily lay in the inadequate financial capability and the lack of motivation was due to concerns over the charity's transparency. The provided intervention focused on facilitating the decision on the amount of donation, which did not really bother our participants. While it is difficult to improve people's financial capability, the intervention could be more related to providing information about the charity's operation or capital flow, which, however, was not reflected in the interface design.

In the FBM, spark and facilitator are discussed as two independent triggers, while the relationship between them is overlooked (Fogg, 2009). Our study shows that the two factors interact with each other and are mutually reinforcing. In scenarios of pre-filling tax return templates and energy labels, the facilitating effect of nudges was highly rated (see Sect. 4.1). At the same time, interviewees also claimed that they would become more motivated to perform the target behavior once the task is simplified. In addition, in scenarios of regulating driving and online activities, the motivating effect is expected to lead to an improved environment due to collective behavioral change, which further facilitates everyone's behavior. Such interaction between motivator and facilitator is a useful complement to the FBM.

Our findings show that nudges and the SCS are associated with different types of motivators (Fogg, 2009): While nudges in our discussed scenarios were mostly associated with motivators of hope and social acceptance, the SCS was more related to fear as the blacklisting and joint punishment mechanisms are the backbones of the system. Usually, different motivators could work together to reinforce the motivating effect. When an individual already has a certain kind of motivation to perform a target behavior, the trigger is more likely to bring about other kinds of motivators. For instance, in the scenario of driving, participants initially wished to avoid accidents (fear as the motivator). The safe driving app with nudging design then inspired their hope to improve their driving skills (hope as the motivator). The combined motivators are more likely to make target behavior happen. From the psychological perspective, motivation is usually distinguished between extrinsic and intrinsic motivation, which is not covered in the FBM discussion but could have different impacts on individuals' behavior. Extrinsic motivation is engendered by social environmental factors such as surveillance, competition, and reward (Deci & Ryan, 2013) while intrinsic means the activity "is motivating in and itself" (Larson & Rusk, 2011). The motivating effect of SCS interventions mainly lies in the fear of punishment (both material and reputational) and the concern over credit score reduction, which are typical extrinsic motivations. Extrinsic motivation works particularly well in situations when individuals are expected to complete a task that they find unpleasant, but may sometimes conflict with intrinsic motivation (Deci & Ryan, 2013). In our case,

the pursuit of a higher credit score or rating (extrinsic motivation) could undermine an individual's altruism or kindness (intrinsic motivation), which is also referred to as the *crowding out* effect (Frey, 1997). The high-level design of the SCS seems to have taken this into account using different degrees of transparency between redlists/rewards and blacklists/punishment (Engelmann et al., 2019). Another negative effect derived from extrinsic motivation is that it might result in resentment or even resistance in the long run. A few participants expressed discontentment and specified that they would abandon social media to avoid the evaluation of their online behavior.

Although both nudging and the SCS respond to the global trend of using digital technology for behavioral change, the FBM analysis indicates that they function in different ways. While all the nudging interventions across the four scenarios were considered as facilitating by at least two thirds of all participants, only one SCS intervention (i.e., online behavior) was regarded as a facilitator by the majority of participants. Rather, the SCS interventions were considered more motivating. This seems plausible given that participants generally perceived the target behavior with the SCS interventions as easier. Thus, from the FBM perspective, the SCS makes more use of fear as the motivator while nudging drives regulation at the soft end of policy interventions (Michalek et al., 2016).

5.2 Public Perceptions

Citizens in various nations are found to generally approve of nudging (Lourenço et al., 2016; Sunstein, 2016). Chinese citizens presented overwhelmingly high approval rates for all types of nudges (see Sect. 4.3), which is consistent with the conclusion from (Sunstein et al., 2017). But different from previous empirical studies which show high-level approval on nudging among the majority of German citizens (Reisch & Sunstein, 2016; Sunstein et al., 2019), our research presents that German participants tend to hold a neutral attitude. The approval rate for the SCS among our Chinese interviewees was 26.7%, which is much lower than 80% as indicated by Kostka's survey (Kostka, 2019), but similar to findings from Mercator's survey (29%) (Rieger et al., 2020). Both our interviews and Mercator's survey focused on university students and informed participants about the effects of the system. However, the two studies present different results on German students' attitudes. Our interviews revealed no positive attitudes toward the SCS while Mercator's survey resulted in an approval rate of 19% (Rieger et al., 2020). The attitude variance probably lies in the participants' different experiences. The surveyed German students in Mercator's research were studying and living in China. Thus, their experience with Chinese society is likely to impact their attitudes toward the system.

In our interviews, Chinese participants showed significantly more positive attitudes towards both nudging and the SCS than their German counterparts. Both (Sunstein et al., 2017) and (Rieger et al., 2020) made efforts to explain the high-level support of Chinese citizens to nudging and the SCS, respectively, and showed that culture is not sufficient to fully explain the high approval rates. Participants from Japan or Taiwan presented much lower approval rates to nudging (Sunstein et al., 2017) and to the SCS (Rieger et al., 2020), although these regions share the Confucian culture with China. Rather, the Chinese social condition or reality contributes

greatly to the higher approval rate for both types of social regulation. As explained by Sunstein et al. (2017), Chinese citizens were confronted directly with problems about the environment, health, and safety, and would thus have a stronger willingness to fix them. In the fieldwork from (Chen & Grossklags, 2022), Chinese interviewees described low national quality (国民素质), large population, and a lack of insolvency laws as characteristics of "China's national conditions", and referred to them as the reasons why the SCS was necessary. A report from (Ipsos Public Affairs, 2017) also highlighted that "moral decline" was regarded as one of the most serious issues in China. The trust game in the survey from (Rieger et al., 2020) also demonstrated a lack of trust and public safety in Chinese society and linked it to the Chinese support of the SCS. The higher approval rate of the SCS from German students who studied in China (19% vs. 0 German local students) also suggests that living experience in China is likely to bring about more positive attitudes about government regulation.

In contrast to the lack of trust among citizens in Chinese society, trust among Chinese citizens in their government has been high (Pew Research Center, 2013) and hit a record of 91% in 2022 (Edelman, 2022). Thus, the Chinese are more likely to accept the government's governance in various areas, which corresponds to the strong/big government model in China (Ackerman et al., 2009) and constitutes another key factor for the strong support of different forms of social control. Furthermore, since digital technology is increasingly used in social control, individuals' opinions towards digital technology can also influence their attitudes towards nudging and the SCS. Previous surveys showed that the Chinese exhibited the most positive attitudes towards artificial intelligence, while people in Germany were among the most pessimistic (Dentsu Aegis Network, 2018; Sindermann et al., 2021), which is in accordance with our results.

Finally, corresponding to the overall trend of increasing privacy worries due to the rapid expansion of digital technologies in all aspects of our life (Quach et al., 2022), privacy infringement was raised by our interviewees as a primary concern over both digital nudging and the SCS. In only one (out of eight) scenario—the energy label case which has nothing to do with personal data collection—privacy worries were not mentioned. There is no significant difference between German and Chinese participants regarding their privacy concerns. But they tended to report different privacy-related behaviors. According to German participants, they are more likely to refrain from behavior that could result in personal data collection, which is in line with findings from (Korella, 2017) about using mobile payment services. German participants stated the intention to stop driving or online surfing to avoid large-scale data collection and surveillance. In contrast, Chinese individuals would continue such behavior despite their privacy concerns. They stressed the trade-off between privacy and other goals, as one Chinese participant mentioned: "Maybe (I have) concerns about my privacy, but we have to sacrifice something if we want to, for instance, control the society." (R1, 31 Oct 2021)

5.3 Perceived Effectiveness

Despite concerns in relation to nudging, the majority of the participants perceived nudging interventions as both motivating and facilitating (see Sect. 4.1). In other

words, nudging was regarded as an effective tool for behavioral change. Online nudges tend to raise more concerns due to personal data collection and thus require more ethical considerations in the design. But neither the scenario discussion nor the perception interviews were able to conclude whether online or offline nudging is more effective in our research.

It is interesting to see that 90% (27 out of 30) participants thought that their reaction to a nudge would change after being informed about its purpose. They explained that they would be more cautious about their decisions once they were aware of nudges and thus would develop some forms of resistance, making nudges less effective. Our interviews also revealed that the public has a relatively high demand for transparency in nudging: About two thirds of participants (7 German and 12 Chinese) would like to be notified about a nudge when confronted with it. They believed that people should be aware of manipulation and granted the right to decide whether they are willing to be nudged, highlighting the importance of autonomy in nudging (Schmidt, 2017; Sunstein, 2015). The rest who did not deem the notification as necessary thought people's choices were influenced by different means anyway, as also argued by Sunstein (2014).

Discussions about the impacts of transparency on the effectiveness of nudging remain inconclusive: On the one hand, nudges are supposed to "work best in the dark" (Bovens, 2009). Our findings seem consistent with this argument, implying that transparency plays an important but negative role in determining the effectiveness of nudging. However, it is important to point out that this ratio (90%) might be exaggerated as it presents a reported behavior in our study rather than a behavior in practice. On the other hand, there are also empirical studies showing that prior notification did not have a significant impact on people's decisions or performance (Bruns et al., 2018; Kroese et al., 2016; Loewenstein et al., 2015). There are two factors to be considered in understanding the differences between these empirical studies and our findings. First, many prior empirical studies were conducted in the Netherlands and the U.S., while our research invited participants from Germany and China. Second, prior studies focus on default nudges in areas of health and environmental protection, while our interviews include different types of nudges in a broader range of areas. It is possible that people have different reactions to different types of nudges or in different contexts.

The SCS was regarded as effective due to its motivating effect (see Sect. 4.2). However, the system's effectiveness is constrained by its transparency level. The majority of the participants (19 out of 30; 63.3%) required a more transparent system—more information regarding the credit score/rating criteria and the technology and algorithms used for credit scoring/rating. The demand for transparency is particularly high among individuals who were skeptical about the reliability of technology in judging human behavior. So, the system's transparency level itself is a key factor for individuals judging the SCS (Chen & Grossklags, 2022; Rieger et al., 2020). In the broader discussion about automated decision-making systems, transparency is highly valued and regarded as a positive contributor to the system's effectiveness (Citron & Pasquale, 2014; Pasquale, 2015). However, experiment results imply that high transparency does not necessarily lead to intended behavior change in practice while a balanced transparency level is required for the sake of effectiveness (Kizil-

cec, 2016). The deliberately engineered transparency in the SCS seems a replication of this principle. On the one hand, the Chinese government makes efforts to enhance SCS transparency by mitigating the system's complexity and fragmentation[9]. On the other hand, parts of the SCS are kept opaque such as the involved digital technologies and algorithms (Kshetri, 2020), as well as the ambiguous link between rewards and behavior (Engelmann et al., 2019) to avoid "crowding-out" effects and to prevent people from gaming the system (Burrell, 2016).

Since digital technology-assisted public shaming is supposed to be a special mechanism employed by the SCS (Chen & Grossklags, 2022), we were also interested in the public perception in this regard, especially compared to traditional behavioral change mechanisms such as financial penalties. The public shaming mechanism of the SCS can be connected to the *face* culture in China, which is about the avoidance of embarrassment (Goffman, 2017). The Chinese are known to have a high degree of sensitivity and consciousness regarding the concept of *face* (Li et al., 2015). The emotion of shame helps maintain a sense of personal identity (Bechtel, 1991) and thus could function in promoting compliance. Therefore, the SCS blacklists are supposed to be particularly effective in Chinese society. However, as presented in Sect. 4.3, Chinese participants deemed financial penalties as more effective than public shaming. In contrast, the majority of German participants (11 out of 15) believed that public shaming was more effective. But they deemed this measure as morally unacceptable.

6 Concluding Remarks

As stated by Marx (2015), "(o)ur personal spatial, communication, social, cultural, and psychological environments, and borders are increasingly subject to technological strategies designed to influence behavior". Nudging and the SCS represent principal but very different cases of such behavioral engineering with digital technologies. In this first exploratory study about two relatively new data-driven approaches for behavioral change, we tried to understand the strategic design of these mechanisms and people's perceptions about them. To this end, we conducted and analyzed 30 interviews with university students and scholars from Germany and China and used the FBM as a conceptual framework for the analysis. On the one hand, this study responds to calls for more comparative work, for example, in the context of privacy research (Masur et al., 2021); on the other hand, it could be seen as preparatory work for a more direct comparison between the two systems.

With the integration of digital technologies, both nudging and the SCS are capable of delivering specified triggers based on the target users' characteristics and are thus expected to be very effective for behavioral change. In other words, digital technologies serve to expand the reach of behavioral change, encompassing a wider array of domains and contexts, while also enhancing effectiveness. Meanwhile, the integra-

[9] The SCS is implemented at both national and local levels. Provinces and cities have developed different policies and models (see, for example, the recent draft of the *Law of the PRC on the Establishment of the Social Credit System*).

tion of digital technologies raises more ethical concerns about privacy infringement and lack of transparency (or autonomy) (Blanchard & Taddeo, 2023; Loefflad et al., 2023; van Maanen, 2022). However, the two systems function in fundamentally different ways. Under the framework of the FBM, we presented such differences in behavioral influence mechanisms between the two systems: While nudging uses both sparks and facilitators as triggers to change individuals' behavior, the SCS interventions are mainly associated with motivating effects. Our interviews showed that people are aware of such differences between the two approaches. We thus argue that fundamentally different mechanisms can be created based on the basic insights of behavioral sciences to influence behavior.

There is evidence suggesting the SCS brings about a deterrent effect and self-censorship effect which aligns the SCS more with laws (Ehrlich, 1972) and distinguishes it from nudging. In our interviews, 11 Chinese participants conceded to being more careful about their behavior in their home country; 2 of whom stressed that they were most cautious about their Internet communications. The same number of German participants imagined that they would be more careful about their behavior during a travel to China. The deterrent and self-censorship effects are in accordance with the prevalent motivating effect, in particular, fearfulness in the context of the SCS.

Participants' perceptions toward nudges and the SCS present both similarities and differences with previous literature. In our study, Germans hold neutral attitudes towards nudging (vs. very positive attitudes in prior work (Reisch & Sunstein, 2016; Sunstein et al., 2019)) and negative attitudes towards the SCS, while Chinese participants are positive about nudging and neutral about the SCS (vs. positive attitudes in prior work (Kostka, 2019)). Different from the popular view that Chinese people do not care about privacy (Jacobs, 2018; Minter, 2016), our study found no significant difference between German and Chinese participants regarding their concerns about privacy and transparency over the two systems. However, the Chinese participants gave high priority to other goals (e.g., social stability and convenience in life) at the same time. The two groups' participants tend to behave in different ways corresponding to their concerns about privacy: German participants would rather stop using certain digital tools or services to avoid privacy infringement, while their Chinese counterparts are not likely to change their behavior in this regard. The Chinese participants' comparatively high approval rate for both nudges and the SCS can be attributed to the social conditions in Chinese society, the high trust in the government (Lehr, 2022), and the positive attitudes toward digital technology in a general sense, while culture does not seem play a critical role in this regard.

Last but not least, our research makes a theoretical contribution to the FBM from two perspectives. First, we highlighted the mutually enhancing effect between the spark/motivator and the facilitator, which brings about more dynamics to the FBM. Second, we made a distinction between extrinsic and intrinsic motivation in the FBM, which helps to better understand the design and effectiveness of different types of behavioral interventions.

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