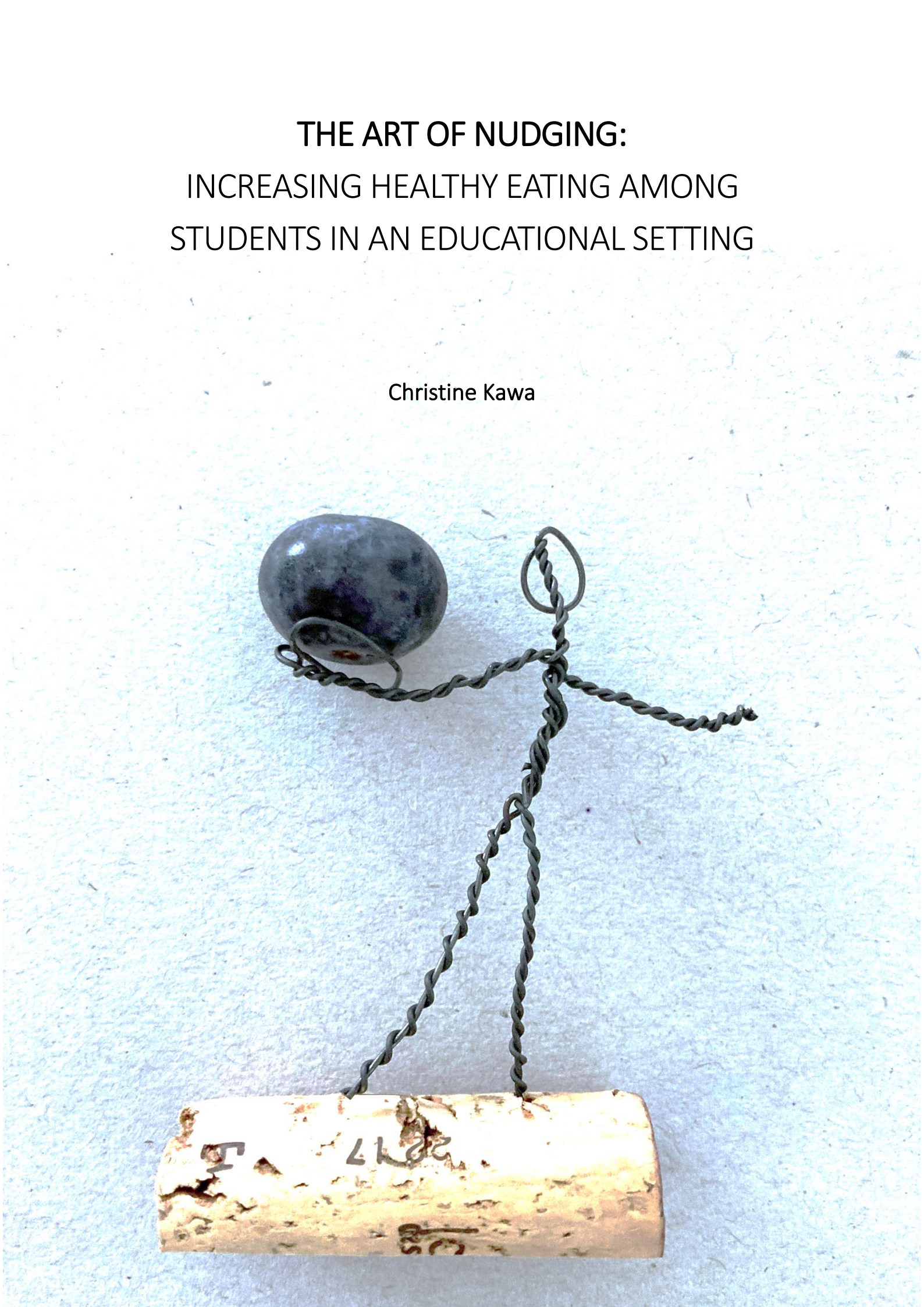
The art of nudging

THE ART OF NUDGING:

INCREASING HEALTHY EATING AMONG STUDENTS IN AN EDUCATIONAL SETTING

Christine Kawa



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Christine Kawa

born 30 September 1987 in Bielefeld (Germany)

Supervisor:
Prof. dr. W.H. Gijselaers

Co-supervisors:
Dr. J.F.H. Nijhuis
Prof. dr. P.M. Ianiro-Dahm (University of Applied Science Bonn-Rhein-Sieg, Germany)

Assessment Committee:
Prof. dr. S. Beausaert (Chair)
Prof. dr. J. de Nooijer
Prof. dr. C. Goukens
Prof. dr. W. Terlau (University of Applied Science Bonn-Rhein-Sieg, Germany)
Prof. dr. habil. A. Pohl (University of Applied Science Bonn-Rhein-Sieg, Germany)

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Chapter 1

1

General Introduction

1.1 Dietary behavior in an educational setting

"Eat your veggies, kids, and have a nice day." - Antoni Porowski (Porowski, 2021)

If only it were that easy! Eating healthily is one of today's difficulties in young adulthood. The World Health Organization recommends a daily fruit and vegetables consumption of at least five portions (World Health Organization, 2016). Most young adults do not comply with these recommendations. Approximately 65% of 18-29 year-olds consume vegetables only at least once a week. About 19% consume vegetables even less than once a week (Mensink et al., 2017). While about 91% of German university students with an average age of 23 years reported trying to eat healthily, only 7% eat vegetables and salads several times a day. Only a small number of young adults (about 27%) consume fresh fruit several times per day (Hilger et al., 2017). Unhealthy dietary behavior is particularly prevalent among university students (Hilger et al., 2017; Kowalkowska & Poínhos, 2021). Dietary behavior in general can be compartmentalized into three categories: 1) food choice, 2) eating behavior, and 3) dietary intake /nutrition (Stok et al., 2018). Food choice describes behavior that occurs before the food reaches the mouth, for example, food preferences or the purchase of food. Eating behavior concerns the actual act of consumption, for example eating habits. Dietary intake /nutrition summarizes all outcomes of what is actually consumed contentwise, for example, healthy or unhealthy food intake or the caloric value of the food (Stok et al., 2018). An individual's dietary behavior can be influenced by several different factors. These may be individual factors like mood, taste, pleasure, familiarity, health concerns, weight control or ethical concerns (Lindeman & Stark, 1999; Steptoe et al., 1995). In addition, these factors may be related to the food itself, such as price, sensory appeal, or convenience (Lindeman & Stark, 1999; Steptoe et al., 1995). In Germany, the top three ranked influential factors of food choice were the sensory appeal of food, its price, and its natural contents (Symmank et al., 2017). Another important factor is the environment (the immediate surroundings) in which the food choice is made (Symmank et al., 2017). For example, food choices made at home may differ from those made at a train station kiosk, a fast food restaurant or a fine dining establishment. While all these factors can apply to students in an educational setting, the setting itself and the circumstances of a student's life (like the living arrangements) can also play a role in dietary behavior.

In Germany, matriculation to university in many cases coincides with a change in living arrangements. Many students move out of their parents' home and need to reorient their eating behaviors, for example cooking for themselves. Specifically, students who lead an individual life not living with their parents have been found to consume fewer vegetables and fruits than students still living with their parents (El Ansari et al., 2012; Harker et al., 2010; Stok et al., 2018). During this time many health-related behaviors are established (Hilger et al., 2017; Kowalkowska & Poínhos, 2021). Young adults face an increased risk of developing unhealthy eating habits which may lead to becoming overweight (Kowalkowska & Poínhos, 2021; Lange et al., 2021). Unhealthy dietary behavior established during the early years, often prevails in adulthood and can cause cardiovascular diseases later in life (Kaikkonen et al.,

2014). Consuming the recommended amount of fruit and vegetables is also known to prevent the development of certain cancers (Wang et al., 2014). Thus, promoting healthy dietary behaviors is especially important for students.

Regardless of their living arrangements, students can be reached within a university setting. More than 50% of German students regularly eat lunch at a university cafeteria or canteen (Hilger et al., 2017). In addition, this setting is of particular interest for the implementation of health interventions, because university life holds many challenges to the development of health eating habits (Lange et al., 2021). In general, healthy eating interventions implemented at cafeterias can improve fruit and vegetable consumption. In a recent systematic review study and meta-analysis, 16 out of the 18 review studies reported a significant increase in fruit and vegetable intake among customers of workplace cafeterias (Naicker et al., 2021). Thus, healthy eating interventions implemented at university cafeterias reach many individuals in this vulnerable (target) group. This is in line with the so-called setting approach of Health Promoting Universities in the Ottawa Charta and Okanagan Charter (Hungerland et al., 2021; Suárez-Reyes et al., 2019; World Health Organization, 1986). In 2015, the Okanagan Charter was formulated to focus attention on universities as an important setting for health promotion (Dietz et al., 2020). Since then, universities in Germany have been required by law to strengthen their health promotion and prevention efforts (Hungerland et al., 2021). In the Okanagan Charter it has been suggested to apply health-focused policies and practices, to create healthy environments and a culture of well-being (Suárez-Reyes et al., 2019). The setting approach describes any area of university life (e.g., eating at the cafeteria) as meaningful for the implementation of interventions aimed at students. In the past, this target group has often been neglected (Hilger et al., 2017; Hungerland et al., 2021). Students' environment in particular plays an important role in the setting approach (World Health Organization, 1986). Thus, incorporating the environment into healthy eating interventions for students is likely to be fruitful for students. However, implementing healthy eating interventions within the environment of a university cafeteria requires modifications to the setting and the catering services need to be involved (Belogianni & Baldwin, 2019). Also, 63% of German students reported that the main barrier to eating healthily was lack of time due to studies (Hilger et al., 2017). A healthy eating intervention implemented within the environment of a university cafeteria setting therefore needs to meet two criteria: 1) easy for the target group of students and the officials implementing the intervention; 2) effective in promoting healthy eating behaviors. Traditional interventions effectively targeting dietary behavior often focus on the provision of information or educational content (Naicker et al., 2021). Especially for university students, a systematic review study of systematic reviews found online or in-class courses to be effective (Belogianni & Baldwin, 2019; Roy et al., 2015). However, such interventions are not necessarily easy to implement. A type of health intervention that encompasses this criterion and is also considered cost-effective is called nudging (Thaler & Sunstein, 2009).

A bibliometric analysis and review study on nudge research concludes that there has been an overall growth in nudge research, especially since 2018 (Jia & Mustafa, 2023). Other reviews

conclude that the specific mechanisms of nudging are not fully understood and that there is a need for more research (e.g., Bauer et al., 2021). Still, nudges are generally described as a suitable strategy for improving dietary behavior in cafeteria settings (Jordan et al., 2020) and can therefore be valuable in supporting healthy dietary behavior in students within an educational setting. Especially because nudges are described as cheap and frequently more cost-effective than conventional health interventions (Benartzi et al., 2017; Damgaard & Nielsen, 2017; Sunstein, 2014; Thaler & Sunstein, 2009), university health officials can benefit from applying nudges in a university setting.

1.2 Nudging

> A nudge is like a GPS device. It leads the way to a determined destination and shows the way, while the driver freely chooses the path to take. – Cass Sunstein (2014)

Nudges and GPS devices, while profoundly differing from each other, share certain characteristics. Both lead the way to a predetermined destination or behavior. Both provide an optimal path to achieve this goal, but the path may be changed and adapted at the individual's free will (Sunstein, 2014). Nudges are described as small and simple changes in the decision-making context of an individual that change the individual's behavior in a predictable way to foster a certain behavior (Thaler & Sunstein, 2009). Essentially, nudges can be applied by any person responsible for creating an environment in which decisions are made. These individuals are called choice architects (Thaler & Sunstein, 2009). Regarding dietary behavior in an educational setting, a choice architect may, for example, be a staff member of a cafeteria or a university. The concept of nudging is built on the dual-process theory as well as on research in heuristics and cognitive biases and effects (Thaler & Sunstein, 2009; Tversky & Kahneman, 1974). According to the dual-process theory, individuals have two modes for processing information – the automatic, intuitive system (system 1) and the reflective, deliberate system (system 2). The automatic system processes information fast, uncontrolledly, and effortlessly, while the reflective system works deliberately, effortfully, and slowly (Thaler & Sunstein, 2009; Tversky & Kahneman, 1974). Nudges can change the decision-making context of an individual so as to influence both modes of information processing (Hansen & Jespersen, 2013). An example of an effective nudge influencing automatic system 1 is the provision of smaller plates in a cafeteria buffet setting. Customers of the cafeteria are unaware of the smaller plate size but automatically adjust their portion size to the smaller plate and choose to take less food. This simple nudge reduced food consumption and food waste (Kallbekken & Sælen, 2013). Reflective system 2 can be effectively targeted by, for example, providing a traffic light colored label indicating the healthiness of the food. A systematic review and meta-analysis found this type of labeling to be the most effective one in improving eating behavior (Cecchini & Warin, 2016). Heuristics can also be used as a basis for nudging (Thaler & Sunstein, 2009). These are simple rules of thumb that shape our decision-making, for example, by making certain information more readily accessible to an individual (e. g., availability heuristic). For example, rearranging healthy fruit at the front of

the counter at a take-away food vendor in an academic hospital where individuals had direct access to the fruit led to a higher proportion of fresh fruits sold compared to the proportion of unhealthy foods sold (Cheung et al., 2019). Nudges can also utilize cognitive biases as a means to modify behavior (Thaler & Sunstein, 2009). Cognitive biases describe systematic thought processes that simplify the way in which we process information. They cause us to focus on personal experience and preferences (Thaler & Sunstein, 2009). A prominent example of a nudge that is based on the status quo bias is the default nudge (Sunstein, 2014; Thaler & Sunstein, 2009). This type of nudge provides an individual with a predetermined choice that can easily be changed, like serving a salad instead of French fries as a side dish in a cafeteria. The default nudge is described as one of the most important nudges because individuals tend to accept our present status as given and rarely change it. As a consequence, most individuals stick to a predetermined, nudged choice (Sunstein, 2014). Given so many different heuristics and cognitive biases, this theoretical background of nudging suggests that nudges can take various forms.

Nudge classifications

To simplify the understanding of nudges and their effectiveness, researchers have developed various classifications and categorizations of nudges (Hansen & Jespersen, 2013; Ly et al., 2013). A prominent classification involves the distinction of nudges along two dimensions (Hansen & Jespersen, 2013). The first dimension reflects which cognitive information processing system is activated by the nudge (Tversky & Kahneman, 1974). Accordingly, a nudge can activate system 1, influencing an individual's automatic decision-making processes, or it can activate system 2, influencing an individual's reflective decision-making processes. Sometimes this distinction is not so clear and certain nudges can influence both decision-making modes (Hansen & Jespersen, 2013). The second dimension distinguishes nudges according to their transparency. Transparent nudges clearly show their intention, while non-transparent nudges conceal their purpose (Hansen & Jespersen, 2013). Consequently, there are four different types of nudges. Table 1 shows this classification and gives an example for each of the four types of nudges.

Table 1. Classification of nudges based on Hansen and Jespersen (Hansen & Jespersen, 2013).

	Transparent	**Non-transparent**
Automatic system 1	The nudge transparently facilitates an automated choice, decision, behavior **Example**: Footsteps on the ground leading to a stairwell causing individuals to take the stairs instead of the elevator	The nudge influences a choice without revealing its purpose **Example**: Using smaller plates in a cafeteria leading to taking less food in a buffet
Reflective system 2	The nudge transparently influences a conscious choice, decision, behavior **Example**: Footsteps on the ground leading to a stairwell with information on how many calories will be burned when taking the stairs	The nudge influences a conscious choice, decision, behavior without providing information on its intention **Example**: Posters with faces to increase compliance rates with social norms

Most classifications of nudges focus on different design aspects of the nudge (Blumenthal-Barby & Burroughs, 2012; Hollands et al., 2013; Wilson et al., 2016). For example, a meta-analysis of nudges promoting healthy dietary behavior in field settings classified nudges as cognitive, affective, or behavioral (Cadario & Chandon, 2020). Table 2 provides an overview of these different types of nudges.

Table 2. Types of nudges based on the classification of Cadario and Chandon (2020).

Classification	Influence	Example
Cognitive nudge	Influence thinking processes	Descriptive nutritional label regarding caloric contents
Affective nudge	Influence emotional processes	Decorations to promote positive feelings towards a certain dish
Behavioral nudge	Influence behavior	Salad instead of French fries as a default side dish

Cognitive nudges influence our thinking processes. An example of a cognitive nudge is the provision of a descriptive nutritional label providing information on the caloric content of a dish on a menu. An affective nudge influences our emotional processing. For example, healthy dishes can be displayed in a more attractive way by improving lighting or adding decorations. These simple changes can promote positive feelings towards this healthy dish. Lastly, behavioral nudges influence our behavior. For example, the convenience of making healthy dietary choices can be enhanced by adding healthy dishes as a default option (Cadario & Chandon, 2020). These different types of nudges have been found to differ in their effectiveness (Cadario & Chandon, 2020). Apparently, there are many different types of nudges that can differ in their effectiveness.

Nudge effectiveness

More and more research focuses on nudging as an effective intervention to improve behavior in an easy and readily applicable way (Jia & Mustafa, 2023). Several systematic reviews and meta-analyses have so far been conducted to draw conclusions on the effectiveness of nudges (Ensaff, 2021). A review of effect sizes showed that 55% of nudge effect sizes (considering 317 effect sizes) reveal positive effects of nudges across different domains of application. This is equal to a Cohen's *d* effect size of 0.41. For the domain of health, 44% of nudge effect sizes showed positive results (considering 97 effect sizes). This is equal to a Cohen's *d* effect size of approximately 0.2 (Hummel & Maedche, 2019). In addition, nudges targeting dietary behavior have been assessed in a number of different studies; targeting children, young adults and older adults, conducted in laboratories, online, in real world food settings involving schools, university cafeterias, and workplace sites (Ensaff, 2021). A systematic review of the effectiveness of healthy eating nudges reported that 80% of the empirical research reviewed (36 articles) showed positive outcomes of nudges on dietary behavior (Vecchio & Cavallo, 2019). In addition, a systematic review study and meta-analysis found healthy eating nudges to be generally effective (Arno & Thomas, 2016). Another review study points out that changing the physical decision-making context yields positive results for dietary behavior (Bauer & Reisch, 2019). For example, school cafeterias can apply healthy eating nudges

effectively according to a systematic review study finding 17 (out of 25) studies with positive nudge results on healthy food selection (Marcano-Olivier et al., 2020). While these results paint a very positive picture of the effectiveness of nudges, nudges have also yielded mixed results and low to moderate effect size regarding dietary behavior (Ensaff, 2021; Wilson et al., 2016). A recent meta-analysis of field experiments found a Cohen's *d* effect size of 0.23 reflecting a decrease in calorie consumption of 124 kcal per day (Cadario & Chandon, 2020). The same meta-analysis found that the effect sizes differed depending on the type of nudge. Cognitive nudges had only a small effect (Cohen's *d* = 0.12; equivalent to a reduction in calorie consumption of 64 kcal per day). Affective nudges showed a Cohen's *d* effect size of 0.24 (equivalent to a reduction in calorie consumption of 129 kcal per day). Behavioral nudges had the strongest but moderate effect size of Cohen's *d* = 0.39. This effect is equivalent to a reduction in calorie consumption of 209 kcal per day (Cadario & Chandon, 2020). Similarly, a different review study on healthy eating nudges concluded that nudges yield inconsistent and weak findings in particular settings and that different types of nudges yield different results (Laiou et al., 2021). For example, changes in the presentation of food effectively encouraged healthier diet choices, while healthy labels on food yielded inconclusive results (Laiou et al., 2021). Furthermore, a quantitative review of the effect sizes of nudging suggested a possible publication bias in mainly publishing studies involving significant nudge results (Hummel & Maedche, 2019). A different systematic review study on healthy eating nudges changing the position of food also came to the conclusion of a possible positive publication bias (Bucher et al., 2016). So far, nudges are reportedly effective specifically in improving dietary behavior. At the same time, problems of small effect sizes, mixed, or inconclusive results show that more research remains to be done. The fact that different types of nudges yield different results highlights especially that nudges can also be problematic.

Research gaps in nudging

Despite the large amount of research conducted on nudging (Jia & Mustafa, 2023), a lack of research persists. One major problem with nudging is the lack of an operational definition as well as an overarching framework (Hausman & Welch, 2010; Laiou et al., 2021; Vlaev et al., 2016). The originators of the term nudging mainly define nudging by providing examples (Thaler & Sunstein, 2009). Yet no clear instructions or guidelines on how to develop a nudge have been provided (Vecchio & Cavallo, 2019). As a consequence, there are numerous different types of nudges and classifications (Cadario & Chandon, 2020). Several review studies and meta-analyses have pointed out several research gaps regarding the effectiveness of nudges on dietary behavior. First, the conditions under which nudges work and which types of nudges work are still not completely understood (Bauer & Reisch, 2019; Hummel & Maedche, 2019). Second, several factors have been found to impact dietary behavior alongside nudging (Bucher et al., 2016). More specifically, an individual's general eating behavior, their preferences as well as their current states can play a role (Bauer & Reisch, 2019; Cadario & Chandon, 2020; Vecchio & Cavallo, 2019). Individuals can differ in their susceptibility to nudging (Bucher et al., 2016) and more research is needed to understand this susceptibility (De Ridder et al., 2022). Third, the duration of nudge effectiveness is still largely

unexplored and long-term as well as longitudinal effects at different time points have rarely been assessed (Bucher et al., 2016; Laiou et al., 2021; Vecchio & Cavallo, 2019). The present dissertation addresses these research gaps by relying on a nudging cue that has already been found to be effective in different settings involving dietary behavior – the so called Giacometti cue (e.g., Brunner & Siegrist, 2012). This cue presents artwork by an Italian artist (Alberto Giacometti). Using artwork as a basis in nudge development is rare. Yet art offers an interesting ground on which a nudge can be built. Research in the marketing domain found that art conveys positive connotations to unrelated products regardless of the specific content of the artwork (Hagtvedt & Patrick, 2008). This *spillover effect* may be used along the lines of cognitive effects that may induce positive affects as a basis for nudge development.

1.2.1 An artwork nudge by Alberto Giacometti

Applying the artwork of Alberto Giacometti as a health intervention targeting dietary behavior has frequently proven effective. Exposure to this artwork improved dietary behavior in several studies targeting different groups across different settings. The artwork of Alberto Giacometti consists of sculptures of thin, human-like, and genderless body shapes with long skinny limbs – as shown in Figure 1 (Giacometti, 1947).

Figure 1. An example of the artwork of Alberto Giacometti called *homme traversant une place* (Giacometti, 1947).

This cue is described as a nudge (Brunner & Siegrist, 2012; Stämpfli et al., 2020) and so far, it elicited a medium effect size of Cohen's *d* = 0.39-0.65 (Stämpfli et al., 2017). More specifically, the Giacometti cue influenced actual food choice. It decreased unhealthy consumption of chocolate or potato chips and increased healthy consumption of blueberries (Brunner & Siegrist, 2012; Stämpfli & Brunner, 2016; Stämpfli et al., 2017). It improved dietary behavior when applied as an unobtrusive screensaver (Brunner & Siegrist, 2012). In addition, it increased the amount of healthy snack purchases from a vending machine by 58% when applied in the form of a large poster (Stöckli et al., 2016). It even led to weight loss over time, when applied in a diary recording dietary behavior (Stämpfli et al., 2020). The Giacometti cue

is described as activating a mental scheme of thinness and weight loss by showing skinny figures (Brunner & Siegrist, 2012). Consequently, individuals consume less food and more healthy food. In a similar vein, studies exposing individuals to an image of a slim model reduced unhealthy snack choices in a controlled setting and unhealthy snack consumption in a field setting (Ohtomo, 2017). While these results favor the use of skinny body shapes as a nudge to improve dietary behavior, these studies either involved only females (Ohtomo, 2017) or only older adults (e.g., Stämpfli et al., 2017). The Giacometti nudge has not been applied to young adults. In line with established research approaches regarding health interventions, their effectiveness needs to be tested in a controlled setting before application in the real world (Brug et al., 2010). The same is true for nudging (Ly et al., 2013).

A Giacometti-like artwork nudge in a controlled educational setting

While the Giacometti nudge can be described as effective in adults (Stämpfli et al., 2020), it has not been tested in younger target groups. Considering that the Giacometti artwork is rather abstract, dating from 1947, a more contemporary artform focusing on similar aspects as the Giacometti artwork might potentially be more suitable for a younger target group and yield similar results. Contemporary artwork is also likely to be more suitable for application in an educational setting. Research has shown that designing health interventions tailored to the specific characteristics of the target group were more effective in changing the actual behavior and choices of individuals (Matz et al., 2017). A logical consequence is the design of a new nudge based on the same characteristics as the Giacometti nudge (thinness to induce weight loss goals) involving a more contemporary artform. This newly designed Giacometti-like nudge targets students in an educational setting.

A more contemporary artwork similar also focusing on often slim body shapes has been created by the artist Gretchen Röehrs (Röehrs, 2018). As portrayed in Figure 2, this artwork depicts drawings of body shapes dressed in food items.

Figure 2. An example of the artwork of Gretchen Röehrs called *Broccolini* (Röehrs, 2018).

A nudge displaying pictures of real healthy food (carrots and grapes) on plates was found to effectively increase fruit and vegetable consumption among children (Sharps et al., 2020). Using a color coded labeling nudge (green for healthy, yellow for less healthy and red for unhealthy) that also made healthy items more accessible in a hospital cafeteria led to a decrease in red items sold and an increase in green items sold (Thorndike et al., 2014). Mindful of the research findings so far, a new nudge was designed to be tested in a controlled educational setting. It involves a skinny body shape silhouette and is *dressed* in clothing made of green fruit and vegetables. This leads to the first research question of this dissertation:

1. What are the effects of a Giacometti-like artwork nudge on the dietary behavior of students in a controlled educational setting?

Artwork nudges in a virtual vignette setting

Besides research on the Giacometti cue (e.g., Brunner & Siegrist, 2012; Stämpfli et al., 2020) artwork has rarely served as a basis for nudge development. With this in mind, extensive testing of this type of nudge is necessary to prevent any unwanted effects. In an educational setting, collecting data, conducting analyses, and implementing evidence-based nudges has been described as easy (Desouza & Smith, 2016). At the same time, a warning has been issued that in an educational setting, a nudge can easily become a *shove,* making certain objectives tougher (instead of easier) to achieve (Desouza & Smith, 2016). The reasons for unintentionally turning a nudge into a shove are that the act of balancing between an individual's freedom of choice and knowing what is best for them (from the educational point of view) can be difficult. In addition, the question of who chooses the appropriate intervention comes into play (Desouza & Smith, 2016). A university may, for example, choose to implement an intervention to improve students' dietary behavior by rearranging the order in which food is presented in a cafeteria. From the university's point of view, this simple and easy nudge may become a shove if it its implementation entails securing approval from various entities like the university's fire protection officer. From the students' point of view, if this rearranged order is contrary to their preferred and habitual order, it may become a shove. In any case, a single case or instance of testing a nudge is not sufficient to avoid shoves or smacks (Desouza & Smith, 2016). Consequently, after testing a health intervention or a nudge in a controlled setting, application in more realistic settings is necessary to better understand its impact (Brug et al., 2010; Ly et al., 2013). One step closer to the application of artwork nudges in a field study is the assessment of their effects in a vignette experiment. A quantitative vignette study has two components – a vignette experiment and a traditional survey (Atzmüller & Steiner, 2010). In the vignette experiment a carefully constructed description, for example of a situation, is presented to the respondents. Next, the respondents complete a traditional survey on parallel measures of respondent-specific characteristics. By combining the ideas of classical experimental settings and survey methodology (Atzmüller & Steiner, 2010) vignette experiments aim at utilizing the advantages of both approaches while counterbalancing their respective weaknesses. For example, survey methods have rather low internal validity

because of their passive way of measuring. Experiments have low external validity due to an often oversimplified setting (Atzmüller & Steiner, 2010). According to a systematic review and meta-analysis and other research, such vignette studies have also been used to assess nudge effects on dietary behavior in a virtual (online) setting (Cecchini & Warin, 2016; Mohr et al., 2019; Van Kleef et al., 2012). Accordingly, the second research question is formulated:

2. What are the effects of different artwork nudges on dietary behavior in a virtual vignette setting?

The Giacometti nudge in a real-world setting

So far, we know that the Giacometti nudge has the potential to improve dietary behavior across different settings. Its effect has mainly been measured with actual food consumption in controlled settings (Brunner & Siegrist, 2012; Stämpfli & Brunner, 2016; Stämpfli et al., 2017). Only one research article has reported its application in a real-world setting. It was effectively applied in the form of a poster next to a vending machine and increased the number of snack choices (Stöckli et al., 2016). In general, food choice nudges were found to be particularly effective (up to 2.5 times as effective) compared to nudge interventions in other domains. When considering research on nudges targeting food choice behaviors in controlled as well as in field settings a Cohen's *d* effect size around 0.65 was reported (Mertens et al., 2022). Healthy eating nudges tested in experimental field settings showed a Cohen's *d* effect size of 0.23 (Cadario & Chandon, 2020). A systematic review study on the effects of nudges on dietary behavior concludes that the majority of these studies were conducted in controlled or laboratory settings, but rarely in real-world field settings (Schüz et al., 2021). There has recently been a call for more research particularly on the effects of nudges on dietary behavior in real-world settings (Ensaff, 2021).

Similarly, systematic reviews conclude that little is known about the long-term effects of nudging (Bucher et al., 2016; Laiou et al., 2021; Vecchio & Cavallo, 2019) and specifically about what happens after a nudge is removed from the decision-making context. According to the definition of a nudge, it needs to be present within the decision-making context to be effective (Thaler & Sunstein, 2009). Some types of nudges have resulted in long-term effects (Congiu & Moscati, 2022; Kurz, 2018). For example, a visibility nudge in a university cafeteria still had the intended sustained (lasting) effect of increasing the number of vegetarian dishes sold after it had been removed (Kurz, 2018). The sustained (lasting) effects of nudges are believed to depend on the cognitive processes that the nudge targets (Lin et al., 2017). For the Giacometti nudge only one study has assessed the long-term exposure effects (lasting six months) of this nudge on weight loss, finding it to be effective (Stämpfli et al., 2020). However, what happens directly after the removal of the Giacometti nudge has not been tested. Accordingly, the third research question is formulated:

3. What are the immediate and lasting effects of the original Giacometti nudge in a real-world setting?

1.2.2 Influences on nudge effectiveness

A recent systematic review study found that the effects of nudges on dietary behavior assessed in real-world settings were not always the same in different target groups. Differences in the effectiveness of these nudges was observed depending on the socioeconomic and sociodemographic characteristics of the respondents (Schüz et al., 2021). Thus, not everybody profits in the same way from nudge interventions. Individual food choices depended on individual differences (Bauer & Reisch, 2019). In a similar vein, individuals differ in the degree to which they utilize system 1 or system 2 in their decision-making processes (Tversky & Kahneman, 1974). Consequently, it is not surprising that a nudge intervention can have different effects on different individuals. However, according to a systematic review study, only one study researched the potential influence of individual differences regarding nudge effects. Different moderators and influencing factors are likely to impact nudge effectiveness (Weimer et al., 2022). Research further suggests that individuals differ in their susceptibility to nudge effects (*nudgeability*) and that this topic lacks research (De Ridder et al., 2022). Therefore, it is still unclear who is and who is not nudgeable (Bucher et al., 2016; Van Gestel et al., 2021). More attention should be paid to research on nudgeability. In this dissertation we focus on two specific factors influencing nudge effectiveness: acceptance of the nudge and awareness of the nudge's presence. Assessing these influential factors regarding nudge effectiveness provides useful insights into nudgeability.

Acceptance of a nudge as a health intervention

A first influencing factor regarding nudge effectiveness is acceptance of a nudge. Understanding who accepts nudges as a health intervention and who does not is important, because those who accept nudges are more likely to follow the intended path and thus benefit from the nudge (Hagman, 2018; Krisam et al., 2021; Van Gestel et al., 2021). According to the Nudge Acceptance Model, individuals differ in the extent to which they accept a nudge as an intervention. The better a nudge is accepted as an intervention the more likely it is to be effective in leading to the anticipated change in behavior (Hagman, 2018). Different factors contribute to the acceptance of a nudge. For example, nudge acceptance depends on the type of cognitive processes targeted by the nudge (system 1 or system 2). In addition, a nudge's level of transparency (whether an individual grasps the intention of the nudge as well as the way it is supposed to modify behavior) plays a role in nudge acceptance (Hagman, 2018). In accordance with this model, further research points out that the acceptance of nudges can vary across types (Reisch & Sunstein, 2016; Sunstein et al., 2018). Overall, nudges targeting dietary behavior have been found to be well accepted across different countries (Junghans et al., 2015; Reisch & Sunstein, 2016). This is also true of European countries like Germany, where a nudge in the form of a public education campaign promoting healthier food achieved the highest acceptance rate (Reisch & Sunstein, 2016) with 90% of a representative sample (N = 1,012) supporting this nudge. A public education campaign meets the requirements of a nudge targeting the deliberate cognitive processes of system 2. In addition, the means of influencing

behavior are likely to be perceived as transparent. A different nudge (subliminal advertising against overeating) was accepted by 42% of the representative sample (Reisch & Sunstein, 2016). This nudge meets the requirements of an automatic system 1 nudge and is likely to be perceived as non-transparent. We can conclude that the acceptance of a nudge depends on the type of nudge and that its level of acceptance can influence nudge effectiveness. Yet there is a lack of knowledge about the type of person who accepts or does not accept nudges (Van Gestel et al., 2021). Since artwork nudges have not been in the focus of researchers so far, their acceptance has not been researched. An artwork or Giacometti nudge is said to work unobtrusively targeting automatic system 1 (Brunner & Siegrist, 2012). Much like the subliminal advertising nudge just described, its means of changing behavior may not be transparent. Nudges can fail if perceived as unacceptable or if the nudged individual does not understand (Hagman, 2018) the nudge's goal correctly. Consequently, assessing the acceptance of nudges like the Giacometti artwork is important in understanding its effectiveness. The fourth and fifth research questions are formulated:

4. Are there differences in nudgeability regarding the acceptance of nudges as health interventions in an educational setting?

5. Specifically, what role does acceptance play in the influence of the original Giacometti nudge on dietary behavior?

Awareness of the nudge's presence

The second factor that is likely to influence nudge effectiveness is awareness of the nudge's presence. As the classification of nudges by Hansen and Jespersen suggests, transparency plays an important role in nudging. When a nudge is transparent, individuals are aware of its presence and understand its purpose (Hansen & Jespersen, 2013). However, nudges often affect our automatic cognitive processes (system 1) and rarely involve deliberate thinking (Thaler & Sunstein, 2009). As a consequence, nudges have often been criticized for limiting the free will (Hansen & Jespersen, 2013; Hausman & Welch, 2010). Nudges targeting automatic system 1 have often been described as patronizing, manipulative, and autonomy-threatening (Blumenthal-Barby & Burroughs, 2012; Mills, 2015; Rainford & Tinkler, 2011). Especially when considering these ethical aspects of nudging, transparency and the disclosure of a nudge's presence become important. Recent research shares the notion that nudge awareness (perceiving a nudge as present) potentially mediates and / or influences nudge effectiveness. Many studies have found that nudge transparency, disclosure, and awareness do not limit its effectiveness, especially in food choice and purchase scenarios (Cheung et al., 2019; De Ridder et al., 2022; Kroese et al., 2015; Wachner et al., 2020). However, more research on this topic is needed (Bruns et al., 2018; De Ridder et al., 2022; Marchiori et al., 2017). Of the Giacometti nudge it has been suggested that being aware of it may have an effect on one's food consumption (Brunner & Siegrist, 2012). More specifically, it has been suggested that the nudge should be in line with an individual's preferences, especially when

that individual is aware of the nudge's presence (Stämpfli et al., 2020). Consequently, the sixth research question is formulated:

6. What role does awareness of an artwork nudge's presence play in its influence on dietary behavior.

1.3 Dissertation overview

This dissertation focuses on artwork nudges as a health intervention in an educational setting to improve dietary behavior. More specifically, artwork nudges based on the skinny, human-like sculptures of the artist Alberto Giacometti (Giacometti, 1947) were tested in different research settings to gain a more profound understanding of the conditions under which nudges work, which type of nudges work, for whom nudges work, what influences nudge effectiveness, and what happens when a nudge is removed from the decision-making context. Accordingly, six research questions were formulated, which will be answered in the chapters of this dissertation.

The first chapter outlines the problem of healthy eating for students in an educational setting, defines dietary behavior in general and justifies the suitability of an educational setting for health interventions in the form of nudging. Next, nudging is defined, and theoretical background on and a classification of different nudges presented while nudges are described as effective in improving dietary behavior. Even though nudges are often effective, there still are research gaps to close. After outlining these research gaps, artwork nudges are described and why they need to be tested in different settings. Finally, influences on nudge effectiveness are discussed.

The second chapter presents the first study assessing the effectiveness of an artwork nudge (a variation of the Giacometti cue) on actual chocolate and blueberry consumption in a controlled setting. This chapter focuses on the first research question: *What are the effects of a Giacometti-like artwork nudge on the dietary behavior of students in a controlled educational setting (RQ 1)?*

The third chapter introduces further variations of the Giacometti artwork nudge as well as the original cue and presents the second study answering the research question: *What are the effects of different artwork nudges on dietary behavior in a virtual vignette setting (RQ 2)?* Moreover, the role of the degree to which an individual is aware of the nudge is discussed in answering another research question: *What role does awareness of an artwork nudge's presence play in its influence on dietary behavior (RQ 6)?*

The fourth chapter introduces the topic of nudge acceptance and potential differences in the extent to which individuals are susceptible to nudges (*nudgeability*). The third study focuses on students' acceptance of different healthy eating nudges (including the Giacometti nudge) as health interventions and different factors that influence nudge acceptance answering the

following research question: *Are there differences in nudgeability regarding the acceptance of nudges as health interventions in an educational setting (RQ 4)?*

Chapter 5 reports the fourth study of this dissertation. This study links nudge acceptance, nudge awareness, and the effectiveness of the original Giacometti nudge regarding the actual meal choices and purchases of students in a real-world university cafeteria focusing on this research question: *What are the immediate and lasting effects of the original Giacometti nudge in a real-world setting (RQ 3)?* In addition to the nudge's effects in a field setting, the roles of nudge acceptance and nudge awareness are assessed answering the following research questions: *Specifically, what role does acceptance play in the influence of the original Giacometti nudge on dietary behavior (RQ 5)? What role does awareness of an artwork nudge's presence play in its influence on dietary behavior (RQ 6)?*

Figure 3 gives an overview of the research questions addressed in this dissertation and the studies conducted.

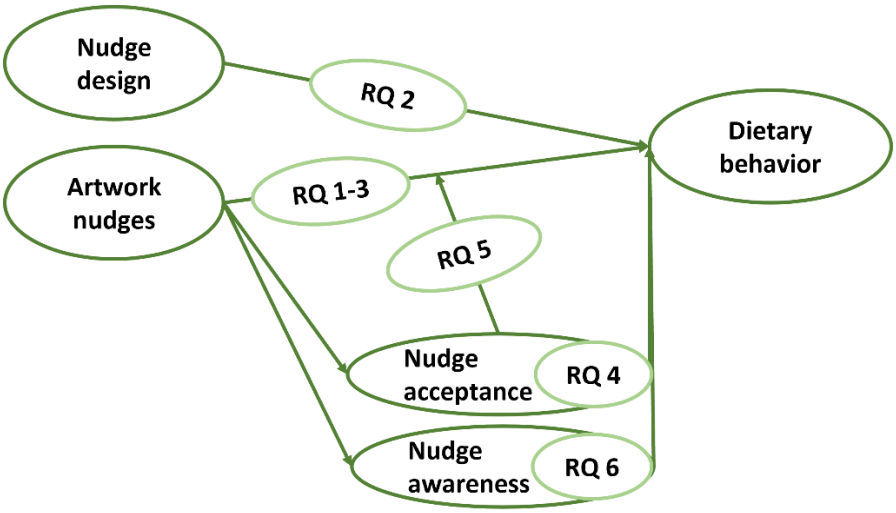

Figure 3. Overview of the research questions addressed by the four studies in the present dissertation.

Chapter 6 concludes the dissertation with a general discussion consisting of a synopsis, practical implications as well as limitations and future research. Chapter 7 summarizes this dissertation in a valorization addendum.

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Chapter 2

Effects of a thin body shape nudge and other determinants of adolescents' healthy and unhealthy food consumption in a school setting

This chapter is based on Kawa, C., Gijselaers, W. H., Nijhuis, J. F. H., & Ianiro-Dahm, P. M. (2022). Effects of a thin body shape nudge and other determinants of adolescents' healthy and unhealthy food consumption in a school setting. *Food Quality and Preference, 96*, 104388. https://doi.org/10.1016/j.foodqual.2021.104388

Abstract

Many adolescent schoolchildren portray an unhealthy eating behavior; consuming large amounts of unhealthy food and only small amounts of healthy food. Nudging has been identified as a promising health behavior influencer to increase healthy food consumption in this target group. The present study analyzed the eating behavior of adolescent schoolchildren, evaluating the effects of a thin body shape nudge as well as the influences of several different determinants. A univariate experimental design was conducted with 91 German high school final-year students. Two groups were exposed to a gender-specific nudge condition. A third group served as a control group. All participants tasted blueberries as well as chocolate and the amount of the consumed food was measured. Effects of several potentially influential factors were assessed. As expected, the results of blocked hierarchical regression analyses revealed effects of gender and hunger on chocolate consumption. Blueberry consumption was influenced by the liking of the blueberries. Against our expectations, exposure to the nudge did not improve the eating behavior in adolescents. However, a discriminant analysis showed, that the nudge is associated with below average chocolate consumption, when participants liked the nudge, were less hungry and more often female. The findings provide useful insights for food providers in school-settings as well as regarding the application of a thin body shape nudge as a health intervention for adolescents.

2.1 Introduction

The World Health Organization reports that obesity across the world has almost tripled since 1975 (World Health Organization, 2020). For example, in Germany 9% of 15-year-old female high school students and 13% of 15-year-old male high school students are overweight or even obese (HBSC-Studienverbund Deutschland, 2015). In addition, adolescent schoolchildren are prone to unhealthy eating behavior (Hilbig, 2009; Krug et al., 2018). Over the last thirty years, the consumption of sweets by German children has almost doubled. While 15 to 18 year-olds in 1988 consumed a daily average of 35.1 grams of sweets, in 2004 their consumption reached a daily average of 61.5 grams (Winkler, 2007). A representative national survey revealed that 14 to 18 year-olds consume approximately 191.5 grams of vegetables, 200.5 grams of fruit, and 64.5 grams of sweets on a daily basis (Heuer et al., 2015). On average, the recommendations for a daily vegetable consumption of 400 grams and fruit consumption of 250 grams (Heseker & Heseker, 2019) are therefore not met by German adolescents (Hilbig, 2009). Thus, improving the eating behavior of adolescents poses a challenge to today's society.

In order to improve their food consumption and improve or maintain their future health status, effective health interventions for adolescents are incumbent (Schroeter & House, 2015). This is true especially for school-settings (Golan & Ahmad, 2018), because adolescents spend long hours in schools often consuming at least one meal there (Nørnberg et al., 2016). So far, public health organizations offered health awareness programs in educational institutions to make young people aware of the risks and dangers of unhealthy food consumption (Veccio & Cavallo, 2019). A recent review evaluating experimental research identified different types of effective interventions targeting children's eating behavior. Most of these interventions for improving eating behaviors focused on rational and conscious means, like changing attitudes or behavioral intentions towards healthier food choices (DeCosta et al, 2017). More and more, research is shifting towards assessing the potential of automatic, unconscious and noninvasive interventions called nudges (Vallgarda, 2012; Hollands et al., 2013). Thaler and Sunstein (2009) describe nudging as "… any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives" (pp. 6). A nudge changes the context of decision-making to promote a certain choice without forbidding any options. Nudges merely make a certain choice more prominent and salient, while impacting the automatic processes that take place during decision-making in individuals (Hollands et al., 2013).

So far, nudges have become an increasingly prominent and effective instrument within the health context (Hummer & Maedche, 2019) and have been researched as a means to tackle unhealthy eating behaviors within different target groups (Arno & Thomas, 2016; Wilson et al., 2016; Veccio & Cavallo, 2019; Sharps et al., 2020; Kanchanachitra et al., 2020). In a review of experimental studies nudging was found to also positively impact the eating behavior in children (DeCosta et al., 2017) and within school-settings (Sharps et al., 2020; Miller et al.,

2016). In a review study, nudging increased the overall consumption and selection of fruits and vegetables in schoolchildren (DeCosta et al., 2017). Recently, a pictorial nudge depicting grapes or carrots on tableware increased the consumption of these foods in young children (Sharps et al., 2020). Depicting grapes on the plate increased grape consumption by approximately 24 grams per serving. Depicting a large portion of carrots on the plate increased carrot consumption by approximately 15 grams (compared to depicting no food on the plate). Nudges have mainly been tested within a school cafeteria setting. However, food is not only consumed within a school's cafeteria. Nudges need to be applied within the specific decision-making context (Thaler & Sunstein, 2009). Furthermore, inconclusive results for nudge effectiveness were also found in school-settings. A systematic review focusing on nudge interventions to increase the vegetable intake within schools focusing on adolescents identified only 12 studies of rather weak or moderate quality (Nørnberg et al., 2016). We therefore conclude that nudges which can be applied outside a school's cafeteria need to be tested as well. In conclusion, a growing amount of research suggests that nudging has the potential for influencing dietary behavior in adolescent schoolchildren within a cafeteria setting, while other areas in which such an intervention can be placed are an interesting topic for research.

The effects of a thin body shape nudge

The design of a nudge to improve eating behavior can take various forms, e.g., the distribution of free vegetables, changes in portion sizes of or depicting a thin body shape (Nørnberg et al., 2016; Brunner & Siegrist, 2012). A nudge's design therefore needs to be considered as well, when assessing its effectiveness. A case in point of an effective nudge for improving eating behavior based on priming is provided by the so-called Giacometti cue. This environmental prime consists of the artwork of Alberto Giacometti depicting a thin, genderless, human-like figure. It activates body-weight related mental contents within a person. Depicting a skinny figure causes people to focus on their body-weight related motives and cause healthier eating behavior (Brunner & Siegrist, 2012; Stämpfli et al., 2017). Brunner and Siegrist (2012) propose that "…most people are, at least to some extent, concerned about their weight. Therefore, exposure to skinny sculptures […] automatically activates the goal of healthy body weight, resulting in decreased consumption" (pp.1111). The Giacometti cue was found to be effective in various settings (e.g., laboratory and workplace) and for different samples (e.g., consumer panels, university students and employees) in decreasing unhealthy food consumption (chocolate and potato chips) as well as increasing healthy food consumption in form of blueberries (Brunner & Siegrist, 2012; Stämpfli et al., 2017; Stämpfli & Brunner, 2016; Stöckli et al., 2016). In addition to the studies on the Giacometti cue, exposure to slim body shapes also reduces unhealthy snack consumption in laboratory and field experiments (Ohtomo, 2017). In conclusion, nudges depicting a thin body shape, especially the Giacometti cue, seem to have the potential to effectively influence eating behavior across various settings.

Despite the effectiveness of the Giacometti nudge's thin figure, other research regarding the exposure to thin or skinny body shapes have shown opposing effects. Female university

students repeatedly exposed to the picture of a thin model consumed more snacks and calories and even gained weight over time (Klesse et al., 2012). Additionally, people choose and consume more food, when watching an obese confederate choosing snacks regardless of whether the food was perceived to be healthy or unhealthy (McFerran et al., 2012). These examples show that nudges might also backfire in certain samples like young females. Unclear research results concerning the effectiveness of a thin or even skinny human body shape call for further research. To the best of our knowledge nudges using thinness as a major design aspect have not yet been applied to influence adolescents' food consumption. This target group has been described as particularly vulnerable, when it comes to influences on eating behavior (Rohde et al., 2014). We conclude that researching the effects of such a nudge on adolescents is incumbent. We further propose that depicting a thin body shape nudge on a poster which can be placed across the school and not only in a cafeteria, is particularly interesting regarding practical implications.

Especially for researching the effects of a thin body shape nudge on eating behavior adolescent schoolchildren pose an important target for two reasons. First, eating habits formed in childhood often influence eating habits in adulthood. Improving eating behavior in early years plausibly can prevent obesity in adulthood (Schroeter & House, 2015). Second, eating disorders tend to arise during late adolescence (Stice et al., 2009; Rohde et al., 2014). Especially, adolescents are tremendously concerned with their body image, because their physical appearance changes in shape and size during puberty (Hogan & Strasburger, 2008). The dual-pathway model of eating pathology proposes that a perceived pressure to be thin (exhibited by for example the media) lead to body dissatisfaction. This dissatisfaction with one's body can promote unhealthy eating behaviors and even eating disorders (Stice, 2001). Young adults are constantly exposed to the concept of thinness in combination with weight loss and eating behavior by the media and social media (Ohtomo, 2017). Medial exposure to thin body shape ideals has even been described as leading to an increased body dissatisfaction (Derenne & Beresin, 2006) and contributes to the development of eating disorders (Spettigue & Henderson, 2004; Harrison, 2016). We need to stress that an unconsciously working nudge using the concept of thinness therefore needs to be tested within a controlled setting before it is applied within a field setting. In this way, we can prevent unwanted effects of such a nudge. Our study does not solely focus on depicting a thin body shape but on conveying mental concepts of healthy eating behavior. Therefore, the nudge was designed with care – building on the depiction of a thin body shape, while highlighting healthy food items in its design.

Further influences on adolescent eating behavior

Eating behavior is the consequence of a complex function involving biology, learning, culture and economic aspects (Renner et al., 2012). This can explain the contradictory findings of health interventions relying on a thin body shape regarding food consumption. Still, other factors influence food consumption as well. For example, gender differences impact food consumption even in young adults (Wardle et al., 1992; Deutsche Gesellschaft für Ernährung,

2008; Dos Santos et al., 2019). In a German sample, adolescent females portrayed slightly healthier eating habits than adolescent males considering fruit, vegetable and sweets consumption (Heuer et al., 2015). As a conclusion, the present study expects men to consume more unhealthy food options than women, while women are expected to consume more healthy food options.

Further studies on eating behaviors of adolescents show that they are also driven by self-control. For example, adolescents high in self-control consumed fewer sweet beverages than adolescents low in self-control (Geyskens et al., 2005; 2008) and intended to consume less calories (Mohr et al., 2019). To sum it up, self-control influences the consumption of healthy and unhealthy food options. The more self-control adolescents have, the more they will be able to resist the temptations of the unhealthy food option (chocolate) and the less they will consume.

Increasing knowledge about a certain behavior has been applied as a form of health intervention to promote healthier eating habits (DeCosta et al., 2017). Greater nutritional knowledge was also associated with healthier eating behavior in children of German descent (Triches & Giugliani, 2005) and a higher educational status is associated with a lower likelihood to be overweight or obese (Brombach et al., 2006). The present study concludes that the higher the degree of knowledge regarding healthy eating behavior is, the less amounts of the unhealthy food option (chocolate) the adolescents will consume.

Hunger and taste have been found to influence adolescent food consumption. Empirical evidence suggests that individuals make unhealthy decisions when they are hungry (Mancino & Kinsey, 2004; Miller et al., 2016) and younger people were more often driven by hunger (Renner et al., 2012). Hunger also influences the amount of chocolate consumed in a student sample (Bossel et al., 2019). Therefore, the hungrier the adolescents are, the more unhealthy food options (chocolate) as well as unhealthy food options (blueberries) they will consume. Research has also concluded that the taste of food has an impact on food purchase as well as consumption (Aertsens et al., 2009; Schroeter & House, 2015). In addition, the taste of chocolate has been found to significantly influence the amount of its consumption in a student sample (Bossel et al., 2019). The present study concludes that the better adolescents like the different food options, the more they will consume.

The dual-pathway model of eating pathology (outlined in 1.1) summarizes that body dissatisfaction can promote unhealthy eating behaviors or even eating disorders (Stice, 2001). Exposure to thin body ideals was found to lead to body dissatisfaction in young adults (Derenne & Beresin, 2006; Spettigue & Henderson, 2004; Harrison, 2006). The present study will therefore include a measure of satisfaction with one's body weight. We therefore can shed further light on possible negative effects a thin body shape nudge might have for adolescents.

It can be concluded that many determinants play a role in the food consumption of adolescents, yet it is unclear how they contribute to eating behavior and how nudge interventions interact with eating behavior.

Added value of the present study

So far, nudging has been found to be effective in increasing healthy food choices (e.g., Veccio & Cavallo, 2019) in various settings like a self-serving buffet setting (e.g., Kongsbak et al., 2016). Specifically, the Giacometti cue was effective in different target groups (e.g., Brunner & Siegrist, 2012; Stämpfli et al., 2016). However, we still lack research on the effective Giacometti cue's nudging effects for the vulnerable target group of adolescents within a school-setting applied outside a cafeteria. The present study therefore uses a target group specific nudge similar to the effective Giacometti nudge. In this way, we can draw practical implications to tackle the societal problem of unhealthy eating behavior in adolescent schoolchildren and add insights to food choice studies involving environmental factors focusing on health and well-being.

We add to existing research in different ways: First, we assess the effects of an automatic and unconscious nudge specifically designed for adolescents on healthy and unhealthy food consumption within a school-setting. This nudge was developed using established positive effects of a thin body shape cue as a benchmark. To our knowledge a thin body shape nudge has never been applied to the target group of adolescents. However, assessing the effectiveness of such a nudge for the target group of adolescents is extremely important to understand and avoid possible negative effects of nudging. Adolescence is described as an extremely vulnerable stage in an individual's life during which eating disorders can occur (Rohde et al., 2014). The media confronts young individuals with portraits of skinny and thin ideals on a daily basis emphasizing weight loss and thinness (Spettigue & Henderson, 2004; Hogan & Strasburger, 2008). Possible effects of a thin body shape nudge which was found to be effective within older samples, therefore needs to be assessed and evaluated within a controlled setting first. With the current study, we are able to draw insights into whether a thin body shape nudge is also effective for the potentially vulnerable target group of adolescents and can be applied within a school-context in order to improve eating behavior. Second, by adding certain influential factors in our analyses under nudge /no-nudge conditions we also aim to improve our understanding of adolescent eating behavior at school. Third, the nudge tested in the present study can easily be applied within a school outside a cafeteria setting. Our behavioral economic intervention based on the successful Giacometti cue has the potential to tackle the societal problem of bad eating behavior of students at a young age.

2.2 Material and methods

The present study took place from January 10th to January 22nd, 2019 at a secondary school in Halle Westfalen, Germany. It is part of the research project *Gesunde Hochschule* at the Bonn-

Rhein-Sieg University of Applied Sciences in Germany. The project was approved by the ethical committee of the University of Bonn (sequence number 086/19) and is therefore in line with the ethical standards of the Declaration of Helsinki. The principal of the secondary school also approved of the study and every single participant gave his or her written informed consent to participate. Full disclosure of the exact topic and aim of the study was provided to all participants after data-collection ended. Also, at that moment all participants received information about nudging and possible effects on eating behavior. They were able to ask questions and receive further information.

In total, 91 secondary schoolchildren participated in the present study. Prior to the analyses 5 participants were removed from the sample – 4 participants because of lactose intolerance and 1 participant because of diabetes. The average age was 17.7 years (ranging from 17-20 years). Table 1 summarizes the descriptive statistics of the sample per condition and gender.

Table 1. Descriptive statistics (means or frequencies) of the sample per condition and gender.

	Male		**Female**	
	Nudge (*n* = 30)	**No nudge (*n* = 15)**	**Nudge (*n* = 31)**	**No nudge (*n* = 15)**
Weight	76 kg	76 kg	60 kg	59 kg
Height	183 cm	181 cm	169 cm	167 cm
Body mass index	22.7	21.0	21.1	23.1
Dieting	5 yes (16.7%)	0 yes (0%)	4 yes (12.9%)	1 yes (6.7%)
	25 no (83.3%)	15 no (100%)	27 no (87.1%)	14 no (93.3%)
Satisfaction with weight[1]	2.27 (*SD* = 1.02)	1.73 (*SD* = .88)	2.52 (*SD* = 1.15)	2.60 (*SD* = .91)

Notes: [1]5-point scale with 1 = very satisfied.

Experimental design

A one-factorial experimental design yielding two experimental conditions and one control group was used. The experimenter randomized 91 participants to these conditions prior to the experiment to ensure that the exposure to the nudge intervention in the experimental conditions matched their gender. We followed established research protocols as discussed in studies on the Giacometti cue (Brunner & Siegrist, 2012; Stämpfli et al., 2017; Stämpfli & Brunner, 2016, Stöckli et al., 2016). Brunner and Siegrist (2012) initially acquired a sample of 96 in a first and 80 in a second study. We therefore assumed sufficient statistical power with our sample of 91 participants in total.

Intervention

In designing the present nudge, we used the successful Giacometti prime of a thin body shape as well as salience effects as benchmarks. A systematic review found that combining priming and salience effects in nudging achieves the most impact (Wilson et al., 2016). Priming nudges incorporate subconscious cues (verbal, physical or sensational) to promote a certain choice. Salience nudges utilize vivid, novel or personally relevant information in order to increase attention towards a certain choice (Wilson et al., 2016). A male and a female version of the nudge was developed, because most studies applying body shape primes matched the gender

of prime and sample (Ohtomo, 2017; Otterbring et al., 2020). Both nudges (depicted in Fig 1) were respectively printed in color on A0-sized posters, without texts or messages (Stöckli et al., 2016).

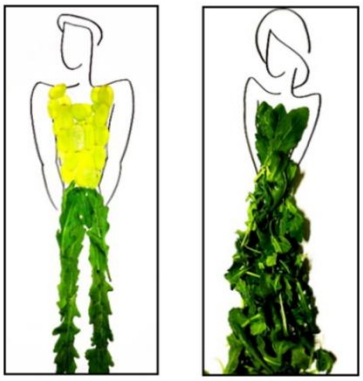

Figure 1. Depicting the male and female nudge.

See Figure A.1-A.3 in the Appendix for an impression experiment's set up and room in which it took place. To ensure that the participants perceive the nudges as vivid, salient and positive, an online pretest was conducted with a total of 107 German students; 42 of these were secondary school students (39%) and 65 were university students (61%).

The experimental conditions were exposed to the nudge on a poster. It was presented during the entire experiment placed on the wall approximately two meters from the participants. The participants directly faced the nudge poster. The female participants of the experimental condition were exposed to the female nudge version, while male participants saw the male nudge version. The control group (male or female) was not exposed to any kind of poster and faced a white wall during the experiment. The school's principal only cleared the final class consisting of 98 students for participation in the study. Therefore, we were not able to evenly allocate the participants to the conditions by nudge versus no nudge and male versus female. Rather we split participants into three conditions – male nudge, female nudge and no nudge. In this way we received a sufficient sample size for each condition.

Study procedure

The experiment took place in a German school-setting during a normal school day in an ordinary classroom. Participants were recruited from the final class of the school. To ensure an unbiased participation, participants were unaware of the experiment's specific contents prior to participating but were fully briefed after the data-collection phase. They were invited to take part in a psychological study. No sessions were scheduled before 9:00 o'clock, between 12:00 – 13:30 o'clock and after 16:00 o'clock to ensure that the food tasting did not occur at a time in which meals are normally consumed. On entering the room, participants were asked

to sit at a table facing the wall with or without a poster depending on the condition. On the table were two ceramic bowls containing 20 blueberries and 20 chocolate pieces (placement -left or right- was counterbalanced within each condition).

The procedure for each 30-minute session was the same in all three conditions. All instructions were read out loud by the experimenter in order to ensure standardization in all conditions. The experimenter greeted the participants and asked them to take a seat. To ensure that the participants (experimental conditions) were able to perceive the nudge poster, the experimenter rearranged material standing next to it. This was also done in the control condition. Participants then received instructions for the food tasting and a questionnaire to rate the presented foods. They were invited to taste and rate blueberries (healthy food) and chocolate (unhealthy food) for 5 minutes. They were explicitly invited as much food as they liked. The amount of both foods eaten was measured afterwards.

While the participants tasted and rated the foods, the experimenter left the room. The participants were therefore alone during the food tasting. After reentering, the experimenter removed the remaining food and the taste rating questionnaire. Next, participants filled in questionnaires assessing possible determinants on food consumption. In order to ensure that the food tasting occurred unbiased all determinants were assessed after the food tasting. At last, the experimenter asked the participants to keep quiet about the contents of the study.

Measures

The dependent variables chocolate consumption and blueberry consumption were measured by assessing the amounts eaten during the food tasting. Both foods were weighed respectively before and after each session unbeknownst to the participants. Each participant was presented with 20 pieces of chocolate and 20 blueberries in separate white ceramic bowls. The bowls were already present, when the participants entered the room. Chocolate and blueberries were chosen as food options, because these options were used in multiple studies assessing the Giacometti cue (e.g., Brunner & Siegrist, 2012). The single chocolate pieces were broken off of a milk chocolate bar weighing approximately 1.6 grams. Blueberries weigh approximately .9 grams. Care was taken that the single chocolate pieces and blueberries were similar in size.

A questionnaire was administered after the food tasting session in order to prevent a confounding influence assessing determinants of food consumption self-control (German version of the *Brief Self-Control Scale* by Sproesser et al., 2011), knowledge regarding healthy eating behavior (*How do you rate your knowledge regarding healthy eating behavior;* 5-point scale ranging from *very bad* to v*ery good*), hunger (5-point scale ranging from *very hungry* to *not hungry at all*) and taste (7-point scale ranging from *very good* to *very bad)*. Demographic questions included gender, age, height (in cm) and weight (in kg). Control variables were satisfaction with the own body weight (5-point scale ranging from v*ery satisfied* to *not satisfied at all*), dieting behavior (*yes* or *no*) and dietary preferences (*none, vegetarian, vegan, gluten free* and / or *other*). In addition, the German version of the *Restraint Scale* was administered

(Dinkel et al., 2005) assessing *concern for dieting* (3-point scale ranging from *never* / *not at all* to *always* / *strongly*) and *weight fluctuations* (scale ranging from 0 to 4). In the experimental conditions, participants stated their liking of the nudge, their level of awareness of the nudge and their perceived influence the nudge has had on their food consumption (Brunner & Siegrist, 2012).

Analysis

Inferential analyses include blocked hierarchical regression analyses on chocolate and blueberry consumption respectively involving three stages. These analyses provide insights on the relation between the nudge as well as the determinants of food consumption and chocolate as well as blueberry consumption. In addition, we can draw conclusions on how much variance of food consumption can be explained by the model. Stage one of the hierarchical regression applies gender as a predictor; stage two adds knowledge regarding healthy eating behavior, self-control, taste rating of the food, hunger and satisfaction with weight as predictors. Stage three adds the nudge as a predictor. All variance inflation factors (VIF) were between 1.00-1.20 indicating that no multicollinearity exists (Field, 2013).

In order to determine for whom the nudge caused less than average chocolate consumption and explore the participants' food consumption further, a discriminant analysis was conducted only including nudged participants. As a grouping variable, we computed a new variable splitting participants into two groups. Group one includes participants who consumed less chocolate than the average of the no nudge control group did ($M < 11.8$); group two includes participants consuming more chocolate than the average no nudge control group participant ($M > 11.8$). We entered the predictors (nudge rating, hunger and gender) together.

2.3 Results

For all inferential analyses, this study assumes a significance level of .05. Before the analyses, participants' chocolate and blueberry consumption was calculated by subtracting the foods' weight after the tasting session from the weight before the tasting session. For chocolate consumption two outliers were identified in the dataset and was therefore winsorized. In addition, the male and female nudge conditions were combined to obtain a general nudge effect on food consumption. Bootstrapping was used; the number of bootstrap samples for the percentile bootstrap confidence intervals was 1000, with a level of confidence for all confidence intervals of 95%. Missing values were deleted listwise.

Food consumption, determinants and controls

Table 2 summarizes the descriptive statistics of the participants' blueberry and chocolate consumption, the potential determinants of food consumption and control variables per nudge condition and gender, while displaying Cronbach's α values. All scales have an acceptable to good reliability (from $\alpha = .68$ to $\alpha = .78$). Across all conditions, larger amounts of

chocolate than blueberries were consumed. No statistical difference exists between the conditions regarding blueberry consumption (F (3, 87) = .29, p = .833). However, statistical differences were found regarding chocolate consumption (F (3, 87) = 5.95, p = .001). As anticipated, males consumed more chocolate and less blueberries than the females (F (1, 89) = 13.27, p = .000). Unexpectedly, males in the nudge condition consumed almost twice as much chocolate compared to the females in the nudge condition (Bonferroni post-hoc p = .001) as well as the males in the no nudge condition (Bonferroni post-hoc p = .012).

Generally, the participants rated blueberry and chocolate tastes positively and indicated lower degrees of hunger. No statistical differences exist between the conditions regarding chocolate rating (F (3, 87) = .16, p = .921) and hunger (F (3, 87) = 2.43, p = .070). Females of the nudge condition liked the blueberries better than males of the nudge condition (F (3, 86) = 3.05, p = .033; Bonferroni post-hoc p = .031). They also rated the nudge more positively than males of the nudge condition (F (1, 59) = 11.90, p = .001). The nudge was generally perceived as being present by the participants, however the participants did not feel influenced by it regarding their food consumption. No statistical differences between the conditions were found regarding perception of the nudge' presence (F (1, 59) = .00, p = .998) and the perception of the nudge's influence on one's eating behavior (F (1, 59) = .31, p = .583). No statistical differences exist between the conditions regarding their concern for dieting (F (3, 85) = 1.49, p = .224) and weight fluctuations (F (3, 85) = .195, p = .899).

Table 2. Means and standard deviations of the central variables per nudge condition and gender and Cronbach's α values.

	Male		**Female**		**Cronbach's α (number of items)**
	Nudge (n = 30)	**No nudge (n = 15)**	**Nudge (n = 31)**	**No nudge (n = 15)**	
Food consumption					
Blueberry consumption[1]	8.9 (5.48)	9.4 (6.43)	9.1 (5.37)	7.7 (4.01)	-
Chocolate consumption[1,2]	17.3 (9.19)	13.4 (8.15)	10.4 (6.71)	10.2 (5.61)	-
Determinants of food consumption					
Self-control	3.21 (.44)	3.31 (.46)	3.20 (.65)	2.96 (.41)	.77 (13)
Knowledge	3.47 (1.04)	3.93 (.70)	3.55 (.93)	3.93 (.70)	-
Blueberry taste rating	2.94 (.90)	2.40 (.88)	2.27 (.91)	2.71 (.99)	.78 (3)
Chocolate taste rating	2.37 (.82)	2.42 (.88)	2.41 (.07)	2.22 (.59)	.73 (3)
Hunger[3]	3.13 (1.28)	3.60 (.99)	3.81 (1.17)	3.00 (1.20)	-
Further controls					
Nudge rating[4]	2.38 (.64)	-	3.08 (.91)	-	.78 (3)
Nudge perceived[4]	3.97 (1.19)	-	3.97 (1.47)	-	-
Nudge perceived influence[4]	1.43 (.90)	-	1.32 (.65)	-	-
Concern for diet[5]	102 (2.97)	43 (2.46[6])	146 (2.67)	60 (2.80[6])	.68 (5)
Weight fluctuations[5]	88 (2.18)	45 (2.62[6])	84 (2.07)	46 (2.81[6])	.73 (3)

Notes: [1]consumption in grams; [2]winsorized variable; [3]Hunger ranges from 1 = very hungry to 5 = not hungry at all; [4]only assessed in the experimental nudge conditions; [5]sum scores; [6]n = 15; Standard Deviations in parentheses.

Chocolate consumption

In order to understand the participants' chocolate consumption a blocked hierarchical regression analysis with several predictors and chocolate consumption as the outcome variable was executed (Table 3). The first stage of the hierarchical regression on chocolate consumption revealed gender as a significant predictor. This model explains 11.9% of the variance in the participants' chocolate consumption. Gender is significantly related to chocolate consumption; males consumed more chocolate than females. At the second stage hunger significantly predicts chocolate consumption. The hungrier the participants were, the more chocolate they consumed. Gender is again a significant predictor. There is a significant improvement of the model. The second stage model explains 21.5% of the variance in the participants' chocolate consumption. At the third stage again gender and hunger were significant predictors for chocolate consumption. The nudge, however, is not significantly related to chocolate consumption. The third stage model explains 22.9% of the variance in the participants' chocolate consumption.

In total, the proposed model significantly explains 22.9% of the variance in the participants' chocolate consumption. Only gender and hunger were identified as significant predictors of chocolate consumption.

Table 3. Hierarchical regression analysis on chocolate consumption.

	Chocolate consumption				
	b	*ß*	*p*	R^2	ΔR^2
Step 1				.119	.119**
Constant	21.72 (2.65)		.000		
Gender[1]	-5.73 (1.69)	-.35	.001		
Step 2				.215	.096**
Constant	31.59 (6.81)		.000		
Gender[1]	-4.26 (1.71)	-.26	.015		
Knowledge	-.64 (.92)	-.07	.489		
Self-control	-1.07 (1.73)	-.07	.539		
Taste rating	-.37 (.93)	-.04	.692		
Hunger[2]	-1.93 (.73)	-.28	.010		
Satisfaction with weight	.47 (.78)	.06	.547		
Step 3				.229	.014**
Constant	34.74 (7.23)		.000		
Gender	-4.20 (1.71)	-.25	.016		
Knowledge	-.36 (.95)	-.04	.702		
Self-control	-1.32 (1.73)	-.08	.447		
Taste rating	-.44 (.93)	-.05	.639		
Hunger[2]	-1.95 (.73)	-.28	.009		
Satisfaction with weight	.35 (.78)	.05	.657		
Nudge[3]	-2.18 (1.80)	-.13	.229		

Notes: Standard Error in parentheses; [1]Gender is coded 1 = male, 2 = female; [2] Hunger ranges from 1 = very hungry to 5 = not hungry at all; [3]nudge vs. no nudge; ** $p < .01$.

Blueberry consumption

In order to understand the participants' blueberry consumption again a blocked hierarchical regression analysis with several predictors was executed with blueberry consumption as the outcome variable (Table 4). At the first stage of the hierarchical regression on blueberry consumption gender was not a significant predictor. This model does not explain any variance of the participants' blueberry consumption. The second stage revealed blueberry taste rating as a significant predictor. The more the participants liked the blueberry's taste, the more they consumed. This model explains 8.3% of the variance in the participants' chocolate consumption. At the third stage again blueberry taste rating predicted blueberry consumption significantly, but the nudge did not. This model explains 8.9% of the variance in the participants' chocolate consumption. No significant improvement of the model was found at this stage.

In total, the proposed model only constitutes 8.6% of the variance in the participants' blueberry consumption. However, this model did not reach significance. Only blueberry taste rating was identified as a significant predictor of blueberry consumption.

Table 4. Hierarchical regression analysis on blueberry consumption.

	Blueberry consumption				
	b	*ß*	*p*	R^2	ΔR^2
Step 1				.000	.000
Constant	9.23 (1.81)		.000		
Gender[1]	-.17 (1.16)	-.02	.883		
Step 2				.083	.083
Constant	19.26 (5.14)		.000		
Gender[1]	-.57 (1.26)	-.05	.650		
Knowledge	-.14 (.64)	-.02	.829		
Self-control	-.84 (1.20)	-.08	.484		
Taste rating	-1.42 (.67)	-.25	.036		
Hunger[2]	-.62 (.51)	-.14	.224		
Satisfaction with weight	-.21 (.55)	-.04	.708		
Step 3				.089	.006
Constant	20.51 (5.45)		.000		
Gender	-.55 (1.26)	-.05	.662		
Knowledge	-.03 (.66)	-.01	.967		
Self-control	-.95 (1.21)	-.09	.438		
Taste rating	-1.43 (.67)	-.25	.035		
Hunger[2]	-.63 (.51)	-.14	.220		
Satisfaction with weight	-.26 (.56)	-.05	.645		
Nudge[3]	-.88 (1.26)	-.08	.485		

Notes: Standard Error in parentheses; [1]Gender is coded 1 = male, 2 = female; [2] Hunger ranges from 1 = very hungry to 5 = not hungry at all; [3]nudge vs. no nudge; $^{**}p < .01$.

Differences in chocolate consumption

To further understand for whom the nudge was effective and caused less than average chocolate consumption, a discriminant analysis was conducted. Only participants who were exposed to the nudge were included in this analysis. Table 5 depicts the descriptive statistics for the *effective* and *ineffective* nudge groups. The effective nudge group includes 27 nudged participants who consumed less chocolate than the average participants of the control condition. The ineffective nudge group consists of 34 nudged participants with a higher than control condition average chocolate consumption.

Table 5. Descriptive statistics for grouping variable.

	Effective nudge (*n* = 27)		**Ineffective nudge (*n* = 34)**	
Chocolate consumption[1]	6.7 (2.15)		19.5 (7.67)	
Hunger[2]	3.85 (1.13)		3.18 (1.29)	
Nudge rating	3.0 (.97)		2.52 (.70)	
	Male	**Female**	**Male**	**Female**
Gender[3]	*n* = 8 (29.6%)	*n* = 19 (70.4%)	*n* = 22 (64.7%)	*n* = 12 (35.3%)

Notes: [1]winsorized variable; [2]Hunger ranges from 1 = very hungry to 5 = not hungry at all; [3]Gender is coded 1 = male, 2 = female; Standard Deviations in parentheses.

Participants of the effective nudge group indicated a lower degree of hunger and a more positive nudge rating than the ineffective nudge group. More females than males were in the effective nudge group, while more males than females were in the ineffective nudge group.

Discriminant analysis revealed that the log determinants were quite similar ($log_{\text{effective nudge}}$ = -1.66; $log_{\text{ineffective nudge}}$ = -1.82; $log_{\text{within groups}}$ = -1.65). Box's *M* indicated that the assumption of equality of covariance matrices holds (F = (6, 21846.3) = .94, p = .465). The discriminate function showed a significant association between groups (L (3) = .81, p = .008) and all predictors were significant and positive (gender = .779; nudge rating = .612; hunger = .584). The cross validated classification showed that overall, 70.5% were correctly classified.

An ANOVA using the grouping variable as an independent variable and hunger as the dependent variable (F (1, 59) = 4.58, p = .036; L = .93) showed that participants of the effective nudge group were significantly less hungry (M = 3.85) than participants of the ineffective nudge condition (M = 3.18). Another ANOVA using the nudge rating as a dependent variable (F (1, 59) = 5.03, p = .029; L = .92) showed that participants for whom the nudge was effective rated the nudge significantly more positively (M = 3.0) than participants for whom the nudge was ineffective (M = 2.52). A χ^2-test on gender revealed that the frequencies distribution of gender significantly differs between the groups with χ^2 (1) = 4.48, p = .034. More females than males were in the effective nudge group, while more males than females were in the ineffective nudge group.

In conclusion, nudged participants who consumed less chocolate than the average control group participant did, rated the nudge more positively, were less hungry and more frequently females.

2.4 Discussion and conclusion

In order to research the effect of a thin body shape nudge on adolescent schoolchildren, we conducted an experiment on healthy and unhealthy food consumption within a school setting. We also assessed several factors (gender, self-control, knowledge regarding healthy eating behavior, taste, hunger, and satisfaction with weight) influencing food consumption.

In contrast to our expectations, exposing adolescents to a thin body shape nudge intervention to decrease chocolate and increase blueberry consumption was not effective. The nudge did not affect food consumption in adolescents. Nudging within a health context generally has an average effect of 44% (Hummer & Maedche, 2019). A specific nudge applied within a school cafeteria's lunch pre-ordering system increased fruit ordering by 51.4% and vegetable ordering by 29.7% (Miller et al., 2016). We propose two explanations for our findings of an ineffective thin body shape nudge. First, psychological reactance elicited by the nudge is a possible explanation. Brunner and Siegrist (2012) proposed psychological reactance might occur, when exposing participants to a thin body shape cue and when a nudge is consciously perceived. Threatening or eliminating someone's personal freedom can lead to reactance in order to restore this personal freedom. Often an opposite behavior as proposed by the threat is then portrayed (Brehm & Brehm, 1981). Participants of the present study reported a high perception of the nudge's presence. It is thus possible that the present nudge caused reactance. Empirical evidence on adolescents and specifically male adolescents further supports our proposed explanation. Adolescents are prone to reactance, when confronted with authority figures or when in a school-setting (Bryan et al., 2016). Especially young males are prone to reactance (Seeman et al., 2004; Woller et al., 2007) and displayed lower acceptance of nudges (Sunstein et al., 2018). Males also show lower trust in institutions (including school settings) than females (Sunstein et al., 2018). In the present study, males expectedly consumed more chocolate than females did. While we expected an increased chocolate consumption in males, the study of Heuer et al. (2015) did not make us expect males to consume almost twice as much chocolate as females. Interestingly, male participants exposed to the nudge descriptively consumed more chocolate than males not exposed to the nudge. Displaying the nudge in the school setting possibly threatened the male students. Psychological reactance may explain that. Additionally, we found that the thin body shape nudge led to less chocolate consumption in comparison to the control group's average in participants who rated the nudge more positively, were less hungry and more frequently female. These results support the proposed explanation of psychological reactance for the high chocolate consumption in males. Males instead of females showed reactant behavior as a possible reaction to disliking the nudge. Accordingly, the nudge possibly was not suitable for male adolescents.

A second explanation for our ineffective thin body shape nudge is that adolescents have grown accustomed to the exposure to thin body shapes. Adolescents are used to a ubiquitous media presence and also a constant exposure to thin body ideals (Ohtomo, 2017; Derenne & Beresin, 2006; Spettigue & Henderson, 2004). In older target groups, the Giacometti cue has rendered

effective results. For example, the Giacometti nudge decreased chocolate consumption by 1.72 grams in the first study (participants' mean age = 35.4 years) and by 1.58 grams in a second study assessing participants with a mean age of 48.9 years (Brunner & Siegrist, 2012). In addition, the Giacometti nudge reduced the total food intake of chocolate and blueberries by 3.99 grams (*d* = 0.39). This nudge also caused participants to consume 6.37 grams more healthy blueberries than unhealthy chocolate (*d* = 0.65; Stämpfli et al., 2017). Possibly, the nudge did not elicit the anticipated reaction within our much younger target group of adolescents, because most participants simply were accustomed to thin body shapes.

The present study also assessed the effects of several influential factors (gender, self-control, knowledge regarding healthy eating behavior, taste, hunger and satisfaction with weight) on adolescent food consumption. Next to the already discussed effect of gender, we found hunger to significantly influence chocolate consumption. Hungrier participants consumed more chocolate than less hungry participants. Research already shows that individuals, especially younger people, make unhealthy food decisions, when hungry (Miller et al., 2016), specifically consuming larger amounts of chocolate (Bossel et al., 2019). Chocolate tempts eating, especially when hungry (Geyskens et al., 2008). Blueberry consumption was influenced by taste. Participants rating the blueberry's taste better consumed more blueberries. This finding is supported by other studies (Bossel et al., 2019). The present study confirms the importance of taste as an influencing factor for blueberry consumption. We found no influence of self-control on food consumption even though self-control plays a crucial role, when people face temptations (Myrseth et al., 2009). According to the critical level perspective, food temptations need to be perceived as strong in order to activate self-control attempts to circumvent consumption (Geyskens et al., 2005). Possibly, exposing participants to only 20 pieces of chocolate and blueberries did not reach a critical level. Additionally, being able to taste tempting food can make self-control concepts obsolete (Geyskens et al., 2008). Knowledge regarding healthy eating behavior did not influence food consumption. Participants in the present study rated their own knowledge fairly high. Similar results were found in a study assessing 18-21 year-old students (Schroeter & House, 2015). Additionally, an inverted U-shaped function has been proposed to explain possible effects of knowledge together with priming on a certain topic (Yi, 1993). High or low knowledge on a topic has no effect, when priming. This explains the present results, as participants indicated a high degree of knowledge.

Ethical considerations of applying a thin body shape nudge to a potentially vulnerable target group demands us to acknowledge the possibility of negative effects the present nudge might have. A thin body shape does not necessarily reflect healthy eating behavior or a healthy lifestyle. Therefore, it was necessary to assess the effects of such a nudge within a controlled setting. Additionally, full disclosure was given to all participants. We found no effect of the nudge regarding the participants' satisfaction with their own weight or their concern for dieting. In general, the participants were rather satisfied with their weight. In the current sample, their satisfaction with their weight did not influence their food consumption. Momentarily, the nudge might have caused reactant behavior in male participants.

Our experimental design was largely based on the Giacometti studies (Brunner & Siegrist, 2012). Still, the limitations of this design might have confounded the results. We need to highlight that a one-time exposure to a thin body shape nudge does not represent reality. Adolescents are constantly exposed to thin body shape ideals (e.g., Derenne & Beresin, 2006) and they would also come across a nudge applied in school setting multiple times on a daily basis. Future studies need to assess the effects of a repeated exposure to nudging, while considering any ethical and negative aspects a repeated exposure might have. In the present study, the sample size was relatively small, even though the Giacometti cue was found to be effective in a study with only 80 participants (Brunner & Siegrist, 2012). Future studies should include larger sample sizes and equally large conditions. Furthermore, it is not clear whether offering only 20 pieces of food within a taste and rate task enables the participants to infer how much they already consumed. This may have influenced consumption (Bossel et al., 2019). Future studies should offer larger, abundant amounts of chocolate. The present study also included a male and a female nudge. Whether participants received the male or female version depended on their own gender. Future studies should not match exposure to the participant's gender to ensure that the effects of the nudge can completely be assessed and analyzed. The nudge itself is also an interesting topic for future research, especially because it was not as effective as intended and it has been argued above that it might not be suitable for the adolescent target group. Changing the nudge and applying it again to adolescents in a controlled setting should add to further understanding its value. The nudge did not reduce the adolescents' satisfaction with their own body weight. Still, research always needs to consider ethics regarding the application of a thin body shape nudge, especially when administering it to a potentially vulnerable and impressionable target group. Carefully designing and testing a nudge in a controlled setting as the present study did, is incumbent.

Despite the fact that the thin body shape nudge of the present study did not reveal the expected effects, we can still draw important conclusions that help to tackle the societal problem of unhealthy eating behavior in adolescent schoolchildren. We found the taste of the fruit to increase its consumption. As most German schools provide food for their students, school officials should consider providing wider varieties of healthy, tasty food and fewer unhealthy food options in line with our results. Desserts can for example include fresh, sweet fruits instead of sugary options. The nudge itself did not impact food consumption. Unexpected high amounts of chocolate consumed by male participants was explained by psychological reactance, possibly elicited by the nudge. When designing nudge interventions for adolescents targeting eating behavior in school-settings, gender differences and the possibility of reactant behavior need to be considered. Furthermore, liking the nudge plays a critical role in its effectiveness and needs to be considered in nudge development. Attention should also be paid to possible subgroups within a target group. Ethical standards and potentially negative effects of a nudge designed for this potentially vulnerable target group must also always be considered.

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Chapter 3

Cafeteria online: Nudges for healthier food choices in a university cafeteria—A randomized online experiment

This chapter is based on Kawa, C., Ianiro-Dahm, P.M., Nijhuis, J.F.H., & Gijselaers, W.H. (2021). Cafeteria online: Nudges for healthier food choices in a university cafeteria—A randomized online experiment. *International Journal of Environmental Research and Public Health, 18*(24), 12924. https://doi.org/10.3390/ijerph182412924

Abstract

Many people do not consume as much healthy food as recommended. Nudging has been identified as a promising intervention strategy to increase the consumption of healthy food. The present study analyzed the effects of three body shape nudges (thin, thick, or Giacometti artwork) on food ordering and assessed the mediating role of being aware of the nudge. Students (686) and employees (218) of a German university participated in an online experimental study. After randomization, participants visited a realistic online cafeteria and composed a meal for themselves. Under experimental conditions, participants were exposed to one out of three nudges while choosing dishes: (1) thin body shape, (2) thick body shape, and (3) the Giacometti artwork nudge. The Giacometti nudge resulted in more orders for salad among employees. The thin and thick body shape nudges did not change dish orders. Awareness of the nudge mediated the numbers of calories ordered when using the Giacometti or thin body shape nudges. These findings provide useful insights for health interventions in occupational and public health sectors using nudges. Our study contributes to the research on the Giacometti nudge by showing its effectiveness when participants are aware (it is effective under conditions where it is consciously perceived).

3.1 Introduction

Several national surveys have shown that Germans do not consume enough fruit and vegetables, falling short of the amounts suggested by guidelines for healthy eating (Heuer et al., 2015; Mensink et al., 2017). In 2018, German insurance companies spent EUR 158 million on health promotion and prevention measures, the majority involving nutrition. These measures frequently concern higher education settings (Bauer & Römer, 2019). According to the Ottawa Charter approach (World Health Organization, 2021), focusing on promoting health within individuals' various life settings, the German population needs to improve their eating habits within their occupational settings. This setting is especially promising for health interventions because German employees spend almost 35 hours per week at work (Federal Statistical Office, 2021), and the majority of German employees (65.4%; *N* = 2627 employees) visit a cafeteria at lunchtime (Jordan et al., 2020). Employers, likewise, should adopt more cost-effective nutrition interventions.

One effective and cheap health intervention in food choice and nutrition across the entire life span includes so-called nudges (Perez-Cueto, 2019; Hummel & Maedche, 2019; Damgaard & Nielsen, 2017). Nudges change the decision-making environment by promoting a specific choice. They usually help individuals avoid, exploit or harness biases and cognitive errors that may occur in their decision-making (Thaler & Sunstein, 2009). Nudges can be classified according to the cognitive system activated in an individual. Type 1 nudges exert influence via the automatic cognitive system not involving deliberation. Type 2 nudges influence one's attention and reflective thinking processes exert influence through deliberation (Hansen & Jespersen, 2013). Several meta-analyses and systematic reviews support the positive effects of nudges on improving eating behaviors (Veccio & Cavallo, 2019), including in university and cafeteria settings Roy et al., 2015; Brunner & Siegrist, 2012; Marcano-Olivier et al., 2020; Van Kleef et al., 2020). For example, nudging within a cafeteria's lunch pre-ordering system led to 51.4% more fruit and 29.7% more vegetable orders than a pre-ordering system without nudging (Miller et al., 2016). Nudge interventions that involved applying a poster in a canteen increased fruit and vegetable consumption (Hamdi, 2020). Although nudges are effective in cafeteria settings, effect sizes are often small (Van Kleef, 2020). A meta-analysis of healthy eating nudges involving field experiments revealed a Cohen's *d* = 0.23 (Cadario & Chandon, 2020). We propose that universities may be able to promote students' and employees' healthy eating by applying healthy eating nudges in a cafeteria setting.

The so-called Giacometti cue exemplifies an effective nudge for decreasing unhealthy food consumption and increasing healthy food consumption (Brunner & Siegrist, 2012; Stämpfli et al., 2017; Stämpfli & Brunner, 2016; Stöckli, 2016; Stämpfli et al., 2020). This nudge uses the artwork of Alberto Giacometti (concerning a thin, genderless, human-like figure) and would be classified as a type 1 nudge (Hansen & Jespersen, 2013). So far, the Giacometti nudge has produced a medium effect size of Cohen's *d* = 0.39–0.65 (Stämpfli & Brunner, 2016). Despite the effectiveness of the Giacometti nudge's thin figure, other research on thin body shape cues has shown contrasting (Manippa et al., 2019) or insignificant effects (Kawa et al., 2022;

Campbell & Mohr, 2011). Additionally, being exposed to a thick body shape either increased unhealthy food consumption (Döring & Wansink, 2017; Otterbring & Shams, 2019) or decreased the choices for unhealthy meals (Kroese et al., 2016). These inconsistent research results regarding thin or thick human body shape cues call for further research on body shape nudges.

The issue has recently been raised that we still lack understanding of the exact workings of a nudge, as well as the conditions under which an individual is susceptible to nudge effects (Bauer et al., 2021; De Ridder et al., 2021). Additionally, a publication bias creating a positively skewed impression of nudge effectiveness may exist (Hummel & Maedche, 2019). A recent systematic review identified differences in nudge effectiveness regarding several demographic variables (such as education and occupation). Nudges are not equally effective for different target groups. These effects are called equity effects and have been found for dietary nudges (Schüz et al., 2021). Assessing nudge effects separately for different target groups reached by a nudge (such as students and employees in a university's cafeteria) is important in order to identify possible equity effects.

Several studies have assessed whether being aware of a nudge and / or its purpose plays a role in its effectiveness. Research on the Giacometti nudge has also explored the possibility that awareness of its presence may cause reactance and hinder its effectiveness (Stämpfli et al., 2017; Stämpfli et al., 2020). However, research on the issue of nudge awareness is scarce and inconclusive (Stämpfli et al., 2020; Bruns et al., 2018; Machiori et al., 2017). Some studies found that disclosing a nudge's presence did not make a difference regarding its effectiveness (Kroese et al., 2016; Wachner et al., 2020). Other studies have found that transparent nudges aimed at healthy eating behaviors cause behaviors opposing the nudge's intent (Bauer et al., 2021). The degree to which an individual is aware of a nudge may play a crucial role in its effectiveness but has not yet been determined (Stämpfli et al., 2020).

Considering the findings so far, we expected the exposure to a Giacometti nudge to result in more orders for healthy food and fewer for unhealthy food, compared to a control group (hypothesis 1). Furthermore, we expected the thin body shape nudge to mirror the effects of the thin Giacometti figure, also resulting in fewer orders for unhealthy food and more for healthy food as compared to a control group (hypothesis 2). The thick body shape nudge was expected to result in more orders for unhealthy food and fewer for healthy food as compared to a control group (hypothesis 3). Furthermore, we expected the awareness of the nudge's presence to mediate the number of calories ordered (hypothesis 4).

The present study had two aims. First, we explored the effect of the Giacometti nudge, as well as thin and thick body shape nudges, on healthy and unhealthy food orders in a workplace setting. We assessed two target groups (students and employees) separately to account for possible equity effects in nudging. Secondly, we observed the role played by nudge awareness regarding calorie orders. We contribute to the existing research on body shape nudges by

assessing the effectiveness of three different types of nudges. We also accounted for possible equity effects in nudging and concluded the role of awareness in nudging.

3.2 Materials and Methods

Setting and Context

Data were collected from June 30th until July 28th, 2020, using a virtual cafeteria setting. All students and employees of a German University of Applied Sciences were invited via an e-mail to participate in an online experiment assessing the selection of different dishes typically available in the university cafeteria (convenience sampling). This population consists of approximately 9812 students and 734 employees. Students are part of one of the following departments: Computer Science (approximately 24.9%); Electrical Engineering, Mechanical Engineering and Technical Journalism (approximately 19.4%); Natural Sciences (approximately 12.3%); Management Sciences (approximately 33.7%); Social Policy and Social Security Studies (approximately 9.7%). Approximately 45.7% of the employees are research / scientific staff, approximately 32.2% are non-research / scientific staff and approximately 21.7% are professors. All participants were informed about the purpose of the study and personal data security. They actively gave their consent to participate. The present study is part of a larger research project which was approved by the ethical committee of the University of Bonn (sequence number 086/19). This project is in line with the ethical standards of the Declaration of Helsinki. This research project's general aim is to assess the health and well-being of the university's students and employees as well as to compose health interventions and to offer programs to improve the health and well-being of these individuals in different areas.

We carefully designed the online food choice scenario to make it as realistic as possible (Figure 1), basing each decision on prevalent research in the area of food choice and nudging. We only included dishes in the food choice scenario that are usually sold in the cafeteria (Kiszko et al., 2014; Bleich et al., 2017), and presented these dishes in the form of photographs under which a descriptive name was given. We also included pictures of the cafeteria's actual food displays and portrayed the dishes on the cafeteria's actual tableware and trays (Markovina et al., 2015; Van Kleef et al., 2016). Participants were asked to imagine having their usual budgets and all dishes were priced as usual. We did not include specific prices in the design, because most studies only did so when they manipulated the price of a dish as an independent variable (Kiszko et al., 2014). If the participants did not want to choose any of the dishes portrayed, they were able to choose an empty tray option. At the end of the food choice scenario, participants were shown their choices. Here, they were able to change their choices if they wished to do so.

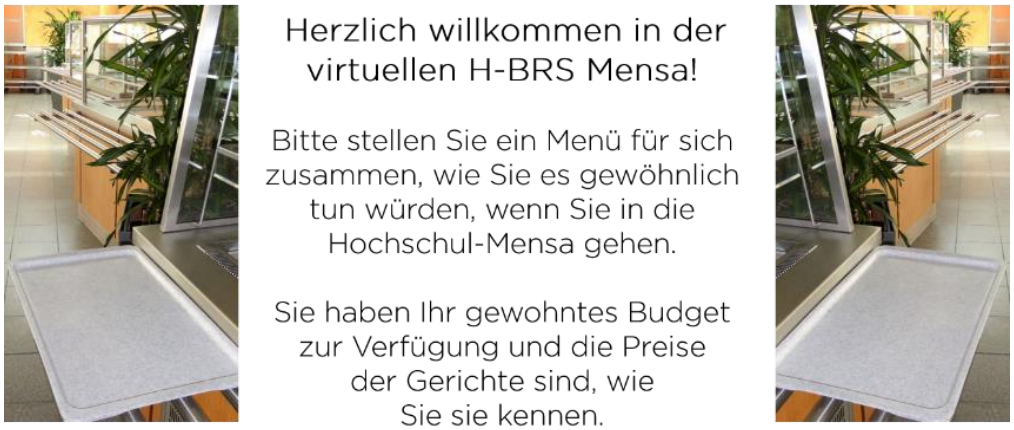

Figure 1. Online food choice scenario depicting the task of composing a typical meal as participants normally would. Participants were asked to imagine having their usual budget as well as the usual prices of the dishes).

Study Design and Procedure

Participants entered the virtual food choice scenario and were asked to compose a meal for themselves as they typically would when visiting the university cafeteria (Kiszko et al., 2014; Bleich et al., 2017). Participants were randomly assigned to one of three experimental conditions or a control condition. In the experimental conditions, the food choice scenario depicted one of three nudges: (1) thin male and female body shape, (2) thick male and female body shape, or (3) a thin, genderless Giacometti nudge (Figure 2).

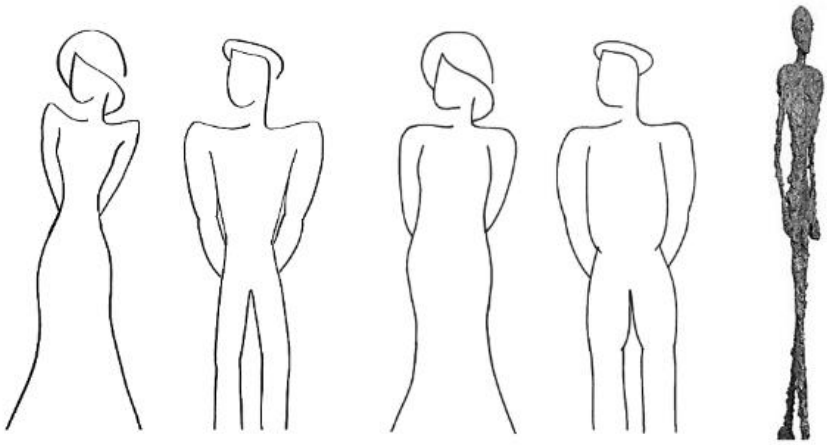

Figure 2. Nudges are shown in the different experimental conditions— from left to right, thin body shape nudge, thick body shape nudge, and Giacometti nudge.

The nudge was displayed on every page of the online experiment (Thaler & Sunstein, 2009). Congruent with an individual's manner of visual representation, the nudge was displayed in the left-hand corner of the screen (Romero & Biswas, 2016). In the control condition, the food choice scenario did not include a nudge, leaving the left-hand corner of the screen blank. Figure 3 displays the food choice scenario in the thin body shape nudge condition.

Figure 3. Example of the food choice scenario in the thin body shape nudge condition.

Based on prevalent research on food choice and nudging, we assessed different dependent variables: (1) the number of healthy dishes (e.g., salads and fruit salads) ordered, (2) the number of unhealthy dishes (e.g., chocolate pudding) ordered, and (3) the numbers of calories ordered (Brunner & Siegrist, 2012; Stämpfli et al., 2017; Stämpfli et al., 2016; Bauer & Reisch, 2019). The latter was calculated by assigning a caloric value to each ingredient of a dish and summing up these calorie counts. The caloric values were based on nutritional information from the German Food Association (Heseker & Heseker, 2019). The caloric values of one dish are as follows: salad has 54 kcal, fruit salad has 83 kcal, and the chocolate pudding has 188 kcal. Before the experiment, we consulted a certified nutritional expert (member of the Association of Oecotrophologen—VDOE e.V.), who categorized salad and fruit salad as healthy and chocolate pudding as unhealthy based on information of the German Food Association and the World Health Organization.

Questionnaire

After choosing the dishes, participants indicated whether they were students or employees. They stated their degree of hunger and their perceived importance of healthy eating on a 5-point scale (*not hungry at all–very hungry; not important at all–very important*). They reported their height (cm) and weight (kg). Furthermore, we assessed self-control with a 5-point scale (*disagree–agree*) using the German version of the *Brief Self-Control Scale* (Sproesser et al., 2011), consisting of 13 items (α = .87; Appendix A). Only in the experimental conditions did participants state their level of awareness of the nudge's presence (Veccio & Cavallo, 2019) (*strongly disagree–strongly agree*) and completed the *Intervention-elicited Reactance Scale*, measuring whether the exposure to an intervention caused psychological reactance (Ungar et al., 2015). This scale consisted of six items (α = .87) and used a 7-point scale (*strongly disagree–strongly agree*). To protect data privacy, participants' genders and ages were not assessed. As compensation, all participants had the option to be included in a lottery for one of two EUR 25 vouchers for a zero-waste store.

Data Analysis

To test hypotheses 1–3, we executed separate fourfold chi-squared tests on the frequencies of ordering a salad, fruit salad (healthy foods), and chocolate pudding (unhealthy food). In each analysis, we compared the differences in frequencies between the subsets of nudge conditions. These tests were performed separately for students and employees. For these analyses, we used a significance level of .05 and bootstrapping with 1000 bootstrap samples for the percentile bootstrap confidence intervals (confidence level of 95%).

To test hypothesis 4, we applied a mediation analysis using the PROCESS v 4.0 macro for SPSS (IBM Corp., Armonk, NY, USA), developed by Andrew F. Hayes. We analyzed participants in the three nudge conditions. Participants under the no-nudge control conditions were not exposed to a nudge, and did not rate nudge awareness; therefore, these participants were not included. In the analysis, the nudge condition represented the predictor; awareness of the presence of the nudge was the mediator; and the outcome was the number of calories consumed. When dealing with an independent variable that involves more than two categories, applying this variable as a multi-categorical variable is suggested (Hayes & Preacher, 2014). We used indicator coding to compare the Giacometti nudge condition to the thin and thick body shape nudge conditions, regarding their influence on the number of calories ordered, considering nudge awareness as a mediator. Here, we used a significance level of .05 and bootstrapping with 5000 bootstrap samples for the percentile bootstrap confidence intervals (confidence level of 95%). Missing values were deleted listwise. Data are available via Mendeley Data (Mendeley Data, 2021; accessed on 21 April 2021).

3.3 Results

Descriptive Statistics

We recruited a sample of N = 904 participants (n = 686 students; n = 218 employees). For the total sample, self-control, the importance of healthy eating (M = 4.07; SD = .79) and satisfaction with one's own weight (M = 3.48; SD = 1.45) could be described as rather high. The participants' hunger was intermediate (M = 2.85; SD = 1.28). The body mass index (BMI) lay within a normal range (M = 23.30; SD = 3.7) and was calculated from the participants' height and weight. The nudges barely elicited reactance within the participants of the experimental conditions (M = 2.13; SD = 1.15). These participants were rather aware of the presence of the nudge (M = 3.46; SD = 1.50). Table 1 provides an overview of the descriptive statistics per nudge condition, separately for students and employees. For both samples, no significant differences between the four conditions existed.

Due to data privacy reasons, we were not permitted to collect data on participants' gender and age. An overview of the cohorts was derived from the university's internal demographic statistics (internal unpublished document). The employee cohort (47.2% male, 51.8% female) consisted of the following age categories: 19–29 years (12.2%), 30–39 years (27.9%), 40–49

years (20.8%), 50–59 years (29.4%) and 60–68 years (9.7%). The student cohort consisted of 59.9% males and 40.1% females. The age categories were 17–24 years (71.5%), 25–30 years (22.1%), and older than 31 years (6.3%).

Table 1. Participant characteristics per nudge condition for students and employees.

	Students (*n* = 686)			
	Thin Body Shape Nudge (*n* = 167)	**Thick Body Shape Nudge (*n* = 170)**	**Giacometti Nudge (*n* = 176)**	**No Nudge (*n* = 173)**
BMI	22.97 (3.87)	22.83 (4.48)	22.67 (3.73)	22.62 (3.12)
Hunger[1]	2.92 (1.19)	2.87 (1.24)	2.83 (1.30)	2.81 (1.28)
Satisfaction with weight[1]	3.48 (1.25)	3.51 (1.15)	3.54 (1.15)	3.61 (1.01)
Importance of healthy eating[1]	3.94 (.91)	3.89 (.83)	4.05 (.82)	4.01 (.78)
Self-control[1]	3.28 (.58)	3.26 (.49)	3.27 (.54)	3.28 (.52)
Elicited reactance[2]	2.15 (2.10)	2.00 (.90)	2.08 (.94)	-
Nudge awareness[1]	3.36 (1.57)	3.65 (1.60)	3.77 (1.43)	-
	Employees (*n* = 218)			
	Thin Body Shape Nudge (*n* = 57)	**Thick Body Shape Nudge (*n* = 50)**	**Giacometti Nudge (*n* = 64)**	**No Nudge (*n* = 47)**
BMI	23.53 (3.19)	23.90 (3.40)	24.33 (3.57)	23.57 (4.20)
Hunger[1]	2.74 (1.34)	2.76 (1.14)	2.81 (1.37)	3.06 (1.34)
Satisfaction with weight[1]	3.42 (1.28)	3.40 (1.20)	3.32 (3.23)	3.57 (1.30)
Importance of healthy eating[1]	4.23 (.69)	4.14 (.86)	4.17 (.73)	4.09 (.69)
Self-control[1]	3.51 (.57)	3.57 (.42)	3.49 (.55)	3.49 (.39)
Elicited reactance[2]	2.20 (1.12)	2.13 (.84)	2.20 (.99)	-
Nudge awareness[1]	3.03 (1.49)	3.04 (1.67)	3.88 (1.23)	-

Note. [1]Scale from 1 to 5, with 5 indicating higher values; [2]scale from 1 to 7, with 7 indicating higher values; standard deviations in parentheses.

The Effects of The Three Nudges

To measure the effects of the three nudges, we conducted chi-square tests (Table 2). We expected the Giacometti nudge (hypothesis 1) and the thin body shape nudge (hypothesis 2) to result in more orders for salad and / or fruit salad and fewer for pudding compared to the no-nudge condition. The thick body shape nudge was expected to result in fewer orders for salad and / or fruit salad and more for pudding compared to the no-nudge condition (hypothesis 3).

For the students, the fourfold chi-squared tests revealed no significant differences regarding the frequency of ordering salad (p = .194), fruit salad (p = .160) or chocolate pudding (p = .869). Therefore, hypotheses 1–3 were not confirmed.

For the employees, the fourfold chi-squared tests revealed significant differences in the frequency of ordering a salad (χ^2 (3) = 8.570; p = .036). Participants in the Giacometti nudge condition ordered 11 more salad dishes than participants in the no-nudge condition, yielding 11.5% more salads ordered considering the total number of salads ordered under all

conditions (96 salads). Thus, hypothesis 1 was partially confirmed. No significant differences regarding the frequency of ordering fruit salad (p = .094) or chocolate pudding (p = .217) were found. Therefore, hypotheses 2 and 3 were not confirmed.

Table 2. Frequencies of the dishes ordered and inferential analyses for the students and employees.

	Students (n = 686)				
	Thin Body Shape Nudge (n = 167)	**Thick Body Shape Nudge (n = 170)**	**Giacometti Nudge (n = 176)**	**No Nudge (n = 173)**	**Chi-Squared Tests**
Salad	71_a (42.5%)	85_a (50.0%)	83_a (47.2%)	68_a (39.3%)	χ^2 (3) = 4.719; p = .194
Fruit salad	46_a (27.5%)	38_a (22.4%)	57_a (32.4%)	54_a (31.2%)	χ^2 (3) = 5.163; p = .160
Pudding	45_a (26.9%)	50_a (29.4%)	49_a (27.8%)	44_a (25.4%)	χ^2 (3) = .717; p = .869
	Employees (n = 218)				
	Thin Body Shape Nudge (n = 57)	**Thick Body Shape Nudge (n = 50)**	**Giacometti Nudge (n = 64)**	**No Nudge (n = 47)**	**Chi-Squared Tests**
Salad	22 (38.6%)	15 (30.0%)	35 (54.7%)	24 (51.1%)	χ^2 (3) = 8.570; p = .036
Fruit salad	22_a (38.6%)	11_a (22.0%)	28_a (43.8%)	15_a (31.9%)	χ^2 (3) = 6.399; p = .094
Pudding	9_a (15.8%)	10_a (20.0%)	6_a (9.4%)	11_a (23.4%)	χ^2 (3) = 4.447; p = .217

Note. $_a$subset of nudge conditions that does not differ significantly; percentages indicate the number of dishes chosen in regard to the number of dishes not chosen.

We were able to partially confirm hypothesis 1 for the employees in the Giacometti nudge condition regarding the number of orders of healthy food. They ordered 11.5% more salads than employees in the no-nudge condition. No significant results were found for the sample of students or the sample of employees regarding fruit salad and chocolate pudding.

The Mediator Effect of Nudge Awareness

We expected the participants' awareness of the nudge to mediate the effect of each nudge on the number of calories ordered. To assess the mediating effect of nudge awareness, we conducted a mediation analysis and found the following patterns. Firstly, nudge awareness differed between the three nudge conditions (Table 3). A post hoc analysis revealed that participants in the Giacometti nudge condition were more aware of the nudge than participants in the thin body shape nudge condition (p = .001). No differences in nudge awareness regarding the thick body shape nudge condition were found ($p_{Giacometti}$ = .127; p_{thin} = .402). Secondly, the three nudge conditions did not differ in terms of the number of calories they ordered (p = .962). Thirdly, a positive and significant correlation of r = .104 (p = .011) existed between nudge awareness and the number of calories ordered. The more aware the participants were of the nudge's presence, the more calories they ordered. Table 3 summarizes the number of calories consumed, the degree of nudge awareness for the three experimental conditions, and the F-values comparing the three conditions.

Table 3. Descriptive statistics for the number of calories ordered and nudge awareness were presented per experimental condition, as well as *F*-values comparing these conditions.

	Thin Body Shape Nudge (*n* = 194)	**Thick Body Shape Nudge (*n* = 188)**	**Giacometti Nudge (*n* = 209)**	***F***
Calories ordered	862.56 (366.47)	873.31 (403.22)	869.57 (389.06)	F (2, 588) = .038 p = .962
Nudge awareness[1]	3.32 (1.56)	3.56 (1.58)	3.87 (1.37)	F (2, 590) = 6.51 p = .002

Note. [1]Scale from 1 to 5, with 5 indicating higher awareness; standard deviations in parentheses.

Mediation analysis revealed the different relationships in the model. Firstly, both the thick and thin body shape nudges were significantly negatively related to nudge awareness, as compared to the Giacometti nudge (Table 4). Participants in the thick and thin body shape nudge conditions were less aware of the nudge than participants in the Giacometti nudge condition. Secondly, relative to the Giacometti nudge, both the thick and thin body shape nudges had no significant direct relationship with the number of calories ordered. Thirdly, nudge awareness had a significant and positive influence on the number of calories ordered. Maintaining constant nudge conditions, those participants who were more aware of the nudge also ordered more calories. Additionally, an indirect relationship relative to the Giacometti nudge existed between the thick and thin body shape nudges on the number of calories ordered via nudge awareness (ß = −8.131, 95% CI [−19.859 to −0.103]; ß = −14.703, 95% CI [−30.205 to −3.276], respectively). This shows that awareness acted as a mediator. In relation to participants in the Giacometti nudge condition, those exposed to the thick and thin body shape nudges were less aware of the nudge's presence and ordered more calories as a result. The main results of the mediation analysis are summarized in Table 4.

Table 4. Main results of the mediation analysis.

	Nudge Awareness	**Number of Calories Ordered**		
		Direct	**Indirect**	**Total**
	Coefficient (*SE*)	**Coefficient (*SE*)**	**Coefficient (*SE*)**	**Coefficient (*SE*)**
Constant	3.866 (.104)***	765.545 (48.757)***		869.569 (26.730)
X1 (Giacometti vs. thick)	−.302 (.151)*	11.871 (38.796)	−8.131 (5.137)	3.739 (38.844)
X2 (Giacometti vs. thin)	−.546 (.150)***	7.696 (38.780)	−14.703 (6.774)	−7.008 (38.526)
Nudge awareness[1]		26.907 (10.568)*		

Note. [1]Scale from 1 to 5, with 5 indicating higher values; *p < .05, ***p < .001.

Hypothesis 4 was confirmed: awareness of the nudge indirectly affected the number of calories ordered. Participants exposed to the thin or thick body shape nudges (compared to participants exposed to the Giacometti nudge) were less aware of the nudge, resulting in more calories ordered. Participants exposed to the Giacometti nudge (compared to participants exposed to the thin and thick body shape nudges) were more aware of the nudge, also resulting in more calories ordered. Considering the frequencies of healthy dishes ordered (Table 1), participants in the Giacometti nudge condition ordered more salads and fruit salads than participants in the other experimental conditions.

3.4 Discussion

This study aimed to explore the effect of three body shape nudges (Giacometti nudge, thin and thick body shape nudges) on healthy (salad and fruit salad) and unhealthy food (chocolate pudding) orders in a workplace setting, separately assessing two target groups (students and employees). Furthermore, we also analyzed the mediating effects of the awareness of a nudge's presence regarding the number of calories ordered.

The Giacometti nudge is an example of an effective technique for increasing healthy food consumption and decreasing unhealthy food consumption and purchasing (Brunner & Siegrist, 2012; Stämpfli et al., 2017; Stöckli et al., 2016; Stämpfli et al., 2020). For example, it increased healthy snack purchases at the university's vending machines by 37% compared to a control condition (Stöckli et al., 2016). In line with these results, we found that the Giacometti nudge increased the number of salad orders. Employees ordered 11.5% more salads than participants in the control condition.

Thus far, the Giacometti nudge has mainly been effectively applied to samples consisting of relatively older people, ranging between 35 and 49 years of age (Stämpfli et al., 2017; Stöckli et al., 2016). When applied to a much younger sample of 17-year-old school students, a thin body shape nudge based on the Giacometti nudge yielded no significant results (Kawa et al., 2022). Our results regarding the Giacometti nudge for the student sample were, likewise, insignificant. The Giacometti nudge appears to be more effective in older participants. A recent systematic review of nudges on dietary choices found that nudges are not equally effective for every target group (Schüz et al., 2021). This was in line with a nudge applied in a university cafeteria, decreasing healthy food choices in interns, whereas increasing healthy food choices in older employees (Bauer et al., 2021). Thus, a nudge found to be effective in a specific target group is not necessarily effective in another target group. Pre-existing preferences have been found to moderate nudge effectiveness, making certain individuals more susceptible than others to nudges (De Ridder et al., 2021). Employees and students may differ in their preferences regarding healthy eating, highlighting the need for further research regarding the susceptibility to nudges (De Ridder et al., 2021).

Research on thin and thick body shape primes may yield inconclusive results. In some studies, these primes increased healthy food consumption and decreased unhealthy food consumption, whereas other studies have reported an opposite pattern ((Manippa et al., 2019; Kawa et al., 2022; Campbell & Mohr, 2011; Döring & Wansink, 2017; Otterbring & Shams, 2019; Kroese et al., 2016). It has been argued that social comparison processes may occur when making dietary choices while in the company of other individuals (McFerran et al., 2010). The degree to which individuals compare themselves to a body shape prime, i.e., as being either thicker or thinner, blurs the effects of such primes. The present study found no significant nudge effects for the thin or thick body shape nudges—either among the employees or the students. We did, however, find rather large standard deviations for the number of calories ordered by individuals in the thin and thick body shape nudge conditions.

This implies that these nudges evoked a rather differentiated reaction in the participants. Our nudges were intended to encourage healthy eating behavior, but it is possible that the participants in the thin and thick body shape nudge conditions did not grasp this intention. It is also possible that the thin and thick body shape nudges were not perceived as particularly thin or thick, and therefore did not elicit the intended effect. Consequently, these two nudges did not have the intended effects.

The role played by the awareness of a nudge on its effectiveness has recently gained attention in research. The results are inconsistent (Stämpfli et al., 2017; Stämpfli et al., 2020; Kroese et al., 2016; Bauer et al., 2021; Wachner et al., 2020), and more research on this topic is necessary (Stämpfli et al., 2020; Bruns et al., 2018; Marchiori et al., 2017). The degree to which an individual is aware of a nudge has been suggested to impact its effectiveness (Stämpfli et al., 2017; Stämpfli et al., 2020; Bauer et al., 2021; De Ridder et al., 2021). In line with these studies, we found relative indirect nudge effects on the number of calories ordered via nudge awareness. Greater awareness of the Giacometti nudge resulted in ordering more calories by ordering more healthy dishes. Thus far, the Giacometti nudge has been classified as an automatic and unconscious type 1 nudge (Hansen & Jespersen, 2013; Brunner & Siegrist, 2012). We found it to be more effective when people were aware of its presence. Accordingly, we could also classify it as a type 2 nudge, exerting its influence via conscious cognitive processes. Although this finding is interesting, it also raises concerns. The more the participants were aware of this nudge, the more calories they ordered in healthy food. Ordering and later consuming more calories may lead to weight gain and health risks, even if these calories come from healthy food. The Giacometti nudge is therefore particularly interesting for individuals who want to eat more healthily, but neither want nor need to reduce their calorie consumption. In contrast, less awareness of the thin body shape nudge resulted in ordering more calories by ordering fewer healthy calories. This nudge is classified as an automatic and unconscious type 1 nudge (Hansen & Jespersen, 2013). Again, this finding raises concerns because participants ordered more calories and simultaneously selected less healthy food. In general, our results emphasize the diverse role that awareness may play in nudging, highlighted by the research so far (Stämpfli et al., 2017; Stämpfli et al., 2020; Kroese et al., 2016; Bauer et al., 2021; Wachner et al., 2020). They also stress that pre-existing preferences play a role in susceptibility to nudge effects (De Ridder et al., 2021). The Giacometti nudge should therefore be applied to individuals with the described pre-existing preferences.

Our findings provide useful practical implications for choice architects in the public food sector, as well as the food industry. The Giacometti nudge was effective in a virtual food choice setting, particularly for individuals who wanted to eat more healthily without reducing their calorie consumption. Virtual food choice settings already exist in many areas of daily life, for example, in online food delivery services, in restaurants using virtual food ordering via tablets or screens, or in pre-ordering systems in lunch cafeterias. Applying an effective nudge in such virtual food choice settings provides an opportunity to improve the food choices of customers easily and cost-effectively (Miller et al., 2016). As an example, cafeterias should set up a virtual

lunch ordering system in which individuals can conveniently order their lunch beforehand and pick it up at an arranged time. Portraying the Giacometti nudge saliently when individuals compose their meal online has the potential to improve food choices under conditions where an individual's pre-existing preferences are to eat healthily without counting calories. These preferences should be assessed by the lunch ordering system before ordering to ensure that the appropriate nudge is portrayed.

It is important to note that this study assessed online food choices, not actual food choices. Even though the food choice scenario was carefully designed, differences may exist between online and actual food choices; the unknown validity of virtual food choice settings needs to be considered (Mikkelsen et al., 2016). Due to the COVID-19 pandemic, we used an online setting instead of a field experiment setting. This online setting nevertheless created standardized conditions regarding nudges. Future studies should still also assess actual food choices and consumption. For data privacy reasons, we were not permitted to elicit participants' gender or age. Age differences may explain the equity effects found for students and employees. Both factors are known to influence eating behavior (Heuer et al., 2015), and should therefore be assessed in future studies. We did not manipulate awareness in the present study but assessed the degree to which participants perceived the nudge as a present. Further insight could be gained by including awareness as a separate factor in future studies.

3.5 Conclusions

Our results suggest that the Giacometti nudge has the potential to influence the ordering of healthier salads among university employees, especially when making individuals aware of its presence. However, it should not be applied as a one-size-fits-all nudge across different target groups, because equity effects may exist and pre-existing preferences in a target group can play a role in nudge effectiveness. The Giacometti nudge increased the number of calories ordered by ordering more healthy food when aware of it. Thus, it is particularly interesting for university employees who want to eat more healthily without reducing their calorie consumption. We found it to be effective in a virtual setting, which allowed for an easy and cost-effective application while paying attention to an individual's specific dietary goals and pre-existing preferences. These findings are particularly useful for choice architects in the public food sector and the food industry in general because they can be applied in any setting involving virtual food choices, such as online lunch ordering systems in cafeterias or online food delivery systems. In this way, choice architects have the opportunity to nudge and individualize healthier eating behaviors.

The results also show that awareness of a nudge plays an important, but ambivalent, role in its effectiveness. The Giacometti nudge was effective when individuals were more aware of its presence. We, therefore, classify the Giacometti nudge as a type 2 nudge (Hansen & Jespersen, 2013), contributing to the theoretical background of nudging. The role played by the awareness of a nudge appeared to vary across nudges, because the participants of the

thin body shape nudge condition were less aware of the nudge and still ordered more, but fewer healthy calories.

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Chapter 4

Are you “nudgeable”? Factors affecting the acceptance of healthy eating nudges in a cafeteria setting.

This chapter is based on Kawa, C., Gijselaers, W.H., Nijhuis, J.F.H., & Ianiro-Dahm, P.M. (2022). Are you “nudgeable”? Factors affecting the acceptance of healthy eating nudges in a cafeteria setting. *International Journal of Environmental Research and Public Health, 19*(7), 4107. https://doi.org/10.3390/ijerph19074107

Abstract

Research has identified nudging as a promising and effective tool to improve healthy eating behavior in a cafeteria setting. However, it remains unclear who is and who is not “nudgeable” (susceptible to nudges). An important influencing factor at the individual level is nudge acceptance. While some progress has been made in determining influences on the acceptance of healthy eating nudges, research on how personal characteristics (such as the perception of social norms) affect nudge acceptance remains scarce. We conducted a survey on 1032 university students to assess the acceptance of nine different types of healthy eating nudges in a cafeteria setting with four influential factors (social norms, health-promoting collaboration, responsibility to promote healthy eating, and procrastination). These factors are likely to play a role within a university and a cafeteria setting. The present study showed that key influential factors of nudge acceptance were the perceived responsibility to promote healthy eating and health-promoting collaboration. We also identified three different student clusters with respect to nudge acceptance, demonstrating that not all nudges were accepted equally. In particular, default, salience, and priming nudges were at least moderately accepted regardless of the degree of nudgeability. Our findings provide useful policy implications for nudge development by university, cafeteria, and public health officials. Recommendations are formulated for strengthening the theoretical background of nudge acceptance and the susceptibility to nudges.

4.1 Introduction

The interest in nudging as a health intervention to improve eating behaviors in individuals is increasing. About 70% (440 reports) of empirical evidence in the field of nudging has focused on dietary behavior (Hollands et al., 2013). Nudges change the decision-making context of an individual such that their behavior becomes more predictable. They facilitate choosing a certain preferred option by changing the environment in which the decision is made. Nudges neither change the incentives for making a specific decision nor forbid or remove a less preferred option. Thus, nudges can be conceived as changes in the environment that can take many different forms. They can be applied by any person responsible for creating a decision-making context (called choice architects) (Thaler & Sunstein, 2009). The dual-process theory of the mind can be considered as a theoretical background of nudging (Thaler & Sunstein, 2009; Tversky & Kahneman, 1974). Nudges can affect either our automatic information processing system (called system 1) or our deliberative system (called system 2). When using system 1, we make fast, intuitive, and automatic decisions. When using system 2, our decisions are slower, deliberate, and controlled (Thaler & Sunstein, 2009; Tversky & Kahneman, 1974). Positive effects of nudges on eating behavior have been found across the entire life span and in various settings (Arno & Thomas, 2016). Reports from 36 reviews and empirical studies showed positive results in 80% of these studies (Veccio & Cavallo, 2019). Others showed that nudging is a promising tool to increase healthy eating behaviors, specifically in cafeteria settings (Van Kleef et al., 2020; Pfannes et al., 2018). For example, nudging is associated with increased fruit consumption (r = .43) (Marcano-Olivier et al., 2019) or choosing healthy food options in 22% of university students (n = 104) visiting a cafeteria (Roy et al., 2015).

Despite the reported effectiveness of nudges on food consumption, many studies on nudging as an intervention to increase vegetable consumption in school-like settings showed weak effects or were of moderate methodological quality (Marcano-Olivier et al., 2019; Nørnberg et al., 2016a). Other researchers considered the effect sizes of nudges promoting healthy eating to be small (Cohen's d = 0.23) (Cadario & Chandon, 2020) or nudges to result in multi-directional effects (Hummel & Maedche, 2019). Nudge effectiveness also depends on the type of nudge (Laiou et al., 2021; Barker et al., 2021), suggesting that one-nudge-fits-all designs will fail to achieve population-broad objectives. For example, nudges applied in a cafeteria improved the eating behavior in employees but resulted in the opposite behavior in students. These mixed findings were attributed to differences in nudge acceptance. It was hypothesized that students did not accept the applied nudges as often as the employees did, resulting in more unhealthy food choices and yielding the nudge ineffective (Bauer et al., 2021). In this sense, nudge acceptance can be viewed as tolerating the nudge's influence on one's behavior. In summary, it remains unclear under which conditions nudges work and for whom they work (Hummel & Maedche, 2019; Van Gestel et al., 2020; De Ridder et al., 2020). Nevertheless, a higher nudge acceptance is associated with increased nudge effectiveness. As a consequence, researchers have called for more research on assessing the acceptance of nudge interventions

to gain more knowledge on the working mechanisms of a nudge and determine what makes a nudge effective (De Ridder et al., 2020).

In general, a majority of people accept healthy eating nudges (Cadario & Chandon, 2019) and thus tolerate the influence a nudge might have on their behavior. Most individuals also want to follow a healthy diet (Junghans et al., 2015). Between 57–71% (depending on the type of nudge) of a representative sample from the UK accepted healthy eating nudges (Reynolds et al., 2019). A representative German sample was described as being open to healthy eating nudges, with 51% of the respondents rating the concept of nudging as (very) positive. Specific nudge interventions, targeted at the general population, were accepted by 71% of the general German population (Krisam et al., 2021). Default nudges (e.g., pre-selecting a favorable option) were strongly accepted when applied in a cafeteria to promote healthy eating (Detlefsen et al., 2018). Research has shown that nudge acceptance is associated with nudge effectiveness (Pe'er et al., 2019). The variance in nudge acceptance, depending on the type of nudge, showed that certain nudges can be perceived as discomforting, manipulative, or coercive—thus being less acceptable (Yan & Yates, 2019). Without nudge acceptance, behavioral change is less likely to occur (Hagman, 2018). Hagman proposed a nudge acceptance model in which nudge acceptance is conceptualized as the conscious rating of a nudge as an intervention. In this model, several factors influence nudge acceptance, for example, the nudge technique (type of nudge) (Hagman, 2018). This means that the underlying working mechanisms of a nudge (whether system 1 or system 2 is activated by the nudge) can influence nudge acceptance. Nudge acceptance depends on several properties of a nudge: (1) whether a nudge biases a person to engage in a specific behavior or debiases a person from a behavior (bias or debias), (2) whether an individual can deduce the intention of the nudge as well as the means of behavioral change (transparency), (3) whether a nudge has societal motives or engages in cognitive or emotional information processing (social aspects), (4) whether a nudge will cause friction when implemented (ease of use). In this kind of research, nudge acceptance is directly linked to nudge effectiveness (actual behavioral change) (Hagman, 2018). We propose that a specific type of nudge that is highly accepted will be highly effective. In addition to the influential factors on nudge acceptance proposed by Hagman (2018), several other influences on nudge acceptance have been assessed so far: culture (Pe'er et al., 2019; Kaiser & Reisch, 2019), political opinions (Sunstein et al., 2017; Jung & Mellers, 2016), individual preferences and habits (Venema et al., 2019; Venema et al., 2020), disclosure of the nudge's purpose (Wachner et al., 2020; Cheung et al. 2019), and psychological factors such as personality traits (Jung & Mellers, 2016). Still, other influential factors such as personal characteristics may exist (Van der Molen et al., 2021; Mohr et al., 2019). Consequently, we argue that other influential factors on nudge acceptance exist as well.

The environment in which a person makes a decision is by definition especially important in nudging. Choice architects are the individuals who create the decision-making context in a specific setting (Thaler & Sunstein, 2009). Thus, they have the opportunity to construct a specific environment in which nudges as well as certain factors promoting health behavior can

be applied. A university cafeteria is an environment in which students meet, gather, eat together, and socialize. In this setting, choice architects have the opportunity to create a context in which, for example, social norms of eating healthily are salient in order to foster healthy eating. Social norms provide guidelines on what kind of behavior is expected by other individuals in a certain situation (Bauer & Reisch, 2019). According to Hagman's nudge acceptance model, the social aspects of nudging affect nudge acceptance (Hagman, 2018). Research has shown that perceiving the strong social norms of healthy eating imposed by one's immediate surroundings increased the acceptance of healthy eating nudges in a cafeteria (Nørnberg et al., 2016b). Because social norms provide guidelines for appropriate behavior, nudges employing the social norms of healthy eating as a working mechanism were found to influence and improve food choices in a systematic review study (Bauer & Reisch, 2019). Despite this positive finding, other studies on these social norm nudges found mixed results. A recent quantitative review found 12 studies on social norm nudges within the health context. This review stated that in 29% of the reviewed cases social norm nudges effectively improved health behavior (Hummel & Maedche, 2019). Based on reviews and empirical studies, we propose that nudges based on social norms have the potential to influence nudge acceptance as well as an individual's eating behavior, but more research is needed. We tested the following hypothesis: (H1) perceived social norms of eating healthy have a positive influence on nudge acceptance.

Next to social norms, health-promoting collaboration is another possible influencing factor on nudge acceptance and effectiveness. Health-promoting collaboration is defined as an environment in which all individuals are highly committed to values involving and fostering health. All relevant individuals in this given environment share this commitment and collaborate on it (Komp et al., 2022). The concept of health-promoting collaboration is in line with the principles of a Health Promoting University (HPU) laid out in the Okanagan Charter (Suárez-Reyes et al., 2019). The aim of an HPU initiative is to incorporate health into the culture, policies, and processes of a university, for example by creating healthy environments and promoting well-being (Suárez-Reyes et al., 2019). This focus on the environment makes the combination of health-promoting collaboration and nudging an interesting research topic. Thus far, health-promoting collaboration has not yet been researched in the context of nudging but has been found to be associated with paying attention to one's own health in a workplace context (Komp et al., 2022). In a university setting, choice architects can also apply this factor purposely. Both social norms and health-promotion collaboration focus on sharing beliefs and values on a specific topic in a given situation. While social norms are imposed externally by the immediate context in which a person acts, health-promoting collaboration focuses on collegial collaboration and shared norms and values. More explicitly, the influence of social norms stems from the external surroundings of an individual. Other individuals dictate what kind of behavior is appropriate in the given situation. Health-promoting collaboration is more about the internal beliefs and values of an individual that are shared with others in a given setting. It is also about reciprocal mindfulness and encouragement in order to promote health-oriented behavior in oneself and others (Komp et al., 2022). Similar

to social norms, health-promoting collaboration creates an environment in which the appropriate behavior is obvious: specifically, an environment in which health plays an important role. This environment is created by the university itself and also by other social groups existing within the university. Therefore, it is possible that health-promoting collaboration can vary within the same general setting. We propose that health-promoting collaboration is likely to affect the acceptance of healthy eating nudges. We tested the following hypothesis: (H2) health-promoting collaboration has a positive influence on nudge acceptance.

Since choice architects within a university and cafeteria setting create the environment in which food decisions are made, they also have a certain degree of responsibility to create an optimal environment for their students and customers. Individuals can differ in the degree to which they feel that a choice architect in a cafeteria and university is responsible or obligated to arrange the environment to promote healthy eating. This perceived responsibility or obligation of a cafeteria or university was found to increase nudge acceptance in a previous study (Nørnberg et al., 2016b). The more a person perceived cafeteria and university officials as responsible for promoting healthy eating, the more this person accepted healthy eating nudges. Recent research in nudging has focused on the importance of transparency. Knowing the source of a nudge (and thus who applies it) was found to be important in nudge acceptance (Hagman, 2018; Felsen et al., 2013) and effectiveness (Hagman, 2018; Kroese et al., 2015). We tested the following hypothesis: (H3) perceived responsibility of a university or cafeteria to promote healthy eating has a positive influence on nudge acceptance.

Thus far, individual psychological factors such as personality traits have rarely been assessed in the nudging context (Jung & Mellers, 2016). The research focus is often limited to aspects of the nudge itself or to the choice architects applying the nudge (Van Gestel et al., 2021). Individual psychological factors should be considered when designing nudges (Mohr et al., 2019), for example, by making certain options in a decision-making context more accessible (Thaler & Sunstein, 2009). Certain psychological factors such as an individual's autonomous motivation have been associated with nudge acceptance, revealing that individuals are more likely to accept nudges that target behavior for which they show autonomous motivation (Van Gestel et al., 2021). Other psychological factors such as procrastination have not yet been researched regarding nudge acceptance. Procrastination is the tendency to postpone unwanted or detested tasks to the furthest possible point in time instead of executing them immediately or in a timely manner. This behavior can occur in different aspects of an individual's life. It often arises within a university context where it is expressed in postponing study-related tasks (Glöckner-Rist et al., 2014; Haghbin & Pychyl, 2016). Procrastination is also prevalent when engaging in health-related behaviors, often resulting in negative consequences for the quality of the task and the person's well-being (Glöckner-Rist et al., 2014). Procrastination is one reason why nudges are necessary, because their effortless impact facilitates making certain preferred choices (Thaler & Sunstein, 2009). Therefore, nudges can counteract procrastinating behavior and prevent the negative effects of procrastination from occurring. Thus far, procrastination has been negatively associated with

the intention to engage in health behaviors (Sirois, 2004). Furthermore, it was linked to poorer health in students (Sirois et al., 2003) and poorer eating behavior such as dieting (Haghbin & Pychyl, 2016). Individuals who procrastinate are likely to benefit from nudges and are more likely to accept nudges because they perceive them as helpful facilitators to circumvent their procrastination. We therefore propose the following hypothesis: (H4) a tendency to procrastinate has a positive influence on nudge acceptance.

Research has shown that nudge effectiveness and acceptance are influenced by certain factors. Most recently, attention has also been paid to the so-called equity effects of nudges. Equity effects in nudging mean that not all individuals benefit equally from one specific nudge (Damgaard & Nielsen, 2017). Regarding nudge effectiveness, a recent systematic review of 38 studies found that healthy eating nudges have differential effects on different target groups. In this review, 30.4% of the nudges created a more positive outcome for individuals that were socioeconomically advantaged compared to individuals that were socioeconomically disadvantaged (Schüz et al., 2021). In addition, a specific nudge that had been effectively applied to improve eating behavior in middle-aged samples was ineffective in young adults (Kawa et al., 2021a). A similar healthy eating nudge applied in an online cafeteria setting was effective for employees but not for students (Kawa et al., 2021b). The cause of these differential effects is unclear. Possibly, they are caused by personal characteristics (Van der Molen et al., 2021). Research has also shown that the effectiveness of nudges varies in terms of their underlying mechanisms (Van Gestel et al., 2021). In nudge development, the underlying working mechanisms of nudges are often based on the so-called MINDSPACE framework (Dolan et al., 2012). This framework summarizes nine different working mechanisms: messenger (paying more attention to given information because its messenger is perceived as credible), incentives (providing information on the costs and benefits of certain behavior), norms (portraying socially accepted behavior in a given situation), default (providing a specific pre-selected choice), salience (making certain behavior more visible and salient), priming (making certain knowledge more accessible), affect (conveying a certain emotion), commitment (making an individual commit to something), and ego (conveying a positive and consistent self-image) (Dolan et al., 2012). Nudges that combined priming and salience effects as working mechanisms were found to be the most effective types of nudges in a systematic review on healthy food and beverage nudges (Wilson et al., 2016). These findings showed that a one-size-fits-all approach for nudging is ineffective (Schüz et al., 2021; Harbers et al., 2021). However, the potential differential effects of nudging have not been fully (Van der Molen et al., 2021). Thorough knowledge of a nudge's target group is helpful in nudge development. Personalizing nudges to meet the needs of the target group can increase nudge acceptance and, consequently, nudge effectiveness (Yan & Yates, 2019; Jung & Mellers, 2016). Nudge acceptance is linked to nudge effectiveness (Pe'er et al., 2019; Hagman, 2018), thus making it more likely that a person is influenced by the nudge. To make nudges more effective, research on the susceptibility to nudges (nudgeability) and a systematic grouping of the influential factors of nudge effectiveness are called for (De Ridder et al., 2021). To draw conclusions on nudgeability (susceptibility to nudges) regarding healthy eating nudges, we

propose the following research questions: Can we identify groups of individuals that vary in their degree of nudge acceptance—and are thus more or less nudgeable? Do groups varying in their degree of nudgeability differ regarding influential factors such as social norms, health-promoting collaboration, responsibility, and procrastination?

The theoretical background on nudging has been criticized for being imprecise and for lacking a robust framework (Vlaev et al., 2016). It also remains unclear under which conditions nudges work and for whom they work (Hummel & Maedche, 2019; Van Gestel et al., 2020; De Ridder et al., 2020), while more research on assessing the acceptance of nudge interventions as well as nudgeability is called for (De Ridder et al., 2020; De Ridder et al., 2021). It is important to investigate who is and who is not nudgeable, to determine which individuals will benefit from nudge implementation (Van Gestel et al., 2021). Certain influences on nudge acceptance have been researched, some with mixed results (Bauer & Reisch, 2019) and others that have not yet been assessed even though they should be considered given previous research findings (Mohr et al., 2019). Therefore, this study aims at providing more insight into the acceptance of different types of nudges and on finding factors that influence nudgeability. (1) We assessed the effect of several potential influencing factors on the acceptance of different types of healthy eating nudges: social norms, health-promoting collaboration, responsibility, and procrastination. These influencing factors are likely to arise in a university and cafeteria setting. (2) We aimed at gaining more knowledge on what makes a person more or less nudgeable by clustering individuals together. The clusters were based on individual nudge scores, and we compared them regarding several influential factors. To this end, we assessed nine different types of nudges to draw conclusions on which type of nudge is suitable for more or less nudgeable individuals. We drew practical implications for developing healthy eating nudges to be applied in a university and cafeteria. Identifying further influential factors on nudge acceptance that have not yet been researched or have shown mixed results in previous studies provides useful information for the theoretical background on nudging.

4.2 Materials and Methods

Study Design and Procedure

Data were collected from 4 October to 7 December 2021 using an online questionnaire. All (*N* = 9526) students at a German university of Applied Sciences were invited via e-mail to participate in a student health survey assessing their health status and possible influential factors on their health (convenience sampling).

All participants were informed about the purpose of the study and personal data security. They actively gave their consent in order to participate. The present study is part of a larger research project which was approved by the ethical committee of the University of Bonn (sequence number 086/19) and is in line with the ethical standards of the Declaration of Helsinki. This research project's general aim is to assess the health and well-being of the university's students and employees as well as to compose health interventions and to offer

programs to improve the health and well-being of these individuals in different areas. As compensation, all participants had the option to be included in a lottery for various health-related products (such as a yoga mat).

Measures

Nudge Acceptance

Thus far, no commonly used tool exists to measure nudge acceptance (Krisam et al., 2021). Nørnberg and colleagues (Nørnberg et al., 2016b) proposed a scale for assessing nudge acceptance that we adapted for the present study and translated into German (see Appendix A). They validated it using factor analysis and reliability analysis. The factor structure showed high eigenvalues and a very good Cronbach's α of .848 for the overall nudge acceptance. The scale by Nørnberg and colleagues (Nørnberg et al., 2016b) was carefully developed based on the MINDSPACE framework often used in nudge development (Nørnberg et al., 2016b). In this framework, 9 different underlying working mechanisms for nudging are described: messenger, incentives, norms, default, salience, priming, affect, commitment, and ego (Dolan et al., 2012). Nørnberg and colleagues utilized this framework to construct 10 items—each item assessing the acceptance of a different type of nudge. Their types of nudges each rely on the 9 working mechanisms proposed in the MINDSPACE framework, while the incentive working mechanism is represented in 2 nudges (Nørnberg et al., 2016b; Dolan et al., 2012). We adapted this nudge acceptance scale further by using the first eight types of nudges (messenger, incentive 1, incentive 2, norms, default, salience, priming, and affect) and added a ninth type (priming and salience). We added this ninth nudge because this type of nudge had been previously applied to the population of the present study in an online experiment (Kawa et al., 2021b). In addition, a combination of priming and salience effects in nudging were found to be very effective (Wilson et al., 2016). The original English scale as well as our German translation are shown in Appendix A. For each individual nudge, participants were asked to indicate their level of agreement to different healthy eating interventions in a university's cafeteria on a 5-point scale (from agree to do not agree). Higher values indicated less nudge acceptance. Each healthy eating intervention represented a different type of nudge. To prevent any order effects, we randomized the order in which the nudges were presented to the participants. No instructions for answering the items on nudge acceptance were provided by Nørnberg and colleagues (Nørnberg et al., 2016b). Because Germans are not very familiar with the concept of nudging (Krisam et al., 2021), we described the nudges as healthy eating interventions (Appendix A).

Factor Influencing Nudge Acceptance

Social norms. We asked the participants to indicate the degree to which their own vegetable intake was influenced by friends and family (social norms) using three items (Nørnberg et al., 2016b). Participants answered on a 5-point scale (from agree to do not agree). Lower values indicated a higher level of perceived social norms. The items were formulated by Nørnberg and colleagues and showed an acceptable Cronbach's α of .659 (Nørnberg et al., 2016b). We

translated these items into German. See Appendix A for the English original and the German translation.

Health-promoting collaboration. Health-promoting collaboration focuses on the role played by health within the university among colleagues regarding health perception and health relevance. This scale was developed based on the Health-Oriented Leadership Questionnaire (Pundt et al., 2017) and translated into German (Komp et al., 2022). Originally, it consisted of 11 items showing a good Cronbach's α of .860. Participants answered on a 5-point scale (from does not apply at all to completely applies) (Komp et al., 2022). For time–economic reasons, we included six items. Each item represented a subscale of health-promoting collaboration: (1) self-care value, (2) self-care awareness, (3) self-care behavior, (4) fellow-student-care value, (5) fellow-student-care awareness, and (6) fellow-student-care behavior. Self-care describes how individuals deal with their own health in respect to others. Fellow-student-care comprises how individuals deal with others regarding health aspects. High values in health-promoting collaboration mean that a strong collegial collaboration at the university exists, where students focus on values, awareness, and behavior surrounding the health and well-being of themselves as well as others (Komp et al., 2022).

Responsibility to promote healthy eating. We assessed the participants' attitudes toward a cafeteria's or university's responsibility in promoting their health using the item: I think it is the school's or the canteen's obligation to try and improve my vegetable intake. Participants answered our German translation on a 5-point scale (from agree to do not agree); thus, lower values indicated a higher level of perceived responsibility. This item was formulated by Nørnberg and colleagues (Nørnberg et al., 2016b). Originally, they assessed responsibility using two oppositely coded items (see Appendix A) with a good Cronbach's α of .725.

Procrastination. Procrastination describes the behavior of completing unwanted, unpleasant, or even despised tasks later rather than in the present moment. We used the Prokrastinationsfragebogen für Studierende (PFS), which specifically focuses on student procrastination within a university setting. The PFS is validated with an acceptable reliability based on factor loadings. It was measured *using four items on a 5-point scale (from almost never to almost always). Higher values repres*ented a proneness to procrastinating study-related tasks within a university setting (Glöckner-Rist et al., 2014).

Demographics

Participants indicated their gender as female, male or diverse. Age was assessed using the categories 17–24, 25–30, and 31 years or older. Participants were also asked to indicate the department of their studies (Computer Science; Electrical Engineering, Mechanical Engineering and Technical Journalism; Natural Sciences; Management Sciences; Social Policy; and Social Security Studies) and whether they were in a bachelor's or master's program.

Sample

The population of students at the university where the study took place consisted of *N* = 9256 students. Of these students, *n* = 1047 completed the questionnaire, yielding a response rate of 11%. After removing participants because of missing values, *n* = 1036 students remained. We further identified four outliers in the sample regarding the nudge acceptance. The final sample consisted of *n* = 1032 participants (60.3% females; 38.9% males; .8% diverse). Of the participants 71.8% were 17–24 years old, 22.0% were 25–30 years old, and 6.1% were 31 years or older. The participants were distributed among the different departments as follows: 14.4% in Computer Science, 20.2% in Electrical Engineering, Mechanical Engineering, and Technical Journalism, 17.9% in Natural Sciences, 37.3% in Management Sciences, and 10.3% in Social Policy and Social Security Studies. Of the participants, 83.3% were studying to receive a bachelor's degree and 16.7% were studying to receive a master's degree. Considering the population of students in the present study, our sample can be described as representative in terms of their pursuit of either a bachelor's or a master's degree. Compared to the overall population, our sample was slightly younger. More female than male students participated in the study, while the overall population consisted of more male than female students. The Computer Science Department was slightly under-represented in our sample. The assessment of representativeness was based on the university's internal demographic statistics (internal unpublished document).

Data Analysis

We calculated an overall nudge acceptance mean based on the acceptance of the nine types of nudges. To test our hypotheses, we conducted multiple regression analyses on the overall nudge acceptance using forced entry ("enter" in terms of SPSS) as a method. In this way, all factors (social norms, health-promoting collaboration, responsibility, and procrastination) are forced into the model simultaneously not determining any order (Field, 2018). We also assessed the effect of the influential factors on each type of nudge in nine separate multiple regression analyses.

To identify individuals that could be grouped together based on their individual nudge acceptance scores on each of the nine nudges, we conducted several cluster analyses following a recommended approach (Field, 2018; Hair et al., 2014; Clatworthy et al., 2005). First, we prepared our data by recoding the nudge acceptance rating of each nudge, social norms, and responsibility (5 now indicating higher values). Second, to determine the number of clusters, we randomly split the sample into two groups and conducted a hierarchical cluster analysis applying Ward's method for both groups separately (Hair et al., 2014). As a similarity measure, we used the squared Euclidean distance (SED), which is commonly used in the field of health psychology (Clatworthy et al., 2005). Third, we conducted a non-hierarchical cluster analysis (k-means algorithm, dictating the number of clusters), providing a more accurate cluster membership. To determine any difference for the influential factors between clusters we used multiple variate analyses and Bonferroni post hoc tests.

For all the analyses, we used SPSS v. 28 (IBM SPSS Statistics for Windows, Version 28.0. Armonk, NY, USA: IBM Corp), applied a significance level of .05, and deleted missing values listwise.

4.3 Results

Descriptive Statistics

The overall nudge acceptance was moderate, while acceptance of the individual nudges varied. Default, priming, salience, and affect nudges showed a high acceptance rate. The acceptance rates for the messenger and incentive 2 nudges were moderate, while the norms nudge, the incentive 1 nudge, and the priming and salience nudge were less accepted. Standard deviations were large, indicating that individuals varied in their nudge acceptance. Table 1 summarizes the descriptive statistics for nudge acceptance and reports an acceptable Cronbach's α reliability. The default, priming, and salience nudges showed rather high acceptance ratings. The affect and incentive 2 nudges had a moderate acceptance, while acceptance for the norms, incentive 1, and priming and salience nudges was low.

Table 1. Descriptive statistics of nudge acceptance.

Nudge Acceptance	*M* (*SD*)	Cronbach's α
Overall nudge acceptance scale	2.87 (.72)	.741 (9)
Messenger nudge	3.43 (1.35)	-
Incentive nudge 1	3.63 (1.37)	-
Incentive nudge 2	3.45 (1.39)	-
Norms nudge	3.57 (1.39)	-
Default nudge	1.79 (1.14)	-
Salience nudge	1.89 (1.10)	-
Priming nudge	1.86 (1.14)	-
Affect nudge	2.28 (1.21)	-
Priming and salience nudge	3.96 (1.27)	-

Note. All items were measured on a scale from 1 to 5, with 1 indicating higher values; standard deviations and number of items in parentheses; *n* = 1031.

Social norms regarding healthy eating were perceived to be moderate. The same was true for the time pressure. The responsibility of the cafeteria or university to promote healthy eating was perceived as high. Participants indicated a moderate health status compared to their peers as well as moderate health-promoting collaboration. They rated healthy eating as important to them. Participants viewed themselves as self-efficient, while work engagement and procrastination were moderate. Table 2 summarizes the descriptive statistics for the influential factors and reports questionable to excellent Cronbach's α reliability.

Table 2. Descriptive statistics of the influential factors.

Factor	*M* (*SD*)	Cronbach's α
Social norms [1]	2.92 (.83)	.610 (3)
Responsibility [1]	3.50 (1.20)	-
Health-promoting collaboration [2]	3.17 (.62)	.641 (6)
Procrastination [2]	2.78 (1.17)	.925 (4)

Note. [1] Scale from 1 to 5, with 1 indicating higher values; [2] scale from 1 to 5, with 5 indicating higher values; standard deviations and number of items in parentheses.

Influences on Nudge Acceptance

The Influence of Social Norms, Health-Promoting Collaboration, Responsibility, and Procrastination on Overall Nudge Acceptance

To test our hypotheses, we conducted a multiple regression analysis on the overall nudge acceptance (Table 3). We proposed that social norms (H1), health-promoting collaboration (H2), responsibility (H3), and procrastination (H4) have a positive influence on nudge acceptance. All variance inflation factors (VIFs) were between 1.02 and 1.05, indicating no multicollinearity. Social norms did not have a significant influence on overall nudge acceptance, even though the *p*-value was very close to reaching significance. We reject hypothesis H1. Furthermore, the analysis revealed health-promoting collaboration and responsibility as significant influences on overall nudge acceptance. The significant positive influence of responsibility on overall nudge acceptance means that the more the participants perceived a cafeteria or university to be responsible for promoting health, the higher was the overall nudge acceptance. H2 can be confirmed. Lower values on the nudge acceptance scale indicate a higher nudge acceptance. Accordingly, the significant negative influence of health-promoting collaboration on overall nudge acceptance means that the more health-promoting collaboration the participants perceived, the more they accepted nudges. Therefore, H3 can be confirmed. Procrastination did not have an influence on overall nudge acceptance, and we reject hypothesis H4. The model explains 16.9% of the variance in overall nudge acceptance.

Table 3. Multiple regression of the overall nudge acceptance.

Influential Factor	*b*	*ß*	*p*	R^2
Constant	2.31 (.17)		<.001	.169
Social norms [1]	.05 (.03)	.06	.053	
Health-promoting collaboration [2]	−.11 (.03)	−.10	<.001	
Responsibility [1]	.23 (.02)	.38	<.001	
Procrastination [2]	−.01 (.02)	−.01	.700	

Note. [1] Scale from 1 to 5, with 1 indicating higher values; [2] scale from 1 to 5, with 5 indicating higher values; standard errors in parentheses.

The Influence of Social Norms, Health-Promoting Collaboration, Responsibility, and Procrastination on the Acceptance of Nine Different Types of Nudges

We performed separate multiple regression analyses on the acceptance of each type of nudge to gain more detailed information (Table 4). These analyses revealed the perceived responsibility (by the participants) of a cafeteria or university to promote healthy eating to be

a significant and positive influential factor on the acceptance of each type of nudge. Health-promoting collaboration was revealed to be a mediocre influence on nudge acceptance. The stronger the health-promoting collaboration was, the more likely three out of nine nudges (incentive 2, default, and salience) were accepted. Social norms and procrastination were weak influencing factors on nudge acceptance, as they only significantly influenced the acceptance of one out of nine nudges (social norms influenced incentive 1 nudge; procrastination influenced priming and salience nudge). The variance of acceptance explained for each type of nudge ranged from 3.1% (priming and salience) to 9.2% (norms).

Table 4. Multiple regression analyses results of influential factors on the acceptance of each nudge.

Influential factor	Nudge								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Social norms	-	.10*	-	-	-	-	-	-	-
Health-promoting collaboration	-	-	−.15 *	-	−.14*	−.26***	-	-	-
Responsibility	.22***	.20***	.31***	.32***	.23***	.13***	.21***	.26***	.17***
Procrastination	-	-	-	-	-	-	-	-	−.07*
R^2	.050	.042	.090	.092	.064	.055	.062	.077	.031

Note. 1 = messenger, 2 = incentive 1, 3 = incentive 2, 4 = norms, 5 = default, 6 = salience, 7 = priming, 8 = affect, 9 = priming and salience; * $p < .05$, *** $p < .001$.

Identifying Groups of Nudgeable Individuals

To answer our research question of whether we can identify groups of individuals varying in their degree of nudge acceptance (nudgeability), we conducted a cluster analysis. First, we randomly split the sample into two subsamples to determine the number of groups. For each subsample, we executed a hierarchical cluster analysis using Ward's method. In these analyses, only those who rated all nine types of nudges (n = 981) were included. Based on the squared Euclidean distance (SED) coefficients in the agglomeration schedule for both samples (subsample 1: n = 488, SED 5 = 4498.73, SED 4 = 4710.87, SED 3 = 4961.11, SED 2 = 5355.70, SED 1 = 6906.79; subsample 2: n = 493, SED 5 = 4685.22, SED 4 = 4918.15, SED 3 = 5289.91, SED 2 = 5745.16, SED 1 = 6951.66), we decided to set the number of groups at three.

Next, we performed a k-means non-hierarchical cluster analysis (20 iterations) to assign cases to the three groups. This analysis reached the three-cluster solution after 14 iterations. All nine nudge ratings contributed highly and significantly to the clustering process (all $p < .001$). The three groups were characterized as follows (Table 5). The first group was characterized by low scores on all types of nudges. It was especially unresponsive to the messenger, incentive 1, incentive 2, and norms nudges, as well as priming and salience nudges (*un-nudgeable*). The second group was characterized by high scores on all types of nudges, indicating a high responsiveness to all types (*nudgeable*), especially the default, salience, priming, and affect nudges. The third group was mixed in their nudge acceptance (*conditionally mixed nudgeable*). It included high scores for the same nudges as the high nudge acceptance group (default, salience and priming) and lower scores for the same nudges as the low nudge acceptance group (messenger, incentive 1, incentive 2, and norms).

Table 5. Descriptive statistics for the acceptance of the nudge types per cluster.

Type of Nudge	Un-nudgeable (*n* = 184)	Conditionally Mixed Nudgeable (*n* = 459)	Nudgeable (*n* = 338)
Messenger nudge	1.55 (.84)	2.40 (1.21)	3.37 (1.28)
Incentive nudge 1	1.61 (.99)	1.87 (1.03)	3.44 (1.27)
Incentive nudge 2	1.69 (.92)	2.09 (1.09)	3.58 (1.15)
Norms nudge	1.77 (1.04)	1.78 (.96)	3.66 (1.19)
Priming and salience nudge	1.47 (.85)	1.62 (.93)	2.92 (1.38)
Default nudge	3.22 (1.45)	4.47 (.87)	4.42 (.94)
Salience nudge	2.98 (1.24)	4.30 (.88)	4.49 (.83)
Priming nudge	2.80 (1.37)	4.43 (.76)	4.48 (.81)
Affect nudge	2.50 (1.18)	3.83 (1.07)	4.26 (.89)

Descriptive statistics for the three groups of nudgeable individuals are shown in Table 6. The un-nudgeable group was the smallest cluster and included slightly more female than male students. Most students were 17–24 years old, while only a few students were 31 years or older. The nudgeable group was the second largest cluster and included slightly more female than male students. The majority of students were 17–24 years old, while only a small percentage of students were 31 years or older. The conditionally mixed nudgeable group was the largest of the three clusters, with more female than male students. The largest proportion of students was 17–24 years old, while only a few students were 31 years or older.

Table 6. Demographic information on the clusters.

		Un-nudgeable (*n* = 184)	Conditionally Mixed Nudgeable (*n* = 459)	Nudgeable (*n* = 338)
Gender	Female	98 (53.3%)	306 (66.7%)	184 (54.4%)
	Male	84 (45.7%)	147 (32.0%)	152 (45.0%)
	Diverse	2 (1.1%)	5 (1.1%)	1 (.3%)
Age	17-24 years	120 (65.2%)	341 (74.3%)	240 (71.0%)
	18-30 years	48 (26.1%)	95 (20.7%)	75 (22.2%)
	31 years / older	16 (8.7%)	21 (4.6%)	23 (6.8%)

We found significant differences between the three groups regarding social norms, health-promoting collaboration, and perceived responsibility (by the participants) of the university or cafeteria to promote healthy eating behavior (multivariate analyses in Table 7). Bonferroni post hoc tests further distinguished differences between the groups. The differences between the three groups for social norms and health-promoting collaboration were caused by a significant difference between the nudgeable and un-nudgeable groups. The nudgeable group perceived stronger social norms and a stronger health-promoting collaboration than the un-nudgeable group. All three groups differed significantly in their perceptions of the responsibility a university or cafeteria has to promote healthy eating. The nudgeable group perceived the cafeteria or university to be more responsible for promoting healthy eating than did the other two groups. The same was true when comparing the conditionally mixed nudgeable and un-nudgeable groups. The three groups did not differ in procrastination.

Table 7. Descriptive statistics for the three clusters, as well as *F*-values comparing these statistics.

Construct	Un-nudgeable (*n* = 184)	Conditionally Mixed Nudgeable (*n* = 459)	Nudgeable (*n* = 338)	*F* (2, 957)
Social norms [1]	2.87 (.82)	3.09 (.84)	3.18 (.81)	8.70, *p* = < .001
Health-promoting collaboration [1]	3.05 (.69)	3.18 (.60)	3.24 (.61)	5.32, *p* = .005
Responsibility [1]	1.82 (.96)	2.41 (1.11)	3.02 (1.20)	70.54, *p* = < .001
Procrastination [1]	2.83 (1.20)	2.74 (1.18)	2.83 (1.13)	.71, *p* = .493

Note. [1] Scale from 1 to 5, with 5 indicating higher values; standard deviations in parentheses.

We concluded that students could be grouped into three different groups based on their nudge acceptance of the nine different types of nudges. While the nudgeable and un-nudgeable groups were united in their high or low acceptance ratings of the different nudges, the conditionally mixed nudgeable group was divided. This cluster accepted certain types of nudges, while others were less accepted. In differentiating further between these clusters, the factors of overall nudge acceptance, perceived responsibility for a university or cafeteria to promote healthy eating, social norms, and health-promoting collaboration were especially relevant. The nudgeable group scored the highest on these factors, while the un-nudgeable group scored the lowest. Procrastination did not play a role.

4.4 Discussion

This study had two specific aims: (1) explaining the acceptance of healthy eating nudges in a university cafeteria setting using different factors that were likely to arise there; (2) determining what makes a person more or less nudgeable (susceptible to nudges). We found overall nudge acceptance to be moderate among subjects and it varied from nudge to nudge. Acceptance of the default, priming, salience, and affect nudges was high. These acceptance levels can be expected based on previous findings on nudge effectiveness of these types of nudges (Wilson et al., 2016). The messenger and incentive 2 nudges were moderately accepted, while acceptance of the norms, incentive 1, as well as priming and salience nudges was low. Specifically, the low acceptance rate of the priming and salience nudge was unexpected, as such a combination of nudges was previously found to be effective (Wilson et al., 2016). The specific design and working mechanisms of a nudge thus played an important role in the acceptance of nudges, undermining a one-nudge-fits-all design. In particular, the responsibility to promote healthy eating as well as a health-promoting collaboration positively influenced nudge acceptance. We also identified three clusters of individuals with varying levels of nudge acceptance: the un-nudgeable group, the conditionally mixed nudgeable group, and the nudgeable group. These groups also differed in responsibility, social norms, and health-promoting collaboration, but not in procrastination.

The Influence of Social Norms, Health-Promoting Collaboration, Responsibility, and Procrastination on Nudge Acceptance

Research has previously shown that the perceived responsibility of a cafeteria or university to promote healthy eating increases nudge acceptance (Nørnberg et al., 2016b). We not only found the same results for overall nudge acceptance but also when considering all nine nudges (messenger, incentive 1, incentive 2, norms, default, salience, priming, affect, and priming and salience) individually. The perceived responsibility of a cafeteria or university to promote healthy eating was the strongest influence on nudge acceptance in our study. It influenced the acceptance of all nine nudges and overall nudge acceptance with a high significance. The nine nudges differed in the specific working mechanism behind them. For example, the norms nudge compared one's own healthy eating behavior to that of peers, while the default nudge automatically provided a salad as a side dish to any chosen main dish. Despite these differences, all nudges portrayed the university or cafeteria as the source of the nudge. Thus, the nudges were transparent because the participants knew who implemented them. Our results underlined recent research that found transparency in healthy eating nudges to be of particular importance in nudge acceptance (Hagman, 2018; Felsen et al., 2013) and effectiveness (Hagman, 2018; Kroese et al., 2015).

Health-promoting collaboration is a newly developed concept that has not yet been assessed in the context of nudge acceptance. Because of its similarities to social norms, we proposed that a strong health-promoting collaboration among peers positively influences nudge acceptance. We were able to confirm this proposition for the overall nudge acceptance as well as for three types of nudges (incentive 2, default, and salience nudge). Feeling supported by others in one's own health and acting within an environment where individuals are highly committed to healthiness were likely to positively influence nudge acceptance. The three nudges for which health-promoting collaboration was a significant influence on nudge acceptance are suitable examples of such a collaboration. First, the incentive 2 nudge uses so-called scare campaigns to promote healthy eating by showing extreme pictures of disease. Accepting the portrayal of such pictures indicates strong and shared values regarding healthiness. Second, the default nudge automatically provides a salad side dish with every main dish. By accepting this nudge, an individual automatically agrees to this health-promoting collaboration. Third, the salience nudge provides salient information on healthy eating in the form of a poster. Such a poster indirectly applies to a health-promoting collaboration. It increases the awareness of one's own health, which is an important aspect of health-promoting collaboration. Healthy eating nudges are by definition health-promoting, because their intention is to foster healthy environments (Thaler & Sunstein, 2009). Thus far, universities employing HPU initiatives to improve the health and well-being of students put rather a lot of effort into shaping the university setting accordingly (Suárez-Reyes et al., 2019). This effort can possibly be facilitated by utilizing nudges.

Another factor that has not yet been researched in nudge acceptance is procrastination. This factor is very relevant, because it is one of the reasons why nudging is an important

intervention. Nudges facilitate decisions that people who are prone to procrastination otherwise might not make (Thaler & Sunstein, 2009). We found procrastination to influence only the acceptance of the priming and salience nudge. Individuals prone to procrastinate accepted this specific nudge more. None of the nudges used in the present study specifically targeted the working mechanisms behind procrastination (Nørnberg et al., 2016b), and the sample in this study did not show a strong tendency to procrastinate. Therefore, procrastination did not seem to be very relevant in the current sample of students.

Previous findings showed that perceiving strong social norms of healthy eating within one's immediate surroundings predicted a higher acceptance of healthy eating nudges (Nørnberg et al., 2016b). In contrast, social norm nudges often show rather mixed findings (Hummel & Maedche, 2019; Bauer & Reisch, 2019). We found social norms to influence only the incentive 1 nudge. This nudge applied to a healthy eating competition and could not be associated with social norms. Interestingly, social norms did not influence the norms nudge. Explaining these findings is difficult, but they fit into the category of unclear results regarding social norm nudges. Similarly, a recent systematic review focusing on nudging in the food waste area only found four high-quality studies on social norm nudging to be effective. This review mentions that social norms should be applied with care as interventions, because they might reinforce negative behavior (Barker et al., 2021).

Identifying Groups of Nudgeable Individuals

Little research has been conducted on so-called nudgeability and the systematic grouping of relevant individual features (De Ridder et al., 2021). Thus far, we know that so-called equity effects exist, which means that nudges affect individuals in different ways. For example, some nudges targeting dietary behaviors (such as nudges that provide information) were found to be more beneficial to less socioeconomically disadvantaged people, while other nudges (such as nudges facilitating behavior) were more beneficial to more socioeconomically disadvantaged people (Schüz et al., 2021). We added to the existing knowledge on differential nudge effects by identifying three clusters of students and relating these clusters to other influential factors. This allowed us to describe groups of students that were either nudgeable, conditionally mixed nudgeable, or un-nudgeable.

In the nudgeable group of students, almost all nudges were equally highly accepted. An exception was the priming and salience nudge, which was only moderately accepted. These students perceived a cafeteria or university to be significantly more responsible for promoting healthy eating than did the conditionally mixed nudgeable and un-nudgeable groups. They also perceived a moderate health-promoting collaboration to be present. This perception was equally moderate in all three groups. The nudgeable group perceived more social norms than the un-nudgeable group, but not the conditionally mixed nudgeable group. Thus, nudgeable students seemed to highly accept healthy eating nudges, especially when applied by an institution (cafeteria or university). They also felt a stronger need for institutions to involve

themselves in promoting healthy eating. We propose that this group of students will easily accept nudges applied by institutions.

Students of the conditionally mixed nudgeable group were divided in their acceptance. While accepting certain nudges strongly (default, salience, priming, and affect nudges), other nudges (messenger, incentive 1, incentive 2, norms, and priming and salience nudges) were not accepted. When considering this cluster of students in terms of comparison to the other two clusters on the influential factors, the conditionally mixed nudgeable students were similar to the nudgeable students. Both clusters portrayed equal and moderate values for the perceived social norms of eating healthily and health-promoting collaboration. Their difference lay in the overall nudge acceptance as well as in the perceived responsibility of a cafeteria or university to intervene. Both values were moderate and significantly lower for the conditionally mixed nudgeable students compared to the nudgeable students. For these students it seems that accepting a nudge depended on certain conditions. Perceiving social norms and health-promoting collaboration was important to them when it came to accepting nudges. In particular, the default (pre-selected healthy side dish) and salience nudges (poster with tips of healthy eating) could be interpreted to include aspects of social norms. The priming (prompting to buy healthy dishes) and affect nudges (healthy names for healthy dishes) could be interpreted to portray health-promoting collaboration. On the contrary, this group of students, for example, did not accept the incentive 1 nudge. In this nudge, a competition for healthy eating behavior was proposed. Driving someone to compete with others was not in line with their perceived importance of health-promoting collaboration. These students preferred certain nudges while disliking others, which was in line with the general description of this cluster. They could only be nudged by certain nudges—for example, the default, salience, priming, and affect nudges.

The un-nudgeable group of students showed low acceptance of six of nine nudges. They only moderately accepted the default, salience, and priming nudges. These students scored significantly lower on all influential factors (except health-promoting collaboration, compared to the high nudge acceptance students). They neither felt the need for the cafeteria to involve itself in healthy eating promotion nor valued involvement by family and peers or fellow students. They appeared generally uninterested.

The default, salience, and priming nudges appeared to be the most appropriate ones for application in a university and cafeteria setting for students. They were at least moderately accepted by students regardless of their degree of nudgeability. The names given to these three clusters already provide a vantage point for nudge development. Nudges developed by institutions for the nudgeable students should focus on identifying the institution providing the nudge, while nudge development for the conditionally mixed nudgeable students should predominantly focus on default, salience, priming, and affect nudges, which foster a health-promoting collaboration and portray social norms. Nudge development for un-nudgeable and uninterested students remains difficult. Neither family, friends, and peers, nor an institution, seemed to matter to this group in nudge acceptance. At the very least, they moderately

accepted default, salience, and priming nudges. Nudge development for this group of students should therefore focus on these working mechanisms of nudges. Another possible source of nudging is the person him- or herself. Self-initiated nudges have been described as imposed by the individuals themselves by consciously and voluntarily changing their own choice architecture (Torma et al., 2018; Ly et al., 2015). These self-applied nudges preserve an individual's autonomy and independence and might therefore be specifically suitable for the un-nudgeable students.

Limitations and Future Research

In the present study, we only assessed the hypothetical nudge acceptance and linked it to nudge effectiveness using theory. Future research should directly connect the nudge acceptance and nudge effectiveness of healthy eating nudges and preferably in an experimental setting measuring actual nudge acceptance. In this way, more robust findings will contribute to understanding the link between nudge acceptance and nudge effectiveness. We only assessed a limited number of influential factors on nudge acceptance, while others are likely to exist. Research on further influential factors will improve our understanding of nudge acceptance and facilitate the development of effective nudges. The present study focused on the target group of university students. As nudges can have different effects on different target groups, other target groups should be considered in future studies as well. We found health-promoting collaboration to positively influence nudge acceptance. This newly developed concept needs to be researched more thoroughly in order to draw concrete practical implications from it. Designing and testing a nudge that purposefully enhances students' perception of a health-promoting collaboration is in line with the HPU framework and may potentially be beneficial. While we were able to formulate clear descriptions of nudgeable students and conditionally mixed nudgeable students, the description of un-nudgeable students remains vague and undistinguished. More research is needed on systematically grouping individuals according to their nudge acceptance and effectiveness. It will also be interesting to research whether a similar cluster formation can be found in other samples. Furthermore, psychological factors (such as personality traits) may yield interesting results in grouping nudgeable individuals. Thus, we can focus on changing their status from un-nudgeable to nudgeable.

Practical and Theoretical Implications

Our study provides useful practical implications for nudge development, particularly for university and cafeteria officials, but also for public health officials. We identified the perceived responsibility of a cafeteria or university to promote healthy food consumption as positively influencing nudge acceptance. In our study, we made clear that the hypothetical interventions (nudges) to which the participants indicated their acceptance were implemented by university or cafeteria officials. Thus, participants were aware of the source of the nudges. Cafeterias and universities should take up this responsibility and transparently apply nudges to foster healthy eating behaviors. Note that these nudges must be tested rigorously before application. University officials in particular should foster health-promoting

collaboration, as this factor also positively influences nudge acceptance. One way of doing so is by employing HPU initiatives within a university (Suárez-Reyes et al., 2019). These initiatives themselves have a great potential to foster health-promoting collaboration within the university's community, which in turn facilitates nudge acceptance and is likely to increase nudge effectiveness. Then, officials take responsibility for promoting healthy eating and create synergetic effects. Creating an environment in which all students value health and healthy eating in particular, as well as support each other in their shared values and beliefs, is likely to increase nudge acceptance and consequently nudge effectiveness. University, cafeteria, and public health officials have the opportunity to create these environments and implement nudges because they are choice architects. We identified three groups of students differing in their nudgeability. Students identified as nudgeable can easily be nudged by providing the source of the nudge (e.g., the institution). Conditionally mixed nudgeable students accept nudges such as default, salience, priming, and affect nudges, which portray healthy eating social norms and health-promoting collaboration. Un-nudgeable students are difficult to nudge, but our results show that default, salience, and priming nudges applied in the form of self-nudging are promising. Our findings suggest that not all individuals may benefit equally from nudges. This needs to be considered in nudge development.

Next to practical implications, we also provide useful information for the theoretical background on nudging, particularly nudge acceptance. We identify health-promoting collaboration and, in particular, the responsibility to promote healthy eating as influential factors for nudge acceptance. Even though these factors still need to be further researched, they provide useful information for understanding nudge acceptance and should be considered in Hagman's nudge acceptance model (Hagman, 2018). In addition, we suggest considering the integration of nudging into the HPU framework to especially enhance efforts made for creating healthy work and study environments, as health-promoting collaboration was found to increase nudge acceptance. Our systematic grouping of individuals according to their nudge acceptance further underlines the importance of the source of a nudge—an institution, family, friends, peers, fellow students, or oneself. The possibility of self-initiated nudging also needs to be considered further.

4.5 Conclusions

We found that students have a moderate overall nudge acceptance level, and that nudge acceptance varies from nudge to nudge. The specific design of a nudge thus plays an important role, and a one-nudge-fits-all design should indeed no longer be applied. The perceived responsibility of a cafeteria or university to promote healthy eating, as well as health-promoting collaboration, positively influenced overall nudge acceptance. We identified three clusters of students differing in their nudge acceptance—nudgeable students, conditionally mixed nudgeable students, and un-nudgeable students. These insights offer practical implications for nudge development by university, cafeteria, and public health officials. Officials need to take seriously their responsibility for promoting healthy eating and an

environment in which students can support each other regarding their shared healthy eating beliefs and values. In this way, acceptance of healthy eating nudges and their consequent effectiveness can be increased. The nudgeable students are very likely to be positively affected by healthy eating nudges. The conditionally mixed nudgeable students are likely to accept nudges as well when these nudges rely on certain mechanisms (default, salience, priming, and affect) and portray social norms and health-promoting collaboration. For the un-nudgeable students, a self-initiated nudge focusing on default options, salience, and priming is likely to be accepted, at least moderately. These types of nudges, when presented as self-nudging, should allow them to consciously and voluntarily choose when to be nudged. Our findings provide further insights into the theoretical background of nudge acceptance and susceptibility to nudging.

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Chapter 5

Effects of a nudging cue targeting food choice in a university cafeteria: A field study

This chapter is based on Kawa, C., Ianiro-Dahm, P. M., Nijhuis, J.F. H., & Gijselaers, W. H. (2023). Effects of a nudging cue targeting food choice in a university cafeteria: A field study. *Healthcare*, *11*(9), 1307. https://doi.org/10.3390/healthcare11091307

Abstract

Many students approaching adulthood often choose high-calorie food products. Concurrently, health interventions applied during this life phase can potentially lead to a healthier lifestyle. Nudge health interventions in experimental cafeteria settings have been found to improve eating behavior effectively, yet research in real-world settings is lacking. Accepting nudges as health interventions impacts nudge effectiveness. The present study applies a pretest–posttest design for a period of three consecutive weeks (no nudge, nudge, no nudge), testing the effectiveness of the so-called Giacometti cue on the number of calories purchased in a real-world cafeteria. Students were exposed to the nudge during the intervention week when entering the cafeteria and when choosing their meals. After purchasing a meal, their choice was recorded, and they completed a questionnaire. The Giacometti cue immediately reduced the number of calories purchased (comparing weeks one and two). After nudge removal, an effect was identified, increasing the number of calories purchased (comparing weeks two and three). Contrary to expectations, higher nudge acceptance resulted in more calories purchased. Neither awareness of the nudge's presence when buying food nor the interaction between acceptance and awareness played a role. We explore potential explanations for the Giacometti cue's effects.

5.1 Introduction

An individual's dietary behavior can be conceptualized as a food choice (behavior occurring before the food reaches the mouth, as in a food purchase), eating behavior (all outcomes related to actual food consumption, such as eating habits), and dietary intake or nutrition (all outcomes encompassing the content of the food consumed, such as caloric intake) (Stok et al., 2018). Thus, any eating behavior and/or dietary behavior starts with a food choice that can have different caloric values. Diets involving calorie-dense foods high in sugar have been associated with several diseases, such as diabetes mellitus or an increased risk of heart disease (Heseker & Heseker, 2019).

A stage of life during which individuals are particularly prone to choosing foods high in calories is emerging adulthood during ages 18–25 (Lange et al., 2021; Kowalkowska & Poínhos, 2021). During this life phase, many individuals participate in tertiary education as college or university students. The World Health Organization (WHO) describes the consumption of high-calorie foods as a risk to global health throughout the lifespan. Specifically, in highly industrialized countries, individuals do not consume enough fruit and vegetables and favor foods high in energy, fats, sugar, and calories (World Health Organization, 2020). For example, university students in Germany have been found to consume less fruit and vegetables than the amounts recommended by the WHO of five servings per day (Harker, et al., 2010). Less than 30% of Germany's university students meet these WHO recommendations (Hilger et al., 2017). University settings are known for having a high availability of food products high in simple sugars and fats, such as ultra-processed foods that are dense in caloric value while lacking nutritional value (Fondevila-Gascón et al., 2022). At the same time, environmental factors, such as the living arrangements of students and whether they make food choices independent from their families, were found to play a role (Fondevila-Gascón et al., 2022). In addition, the environment in which a food choice is made has been found to influence this choice (Symmank et al., 2017).

The Ottawa Charta describes the environment (setting) in which food is provided (for example, cafeterias) as relevant in implementing health interventions (Hungerland et al., 2021; World Health Organization, 1986). The WHO further suggests creating healthy food environments in which healthy diets are promoted (World Health Organization, 2020). Thus, applying health interventions within a cafeteria to foster a healthy environment can bring about positive outcomes for students, specifically because the majority of university students eat regularly in their university cafeteria (Hilger et al., 2017; Jordan et al., 2020). Additionally, meal plans in cafeterias can be adjusted to contain more low-calorie food products in a cost-effective way (Jordan et al., 2020; Naicker et al., 2021). Systematic reviews mention various promising strategies to improve dietary behaviors among university students (for example, cookery classes or nutrition labels on food products) (Naicker et al., 2021; Dietz et al., 2020). These strategies have in common that the target group needs to be actively involved in activities requiring more of their time (e.g., joining food classes). Research shows that environmental cues can act as health primes that effortlessly lead individuals to reduce, for example, their

consumption of high-calorie potato chips (Stämpfli & Brunner, 2016). These environmental cues can yield favorable outcomes in complex, real-world settings in which individuals have limited cognitive decision-making capacities (Stämpfli & Brunner, 2016). This is in line with the framework of situated interventions that describes situational cues embedded within the decision-making environment to change behavior effectively. This framework specifically involves environmental cues, such as nudges (Papies, 2017). Taking this into account, interventions involving environmental cues may be more effective in achieving fewer choices of high-calorie foods.

There is a growing trend in research focusing on the effectiveness of environmental cues called nudges (Jia & Mustafa, 2023). Nudges have demonstrated that they can be effective, unobtrusive interventions to influence food choices when students purchase food in cafeteria settings (Jordan et al., 2020). They circumvent any obstacles due, for example, to schematic cognitive biases, self-control, or procrastination problems (Thaler & Sunstein, 2009). Because everyday food choices are mostly made automatically and instinctively without long considerations, nudges are especially considered suitable for targeting this type of behavior (Ensaff, 2021; Wilson et al., 2016).

A nudge is defined as “any aspect of the choice architecture that alters people’s behavior in a predictable way without forbidding any options or significantly changing their economic incentives” (Thaler & Sunstein, 2009, p. 6). Thus, nudges can be small, subtle changes to the social and physical decision-making environment that steer the decision in a predictable direction (Ensaff, 2021). The originators of the term nudging, Thaler and Sunstein, state that individuals often rely on heuristics or cognitive effects, especially when making fast decisions. Relying on these mental shortcuts often leads to suboptimal choices (Thaler & Sunstein, 2009). Nudges target these mental shortcuts by highlighting a specific choice within an environment (Thaler & Sunstein, 2009). Consequently, a nudge can be any form of environmental cue that steers behavior.

Many different types of nudges exist and can be classified into different categories. These categorizations often consider which heuristic, cognitive effect, or cognitive system is targeted (Wilson et al., 2016; Cadario & Chandon, 2020; Bauer & Reisch, 2019). Nudges are said to be based on the dual-process theory of the mind (Tversky & Kahneman, 1974). Many nudges function by activating an individual’s automatic decision-making processes (System 1) and therefore affect fast and intuitive decisions (Blom et al., 2021). A nudge that activates automatic processes is, for example, a default setting in which a customer always receives a salad as a side dish instead of French fries. Nudges can also impact an individual’s deliberate and conscious decision-making processes (System 2) by activating reflective thinking processes (Hansen & Jespersen, 2013). Then, a nudge can, for example, provide specific information relevant to the given food choice scenario initiating conscious deliberation processes (Hansen & Jespersen, 2013). In summary, nudges influence behavior by making an optimal choice more explicit using simple environmental cues in a decision-making context.

Therefore, nudges are a promising low-cost food choice intervention suitable in complex, real-world settings.

In general and across different research settings, the meta-analyses and literature review studies point out that food choice nudges can be considered to be effective, yielding moderate-to-high effects (Ensaff, 2021; Wilson et al. 2016; Veccio & Cavallo, 2019; Mertens et al., 2022) of, for example, a Cohen's *d* effect size of 0.43 (Mertens et al., 2022). However, this positive image of nudging fades away when taking into account whether the research findings on nudges were collected in lab settings or in real-world field settings. Research findings for real-world settings demonstrate rather mixed results, revealing weak or moderate effect sizes (Ensaff, 2021; Cadario & Chandon, 2020). For example, food choice nudges tested in real-world field experiments show a Cohen's *d* effect size of 0.23, which is equivalent to a reduced calorie consumption of 124 kcal per day (Cadario & Chandon, 2020). In general, it appears that the effect sizes of nudges targeting dietary behavior are smaller in real-world field settings than in controlled laboratory settings. As a consequence, more research on nudging in real-world food choice contexts has been called for (Ensaff, 2021). There is a limited understanding of which conditions enable the potential effects of nudges (De Ridder et al., 2022; Bauer et al., 2021). The present study addresses this call by focusing on how nudges target food choice behavior in a typical real-world field setting.

For the present study, a suitable environmental cue that primes eating behavior and reduces the consumption of high-calorie food products is the Giacometti cue (Stämpfli & Brunner, 2016; Brunner & Siegrist, 2012). It is based on the artwork of Alberto Giacometti and shows skinny, human-like sculptures (Giacometti, 1947). The application of this environmental cue corresponds with the concept of nudging and is particularly suitable for implementation in the real world because it does not involve higher cognitive capacities to be effective (Stämpfli & Brunner, 2016). Research shows that immediate exposure to Giacometti's skinny sculptures can reduce the consumption of high-calorie chocolate with a Cohen's *d* effect size ranging from 0.39–0.65 (Stämpfli et al., 2017). The underlying explanatory mechanisms of the Giacometti cue are described as priming weight-related mental concepts that lead, for example, to reduced consumption of high-calorie foods (Brunner & Siegrist, 2012). Priming effects primarily target the automatic decision-making processes of System 1 (Tversky & Kahneman, 1974). The Giacometti cue's immediate effectiveness has been shown for individuals ranging from 35–39 years of age (Brunner & Siegrist, 2012; Stämpfli et al., 2017), and it was applied before in a real-world field setting in the form of a poster next to a vending machine. At that time, it was able to increase healthy snack choices made (Stöckli et al., 2016). While it is immediately effective for older individuals, (e.g., Stämpfli et al., 2017), it has not been tested on young adults. Moreover, it has only been tested in a real-world field setting involving snack purchases made from a vending machine (Stöckli et al., 2016) and dietary behavior at home (Stämpfli et al., 2020) but not involving actual food choices made in a real-world university cafeteria. In the present study, we formulate several research questions focusing on the implementation of the Giacometti cue in a real-world university cafeteria targeting the dietary behavior of students on the threshold of adulthood. The first research

question concerns the general and immediate effectiveness of this cue in this specific setting: (1) *What is the immediate effect of the Giacometti cue on actual food purchases in a real-world university cafeteria?*

The research so far on nudging has seldom ascertained the longitudinal effects of nudges or effects over time (Eichhorn & Ott, 2019; Congiu & Moscati, 2022). A systematic review on nudges targeting dietary behavior acknowledges that more research needs to be conducted assessing nudge effects at different points in time—for example, after the removal of a nudge or longitudinal effects (Veccio & Cavallo, 2019). A study assessing the effects of a nudge aiming to increase the sales of vegetarian dishes in a university cafeteria after it had been removed from the setting showed that nudging can lead to persistent changes over time (Kurz, 2018). Sales of vegetarian dishes were 6% higher in the intervention week (when the nudge was present) than in the baseline week (before the nudge was implemented). The nudge in this study made vegetarian dishes more visible, for example, by moving them into a more prominent position for the customer during the decision-making process (Kurz, 2018). Even in the posttest period (after the visibility nudge had been removed), sales of vegetarian dishes were 4% higher than in the baseline period (Kurz, 2018). It has been suggested that the long-term effects of nudges may depend on whether the nudge targets automatic (type 1 nudge) or deliberate cognitive processes (type 2 nudge) (Lin et al., 2017). Type 1 nudges may elicit lasting effects by possibly creating new habits that override the immediate desire (Congiu & Moscati, 2022). The visibility nudge described above qualifies as a type 1 nudge. Similarly, the Giacometti cue qualifies as a type 1 nudge targeting automatic cognitive processes (Brunner & Siegrist, 2012). In order to understand its longitudinal effects, one study assessed long-term exposure for six months to this cue. In this study, it was found to be effective in leading to weight loss after a six-month-long exposure to the nudge (Stämpfli et al., 2020). The nudge was presented on the material used in a weight loss program targeting individuals wishing to lose weight (Stämpfli et al., 2020). To the best of our knowledge, this is the only study involving any longitudinal effects of the Giacometti cue. That study assessed weight loss over time induced by the six-month-long exposure to the Giacometti cue. It did not assess what happens after the weight loss program (thus, the exposure to the Giacometti cue) ended (Stämpfli et al., 2020). The question of what happens when a nudge, and specifically the Giacometti cue, is removed is particularly interesting because, by definition, a nudge needs to be present within the decision-making context to have an effect (Papies, 2017; Thaler & Sunstein, 2009). In a lab setting, a randomized-untreated (no nudge) control group design with a pretest and posttest would be an obvious choice for assessing nudge effects because it controls for threats to internal validity. However, in a real-world setting such as a university cafeteria, it is necessary to consider that the cafeteria is visited by different visitors on different days. In such a situation, it requires us to deal with non-randomized samples and examine the effects of introducing and removing the treatment. This requires a research removed-treatment design with pretests and posttests, closely approximating meeting the research requirements for having a no-treatment control group (Cook & Campbell, 1986; Cook & Campbell, 1979). In a field setting, it is essential to assess the effects of removing the Giacometti cue. Because it

provides proxy estimates for the effects of introducing the cue, and effects after removing the cue, assuming that the respondent groups are comparable. In conclusion, when considering the first week of collecting data as a pretest (no Giacometti cue), the second research question asks: (2) *How does the removal of the Giacometti cue from a real-world university cafeteria affect the actual food purchases?*

A quantitative review of effect sizes concerning nudges concluded that nudge effectiveness relies in part on how it is perceived by the individual (Hummel & Maedche, 2019). According to the Nudge Acceptance Model (Hagman, 2018), nudge acceptance is linked directly to nudge effectiveness. Highly accepted nudges are more effective. The nudge technique, i.e., how the nudge is designed and used, also affects nudge effectiveness. Nudges have differential outcomes depending on which cognitive processes they tap into (automatic System 1 or reflective System 2 processes). This relationship between nudge technique and effectiveness is mediated by nudge acceptance (Hagman, 2018). Thus, nudge acceptance plays a crucial role in the successful implementation of a nudge (Yan & Yates, 2019). While there is a consensus that nudges are generally accepted by the public at large, little is known about the conditions under which nudges are viewed as acceptable (Van Gestel, 2021). In addition, nudge acceptance has been found to vary from type of nudge to type of nudge (Cadario & Chandon, 2020; Barker et al., 2021; Laiou et al., 2021) and also from target person to target person (Bauer & Reisch, 2019; Schüz et al., 2021). Specifically, university students seem to be more or less susceptible to nudges and accept nudges differently (Kawa et al., 2022a). The relationship between nudge acceptance and nudge effectiveness has seldom been tested in empirical research in general and in real-world field studies specifically (Ensaff, 2021). While all of this is known about nudging in general, little is known about the acceptance of the Giacometti cue as a health intervention and how this impacts its effectiveness. The research so far shows that the Giacometti cue induces a rather low acceptance rate in university students when it is assessed in a questionnaire without showing a picture of the cue (Kawa et al., 2022a). So far, its acceptance has not been assessed in a real-world setting. When this nudge is applied in a real-world public setting (such as a cafeteria), it cannot be guaranteed that only a specific target group (for example, older individuals) is exposed to it. Researching the specific situation in which an intervention is implemented is always necessary (Papies, 2017). Therefore, assessing the effects of the Giacometti cue, as well as its acceptance, are crucial. To first establish the relationship between the acceptance of the Giacometti cue and real-world food purchases, which is the dependent variable assessing nudge effectiveness in the present study, we formulate two additional research questions: (3) *What is the role of acceptance of the Giacometti cue on actual food purchases in a real-world university cafeteria?* (4) *Does acceptance of the Giacometti cue moderate the nudge's immediate effect on actual food purchases in a real-world university cafeteria?*

In explaining nudge effectiveness, the growing body of literature focuses on the degree to which individuals are aware of the nudge's presence and on the degree to which it influences deliberate and conscious decision-making processes (Hansen & Jespersen, 2013; Marchiori et al., 2017; Van Gestel et al., 2020). Most often, nudge effectiveness regarding food choice

remains the same regardless of whether an individual is aware of the nudge (Blom et al., 2021; Congiu & Moscati, 2022; Kroese et al., 2015). In addition, disclosing the rationale behind the nudge (and consequently making individuals aware of its presence) did not change the nudge's effectiveness (Wachner et al., 2020). For example, a field experiment assessing a nudge's effectiveness in increasing healthy snack choices (by repositioning healthy snacks) found the nudge to be effective regardless of whether the individuals were aware of its purpose (Kroese et al., 2015). Awareness of the nudge did not add, enhance, or decrease its effectiveness. Additionally, the acceptance of this nudge remained high across the different conditions (Kroese et al., 2015). Research further suggests that the effects of being aware of a nudge can vary from type to type, and more research is needed (Congiu & Moscati, 2022). Thus, while informing individuals about the presence of a repositioning nudge does not change the nudge's effectiveness, the results may be different for a priming nudge, such as the Giacometti cue. It has been suggested that being aware of the Giacometti cue may lead to reactant behavior (Brunner & Siegrist, 2012; Stämpfli et al., 2020). Reactance may then lead to behavior opposite of what was intended—in our case, making high-calorie food choices. Reactance has been suggested as a tentative reason why the Giacometti cue was ineffective in a controlled field setting (Kawa et al., 2022b). While making individuals aware of a nudge usually does not detract from its effectiveness, the opposite has been suggested for the Giacometti cue. Accordingly, we formulate research question five: (5) *What is the role of the level of awareness of the Giacometti cue in actual food purchases in a real-world university cafeteria?* It is important to test this research question in a real-world field setting assessing the level of awareness after the nudge has had its impact on preventing any confounding effects. Even though disclosing a nudge did not reduce its high acceptance level (Kroese et al., 2015), different findings can be expected for the Giacometti cue because it did not achieve high acceptance ratings in an earlier study (Kawa et al., 2022a). Consequently, we formulate our sixth research question, which to the best of our knowledge, has not been assessed so far: (6) *What is the combined immediate effect of Giacometti cue acceptance and awareness on actual food purchases in a real-world university cafeteria?*

In our present study, we take up the call for more research assessing the effects of nudges on food choice in real-world field settings (Ensaff, 2021). We apply a one-group pretest–posttest design in which the Giacometti cue serves as a nudge intervention to assess the following two aims: (1) Understand the effects of this cue on the actual food purchase of students in a complex real-world setting (a target group that has not yet been exposed to this cue), and (2) shed light on the working mechanisms of this cue regarding nudge acceptance and awareness. With these aims, we contribute to the understanding of when the Giacometti cue is effective for university students (research questions 1: during exposure and research question 2: after removal of the cue). The first two research questions test the validity of the nudge's definition and that it needs to be present within the context to be effective (Thaler & Sunstein, 2009). In assessing the roles played by two influential factors (research questions 3 and 4: nudge acceptance; research question 5: nudge awareness; and research question 6: interaction between acceptance and awareness), we contribute to explaining under which conditions the

Giacometti cue works in a real-world setting. In this, we test the Nudge Acceptance Model (Hagman, 2018) and answer the call for more research regarding awareness of the Giacometti cue's presence (Stämpfli & Brunner, 2016). Thus, we can draw clear inferences regarding the theoretical background of nudging while testing its effectiveness in the real-world. An overview of our research model is presented in Figure 1.

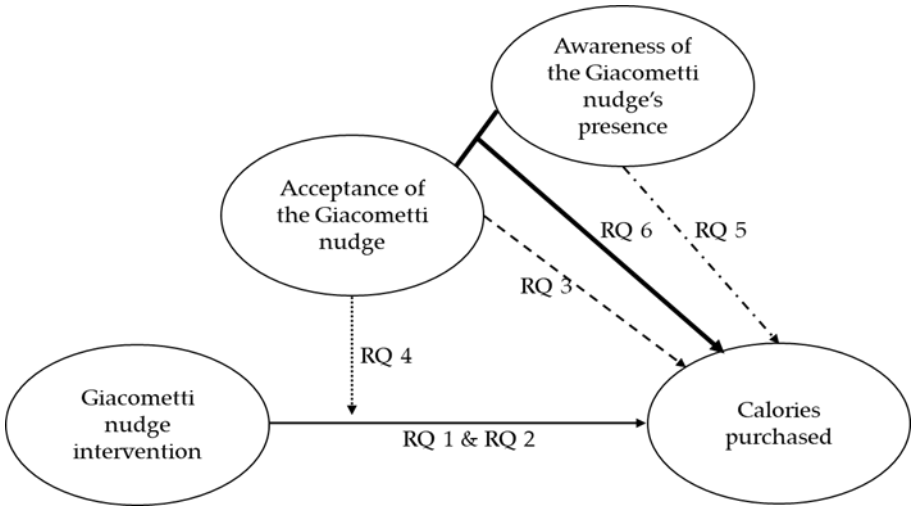

Figure 1. Overview of the present research model showing the research questions (RQ).

5.2 Material and Methods

Setting

Data were collected at a university cafeteria in North Rhine-Westphalia (Germany) from October 10 to October 28, 2022 at lunch time. We collected data Monday through Friday from approximately 11:45 a.m. to 1:45 p.m. This period marks the beginning of the new semester for the students. The cafeteria has two floors offering different dishes with adjacent seating areas. The ground floor cafeteria offers freshly made pizza and pasta as well as specialty dishes (for example, a vegan risotto). The first-floor cafeteria offers more common meat or fish dishes, vegetarian dishes, vegan dishes, and soup (for example, lasagna or pea soup). A variety of side dishes (for example, potatoes or carrots) is only offered on the first floor. Both cafeterias offer desserts and include a large salad bar. Table A1 in Appendix A exemplifies the various dish choices of an ordinary day. The main dishes offered on both floors can be considered equal regarding price and caloric value. On both floors, meat or fish, vegetarian, or vegan main dishes are offered for approximately the same prices. We only collected data on the first floor of the cafeteria because the ground floor cafeteria was closed during the pretest week due to a shortage of staff. This issue is discussed in the limitations section. Usually, about 2500 daily customers (mainly students) purchase and consume their lunch at this cafeteria. The three data collection weeks can be described as comparable. No exams took place during any of the weeks, the weather was comparable, and no special circumstances within the near vicinity of the cafeteria occurred.

Design and procedure

All subjects gave their informed consent to inclusion before they participated in the study. This study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethical Review Committee Inner City Faculties (ERCIC) of Maastricht University (ERCIC_368_26_06_2022). For this real-world field setting, we used a one-group pretest–posttest design over a period of three consecutive weeks. The first week served as the pretest measure. In the second week, the nudge was introduced as an intervention, and in the third week (posttest), the nudge was removed. The nudge was placed in the entrance hall of the cafeteria under the two displays showing the dish options of the day. It was also placed on every counter where the participants chose their dishes (see Section 2.4 Materials). Research in real-world field settings qualifies as quasi-experimental research in which randomization is not possible as it would be in a controlled laboratory (Cook & Campbell, 1986). In assessing actual behavior that is unconfounded by the artificiality of a controlled laboratory setting, findings-based quasi-experimentation is considered valid and interpretable. Comparing behavior changes between different data collection points (observation 1: before the intervention, observation 2: during the intervention, and observation 3: after removal of the intervention) can be interpreted as induced by an intervention (Cook & Campbell, 1986). Thus, the present research design yields interpretable findings in a real-world setting. Such a one-group pretest–posttest design is often used to evaluate the effectiveness of interventions (Campbell et al., 1963) and has been used previously in a field study on a visibility nudge in a university cafeteria (Kurz, 2018). This author compared the baseline and intervention weeks to determine the immediate effects of the nudge as well as the baseline and posttest weeks to determine the effects of the nudge after it had been removed from the setting. Field studies involve strengths and weaknesses that will be discussed in the limitations section.

Data were collected by a team of five female researchers between the ages of 20 and 35. They all dressed unobtrusively and were of average height and weight. Visitors to the cafeteria usually enter the cafeteria on the ground floor, automatically approaching the menu displays that show the daily meal choices for both floors of the cafeteria. Then, they decide whether to purchase their meal on the ground floor or climb the stairs to the first floor. Next, they approach one of the different food counters, choose their specific dish, purchase it, and sit down in the adjacent seating area to consume their meal. During data collection, customers were approached at random by one of the researchers shortly after they took their seats and started eating their meals. The researchers asked the individuals to participate in a short study about their meal choices made in the cafeteria that day, explained the procedure, and asked the customers to confirm their participation after giving their informed consent. The researcher then noted the participant’s meal choice (main dish(es), side dish(es), and dessert(s)) and asked the participant to complete the remaining questionnaire themselves. After filling out the questionnaire, participants inserted the questionnaire into an envelope provided by the researcher. Participants could only participate once. The research team ensured this prior to participation by specifically asking whether individuals had participated

before. However, in the posttest week, the participants were allowed to participate again to achieve a group size comparable to that of the pretest and intervention weeks.

Participants

Participants were students and staff (usually postgraduate students) of the university having their lunch at the cafeteria. A priori power analysis (G*Power) revealed a required total sample size of *N* = 1548 to achieve a statistical power of 0.95 to detect an effect size of Cohen's *f* = 0.10 (Faul et al., 2007). This expected effect size is based on the effect size found for the effects of the Giacometti cue and nudging in general (Stämpfli et al., 2017; Cadario & Chandon, 2019). In total, *N* = 2899 participated in the study. Of these, 1407 (48.9%) were male, 1451 (50.4%) were female, and 21 (.7%) were gender-diverse. In total, 2601 (94.8%) students participated, while 128 (4.7%) reported that they were faculty members. Only 16 (.6%) participants were external to the university. On average, participants were *M* = 22.08 (*SD* = 3.77) years old. They were *M* = 175.9 cm (*SD* = 9.70) tall and weighed *M* = 68.5 kg (*SD* = 11.99) on average. The specific values per data collection week are displayed in Table 1 (see Section 3 Results). Participants in the three data collection weeks differed in gender, age, and weight (see Section 3 Results). More participants in the intervention week reported being gender-diverse than in the pretest and posttest weeks and were slightly older. Participants in the intervention week also weighed slightly more than participants in the posttest week. Participants indicated their motives for choosing their meal by checking all motives that applied. These motives can be ranked as follows: 1, need and hunger (*N* = 2010, 69.33%); 2, liking (*N* = 1830, 63.13%); 3, price (*N* = 1415, 48.81%); 4, convenience (*N* = 928, 32.01%); 5, health (*N* = 814, 28.08%); 6, sociability (*N* = 696, 24.01%); 7, habits (*N* = 614, 21.12%); 8, pleasure (*N* = 397, 13.69%); 9, visual appeal (*N* = 318, 10.97%); 10, natural concern (*N* = 137, .05%); 11, traditional eating (*N* = 110, .04%); 12, weight control (*N* = 90, .03%); 13, affect (*N* = 73, .03%); 14, social image (*N* = 45, .02%); and 15, social norm (*N* = 34, .01%). Comparisons of individuals who participated in the posttest week regarding their number of participations revealed that individuals who participated once were slightly older (*M* = 22.4; *SD* = 3.40) than individuals who participated twice (*M* = 21.26; *SD* = 2.70), with *t* (960.08) = 5.84, *p* < .001. Second participation in the posttest week likewise affected neither the acceptance of the Giacometti cue (*t* (961) = −.481, *p* = .637) nor the number of calories purchased (*t* (854) = −.687, *p* = .492) (Table A2 in Appendix B).

Materials

In the intervention week, the participants were exposed to a nudge intervention in the form of posters displaying sculptures by the artist Alberto Giacometti (Giacometti, 1947). The intervention was placed at all prominent places in the cafeteria where individuals usually make food choices (Supplementary Material File S1: layout of the cafeteria). In the entrance hall, directly under the displays showing the dish choices of the day, we placed a diagonal DIN A0 poster of the sculptures called *Piazza* (Figure A1 in Appendix C). At each counter on both cafeteria floors, we placed a DIN A5 poster of the sculpture called *L'homme qui marche* (Figure

A2 in Appendix C). Both Giacometti cues had been previously used in other studies (Stämpfli & Brunner, 2016; Brunner & Siegrist, 2012; Stämpfli et al., 2017; Stöckli et al., 2016; Stämpfli et al., 2020; Kawa et al., 2021). They have been found to be effective when applied in different formats, such as a screensaver (Brunner & Siegrist, 2012), a DIN A0 poster (Stöckli et al., 2017), and a small sticker (Stämpfli et al., 2020). Its implementation in a cafeteria is not likely to disrupt the workflow and work processes of the cafeteria staff because it needs only be implemented once. For the practical implementation of nudges, it is important that a nudge does not inhibit the workflow within the setting where it is applied (Ensaff, 2021).

Measures

In the present study, we used a structured interview with a questionnaire. First, the researcher assessed the meal choice of the participant by means of an interview question. The researcher asked the participant what their meal choice was and noted the answer on a questionnaire. The researcher made sure that the entire meal choice was assessed and specifically asked the participant to indicate their choice of main dish(es), side dish(es), and dessert(s). Any additions to the meals (like ketchup, salad dressing, piece of bread, etc.) were also noted. If participants chose a salad from the salad bar as a main dish, the researchers categorized it according to its ingredients as vegan (green salad with vegetables), vegetarian (green salad with cheeses, etc.), and carb (green salad with couscous, potatoes, etc.). A combination of these categories was also possible. In addition, the researcher noted the data collection week (1 = pretest, 2 = intervention, and 3 = posttest) and the date and time of the questionnaire. Second, the researcher passed the questionnaire to the participant with a request for them to complete the questionnaire themselves to ensure anonymity regarding biometric data.

The questionnaire consisted of several sections. First, the participants' motives for choosing their meals were assessed by checking all relevant motives. A list of 15 motives was provided based on The Eating Motivation Survey (Renner et al., 2012). Second, participants indicated their level of hunger while choosing their meal on a 5-point scale ranging from not hungry at all to very hungry. Next, they rated their level of acceptance of nine different types of nudges on a 5-point scale ranging from do not agree to agree. This scale had been previously used in research on nudge acceptance (Kawa et al., 2022a; Nørnberg et al., 2016). We found a Cronbach's alpha value of .694. The nine nudges are the messenger nudge, incentive 1 nudge, incentive 2 nudge, norms nudge, default nudge, salience nudge, priming nudge, affect nudge, and the Giacometti cue. Table A3 (Appendix D) shows the exact wording used to assess acceptance in German and English. While the acceptance of the Giacometti cue was of primary interest (I think it would be acceptable to advertise vegetable consumption in the cafeteria using posters on which skinny artistic sculptures are displayed), we added the acceptance of the other nudges mainly to report this information to the person in charge of food provision at the cafeteria. In assessing the acceptance of all nine different types of nudges, we used the same scale and the same items throughout all three weeks. Thus, the acceptance of the Giacometti cue was assessed in all three weeks in the same way. We intentionally described the nudge as a skinny artistic sculpture, not mentioning the name of the sculpture or the artist.

In this way, we ensured that students who knew either the artist or sculpture would not answer differently than students who did not know the artist or sculpture. Finally, the participants indicated whether they were sitting in a group or alone and answered several demographic questions (age, height in cm, weight in kg, and gender). They were also asked to indicate their affiliation with the university (student, faculty member, or external) and state the number of times they had purchased a meal in this cafeteria in the current week (1–5 times). Only in the intervention week, when the nudge was present, were participants asked to assess their level of awareness regarding the Giacometti posters on a 5-point scale (not at all to very) after indicating their acceptance of the Giacometti cue (Supplementary Material File S2: questionnaire intervention week). We specifically asked how strongly the participants consciously perceived the posters in the cafeteria that day. To prevent any confounding effects of asking about the participants' awareness of the presence of the cue, we did not portray a picture of the cue on the questionnaire, and we assessed nudge acceptance before awareness.

The dependent variable in this study was the number of calories purchased in the main dish(es). For each main dish, a caloric value was calculated based on the recipe provided by the cafeteria staff and a table of nutritional values (Heseker & Heseker, 2019). Since some participants purchased two main dishes, we added the caloric values for all main dishes per participant. Main dishes normally do not include side dishes. Side dishes must be chosen separately. Thus, the caloric value of the main dishes purchased does not include the number of calories from any side dishes. The cafeteria usually offers around seven different main dishes per day to choose from. This was the case in the intervention week (number of main dishes ranging from 6–8) and the posttest week (number of main dishes ranging from 4–9). In the pretest week, the ground floor counters remained closed, and only about four different main dishes per day were offered that week (the number of main dishes ranging from 4–5). The following describes the average number of calories contained in the various main dishes offered per week: In the pretest week, main dishes ranged in their caloric value from 214 calories (pan-fried white cabbage, carrots, and peppers) to 1063 calories (currywurst with French fries) yielding an average count of 296 calories. In the intervention week, the main dishes contained, on average, 591 calories, ranging from 213 calories (pea soup) to 1063 calories (currywurst with French fries). In the posttest week, main dishes ranged in their caloric value from 213 calories (pea soup) to 1063 calories (currywurst with French fries), yielding an average number of 554 calories.

Analysis

As described in the measures section, the caloric values of the main dishes purchased were calculated for each participant. The cafeteria staff provided detailed recipes for the different main dishes, including the ingredients, exact measurements as well as portion size. The caloric value for every single dish offered was calculated based on a table of nutritional values using this information (Heseker & Heseker, 2019). This caloric value was then assigned to the participants.

To answer the first (*what is the immediate effect of the Giacometti cue on actual food purchases in a real-world university cafeteria?*) and second research question (*how does the removal of the Giacometti cue from a real-world university cafeteria affect the actual food purchases?*), we conducted a univariate ANOVA on the number of calories purchased with main dishes using the data collection weeks as the independent variable. Bonferroni post hoc tests were applied to assess differences in the number of calories regarding the data collection weeks. To test the immediate effects of the Giacometti cue (research question 1), we considered the Bonferroni post hoc test comparing the pretest week and the intervention week because, by definition, a nudge has to be present within the decision-making context to be effective (Thaler & Sunstein, 2009). This approach has been used in earlier studies on nudges (Kurz, 2018; Kroese et al., 2015). To test the effect of the Giacometti cue after its removal (research question 2), we considered the Bonferroni post hoc test, comparing the pretest week and the posttest week. This is the established analysis in a one-group pretest–posttest design (Campbell et al., 1963) and has also been used before in a study on persistent nudge effects (Kurz, 2018).

Research questions 3, 5, and 6 involve the number of calories purchased as a dependent variable as well as the acceptance of the Giacometti cue and the awareness of the Giacometti cue as independent variables. Because of a positive skewness of nudge acceptance (1.96; *SE* = .079) and nudge awareness (2.10; *SE* = .079), we computed groups based on the participants' levels of acceptance and awareness of the Giacometti cue. Regarding the acceptance, participants were split into two groups: acceptance values of 1 qualified as low acceptance, and values of 2–5 qualified as high acceptance (n_{low} = 634; n_{high} = 264). This is based on the distribution pattern of Giacometti cue acceptance. The same procedure was performed for awareness of the Giacometti cue (n_{low} = 697; n_{high} = 201): awareness values of 1 qualified as low awareness, and values of 2–5 qualified as high awareness. Next, we conducted a univariate ANOVA to test these research questions. Only the number of calories purchased during the intervention week was considered in this analysis because the nudge needs to be present within the decision-making context to be effective (Blom et al., 2021).

To answer the third research question (*what is the role of acceptance of the Giacometti cue on actual food purchases in a real-world university cafeteria?*), we considered the main effect of the Giacometti cue acceptance on calories purchased. To answer the fifth research question (*what is the role of the level of awareness of the Giacometti cue in actual food purchases in a real-world university cafeteria?*), we considered the main effect of the awareness of the Giacometti cue's presence on calories purchased. To answer the sixth research question (*what is the combined immediate effect of Giacometti cue acceptance and awareness on the actual food purchases in a real-world university?*), we considered the interaction effect of acceptance and awareness on calories purchased.

To answer research question 4 (*does acceptance of the Giacometti cue moderate the nudge's immediate effect on actual food purchases in a real-world university?*), we conducted a moderation analysis using the PROCESS v 4.0 macro for SPSS developed by Andrew F. Hayes

(Hayes, 2022). In the analysis, the data collection week represented the predictor, the dummy coded variable of the Giacometti cue's acceptance was the moderator variable, and the number of calories purchased in main dishes was the outcome variable. Again, we only considered the pretest and intervention week in this analysis because a nudge needs to be present in the decision-making context to be effective (Blom et al., 2021). We used a significance level of .05 and bootstrapping with 10,000 bootstrap samples for the percentile bootstrap confidence intervals (confidence level of 95%).

For all the analyses, we used SPSS v. 28 (IBM SPSS Statistics for Windows, version 28.0. Armonk, NY, USA, IBM Corp.), applied a significance level of .05, and deleted missing values listwise.

5.3 Results

The descriptive and inferential statistics for the three points of data collection are summarized in Table 1.

Table 1. Descriptive statistics for each data collection week and inferential statistics comparing the weeks.

		Pretest (*n* = 957)	**Nudge intervention (*n* = 968)**	**Posttest (*n* = 974)**	**Inferential statistics**
Gender	Male	470 (49.6%)	487 (50.7%)	450 (46.4%)	$\chi^2 = 11.79$, $p = .019$
	Female	476 (50.2%)	468 (48.7%)	507 (52.3%)	
	Diverse	2 (.2%)	6 (.6%)	13 (1.3%)	
Age		21.86 (3.59)	22.47 (4.42)	21.91 (3.16)	F (2, 2875) = 7.77, $p < .001$
Height		176.1 (9.71)	176.1 (9.68)	175.4 (9.71)	F (2, 2840) = 1.55, $p = .213$
Weight		68.6 (11.59)	69.4 (12.59)	67.6 (11.71)	F (2, 2727) = 5.05, $p = .006$
Hunger		4.16 (.798)	4.15 (.789)	4.12 (.821)	F (2, 2888) = .858, $p = .424$
Number of calories purchased in main dishes		386.0 (6.01)	363.9 (5.98)	432.7 (6.15)	F (2, 2666) = 33.33, $p < .001$
Acceptance of the Giacometti nudge		1.46 (.965)	1.58 (1.077)	1.43 (.904)	F (2, 2880) = 5.766, $p = .003$).
Nudge awareness[1]		-	1.54 (1.166)	-	-

Note. *SD* in brackets for all variables except gender; [1]nudge awareness was only assessed in the intervention week. Control variables are displayed above the dotted line.

There are no significant differences between the data collection weeks regarding height, overall nudge acceptance, and hunger. Regarding gender, the frequencies of gender-diverse individuals differ between the data collection weeks. There are slightly more gender-diverse individuals in the posttest week than in the pretest and intervention week. We find significant differences between the data collection weeks for age. Bonferroni post hoc test revealed that participants in the intervention week are slightly older than participants in the pretest week ($p < .001$) and in the posttest week ($p = .001$). Participants in the pretest and posttest weeks do not differ in age ($p = .786$). There are significant differences in participants' weights between the data collection weeks. Participants in the intervention week weigh slightly more than participants in the posttest week ($p = .002$). There are no differences in weight between

participants in the pretest and intervention week (p = .157) or between the pretest and posttest weeks (p = .081). Regarding Giacometti cue acceptance, there is a significant difference between the data collection weeks. Participants in the intervention week accept the Giacometti cue more readily than participants in the pretest week (p = .012) and participants in the posttest week (p = .001). There is no difference in Giacometti cue acceptance between the pretest and posttest weeks (p = .489). Considering all data collection weeks, we find significant correlations of gender with acceptance of the Giacometti cue (r = −.189, p < .001) as well as of acceptance and numbers of calories purchased (r = −.157, p < .001). For a simpler interpretation of these results and due to the small number of gender-diverse individuals in this sample, we only considered males and females. These correlations indicate that female participants accept the Giacometti cue less readily and purchase fewer calories. We also find a positive correlation between acceptance of the Giacometti cue and level of awareness of this nudge (r = .120, p < .001). The more aware the participants were of the nudge, the more they accepted it.

A univariate ANOVA reveals a significant main effect of the data collection weeks on the number of calories purchased with main dishes (F (2, 2666) = 33.330, p < .001; R^2 = .024; η^2 = 0.024). The Giacometti cue has a small effect and explains about 2% of the variance in the number of calories purchased. To answer research question 1 (*what is the immediate effect of the Giacometti cue on actual food purchases in a real-world university?*), we considered the Bonferroni post hoc test comparing the pretest and the intervention week. The average of calories purchased in the intervention week (M = 363.90; SD = 168.42) is significantly lower than the average of calories purchased in the pretest week (M = 385.96; SD = 193.59), p = .028. We conclude that the Giacometti cue significantly and immediately reduces the number of calories purchased.

To answer research question 2 (*how does the removal of the Giacometti cue from a real-world university cafeteria affect the actual food purchases?*), we considered the Bonferroni post hoc test comparing the pretest and posttest weeks. The average of calories purchased in the pretest week (M = 385.96; SD = 193.59) is significantly lower than the average of calories purchased in the posttest week (M = 432.71; SD = 178.19), p < .001. To ensure that the second participation of participants in the posttest week did not confound the results for the second research question, we repeated the analysis filtering out individuals who participated for a second time. The results remain the same with F (2, 2290) = 20.509, p < .001, and a Bonferroni post hoc test with p < .001. The average of calories purchased in the pretest week (M = 385.96; SD = 193.59) is significantly lower than the average of calories purchased in the posttest week (M = 429.11; SD = 178.87), only considering individuals who participated once in the study. We conclude that participants purchased more calories after the nudge had been removed.

To answer research question 3 (*what is the role of acceptance of the Giacometti cue in actual food purchases in a real-world university cafeteria?*), we considered the main effect of nudge acceptance on the number of calories purchased in the intervention week. The univariate ANOVA reveals a significant main effect of the acceptance of the Giacometti cue (F (1, 894) =

4.717, p = .030; η^2 = 0.005). Individuals with a high acceptance of the Giacometti cue purchase more calories (M = 385.54; SD = 189.22) than individuals with a low Giacometti cue acceptance (M = 354.88; SD = 159.09). This effect is considered small. We conclude that those participants who readily accepted the Giacometti cue purchased more calories than participants who did not accept the cue.

To answer research question 4 *(does acceptance of the Giacometti cue moderate the nudge's immediate effect on actual food purchases in a real-world university?*), the moderation analysis considering data from the pretest and intervention week finds no significant interaction between the data collection weeks and acceptance of the Giacometti cue (b = 32.16; SE = 19.30; t = 1.667, p = .096; 95% CI [−5.690 to 70.011]). The model is significant with F (3, 1798) = 4.008 and p = .007 (R^2 = .007). Acceptance of the Giacometti cue does not moderate the effect of the nudge on the number of calories purchased. We conclude that accepting the Giacometti cue more or less does not impact the number of calories purchased.

To answer research question 5 (*what is the role of the level of awareness of the Giacometti cue in actual food purchases in a real-world university cafeteria?*), we considered the main effect of nudge awareness on the number of calories purchased in the intervention week. The univariate ANOVA does not show a significant main effect (F (1, 894) = .321, p = .571; η^2 = 0.000). We conclude that individuals with a high versus a low awareness of the Giacometti cue do not differ in their number of calories purchased.

To answer the sixth research question (*what is the combined immediate effect of Giacometti cue acceptance and awareness on actual food purchases in a real-world university?)*, we considered the interaction effect between nudge awareness and nudge acceptance on the number of calories purchased. The univariate ANOVA does not show a significant interaction effect (F (1, 894) = .048, p = .827; η^2 = 0.000). There is no combined effect of these variables on the number of calories purchased while the nudge was present. Students high or low in nudge acceptance do not differ from students high or low in nudge awareness regarding the number of calories purchased. The corresponding descriptive statistics (Table 2) show that most students (57.6%) have low acceptance and also awareness ratings. This group of students purchased the smallest number of calories. In contrast, only a few students (9.4%) show high acceptance as well as awareness ratings. These students purchased the largest number of calories. We conclude, descriptively speaking, that students who did not accept the nudge and were unaware of its presence purchased the least calories, while students who accepted the nudge and were aware of its presence purchased the most calories.

Table 2. Descriptive statistics of the interaction between Giacometti nudge acceptance and awareness in the intervention week regarding numbers of calories purchased.

		Acceptance of the Giacometti nudge			
		Low (*n* = 634)		**High (*n* = 264)**	
		M (SD)	***n (%)***	***M (SD)***	***n (%)***
Awareness of the	Low (*n* = 697)	354.44 (156.54)	517 (57.6)	382.02 (196.53)	180 (20.0)
Giacometti nudge	High (*n* = 201)	359.36 (172.29)	117 (13.0)	393.10 (173.42)	84 (9.4)

5.4 Discussion

The present study contributes to bridging the gap in research assessing the effects of nudges on food choice in real-world settings (Ensaff, 2021). In testing the real-world effectiveness of the Giacometti cue regarding the new target group of university students, we add to the ecological validity of prior findings and, thus, the generalizability of this cue. By researching what happens when the Giacometti cue is removed from the setting, we gain insights regarding the nudge's validity. In assessing the roles played by acceptance and awareness, we deepen our understanding of the conditions under which nudges can be effective. We found the Giacometti cue to be immediately effective in reducing the number of calories purchased (research question 1). When it was removed from the decision-making context, it had a reversal effect, increasing the number of calories purchased (research question 2). In addition, individuals with a high acceptance of the Giacometti cue purchased more calories than individuals with a low acceptance (research question 3). The effect of the Giacometti cue was not influenced by the extent to which the participants accepted the Giacometti cue (research question 4). Being more or less aware of the Giacometti cue's presence did not affect the number of calories purchased (research question 5). Comparing students with high versus low nudge acceptance with students with high versus low awareness yielded no significant findings regarding the number of calories purchased.

Effects of the Giacometti Cue

Our first two research questions focus on the effects of the Giacometti cue during exposure and after its removal in a real-world field setting. Research on the Giacometti cue found it to effectively improve the dietary behavior of adults ranging between 35 and 39 years of age with a moderate effect size (Brunner & Siegrist, 2012; Stämpfli et al., 2017). For young adults, the Giacometti cue was ineffective when applied in a virtual setting (Kawa et al., 2022b; Kawa et al., 2021). In the present study, the Giacometti cue had an immediate effect of reducing the number of calories purchased by university students in a real-world university cafeteria. This is in line with the results of most of the studies assessing the Giacometti effect (e.g., Brunner & Siegrist, 2012), and also with other studies regarding immediate nudge effects in cafeteria settings, (e.g., Kurz, 2018). Based on the literature regarding the effectiveness of the Giacometti cue so far, its immediate effect of reducing the number of calories purchased was expected (research question 1).

In addition to immediate effects, some types of nudges established effects that lasted even after the nudge had been removed from the decision-making context (Congiu & Moscati, 2022; Kurz, 2018). For example, a visibility nudge in a university cafeteria still had the intended lasting effect of increasing the number of vegetarian dishes sold after they had been removed (Kurz, 2018). Such lasting effects of nudges are believed to depend on the cognitive processes that the nudge targets (Lin et al., 2017). So far, only one study has assessed the longitudinal effects of a six-month exposure to the Giacometti cue in approximately 48-year-old individuals with weight loss goals (Stämpfli et al., 2020). They found that specifically restraint eaters aware of the nudge lost weight after the six-month-long exposure, showing that the Giacometti cue does not lose its efficacy during long-term exposure. This study did not assess any effects after the removal of the nudge (Stämpfli et al., 2020). Based on research findings so far, it can be assumed that the Giacometti nudge either shows a lasting effect of reduced numbers of calories purchased or non-significant results. However, in the present study, the number of calories purchased by students increased after the nudge had been removed from the decision-making context. It seemed to have a lasting effect; however, according to earlier research and the purpose of the nudge, this increase was not expected. The evidence on the Giacometti cue so far has not predicted an increase in the number of calories purchased (Stöckli et al., 2017; Stämpfli et al., 2020). The results of our study, therefore, support the call for research on the long-term effects of nudges (Veccio & Cavallo, 2019; Van Gestel et al., 2020). Similar unintended effects of nudges have been reported regarding food choices (Wansink & Chandon, 2006; Wilcox et al., 2009). One study found young adult interns in a workplace cafeteria to unexpectedly reduce their healthy food choices after having been nudged by personalized e-mails and green footsteps on the floor. It has been suggested that these nudges may have been regarded as overly intrusive and paternalistic to be acceptable (Bauer et al., 2021). Such defiance arousal has been described as one reason for the backfiring effects of health interventions (Stibe & Cugelman, 2016). A backfiring effect is an unintended negative intervention outcome causing the opposite effect of that intended by the intervention (Stibe & Cugelman, 2016). A possible explanation for the unexpected increase in calories purchased after the Giacometti cue had been removed is that it may have aroused defiance. Low acceptance ratings of this cue found in the present study, as well as previous research (Kawa et al., 2022a), indicate that it was not well received as a health intervention in general. Participants possibly counteracted by increasing the number of calories purchased after its direct exposure was removed. These findings point to the important role of nudge acceptance.

The role of nudge acceptance

The present study researched the role of nudge acceptance by addressing two research questions: *What is the role of acceptance of the Giacometti cue on actual food purchases in a real-world university cafeteria* (research question 3)? *Does acceptance of the Giacometti cue moderate the nudge's effect on actual food purchases in a real-world university cafeteria* (research question 4)? Considering the role of Giacometti cue acceptance, we found that individuals who readily accepted the nudge purchased more calories than individuals who did

not accept the nudge when exposed to it (with a small effect). In addition, we found no moderation effect of nudge acceptance considering the difference in the number of calories purchased before nudge exposure and during nudge exposure. The level of nudge acceptance did not influence the relationship between the Giacometti cue and the number of calories purchased. These results were not expected—especially those involving higher numbers of calories purchased by individuals who accepted the nudge. To explain these results, we need to consider the Nudge Acceptance Model in more detail (Hagman, 2018). According to this model, the more a nudge is accepted, the more likely it is to be effective (Hagman, 2018). In our case, this means that those participants who readily accepted the Giacometti cue should have purchased fewer calories. Instead, they purchased more. Moreover, the immediate effect on the number of calories purchased (research question 1) should have been moderated by the level of nudge acceptance. We found no such effect. The Nudge Acceptance Model proposes that nudge acceptance, and subsequently behavior change, is influenced by the degree of transparency of the nudge (Hagman, 2018). Transparency encompasses whether or not a nudged individual correctly understands the purpose of the nudge as well as the intended behavior change (Hansen & Jespersen, 2013; Hagman, 2018). Thus, for a nudge to be accepted and cause the intended behavioral change, the nudged individual needs to understand the purpose of the nudge. In the case of the present study, it is possible that the purpose behind the Giacometti cue was not transparent enough for the individuals to understand it correctly. The cue's skinny body shape is intended to prime weight-related cues, which suggest weight loss (e.g., Brunner & Siegrist, 2012; Stämpfli et al., 2020), leading to a reduction in calories purchased. Considering that the Giacometti cue depicts a particularly skinny (even underweight) body shape, it is possible that this cue did not activate thoughts of weight-loss in young university students but rather thoughts of weight-gain to counteract underweight. In this case, readily accepting the Giacometti cue and consequently purchasing more calories is logical. This explanation is strengthened when considering that an individual's response to an intervention (including nudges) depends, for example, on an individual's preferences (Bauer & Reisch, 2019; Bauer et al., 2021). These motives did not match the purpose of the Giacometti cue, looking at the individuals' preferences regarding the reasons for choosing a particular meal in the present study. Students ranked weight control number twelve out of fifteen motives for choosing their meal (see Section 2.3).

So far, little is known about the relationship between nudge acceptance and nudge effectiveness in real-world settings (Ensaff, 2021). Considering the Giacometti cue, we can conclude from the present study that transparency (thus correctly reconstructing the purpose behind a nudge) is necessary for this cue to have the intended effect. So far, the Giacometti cue has only been researched as displaying a skinny body shape without any explanatory information regarding its purpose. This Giacometti cue can benefit from modifications to improve its acceptance and ensure that its aims are correctly understood when applied to students in a real-world university cafeteria.

The role of nudge awareness

In research question 5, we proposed that the degree to which university students are aware of the Giacometti cue plays a role in their real-world food choices. Nudges have been described as influencing automatic and unconscious decisions as well as deliberate and conscious decisions (Hanse & Jespersen, 2013). Making someone aware of the nudge's presence does not affect the effectiveness of nudges (e.g., Wachner et al., 2020), specifically so in a real-world setting (Kroese et al., 2015). As expected, and in line with this finding, the present study did not find the degree to which participants were aware of the Giacometti cue (high versus low awareness) to affect the number of calories they purchased when exposed to the nudge. In our study, we assessed nudge awareness after exposure to the Giacometti cue. We neither made them deliberately aware of the nudge nor did we disclose its purpose. We consider this approach as assessing the unconfounded level of awareness and not its perceived purpose. We focused on whether the students noticed the nudge in a hectic university cafeteria. Because the students were generally unaware of the Giacometti cue, and it effectively reduced the number of calories purchased when it was present within the setting, we can confirm that its influence was unconscious. This is in line with earlier studies on the Giacometti cue (Stämpfli & Brunner, 2016; Brunner & Siegrist, 2012). Thus, regarding the role of awareness, we can confirm earlier research suggesting that the Giacometti cue influences subconscious cognitive processes. It does not have to be consciously perceived to be effective and can therefore be applied in hectic real-world settings, such as university cafeterias.

In the sixth research question, we inquired about the combined effect of Giacometti cue acceptance and awareness of its presence in food purchases. This type of research question has not yet been explored in research on nudge effectiveness, and we found no combined effect in the present study. So far, disclosing the purpose of a nudge (thus making individuals aware of its presence) neither reduced nudge effectiveness on dietary behavior nor its acceptance when dealing with a highly accepted nudge (Kroese et al., 2015). As explained above, the Giacometti cue did not achieve good acceptance ratings in the present study nor in an earlier study involving university students (Kawa et al., 2022a). In the present study, only 29.4% of students accepted this nudge. In addition, most students (77.6%) were not aware of it. We found differences in the number of calories purchased when the nudge was present, comparing individuals with high or low acceptance levels of the Giacometti cue. However, these differences did not vary in relation to the groups with high and low awareness of the Giacometti cue's presence. These are positive results for the Giacometti cue. The level of acceptance did not change when students were aware of the Giacometti cue, and consequently, the number of calories purchased while the nudge was present did not change. Even though the combined effect of nudge acceptance and awareness was not significant, the descriptive statistics would suggest that the Giacometti cue may have its intended effect of inducing students to purchase fewer calories if they do not accept the nudge and are unaware of its presence. Students who accept this nudge and are aware of its presence may purchase larger numbers of calories. Again, this unexpected increase in calories purchased for individuals who were highly aware of the cue and readily accepted it can be explained by the

lack of a clear statement regarding the nudge's purpose (see Section 4.2). Still, we do not know if nudge awareness amounts to (mis)understanding its purpose. In this regard, we conclude that more research is needed to determine if the purpose of the Giacometti cue is correctly understood and whether the cue's effectiveness benefits from making individuals aware of the cue and its purpose.

Methodological Reflections and Future Research

Study design: The present field study using a one-group pretest–posttest design was carefully designed based on well-established standards and previously used approaches (Kurz, 2018; Campbell et al., 1963). A weakness of the field study design is that replicability is difficult (Eberhardt & Thomas, 1991). These difficulties can be counteracted to ensure that valid data is obtained—for example, large sample size and measurements before and after the intervention (Eberhardt & Thomas, 1991). Another weakness is that confounding variables may play a role in a field setting. This weakness can be counteracted by standardizing conditions and settings as much as possible (Campbell et al., 1963). A strong point of the present study is that we took the proposed measures to counteract any weaknesses: (1) To obtain valid data, we reached a large sample size and applied measurements before and after the intervention. Even though replicating the exact dish choices offered in the present study is difficult in another cafeteria setting, we ensured replicability by calculating the caloric value for each dish. This can be accomplished for any dish offered in any cafeteria setting. Future studies that aim at replicating our results should, therefore, also calculate the caloric values of the dishes offered in their setting. (2) We also took measures to keep the conditions as standardized and constant as possible (Campbell et al., 1963). Despite all this, during the pretest week, the ground floor cafeteria was closed due to an unforeseen staff shortage. Consequently, the range of meals, as well as the average calorie content of the main dishes, was smaller in the pretest week than in the other two weeks. While this is an unforeseen limitation of the study, it does not limit our findings, as we found that the students purchased fewer calories in the intervention week than in the pretest week (when the average number of calories per main dish was higher than in the pretest week). Future studies need to be aware of unforeseen events that can hinder the standardization of conditions.

Food choice and purchase: The dependent variable in the present study is the actual purchase of main dishes (converted into corresponding numbers of calories). This represents the number of calories students intended to consume as their lunch. A strong point of this measure is the relative ease of data collection which allowed for a large sample size to be assessed, increasing the generalizability of our findings. Because the subsequent calculations of the dishes' caloric values were based on the exact recipes provided by the cafeteria staff, these values are very precise. Calories are often used as a dependent variable in research (also involving nudges) (Bauer & Reisch, 2019). A weakness of this measure is that we do not know whether participants actually consumed everything they purchased. Because caloric values were based on dish recipes, these calculations are valid. However, low numbers of calories do not reflect a healthy diet, and we cannot draw clear conclusions in this regard. A lower caloric

intake may be an important aspect of a healthy diet (Heseker & Heseker, 2019), but healthy eating also involves the consumption of, for example, high in nutrients and vitamins (Heseker & Heseker, 2019; Gibson, 2022). We want to clarify that we do not suggest that low-calorie food choices represent healthy eating behavior. Unobtrusively assessing actual food consumption in a real-world setting is difficult and hardly feasible for a large sample size. Still, future research should consider actual food consumption as a more precise measure, better reflecting the effects of the Giacometti cue in a real-world cafeteria.

Giacometti cues: In the present study, we presented sculptures designed by Alberto Giacometti that are known to display skinny, human-like figures. We applied these cues on posters in a busy university cafeteria. A strong point of using this cue is that it effectively improved snack choice when applied as a poster next to a vending machine in a university cafeteria (Stöckli et al., 2017). Therefore, our chosen format is suitable. This artwork combines two lines of research in the field of food choice: the influence of body shape primes and the influence of external cues (Brunner & Siegrist, 2012). A weakness of this cue is that while it represents a skinny individual, it does not show real (or realistic) individuals. It can neither be described as aesthetic nor attractive from a conventional point of view. While the present study measured acceptance and awareness of the Giacometti cue, it did not assess in which way individuals perceived the cue. Its low acceptance rates may indicate a disliking of the cue. Research in the marketing domain found that art conveys positive connotations to unrelated products regardless of the specific content of the artwork (Hagtvedt & Patrick, 2008). Whether this is true regarding the Giacometti cue is yet to be determined. Future research should therefore focus on how the Giacometti nudge is perceived. Do individuals recognize it as art? Do they recognize the artist? Do they associate artistic pleasure with this sculpture, displeasure, or rather a weight prime?

Control variables: We assessed fifteen different motives for choosing one's meal based on a validated questionnaire. A strong point of this procedure is that we learn more about the sample of university students and for what reasons they chose their meals within the real-world cafeteria setting. A weakness is that these reasons did not include veganism, vegetarianism, or food allergies. These reasons may have played a role in food choice. Future research should consider these reasons as control variables.

Constraints of time and resources: The present study was conducted over three consecutive weeks. A strong point of this approach is its feasibility and that this allows for a more standardized setting because it involves the collection of data over time. A weakness is that due to constraints of time and resources, we were not able to assess any long-term effects of the Giacometti cue by, for example, repeating the study after a certain period. Future studies should consider the assessment of possible long-term effects in their study design. The present study focuses on the Giacometti cue and its effects on food choice. A weakness of this focus is that we were not able to compare the found effects to other nudging cues. A strong point of this focus is again its feasibility. Adding a second cue or type of nudge would have

expanded the data collection period. Still, comparing the effects of the Giacometti nudge to the effects of other cues and nudges is an interesting topic for future research.

Giacometti cue acceptance: To measure acceptance of the Giacometti cue, we asked the participants to indicate whether they accepted the portrayal of artwork showing skinny artistic sculptures. The strong point is that this measure was used in a previous study (Kawa et al., 2022a). A weakness is that this question probes two aspects simultaneously—namely, skinniness and artwork. Because we did not want to confound the effect of the Giacometti cue, we did not show a picture of the nudge as an example. In addition, we intentionally did not include the name of the artist or sculpture in this assessment. An interesting subject for future studies is how the acceptance of the Giacometti cue is perceived when the artist and a picture are included. The acceptance of the Giacometti cue as a health intervention and its impact on nudge effectiveness remains a prominent topic for future research because the present findings in this regard were unexpected. The reasons for these findings should be empirically assessed. Moreover, other modifications to this cue may be beneficial. For example, future studies need to assess whether clearly stating the purpose behind this nudge (and therefore increasing its transparency) leads to the intended effect of higher nudge acceptance causing fewer calories purchased. So far, research found that transparency does not hinter a nudge's effectiveness (De Ridder et al., 2022). A study on the transparency of the Giacometti cue may explain our unexpected results regarding nudge acceptance. Future studies should also assess specifically how the target group of young adults perceived the purpose of the nudge. Did the cue initiate weight-loss or rather weight-gain associations in young adults?

Implications for Theory and Practice

Several implications regarding the theoretical background of nudging, as well as the practical application of nudges, can be drawn from this study. The Giacometti cue was applied in a real-world setting with the goal of improving the food choice of university cafeteria customers. While this implementation was easy, cost-effective, and led to fewer calories being purchased in the intervention week, its effect of increasing the number of calories purchased after it had been removed from the setting was unexpected. As a practical implication, these findings stress the importance of testing a nudge's effectiveness even if it has been identified as suitable, easy to apply, and cost-effective. As a theoretical implication, the results show that a nudge may also have an effect even if it is removed from the setting—contrary to its definition (Thaler & Sunstein, 2009).

Most individuals perceived the Giacometti cue as unacceptable. In addition, those individuals who consciously accepted it purchased the most calories. As a practical implication, the acceptance of any nudge should always be ascertained prior to its implementation. As a theoretical implication, these results show that regarding the Giacometti cue, another important factor of the Nudge Acceptance Model (Hagman, 2018) is the understanding of the purpose behind the nudge (transparency). Its purpose needs to be correctly understood to

have the intended effect. Future research is necessary to understand these specific findings. What do young adults associate with this cue—weight gain or weight loss?

Combining the just mentioned implications indicates that the Giacometti cue's effectiveness can benefit from the refinement of its use in a real-world cafeteria targeting university students. These refinements should focus on ensuring that its purpose is correctly understood while increasing its acceptance. For example, adding a message that explains the purpose of the cue may increase its acceptance and transparency. Another way to increase its acceptance is to present actual skinny sculptures based on Giacometti's artwork instead of posters. The nudge is then more likely to be perceived as genuine artwork. Our understanding of the Giacometti cue's effects can also benefit from comparing its effects with those of another artwork nudge, which can be clearly associated with weight loss.

The level of awareness of the Giacometti cue's presence did not change its acceptance nor did it change the number of calories purchased while present. As a practical implication, these findings indicate that the Giacometti cue can be applied in a real-world cafeteria setting without the need to focus customers' attention on it. This is good news for highly frequented university cafeterias. As a theoretical implication, these findings underline research findings so far regarding the role played by awareness and transparency of a nudge (De Ridder et al., 2022).

5.5. Conclusions

The present study investigated the effects of the Giacometti cue on food choice in a real-world university cafeteria setting. The role played by nudge acceptance, and nudge awareness, as well as the combined effects of these influences, were also assessed. Based on our findings, we conclude the following: (1) The Giacometti cue has an immediate and intended effect of reducing the number of calories purchased when it is present in a real-world university cafeteria. (2) Unexpectedly, the removal of this cue led to an increase in calories purchased. This increase can possibly be explained by defiance arousal. (3) As individuals who readily accepted the nudge unexpectedly purchased more calories than individuals who did not accept the nudge, nudge acceptance plays an important role. This role is not fully understood and may be explained by a lack of transparency of the nudge's purpose. (4) As expected, the Giacometti cue does not have to be consciously perceived to be effective in a real-world university cafeteria. Therefore, it is suitable for application in such a hectic environment.

The present findings have implications for the practical application of this cue in a real-world cafeteria as well as theoretical implications regarding the nudge definition and the Nudge Acceptance Model (Hagman, 2018)—specifically regarding the importance of nudge transparency. Moreover, the Giacometti cue may benefit from modifications, which need to be assessed in future studies. More research is needed to understand the unexpected findings in the present study—specifically involving the question of whether making individuals aware

of the nudge's presence and purpose increases its acceptance and, consequently, its intended effectiveness in reducing the number of calories purchased.

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Chapter 6

General Discussion

The present dissertation set out to investigate the effects of artwork nudges on dietary behavior as well as influencing factors on these effects in an educational setting. Based on research findings so far and existing research gaps regarding the effects of nudges on dietary behavior, six research questions were formulated:

1. What are the effects of a Giacometti-like artwork nudge on dietary behavior of students in a controlled educational setting?
2. What are the effects of different artwork nudges on dietary behavior in a virtual vignette setting?
3. What are the immediate and lasting effects of the original Giacometti nudge in a real-world setting?
4. Are there differences in nudgeability regarding the acceptance of nudges as health interventions in an educational setting?
5. Specifically, what role does acceptance play in the influence of the original Giacometti nudge on dietary behavior?
6. What role does awareness of an artwork nudge's presence play in its influence on dietary behavior?

Figure 4 portrays how these research questions were addressed in the four research studies that encompass the present dissertation.

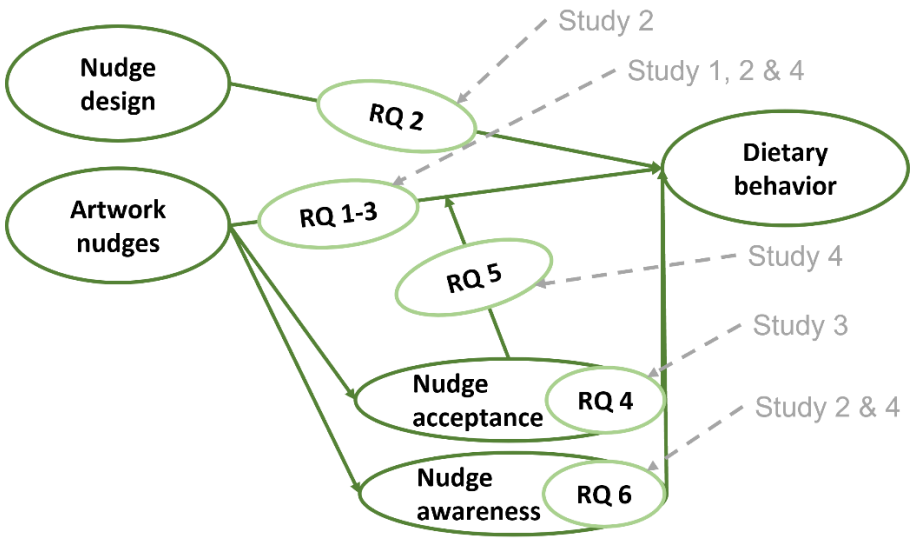

Figure 4. Portrayal of research questions and research studies.

6.1 The effect of artwork nudges on dietary behavior

As Study 1 (Chapter 2) showed, a Giacometti-like artwork nudge did not increase the consumption of healthy blueberries or decrease the consumption of unhealthy chocolate of school students in an experimental field setting. However, exposure to this nudge seemed to increase chocolate consumption in male participants. Study 2 (Chapter 3) showed that

different Giacometti-like nudges did not effectively increase orders of healthy salad or fruit salad or decrease orders of unhealthy chocolate pudding in a virtual vignette setting in university students or employees. The original Giacometti nudge effectively increased the orders of healthy salads in this virtual setting only for university employees but not in students. Unexpectedly, participants who were more aware of this nudge ordered more calories by ordering more healthy dishes compared to participants exposed to the other nudges. In Study 4 (Chapter 5) it was found that in a real-world setting, the original Giacometti nudge effectively reduced the number of calories purchased for university students when it was present in the decision-making context. However, after it was removed from the environment, it unexpectedly increased the number of calories purchased by the students (Study 4, Chapter 5). In a similar unexpected vein, participants with a higher acceptance of the original Giacometti nudge purchased more calories than participants with a lower acceptance of this nudge. While the expected Giacometti nudge effect was seen among university employees, for students in educational settings the effectiveness of this nudge can only be described as unclear. In addition, the Giacometti nudge does not always render the intended effect regarding a younger target group. A lasting effect of the original Giacometti nudge was found to exist in the cafeteria setting for university students. However, the fact that this lasting effect increased the number of calories purchased was unexpected (Study 4, Chapter 5). Consequently, in answering research question 1, 2 and 3 of *what the (immediate and lasting) effects of different artwork nudges are on dietary behavior of students in different educational settings* the results suggest that the original Giacometti nudge seems to cause a reversal effect in dietary behavior: after taking away this nudge the number of calories ordered and purchased unexpectedly increased. These findings suggest that for both, the vignette setting as well as in the real-world cafeteria setting a reversal effect is caused by the Giacometti nudge.

According to several systematic reviews and meta-analysis, nudging in the domain of dietary behavior yields positive results (Arno & Thomas, 2016; Bauer & Reisch, 2019). When nudges are applied in school cafeterias they were found to improve healthy food selection (Marcano-Olivier et al., 2020). To put the magnitude of these findings into perspective and to draw conclusions on their clinical relevance several review studies consider effects sizes. Nudges in the overall health domain were found to have an effect size of Cohen's d = 0.2 (Hummel & Maedche, 2019). Nudges targeting healthy food selection elicit an effect size of Cohen's d = 0.23 (Cadario & Chandon, 2020). These are small effects equal to a reduction in calorie consumption of 124 calories per day (Cadario & Chandon, 2020). The effects elicited by the artwork nudges in the present thesis were similarly small. In Study 1 (Chapter 2) only a small percentage of variance (about 1%) in the participants chocolate consumption was explained by the Giacometti-like nudge. In Study 2 (Chapter 3) the original Giacometti nudge (relative to the other two nudges) only reduced calorie consumption by 8 to 14 calories per meal as an indirect effect (when participants were highly aware of the nudge). In Study 4 (Chapter 5) the original Giacometti nudge reduced calorie purchase by about 22 calories per purchase. Considering that females should consume about 2000 and males about 3000 calories per day

(Heseker & Heseker, 2019) the effects of artwork nudges indeed are small, but nonetheless have the potential to improve dietary behavior.

All studies for this thesis were conducted in an educational setting – a high school (Study 1, Chapter 2), a university (Study 3, Chapter 4), and a university's cafeteria (Study 2, Chapter 3, and Study 4, Chapter 5). In each setting certain social practices and norms play a role and can influence eating behavior (e.g., Renner et al., 2012). Study 3 (Chapter 4) revealed that the degree to which healthy eating social norms exist are important in increasing nudge acceptance. In addition, nudge acceptance can be increased when the environment is perceived as health-promoting, and when officials within the given setting take up their responsibility for promoting health. This suggests that the currently investigated nudges may function differently when applied outside an educational environment which is likely to involve different practices and norms.

To conclude the present thesis together, it seems that it is difficult to predict in advance which results can be expected from a nudge depending on its characteristics, the settings and the target group. The present findings raise the question whether the results are caused by the samples focused on in the research of this dissertation. In the introduction chapter it was mentioned that nudges have been rarely applied to student samples, calling for more research. The present dissertation considered indeed much younger samples than any of the other studies executed regarding the Giacometti nudge (e.g., Brunner & Siegrist, 2012) and its application across different settings (e.g., Stämpfli & Brunner, 2016; Stöckli et al., 2016). Gathering data from these different target groups may explain the different results found in the present dissertation. The research results suggest that younger samples react differently to artwork nudges like the original Giacometti nudge as well as Giacometti-like nudges. Study 1 (Chapter 2) indicates that men and woman can react differently to nudges. In this respect, the present findings in this thesis seem to align with current research on nudges that nudge effectiveness depends on the degree to which an individual is susceptible to a nudge's influence (Bauer & Reisch, 2019; Schüz et al., 2021; Weimer et al., 2022).

Finally, the lack of consistent effects in the hypothesized directions – non-significant findings in Study 1, 2 and 4 – may raise questions whether the non-significant findings are indeed showing that the hypothesized relations do not exist or whether this is caused by a lack of statistical power in the research designs we used. However, estimates concerning the required sample sizes were made based on a meta-analysis demonstrating that healthy eating nudges elicit a rather small Cohen's *d* effect size of 0.23. To address the possibility that the original Giacometti nudge as well as the Giacometti-like nudges did not elicit strong enough statistical effects, we conducted a priori as well as post hoc power analyses (G*Power) to assess whether our sample sizes were large enough to show even small effects (Faul et al., 2007). Based on these analyses, it can be concluded that the non-significant findings truly show non-significant relationships.

6.2 The role of nudge acceptance

Study 3 (Chapter 4) showed that nudge acceptance varies from type of nudge to type of nudge. Students accepted default and priming nudges the most while artwork nudges were accepted the least. Nudge acceptance of students was also found to be positively influenced by the degree to which they perceived the university and / or cafeteria to be responsible for promoting healthy dietary behavior. The more students felt officials were responsible for health promotion the more they accepted nudges in a cafeteria and university setting. Nudge acceptance was also influenced by the degree to which students perceived the environment as promoting health collaboration among students as well as by the degree to which social norms of eating healthy were perceived to exist. When students perceived shared health-focused values within a university and / or cafeteria they were more likely to accept nudges targeting dietary behavior. Study 3 (Chapter 4) also showed that nudge acceptance varied from individual to individual. Students were clustered into three different groups depending on their level of accepting nudges targeting dietary behavior: the un-nudgeable, the conditionally-mixed nudgeables, and the nudgeables. Nudgeable students accepted nudges targeting dietary behavior applied by institutions more easily. They seemed to highly accept healthy eating nudges, especially when applied by an institution (cafeteria or university) while feeling a stronger need for institutions to involve themselves in promoting healthy eating. Conditionally-mixed nudgeable students only accepted certain types of nudges that were in line with their opinions and values like health-promoting collaboration. Un-nudgeable students were generally uninterested and uninvolved and did not accept nudges targeting dietary behavior in a university cafeteria setting. Regarding the Giacometti nudge, none of the three groups of students accepted this specific nudge as a health intervention on dietary behavior in a university cafeteria. Acceptance of the Giacometti nudge was assessed by rating the portrayal artwork depicting skinny individuals. These same results were found for the original Giacometti nudge (using the same measure) when it was applied in a real-world university cafeteria (Study 4, Chapter 5). In this context, nudge acceptance did not moderate the effect of the original Giacometti of decreasing the number of calories purchased while the nudge was present in the setting. This finding did not support the Nudge Acceptance Model (Hagman, 2018). However, interesting results were found regarding the nudgeability of university students in the cafeteria setting (as three different groups of nudgeable students were found). For the Giacometti nudge in particular, students generally opposed this nudge. Thus, in answering the fourth (*Are there differences in nudgeability regarding the acceptance of nudges as health interventions in an educational setting?*) and fifth research question (*Specifically, what role does acceptance play in the influence of the original Giacometti nudge on dietary behavior?*) it can be concluded that individuals differ in their nudgeability. To increase nudge acceptance within universities and / or cafeterias the environment needs to promote health collaboration among students, put across that officials take up their responsibility of promoting health and induce healthy eating as a social norm.

6.3 The role of nudge awareness

In Study 2 (Chapter 3) involving a virtual vignette setting, the degree to which individuals were aware of the original Giacometti nudge mediated its effects on the number of calories ordered by university employees. Relative to the Giacometti-like nudges, those exposed to the original Giacometti nudge were more aware of the nudge's presence and ordered more calories (by ordering more healthy foods) as a result. Taking these findings into account, the Giacometti nudge also qualifies as a nudge affecting deliberate cognitive processes of system 2 (Hansen & Jespersen, 2013). In Study 2 (Chapter 3), nudge awareness did not limit nudge effectiveness per se. The original Giacometti nudge still influenced dietary behavior, even when individuals were aware of its presence. It is, however, worrisome that the number of calories ordered increased, even if individuals ordered more healthy foods. It needs to be kept in mind that neither a high number of calories reflects a healthy diet nor that a lower number of calories reflects an unhealthy diet (Heseker & Heseker, 2019). In addition, the rationale of *the more the better* does not necessarily apply here. Consequently, these findings limit the effectiveness of the Giacometti nudge to a particular group of individuals, who want to eat healthier without wanting to or needing to count calories. In a similar vein, it is suggested that the Giacometti nudge should be in line with an individual's preferences especially when one is aware of the nudge's presence (Stämpfli et al., 2020). While the degree to which individuals were aware of the original Giacometti nudge did not impact the number of calories purchased by students in a real-world university cafeteria setting (purchase was not categorized as healthy or unhealthy; Study 4, Chapter 5), the alignment of this nudge with the preferences may be questionable. In research so far, nudge disclosure and transparency has mainly been operationalized by deliberately making individuals aware of the nudge's presence as well as its intention (e.g., Wachner et al., 2020). In the present dissertation, nudge awareness was assessed as the mere noticing of the nudge's presence without disclosing its intentions. Consequently, it is possible that even though individuals were aware of the Giacometti nudge's presence, they did not grasp its purpose. As explained before, the acceptance of original Giacometti nudge was rather low (Studies 3 and 4, Chapters 4 and 5). Also, participants were rather unaware of the nudge's presence and no combined moderating effects of nudge awareness and nudge acceptance on its effectiveness were found (Study 4, Chapter 5). In answering the sixth research question of *what role awareness of an artwork nudge's presence plays in its influence on dietary behavior* it can be concluded that artwork nudges can be classified as a nudge potentially affecting both cognitive systems 1 and 2 (Tversky & Kahneman, 1974). The original Giacometti nudge specifically better serves an unconscious system 1 nudge. However, it remains unclear whether it classifies as transparent or non-transparent and whether its purpose is understood correctly. Moreover, the purpose of the original Giacometti nudge of following a healthy, balanced, and slight diet is admittedly rather complex and may necessitate further education.

6.4 Practical relevance

In 2015, the Okanagan Charter was formulated to focus attention on universities as an important setting for health promotion (Dietz et al., 2020). Since then, universities in Germany are required by law to strengthen their health promotion and prevention efforts (Hungerland et al., 2021). Despite this, few universities focused on the target group of students after the law had been passed, even though students in their emerging adulthood phase of life (age 18-25) pose a particularly vulnerable target group (Hungerland et al., 2021). Most students do not prioritize taking care of their own health (Lange et al., 2021). Even health-conscious students when eating outside their home tend to choose food based on short-term goals (such as ease and taste) instead of long-term health goals (Bauer et al., 2022). Since 2019, more and more attention has been paid to applying specific health promotion and prevention strategies and interventions for students. That year 631 Mio. € were spend on different health-promotion activities in a university setting in Germany (Hungerland et al., 2021). Since nudges are described as cheap and often times as more cost-effective that conventional health interventions (Benartzi et al., 2017; Damgaard & Nielsen, 2017; Sunstein, 2014; Thaler & Sunstein, 2009), university health officials can benefit from applying nudges in a university setting. In the Okanagan Charter it has been suggested to apply health-focused policies and practices, to create healthy environments and a culture of well-being (Suárez-Reyes et al., 2019). Applying such policies and practices can be challenging in the real-world because there is an increased and all-around exposure to convenient and low quality foods in addition to suboptimal social practices revolving around snacking and out-of-home consumption exist (Swinburn et al., 2011; Van Rongen et al., 2020). All this can be warranted by health-focused nudging strategies, because they utilize the existing environment to steer choices and behaviors (Thaler & Sunstein, 2009). Even though the specific artwork nudges tested in this dissertation were not always effective and at times yielded suboptimal results, it has been shown that nudges in general can easily and cost-effectively be applied targeting students in an educational setting.

Successful nudge application requires the nudge acceptance (Hagman, 2018). This dissertation showed that the acceptance of nudges targeting dietary behavior in a university cafeteria is influenced by several factors – perceived responsibility of cafeteria or university officials to promote healthy eating, the degree to which shared values and beliefs focusing on health promoting exist among the students as well as the degree to which social norms of healthy eating exist in the environment. Food providers and officials in educational settings can utilize this information to create an optimal environment for nudge application. Such an optimal environment is likely to improve the nudgeability of students. In line with the results of this dissertation, food providers and officials can, for example, focus on clearly stating their intention and wish to promote healthy eating. When students are aware of these intentions and wishes the environment is likely to be perceived as responsible, health-promoting and inducing healthy eating as a social norm.

As described in the Okanagan Charter, universities should need to focus on promoting health among students (Dietz et al., 2020). Similarly, nudges have been described as an optimal tool for improving dietary behavior (Ensaff, 2021). This dissertation showed that different types of nudges are accepted differently. Furthermore, individuals differed in the degree to which they are susceptible to nudges targeting dietary behavior in an educational setting. While there appear to be students that can be characterized as un-nudgeable, most students were nudgeable or nudgeable under certain conditions. These findings support nudging as a promising tool for promoting healthy dietary behavior. In combination with the findings on the influential factors the conditions under which some students are nudgeable can be optimized by practitioners as described in the previous paragraph. Although we need to keep in mind individual differences in nudgeability, even the un-nudgeables may benefit from optimizing the educational setting (e.g., by increasing health-promoting collaboration among students). Because even health-conscious students when eating outside their home tend to choose food based on short-term goals (such as ease and taste) and not based on long-term health goals all groups of nudgeable students can benefit from being educated on what a healthy diet consists of (Bauer et al., 2022). In this regard, increasing health-promoting collaboration among students has the potential to foster a sound and correct understanding of what healthy eating actually is. Considering the findings that the original Giacometti nudge increased the number of calories ordered by ordering healthy food (when highly aware if the cue) this is an important issue in the educational setting. In addition, possible misconceptions regarding the nudge's purpose need to be prevented.

To successfully nudge students in an educational setting, the effectiveness of the nudge should be high, while efforts should be low. This dissertation showed that while the application of nudges is easy, designing and developing a successful nudge is a challenge. Even when a nudge is developed based on empirical research and a theoretical background it needs to be tested in different settings. This dissertation proposes the following benchmark for getting the most out of a newly designed nudge and making sure that its intended effects reach the target group: 1) carefully design a nudge based on empirical and theoretical considerations, 2) rigorously test this nudge's effectiveness and acceptance in different settings regarding the intended target group as well as the target group's nudgeability. Furthermore, assessing whether the environment is optimal for the application of the nudge, 3) modifying the nudge based on empirical and theoretical considerations, 4) repeating steps two and three until all parties involved reach a maximally positive outcome is crucial. This benchmark for a successful nudge is outlined in table 3.

Table 3. Benchmark for successful nudges including the artwork nudge development as an example.

Steps	Description	Artwork nudge example
Step 1: Careful nudge design	Based on empirical and theoretical considerations	**Empirical considerations:** • Research conducted on the effects of art (Hagtvedt & Patrick, 2008) • Research on the Giacometti artwork (e.g., Brunner & Siegrist, 2012; Stämpfli & Brunner, 2016; Stämpfli et al., 2017; Stämpfli et al., 2020; Stöckli et al., 2016) **Theoretical considerations:** • Definition of a nudge (Thaler & Sunstein, 2009) • Activation of cognitive systems according to the dual-process theory of the mind (Tversky & Kahneman, 1974) • Nudge classification (Hansen & Jespersen, 2013)
Step 2: Rigorous nudge testing for the intended target group	• Nudge effectiveness • Nudge acceptance • Across various settings • Environment regarding suitability for nudge application	• Does the nudge result in intended behavior change? • Is the nudge accepted by the intended target group? • Is the intended target group *nudgeable*? • Is the environment optimal for nudge application? • Is the nudge effective across various settings (e. g. experimental, field, online, real-world)?
Step 3: Consider nudge modifications	• In case the nudge was not successful, reconsider its theoretical basis • Possible modify the design of the nudge	Artwork nudge based on the artwork of Gretchen Röehrs (Röehrs, 2018) and Alberto Giacometti (Giacometti, 1947) were adapted to depicting only a thin body shape (Studies 1 and 2, Chapters 2 and 3)
Step 4: Repeat steps 2 and 3	• Repeat until the maximally positive outcome is reached	• Thick body shape was designed (Study 2, Chapter 3) • Acceptance of the original Giacometti nudge was assessed (Studies 3 and 4, Chapters 4 and 5)

This benchmark is particularly valuable for artwork nudges (like the original Giacometti nudge) yielding inconsistent effects because it allows for target-group specific nudge designs. These nudge design efforts are in line with recent considerations of Sunstein (2022). He argues that some nudges might hurt specific groups and that in preventing this from happening more targeted nudges are needed. In addition, he stresses that researchers and officials in the public and private sectors need to consider these findings. The benchmark above helps in meeting this need.

6.5 Critical methodological reflection and future research

All publications in the present thesis were carefully designed based on previous empirical research and involved a critical peer-review process. Nevertheless, a critical reflection of the strong and weak points is in order. These critical reflections yield interesting ideas for future research.

6.5.1 The nudges

Research in the present dissertation has been heavily based on research studies in the domain of healthy eating nudges particularly focusing on studies involving the Giacometti cue. The central aspects of the Giacometti cue's design (for example a skinny and human-like silhouette) were replicated in the presented nudges. Prior research on nudging based on this artwork suggests that this aspect is crucial to the effectiveness of the original Giacometti nudge (Brunner & Siegrist, 2012). To generalize these findings to more contemporary artwork, the original Giacometti nudge was initially adapted (Study 1 and 2, Chapters 2 and 3). However, the effectiveness of the original Giacometti cue could not always be replicated in the present dissertation. For example, in studies 1 and 2 (Chapters 2 and 3) the Giacometti-like nudges were not effective (Studies 1 and 2, Chapters 2 and 3). After these non-significant results regarding the adapted artwork nudges, any adaptations to the nudge were gradually reversed throughout Studies 2 and 4 (Chapters 3 and 5). Study 4 (Chapter 5), then, focused on the original Giacometti nudge and found it to immediately reduce the number of calories purchased by students in a real-world setting.

Possible reasons for the discrepancy between the findings of the present dissertation and prior research on the Giacometti cue are the following.

1) The Giacometti-like nudges were not similar enough to the original cue. The Giacometti-like nudges were not genderless (as the original cue) but showed male and female body shapes. Future research should specifically assess whether a central aspect of original Giacometti nudge's effectiveness is the lack of gender depiction. Alberto Giacometti also created skinny female body shapes (Giacometti, 1948). Comparing the effectiveness of the original Giacometti cue with a female Giacometti cue may render interesting results.

2) Another possible aspect is the perceived similarity to the nudge. The adapted artwork nudges were designed in a way to convey a feeling of similarity between the nudged individual and body shape displayed by the nudge. The Giacometti sculpture is rather abstract without obvious similarities. Future studies should consider using artwork like that of Alberto Giacometti which conveys a stronger sense of similarity and focuses on the aspect of thinness. A possibility is the already described artwork *Edibles* by Gretchen Röehrs (Röehrs, 2018).

3) None of the Giacometti nudges presented in this dissertation disclosed their purpose of improving dietary behavior. Even though the original Giacometti cue was effective despite not disclosing any purposes (e.g., Brunner & Siegrist, 2012), recent research interests in nudging suggest that disclosing the purpose of nudges rather helps without hindering effectiveness (De Ridder et al., 2022). As the acceptance of the Giacometti nudge was found to be low (Studies 3 and 4, Chapters 4 and 5) assessing the effectiveness of these artwork nudges while disclosing their purpose is an interesting topic for further research. Stating the purpose of the Giacometti nudge may increase its acceptance and consequently result in an increased effectiveness (as the Nudge Acceptance Model by Hagman (2018) suggests). As the results of

the applied artwork nudges are mixed, further research is needed to specifically determine what makes the original Giacometti nudge effective. In this, the original Giacometti cue may be adjusted by varying gender and disclosing its purpose respectively.

6.5.2 The samples

The research studies involved in the present dissertation mainly targeted students in Germany. Each sample was specifically selected for the individual studies. The first study targeted school students from a small town in North Rhine-Westphalia, Germany (Chapter 2). The second study focused on students and employees of a small university in North Rhine-Westphalia, Germany (Chapter 3). The third study (Chapter 4) targeted students from the same university in the second study. Finally, the fourth study sampled students from a large university in North Rhine-Westphalia, Germany (Chapter 5). The present findings represent a sample of young students between the ages of 17 and 23 from North Rhine-Westphalia, Germany in an educational setting. This homogeneity in samples regarding age and educational background increase the generalizability of the present findings.

Based on the research outcomes, it can be concluded that the original Giacometti nudge is effective for the target group when applied in a real-world university cafeteria. More research is needed to cross-validate the findings to more student populations in Germany. Also, closer attention needs to be paid to other possibly influential factors that make up this sample. Specifically, the approval of nudges was found to differ within this sample (Study 3, Chapter 4). Along the same lines, nudge approval was found to vary along the intercultural background of the individuals (e.g., Sunstein et al., 2018). Countries can be categorized into three groups along their acceptance of nudges targeting different behaviors (Sunstein et al., 2018). First, so-called principled pro-nudge nations like Germany, France, the United Kingdom as well as the United States (industrialized Western democracies) welcome nudges under the condition that they are in line with their interests and values without involving illegal purposes. Second, pro-nudge nations like China and South Korea generally approve of nudges. Third, cautiously pro-nudge nations like Japan, Hungary and Denmark clearly show lower approval rates than other nations (Sunstein et al., 2019; Sunstein et al., 2018). Study 3 (Chapter 4) of this dissertation describes a similar categorization regarding nudge acceptance of German university students – nudgeables, conditionally-mixed nudgeables, and un-nudgeables. Considering these classifications as principled pro-nudge and conditionally-mixed culture (e.g., food culture) may either be an explanatory or a confounding factor. More research is needed for the sake of generalizability of the present findings to other parts of Germany. Also, the role of culture and specifically food culture are interesting research topics.

6.5.3 The research designs and settings

The artwork nudges applied in the present dissertation were intentionally applied in different settings using different research designs: Study 1 (Chapter 2) used a controlled quasi-experimental design in a high school setting. Studies 2 and 3 both use a vignette study design

(Chapters 3 and 4). Study 2 involves a vignette design in a virtual online cafeteria. In Study 3 (Chapter 4) a survey was conducted in a university setting; Study 4 (Chapter 5) was a field study in a real-world university cafeteria. Thus, throughout the course of the present dissertation artwork nudges were initially tested for effectiveness under controlled conditions controlling for possible confounding influences. Finally, the most promising of the artwork nudges was applied in a real-world setting. These various research designs and settings allow for the artwork nudges to be assessed from different angles and draw conclusions on under what circumstances the artwork nudges work best. It can be concluded that the original Giacometti nudge is effective in a virtual online setting and in a field setting. These findings indicate another interesting topic for future research: Developing and testing a lunch pre-order smartphone application. Such a smartphone application can be used by students to pre-order their meal online and pick it up at the real-world cafeteria at a designated time. During the registration process for this application, information that is relevant for nudge exposure (e.g., age, nudgeability, etc.) can easily be gathered. This exemplary smartphone application combines the successes of the Giacometti nudge from Study 2 and 4 (Chapters 3 and 5).

In discussing the setting we need to keep in mind that all research studies of the present thesis were conducted in an educational setting (a high school or university). This means that our findings are valid within this setting. Different findings may arise when applying the artwork nudges in another setting. Future research can consider applying the nudges in different settings involving the same target group of young adults, for example, kiosks adjacent to high schools or universities in which the target group is likely to shop.

6.5.4 Measurement of dietary behavior

The title of the present dissertation focuses specifically on healthy eating in an educational setting. Throughout the different research studies healthy eating was operationalized in different ways: In Study 1 (Chapter 2) the actual food consumption of blueberries and chocolate was measured by carefully weighing the provided amounts before and after a food tasting session (interval scaled data). In Study 2 (Chapter 3) it was initially planned to assess the actual meal purchase in a real-world cafeteria. Due to the outbreak of the Covid pandemic, these plans had to be changed. Instead, Study 2 measured the meal orders made in a virtual cafeteria setting (nominal scaled data). The number of calories ordered were carefully calculated based on the recipes of the meals (interval scaled data). In Study 4 (Chapter 5) the purchase of meals in a real-world university cafeteria were assessed and again the number of calories purchased were calculated based on the recipes of the meals (interval scaled data). While these operationalizations do not encompass healthy eating in its entirety, important aspects of healthy eating were captured. A nutritional expert was contacted to ensure that the operationalizations may be used to represent parts of healthy eating behavior. In addition, measuring the number of calories is an often used approach in research involving nudges (Bauer & Reisch, 2019). This is also in line with the conceptualization of dietary behavior food choice (behavior occurring before the food reaches the mouth as in a food purchase), eating behavior (all outcomes related to actual food consumption, such as eating habits), and dietary

intake or nutrition (all outcomes encompassing the content of the food consumed, such as caloric intake) (Stok et al., 2018). Furthermore, interval scaled data, for example, provided by calculating the number of calories of a meal, is truly quantitative and allows for the quantification of difference between values. Nominal data is qualitative and does not allow for such quantifications (Field, 2018). Measuring dietary behavior with quantitative data in all the present dissertation's studies is a strong point. Even though a lower caloric intake may be an important aspect of a healthy diet (Heseker & Heseker, 2019), assessing dietary behavior should not be reduced to the number of calories. A low caloric value of a meal is not equal to a healthy diet. An optimal dietary behavior involves other important aspects, for example, nutrients and vitamins (Gibson, 2022; Heseker & Heseker, 2019). Future research should therefore focus on assessing quantitative data that more thoroughly reflect an optimal dietary behavior (for example actual food consumption). For example, diary studies have the potential to reflect an individual's eating behavior over a longer period of time enabling a researcher to draw a sound conclusion the healthiness of an individual's eating behavior. A diary study involving middle-aged dieters has already been executed using the original Giacometti nudge (Stämpfli et al., 2020) and can be interesting for future research involving young adults in an educational setting.

6.5.5 Timing

So far, research on nudging has not definitely determined the effects of nudges at different points in time as well as long-term or longitudinal effects (Eichhorn & Ott, 2019; Vecchio & Cavallo, 2019). Research on the Giacometti nudge showed that it led to weight loss in individuals exposed to this nudge over a period of six months (Stämpfli et al., 2020). Study 4 (Chapter 5) found an opposing lasting effect of the original Giacometti cue of leading to a higher number of calories purchased. Future studies should involve longitudinal research designs to determine the effects of nudges at different points in time asking the following questions: What happens after a long-term exposure to the nudge? What happens directly after removing the nudge? What happens weeks and months after the removal of a nudge? Can immediate nudge effects be renewed when reinstating the nudge?

6.5.6 Learnings

Using a variety of artwork nudges, samples, research designs and settings throughout the present dissertation yields one major learning: There is no *one-size-fits-all* nudge. The successful application of a nudge depends on its design, the target group as well as the circumstances on which it is applied. This is in line with recent considerations of Sunstein (2022) and his called for targeted nudges. The present dissertation supports the careful application of the original Giacometti if certain conditions are met. These specific conditions will be elaborated on in the concluding remarks of this dissertation.

6.6 Conclusion

"Art is in the eye of the beholder, and everyone will have their own interpretation." E. A. Bucchianeri (Bucchianeri, 2011)

The findings of the present dissertation stress the truthfulness of this citation. The effects of the artwork nudges applied in the present research studies were mixed and not always as intended or expected. The original Giacometti artwork nudge was only effective in improving the eating behavior of employees in a virtual cafeteria and of students in a real-world cafeteria. Even though it was effective, it was not well-accepted, and its lasting effect was unexpected. In addition, it increased the number of calories ordered by university employees who were highly aware of the nudge – another unexpected finding. In addition, nudgeability varied among university students. Still, practitioners can draw important conclusions from the present dissertation: Nudges need to be designed based on a sound theoretical background, tested rigorously and possibly refined. As individuals may differ in their nudgeability, nudge application needs to carefully consider the target group to which it will be applied. The application of nudges in an educational setting is easy and cost-effective. It is also a form of art that admittedly has not been mastered to perfection and more research is needed: 1) The effectiveness of a nudge always needs to be assessed; 2) The effectiveness of artwork nudges as an intervention to promote healthy dietary behavior remains a less researched topic; 3) Future research should focus on how different characteristics of the sample and / or population affect nudge effectiveness. Chapter 7 elaborates on the contributions of the present dissertation for future research in this field.

After all these prior elaborations two simple (but difficult) questions remain: *1) Should the original Giacometti nudge be applied in an educational setting to improve healthy eating?* The answer to this simple question is a difficult CONDITIONALLY-MIXED YES. Even though this specific nudge is easy to apply in an educational setting, it showed reversal and target group specific effects. Consequently, this nudge may improve dietary behavior for individuals with certain characteristics: student enrolled in a German university in North Rhein-Westphalia; age ranging from 17-23 years; nudgeable or conditionally-mixed nudgeable; wants to eat healthy without wanting or needing to count calories. However, as indicated before more research is needed to elaborate on the specific characteristics of target group that can be nudged by the original Giacometti nudge. For the application of the original Giacometti nudge the setting must met certain conditions as well: real-world university cafeteria; unobtrusive placement of the nudge; the setting needs to be perceived as promoting health collaboration and that responsibility of healthy eating is taken seriously by choice architects. Even when these conditions are met, rigorous testing of nudge effects is still necessary. For choice architects in practice, meeting these conditions is challenging. *2) Should artwork nudges be applied in an educational setting to improve healthy eating?* The answer to this simple question is a not so simple. Artwork nudges in general hold a great potential for the design of new nudges which can easily be applied in different educational settings. They are easy and cost-effective to apply and may also target other types of health-related behavior (e.g.,

physical activity). Thus, focusing on the educational setting, the answer to the question above is a YES! When focusing on the aspect of healthy eating the answer again is CONDITIONALLY-MIXED YES. The present dissertation showed how important rigorous testing for any reversal effects and target group specific effects is. As the present artwork nudges were only based on the artwork of Alberto Giacometti more research is needed to draw generalized conclusions regarding artwork nudges. Different types of artwork potentially yield more consistent results than the nudges based on Alberto Giacometti's artwork. In addition, the present thesis aimed at improving dietary behavior. As suggested in the critical methodological reflections healthy eating was not operationalized in its entirety. Consequently, the conclusions do not reflect healthy eating in its entirety.

For a final conclusion of this doctoral thesis a decisive YES or NO regarding the application of artwork nudges and the original Giacometti nudge would be preferable. However, for several reasons I refrain from making such a clear-cut decision: 1) Nudging originated from behavioral economics in 2008. So far, the majority of research was conducted in the domain of economics (*n* = 226; 13.25%) (Jia & Mustafa, 2023). Thus, early research in nudging focused on economic behaviors, for example, saving money for retirement. Later, nudging was applied across various categories of decision making as an intervention tool including nutrition (*n* = 69; 4.05%) (Jia & Mustafa, 2023). While there is a rising trend in nudging research targeting people's daily behaviors, like healthy (eating) lifestyles (Jia & Mustafa, 2023) very few research studies focused on artwork nudges. 2) The originators of nudging, Thaler and Sunstein, mainly defined nudging be giving examples of nudging economic behaviors and no clear design plan for nudges was provided (e.g., Hollands et al., 2013). This led to numerous different categorizations and typologies of nudges (e.g., Hansen & Jespersen, 2013). So far, research was able to determine that nudge effects can be influenced by different environmental or individual aspects (such as the positioning of options or individual preferences) (e.g., Venema et al., 2019; Kroese et al., 2015). The present thesis showed that this is also true for the effects of artwork nudges. In order to make a clear-cut decision regarding artwork nudges, there is more to be done in nudge research. Even though the present thesis does not provide a decisive YES or NO regarding the application of artwork nudges, it provides a clear signal to research focusing on nudging healthy eating behavior: CONTINUE YOUR RESEARCH!

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Chapter 7

7

Valorization Addendum

7.1 Social relevance

The growing trend in scientific research on nudging (Jia & Mustafa, 2023) stresses its social relevance and topicality. In 2018, one year after Richard H. Thaler received a Nobel Prize for his contributions to behavioral economics (and nudging) (Thaler, 2023) the interest in nudging throughout the scientific world spiked (Jia & Mustafa, 2023). While research topics regarding nudging are manifold (Jia & Mustafa, 2023), current topics on the research agenda are for example nudgeability, the role of moderators (like pre-existing preferences) in nudging, the effectiveness of different types of nudges (system 1 or system 2 nudges), the disclosure of a nudge's purpose (De Ridder et al., 2022) as well as the long-term and longitudinal effects of nudges (Eichhorn & Ott, 2019; Vecchio & Cavallo, 2019). The present dissertation investigated these current topics in an educational setting focusing on specific artwork nudges.

The goal of the present dissertation was to determine the effectiveness of different artwork nudges in an educational setting regarding healthy eating. These nudges are specifically based on the artwork of Alberto Giacometti and aim at improving the dietary behaviors of individuals (mainly university students), for example in a university cafeteria. There are two groups of beneficiaries from the insights of the current dissertation – the nudged individuals and the nudging individuals (choice architects). First, when a nudge is applied effectively individuals are able to effortlessly improve their decision-making (in this case regarding healthy eating behavior) while retaining all choice options (Thaler & Sunstein, 2009). Regarding the original Giacometti nudge it was concluded that while this nudge is a promising tool for the improvement of dietary behavior in students, it needs to be implemented carefully and necessitates empirical testing. In line with Sunstein (2022), it should be applied as a targeted nudge to ensure that only beneficiaries of this specific nudge are reached. Second, choice architects also benefit from the present findings. These choice architects are any individuals who are in charge of designing a decision-making context (Thaler & Sunstein, 2009). In the educational setting choice architects, for example, are the officials and staff of a university cafeteria or a university in general. Gaining deeper insights into how to design and implement an effective nudge simplifies the creation of an environment in which healthy choices can be made easily and effortlessly. Universities in Germany are required by law to create such healthy environments (Bauer & Römer, 2019). Food providers like university cafeterias are also required to meet strict regulations regarding healthiness and environmental settings (German Nutrition Society [DGE], 2022). Universities represent an important setting in which health interventions focusing on dietary behavior take place (Dietz et al., 2020). Applying a successful artwork nudge at a university cafeteria is particularly interesting for real-world decision-making contexts, because they can be applied easily and cost-effectively (e.g., Damgaard & Nielsen, 2017) and promote economic goals, for example, within the public health domain (Sunstein, 2014). The economic costs for health interventions in an educational setting are high. For example, in 2019, 631 million Euros were spend on health promoting interventions by German universities (Hungerland et al., 2021). Reducing these high costs by applying cost-effective nudges is in the interests of both sides of the nudge – the nudged

individual as well as the nudging individual. Again, the original Giacometti nudge is considered promising when its implementation is carefully and empirically tested keeping in mind that it should target specific individuals.

7.2 Contribution of the empirical findings of this dissertation for choice architects in educational settings

A choice architect is any individual responsible for constructing the environment and context in which decisions are made (Thaler & Sunstein, 2009). In an educational setting (like a school or a university), a choice architect responsible for an environment in which dietary behavior takes place (for example a cafeteria) may be a food provider or a university official. For choice architects wishing to apply nudges in real-world settings, developing and applying a new nudge involves four steps. First, the choice architect needs to understand the context in which the nudge will be applied (Ly et al., 2013). This means that the decision-making context as well as any heuristics or influences involved in the decision-making process need to be understood. Second, a nudge suitable for the decision-making context envisaged needs to be selected. Third, areas in which the nudge can be implemented need to be identified. Fourth and finally, the nudge needs to be tested for effectiveness and revised in several iterations if necessary (Ly et al., 2013). The research in the present dissertation stresses the importance of following this approach before applying a nudge openly in public – especially when a new target group is involved. Study 1 (Chapter 2) showed that even a nudge developed based on sound empirical evidence does not necessarily yield the intended results. The Giacometti-like nudge did not improve the eating behavior of school students in a controlled high school setting. Before a choice architect implements a new nudge, rigorous testing is necessary. Study 2 (Chapter 3) likewise showed that a nudge can affect target groups differently. While the Giacometti-like nudges were not effective, the original Giacometti nudge improved the eating behavior of university employees, but not university students in an online setting. When the original Giacometti nudge was applied in a real-world setting it improved the eating behavior of university students while present in the decision-making context (Study 4, Chapter 5). The effectiveness of a nudge may therefore also vary depending on the setting in which it is implemented. Choice architects, like food providers or university officials need to keep these results in mind and accordingly rigorously test a nudge in the specific setting in which it is to be applied.

Next to the rigorous testing in a specific environment, choice architects also need to keep in mind that individuals differ in the degree to which they are susceptible to nudges (nudgeable). Study 2 (Chapter 3) showed that while university employees improved their eating behavior when exposed to a virtual nudge, university students were not affected. Study 3 (Chapter 4) presented a typology of nudgeability regarding university students based on the acceptance of a nudge as a health intervention. The same nudge may yield different results depending on factors like nudge acceptance. Next to assessing the specific context in which a nudge will be applied, practitioners also need to pay close attention to the specific target groups that this

nudge may reach. Study 4 (Chapter 5) revealed that the original Giacometti nudge was perceived as rather unacceptable within a real-world setting. Still, it effectively reduced the number of calories purchased while present in the setting. After its removal, the number of calories purchased increased unexpectedly. Choice architects, therefore, also need to keep in mind what happens when a nudge is removed.

Study 4 (Chapter 5) showed that an artwork nudge like the original Giacometti nudge can improve the eating behavior of students in a real-world setting while present. The application of this artwork nudge in a university cafeteria was easy, cheap, and did not disturb the processes and workflow of the cafeteria staff. When identifying a suitable nudge to apply in a real-world setting, choice architects should consider artwork nudges like the original Giacometti nudge as a suitable tool while keeping in mind that it should be targeted to a specific group of individuals (Sunstein, 2022).

Finally, the research in the present dissertation was able to show that choice architects can improve nudge acceptance (and possibly nudge effectiveness as a result) by creating an optimal setting in which a nudge can be applied. Study 3 (Chapter 4) revealed that when university students perceived the environment as health-promoting their acceptance of different types of nudges increased. Similarly, when university students perceived food providers and university officials to assume the responsibility of providing and creating a healthy environment, their nudge acceptance increased. Consequently, choice architects need to create a health-promoting environment and actively assume the responsibility for doing so to reach optimal results of a nudge applied within this setting.

To sum up the findings of the present dissertation, the four studies contribute to the understanding and application of nudges by choice architects in an educational setting in several ways. These can be summarized by adding to the Nudge Development Model proposed by Ly et al. (2013). Figure 5 presents a summary of these contributions (shown in bold face).

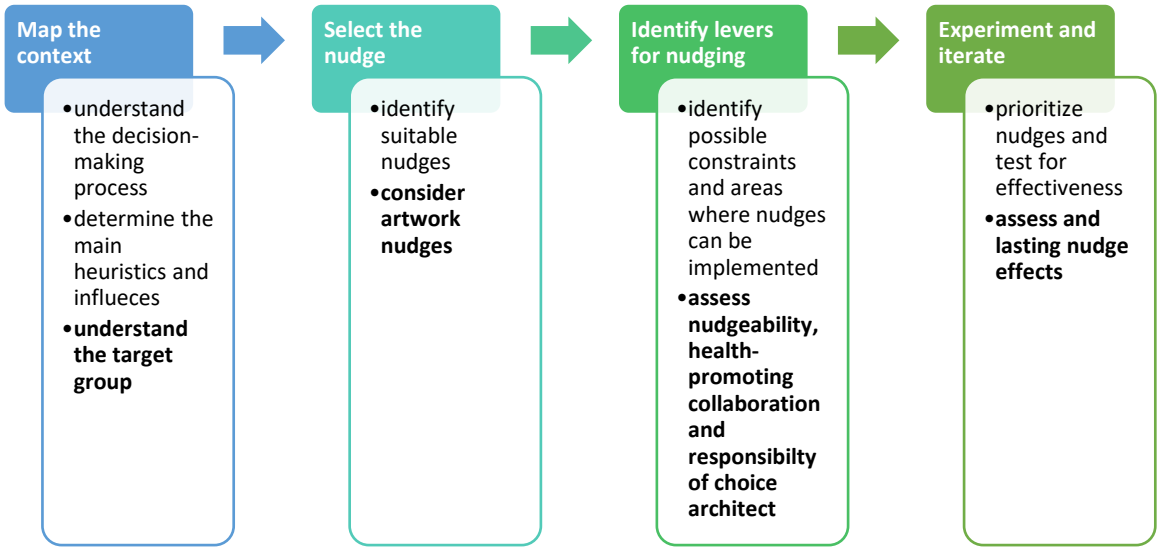

Figure 5. Contributions to the Nudge Development Model (Ly et al., 2013) shown in bold face.

7.3 Current valorization activities in nudging

In the present dissertation the research was conducted focusing on an educational context. One research study sampled the graduating class of high school students (Chapter 2); another study sampled university employees (Chapter 3); three studies sampled university students (Chapters 3-5). Thus, the focus of this dissertation was on university students. Even though health interventions are regularly applied within the university context and 80% of university members are students, these interventions rarely focus on students (Hungerland et al., 2021). In addition, there was heterogeneity in the group of students regarding health as well as socio-economic aspects (Hungerland et al., 2021; Lange et al., 2021). Therefore, even when health promotion takes place in a university setting, it is not guaranteed that these efforts will reach all students alike. The present dissertation was able to develop a typology of university students regarding their susceptibility to nudges (nudgeability; Chapter 4). Three types of students were identified: the nudgeables, the conditionally-mixed nudgeables, and the un-nudgeables. This typology should be considered in nudge development. One nudge design most likely does not reach all three types of students equally effectively (e.g., Sunstein, 2022). Therefore, the design of a nudge may differ and should be targeted to one of the specific groups.

This typology of nudgeable students is based on the acceptance of different types of nudges as a health intervention applied in a university cafeteria and / or university. So far, no commonly used tool to measure nudge acceptance has been presented (Krisam et al., 2021). In this dissertation assessment of nudge acceptance relied on a previously used scale for measuring nudge acceptance (Nørnberg et al., 2016). This scale was carefully developed based

on the MINDSPACE framework often used in nudge development (Dolan et al., 2012; Nørnberg et al., 2016). This nudge acceptance scale was validated using factor analysis and reliability analysis revealing a very good Cronbach's α of .848 (Nørnberg et al., 2016). For the third and fourth studies of this dissertation (Chapters 4 and 5), this scale was adapted and translated into German reaching an acceptable Cronbach's α value of .741 (Chapter 4). The dissertation at hand thus contributes to the development of a commonly used tool to measure nudge acceptance facilitating research on this topic in different countries.

Health promotion at universities should play a bigger role, as proposed in the Okanagan Charter (Hungerland et al., 2021). When nudges are applied as a health promoting intervention, the acceptance of the nudge as a health intervention plays an important role. The more readily a nudge is accepted the more likely it is to be accepted according to the Nudge Acceptance Model (Hagman, 2018). To better understand how nudge acceptance may be improved, the fairly new concept of health-promoting collaboration was introduced as an influential factor in the third study (Chapter 4). The acceptance of various types of nudges was found to increase when individuals felt supported by others in their own health and when they perceived their environment as one where individuals are highly committed to healthiness. Thus, nudge acceptance may be increased when the environment is perceived as health-promoting. This may in turn improve nudge effectiveness.

The research in this dissertation focused on artwork nudges (specifically based on Alberto Giacometti's artwork). So far, these nudges have seldom been applied and researched. The original Giacometti nudge improved the eating behavior of university employees in a virtual setting (Study 2, Chapter 3) and of university students in a real-world setting (Study 4, Chapter 5). While more research on artwork nudges is needed, the present dissertation contributes to making this promising type of nudge more visible. Other areas of nudge research, for example research on physical activity nudges, may follow the example of this thesis and use artwork to nudge.

7.4 Conclusion

In researching the effectiveness of artwork nudges and focusing on the acceptability of nudges, the present dissertation contributes not only to the theoretical background of nudging but also to the practical application of nudges. This dissertation further bridges the research gap regarding nudgeability, an influential factor in nudge effectiveness and the possible long-term effects of nudging. Specifically, choice architects developing and implementing nudges to improve dietary behavior in an educational setting can benefit from these results, and consequently, so also can individuals exposed to these nudges. The new tools developed in this dissertation pave the way to more research specifically on nudge acceptance. Still, it needs to be kept in mind that there is a long way ahead of us to draw final conclusions on how artwork nudges (specifically artwork nudges based on the artwork of Alberto Giacometti) can improve healthy eating in an educational setting without risking

inconsistent results. Continuous evaluation of nudge effects is incumbent on researcher is the area of healthy eating.

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A

Appendices

Appendix I Experimental setting described in Chapter 2

Appendix II Questionnaire used in Chapter 3

Appendix III Questionnaires used in Chapter 4

Appendix IV Supplementary material from Chapter 5

Appendix I
Experimental setting described in Chapter 2

Figure A.1 Depicts the classroom in which the experiment took place.

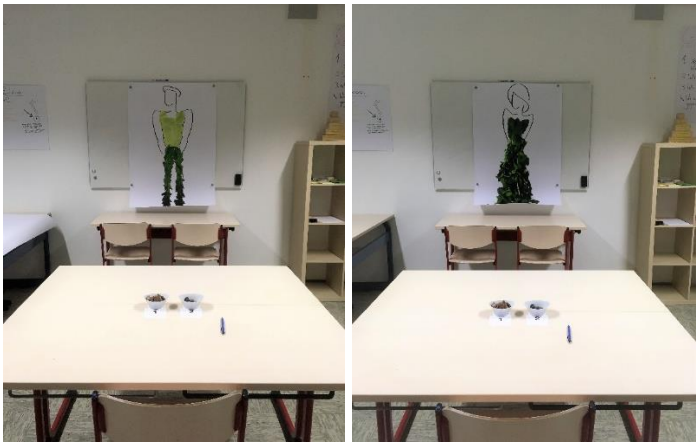


Figure A.2 Depicts the experimental set-up for the male and female nudge experimental conditions.

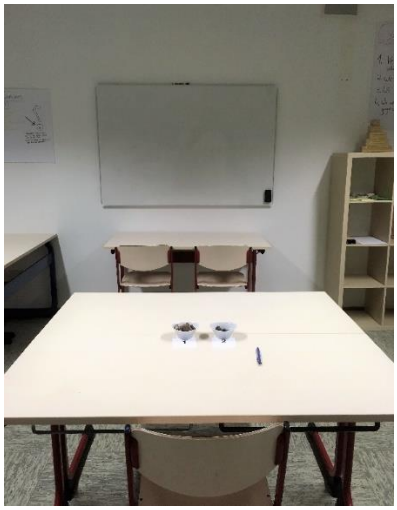


Figure A.3 Depicts the experimental set up for the no nudge condition.

Appendix II
Questionnaire used in chapter 3

The following lists the instructions and the 13 items of the German version of the Brief Self-Control Scale (Sproesser et al., 2011). Participants answered on a 5-point scale, ranging from disagree (*stimmt nicht*) to agree (*stimmt genau*).

Nun möchte ich Ihnen noch einige Fragen zu Ihrer Person stellen. Bitte lesen Sie sich die untenstehenden Sätze genau durch und schätzen Sie sich selbst ein.

1. Ich kann Versuchungen gut widerstehen.
2. Schlechte Angewohnheiten kann ich mir nur schwer abgewöhnen.
3. Ich bin fleißig.
4. Ich sage Dinge, die unangebracht sind.
5. Ich tue Dinge, die Spaß machen, auch wenn sie schlecht für mich sind.
6. Ich lehne Dinge ab, die schlecht für mich sind.
7. Ich wünschte, ich hätte mehr Selbstdisziplin.
8. Andere würden sagen, dass ich eine eiserne Disziplin habe.
9. Vergnügen und Spaß halten mich nicht davon ab, meine Arbeit zu erledigen.
10. Es fällt mir schwer, mich zu konzentrieren.
11. Ich kann erfolgreich auf langfristige Ziele hinarbeiten.
12. Bestimmte Dinge kann ich nicht sein lassen, obwohl ich weiß, dass sie falsch sind.
13. Manchmal handle ich, ohne alle Alternativen abzuwägen.

Appendix III
Questionnaires used in chapter 4

The following lists the German instructions and items used to measure nudge acceptance (Table A.1), social norms (Table A.2), and responsibility (Table A.3) used in the present study as well as the English original by Nørnberg and colleagues (Nørnberg et al., 2016b) (based on the MINDSPACE framework (Dolan et al., 2012)). Participants answered on a 5-point scale, ranging from agree (stimme zu) to do not agree (stimme nicht zu).

Table A.1. German and English items measuring nudge acceptance.

	Item
Instructions German	Im Folgenden werden Dir mehrere Aussagen zum Thema Akzeptanz von Maßnahmen im Bereich der Ernährung präsentiert. Bitte gib an, inwiefern Du diesen Aussagen zustimmst. Ich denke, es wäre akzeptabel, ...
Instructions English	Not provided.
Messenger nudge German	...wenn die Hochschule berühmte Personen benutzen würde, um mich über Gesundheit im Zusammenhang mit Gemüseverzehr zu informieren.
Messenger nudge English	I think it would be acceptable if the school or the canteen used celebrities to inform me about health related to eating vegetables.
Incentive 1 nudge German	...wenn die Hochschule einen Wettbewerb veranstalten würde, bei dem der Gewinner den größten Gemüseverzehr in einer Woche hat.
Incentive 1 nudge English	I think it would be acceptable if the school or canteen held a competition where the winner would be the one with the largest vegetable intake in 1 week.
Incentive 2 nudge German	...wenn die Hochschule Kampagnen mit abschreckenden Botschaften benutzen würde, um mich zu einem höheren Gemüseverzehr zu bewegen (zum Beispiel durch das Zeigen von Krankheiten, die durch einen geringen Gemüseverzehr entstehen).
Incentive 2 nudge English	I think it would be acceptable if the school or canteen made scare campaigns to get me to eat more vegetables, e.g., by showing examples of diseases caused by low vegetable intake.
Norms nudge German	...wenn die Hochschule mich darüber informieren würde, wie viel Gemüse ich im Vergleich zu meinen Freunden und Kommilitonen esse.
Norms nudge English	I think it would be acceptable if the canteen informed me about how many vegetables I eat compared to my friends and classmates.
Default nudge German	...wenn die Hochschule mir automatisch einen grünen Salat zu meinem Mittagessen servieren würde, um mich zu einem höheren Gemüseverzehr zu bewegen, falls ich den Salat einfach abwählen kann.
Default nudge English	I think it would be acceptable if the canteen automatically gave me a green salad with my lunch in order to get me to eat more vegetables if I easily could choose not to take it.
Salience nudge German	...wenn es in der Hochschule Poster mit einfachen Tipps geben würde, wie ich mehr Gemüse essen kann, um mich gesünder zu ernähren.
Salience nudge English	I think it would be acceptable if the school or canteen had posters with simple and easy tips on how I could eat more vegetables to get me to eat healthier.
Priming nudge German	...wenn die Mitarbeiter der Mensa mich fragen würden, ob ich mehr Gemüse haben möchte, wenn ich mein Mittagessen kaufe.
Priming nudge English	I think it would be acceptable if the staff in the canteen asked me if I wanted more vegetables when buying my lunch.

Affect nudge German	...die Bezeichnung der Gerichte in der Mensa zu verändern, damit die Gerichte, die viel Gemüse enthalten, ansprechender klingen und dazu führen, dass ich sie wähle.
Affect nudge English	I think it would be acceptable to change the names of the dishes in the canteen so the dishes containing many vegetables would sound more appealing and make me want to choose them.
Priming and salience nudge German[1]	...wenn in der Mensa der Gemüseverzehr mit Postern beworben werden würde, auf denen zum Beispiel dünne Personen zu sehen wären.
Priming and salience nudge English[1]	I think it would be acceptable to advertise vegetable consumption in the cafeteria using posters on which for example skinny individuals were displayed.
Commitment German[2]	-
Commitment English[2]	I think it would be acceptable if the school encouraged me to sign up for a "6 a day" or "I love vegetables" club to make me feel obligated to eat more vegetables.
Ego German[2]	-
Ego English[2]	I think it would be acceptable if the canteen had posters showing happy and popular teenagers eating vegetables and a lonely and sad teenager eating unhealthy food in order to make me feel like eating more vegetables.

Note. [1] own item translated into English; [2] These types of nudges were not assessed in the present study (no German version exists).

Table A.2. German and English items measuring social norms (Nørnberg et al., 2016b).

	Item
Item 1 German	Meine Freunde essen jeden Tag Gemüse.
Item 1 English	My friends eat vegetables every day.
Item 2 German	Meine Eltern essen jeden Tag Gemüse.
Item 2 English	My mom and dad eat vegetables every day.
Item 3 German	Mein soziales Umfeld ermutigt mich jeden Tag Gemüse zu essen.
Item 3 English	My parents encourage me to eat vegetables every day.

Table A.3. German and English items measuring responsibility (Nørnberg et al., 2016b).

	Item
Item 1 - German	Ich denke, es ist die Pflicht der Hochschule oder Mensa, mich zu einem besseren Gemüseverzehr zu bewegen.
Item 1 - English	I think it is the school's or the canteen's obligation to try and improve my vegetable intake.
Item 2 - German[1]	-
Item 2 - English	I do not think it is the school's or the canteen's responsibility to try to get me to eat healthier.

Note. [1] item was not used (no German version exists).

Appendix IV
Supplementary material used in chapter 5

Sample menu

Table A1. Sample menu from 17 October 2023 (Monday in the intervention week).

Dish Category	Dishes	Calories (Total)
Vegetarian/vegan	Brussel sprouts and mustard fricassee (vegan)	280
Meat/fish	Lemongrass tofu Vietnamese style with basmati rice (vegan)	624
	Turkey Schnitzel with apple-onion sauce	439
	Pasta with meat sauce	454
Vegetarian stew	Lentil soup (vegan, large portion)	224
	Lentil soup (vegan, small portion)	112
Pizza	Pizza margarita	579
	Pizza verdure (vegan)	549
Salad bar	Salad bar vegan (green salad with vegetables)	60
	Salad bar vegetarian (green salad with cheeses, etc.)	270
	Salad bar carb (green salad with couscous, potatoes, etc.)	210
	Salad bar vegan, carb (green salad with vegetables, couscous, potatoes, etc.)	195
	Salad bar vegan, vegetarian (green salad with vegetables, cheeses, etc.)	300
	Salad bar vegetarian, carb (green salad with cheeses, couscous, potatoes, etc.)	405
	Salad bar vegan, vegetarian, carb (green salad with vegetables, cheeses, couscous, potatoes, etc.)	435

Further analyses

Table A2. Descriptive and inferential statistics regarding the individuals from the posttest week and their number of participations in this study.

		Participated once (*n* = 547)	Participated twice (*n* = 423)	Inferential statistics
Gender	Male	248 (45.5%)	(47.5%)	χ^2 (2) = 1.15, p = 0.563
	Female	288 (52.8%)	(51.5%)	
	Gender-diverse	9 (1.7%)	4 (1.0%)	
Age		22.41 (3.40)	21.26 (2.70)	t (960.08) = 5.84, p < 0.001
Height		174.9 (9.59)	176.04 (9.85)	t (954) = −1.758, p = 0.079
Weight		68.0 (12.01)	67.1 (11.34)	t (915) = 1.17, p = 0.243
Hunger		4.12 (0.82)	4.11 (0.83)	t (965) = 0.154, p = 0.878
Number of calories purchased in main dishes		428.88 (179.36)	437.33 (177.44)	t (854) = −0.687, p = 0.492
Acceptance of the Giacometti cue		1.42 (0.84)	1.45 (0.99)	t (961) = −0.481, p = 0.637

Note. *SD* in brackets for all variables except gender. Control variables are displayed above the dotted line.

Setting with placement of the Giacometti cue

Figure A1. Exemplary placement of the Giacometti cue, Piazza, during the intervention week. The original work can be found at https://www.guggenheim.org/artwork/1426 (accessed on 27 April 2023).

Figure A2. Exemplary placement of the Giacometti cue, L'homme qui marche, during the intervention week. The original work can be found at https://www.giacometti-stiftung.ch/highlights/objekt/?tx_artcollection_single%5Bartpiece%5D=419&cHash=beff4c349886757dc16117ec4da72324 (accessed on 27 April 2023).

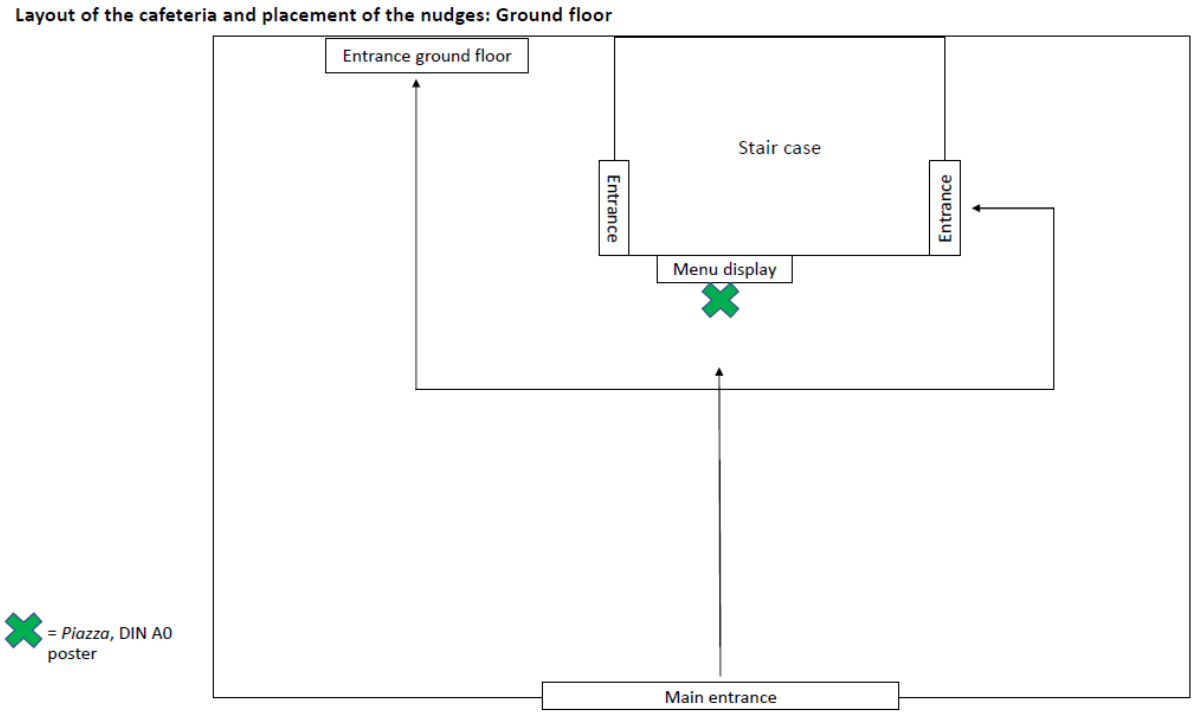
Nudge acceptance items

Table A3. German and English items that measure nudge acceptance.

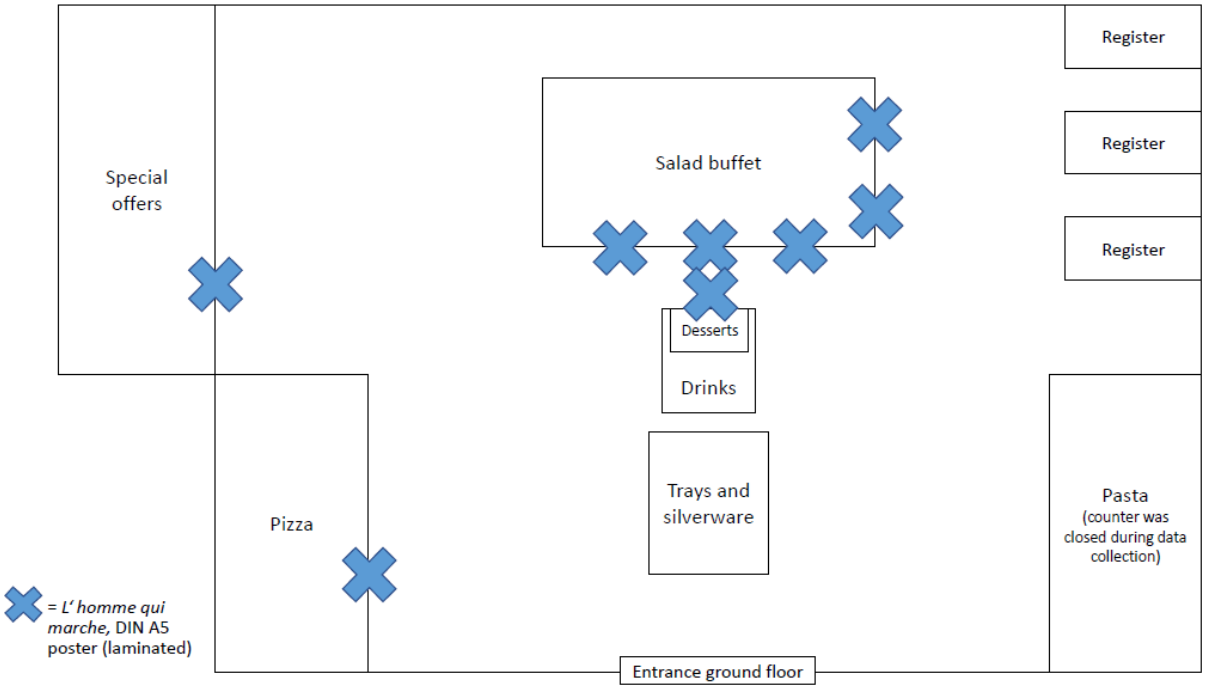
Type of Nudge	Item
Messenger nudge German	Berühmte Personen als Informationsquelle
Messenger nudge English[1]	Celebrities as a source of information
Incentive 1 nudge German	Wettbewerb zum größten Gemüseverzehr
Incentive 1 nudge English[1]	Competition on the largest vegetable intake
Incentive 2 nudge German	Kampagnen mit abschreckenden Botschaften
Incentive 2 nudge English[1]	Scare campaigns
Norms nudge German	Informationen zum Gemüsekonsum von Kommilitonen
Norms nudge English[1]	Information on vegetable consumption of fellow students
Default nudge German	Grüner Salat als automatische Beilage (die auch abgewählt werden kann)
Default nudge English[1]	Green salad as a default choice (which can easily be deselected)
Salience nudge German	Poster mit Tipps für einen höheren Gemüsekonsum
Salience nudge English[1]	Posters with tips on how I could eat more vegetables
Priming nudge German	Ansprache durch Mensa-Mitarbeiter, die nach zusätzlicher Gemüse-Auswahl fragen
Priming nudge English[1]	Staff asking about additional vegetable choices
Affect nudge German	Ansprechendere Bezeichnung von Gerichten mit viel Gemüse
Affect nudge English[1]	More appealing names for dishes containing many vegetables
Giacometti cue German[2]	Poster, auf denen sehr dünne künstlerische Skulpturen zu sehen sind
Giacometti cue English[2]	Posters on which skinny artistic sculptures are displayed

Note. [1] The items in English (Nørnberg et al., 2016) were translated into German. [2] These are based on prior work of the authors (Kawa et al., 2022).

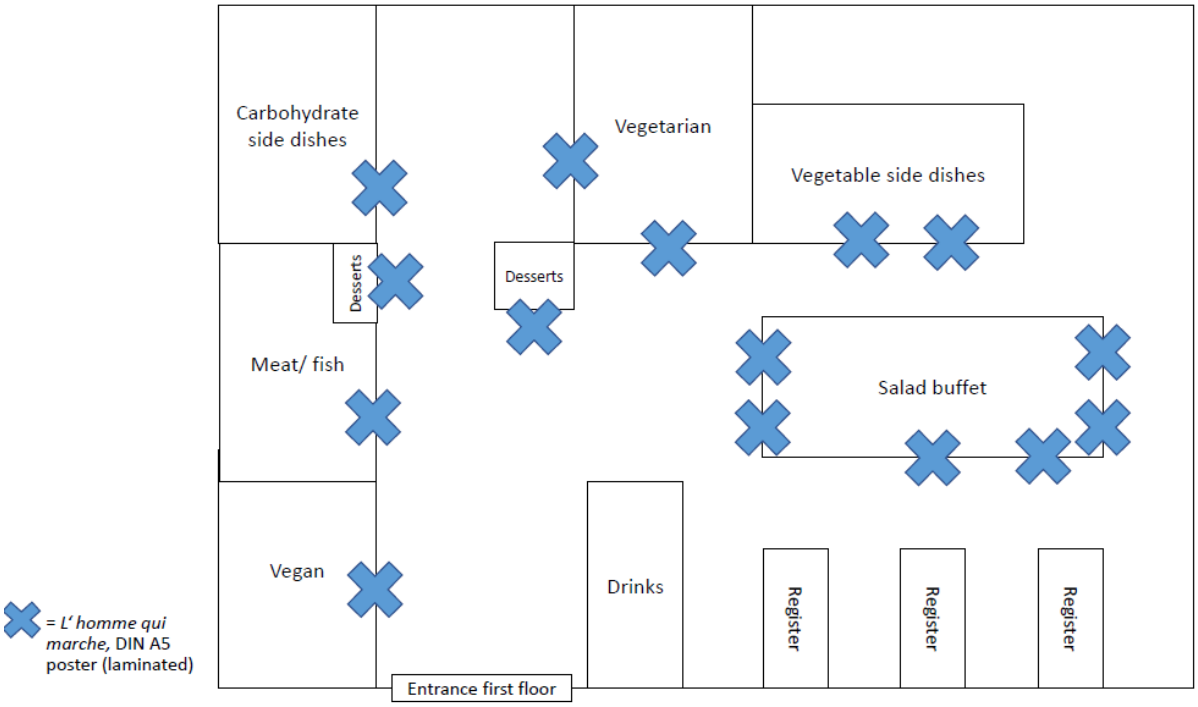
Layout of the cafeteria (supplementary material)



Layout of the cafeteria and placement of the nudges: Ground floor



Layout of the cafeteria and placement of the nudges: First floor



Questionnaire intervention week (supplementary material)

Hochschule Bonn-Rhein-Sieg
University of Applied Sciences

Menüwahl

Maastricht University

Liebe/r Teilnehmende/r,

diese Umfrage findet als Kooperation der Universität Maastricht, der Hochschule Bonn-Rhein-Sieg und der Mensa Campo statt. Sie ist Teil meiner Doktorarbeit zu den Effekten von Maßnahmen im Bereich Ernährung. Die Fragen behandeln z. B. die Gründe zur Menüwahl und die Akzeptanz von verschiedenen Maßnahmen zur Förderung von gesunder Ernährung.

Bei Fragen kannst du dich an Christine Kawa wenden:
Christine Kawa, M. Sc.
Hochschule Bonn-Rhein-Sieg
Von-Liebig-Str. 20
53359 Rheinbach
E-Mail: christine.kawa@h-brs.de

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Landesbeauftragte für Datenschutz und Informationsfreiheit Nordrhein-Westfalen
Kavalleriestr. 2-4, 40213 Düsseldorf, Tel.: 0211/38424-0, E-Mail: poststelle@ldi.nrw.de

Ich habe die Informationen zur Studie und zur Verwendung meiner Daten gelesen. Ich hatte die Möglichkeit Fragen zu stellen und über meine Teilnahme nachzudenken. Ich bin 16 Jahre oder älter und stimme zu, an dieser Studie teilzunehmen.

Dies bestätige ich durch Ankreuzen:

○

Bitte umblättern.

Menüwahl: VX#_____ Datum: _____10.2022 Uhrzeit: _____

1. **Hauptgericht:** _____
2. **Beilagen:** _____
3. **Dessert:** _____
4. **Bitte nenne die Gründe für deine Wahl.** (Mehrfachauswahl möglich)

◯ Geschmack
◯ Gewohnheit
◯ Hunger
◯ Gesundheit (weil es gesund ist)
◯ Einfachheit (weil es wenig Aufwand bedeutet)
◯ Genuss (weil ich mir etwas gönnen wollte)
◯ Tradition (weil ich damit aufgewachsen bin)
◯ Natürlichkeit (weil es naturbelassen ist)
◯ Gemeinschaft (weil es gesellig ist)
◯ Preis
◯ Präsentation (weil es mich anspricht)
◯ Gewichtskontrolle
◯ Gefühlsregulierung (um negative Gefühle zu kompensieren)
◯ Soziale Normen (weil es von mir erwartet wird)
◯ Soziales Image (weil es „in" ist)

5. **Wie hungrig warst du, als du dein Essen gewählt hast?**

◯ gar nicht hungrig ◯ kaum hungrig ◯ teils/ teils ◯ etwas hungrig ◯ sehr hungrig

Im Folgenden stellen wir dir eine Aussage zum Thema Akzeptanz von Maßnahmen im Bereich der Ernährung vor. Bitte gib an, inwiefern du diesen Aussagen zustimmst.

6. **Ich denke, es wäre akzeptabel, wenn die Mensa die folgenden Maßnahmen anwenden würde, um gesunde Ernährung zu bewerben:**

	stimme nicht zu	stimme eher nicht zu	teils/ teils	stimme eher zu	stimme zu
Berühmte Personen als Informationsquelle	◯	◯	◯	◯	◯
Wettbewerb zum größten Gemüseverzehr	◯	◯	◯	◯	◯
Kampagnen mit abschreckenden Botschaften	◯	◯	◯	◯	◯
Informationen zum Gemüsekonsum Kommilitonen	◯	◯	◯	◯	◯
Grüner Salat als automatische Beilage (die auch abgewählt werden kann)	◯	◯	◯	◯	◯
Poster mit Tipps für einen höheren Gemüsekonsum	◯	◯	◯	◯	◯
Ansprache durch Mensa-Mitarbeiter, die nach zusätzlicher Gemüse-Auswahl fragen	◯	◯	◯	◯	◯
Ansprechendere Bezeichnung von Gerichten mit viel Gemüse	◯	◯	◯	◯	◯
Poster, auf denen sehr dünne künstlerische Skulpturen zu sehen sind	◯	◯	◯	◯	◯

7. **Wie sehr hast du das Poster heute in der Mensa bewusst wahrgenommen?**

◯ gar nicht ◯ kaum ◯ teils/ teils ◯ etwas ◯ sehr

Angaben zu deiner Person: Diese dienen nur dazu, die Stichprobe dieser Umfrage beschreiben zu können. Wenn du eine Frage nicht beantworten möchtest, überspringe diese Frage.

8. **Zutreffendes bitte ankreuzen:** ◯ Ich sitze in einer Gruppe am Tisch ◯ Ich sitze allein am Tisch
9. **Alter:** _____Jahre
10. **Körpergröße:** _____ cm (z.B. 163cm)
11. **Körpergewicht:** _____ kg
12. **Geschlecht:** ◯ Männlich ◯ Weiblich ◯ Divers
13. **Status:** ◯ Studierender ◯ Unimitarbeiter ◯ Hochschulextern
14. **Wie viele Male hast du diese Woche schon in dieser Mensa gegessen:**

◯1 ◯2 ◯3 ◯4 ◯5

HERZLICHEN DANK für deine Teilnahme an dieser Umfrage!