The proximity effect for decreasing the likelihood for snack consumption and exploring its risk for compensation behavior.

Master thesis

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Abstract

Objective: The current study examined the *proximity effect* which holds that placing food further away from people consistently decreases the likelihood of consumption. The study aimed to replicate findings from previous studies with the hypotheses that placing snack food further away decreases the likelihood of consumption and is associated with more perceived effort to obtain it. As individuals may feel the tendency to compensate, the associations of compensation behavior between distance and consumption were explored.

Methods: In the study (N=69), distance to a bowl of snack food was randomly varied at a distance of 20 or 70 cm. Outcome variables were the amount of participants that consumed the snack (likelihood of consumption), the consumed amount, perceived effort and compensation behavior as assessed by providing two choice options in a lottery, varying in healthiness.

Results: The study showed that a distant snack indicates a lower likelihood- and amount of consumption. Participants perceived a distant snack more effortful to obtain compared to a closer snack. There was found no greater likelihood for compensation behavior with a distant snack or when refrained from snacking.

Conclusions: Placing a snack food further away may serve as an effective strategy for changing the food environment to decrease snack consumption, indicating no associations with compensation behavior.

Keywords: *obesogenic environment; nudging; proximity effect; food consumption; compensation behavior*

In current society, people are frequently confronted with easily accessible unhealthy food (Hill, Wyatt, Reed & Peters, 2003). This has been referred to as an obesogenic environment which is defined as "the sum of influences that the surroundings, opportunities, or conditions of life have on promoting obesity in individuals or populations" (Swinburn and Egger, 2002, p. 292). Restaurants have been indicated as an aspect of the obesogenic environment as well as workplace and school food environments (Lake & Townshend, 2006). Obesogenic environments may directly influence food intake with the consequence of overeating and increased risk of obesity (Swinburn et al., 2011). Obesity is a significant health and social problem which is currently widespread: according to a World Health Organisation factsheet from 2018, over 1.9 billion adults are overweight and 600 million are obese. Obesity may consequently lead to an increased risk of severe diseases such as Type-2 diabetes, cardiovascular diseases and various cancers (Bray, 2004). As obesogenic environments may directly influence food intake, it has been proposed that changes to the food environment need to be made to help people regulate their food intake (Wadden, Brownell & Foster, 2002). Accordingly, the current study aimed to examine a change to the food environment that might have potential to adjust these obesogenic environments to decrease unhealthy food consumption.

Nudging

One promising way of changing the food environment is nudging. A nudge refers to "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, 2008, p.6). Nudging is based on the principle that individuals make most decisions in a fast and automatic way. To aim for making the best decisions, we use signals from our surroundings and rules of thumb (Kahneman, 2012). Nudging can be used by subtly altering these choice surroundings, and by helping individuals in making the better or healthier choice. There has been growing interest in the use of nudges over the past years because they are considered cheap and have the potential to promote goals such as public health (Sunstein, 2014). Thaler and Sunstein (2008) emphasize that the purpose of using nudges should be to make life simpler, safer or easier for people and that nudging should be used with the best intentions.

Nudges have been applied to a wide variety of behaviors, such as organ donation (Johnson & Goldstein, 2003), saving (Choi et al., 2004) and pro-environmental behavior (Pichert & Katsikopoulos, 2008). Recent systematic reviews on nudging propose the potential of nudges to serve as an applicable intervention, but also recognize the scarcity of the empirical evidence (Arno & Thomas, 2016; Bucher et al., 2016) and it remains uncertain whether and how such interventions might be implemented to improve diets at population level (Hunter et al., 2019). Therefore, the current experimental study first aimed to contribute empirical evidence to address whether nudges are an effective strategy in choosing a diet more optimally. The examined nudge follows from a food proximity effect on the likelihood of consumption. Also, it was explored whether food distance and consumption are associated with subsequent compensation behavior.

Proximity effect

The effects of food distance on consumption have been elaborately researched: there appears to be a proximity effect in which placing food further away from the consumer consistently decreases the likelihood that they select and consume it (Bucher et al., 2016; Hunter et al., 2018). In helping consumers to make a healthier choice, the proximity effect and its insights could further develop into a promising area for nudging. To portray this, two studies by Maas, de Ridder, de Vet & de Wit (2012) examined whether a larger distance to a snack reduced the probability- and amount of snack consumption. They placed a bowl of M&M's either proximately, within-reach or distal. In the proximal condition, fewer participants consumed the snack and they consumed lower amounts in comparison to the within-reach condition, indicating that placing the snack further away reduced the probability and amount of consumption.

Evidence for the proximity effect has also been found in more recent research. Hunter and colleagues (2018) used a similar design with the study from Maas and colleagues (2012) and used the two effective conditions: proximal (20cm away from the participant) and distal (70cm). In line with findings from Maas and colleagues (2012) the study demonstrated that placing a snack further away reduces the likelihood of consumption. However, this study did not find a proximity effect on the amount of consumption, indicating that participants in the proximal condition did not consume more compared to the participants in the distal condition.

Additionally, evidence for the proximity effect is not limited to unhealthy foods, but has also been found for healthy foods. A recent review by Bucher and colleagues (2016) demonstrated that food proximity can influence food choice. This effect was found to be robust, and of influence on both unhealthy (e.g., chocolate, desserts, savoury snacks) and healthy (e.g., sliced fruits and vegetables) consumption which suggests that food proximity may also be important in the likelihood of healthy food consumption. Elaborating on these findings, a recent study (Knowles, Brown & Aldrovandi, 2019) aimed to replicate the proximity effect in a competitive food environment presenting an unhealthy and a healthy snack at varying distances. The study demonstrated that "the snack being consumed was influenced by the relative distance of another snack" (Knowles, Brown & Aldrovandi 2019, p.100), which provides evidence for a relative proximity effect.

Perceived effort

Despite the proximity effect being fairly robust, little is known about why the effect occurs as the effect still holds regardless of cognitive resources (Hunter et al., 2018) and food preference (Privitera & Zuraikat, 2014; Knowles, Brown & Aldrovandi, 2019). It is suggested that distant snacks, that require people to reach for them, are rated as more effortful to obtain in comparison to closer snacks (Maas et al., 2012; Hunter et al., 2018; Knowles, Brown & Aldrovandi, 2018). When a person perceives effort to obtain a snack, he/she might only be ready to invest effort when the motivation to eat is high enough to overcome that effort (Waugh & Gotlib, 2008). For this reason, perceived effort is thought to be the mediating factor for the effect of distance on food choice (Maas et al., 2012) but its true mediating role is yet to be identified. Replicating previous studies on perceived effort (Maas et al., 2012; Hunter et al., 2018), perceptions of effort were assessed to examine processes that may explain the effects of distance. Whether people perceive distance in terms of effort bears important implications for the yet to be explored mechanisms that underlie manipulating distance and its effects on food consumption.

Compensation behavior

As previously described, the current study determined whether positioning a snack at a larger distance could serve as an effective strategy to influence consumption behavior. Still, one challenge to altering behavior is the tendency to compensate for behavioral changes. There exist worries concerning long-term effects of nudges and if there is a possible risk of compensation behavior after being nudged (Bucher et al., 2016). In the food realm, only a few studies focused on compensation behaviors when a nudge is used. For portion size changes, there is some evidence that reducing offered portion sizes does not necessarily lead to immediate compensation (Schwartz et al., 2012). Though, in this study it is not clear whether immediate calorie savings will be compensated later on. Other studies point out that people may compensate for exercising by eating more calories after the workout than they burned during it (Church et al., 2009). Unfortunately, people do not tend to compensate in a healthier direction. For instance, a study showed that participants who were given a larger bag of potato chips ate more of it but did not compensate by eating less at a dinner meal later at night (Rolls et al., 2004).

The amount of literary evidence considering compensation behavior in a distance manipulation is limited. Maas and colleagues (2012) pointed out that there is no risk of compensatory behavior for those exposed to snacks at relatively larger distances. In this study, compensatory behavior was assessed by food craving (craving experienced after exposure to the unhealthy snack). Subsequent food craving provides insight into compensation behavior after a distance manipulation. Still, this finding required further examination, especially with a measure that more directly assesses actual behavior. The current study focused on subsequent compensation behavior rather than food craving to gain more insight as still little is known regarding compensation behaviors. Specific compensation behavior theories are yet to be explored but there exist two theories that may explain this phenomenon. These are self-licensing theory and consistency theory.

One theory that may underlie compensation behavior is self-licensing theory. According to the logic of moral self-licensing, past good deeds can make people more likely to do potential immoral things without worrying about feeling or appealing immoral (Monin & Miller, 2001). It may subsequently result in the tendency of justifying giving into a temptation by means of making up reasons and excuses (De Witt Huberts, Evers & De Ridder, 2012) which implicates

that nudging people to refrain from snacking may later on serve as a license to indulge. This may suggest that not only external factors (such as the temptations from the obesogenic environment) but also more internal factors, such as self-licensing, may be underlying compensation behavior.

As previously described, self-licensing theory aims to explain a discrepancy between behavior at two seperate moments. Contradictory to these theories of discrepancy, there is also evidence that individuals generally have the tendency to act consistently. This follows from social psychology where, in most circumstances, consistent behavior is valued and adaptive as it is associated with personal and intellectual strength (Cialdini, 2009, p. 59). Whereas inconsistency is commonly found to be an undesirable personality trait as the person whose beliefs, words and deeds don't match is generally perceived as confused and even two-faced (Asch, 1946). Cialdini (2009, p.60) also describes consistency as "an attractive mental shortcut through the complexities of modern life". He proposed that when having made your mind up about an issue, you don't have to reflect on it again and just believe, say or do whatever is consistent with the earlier decision. Therefore, people thrive for acting consistently. This might, contradictory to self-licensing theory, result in no compensation behavior when refrained from snacking as people tend to remain consistent with their initial behavior.

Research overview

Comparable to earlier studies that used likelihood of consumption as an outcome variable (Maas et al., 2012; Hunter et al., 2018), the current study likewise examined whether a larger snack distance reduces the likelihood of intake by providing participants a snacking opportunity. The likelihood of consumption was assessed for two varying distances and therefore, distance was included as the independent variable. The amount of consumption, perceived effort and compensation behavior were also measured as outcome variables. Compensation behavior was assessed in a lottery in which participants could choose between two options that differed in healthiness to possibly compensate for their initial consuming behavior.

The first hypothesis was that a larger distance to a snack decreases the likelihood of snack consumption (Maas et al., 2012; Hunter et al., 2018). We did not formulate any a priori hypothesis for the effect of increasing snack distance on amount of consumption, given

inconsistent results in previous studies (Maas et al., 2012; Hunter et al., 2018). With regards to perceived effort in the distance manipulation, it was expected that a larger snack distance is associated with higher perceived effort (Maas et al., 2012; Hunter et al., 2018). The main objective was to identify any possible compensation behavior associated with a distant snack or refraining from snack consumption. Whether compensation behavior could be an outcome of several options (a consequence of self-licensing or a strive for consistency), the hypothesised risk of subsequent compensation behavior was left open and studied for exploring purposes.

Method

Participants

Previous studies on the proximity effect have typically found medium to large effect sizes. Following Hunter and colleagues (2018) a minimum sample of 56 participants is required to detect a main effect of proximity on the likelihood of snacking. In order to be more conservative, and in order to be able to explore other relationships, it was decided to recruit 80 participants. Participants could subscribe for participation in return for course credit or a financial reward of €2. Participants were recruited by posters at University Utrecht and Facebook.

Preceding data analysis, exclusion criteria were formulated. Namely, excluding participants with severe overweight (Body Mass Index higher than 30 kg m2), with past or current eating pathology, who moved the bowl of snacks, who did not like the snack at all, and who were aware of the nature of the study beforehand, as these factors might have influenced eating behavior. Subsequently, two participants were of severe overweight, three reported to have past or current eating pathology, three moved the bowl (data analysis was also conducted with including them to compare results) and one indicated not to like the snack. Finally, two participants stated that the study assessed the effect of distance on food consumption and included the link between the relaxation kits so it was assumed they knew about the study beforehand. Therefore, 9 participants were excluded conform exclusion criteria.

As a result, the sample consisted of 69 participants (34 in the proximal condition, 35 in the distal condition). The sample included only students with age 18-35 (M = 23.81, SD = 3.37) of which 30 males and 39 females. Their mean BMI was 22.73 kg m2 (SD = 2.54).

Design

The design of the study was a one factor between subjects experimental design with distance (proximal vs. distal) as the independent variable and likelihood of snack intake, perceived effort and compensation behavior as main dependent variables.

Procedure

Participants were invited to the laboratory to participate in a relaxation study. This cover study was used to create the setting in which unhealthy snacks could be presented to the participants without them questioning the study's purpose. Participants were tested individually in sessions between 1 PM and 5.30 PM to focus on afternoon snacking exclusively. The laboratory setting included a chair and a table with relaxation magazines and a bowl of snacks. Participants were randomly allocated to one of the two conditions. In the proximal condition, the bowl of snacks was easy to reach, placed on a table at a distance of 20 cm from table-edge at the side of where the participants sat. For the distant condition, the participant needed to reach over the table in order to be able to attain the snacks, which were placed at a distance of 70 cm. Distances are in line with previous studies on the proximity effect (Maas et al., 2012; Hunter et al., 2018). In both conditions, the snacks were placed in sight. See appendix I for an image of the table layout per distance condition.

After giving consent on a laptop, the experimenter informed the participants that they had a moment for relaxation for 5 minutes in which they could read and should feel free to eat from the snacks. For the second part of the experiment, the experimenter returned, removed the magazines and the bowl of snacks and brought the laptop. Participants filled out a questionnaire about how relaxed they felt, their perceived effort in obtaining the snack, demographics, time since last meal, motivation to eat healthily and liking of chocolate (assessed in this order). Subsequently, participants filled in their weight and height and to assess compensation behavior, participants were asked to join in a lottery for all participants with the prize being a relaxation kit. Participants chose out of two options which one they favoured to possibly win. The lottery represented the choice whether to compensate for the preceding snacking behavior. The

hypothetical choice whether to compensate or not was in this way a more realistic choice with possible real consequences. Which kit was presented where (left or right) was counterbalanced across participants. Finally, participants were asked about the purpose of the study and were debriefed.

Materials

In line with previous studies on the proximity effect (Maas et al., 2012; Hunter et al., 2018), chocolate M&M's without peanuts were used in the study. The M&M's have a caloric value of 480 kcal per 100g. The M&M's were located on the table in a white bowl, weighing 350 g (excluding the weight of the bowl) which is equivalent to approximately 350 M&M's. Weighing the bowl before and after the experiment took place without the participant being present. Three magazines on unrelated topics (cars, traveling and business life) were presented on the table. The magazines were inspected to contain no food-related content.

In previous studies (Hunter et al., 2018; 2019) some participants moved the bowl. Accordingly, in the current study, the bowls were placed on non-slip mats to increase the effort to move them and therefore decrease the chance that participants moved them. Participants were presented two relaxation kits that both included a yoga magazine, candles and a puzzle book but differed in healthiness of snacks. The unhealthy kit included a chocolate bar and licorice and the healthy kit included snack tomatoes and a little gingerbread. See appendix II for visual representations of the relaxation kits.

Measures

The questionnaires were conducted using Gorilla. For visual representations of the used questionnaires, see Appendix III.

Perceived effort. Perceived effort was assessed with a short questionnaire based on Maas et al., (2012). This questionnaire contained 5 items (e.g., 'It required effort to be able to get the M&M's', 'The M&M's were effortlessly obtainable' [reverse coded]) which were assessed on a 7 point likert scale, ranging from 1 (not at all) to 7 (very much). We also included filler items, measuring the perceived effort to obtain magazines which were also presented on the table. In

line with Maas and colleagues (2012) the questionnaire revealed high reliability (Cronbach's alpha = 0.81) and therefore all items were averaged into one score.

Control variables

Time since last meal. To gain insight into participants eating behavior prior to the experiment, participants were asked to indicate the time since their preceding eating moment in minutes.

Appetite. To provide an indication of the participants' hunger state, participants were asked to indicate their appetite for three items ('How hungry are you at this moment?', 'How much appetite do you have at this moment' and 'How much do you feel like having a bite at this moment') on a 7-point scale ranging from 1 (not at all) to 7 (very much). The items revealed high reliability (Cronbach's alpha = 0.89) and therefore all items were averaged into one score.

Motivation to eat healthy. To gain insight into to what extent the participants were motivated to eat healthy, four items concerning healthy eating behavior were presented ('How much joy do you feel when you eat healthily?', 'How much sorrow do you feel if you fail to eat healthily?','How committed are you to eating healthily?' and 'How important is eating healthily to you in your life?') on a 7-point scale ranging from 1 (not at all) to 7 (very much). We also included filler items about the motivation to read, in order to not disclose the study's purpose. The items revealed sufficient reliability (Cronbach's alpha = 0.76) and therefore all items were averaged into one score.

Liking of the snack. Participants indicated how much they liked chocolate ('How tasty do you find chocolate?') on a 7-point scale ranging from 1 (not at all) to 7 (very much). To mask the study's objective, participants also indicated their liking for three other unhealthy snacks (two savoury and one sweet) and for four healthy snacks (two savoury and two sweet).

BMI. To determine body mass index (BMI), participants filled in their length in cm and weight in kilos.

Results

Descriptives

Table 1 shows the means and standard deviations of the included variables as well as the correlations between the variables. Liking of the snack was significantly associated with likelihood of intake as well as amount of intake.

Table 1. Means (M), Standard Deviations (*SD*) and correlations between the variables (*N* = 69).

	M,(*SD*)	1	2	3	4	5	6	7	8	9	10
1. Amount consumed (g)	8.58(10.93)	1									
2. Likelihood of consumption	-	-0.90**r_s	1								
3. Perceived effort	2.37(1.37)	-0.25*r_s	0.34**r_s	1							
4.Compensation behavior	-	-0.05r_s	0.06r_s	-0.02	1						
5. Time since last meal (m)	106.73(120.21)	0.03r_s	-0.04r_s	0.18	0.17r_s	1					
6. Appetite	3.70(3.74)	0.27*r_s	-0.10r_s	-0.02	0.06r_s	-0.05	1				
7. Motivation to eat healthy	4.80(1.00)	0.03r_s	0.05r_s	0.05	0.25*r_s	-0.16	0.00	1			
8. Snack liking	5.32(1.44)	0.28*r_s	-0.25*r_s	-0.19	0.12r_s	-0.03	0.30*	-0.04	1		
9. BMI	22.74(2.59)	-0.18r_s	0.14r_s	0.14	-0.02r_s	0.25*	-0.06	0.05	-0.02	1	
10. Age	23.81(3.37)	-0.16r_s	0.05r_s	0.05	-0.18r_s	0.16	-0.20	0.12	0.01	0.42**	1
11. Gender	-	0.25*r_s	-0.17r_s	-0.05r_s	-0.12r_s	-0.20r_s	0.06r_s	0.28*r_s	0.24*r_s	-0.28r_s	-0.25*r_s

**p < 0.05, **p < 0.01, N=69.*

Note. Gender: 1 = man, 2 = female

Note. r_s = spearman correlation, as variables were not normally distributed or categorical

Note. Compensation behavior: 1 = healthy kit, 2 = unhealthy kit

Note. For time since last meal N=62 (participants indicated eating M&M's as last eating moment instead of prior to the experiment)

Randomization

To determine whether randomization of participants over the two conditions was successful, a randomization check was performed for age, gender, motivation to eat healthy, snack liking and BMI. Using independent samples *t*-tests, no differences between conditions in age (t (67) = -0.38, p = 0.702), motivation to eat healthy (t (67) = 1.24, p = 0.220), snack liking ((t (67) = -1.03, p = 0.306) and BMI (t (67) = 0.20, p = 0.841) were found. For gender, a chi square test

was used, which was also not statistically significant ($\square^2$ (1, N = 69) = 1.83, p = .176), indicating proper randomization across conditions. Due to successful randomization between conditions, liking of the snack was not included as a covariate. This was substantiated with an additional logistic regression analysis for the first hypothesis (see: appendix IV: additional exploratory analyses, likelihood of consumption) for determining whether including liking of a snack as a covariate led to changed results.

Main analyses (For additional exploratory analyses, see appendix IV)

Likelihood of consumption. The first hypothesis proposed that a larger distance to a snack decreases the likelihood of it to be consumed. In total, 39 (56.5%) participants decided to eat the snack. To ascertain whether a larger snack distance decreases the likelihood of consumption, a chi-square test for goodness of fit was performed. The chi-square test was statistically significant ($\square^2$ (1, N = 69) = 7.89, p = .005). Based on the odds ratio, the odds of consuming a snack were 4.20 times higher in the proximal condition than the distal condition. In the proximal condition, 74% (SD = 0.45) of the participants consumed any of the snacks, compared to 14% (SD = 0.50) in the distal condition, indicating that a distant snack significantly decreases the likelihood of snack consumption.

Amount of consumption. The second part of the first hypothesis was left open to determine whether a larger distance to a snack affects the consumed amount. Over all participants, the average amount that was consumed was 8.38g (SD = 10.93) which is equal to an intake of 40.22 kcal. Still, 30 participants did not consume any of the snacks (i.e., 0g), which resulted in a positively skewed distribution and positive Kurtosis. As to correct for positive skew and Kurtosis, a log data transformation was applied and an independent samples t test was conducted with the transformed data. For ease of interpretability, however, the actual means and standard deviations are reported.

The independent samples t-test over the full sample showed a significant effect of distance on the amount consumed (t (67) = -2.4, p = 0.017), such that on average participants in the proximal condition (M = 10.21, SD = 10.25) consumed more than participants in the distal

condition (M = 7.00, *SD* = 11.48). It represented a medium-sized effect: *d* = 0.58. These findings from the *t*-test indicate that a larger distance to a snack decreases the amount of its consumption. Considering caloric intake, the proximal condition consumed on average 49.01 kcal compared to 33.60 kcal in the distal condition.

Perceived effort. The second hypothesis suggested that a distant snack is associated with more perceived effort to obtain it. Over all participants, the average perceived effort in obtaining the snack was 2.37 (*SD* = 1.37). To determine whether a larger snack distance is associated with higher levels of perceived effort, an independent samples *t*-test was used. The *t* test was statistically significant, with participants in the distal condition perceiving higher effort (M = 3.15, *SD* = 1.32) than the proximal condition (M = 1.57, *SD* = 0.86; t (67) = 5.89, p < .001) with an effect size that can be considered large: *d* = 1.42. These findings from the *t* test indicate that a distant snack is perceived more effortful to obtain.

Compensation behavior. Over all participants, 30 (43.5%) chose the unhealthy relaxation kit and 39 (46.5%) chose the healthy kit. To explore whether a distant snack is associated with a higher likelihood of compensation behavior, a chi-square test was used. The chi-square test between these two groups was not statistically significant (□² (1, *N* = 69) = 0.15, *p* = 0.704), indicating that a larger snack distance did not affect compensation behavior.

To explore whether refraining from snacking affected compensation behavior, a chi-square test was used to compare compensation behavior between the participants who consumed the snack and the participants who didn't. This chi-square test was also not statistically significant (□² (1, *N* = 69) = 0.22, *p* = 0.639) which indicates that refraining from snacking did not affect compensation behavior.

Discussion

Overall conclusion

The current study examined whether manipulating distance to a snack influences snack intake, perceived effort and compensation behavior. In line with findings from previous studies using a

similar design (Maas et al, 2012; Hunter et al., 2018), the current study found substantial support for the hypothesis that increasing distance to a snack (M&M's) is an effective strategy for decreasing the likelihood of it to be consumed. Overall, the participants in the proximal condition were more likely to consume the snack compared to the ones in the distal condition. Also in line with findings from Maas and colleagues (2012) and in contrast with the findings from Hunter and colleagues (2018), the current study found support for the finding that increasing distance to a snack decreases the amount of its consumption. One possible explanation Hunter and colleagues (2018) provided for the inconsistent findings is that the proximity effect may operate as a smaller effect in general population samples compared to student samples. The current sample only involved student participants and was therefore more similar to the sample used in the study of Maas and colleagues (2012) which might explain the similar findings.

A medium effect size was found for both conditions but when looking at the caloric intake, the distal condition consumed only on average 15.41 kcal less compared to the proximal condition. Therefore, the study supports evidence for the notion that increasing distance decreases the amount of snack consumption but in terms of caloric intake the effect is not that substantial. Moreover, as participants in the proximal condition consumed more on average compared to the participants in the distal condition we also determined whether the effect still holds when excluding participants who refrain from snacking. In line with previous findings (Maas et al., 2012) this effect disappeared when looking at the subsample of participants who consumed any of the snacks which may be due to lower statistical power, as only 39 participants consumed the snack which results in a relatively small sample size.

Furthermore, support for the hypothesis that increasing distance to a snack affects perceived effort has been found. In line with findings from previous studies that suggest distant snacks are rated as more effortful to obtain compared to closer snacks (Maas et al., 2012; Hunter et al., 2018), the current study pointed out that participants in the proximate condition had lower indications of perceived effort in obtaining the snack compared to those in the distal condition. Cohen's *d* appeared to be bigger than 1, as the differences between the means was larger than one standard deviation. As this indicates a large effect size (Cohen, 1988), it should be noted that the actual size difference between conditions on perceived effort values was less convincing. As

also demonstrated in previous studies (Maas et al., 2012; Hunter et al., 2018), the obtained indications of perceived effort were low values with small standard deviations which may imply that the actual differences were not that substantial. One factor that may explain these low values is that they are obtained after a relaxation period, possibly resulting in overall low levels of perceived effort, as the participant was in a relaxed state. The small standard deviations may also imply that the 7-point scale used by Maas and colleagues (2012) might need to be computed in a larger scale to determine whether the effect size might still be this large.

Finally, the current study aimed to explore the potential risk of subsequent compensation behavior after deciding not to eat the snack. It is of importance to look into the risk of compensation behavior in the food realm as little is known still and because worries exist regarding long-term effects of nudges (Bucher et al., 2016). In line with findings from a previous study on compensation behavior (Maas et al., 2012), which demonstrated that distance does not affect craving, the current study found no effect of distance on compensation behavior. This suggests that placing a snack further away might not lead to an increased risk of compensation behavior. The study also found no effect of snacking on compensation behavior, indicating that having refrained from snack consumption might not be of risk for compensation in the future. The findings regarding compensation behavior have been replicated by assessing actual compensation behavior instead of food craving (Maas et al., 2012) which contributes new insights into compensation behavior. Still, as to why and when individuals might compensate is yet to be discovered and the current study's findings are only one of the first considering compensation behavior in a distance manipulation.

The absence of effects of distance and the likelihood of consumption between compensation behavior is not to be explained by self-licensing theory (Monin & Miller, 2001) or consistency theory (Cialdini, 2009). Regarding self-licensing, individuals would be more likely to make an unhealthy decision, with the justification of having chosen the right option before, which was not demonstrated in the study. Consistency theory (Cialdini, 2009) is also not applicable to explain why people perform compensation behavior as the absence of effects indicate no thrive for people to act consistently.

Limitations and areas for future research

Environment. The experiment was conducted in a controlled environment with the advantage of controlling for other possible confounding factors. The experiment involved the manipulation of distance to a single food. In a more typical food environment, people are confronted with many more choices or options of food products. Therefore, elaborating on the study of Knowles, Brown & Aldrovandi (2019) future research might consider examining whether the effects hold under more complex conditions within a competitive food environment.

Perceived effort. In previous research (such as Maas et al., 2012) perceived effort is being referred to as the supposed mediating factor for the effect of distance on food choice. From the current research perceived effort also appeared to be a possible underlying mechanism, as the effect of snack distance on snack consumption may be mediated by perceived effort. To be able to identify the true mediating role of perceived effort may require asking the participants to indicate their perceived effort with being exposed to the snacks simultaneously. However, this may conflict with the manipulation and would reveal the study's objective. The current study managed to obtain assessments of perceived effort right after being exposed to the snack. Future research aiming to contribute on the evidence of perceived effort as the underlying mechanism on the effect of distance may focus on devising a study design that allows assessing perceived effort during snack exposure without reveal the study's objective. For instance by assessing perceived effort while being exposed to a snack (including filler items) followed up by the alleged relaxation period in which participants could snack.

Compensation behavior. The current study found no link between distance and snacking between compensation behavior which may indicate an absence of a risk for compensation behavior in a distance manipulation. Still on account of the variety of limitations the study design leaves room for improvements. Compensation behavior was assessed to determine whether participants were likely to compensate for their eating behavior. Offering the choice between two relaxation kits was rather hypothetically, but as the choice could have real outcomes, it provided an indication for what the participants would really choose. However, the participants now had

only two choice options and in reality, individuals are presented with a variety of choice options, presented at multiple time intervals to possibly compensate. Also, the participants were forced to choose between two choice options while in reality, individuals also have the option to not choose anything. Perhaps future studies might consider assessing compensation behavior after a longer period after snack exposure and, when a variety of compensating options are presented, also provide the option for participants to choose nothing. This may be operationalized by an evening follow-up on the day of the experiment in which participants could disclose which foods (and the amounts) they consumed to assess compensation behavior over the subsequent day.

Another limitation was the design that is used to assess compensation behavior. The effect from distance on compensation behavior is controlled experimentally. The effect from snacking on compensation behavior, however, follows from a quasi-experimental design in which we could not manipulate whether participants would snack or not. Future research might consider including two conditions (snacking vs. non-snacking) and address subsequent behavior. Furthermore, for gaining more insight into compensation behavior, it might be relevant for future studies to look at the combined effect of distance and snacking behavior on compensation behavior.

Conclusion

The current study contributed to the scientific evidence on the proximity effect on snacking behavior and subsequent compensation behavior. In line with expectations, the study results showed support for the evidence on the proximity effect, the effect of distance on likelihood of consumption and perceived effort. The study also demonstrated that increasing distance to a snack, decreases the amount of consumption. The study's findings indicate no risk for compensation behavior after placing snacks further away. Still, the current study is only a starting point for future research into actual compensation behavior.

More insight into positional influences of food and its potential risk for compensation behavior may be of value for public policy concerning the obesogenic environment. For part-takers of the obesogenic environment such as restaurants, workplace- and school food environments, it is recommended to be aware of the positional influences of food and to respond

with the best intentions. There still remains room for nudging to become more evidence based and for compensation behavior to have more theoretical background. Still, the current study may act as a framework for a promising future in which consumers are successfully nudged into less intake of energy-dense unhealthy foods so that obesity will no longer be such a widespread issue.

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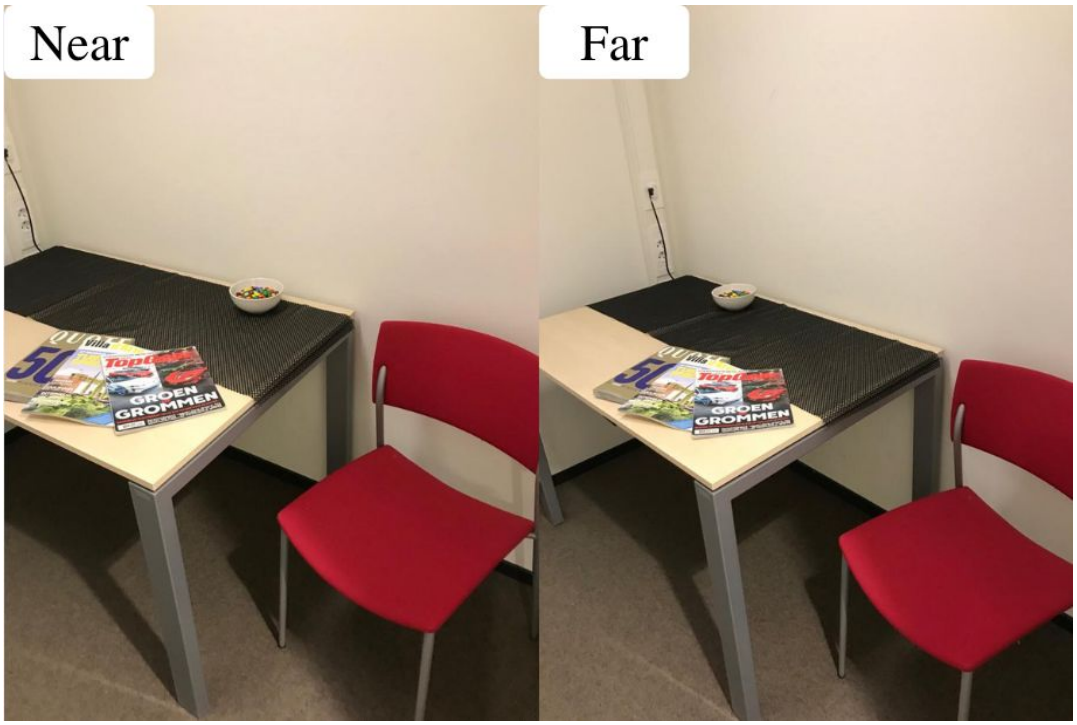
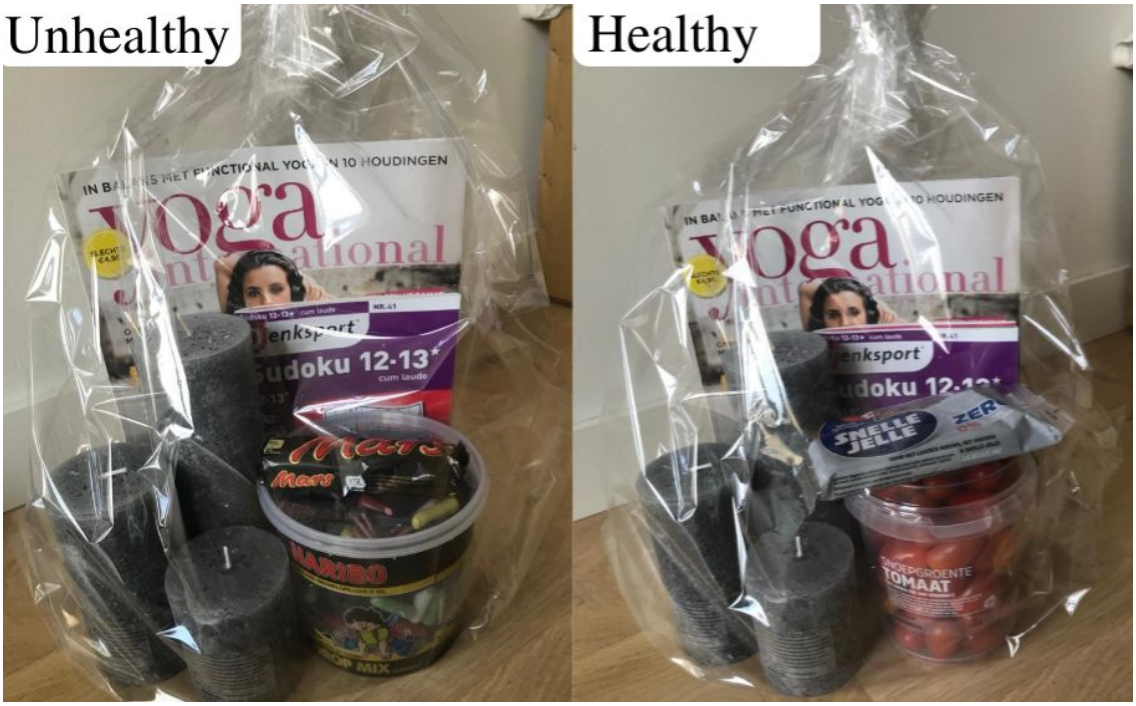
Appendix I: Snack presentation in each distance condition



Appendix II: Visual representation of provided choices of relaxation kit as presented on the screen



Appendix III: Questionnaires

Dear Student,

Thank you for your interest in participating in this study from the department of Social, Health, and Organizational Psychology at Utrecht University. The study is about relaxation and personality.

After agreeing to participate, there will be a relaxation experiment conducted (about 5 minutes) and afterwards two small questionnaires will be administered (about 5 minutes). After finishing the experiment, a debriefing will follow.

Participation in the current study is entirely voluntary and you are free to quit your participation at any time, without giving reasons. The collected data will be treated confidentially. No names or other personal information will be asked, used, or stored.

Completing this study will take approximately 10 minutes. The reward for participation will be either €2 or 0.25 PPU, plus the possibility to enter a lottery to win a relaxation kit. If you want to enter the lottery, we will ask for your e-mail address. We will store your e-mail address separately from the other data in the experiment.

Next

Consent

Thank you for being willing to take part in this experiment. Before we continue, we need your consent to the following:

1. I consent to performing the task in the laboratorium and to filling in questionnaires
2. I understand my participation is voluntary and I can quit the experiment whenever I want without having to provide a reason
3. I agree to be informed sufficiently about the experiment's procedure to participate
4. I understand and consent to the collection of my responses and that they will be stored securely in a database

☐ **I consent to items 1-4 above and want to continue my participation in this study**

Next

Thank you for participating the study. You may now hand over the laptop to the researcher and you'll get further instructions.

Next

Two small questionnaires will now follow. For the study, it is neccessary to answer the questions as honest as possible. Please click next to proceed with the first questionnaire.

Next

As the study focuses on relaxation, we want to ask you how relaxed you feel after the planned relaxation period.

Please rate on a scale of 1 to 7, with 1 indicating 'Not at all' and 7 being 'Very much', how much you agree with the statements below.

I feel tense

Not at all	1	2	3	4	5	6	7	**Very much**

I experience stress

Not at all	1	2	3	4	5	6	7	**Very much**

I feel at ease

Not at all	1	2	3	4	5	6	7	**Very much**

I feel relaxed.

Not at all	1	2	3	4	5	6	7	**Very much**

Next

We now want to ask you a few questions about some elements in the experimenter room.

Please rate on a scale of 1 to 7, with 1 indicating 'Not at all' and 7 being 'Very much', how much you agree with the statements below.

Reaching the chocolate was effortless.

Not at all	1	2	3	4	5	6	7	**Very much**

The magazines were within easy reach.

Not at all	1	2	3	4	5	6	7	**Very much**

To what extent did you have to use effort to attain the chocolate.

Not at all	1	2	3	4	5	6	7	**Very much**

I had to work hard to get the magazines.

Not at all	1	2	3	4	5	6	7	**Very much**

The chocolate was within easy reach.

Not at all	1	2	3	4	5	6	7	**Very much**

Before reaching the chocolate, I had to do something else.

Not at all	1	2	3	4	5	6	7	Very much

Reaching the magazines was effortless.

Not at all	1	2	3	4	5	6	7	Very much

Before reaching the magazines, I had to do something else.

Not at all	1	2	3	4	5	6	7	Very much

To what extent did you have to use effort to attain the magazines.

Not at all	1	2	3	4	5	6	7	Very much

I had to work hard to get the chocolate.

Not at all	1	2	3	4	5	6	7	Very much

Next

Please answer the following questions about yourself and your personality.

Please state your age (in years)

Please state your gender

- Female
- Male
- Rather not say/Other

Please state your nationality

Next

Please answer the following questions about your overall eating behaviour.

Do you have any current eating pathology?

- ( ) Yes
- ( ) No
- ( ) Rather not say/Other

How long ago did you last eat? (in minutes)

Please rate on a scale of 1 to 7 with 1 indicating 'Not at all' and 7 being 'Very much', the following:

How hungry are you at this moment?

Not at all	1	2	3	4	5	6	7	**Very much**

How much appetite do you have at this moment?

Not at all	1	2	3	4	5	6	7	**Very much**

How much do you feel like having a bite at this moment?

Not at all	1	2	3	4	5	6	7	**Very much**

Next

Please answer the following questions about your personality.

How much joy do you feel when you read?

Not at all	1	2	3	4	5	6	7	**Very much**

How much joy do you feel when you eat healthily?

Not at all	1	2	3	4	5	6	7	**Very much**

How much sorrow do you feel if you fail to read?

Not at all	1	2	3	4	5	6	7	**Very much**

How much sorrow do you feel if you fail to eat healthily?

Not at all	1	2	3	4	5	6	7	**Very much**

How committed are you to reading?

Not at all	1	2	3	4	5	6	7	**Very much**

How committed are you to eating healthily?

Not at all	1	2	3	4	5	6	7	**Very much**

How important is reading to you in your life?

Not at all	1	2	3	4	5	6	7	**Very much**

How important is eating healthily to you in your life?

Not at all	1	2	3	4	5	6	7	**Very much**

Next

Please rate on a scale of 1 to 7, with 1 indicating 'Not at all' and 7 being 'Very much', how much you like the following products for snacking.

How tasty do you find popcorn?

Not at all	1	2	3	4	5	6	7	**Very much**

How tasty do you find apples?

Not at all	1	2	3	4	5	6	7	**Very much**

How tasty do you find M&M's?

Not at all	1	2	3	4	5	6	7	**Very much**

How tasty do you find carrots?

Not at all	1	2	3	4	5	6	7	**Very much**

How tasty do you find peanuts?

Not at all	1	2	3	4	5	6	7	**Very much**

How tasty do you find licorice?

Not at all	1	2	3	4	5	6	7	**Very much**

How tasty do you find crackers?

Not at all	1	2	3	4	5	6	7	**Very much**

How tasty do you find bananas?

Not at all	1	2	3	4	5	6	7	**Very much**

Next

Please estimate your weight and height and state them below.

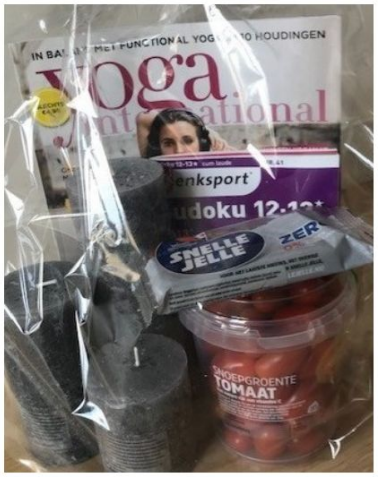
Weight (in kilos, if necessary, rounded off to the nearest whole number) If you're not used to kilos as a unit of weight you may use this converter: https://www.metric-conversions.org/weight/pounds-to-kilograms.htm.

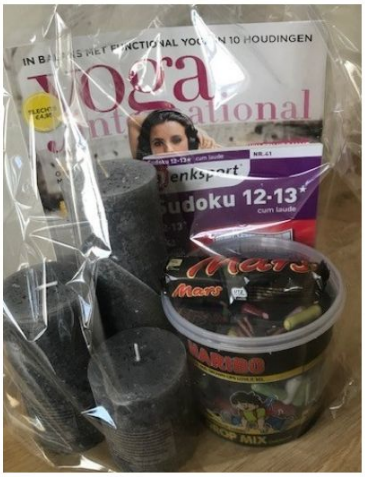
Body length (in cm, if necessary, rounded off to the nearest whole number)

Next

As a reward for your participation, there will be a lottery held over all the participants. The prize is a relaxation kit worth €20,-. Please choose which relaxation kit you'd prefer to make a chance to win.

Next





You have almost reached the end of the study. We want to ask you a few final questions.

If you want to enter the lottery for winning the relaxation kit, please enter your email address below. The researcher will contact you as soon as the study has ended.

Next

Do you think you know what the study was investigating?

- No
- Yes, I think I know what the study was investigating: (Please state below)

Next

Dear participant,

Thank you for participating in the study.

In this study we were interested in snacking behavior and spillover effects. Therefore, you were given the opportunity to relax and snack in the meantime. For half of the participants, the snacks were placed close to them, while for the other half of the participants the snacks were placed further away from them.

Afterwards you had the chance to enter a lottery to win a relaxation kit. One of the kits was relatively healthier than the other one. We are interested in the effects of snacking behavior on the choice for one of the two relaxation kits. The lottery will take place as soon as the study has ended.

We hope to have informed you sufficiently and if you have any questions in the future concerning the study, feel free to email: relaxationstudy2019@gmail.com.

Do you wish to be informed about the study's results in the end by email?

- ○ No
- ○ Yes, my email adress is:

Next

You may now return to the experiment leader to receive your reward for participation., the researcher will hand you the form for the 0.25 PPU or the €2 cash.

You may now return the laptop to the researcher.

Next

Appendix IV: additional exploratory analyses

Likelihood of consumption. As snack liking was significantly associated with likelihood of consumption, an additional logistic regression analysis was conducted to determine whether the effect of distance on likelihood of consumption would still hold when snack liking was included as a covariate. The logistic regression analysis was statistically significant (Wald (df = 61, N = 69) = 6.66, p = 0.010). The odds ratio indicated that a participant in the proximate condition is 29.4% more likely to snack compared to the distal condition when controlled for snack liking.

Amount of consumption. A *t*-test was performed on the subsample of participants who ate at least one M&M to determine whether the effect from distance on amount of consumption still holds. In the subsample of participants who snacked (N = 39), the average consumed amount is 15.2g (SD = 10.54). Again using the transformed data, as the data was not normally distributed, the independent samples *t*-test on the subsample (with participants who consumed the snack) showed no significant relation between distance and amount of consumption ((t (37) = 0.69, p = 0.494). The second *t*-test indicates that over only the subsample of snack consuming participants, distance does not affect the amount of consumption.

Participants who moved the bowl. An additional *t*-test was performed on the sample to compare participants between conditions in their consumed amount with inclusion of the participants who moved the bowl (N = 3). Over the sample (N = 72), the average consumed amount is 9.03g (SD = 11.37). This *t*-test was not to be significant: t (70) = -0.45, p = 0.652). The additional *t*-test indicates that including the participants who moved the bowl would lead to changed results, due to its effects on consumption behavior.