Social recipes for appetite
Peer influence on young people's food choice and intake

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GENERAL ABSTRACT

Background and objectives

People often consume their meals and snacks in the presence of others. In view of the growing obesity epidemic, it is important to investigate social factors that influence people’s eating behavior. People are believed to adjust their consumption behavior to social benchmarks in situations without pre-existing guidelines and/or when they have social motives to conform to others. The research described in this dissertation aims to advance the understanding of peer modeling in young people’s food choice and intake.

The current thesis is divided into three parts. The first part aims to provide more insight into the influence of peers on food choice. Given that we are challenged with numerous different food choices in our social environment on a daily basis, social modeling of food choices between low- and high-energy-dense food products was examined. Nevertheless, the current obesity epidemic is vastly linked to people’s preference to eat high-energy-dense foods. Therefore, the second part of this thesis focuses on social modeling of high-energy-dense food intake. The amount of palatable food intake was investigated in conjunction with factors that can put young people at risk of peer influence. The third and final part of this thesis presents an intervention which aimed to explore the possibility to increase young people’s resistance to peer influence on high-energy-dense food intake.

Methods

To measure the impact of one’s consumption behavior on food choice and intake, social modeling studies were conducted in which naive participants were exposed to a peer (i.e., the experimental confederate) who was instructed to select and/or eat a predetermined amount of food. The confederate was either a live or remote model (i.e., information was given about the food selected/eaten by another non-existent participant). To ensure that the participants acted in a natural manner, a cover story was delivered to conceal the actual aim of the study. To help the live confederates carry out their secret assignments (i.e., eat a predetermined amount of food at set time points), a unique buzzer device was hidden in the participant’s pocket or sock that could be set off remotely by
the experimenter. This enabled the experimenter to manipulate the exact same time points of food intake across all participants in the social modeling sessions. The influence of a peer on food choice and intake was examined in conjunction with individual and situational characteristics.

Results

Chapters 2 – 8 of this dissertation consistently demonstrated the impact of a peer on young people's food choice and intake. Specifically in Chapters 4 – 7, it was demonstrated that young people are likely to adjust the amount of their food intake to that of their eating companion. The findings of Chapter 2 and 3 provided evidence that social modeling processes occur in food choices between low- and high-energy-dense products as well. Although social modeling behavior seems ubiquitous, the findings of Chapters 4, 5 and 7 revealed that the social modeling effect is weaker for some people than others or that the process takes place differently based on body weight, self-esteem or emotions. Furthermore, Chapters 6, 7 and 8 provided preliminary evidence to believe that young people might not be aware of social modeling processes.

Conclusions

The person(s) surrounding us while we are eating can be a powerful marker as well as tool for our food choice and intake. Social norms have an important influence on our eating behavior because the performance of these behaviors endorses our sense of belonging. Every social situation holds its own array of norms for appropriate behavior which is derived from the behavior of others. Although some young people are more susceptible to be influenced by other’s food choice and intake than others (e.g., due to our body weight and self-esteem) and personal norms might strengthen or protect against this influence, social modeling behavior is likely to impact all of us because we are often not really aware of social influences. The findings and suggestions presented in this dissertation could be used as a starting point for developing and testing adequate interventions aimed at encouraging healthy eating behaviors among young people. Besides strategies to encourage young people to eat (novel) low-energy-dense foods, the use of a peer model
to discourage high-energy-dense food choice and intake should receive more attention. Given that people’s eating habits are embedded in our home and school environment, there is an inherent responsibility for these social networks.
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CHAPTER 1
General introduction
The obesity epidemic

In the past 30 years, the rate of obesity has more than doubled in children and tripled in adolescents. In the United States, more than 1/3 of youth aged between 2 and 17 are overweight or obese (CDC, 2012b; Ogden, Carroll, Curtin, Lamb, & Flegal, 2010). In Europe, the prevalence of overweight and obesity doubled within the last decade and is still rising. In the Netherlands, 15% of people aged under 25 is overweight and around 3% of boys and 4% of girls is obese (Ministry of Health, 2009; TNO, 2010). Considering that there are 4.94 million young people, this indicates that 741,000 are overweight of which 148,200 boys and 197,600 girls are obese. This means that an average Dutch school classroom of 28 – 30 pupils has 4 to 5 overweight pupils of which one boy and girl is obese.

On the short term, overweight/obese youth are at risk of cardiovascular disease (e.g., high cholesterol or high blood pressure), pre-diabetes (i.e., blood glucose levels that indicate a high risk for the development of diabetes), bone and joint problems, sleep apnea, and social and psychological problems such as stigmatization and low self-esteem (CDC, 2012b; I’Allemand et al., 2008; Lobstein, Baur, & Uauy, 2004; Puhl & Latner, 2007). Children who are overweight/obese are also at greater risk of poor health and well-being during adolescence and adulthood. The long-term effects include health problems such as heart disease, stroke, type 2 diabetes, osteoarthritis and several types of cancer including cancer of the breast, colon, esophagus, kidney, pancreas, gall bladder, thyroid, ovary, cervix, and prostate, as well as multiple myeloma and Hodgkin’s lymphoma (CDC, 2012b; Dietz, 1998; I’Allemand, et al., 2008; Panhuis-Plasmans, Luijben, & Hoogenveen, 2012; Reilly et al., 2003; Wang & Dietz, 2002). The annual medical spending attributable to overweight and obesity is estimated on $ 1,400 dollars per person in the US and overweight is responsible for up to 10% of the national health care costs in the Netherlands (Finkelstein, Trogdon, Cohen, & Dietz, 2009; Panhuis-Plasmans, et al., 2012; Wang & Dietz, 2002).

Genetic or metabolic factors play a role in the development of overweight and obesity. However, the shift in many countries towards an increased weight indicates that they do not predict future health alone (CDC, 2012a). Genes may cause one’s susceptibility for obesity, but a range of diverse and complex societal, environmental, economic and personal influences can further instigate a person to become overweight or obese.
As individuals make decisions based on their social surroundings, attention needs to be paid to people’s social environment and it is important to investigate one’s susceptibility to social influences. Several social factors have been identified for the general population; however, it is likely that these factors affect young people differently than adults. For example, children have different leisure-time activities, they possess less developed self-control than adults and school-related factors are likely to influence children’s dietary intake. As (over)eating tendencies are primarily embedded and learned during childhood, it is important to focus on the social environment of children and young people for initiatives to understand eating behavior. This thesis aims to contribute to that understanding on the subject of peer modeling in young people’s food choice and intake at schools and in the supermarket.

Social survival

Adapting behavior to the standards within our environment is believed to rely on an evolutionary purpose to survive (Lakin, Jefferis, Cheng, & Chartrand, 2003; Rizzolatti & Craighero, 2004). People develop behavioral skills as well as social competences through conscious and non-conscious imitation of gestures and behaviors such as coordinated motor activities, actions with objects, language development, mutual involvement and shared understanding (Charman et al., 2000; Eckerman & Didow, 1996; Laible & Thompson, 2007; Lakin, et al., 2003; Meltzoff, 1988). By observing and imitating the actions of others, our ancestors learned crucial information, which made them understand how to survive and reproduce in their environment. Intertwined with their action understanding and physical survival was their social survival: individuals who were ostracized from the group had fewer chances to survive whereas individuals who were included by working together and maintaining good relationships were more likely to fulfill survival activities within the group (Lakin, et al., 2003). Following this line of reasoning, research has provided evidence to believe that individuals have a higher order goal to affiliate because it leads to an increased liking between persons due to their need to belong (Chartrand & Bargh, 1999; Chartrand, Maddux, & Lakin, 2005; Lakin & Chartrand, 2003). Thus, people copy actions and behaviors to learn as well as to affiliate with others, be liked and socially embedded (Baumeister & Leary, 1995; Lakin, et al., 2003). This is not only apparent in
the adaptation of people’s body postures, gestures, mannerisms or actions. We also tend to use other’s food intake as a point of reference or guideline for our consumption behavior (Herman, Roth, & Polivy, 2003).

**The presence of others influences our consumption behavior**

Infants use relatives as role models in developing behavioral skills and social competence through observation and modeling behavior; however, *peers* become more important role models as young people mature and spend a lot of time at school (Fuligni & Eccles, 1993). We often eat in different social contexts in the presence of parents, siblings, relatives, classmates, friends or colleagues. In each social setting, the people surrounding us can affect our food intake, regardless of being aware of these social influences. Even strangers making food choices in our proximity at a buffet, local supermarket, kiosk or cinema might affect our consumption behavior.

The presence of others is believed to intensify the level of arousal that drives people’s actions such as food intake (Zajonc, 1965; Zajonc & Sales, 1966). Early studies on *social facilitation* demonstrate that people increase their food intake with approximately 40% when eating in the presence of others compared to when eating alone. The increase in food intake is believed to be proportionate to the number of people; that is, when eating with a larger number of people, we tend to spend more time on ‘social eating’ and end up eating more than without pleasant company while eating alone (de Castro, Brewer, Elmore, & Orozco, 1990; Herman, et al., 2003; Zajonc, 1965; Zajonc & Sales, 1966). Nevertheless, the presence of others can inhibit our food intake as well. There are situations in which we adjust the energy density of our meal or suppress our food intake because we want to convey a good impression. As we already tend to feel secure and socially embedded among our close relatives, *impression management* is likely to occur when we care about how we are being perceived by significant (acquainted) others or when we are in the presence of strangers. For example, to avoid prejudicial effects regarding body weight, obese people may suppress their intake when eating in the presence of slimmer looking peers. In children, normal-weight children were found to consume more in the presence of others (than when alone) whereas overweight children were found to consume more when they were alone than in the presence of a normal-weight peer (Salvy, Coelho, Kieffer, & Epstein, 2007).
People adhere to a social benchmark of food intake

Social facilitation and impression management processes are incorporated in social modeling behavior. Social modeling studies examine whether people eat more or less according to the eating behavior of others. Numerous studies in adolescents and adults have shown that people adjust their food intake to that of an eating companion regardless of feelings of hunger or satiety and in different situations (Feeney, Polivy, Pliner, & Sullivan, 2011; Goldman, Herman, & Polivy, 1991; Herman & Polivy, 2005; Hermans, Larsen, Herman, & Engels, 2009; McFerran, Dahl, Fitzsimons, & Morales, 2010). For example, people still ate minimally after being deprived from food for 24 hours due to the small amount of food intake of others (Goldman, et al., 1991). Herman and Polivy’s normative framework provides an interpretation of why people model the food intake of others (Herman, et al., 2003). People are believed to monitor what others eat to resolve their own uncertainty about how to act in certain situations. As it appears that the social environment even overrides strong internal physiological signals such as hunger and satiety, people are also believed to have social motives to conform to others eating to avoid the risk of being ostracized or standing out by deviant behavior.

The complexity of social modeling behavior lies in the extent to which individuals adapt the food intake of others. Although we tend to use each other’s consumption behavior as a permissive guideline or social norm for ‘appropriate’ eating behavior, we show different matching degrees based on personal characteristics and situational factors. For example, previous studies have shown different matching degrees due to a person’s body weight, sex or the (un)friendly atmosphere during a social interaction (Hermans, Engels, Larsen, & Herman, 2009; Salvy, Jarrin, Paluch, Irfan, & Pliner, 2007; Salvy, Romero, Paluch, & Epstein, 2007). In addition, it is suggested that the social modeling effect in food choice is less robust than in designs which test social modeling behavior in relation to the amount of food intake (especially in designs with high-energy-dense products only) (Pliner & Mann, 2004; Robinson & Higgs, 2013). A study in which social modeling behavior of low- as well as high-energy-dense food choice and intake was examined in young female adolescents, found that females who were led to believe that others consumed a high amount of high-energy-dense food ate more than those who were exposed to
the low-intake amount information; however, this social modeling effect was not found in low-energy-dense foods. Moreover, when both type of foods were offered at the same time and participants had to choose between foods while provided with information about food choices of prior participants, who either chose low- or high-energy-dense products, nearly all young females chose high-energy-dense foods (Pliner & Mann, 2004). Given that people seem to have a preference for high-energy-dense foods (Rozin & Vollmecke, 1986), it is important for intervention purposes to examine the robustness of the social modeling effect in situations in which people have a choice between low- as well as high-energy-dense foods and whether there are factors that can influence the modeling effect in high-energy-dense food intake.

To date, the field of knowledge on social modeling behavior of food choice and intake in young people (up to 15 years of age) is limited but emerging. The experimental studies that provide insight into social influence on young people’s eating behavior are primarily related to social facilitation processes or the encouragement of novel foods (see Appendix 1 for an overview; the relevant literature will be discussed in the following paragraphs and/or chapters). The research in this dissertation opens up a new research area in investigating peer modeling of food choice and intake among schoolchildren by means of experimental social modeling scenarios.

**Framework of this thesis**

The current thesis is divided into three parts. The first part aimed to provide more insights into the influence of peers on food choice. Given that we are challenged with numerous different food choices in our social environment on a daily basis, social modeling of food choices between low- and high-energy-dense food products was examined. Nevertheless, the current obesity epidemic is vastly linked to people’s preference to eat high-energy-dense foods. Therefore, the second part of this thesis focused on social modeling of high-energy-dense food intake. The amount of palatable food intake was investigated in conjunction with factors that can put young people at risk of peer influence. The third and final part of this thesis presented an intervention which aimed to explore the possibility to increase young people’s resistance to peer influence on high-energy-dense food intake.
CHAPTER 1

Notably, the current chapter only intends to provide brief rationales behind this thesis’s studies (ergo chapters) while referring to the existing literature on social facilitation, impression management and social modeling processes in young people’s food choice and intake. Further elaboration on each study is presented and discussed within each of the following chapters. Before introducing the studies, the experimental design of the social modeling studies needs to be addressed.

SOCIAL MODELING OF FOOD CHOICE AND INTAKE

Social modeling scenario

In a (social facilitation) scenario in which each person is free to choose the type or amount of food to be eaten, it is difficult to determine whether an individual is being influenced by someone else or vice versa. The most significant difference between the experimental studies on social facilitation processes and a typical social modeling design is that the intake of the eating companion is predetermined by the experimenter in a social modeling scenario. A social modeling design enables to measure the impact of one’s consumption behavior on food intake by pairing a naive person (i.e., the participant) with an eating companion who is instructed by the experimenter to select and/or eat a predetermined amount of food (i.e., the experimental confederate).

The confederate can be either a live or a remote model. Live models are instructed persons. In studies with remote models, participants are often provided with a sheet of information about the amount of food eaten by other non-existent participants. It is also possible to show a video clip of a remote video-model selecting or eating food (Romero, Epstein, & Salvy, 2009). In either way, the behavior of the live and remote models turns out to be a benchmark or norm for the participants (Feeney, et al., 2011). To ensure that the participants act/eat in a natural manner, it is common to deliver a cover story to conceal the actual aim of the study.

The experimental studies of this thesis aimed to enhance the current existing social modeling designs by the following:

- Previous studies have used taste testing or rating of food liking as cover story. Given that this requires the participants to direct attention to food, the participants in the studies presented in this
dissertation were asked to complete a fake task which was not related to food. While the participants were performing the task, food was available of which they were free to eat as little or much as they liked.

- To help the confederate carry out their secret assignment (i.e., eat a predetermined amount of food at set time points), a unique buzzer device was invented. The buzzer was hidden in the participant’s pocket or sock and could be set off remotely by the experimenter. This enabled the experimenter to manipulate the exact same time points of food intake across all participants during the social modeling sessions.

- To avoid confederate effects, each confederate was paired with a participant only once and the experimenter made sure the children were not close friends.

- In some of the studies of this dissertation, the confederates were located at the same school as the participants. Therefore, an additional cover story was delivered to the confederates to ensure that the participants would not become aware of the confederate’s instructions. Before each social modeling session, the experimenter checked whether the participants became suspicious about the research aims. In addition, all sessions were videotaped to check whether the confederates kept their secret and carried out the instructions.

- The concept remote confederate was broadened by means of computer confederates because children grow up in an environment in which they increasingly engage in social interactions via computer-based communications.

- All the experimental studies were conducted in schools or supermarkets. This allowed for testing the participants in more naturalistic settings than the laboratory settings used in previous studies in children, adolescents and adults.

**PART I. PEER INFLUENCE ON FOOD CHOICE**

**Low- and high-energy-dense foods**

One aspect of people’s food choice relies on evolutionary predispositions that originate from the need to discover by trial and error what is safe to eat (Rozin & Vollmecke, 1986). Therefore, children
feel cautious or anxious to pick unfamiliar foods and face difficulties in trying novel foods for a certain period in their life. Studies have shown that others can encourage or discourage young people to eat unfamiliar food products. For example, intervention studies have used role models to encourage children to eat novel low-energy-dense foods by means of a pre-instructed teacher or a peer model (i.e., the confederates), in which peers were found to have a stronger impact than teachers (Hendy & Raudenbush, 2000) and girl models were more effective than boys to encourage consumption (Hendy, 2002). Other studies examined the impact of groups of live or remote peer models (Birch, 1980; Greenhalgh et al., 2009; Horne et al., 2004) or the role of (un)familiar adults (Addessi, Galloway, Visalberghi, & Birch, 2005; Harper & Sanders, 1975) on the willingness to consume (novel/low-energy-dense) foods. Notably, these studies did not focus on food choices in the sense that both low- and high-energy-dense products were offered. As children face a food environment which offers a range of (un)familiar low- to high-energy-dense products, one of the aims of this thesis was to investigate whether a peer could influence the preference for familiar versus unfamiliar low- and high-energy-dense foods (Chapter 2).

Another scenario in which young people face food choices between low- and high-energy-dense products prior to their intake is when they are shopping for foods. The transition from the intention to consume foods to actual consumption starts with food choices made in the supermarket. The consumer socialization process develops when young people shop with friends (Mangleburg, et al., 2004; Valkenburg & Cantor, 2001). Young people, in particular, are found to spend their money on food and snacks (Alhabeeb, 1996). In addition, young people shop together to reduce their uncertainty about expenditures via the other’s knowledge or for support in decision making through social comparison in which they use significant others as their reference group (Bearden & Etzel, 1982; Kiecker & Hartman, 1994). Although people often shop together (Mangleburg, Doney, & Bristol, 2004), the research area of peer influence on the purchase of low- or high-energy-dense food products has been left untouched. Chapter 3 consists of a study in which youngsters were asked to shop together in their local supermarkets to examine the influence of a peer on the energy density of food purchases.
Part II. Peer influence on high-energy-dense food intake

The second part of this thesis aims to gain more insight into factors that can contribute to young people’s vulnerability to social modeling of high-energy-dense food intake. Based on previous literature, individual factors or processes are examined that can affect our susceptibility to peer influence. Additionally, an attempt is made to explore our level of awareness to peer influences because it is suggested that normative social influence happens unnoticed and is “underdetected” (Nolan, Schultz, Cialdini, Goldstein, & Griskevicius, 2008).

Susceptibility to peer influences

As was mentioned before, the few studies in young people’s social modeling behavior have concentrated on the encouragement to eat low-energy-dense (novel) foods especially (Greenhalgh, et al., 2009; Hendy, 2002). There is one study on social modeling of high-energy-dense food intake in children (which employed a remote confederate design). Video clips of children selecting small or large portions of palatable foods were shown to participants before they had to select and eat their own palatable food (Romero, et al., 2009). Young girls were found to consume more when exposed to a remote model selecting a large portion than those exposed to the small portion-model. Studies in social facilitation processes have examined the role of company (i.e., eating alone vs. with strangers, sibling, friends or mothers) on young people’s high-energy-dense food intake (see Appendix I for an overview of the outcomes). There is also quite some evidence involving social facilitation and impression management processes indicating that body weight plays a role in the extent to which young people are influenced by the other’s palatable food intake. Studies in which dyads or small groups of children could eat as little or much as they liked, showed that when overweight children were eating together they consumed more than non-overweight children (Salvy, Howard, Read, & Mele, 2009; Salvy, Romero, et al., 2007). In addition, overweight girls eating with someone of similar weight status were found to consume more than when eating with a slimmer peer whereas normal-weight girls who ate with overweight girls did not eat more than when eating with someone of their own weight (Salvy, Romero,
et al., 2007). Although this research shows evidence that young people differ in their food intake based on their weight status in a social eating context, there are some limitations to this kind of research. For example, it is not clear who modeled whom if any guidelines or norms were followed with regard to the amount of palatable food consumed. Therefore, one of the aims of this thesis is to further investigate the role of young people’s body weight in peer modeling of high-energy-dense food intake. Chapter 4 involves a study to examine whether social modeling behavior differed between normal-weight and overweight girls and boys when eating with a normal-weight same-sex peer who was instructed to eat nothing or a small or large amount of candy.

Furthermore, the few studies that examined long-term effects (ranging from a few days to one month) of social modeling in children’s low-energy-dense food intake have yielded contradictory findings. One study did not find that peer influence lasted for a month (Hendy, 2002) whereas other studies showed that children modified their low-energy-dense food intake after repeated exposure to peers during 4 days (Birch, 1980) or 2 weeks (Horne, et al., 2004). How this would apply for high-energy-dense foods has not (yet) been explored in young people as well as other age groups. Therefore, an additional aim of the study presented in Chapter 4 was to examine whether a norm that was set in high-energy-dense food would still be used as a guideline a few days later.

Interestingly, people’s body weight and appearance is strongly linked to their confidence level and self-esteem. Self-esteem plays an important role in social interactions and is seen as a monitor of social acceptance and exclusion (Baumeister & Leary, 2000; Heatherton & Vohs, 2000; Heatherton & Wyland, 2003; Leary, Tambor, Tergal, & Downs, 1995). It is believed that people with high self-esteem feel less need to affirm social bonds (e.g., by social modeling behavior) compared to people with low self-esteem because they worry less about how they are perceived by others and perceive a lower probability of rejection (Baumeister & Leary, 1995; Bohrnsedt & Felson, 1983; Heatherton & Vohs, 2000; Heatherton & Wyland, 2003; Kenny & DePaulo, 1993). Despite the notion that self-esteem may play a role in peer modeling of food intake, there is limited published evidence supporting this. There is one study in young female adults which found a strong matching effect in eating companions where one person had low self-esteem whereas there was no matching effect in dyads where
both eating companions had high self-esteem (Robinson, Tobias, Shaw, Freeman, & Higgs, 2011). The findings suggest that desire for social acceptance may be an underlying cause of social modeling of food intake. To gain more insight into whether young people are susceptible to adjusting their food intake to that of a peer due to a possible need to belong or affiliation goals, the study in Chapter 5 examined the role of self-esteem in social modeling behavior. Besides the role of global explicit self-esteem, two other constructs of self-esteem were explored as well. In general, the current literature examining people’s self-esteem often focuses on people’s general psychological well-being. Nevertheless, research has shown that young people’s eating behavior is also related to their body esteem (Ricciardelli & McCabe, 2001). In addition, having low body esteem is found to predict people’s general self-esteem but not necessarily vice versa (Rosenberg, Schooler, Schoenbach, & Rosenberg, 1995; Tiggelman, 2005). Therefore, body esteem is included into the study as well. The other construct of self-esteem that was assessed is implicit self-esteem. Implicit self-esteem is not based on people’s conscious reflective responses (i.e., explicit self-esteem) but on their intuitive and automatic responses to self-relevant stimuli. It is postulated that implicit self-esteem may play a role in the interconnectedness between people (DeHart, Pelham, Fiedorowicz, Carvallo, & Gabriel, 2011). The possible role of implicit self-esteem in young people was explored because this was the first study to assess such measure in social modeling of eating behavior.

**Awareness of peer influences**

Influence can be considered as non-conscious when people are not aware of it as being influential (Nolan, et al., 2008). Research has shown that people are not aware of the impact of the social environment and their susceptibility to peer influences (Croker, Whitaker, Cooke, & Wardle, 2009; Vartanian, Herman, & Wansink, 2008). It is suggested that observed behavior of other people may be processed unconsciously and prime or trigger a similar response (Chartrand & Bargh, 1999; Nolan, et al., 2008). In line with this reasoning, it is possible that witnessing someone reaching for food may trigger us to pick and eat food as well. In the study presented in Chapter 6 of this dissertation, it was examined whether the adaptation to others’ high-energy-dense food intake may partially be attributed to the imitation of intake cues such as food picking
movements. Few studies in a new line of research on imitation processes in consumption behavior have shown evidence that young adults are more likely to take a bite or sip in response to someone else's intake cues than without such a cue (Hermans et al., 2012; Koordeman, Kuntsche, Anschutz, van Baaren, & Engels, 2011; H. Larsen, Engels, Granic, & Overbeek, 2009). Furthermore, the findings showed that people are more likely to imitate at the start of a social interaction than at the end. A proposed reason for the decrease in imitation responses after the first bites or sips is that we feel more confident or at ease after a while and may perceive to have fulfilled our higher order goal to affiliate (Hermans, Lichtwarck-Aschoff, et al., 2012). These potentially automatic processes provide reasons to further investigate imitation processes in children. Furthermore, the indications that normal-weight and overweight persons differ in eating tendencies in social contexts provides compelling reasons to examine the role of body weight. Therefore, Chapter 6 employed a more in-depth manner to explore whether imitation might play a role in social modeling of food intake.

Another possible reason of why we are less aware of our eating behavior in our social environment is due to distraction. For example, research has shown that watching television (TV) while eating can disrupt the ability to regulate food intake and facilitates (over)eating (Bellisle, Dalix, & Slama, 2004; Temple, Giacomelli, Kent, Roemmich, & Epstein, 2007). When we watch TV, we experience a spectrum of emotions ranging from happy to sad feelings. Although people often watch eventful TV programs with others during meal time or have movie nights with snack foods, there is limited published research that focuses on the interaction between emotions and social context in relation to food intake. One study in which obese women kept a food diary reported that the experience of emotions and the social eating context separately influenced food intake; that is, more food was consumed in social contexts compared to when eating alone and food intake was higher in positive as well as negative emotional states compared to neutral emotional states (Patel & Schlundt, 2001). In social situations, emotions are found to affect people's awareness of their actions and compliance (Dolinski, 2001). It is suggested that while people's cognitive capacity deals with changes in the emotional state, it can cause other responses to occur automatically or mindlessly.
(Baumeister, Vohs, DeWall, & Zhang, 2007; Dolinski, 2001; Wansink, 2006). It is possible that television watching and emotional engagement creates a distracting situation in which young people model palatable food intake of others. Therefore, it was examined in Chapter 7 whether watching a happy, neutral or sad movie clip has an impact on social modeling of high-energy-dense food intake.

**PART III. INTERVENTION**

**Susceptibility to peer influences after raising awareness**

In the previous paragraphs it was already mentioned that interventions are primarily directed at encouraging young people to eat novel foods or increase healthy eating by peer modeling; however, to prevent obesity, young people must also decrease unhealthy eating. Given that individuals are often unaware of the influence of their social environment (Nolan, et al., 2008), the last study presented in Chapter 8 of this dissertation examined whether it is possible to reduce children’s susceptibility to peers’ candy intake by making them aware of peer modeling in food intake. For that reason, two types of short interventions (duration 8 minutes) were designed in which young people were explained social modeling behavior with illustrative photos, video clips and interactive tasks. The young people were exposed to either a standard intervention or an animated intervention or were not exposed to an intervention (i.e., the control group). The animated version was similar to the standard intervention but added a monkey puppet as (cue) reminder. A cue reminder may trigger an recall of the prevention message (Dal Cin, MacDonald, Fong, Zanna, & Elton-Marshall, 2006; Kleinjan, Strick, Lemmers, & Engels, 2012). A social modeling experiment was conducted one day after the intervention to (pilot) test whether the interventions affected the extent to which young people modeled their peer’s high-energy-dense food intake. In addition, it was examined if the interventions had different effects on young boys and girls because literature provides evidence that health messages might have a greater impact on girls than boys (Grogan, Bell, & Conner, 1997).
Aim and focus of this dissertation

The research described in this dissertation aims to advance the understanding of peer modeling in young people’s food choice and intake in a theoretical (normative) framework. Throughout this dissertation, it will become clear that the person(s) surrounding us while we are eating can be a powerful marker as well as tool for our food choice and intake. The factors that are investigated are related to social modeling behavior in low- and high-energy-dense food choices, and susceptibility and awareness processes concerning high-energy-dense food intake (see

Table 1.1 Dissertation outline

<table>
<thead>
<tr>
<th>Chapter</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low- vs. high-energy-density</td>
<td>Shopping behavior</td>
</tr>
<tr>
<td>Main topic</td>
<td>Familiarity food products</td>
<td></td>
</tr>
<tr>
<td>Confederate</td>
<td>Remote</td>
<td>Live</td>
</tr>
<tr>
<td>Sample size (excl. confederates)</td>
<td>N = 316</td>
<td>N = 89</td>
</tr>
<tr>
<td>Age</td>
<td>Children (M=7.13)</td>
<td>Teenagers (M=10.86)</td>
</tr>
<tr>
<td>Task</td>
<td>Computer-interaction at school</td>
<td>Food purchases at supermarket</td>
</tr>
</tbody>
</table>
Table 1.1 for the outline of this dissertation). The identification of young people who are at risk of peer influence and the situations in which young people model is important for the understanding of our eating behavior. The last chapter (Chapter 9) provides a reflection on the main findings in a theoretical (normative) framework and in view of other studies. As this is a new line of research, limitations and implications for future research and theory will be discussed. The impact of the examined factors and their relative contribution to food choice and intake can help to provide tools that contribute to the prevention of (un)healthy eating patterns, e.g., through school policy or parental education of youngsters.

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
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<tbody>
<tr>
<td><strong>Food intake</strong></td>
<td><strong>High-energy-density</strong></td>
<td><strong>Emotions</strong></td>
<td><strong>Intervention</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body weight &amp; follow-up</td>
<td>Self-esteem</td>
<td>Imitation</td>
<td>Emotions</td>
<td>Intervention</td>
<td></td>
</tr>
<tr>
<td>Live</td>
<td>Remote</td>
<td>Live</td>
<td>Live</td>
<td>Live</td>
<td></td>
</tr>
<tr>
<td>N = 223</td>
<td>N = 118</td>
<td>N = 68</td>
<td>N = 112</td>
<td>N = 141</td>
<td></td>
</tr>
<tr>
<td>Children (M=8.66)</td>
<td>Teenagers (M=11.14)</td>
<td>Children (M=8.56)</td>
<td>Children (M=7.78)</td>
<td>Children (M=7.84)</td>
<td></td>
</tr>
<tr>
<td>Puzzle at school</td>
<td>Computer-interaction at school</td>
<td>Puzzle at school</td>
<td>Watch TV at school</td>
<td>Puzzle at school</td>
<td></td>
</tr>
</tbody>
</table>
## Appendix 1

### Social facilitation

<table>
<thead>
<tr>
<th>Authors</th>
<th>Design/Predictor</th>
<th>Setting (no model)</th>
<th>(Cover)task</th>
<th>Food</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Klesges, Stein, Eck, Isbell, &amp; Klesges, 1991)</td>
<td>Energy density and company (mother vs. alone)</td>
<td>Lab</td>
<td>Compose a lunch from the buffet table</td>
<td>47 foods and beverages categorized as low, average and high in ED</td>
</tr>
<tr>
<td>(Laessle, Uhl, &amp; Lindel, 2001)</td>
<td>Company (mother vs. alone), weight status (nw vs. ow) and consumption style (bite size, eating pace)</td>
<td>Lab</td>
<td>Taste test yoghurt brand for as much and long as they liked</td>
<td>yoghurt</td>
</tr>
<tr>
<td>(Salvy, Coelho, et al., 2007)</td>
<td>Alone vs. group of 4 (2 nw and 2 ow)</td>
<td>Lab</td>
<td>Liking of games and different foods</td>
<td>Pizza</td>
</tr>
<tr>
<td>(Salvy, Elmo, Nitecki, Kluczynski, &amp; Roemmich, 2011)</td>
<td>- Energy density and company (mother vs. friend dyads) in children - Sex vs. company (mother vs. friends dyads) in adolescents - Age vs. type of food (meals or snacks)</td>
<td>Lab</td>
<td>Compose a lunch from the buffet table</td>
<td>Sandwich components (i.e., cold meats, cheese, bread), HED (i.e., apples, yogurt, baby carrots) and LED (i.e., chips, cookies, cupcakes) snacks</td>
</tr>
<tr>
<td>(Salvy, et al., 2009)</td>
<td>- Friend vs. stranger dyad (ow/nw or nw/nw or ow/ow) - Sex vs. company (friends vs. stranger) dyad - Energy density and weight dyads (ow/nw or nw/nw or ow/ow)</td>
<td>Lab</td>
<td>Play games (45 min.)</td>
<td>Chips and cookies &amp; carrots and grapes</td>
</tr>
<tr>
<td>(Salvy, Kieffer, &amp; Epstein, 2008)</td>
<td>Alone vs. stranger dyad (ow/nw or nw/nw or ow/ow)</td>
<td>Lab</td>
<td>Liking of games and different foods</td>
<td>Chips and cookies &amp; carrots and grapes</td>
</tr>
<tr>
<td>(Salvy, Romero, et al., 2007)</td>
<td>Discordant (ow/nw) vs. concordant (nw/nw or ow/ow) weight dyads</td>
<td>Lab</td>
<td>Sorting pictograms of (dis)liked food and activities</td>
<td>Chocolate cookies</td>
</tr>
</tbody>
</table>

*1 ow = overweight; nw = non-overweight; 2 HED = high-energy-dense; LED = low-energy-dense*
<table>
<thead>
<tr>
<th>N</th>
<th>Sex/age</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>53</td>
<td>Boys/girls (4-7y)</td>
<td>- Children choose more foods of poor nutritional value of which nearly 25% of all calories in the form of added sugar alone than when monitored by mother.</td>
</tr>
</tbody>
</table>
| 80 | Boys/girls (9-11y) | Differences between ow and nw emerged when with mother and not alone:  
- Ow ate faster than nw when with mother than alone.  
- Ow ate larger bites than nw with mother than alone.  
- Ow accelerated eating rate toward the end of the task. |
| 32 | Boys/girls (6-10y) | - Ow ate more alone than when with others.                                                                                                                                                    |
| 23 | Boys/girls (5-7y)  | - Children ate more HED snacks (kcal) in friend dyads than mother dyads.                                                                                                 |
| 27 | Boys/girls (13-15y) | - Children ate similar LED snacks (kcal) in friend as in mother dyads.  
- Females and not males ate more LED foods in friend dyads than in mother dyads.  
- Females ate less HED snacks in friend dyads than in mother dyads.  
- Males ate similar amounts of HED snacks in friend as in mother dyads.  
- Children and adolescents consumed similar amounts of sandwich components in friend dyads as mother dyads. |
| 72 | Boys/girls (9-15y) | - Ow/ow friend dyads ate more kcal than other dyads all conditions.  
- Children who ate with a friend ate more kcal (HED as well as LED) than those who ate with stranger.  
- In HED food only: boys and girls ate similar amounts in stranger dyad but boys ate more than girls in friend dyad.  
- Ow/ow dyads ate more HED as well as LED kcal than ow/nw dyads  
- Nw/nw dyads ate more LED as well as HED kcal than in nw/ow dyads. |
| 39 | Boys/girls (10-12y) | - Ow ate more when alone than in dyads.  
- Ow ate more when alone than nw alone.  
- Nw intake was unaffected by the social context.  
- Peers’ healthy intake was a predictor of participants’ healthy intake. |
| 46 | Girls (8-12y) | - Ow/ow dyads ate more kcal than ow/nw.  
- Ow/nw dyads ate similar kcal as nw/nw dyads.  
- Peers’ intake was a predictor of participants’ intake. |
### Social facilitation\(^1\)\(^2\) (continued)

<table>
<thead>
<tr>
<th>Authors</th>
<th>Design/Predictor</th>
<th>Setting (no model)</th>
<th>(Cover)task</th>
<th>Food</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Salvy, Vartanian, Coelho, Jarrin, &amp; Pliner, 2008),</td>
<td>Alone vs. dyad (stranger or siblings)</td>
<td>Lab</td>
<td>Sorting pictograms of (dis)liked food and activities</td>
<td>Chocolate cookies</td>
</tr>
</tbody>
</table>

\(^1\) ow = overweight; nw = non-overweight;  
\(^2\) HED = high-energy-dense; LED = low-energy-dense

### Social modeling\(^1\)\(^3\)

<table>
<thead>
<tr>
<th>Authors</th>
<th>Design/Predictor</th>
<th>Setting/ model</th>
<th>(Cover)task</th>
<th>Food</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Addessi, et al., 2005)</td>
<td>Familiar adult eating nothing vs. eating novel different colored food vs. same colored food as participant</td>
<td>School Real confed</td>
<td>Appetizer/snack before lunch</td>
<td>Yellow, red or green semolina</td>
</tr>
<tr>
<td>(Birch, 1980)</td>
<td>Over 4 days repeated exposure to peers eating nonpreferred food</td>
<td>School Groups of 4-5 of which 3-4 real confed</td>
<td>School lunch</td>
<td>Lunch with 2 preferred and 2 nonpreferred foods</td>
</tr>
<tr>
<td>(Greenhalgh, et al., 2009)</td>
<td>Repeated exposure to novel foods when alone after exposure to novel foods with negative commenting non-eating or positive commenting eating peers vs. alone (control condition)</td>
<td>Lab Groups of 5 of which 4 real confed</td>
<td>Team games paused by snack sessions</td>
<td>Coloured blue novel foods and other snack foods (i.e., grapes, cheese, pitta bread and carrot)</td>
</tr>
<tr>
<td>(Harper &amp; Sanders, 1975)</td>
<td>Introduction of novel foods to child by 1 or 2 adults (mother and/or female or male stranger) who ate vs. not ate the food before they were offered to child</td>
<td>Home Real confed</td>
<td>Home during play time</td>
<td>Snacks (i.e., tortilla ham cheese, macademia or date)</td>
</tr>
</tbody>
</table>

\(^1\) ow = overweight; nw = non-overweight;  
\(^3\) confed = confederate
### N  Sex/age  Findings

<table>
<thead>
<tr>
<th>N</th>
<th>Sex/age</th>
<th>Findings</th>
</tr>
</thead>
</table>
| 44 | Boys/girls (5-11y) | - Sibling dyads ate more kcal than stranger dyads or alone.  
- Matching degree was high in strangers, but not in sibling dyads. |

<table>
<thead>
<tr>
<th>N</th>
<th>Sex/age</th>
<th>Findings</th>
</tr>
</thead>
</table>
| 27 | Boys/girls (2-5y) | - Children ate more novel food when their food matched the color of the food eaten by the adult than when it had a different color or when the adult was not eating.  
- There were no differences between the different color and not eating condition. |
| 39 | Boys/girls (3-10y) | - Even in the presence of initially high preferred foods, children's food choice and consumption on day 1 (baseline) shifted from preferred to nonpreferred food by day 4. |

<table>
<thead>
<tr>
<th>N</th>
<th>Sex/age</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>Boys/girls (5-7y)</td>
<td>- Overall, children ate novel foods after repeated exposure to positive peer.</td>
</tr>
</tbody>
</table>
| 49 | Boys/girls (5-7y) & (3-4y) | - Children of 5-7y do not eat novel foods after exposure to a negative peer; however this can be reversed after exposure to a positive peer. In 3-4y this reversal was not found.  
- After repeated exposure to positive peers, children ate more novel foods than in the control condition (see paper for specific details). |

<table>
<thead>
<tr>
<th>N</th>
<th>Sex/age</th>
<th>Findings</th>
</tr>
</thead>
</table>
| 80 | Boys/girls (1-4y) | - More children ate novel foods when the adults were eating than when the adults were only offering the food.  
- Mothers are more effective in inducing children to try novel foods than strangers when foods were offered.  
- Even when alone with a child, the stranger’s eating (regardless sex) elicited more eating of novel foods. |
Social modeling\(^{1,3}\) (continued)

<table>
<thead>
<tr>
<th>Authors</th>
<th>Design/Predictor</th>
<th>Setting/model</th>
<th>(Cover)task</th>
<th>Food</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Hendy &amp; Raudenbush, 2000)</td>
<td>- St1. Silent teacher eating vs. talking non-eating teacher</td>
<td>School</td>
<td>Have lunch</td>
<td>Two warm regular lunch meals with familiar items (St1&amp;2)</td>
</tr>
<tr>
<td></td>
<td>- St2. Repeated exposure during 3 meals: Silent teacher eating new foods vs. talking non-eating teacher</td>
<td></td>
<td></td>
<td>Two warm regular lunch meals plus 4 unfamiliar items (St3&amp;4)</td>
</tr>
<tr>
<td></td>
<td>- St3. Repeated exposure during 5 meals: Encouraging teacher eating new foods vs. talking non-eating teacher</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- St4. Repeated exposure during 5 meals: Encouraging teacher eating new foods vs. Encouraging peer eating new foods vs. exposure without a peer or teacher; After 1 month food preference rating</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Hendy, 2002)</td>
<td>Encouraging girl vs. boy vs exposure to novel foods and food acceptance; After 1 month food preference rating</td>
<td>School in groups of 3-5 children</td>
<td>Have lunch</td>
<td>Two warm regular lunch meals plus 3 unfamiliar items</td>
</tr>
<tr>
<td>(Horne, et al., 2004)</td>
<td>Over 16 days repeated exposure to heroic peers (the Food Dudes) who enjoy eating fruit and vegetables vs. no intervention</td>
<td>School Remote confeds</td>
<td>Watch video adventures of heroic peers and have school lunches</td>
<td>Fruits and vegetables</td>
</tr>
<tr>
<td>(Romero, et al., 2009)</td>
<td>Ow vs. nw * small vs. large serving</td>
<td>Lab Remote video confed</td>
<td>Sorting pictograms of (dis)liked food and activities</td>
<td>Chocolate cookies</td>
</tr>
</tbody>
</table>

\(^1\) ow = overweight; \(^2\) nw = non-overweight; \(^3\) confed = confederate
<table>
<thead>
<tr>
<th>N</th>
<th>Sex/age</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>Boys/girls</td>
<td>- No differences between the conditions were found (St1).</td>
</tr>
<tr>
<td></td>
<td>(M = 4.7)</td>
<td>- No differences between the conditions were found (St2).</td>
</tr>
<tr>
<td>26</td>
<td>Boys/girls</td>
<td>- Across three mealtime presentations food acceptance dropped (St2).</td>
</tr>
<tr>
<td></td>
<td>(M = 4.4)</td>
<td>- Children accepted new foods across five mealtime presentations more with an encouraging teacher than with an observing teacher and simple exposure to the foods (St3).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- No differences between the conditions were found in boys; however, girls accepted new foods more when with a peer than with an observing teacher or simple exposure to the foods (St4).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- On the long-term, there were no differences in boys whereas in girls the acceptance of new foods lasted after exposure to a peer instead of a teacher or the foods (St4).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- The encouraging peer had a more powerful effect than the encouraging teacher (St4).</td>
</tr>
<tr>
<td>64</td>
<td>Boys/girls</td>
<td>- Girl models were more effective than boy models to increase the food acceptance.</td>
</tr>
<tr>
<td></td>
<td>(M = 4.6)</td>
<td>- There were no long-term effects of girl models outside the same mealtime context.</td>
</tr>
<tr>
<td>749</td>
<td>Boys/girls</td>
<td>- Long-term increase in vegetable and fruit consumption in children after exposure to intervention.</td>
</tr>
<tr>
<td></td>
<td>(5-11y)</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Girls</td>
<td>Two main effects:</td>
</tr>
<tr>
<td></td>
<td>(8-12y)</td>
<td>- Children exposed to the large serving condition ate more kcal than those exposed to the small serving condition.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Ow ate more kcal than nw.</td>
</tr>
</tbody>
</table>
PART I
PEER INFLUENCE ON FOOD CHOICE

Low- and high-energy-dense foods
CHAPTER 2

Kirsten E. Bevelander
Doeschka J. Anschütz
Rutger C. M. E. Engels
Behavioural Science Institute, Radboud University Nijmegen, the Netherlands

The effect of a fictitious peer on young children’s choice of familiar versus unfamiliar low and high energy-dense foods

British Journal of Nutrition (2012); 108(6), 1126-1133
Peer influence on familiar vs. unfamiliar food choices
Abstract

This experimental study was the first to investigate the impact of a remote (non-existent) peer on children’s food choice of familiar versus unfamiliar low and high energy-dense food products. In a computer task, children (N = 316; 50.3% boys; M age = 7.13±.75) were asked to choose between pictures of familiar and unfamiliar foods in four different choice blocks using the following pairs: 1) familiar versus unfamiliar low energy-dense foods (fruits and vegetables), 2) familiar versus unfamiliar high energy-dense foods (high sugar, salt and/or fat content), 3) familiar low energy-dense versus unfamiliar high energy-dense foods and 4) unfamiliar low energy-dense versus familiar high energy-dense foods. Participants who were not in the control group were exposed to the food choices (either always the familiar or always the unfamiliar food product) of a same-sex and same-age fictitious peer who was supposedly completing the same task at another school. The findings revealed that the use of fictitious peers increased children’s willingness to try unfamiliar foods, although children tended to choose high energy-dense foods over low energy-dense foods. This study provided insights into children’s choices between (un)familiar low and high energy-dense foods in an everyday situation. Intervention programs that use peer influence to focus on improving children’s choice of healthy foods should take into account children’s strong aversion to unfamiliar low energy-dense foods as well as their general preference for familiar and unfamiliar high energy-dense foods.
Introduction

In the presence of others, people consume more or less food than when eating alone (de Castro & Brewer, 1991; Redd & de Castro, 1992) and are influenced to make particular food choices or purchases (Bevelander, Anschütz, & Engels, 2011; Childers & Rao, 1992). It is argued that social modeling behavior in food choice and intake originates from people’s need to conform to a social norm, to impress or to avoid others’ judgment (Herman & Polivy, 2005; Herman, et al., 2003). Moreover, an important part of children’s development is to learn through social modeling behavior, with their parents or guardians as role models; gradually, other people in children’s environment gain influence, such as peers at school (Eccles, 1999; Keenan & Evans, 2009). Social modeling experiments in food choice have examined whether a person adapts to the behavior of real instructed peers or to information about fictitious peers (remote confederates). In adolescents, social modeling of food intake was found to have similar effects regardless of whether peers are real or fictitious (Feeney, et al., 2011), which illustrates the strong impact of others on people’s consumption behavior. Therefore, social modeling might be an effective mechanism through which children’s food choices can be influenced. The present study focused on the influence of peers on young children’s choices of (un)familiar low and high energy-dense foods.

One aspect of people’s food choices relies on evolutionary predispositions that originate from the need to discover by trial and error what is safe to eat. Therefore, people feel cautious or anxious to try unfamiliar foods, and most people have an aversion to bitter or sour tastes that can be traced back to toxic foods found in nature (Rozin & Vollmecke, 1986; Steiner, Glaser, Hawilo, & Berridge, 2001). Furthermore, people have an innate preference for sweet tastes (Rozin & Vollmecke, 1986; Steiner, et al., 2001). In contrast, a preference for high-fat or salty foods is said to be learned during infancy and childhood. Individuals develop food preferences by experiencing (sensory) pleasure or ‘food reward’ from the combination of smell, taste and texture of high-fat sweet or salty foods (Birch, 1999; Desor, Greene, & Maller, 1975; Drewnowski, 1997). In addition, food preferences and aversions can change based on good or bad experiences (e.g. through illness after eating spoiled food) (Rozin & Vollmecke, 1986). Although evolutionarily explainable, the
CHAPTER 2

preference for high-fat sweet and salty food products and/or high levels of unwillingness to try unfamiliar food products can lead to low variety in children’s diet and a higher intake of energy-dense foods. This might result in being overweight or obese during childhood and later in life (Birch & Fisher, 1998; Davison & Birch, 2001; Falciglia, Couch, Gribble, Pabst, & Frank, 2000).

Studies have demonstrated children’s general preference for high versus low energy-dense foods (Birch & Fisher, 1998) as well as their preference for higher energy-dense (or sweet) foods within ‘healthy’ fruits and vegetables (i.e. children preferred the relatively high energy-dense banana, potato or apple to low energy-dense cabbage, courgette or melon) (Gibson & Wardle, 2003). Furthermore, young children in particular are found to be ‘picky’ with regard to the intake of (un)familiar foods or to feel anxious about trying unfamiliar food products (Birch, 1998; Dovey, Staples, Gibson, & Halford, 2008; Wardle & Cooke, 2008). This has been explained by environmental predispositions (e.g. the negative response of others to unfamiliar or appalling foods), as well as evolutionary factors. Studies have shown that others can encourage or discourage people to try unfamiliar food products, depending on people’s food choice or information provided about the taste or nutritive value of the food (Greenhalgh, et al., 2009; Hobden & Pliner, 1995; Pelchat & Pliner, 1994). Research has provided evidence for the influence of parents on their children’s willingness to eat (un)familiar food products; children have been given access to various food products at home and parents have acted as discouraging or encouraging role models based on the parents’ own food preferences and food intake (Falciglia, Pabst, Couch, & Goody, 2004; Haire-Joshu et al., 2008; Harper & Sanders, 1975; Patrick & Nicklas, 2005; Skinner, Carruth, Bounds, & Ziegler, 2002; Videon & Manning, 2003). In addition to demonstrating the influence of parents on children’s food choices, experimental social modeling studies have also shown that children are willing to try unfamiliar food products if they use pre-instructed teachers or peers as role models (confederates) (Addessi, et al., 2005; Birch, 1980; Hendy, 2002; Hendy & Raudenbush, 2000). Confederates who verbally expressed their liking for a food prior to food intake were more influential in food acceptance than silent confederates. Peers were also found to have a stronger effect on food acceptance than teachers (Hendy, 2002; Hendy & Raudenbush, 2000).
Reasonably, this research area (Birch, 1980; Hendy, 2002; Hendy & Raudenbush, 2000) as well as intervention programs (e.g. taste lessons at school (Reverdy, Chesnel, Schlich, Köster, & Lange, 2008) or parent education programs at home (Haire-Joshu, et al., 2008)) have focused primarily on the encouragement of low energy-dense foods (e.g. fruits or vegetables) to improve children’s willingness to eat ‘healthy’ (un) familiar foods. However, none has focused on familiar versus unfamiliar low and high energy-dense food choices even though children choose between these different types of foods every day in, for example, school cafeterias. The present experimental study broadened the existing research scope by investigating the impact of a fictitious peer (remote confederate) on children’s food choice when they are offered familiar versus unfamiliar low or high energy-dense foods. Based on previous literature, it was hypothesized that with a choice between a familiar and an unfamiliar food, children would follow a remote peer in choosing unfamiliar foods a) when both products were high in energy density and b) when an unfamiliar high energy-dense product was paired with a familiar low energy-dense product. Furthermore, it was expected that children would follow a remote peer in choosing familiar foods c) when both products were low in energy density and d) when a familiar high energy-dense food product was paired with an unfamiliar low energy-dense food product.

**Experimental methods**

**Participants**

A total of 346 children from 12 urban and suburban schools in the Netherlands secured written consent from their parents to participate. The final research sample consisted of 316 children; 30 children did not participate because they took sick leave or did not complete the computer task. The mean age (SD) of the sample (50.3% boys) in grade 1 (n = 139) was 6.6 years (0.59) and in grade 2 (n = 177) it was 7.6 years (0.54). Most participants (83.2%) were normal weight, 15.2% were overweight and 1.6% were underweight. Participants were randomly divided into three groups: two experimental groups and one control group. In a pilot study, 27 children from similar grades were recruited and used in preliminary
testing to verify children’s familiarity with the food products employed in the experimental tasks.

The present study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the ethics committee of the Faculty of Social Sciences, Radboud University Nijmegen. Written informed consent was obtained from all caregivers.

**Study design**

The study involved a computer choice task with food pictures. We used both a between-participants design (two experimental conditions and a control condition) and a within-participants design (four choice blocks). The participants were randomly assigned to one of the three experimental conditions, i.e. the control condition (without confederate), the ‘confederate – familiar food’ condition or the ‘confederate - unfamiliar food’ condition, in which the confederate always chose the familiar or the unfamiliar food products. Within each condition, participants were asked to choose between 2 (familiar versus unfamiliar) food pictures that appeared on the screen in 12 predetermined pairs per 4 choice blocks. Thus, each participant had to make a total of 48 choices (see Appendix 2 for the product list). **Table 2.1** illustrates the four choice blocks of food pictures using the following pairs: 1) familiar versus unfamiliar low energy-dense foods (fruits and vegetables) (B1_FL-UL), 2) familiar versus unfamiliar high energy-dense foods (salty and sweet snacks) (B2_FH-UH), 3) familiar low energy-dense versus unfamiliar high energy-dense foods (B3_FL-UH) and 4) familiar high energy-dense versus unfamiliar low energy-dense foods (B4_FH-UL).

The 4 choice blocks as well as the 12 food pairs appeared in randomized order on the computer screen. In addition, each food picture of the pairs

<table>
<thead>
<tr>
<th>Choice block</th>
<th>Familiar food</th>
<th>vs.</th>
<th>Unfamiliar food</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1_FL-UL</td>
<td>Low</td>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>B2_FH-UH</td>
<td>High</td>
<td></td>
<td>High</td>
</tr>
<tr>
<td>B3_FL-UH</td>
<td>Low</td>
<td></td>
<td>High</td>
</tr>
<tr>
<td>B4_FH-UL</td>
<td>High</td>
<td></td>
<td>Low</td>
</tr>
</tbody>
</table>
(familiar versus unfamiliar) was presented in randomized order on the left or right side of the screen. Each time a food picture appeared, the participant heard a voice that revealed the name of the food product. Therefore, each participant had the same understanding of the food picture. The computer program did not allow children to answer before clarification of the food picture or to skip to the next food picture choice.

Setting and procedure

In January 2010, 12 primary schools granted permission to conduct the experiments at school with the cooperation of teachers. Subsequently, the teachers distributed the detailed consent forms to the parents of the school children in grades 1 and 2. Data collection took place from February through April 2010 between 08:30 hours and 15:30 hours. Participants were seated individually at a table with a laptop and a headphone and were instructed to play a computer game. The participants were asked to pick one of the two pictures on the computer screen after they had heard a voice clarifying which food products were displayed.

The participants in the two experimental confederate conditions were told that there was a peer playing the same game at another school. The participants were subtly made aware that the peer was of the same sex and age and named either ‘Sophie’ or ‘Daan’ for girls or boys (common Dutch names), respectively. The participants were told that Sophie or Daan had started a few moments earlier. Therefore, the participants could see the preference of the peer via a third smaller picture between the two main food pictures that appeared after the participant heard the clarification of the food pictures (for examples, see Figure 2.1). After instruction, the experimenter left the room but returned as soon as the participants had completed the computer task. The participants’ height and weight were measured and a short questionnaire was administered by the experimenter.

Measures

Body weight. The experimenter measured height and body weight individually according to standard procedures (without shoes but fully clothed). Height was measured to the nearest 0.5 cm using a stadiometer (Seca 206, Seca GmbH & Co., Hamburg, Germany) and weight was measured to the nearest 0.1 kg using a digital scale (Seca Bella 840, Seca GmbH & Co.). The body mass index (BMI) for each child was calculated.
Figure 2.1. Choices on screen during the computer task.

a) B1_familiar low-energy-dense v. unfamiliar low-energy-dense in unfamiliar confederate condition for boys.
b) B2_familiar high-energy-dense v. unfamiliar high-energy-dense in familiar confederate condition for girls.
c) B4_familiar high-energy-dense v. unfamiliar low-energy-dense in control condition.
using the formula: weight [kg]/height²[m]. BMI (z-score) was determined by means of internationally based cutoff points for boys and girls (T. J. Cole, Bellizzi, Flegal, & Dietz, 2000; T. J. Cole, Flegal, Nicholls, & Jackson, 2007; T. J. Cole & Roede, 1999). These cutoff points are representative of current z-BMI standards for Dutch children.

Food choice computer task. The food choice in the computer task was expressed in the number of familiar food pictures chosen, ranging from 0 to 12 (each choice block consisted of 12 food pairs). This study did not concentrate on taste differences between sweet, bitter, sour or salty food products. Therefore, a mixture of pictures displaying fruits and vegetables or (sweet and salty) snacks was used as low or high energy-dense food products, respectively.

Questionnaire Measures

Hunger. The state of hunger might influence a participant’s food choice. After the experiment, participants had to indicate their state of hunger on a visual analogue scale (VAS) (0 cm = ‘not hungry at all’; 15 cm = ‘very hungry’). VASs have proven to be as reliable as Likert scales, and in the past they have been used in samples with young children (Bevelander, et al., 2011).

Liking of the task. To measure the extent to which the participants liked the task, we used a VAS (0 cm = ‘do not like at all’; 15 cm = ‘like it a lot’) (Bevelander, et al., 2011).

Analytical strategy

Data were analyzed using SPSS for Windows (version 17.0, 2008, SPSS Inc., Chicago, IL, US). Alpha was set at \( P < .05 \). For the computer task, we used a 3 x 4 two-way mixed ANCOVA with the between-subjects factor condition (familiar, unfamiliar and control) and the within-subjects factor choice blocks (B1_FL-UL, B2_FH-UH, B3_FL-UH and B4_FH-UL). Cohen’s \( f^2 \) effect size was calculated to assess the effect size over the three conditions (Cohen, 1988). Cohen’s \( f^2 \) is used for three or more groups and effect sizes .02, .15 and .35 are termed small, medium and large, respectively. Pair-wise comparisons with Bonferroni correction were carried out to measure the different significance levels between the control and experimental conditions. Effect sizes between different conditions were calculated with Hedges \( g \), which takes into account sample size and
adjusts to the overall effect size (Hedges & Olkin, 1985). Effect sizes .20, .50 and .80 are termed small, medium and large, respectively.

**Results**

*Randomization checks*

To check whether there were differences between the control group and experimental conditions on BMI (z-score), hunger and liking of the task one factor ANOVA’s were performed. Pearson’s chi square tests were performed to check whether there were differences in school grade or sex. **Table 2.2** summarizes the means and SDs for all variables across each condition. No differences ($P > 0.10$) were found between the conditions, which indicated that randomization was successful.

*Food choice computer task*

Pearson’s correlations were performed for the model variables of grade, sex, liking of the task and hunger on the total number of familiar food choices in the computer task. Weight status was related to the fourth choice block (familiar high versus unfamiliar low energy-dense foods) ($r = -0.12$, $P < 0.05$) in the computer task. Therefore, BMI (z-score) was entered in the model as a covariate in our analyses.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Control group ($n = 106$)</th>
<th>Confederate Familiar food ($n = 106$)</th>
<th>Confederate Unfamiliar food ($n = 104$)</th>
<th>$P$ value$^2$</th>
</tr>
</thead>
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<tr>
<td>Grade (1/2) ($n/n$)</td>
<td>40/66</td>
<td>50/56</td>
<td>49/55</td>
<td>.28</td>
</tr>
<tr>
<td>BMI (z-score)</td>
<td>.27 (1.18)</td>
<td>.56 (1.19)</td>
<td>.41 (0.95)</td>
<td>.18</td>
</tr>
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<td>Sex (boy/girl) ($n/n$)</td>
<td>56/50</td>
<td>52/54</td>
<td>51/53</td>
<td>.82</td>
</tr>
<tr>
<td>Liking of task$^3$</td>
<td>12.79 (2.42)</td>
<td>13.14 (1.92)</td>
<td>13.12 (1.83)</td>
<td>.39</td>
</tr>
<tr>
<td>Hunger$^2$</td>
<td>5.26 (4.64)</td>
<td>5.29 (4.46)</td>
<td>5.23 (4.75)</td>
<td>.99</td>
</tr>
</tbody>
</table>

$^1$ All values are in means (SD).

$^2$ Reflects the differences in total means between intake conditions by one-factor ANOVA or Pearson’s chi square test.

$^3$ cm on Visual Analogue Scale (VAS).
Main analyses

No significant interaction was found between the experimental conditions and four choice blocks \((P = .41)\). Among the four blocks, no differences in children’s choices were influenced by the confederate. In general, there was a significant main effect of experimental condition \((F_{2, 312} = 13.06, P < .001, \text{Cohen’s } f^2 = .28)\) on the number of chosen familiar food products. Bonferroni post-hoc tests showed that the number of choices for familiar products in the confederate – unfamiliar food condition was significantly lower \((M = 8.2, \text{SEM} = .2)\) than in both the control \((M = 9.3, \text{SEM} = .2, P = .002, g = .48)\) and confederate – familiar food condition \((M = 9.7, \text{SEM} = .20, P < .001, g = .69)\). The choice of familiar products between the control and confederate – familiar food condition did not differ significantly \((P = .40, g = .21)\). **Figure 2.2** illustrates the mean differences in familiar food products chosen between conditions. Hence, the participants in the confederate – familiar food condition did not choose

![Figure 2.2](image1.png)

*Figure 2.2. Choice for familiar food products*
significantly more familiar food products than participants without a confederate in the control condition. Overall, the participants preferred familiar food products but were more inclined to choose unfamiliar food products when the confederate chose unfamiliar food products.

In addition to the effect of condition, there was a significant main effect of choice blocks \( (F_{3, 936} = 38.35, P < .001, \text{Cohen's } f^2 = .60) \) on the number of chosen (un)familiar food products. Table 2.3 shows Bonferroni corrected post-hoc tests for the four choice blocks. Except for B1_FL-UL and B4_FH-UL \( (P > 1) \), all blocks differed significantly \( (P < .001) \) from each other. The participants chose the least for unfamiliar low energy-dense foods when this type of food was paired with familiar foods low in energy density (B1_FL-UL) as well as familiar foods high in energy-density (B4_FH-UL). Participants were most likely to choose unfamiliar foods when high in energy density and paired with familiar low energy-dense foods (B3_FL-UH) or when both foods were high in energy density (B2_FH-UH).

Finally, there was a significant main effect of the covariate BMI (z-score) on the number of chosen familiar food products \( (F_{2, 312} = 4.16, P = .04, \text{Cohen's } f^2 = .10) \). The higher the weight status, the more familiar food products were chosen.

### Discussion

The present study was the first experimental study to investigate the influence of a fictitious peer on children’s food choice in (un)familiar low or high energy-dense foods. The findings showed that a fictitious peer did have a general influence on food choice, but this influence
did not differ among various combinations of familiar and unfamiliar high or low energy-dense foods. Although the children had a strong preference for familiar foods in general, those who were exposed to a fictitious peer choosing unfamiliar foods more often chose unfamiliar foods themselves. Furthermore, children were found to be most averse to unfamiliar low energy-dense food products regardless of whether they were displayed alongside familiar low or high energy-dense food products. However, they were inclined to choose an unfamiliar product when both (unfamiliar and familiar) products displayed were high in energy density, and in particular when the products were displayed alongside familiar low energy-dense foods. In addition, a higher weight status was related to a higher number of familiar food products chosen.

Consistent with previous research, this study underlined children’s natural and strong preference for familiar food products (Rozin & Vollmecke, 1986). The findings showed that children who were paired with a peer who chose familiar foods did not choose more familiar products than children who were not paired with a peer. This supports findings of previous studies indicating children’s evolutionary preference for familiar foods and their anxiety toward trying unfamiliar foods (a.k.a. food neophobia) (Pliner & Hobden, 1992; Rozin & Vollmecke, 1986). Food neophobia is an individual trait that peaks when children are between two and six years old (Dovey, et al., 2008); it generally declines over time due to exposure to various foods throughout life (L. Cooke, 2007; Raudenbush & Frank, 1999). In addition, some children are characterized as ‘picky’ eaters because they reject unfamiliar as well as some familiar foods (Dovey, et al., 2008). The reluctance to try unfamiliar foods by both neophobic and picky eaters can lead to a higher intake of energy-dense (mostly high-fat) foods and less food variety in their diets compared to children without food neophobia (Carruth et al., 1998; Falciglia, et al., 2000). A higher intake of energy-dense foods is associated with a higher weight status in children (Davison & Birch, 2001). This might be in line with the findings of this study which showed that a higher weight status was related to a higher preference for familiar food products. Nevertheless, there is no hard evidence for a direct relationship between food neophobia and being overweight.

This study revealed the impact of a fictitious peer on unfamiliar food choice; children were inclined to choose more unfamiliar foods when
paired with a fictitious peer who always chose unfamiliar foods compared to children who were not exposed to the peer’s choice or were paired with a peer who always chose familiar foods. The peer exposure used in this study might be described as fairly simple; however, it might have implications for studies that use a more profound exposure to fictitious peer influence (e.g. long-term encouragement through text messages by phone or interactive conversations in chat rooms on the internet). Previous studies have found that different kinds of live peer models also have a different impact on food choice in children. For example, children paired with familiar peers ate more palatable food than those paired with strangers (Salvy, Vartanian, et al., 2008) and peers had a stronger effect on food acceptance than teachers (Hendy & Raudenbush, 2000). Due to extensive (social media) access by children and their peers, it would be interesting to investigate the impact of a fictitious peer (instead of a live peer) about whom the children assume familiarity or a particular status.

Contrary to all our hypotheses, the fictitious peer had no different impact on children’s food choices in the combinations of familiar versus unfamiliar low or high energy-dense foods. In general, children were reluctant to try unfamiliar low energy-dense foods but were inclined to choose (un)familiar high energy-dense foods. This preference for high energy-dense foods in a choice situation between high versus low energy-dense foods has also been seen in adolescents. A study by Pliner and Mann (2004), in which information about the food choice (between high or low energy-dense snacks) of several fictitious peers was provided, showed that fictitious peers did not have an impact on participants’ food choice; nearly all adolescents chose the high energy-dense snacks. To date, research studies predominantly have examined the influence of peers on unfamiliar low energy-dense food intake, e.g. children were encouraged by a peer to try unfamiliar vegetables or fruits but without the presence of other food products such as snacks (Birch, 1980; Hendy, 2002). The findings of the current study might imply that when children have a choice between low and high energy-dense food products (e.g. vegetables versus snacks in school cafeterias) they will mainly choose high energy-dense food products, regardless of what their peers choose. It might be wise to not focus on encouraging only the intake of low energy-dense ‘healthy’ foods. Peer influence might be more effective when the rejection of high energy-dense ‘unhealthy’ foods is also included. For example,
Peer influence on familiar vs. unfamiliar food choices

a behavior change program of the Department of Health in the United Kingdom developed exciting DVD adventures of ‘Food Dudes’ (heroic cartoon characters) as part of its program to encourage children to get acquainted with and eat (un)familiar fruits and vegetables (Lowe, Horne, Tapper, Bowdery, & Egerton, 2004). The Food Dudes battle against the evil ‘Junk Punks’. This approach was based on a study that found that children inhibited their food intake when paired with peers who made negative comments and did not eat the test food (Greenhalgh, et al., 2009). However, further research is needed to investigate positive as well as negative peer influence on food choice when different kinds of food are offered.

This study was not without limitations. First, the study did not include a scale that measured the reluctance to eat (un)familiar foods. It is highly recommended to include a food neophobia scale in future research to, for example, investigate whether food neophobia interferes with peer influence. Second, this study did not test the actual food intake of children. Previous literature showed that food preferences are a predictor of dietary intake (Birch & Fisher, 1998; Drewnowski & Hann, 1999) and this study provided new insights into children’s willingness to try a food product based on its name and appearance. Nevertheless, it would be interesting to replicate this study and test actual food intake in a real-life setting. Third, the study sample consisted of mostly normal-weight participants. It would be interesting to replicate this study to examine the impact of a fictitious peer on low and high energy-dense food choice in conjunction with weight status (i.e. normal weight versus overweight). Fourth, the confederate always chose either familiar or unfamiliar food products. Although real-life choices made by others might not be as uniform, children encounter ‘role models’ that are carrying out a rather one-sided health message (e.g. encouragement to eat ‘healthy’ fruits and vegetables) and they can choose to follow that person or not. The children’s reaction to the confederate and his/her choices represent a realistic reflection of a real life (health promotion) situation. Finally, hunger status was measured after the computer task. Children exposed to food pictures might have become hungrier during the experiment which might have affected their hunger rating. Although it is common in social modeling studies to measure hunger status after the experiment to conceal the actual purpose of the study to avoid demand characteristics (Bevelander,
et al., 2011; Hermans, Larsen, et al., 2009), future studies should reconsider whether it is necessary to measure hunger status after the experiment when using this type of design.

In conclusion, this study extended previous research by combining familiar and unfamiliar food choices with low and high energy-dense products. Although children have a natural tendency to choose familiar products, fictitious peers can influence them to choose unfamiliar food products. However, children are more willing to try high energy-dense foods. The research area related to peer influence should broaden its scope to pay more attention to the negative as well as the positive impact of remote peers. Intervention programs might profit from the use of long-term messages from remote peers to increase children’s willingness to try (un)familiar healthy food products and reject (un)familiar unhealthy food products.

Acknowledgements

The authors would like to acknowledge the teachers and schoolchildren of the primary schools and the students of the Hogeschool Arnhem and Nijmegen (HAN) for their help during the study. The present study was supported by a grant of the Behavioural Science Institute of the Radboud University Nijmegen, the Netherlands.
# Appendix 2

<table>
<thead>
<tr>
<th>Trials</th>
<th>Familiar</th>
<th>Unfamiliar</th>
</tr>
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<tbody>
<tr>
<td>Block 1</td>
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<td>Low energy-dense</td>
</tr>
<tr>
<td>1</td>
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<td>Catjang peas</td>
</tr>
<tr>
<td>2</td>
<td>Cucumber</td>
<td>Fennel</td>
</tr>
<tr>
<td>3</td>
<td>Strawberry</td>
<td>Pomegranate</td>
</tr>
<tr>
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<td>Peach</td>
<td>Pear-shaped guava</td>
</tr>
<tr>
<td>5</td>
<td>Red cabbage</td>
<td>Rhubarb</td>
</tr>
<tr>
<td>6</td>
<td>Red onion</td>
<td>‘Schorseneren’</td>
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<tr>
<td>7</td>
<td>Maize</td>
<td>Bamboo sticks</td>
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<tr>
<td>8</td>
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<td>9</td>
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<td>Indian fig</td>
</tr>
<tr>
<td>11</td>
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<td>Passion fruit / maracuja</td>
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<tr>
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<td>Scone</td>
</tr>
<tr>
<td>14</td>
<td>Donut</td>
<td>Churros</td>
</tr>
<tr>
<td>15</td>
<td>Filled ‘speculaas’</td>
<td>Alfajores</td>
</tr>
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<td>Macademia nuts</td>
</tr>
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<td>Wasabi nuts</td>
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</tr>
<tr>
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<td>Indonesian cake (‘spekkoek’)</td>
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</tr>
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## Trials

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**Block 4**

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CHAPTER 3

Kirsten E. Bevelander
Doeschka J. Anschütz
Rutger C. M. E. Engels

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Social modeling of food purchases at supermarkets in teenage girls

*Appetite (2011); 57(1), 99-104*
Peer influence on food purchases
CHAPTER 3

Abstract

Ample experimental research has demonstrated the impact of peer influence on food intake in adolescents and adults. However, none of these studies focused on modeling effects on food purchases in supermarkets. This study investigated whether the food purchase behavior of a confederate peer would be adopted by the participant. Teenage girls (N = 89) were asked to perform a shopping task in a local supermarket. They had to shop with a same-sex confederate peer who had been instructed earlier to purchase either five low-kilocaloric food products, five average-kilocaloric or five high-kilocaloric food products. Significant main effects for the experimental purchase condition and hunger were found on the amount of kilocalories of the purchased food products. Teenage girls who shopped with a peer in the high-kilocaloric condition purchased higher kilocaloric food products relative to the girls who shopped with a peer in the low-kilocaloric condition. In addition, girls who reported to be hungry purchased higher kilocaloric food products in general. These findings might imply that teenage girls follow unhealthy food purchases of a peer during shopping. Health promotion might benefit from our findings by also focusing on food purchases and not only food intake.
Introduction

In the last decade, the prevalence of children and teenagers being overweight or obese has doubled in the Netherlands (Rijksinstituut voor Volksgezondheid en Milieuhygiëne [RIVM](2010). Since the 1980s, the prevalence of being overweight or obese in girls (7.2% and 0.5%, respectively) has been higher than in boys (5.1% and 0.3%, respectively) and is still rising for both girls (14.9% and 2.2%, respectively) and boys (13.3% and 1.8%, respectively) at present (Nederlandse organisatie voor Toegepast-Natuurwetenschappelijk Onderzoek [TNO](2010). Childhood obesity leads to a higher risk of adult obesity, increasing the probability of health problems such as diabetes and cardiovascular disease (Dietz, 1998; Reilly, et al., 2003). Ample research has been conducted on genetic, environmental and social factors related to people’s food intake. However, less is known about predictors of food purchases in food stores before consumption. In the U.S., it appears that people who live in close proximity to convenience stores are more likely to be overweight than those who live near supermarkets that offer a greater variety of products (Morland, Diez Roux, & Wing, 2006). Furthermore, parents shopping with their children influence the brand choice of their children and children shopping with their parents influence the amount and type of food products purchased (Bearden & Etzel, 1982; Childers & Rao, 1992). Although people often shop together (Mangleburg, Doney, & Bristol, 2004), the research area of peer influence on the purchase of (un)healthy food products has been left untouched. To our knowledge, this is the first experimental study that investigated peer influence on food purchase at the supermarket.

At a young age, children are able to make purchases on their own and are acknowledged as autonomous consumers (Cook, 2000; Valkenburg & Cantor, 2001). The context in which children acquire financial knowledge, skills, beliefs and attitudes is influenced by family, mass media and peers (Alhabeeb, 1996). This consumer socialization process starts when children accompany their parents during shopping and develops when they shop with friends as teenagers (Mangleburg, et al., 2004; Valkenburg & Cantor, 2001). As an important social event, teenagers meet each other in shopping areas to socialize during and after school hours (Mangleburg, et al., 2004; Matthews, Taylor, Percy-Smith, & Limb, 2000).
Most (75%) high schools in the Netherlands are located near shopping places such as supermarkets, snack bars, or petrol stations functioning as little convenience stores (Middelbeek et al., 2007). Teenagers are allowed to leave the schoolyard during school hours and have access to these food facilities (Middelbeek, et al., 2007). They are considered important consumers because they do not have substantial fixed expenses (e.g., costs for housing) and they receive income through family allowances, part-time employment and gifts from relatives (Alhabeeb, 1996). Young teenagers, in particular, are found to spend their money on food and snacks; however, this behavior declines as clothing and entertainment products become more important at older age (Alhabeeb, 1996). Girls spend more time on shopping and meal preparation than boys (Mauldin & Meeks, 1990). Boys like to congregate in shopping areas in groups of five or six whereas girls go shopping in smaller groups of two or three (Matthews, et al., 2000; Mortelmans, Van Assche, & Ottoy, 2002; Tootelian & Gaedeke, 1992). In general, girls are found to be more strongly influenced by the opinion of their peers than boys (Eagly, 1983). Therefore, this study focused on teenage girls.

People need purchase pals (i.e. people who shop together) to reduce their uncertainty about expenditures via the pal’s expert knowledge or for support in decision making through social comparison in which they use significant others as a reference group (Bearden & Etzel, 1982; Kiecker & Hartman, 1994). Peer influence has been investigated in social modeling studies with regard to eating behavior and social norms (Bevelander, Anschütz, & Engels, 2012b; Herman, et al., 2003; Hermans, Larsen, Herman, & Engels, 2008). Modeling studies examine whether naïve participants adapt to the behavior of remote or real instructed confederates. In the presence of others, people consume more or less than when eating alone to conform to, impress or avoid judgments of others (de Castro, 1994; de Castro & Brewer, 1991; Salvy, Romero, et al., 2007). In general, adolescents and adults adapt their intake to the intake of others regardless of hunger, satiety, diet, or weight status (Herman & Polivy, 2005) or palatability of the food (Hermans, Larsen, et al., 2009). This adaptation is also found in young children (Bevelander, et al., 2012b). To our knowledge, no research has been conducted on peer influences on food purchase choices at the supermarket in teenage girls.
Therefore, the present modeling study focused on the food purchase of young teenage girls in the supermarket. Based on the above mentioned modeling studies, we expected that the product choice would strongly depend on the confederate's type of food choice.

**Experimental methods**

*Design*

A between-participants design with three experimental conditions in which the participants were exposed to confederates who were instructed to buy five low-kilocalorie food products (low-kcal purchase condition), five average-kilocalorie food products (middle-kcal purchase condition) or five high-kilocalorie food products (high-kcal purchase condition) was used. Table 1 shows the caloric values of the food purchase of the confederate for the three different conditions. To rule out modeling behavior triggered by familiarity of the peer, the researchers ensured that the participants did not attend the same school or, at least, were not classmates. Children have been found to model food intake of familiar peers more often than that of strangers (de Castro, 1994; Salvy, Vartanian, et al., 2008), but one problem with using familiar peers is that peer selection processes cannot be ruled out as an explanation for similarities in food choice. To avoid this confederate effect, each same-sex confederate was coupled only once with a participant. The couples were randomly assigned to one of the three conditions.

*Participants and confederates*

The ethics committee of the Faculty of Social Sciences, Radboud University Nijmegen approved the present study. The participants and confederates were recruited by an active consent procedure. Each child engaged in the study only once, as participant or as confederate. The sample consisted of 206 teenage girls who acted as a participant or a confederate in this study. Fourteen couples were excluded from analyses because the confederate did not follow the instructions (e.g., purchased other or more food products than assigned). The final sample consisted of 89 participants of which 3.4% were underweight, 91% were normal weight and 5.6% were overweight or obese (see body mass index (BMI)
classifications below). The mean (±SD) age of the girls in grade 5 (n = 50) was 10.48 (± .54) years and in grade 6 (n = 39) 11.36 (± .58) years.

Procedure

Detailed informed consent forms were distributed to the girl’s parents/guardians by the teachers at one of the 18 participating primary schools in November and December 2009. The parents/guardians who gave permission to include their child in our study were asked to provide their telephone number on the consent form. The experimenter contacted the parents/guardians and their daughter to make an appointment in the supermarket. The girls were paired with girls from the same school but another class or from a different school in the proximity of the supermarket. From January until June 2010, the experimental sessions were conducted at eight supermarkets near the children’s primary schools.

We used a cover story to avoid effects that might be triggered by the girls’ suspicions about the research topic. Both participants and confederates were told that the experimenters were interested in changes in food purchase over time in which purchase information of three generations was examined. The experimenters explained that the girls’ grandmothers and mothers probably purchased different products than they would do at present. Each confederate was scheduled to arrive 10 minutes before the participant came to the supermarket. The confederate was asked to participate in a memory game that had to remain a secret from the participant. The confederate was instructed to remember to purchase exclusively five food products. The food products were pointed out by the experimenter while walking through the supermarket aisles, which the confederate also had to walk with the participant. The confederate was asked to remember the products out loud to confirm her understanding of the request. Confederates were instructed to buy the same products per kcal purchase condition (see Appendix 3). When the participant arrived at the supermarket, the participant and confederate were instructed together to shop for food products for lunch and snacks because they were about to go on a school trip. The experimenter explained that there were no money limitations. The girls were instructed to put each of their products in their own shopping basket and they were not allowed to share food products. After
the girls finished shopping, the participant was questioned individually
to provide details of her purchase (e.g., how many slices of a loaf of
bread, the number of tangerines from a net, or the number of glasses of
milk from the carton she would consume on the school trip). After the
supermarket sessions, the experimenter came to the girls’ primary school
to measure weight and height and to conduct a final questionnaire. The
participants and confederates were debriefed after data collection was
finished at their school.

Measures

Body weight. Body weight and height were measured individually
by the experimenter according to standard procedures (without shoes
but fully clothed) at the elementary schools. Weight and height were
measured to the nearest of 0.1 kg and 0.5 cm, respectively. The body
mass index for each child was calculated using the formula: weight [kg]/
height$^2$ [m]. We determined whether the children were underweight,
normal weight, overweight or obese by means of internationally based
cut off points (z-BMI) for Dutch boys and girls (T. J. Cole, et al., 2000; T. J.

Food purchase. The participants’ specified food purchases were
calculated into total kilocalories (kcal) according to their food labels,
which were used as dependent variables for the analyses.

Food match. We registered which products the participants purchased
and examined how many of the food products exactly matched the
product type of the confederate.

Number of products. Participants were free to purchase as many food
products of any kind as they wanted. We counted the products and
controlled for the number of food products since this might affect the
total amount of kcal of their purchase or the food match.

Questionnaire measurements

Hunger. We controlled for the state of hunger since this might influence
the participant’s food purchase. After the shopping task, the participants
had to indicate their hunger on a Visual Analogue Scale (VAS): 0 mm ‘not
hungry at all’ through 150 mm ‘very hungry’. Visual Analogue Scales are
proven to be as reliable as Likert scales and were used in samples with
children before (Bevelander, et al., 2012b).
Liking of the task. To measure the extent to which the participants liked the task we used a VAS: 0 mm ‘do not like at all’ through 150 mm ‘like it a lot’ (Bevelander, et al., 2012b).

Liking and familiarity of the confederate. Liking and familiarity of the confederate has been found to influence food intake (Salvy, Vartanian, et al., 2008) as well as purchase behavior (Sommer, Wynes, & Brinkley, 1992). To measure the extent to which the participants liked the confederate we used a VAS (0 mm ‘do not like at all’ through 150 mm ‘like him/her a lot’). Further, participants were asked whether they knew the confederate with answers ‘not at all’, ‘have seen him/her in the neighborhood/at school’, ‘I sometimes play with him/her’ or ‘he/she is a good friend.’ Next, they were asked to rate their familiarity with the confederate by use of VAS (0 mm ‘not at all’ through 150 mm ‘very good’).

Analytical strategy
First, we used regression analyses to investigate whether the purchase of extra food products would influence product matching or the amount of kcal per purchase condition. Second, we checked whether randomization across the various purchase conditions was successful using one-factor analyses of variance on grade, z-BMI, hunger, liking of the task, liking of and familiarity with the confederate, and the number of extra food products purchased. Third, and for our main research question with regard to social modeling behavior, we performed analyses of covariance to examine the main effects of purchase condition on the total caloric food purchase. In line with previous studies (Bevelander, et al., 2012b; Hermans, et al., 2008), if significantly correlated with food purchase, hunger, purchase of extra food products, liking of the task, and liking of or familiarity with the confederate were entered in the model as covariates. Cohen’s $f^2$ effects size was calculated to assess the effect size over the three conditions (Cohen, 1988). Cohen’s $f^2$ is used for three or more groups and effect sizes .02, .15, and .35 are termed small, medium, and large, respectively. Pairwise comparisons with Bonferroni correction were carried out to measure the different significance levels between the three purchase conditions. Effect sizes between different conditions were calculated with Hedges $g$, which takes into account sample size and adjusts to the overall effect size (Hedges & Olkin, 1985). Effect sizes .20, .50 and .80 are termed small, medium and large, respectively.
Results

Descriptive data on food match

We examined whether the amount and kind of the participant’s food products exactly matched the confederate’s food products. Only 20.2% of teenage girls purchased the same number of food products as the confederate, whereas 76.4% bought more than five food products. Only 3.4% of teenage girls did not match the purchased food products of the confederate at all and 12.4% purchased one similar food product. The majority of the participants made purchases that exactly matched two, three or four food products (29.2%, 27%, and 16.9%, respectively) of the confederate. 11.2% of teenage girls purchased the five food products identical to those of the confederate.

The two types of snacks matched the most (60.7%; 76.4%), followed by drinks (55.1%), the type of bread (46.1%) and the type of sandwich filling (37.1%). To rule out the possibility that product matching was caused by the amount of food products or the purchase condition, we carried out a multiple regression analysis predicting the food match by the number of purchased food products and purchase condition. The product match was not related to the amount of food products purchased ($\beta = .01, P = .23$), or to the purchase condition ($\beta = .13, P = .95$).

Randomization checks

We checked for differences between the purchase conditions on school grade, z-BMI, hunger, liking of the task, liking of and familiarity with the confederate, and the number of extra food products purchased. Table 3.1 summarizes the means and standard deviations (SDs) for all variables across each condition. No differences ($P > .10$) were found between the conditions which indicated that randomization was successful.

Food purchase

Pearson’s correlations among model variables are shown in Table 3.2. Hunger and the number of extra food products purchased were related to the total kcal food purchase and entered in the model as covariates.

Main analysis

The main focus of our study was to test whether the participant was affected by the food purchase of the confederate. There was a significant
### Table 3.1. Randomization checks of variables across each purchase condition measured by condition

<table>
<thead>
<tr>
<th>Variables participants</th>
<th>Low kcal (n = 31)</th>
<th>Middle kcal (n = 30)</th>
<th>High kcal (n = 28)</th>
<th>Total (N = 89)</th>
<th>P-value (^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade (5/6) (n/n)</td>
<td>18/13</td>
<td>15/15</td>
<td>17/11</td>
<td>50/39</td>
<td>.91</td>
</tr>
<tr>
<td>z-BMI</td>
<td>.27±0.82</td>
<td>-.15±1.27</td>
<td>.09±1.15</td>
<td>.08±1.09</td>
<td>.31</td>
</tr>
<tr>
<td>Liking of task(^3)</td>
<td>11.32±1.76</td>
<td>11.80±2.42</td>
<td>11.90±1.97</td>
<td>11.68±2.06</td>
<td>.50</td>
</tr>
<tr>
<td>Liking confed(^3)</td>
<td>12.58±2.45</td>
<td>13.27±2.02</td>
<td>12.80±2.73</td>
<td>12.86±2.41</td>
<td>.51</td>
</tr>
<tr>
<td>Familiarity confed(^3)</td>
<td>6.73±5.05</td>
<td>6.96±4.23</td>
<td>6.85±4.86</td>
<td>6.89±4.70</td>
<td>.98</td>
</tr>
<tr>
<td>Hunger(^3)</td>
<td>4.09±3.41</td>
<td>3.06±2.41</td>
<td>4.60±4.42</td>
<td>3.98±3.49</td>
<td>.22</td>
</tr>
<tr>
<td>Number of extra products</td>
<td>2.41±.92</td>
<td>3.03±1.30</td>
<td>2.82±1.57</td>
<td>2.44±2.44</td>
<td>.17</td>
</tr>
<tr>
<td>Age confederates</td>
<td>11.05±.72</td>
<td>10.89±.76</td>
<td>10.95±.69</td>
<td>10.98±.72</td>
<td>.48</td>
</tr>
<tr>
<td>z-BMI confederates</td>
<td>.22±1.00</td>
<td>.33±1.63</td>
<td>.17±1.63</td>
<td>.24±1.18</td>
<td>.98</td>
</tr>
</tbody>
</table>

\(^1\) All values are in means ± SDs. VAS, visual analogue scale.
\(^2\) Reflects the differences in total means between intake conditions by one-factor ANOVA.
\(^3\) cm on VAS.

### Table 3.2. Pearson’s correlations of model variables

<table>
<thead>
<tr>
<th></th>
<th>Grade</th>
<th>z-BMI</th>
<th>Liking</th>
<th>Liking</th>
<th>Familiarity</th>
<th>Familiarity</th>
<th>Hunger</th>
<th>Hunger</th>
<th>Nr of extra products</th>
<th>Nr of extra products</th>
<th>Match</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade</td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>z-BMI</td>
<td>-.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liking task</td>
<td>-.75</td>
<td>-.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liking confederate</td>
<td>-.02</td>
<td>.05</td>
<td>.23*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Familiarity confederate</td>
<td>-.08</td>
<td>-.03</td>
<td>.05</td>
<td>.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hunger</td>
<td>-.16</td>
<td>-.02</td>
<td>.00</td>
<td>-.17</td>
<td>.19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nr of extra products</td>
<td>.11</td>
<td>.05</td>
<td>.08</td>
<td>-.14</td>
<td>-.18</td>
<td>.14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Match</td>
<td>.10</td>
<td>.02</td>
<td>.06</td>
<td>.12</td>
<td>-.11</td>
<td>.03</td>
<td>.02</td>
<td>.02</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kcal food purchase</td>
<td>-.09</td>
<td>.07</td>
<td>-.03</td>
<td>-.15</td>
<td>-.15</td>
<td>.36**</td>
<td>.53**</td>
<td>.12</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

\(^*\) P < .05, \(^**\) P < .001
main effect of both covariates, hunger ($F_{1,54} = 10.65, P < .01$, Cohen’s $f^2 = .33$) and the amount of food products purchased ($F_{1,54} = 29.88, P < .001$, Cohen’s $f^2 = .57$), on the amount of kcal of the participant’s food purchase. Moreover, the results showed a significant main effect for purchase condition on the amount of kcal of the purchased food products ($F_{2,54} = 4.11, P = .02$, Cohen’s $f^2 = .26$). The model explained 42.2% of the variance in food purchase.

Pairwise comparisons with Bonferroni correction revealed significant differences in food purchase between the low ($M = 945.88$ kcal $\pm$ SEM 90.54) and high ($M = 1314.52$ kcal $\pm$ SEM 95.63) kcal-purchase condition ($P = .019$, $g = .72$), but not between the low and middle ($M = 1046.30$ kcal $\pm$ SEM 95.63) purchase condition ($P = \text{ns}$, $g = .20$), or the middle and high purchase condition ($P = \text{ns}$, $g = .52$). We also tested whether $z$-BMI and school grade affected the main findings but this was not the case.

**Discussion**

The present study was the first to investigate peer influence on food purchases in teenage girls by conducting a modeling experiment in a supermarket. Our findings showed that a girl’s food choice is affected by a peer. Teenage girls follow their purchase pal in purchasing food products with high-kcal values compared to the girls shopping with a peer purchasing low-kcal products in the supermarket.

These findings provide new insights with regard to food shopping. Previous literature regarding social conformity or modeling (Herman, et al., 2003) explained that in the presence of peers, people consume more or less due to social facilitation (de Castro & Brewer, 1991; Redd & de Castro, 1992) or impression management (Herman, et al., 2003) than when eating alone. Peers serve as guides or evaluators as to how much is appropriate to eat in a given situation. Subsequently, people adhere to the social norm that has been established by peers (Herman & Polivy, 2005). Purchase behavior in the supermarket seems to be affected by a peer in a way that is similar to eating behavior being affected by a peer in previous studies, i.e., the presence of peers facilitated the amount of caloric intake in children and adolescents (Bevelander, et al., 2012b; Hermans, et al., 2008; Hermans, Larsen, et al., 2009; Salvy, Romero, et al., 2007). In addition, a study on food selection in children showed that instead of choosing
their preferred food, children altered their choice to conform to choices made by other children who were present in the same room (Birch, 1980). Conversely, Pliner and Mann (2004) did not find this effect in food choices among female adolescents but argued that there was no reason for social conformity because they provided choice information from non-existent remote confederates instead of real confederates. In relation to shopping behavior, Sommer, Wynes and Brinkley (1992) referred to social facilitation concerning the increased amount of products that had been purchased in the presence of a peer. Other studies also have shown that people conform to the opinion or choices of others with regard to product evaluations and brand choice (Burnkrant & Cousineau, 1975; Childers & Rao, 1992). The current study showed that the presence of peers during shopping affects the caloric value of product purchases as well, which had never been tested before. This might imply that teenage girls are easier influenced to purchase less healthy food products compared to low or middle caloric food choices. Perhaps this is due to our sample in which teenage girls were not inclined to watch their caloric food purchases. This might be different for girls who are on a diet or overweight teenagers. Nevertheless, further research is needed to investigate whether peers influence individuals to shop for (un)healthier food than when they shop alone. This might provide implications for the use of shopping pals (e.g., in weight loss interventions). We also encourage the investigation of individual characteristics such as weight status, self-esteem, impulsiveness, or dieting status to demonstrate whether they affect the extent to which individuals follow a peer in consumer behavior.

Furthermore, our study showed that an increased state of hunger in young teenage girls resulted in the purchase of higher total caloric amounts, regardless of the purchase pal’s behavior or the amount of food products purchased. This supports the common assumption that people should avoid shopping when hungry to prevent purchasing more than they planned. A study by Nederkoorn, Guerrieri, Havermans, Roefs and Jansen (2009), in which adolescents were asked to shop in a Web-based virtual supermarket, also showed that hungry participants were vulnerable to purchasing high-calorie snack foods. In addition, other studies that examined the relation between food deprivation and food purchasing behavior in adolescents and adults by means of shopping expenditures or number of food items (Mela, Aaron, & Gatenby,
1996; Nisbett & Kanouse, 1969), choices between free healthy and unhealthy food samples or by examining buying intentions (Read & van Leeuwen, 1998; Tom & Rucker, 1975), demonstrated the effect of hunger on purchasing behavior (i.e., individuals purchased more groceries when they were food deprived). However, differences were found in normal weight versus overweight individuals. Overweight individuals purchased less or planned to purchase less, when their deprivation state was higher (Mela, et al., 1996; Nisbett & Kanouse, 1969; Tom & Rucker, 1975). This might attributed to their awareness of their hunger and their willingness to follow recommendations for weight control (Mela, et al., 1996). It would be interesting to replicate the present study by including normal weight as well as overweight teenagers in different deprivations states and those who are dieting. This might provide further insight into shopping behavior of restrained eaters.

A few limitations must be considered in interpreting the findings of this study. First, this study did neither take into account the nutritive value of food such as sugar, fat or sodium content, nor did it focus on factors as convenience or taste. The study conditions were classified by low, middle and high caloric food conditions only. Although the food products in the high caloric food condition might be labeled as ‘unhealthy’, the difference between the low and middle condition is less distinct. Therefore, a generalization to ‘healthy’ or ‘unhealthy’ food products should be avoided. Future research is advised to investigate factors as convenience, taste or focus on nutritive food values. Second, this study included girls only. Although boys engage less in actual food shopping behavior (Kraak & Pelletier, 1998), we recommend investigating food purchase behavior in boys as well. A study of gender roles and consumption stereotypes found that unhealthy food products were seen as more masculine whereas healthy food products were associated with femininity (Vartanian, Herman, & Polivy, 2007). This might indicate that boys would be more affected by peers who buy high-caloric food products. As far as we know, food shopping in teenage boys has not been investigated. Third, this study was conducted in the Netherlands where food shopping in supermarkets is common whereas shopping in convenience stores or corner stores is uncommon due to their scarcity compared to e.g., the United States. Furthermore, Dutch schools do not have school cafeterias as they have in the U.S. (Kubik, Lytle, Hannan, Perry, & Story, 2003). Previous studies
have shown that food choices made by peer leaders in school cafeterias had effect in making healthier food choices in the U.S. (Birnbaum, Lytle, Story, Perry, & Murray, 2002). Nevertheless, in the Netherlands, children bring their own lunch, buy their lunch in supermarkets nearby the school or spend their lunch break at home. Therefore, there might be limitations to comparing these findings across cultures. It would be interesting to replicate this study in school cafeterias or convenience stores in the U.S. Fourth, some girls were accompanied to the supermarket by one of their parents/guardians. Family members have been found to foster a sense of responsibility in comparison to peers (Borges, Chebat, & Babin, 2010). This sense of responsibility might have restricted the food purchase of the girls, although we prevented the parents/guardians from going into the supermarket while the girls were shopping. Also, we informed the girls that all purchase information would be kept confidential. Finally, the girls were paired with an unfamiliar peer whereas they often shop with a group of friends (Tootelian & Gaedeke, 1992). Further research is needed to examine the effects of peer group norms, friendship cliques, and (non-) verbal communication that could restrict or encourage shopping behavior in a peer group. In addition, the girls did not actually consume the purchased products. A longitudinal study on shopping behavior in friends in conjunction with a study of their weight would give more information about peer influence and food consumption.

In conclusion, this study provided more insight into the effect of peers on food purchases and the role of hunger during shopping in teenage girls. Peers might facilitate the purchase of unhealthy food products. These findings might be of value for government, health, and school policies (e.g., by directing health education to peer groups at schools). In addition, supermarkets in close proximity to schools could be encouraged to reconsider their allocation of snack foods. For example, a community project of a local authority in the Netherlands, in which several health institutions and an insurance company are involved, made agreements with local supermarkets to put fruit and vegetable snacks at their cash registers instead of chocolate bars and other snack food (GezondGewichtUtrecht, 2011). Hungry individuals might profit from this as well, although, it might be wise not to go shopping while hungry.
Appendix 3

Food purchase (kcal) of confederate by condition

<table>
<thead>
<tr>
<th></th>
<th>Low kcal-purchase</th>
<th>Average kcal-purchase</th>
<th>High kcal-purchase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lunch (2 products)</td>
<td>193</td>
<td>374</td>
<td>490</td>
</tr>
<tr>
<td>Drink (1 product)</td>
<td>0</td>
<td>190</td>
<td>117</td>
</tr>
<tr>
<td>Snacks (2 products)</td>
<td>105</td>
<td>255</td>
<td>1458</td>
</tr>
<tr>
<td>Total</td>
<td>298</td>
<td>819</td>
<td>2065</td>
</tr>
</tbody>
</table>

Low kcal condition: rice crackers, marmalade light, tangerins, gingerbread, water.
Middle kcal condition: wheat bread rolls, chocolate sprinkles, yoghurt drink, banana, raisin biscuits.
High kcal condition: croissants, cheese, cola, chips, almond paste cake.
PART II
PEER INFLUENCE ON FOOD INTAKE

High-energy-dense foods
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Social norms in food intake among normal weight and overweight children

Appetite (2012); 58(3), 864-872
A prolonged effect of peer modeling and the role of body weight
CHAPTER 4

Abstract

This experimental study investigated whether children’s food intake is influenced by a peer’s intake directly and over time and whether this depends upon weight status. The study consisted of two sessions taking place at Dutch primary schools. During the first (social modeling) session, the participants (N=223) were asked to solve a puzzle with a same-sex normal-weight confederate who was instructed to either eat nothing, a small or large amount. In the second session (about two days later), the participants had to solve the puzzle alone while they could freely eat. The study involved a three (no, low, high confederate intake) by two (normal weight, overweight) between-participants design. An interaction effect in the first session suggested that overweight children might be triggered to (over)eat when a peer eats a high amount of snack food, whereas the food intake of normal-weight children seemed to depend on whether the confederate did actually eat, regardless of the amount. The guideline set during the first session persisted over time and influenced food intake during the second session, while differences between normal- and overweight children became insignificant. Peers can set an example as to what food intake is appropriate which could affect long-term food intake.
Introduction

Childhood obesity leads to a higher risk of adult obesity and increases the probability of health problems such as diabetes and cardiovascular disease (Lobstein, et al., 2004; Reilly, et al., 2003). Children rarely eat alone, that is, they generally consume their meals and snacks in the presence of caretakers, siblings, or peers at home or at school (Birch & Fisher, 1998; Eccles, 1999). While a child’s dietary intake is strongly influenced by parents and caregivers (Oliveria et al., 1992), it is also strongly influenced by peers at school (Feunekes, de Graaf, Meyboom, & van Staveren, 1998).

Children develop social competence and behavioral skills through observation and modeling behavior (Laible & Thompson, 2007). Modeling studies in food intake have examined whether a naive participant adopts the food intake of an experimental confederate (e.g., an instructed peer). Studies in adolescents and adults have shown that people model eating behavior (Hermans, et al., 2008). Nevertheless, they do not always match their confederates when it comes to amount and pace of food intake (Herman & Polivy, 2005). Therefore, it might be that people use others’ food intake as a permissive guideline for how much they can eat (Herman & Polivy, 2005; Herman, et al., 2003). No previous studies in adolescents and adults have investigated whether people adhere to these guidelines over time. Only few studies have examined long-term effects of social modeling in children by use of pre-instructed teachers or peers as role models (confederates), however, to promote intake of novel or healthy foods (Hendy, 2002; Reverdy, et al., 2008). The studies did not find long-term effects of peer models. To our knowledge, long-term effects in social modeling studies were not investigated in relation to the intake of palatable snacks while individuals are often in company of others during snack occasions.

Empirical research has demonstrated that young girls consume more after seeing a video-confederate eat a large portion rather than a small portion of snack food (Romero, et al., 2009). A study by Salvay et al. in which overweight and normal weight dyads were tested in a free-eating setting, showed that young girl’s snack intake was predicted by the co-eater’s weight status (Salvy, Romero, et al., 2007). In general, the overweight dyads ate more than normal weight dyads. Moreover, overweight girls eating with an overweight peer were found to consume more than when
eating with a normal weight peer whereas normal weight girls who ate with overweight girls did not eat more than when eating with a normal weight peer, presumably due to prejudicial attitudes towards overweight status. An additional study of Salvy et al. demonstrated that the presence of a normal weight peer affects the amount of food intake in normal weight and overweight children (Salvy, Coelho, et al., 2007). In general, overweight children consumed more than normal weight children when they were alone. Also, overweight children were found to consume more when alone than when in the presence of a normal weight peer whereas normal weight children consumed more in presence of others than when alone. Both studies provided evidence that the participant’s consumption was influenced by the co-eater and that overweight children inhibited their food intake when in the presence of a normal-weight peer. Herman, Roth and Polivy (2003) explained these differences by referring to social facilitation and stigmatization, i.e. in the presence of others, individuals consume more (de Castro & Brewer, 1991; Redd & de Castro, 1992) or less than when eating alone, depending on circumstances such as the presence and appearance of co-eaters (Hermans, et al., 2008).

The present study tested whether the food intake of a normal weight peer had an immediate effect on the food intake of normal-weight and overweight children and whether the influence of the peer’s intake on consumption was maintained over time. The study combined a social modeling experiment with a free-eating session held a few days later at school. It was hypothesized that in the first session (the modeling experiment), normal weight as well as overweight children would adapt their intake to the food intake of a normal weight peer confederate. A second aim of the study was to test whether the guideline or intake norm established during the first session would affect children’s food intake when they ate alone in the second session (the free-eating session). Based on literature that showed differences in food intake between normal weight and overweight children when in presence of a peer or alone, it was tested whether there was an interaction effect between weight status and the peer’s food intake. In the second (free-eating) session, it was expected that normal weight children kept to the social guideline that was previously set by a peer whereas overweight weight children would not keep to this guideline and have a higher food intake than normal weight children due to the absence of a normal weight peer.
Experimental methods

Design and participants

This study involved a 3 (experimental condition: no, low, high confederate intake) by 2 (participant weight status: overweight, normal-weight) between-subjects experimental design testing the effect on participant’s food intake directly in the first (social modeling) session and over time in the second (free-eating) session.

For the first (modeling) session, overweight and normal-weight participants were paired with normal-weight confederates. To avoid a confederate effect, each confederate was paired with a participant only once. The confederates were instructed to eat 10 chocolate-coated peanuts (high-intake condition), 3 chocolate-coated peanuts (low-intake condition) or nothing (no-intake condition). The dyads were randomly assigned to one of the three intake conditions. Overweight children were only included as participants, but normal-weight children could be either participant or confederate. The experimenters randomly assigned participants to confederates on an ad hoc basis at school with the criteria that they were the same sex but not classmates. Next, the pairs were randomly assigned to the experimental conditions. This matching procedure did not affect the outcomes (see Table 4.1 for randomization checks).

Figure 4.1 depicts a flow diagram of the recruitment procedure of the study. All schools that participated in this study were schools of which more than 70% of the children had a West-European or Dutch background. Further inclusion criteria for this study were that the children were without medical conditions that affected their intake and were old enough to understand the questionnaire. The sample consisted of 474 children (237 participants) who participated in this study once as participant or as confederate. The majority of children had two Dutch caregivers (93%), 2.9% had one Dutch caregiver and one caregiver from another Western-European country, 2.7% had one Dutch caregiver and one caregiver from the United States, Canada, Nigeria, Indonesia or Morocco and the remaining 1.4% had both parents of similar foreign nationality (Turkey, Dominican Republic). Fourteen dyads were excluded from the analyses because the confederate did not follow instructions, the participant became aware of the aim of the study, or the participant could not participate in the second (free-eating) session. Therefore, the final sample consisted of 223 participants.
Recruitment (September/October 2008)
13 elementary schools participated
1,322 households were sent informed consent forms
574 households gave written consent for 630 children

Screening (November/December 2008)
549 children were measured height and weight
81 children were absent (e.g., by sick-leave or relocation)

Experimental sessions (February – July 2009)
474 children (237 dyads) participated as participant or confederate
75 children did not participate (e.g., by sick-leave or the study design)

Final sample consisted of 223 dyads
14 dyads were excluded (by confederates that did not follow protocol, participant’s awareness study aim or absence second session)

Figure 4.1. Flow diagram of the recruitment procedure

The present study was approved by the ethical committee of the Faculty Social Sciences, Radboud University Nijmegen. The study was registered at the Dutch Trial Register as NTR2055. Written informed consent was obtained from all caregivers.

Setting and procedure
From February through July 2009, experimental sessions were conducted in the children’s primary schools. All experimental sessions took place within one week and on schooldays between 8:30 AM and
3:30 PM. Each session took 10 minutes and was videotaped. In the first session, a room was furnished with at least one table and two chairs, each chair on opposite sides of the table. Also, two glasses of water, two bowls of chocolate-coated peanuts, and one 100-piece children’s puzzle were provided. The room for the second session was furnished for one person and contained six bowls of snacks (savory snacks and sweet snacks). The experimenters made sure that all the bowls with food were filled up over the brim of the food bowl before each session. The video camera was placed on a tripod at the side of the table and was connected to a transmitter-sender 2.4 GHz audio/video device and remote LCD monitor that enabled the experimenters to observe the children in another room. The experimenters checked the children’s activities at random times and when the confederate received a signal to pick a chocolate peanut to see whether the confederate followed instructions. At the end of each session, the experimenter administered a questionnaire. To avoid effects that might be triggered by suspicion about the research topic, a cover story was created and delivered before starting the experiments in each school, that is, each class was told that the experimenter was interested in different strategies used to solve a puzzle while working together or alone. In addition, the confederates were told that they would be involved in a secret mission to make even more fun out of the puzzle task. So, the experimenters were also interested whether they could keep a secret while cooperating with someone else. After the experimental session ended, the experimenters asked the confederates if they could keep their secret for another one or two days so it was possible to also surprise other children with a secret mission. Before each session, the experimenters came to pick up the confederate or participant out of their classroom and checked whether the participant was not already aware of the actual aim of the study before participating. The children who inquired about the video camera were told that the session was videotaped to recapture their cooperation and technique for solving the puzzle. The participants and confederates were debriefed after the completion of data collection.

For the first session, each normal-weight confederate was instructed before the participant entered the room. The confederates were told about their secret mission: They were asked to eat a chocolate-coated peanut only when they were signaled by “the buzzer.” The experimenter signaled them with a small vibrating device (buzzer), which the confederates wore
in either their pocket or sock. The experimenter set the buzzer interval to control the timing of food intake. In the various food intake conditions, the confederates were buzzed immediately after the experiment started and every minute (high-intake) or every three minutes (low-intake) thereafter. Before the participants entered the room, they were told there would be food and water available and that they could eat as little or as much of the food as they desired. After 10 minutes, two experimenters entered the room and asked the children how they were moving along with the puzzle. The participants were then led to another room where the questionnaire was administered. The participants were informed that their answers would be kept confidential and their anonymity was ensured. The experimenter read all the questions aloud, and the participants could also read the questions and give the answers.

The second session took place at least a day (M = 2.0; SD = 1.7) after the first session. Before entering the room, the participants were told that they would be given the same puzzle they had in the first session and that snacks and water were available. As in the first session, the experimenter entered the room after 10 minutes and administered a second questionnaire.

**Measures**

*Body weight.* The experimenter measured individual height and body weight according to standard procedures (without shoes but fully clothed). Height was measured to the nearest of 0.5 cm using a stadiometer (Seca 206, Seca GmbH & Co., Hamburg, Germany) and weight was measured to the nearest of 0.1 kg using a digital scale (Seca Bella 840, Seca GmbH & Co.). The body mass index (BMI) for each child was calculated using the formula: weight [kg]/height²[m]. It was determined whether the children were underweight, normal weight, overweight or obese using a relative measure for BMI (z-BMI) and internationally based overweight and obese cut off points for boys (>94.5 BMI centile with z-score >1.60) and girls (>93.5 BMI centile with z-score > 1.52) (T. J. Cole, et al., 2000; T. J. Cole & Roede, 1999). Underweight boys (<2nd BMI centile with z-score <-2.2) and girls (<3rd BMI centile with z-score <- 1.9) were excluded from participation (T. J. Cole, et al., 2007). These cutoff points were representative of current z-BMI standards for Dutch children (StichtingVoedingscentrumNederland, 2011a). This study refers to
overweight as well as obese children due to the small number of obese children \( n = 11 \) in the study sample.\(^1\)

**Food intake.** The experimenter weighed the bowls of snack food before and after each session using a digital scale (Kern 440, Kern & Sohn, Balingen, Germany). For both sessions, actual food intake was calculated by subtracting the weight in grams of the bowls of test food at the start and end of each session. The consumed grams of test food were converted into kilocalories (kcal) and used as the dependent variable in the analyses. In the first session, the children were offered one kind of test food (chocolate-coated peanuts) (Hermans, Engels, et al., 2009). In the second session, the children were offered both sweet (chocolate-coated peanuts, chocolate cookies, banana-flavored sweets) and savory (chips, seasoned coated peanuts, salty biscuits) snacks.\(^2\) A variety of foods was used to examine whether a social norm for food intake that might have been set during the first session would be maintained or spillover into other palatable food products in the second session.

**Measurements questionnaire**

**Hunger.** To prevent participants from guessing the research topic, they were allowed to eat freely in their daily routine. The state of hunger was controlled for since it might influence the participants’ food intake. After both sessions, the participants had to indicate their hunger on a Visual Analogue Scale (VAS) (0 cm, not hungry at all; 15 cm, very hungry). Visual analogue scales have been proven to be as reliable as Likert scales, and they have been used in samples with young children (Anschütz, Engels, & Van Strien, 2009).

**Time of day.** Participants’ food intake might be related to time of day. Afternoons are more commonly snack time than mornings (Cross, Babicz, & Cushman, 1994). In practice, it was impossible to test the children at the same time of day in the first and second sessions. Therefore, the actual

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\(^1\) The sample was tested by excluding obese participants from the analyses to determine whether they affected the findings but this was not the case.

\(^2\) Presenting more or less food might influence intake. Therefore, all the bowls were filled up over the brim of the food bowl before each session: \( M = 685.90 \pm 87.06 \text{ gram chocolate-coated peanuts}; \ M = 444.66 \pm 47.20 \text{ gram banana-flavored sweets}; \ M = 377.54 \pm 34.62 \text{ gram chocolate cookies}; \ M = 435.14 \pm 43.85 \text{ gram seasoned coated peanuts}; \ M = 261.45 \pm 21.11 \text{ gram salty biscuits}; \ M = 252.05 \pm 17.26 \text{ gram chips}. \)
time of day on which the participant started the session was controlled for in the analysis.

Liking of the test food. In the first session, liking of the test food was controlled for since this might affect the participants’ food intake. The participants were asked to indicate how much they liked the snack food on a VAS (0 cm, not at all; 15 cm, very much) (Anschütz, et al., 2009). For the analysis of the second (free-eating) session, the mean scores for sweet and salty foods were computed.

Liking of the task. To measure the extent to which the participants liked the task, a VAS was used (0 cm, do not like at all; 15 cm, like it a lot) for both sessions (Anschütz, et al., 2009; Hermans, et al., 2008).

Liking and familiarity of the confederate. Liking and familiarity of the confederate has been shown to influence food intake (Salvy, Vartanian, et al., 2008). To measure the extent to which the participants liked the confederate, a VAS was used (0 cm, do not like at all; 15 cm, like him/her a lot). Furthermore, participants were asked whether they knew the confederate using the with answers not at all, have seen him/her in the neighborhood/at school, I sometimes play with him/her or he/she is a good friend. Next, they were asked to rate their familiarity with the confederate on a VAS (0 cm, not at all; 15 cm, very good).

Grade difference between participant and confederate. Children might model older peers more frequently than younger peers and differentially affect each other (Schunk, 1987). Children who differ in age but are in the same grade might not be perceived by another to be older or younger. Therefore, the grade of the confederate was considered in the analysis by rating whether the confederate was in a lower (0), the same (1), or higher grade (2) than the participant.

Analytical strategy

Randomization checks were performed by using one-factor analysis of variance to test for differences among the three experimental groups. Next, Spearman’s rank and Pearson’s correlations were performed for the model variables of age, sex, BMI (z-scores), hunger, liking of the test food, liking of the task, liking of the confederate, familiarity with the confederate, grade difference between the participant and the confederate (Spearman’s rho), time of day and food intake to determine which variable had to be controlled for in the main analyses.
For first session, analyses of covariance was performed to examine the main effects for experimental condition (no, low, high confederate intake) and BMI (z-score) on the total food intake (kcal) and the interaction effect between the BMI (z-score) groups and the experimental conditions on the total food intake (kcal). Hunger, liking for the test food, and time of day were statistically controlled for since these variables correlated significantly with food intake. For the second session, analysis of covariance was performed to examine the main effects for experimental condition (no, low, high confederate intake) and BMI (z-score) on the total food intake (kcal) and the interaction effect between the BMI (z-score) groups and the experimental conditions on the total food intake (kcal). The variable of hunger, liking of sweet and salty test foods and time of day were statistically controlled for in the second session. Additional analysis (MANCOVA) was performed for the second session, testing the main effects for experimental condition (no, low, high confederate intake) and BMI (z-score) on sweet and salty food intake (kcal) and the interaction effect between the BMI (z-score) groups and the experimental conditions (kcal). Hunger, liking of sweet and liking of salty test foods, and time of day were statistically controlled for.

Pairwise comparisons with Bonferroni correction were carried out to determine significant differences between the three experimental conditions. Following a significant interaction, simple contrast comparisons were carried out to determine which differences within (normal weight compared to overweight children for each of the three experimental conditions) and across (no-intake compared to low-intake compared to high-intake for each of the two weight groups) experimental condition means were significant. The simple contrast analysis breaks down an interaction term and looks at the effect of one independent variable at individual levels of another independent variable. The test uses the error term and degrees of freedom from the entire design (Field, 2005). For both sessions, Cohen’s $f^2$ effects size was calculated to assess the effect size over the three conditions (Cohen, 1988). Cohen’s $f^2$ is used for three or more groups, and effect sizes .02, .15, and .35 are termed small, medium, and large, respectively. The effect size quantifies the size of the difference between groups. In a between-subjects design, approximately 20 participants per group are required to detect a moderate to large effect size (Cohen, 1992). In addition, the effect sizes between the experimental conditions and weight groups were calculated.
with Hedges g, which takes into account sample size and accordingly adjusts to the overall effect size (Hedges & Olkin, 1985). Effect sizes .20, .50, and .80 are termed small, medium, and large, respectively.

**Results**

**Descriptives**

The study sample consisted of 223 participants of which 145 children (53% boys) were normal weight and 78 (51% boys) were overweight. The mean (SD) age of the children in grade 2 (n = 81) was 7.70 (.60) y in grade 3 (n = 66) 8.65 (.54) y and in grade 4 (n = 76) 9.61 (.52) y.

| Table 4.1. Randomization checks of variables measured by experimental condition |
|-----------------------|---------------------|---------------------|
| Variables             | Weight status       | No – intake confederate (n = 74) |
|                       | Normal (n = 48)     | Over (n = 26)        | Total (n = 74)    |
| Age (y)               | 8.70±0.90           | 8.80±0.90            | 8.80±0.90         |
| Boys/girls (n/n)      | 28/20               | 13/13               | 41/33             |
| BMI (z-score)         | 0.60±0.70           | 2.00±0.40           | 1.10±0.90         |
|                       | -1.30 - 1.59        | 1.53 - 3.24         | -1.30 - 3.24      |
| Hunger²               | 3.90±3.80           | 2.40±3.70           | 3.40±3.80         |
|                       | 0.00 - 13.20        | 0.00 - 14.90        | 0.00 - 14.90      |
| Liking test food³     | 12.10±3.50          | 10.50±4.70          | 11.50±4.00        |
|                       | 0.10 – 15.00        | 0.00 - 15.00        | 0.00 - 15.00      |
| Liking of task³       | 11.90±2.20          | 11.40±2.90          | 11.70±2.40        |
|                       | 7.00 - 15.00        | 5.50 - 15.00        | 5.50 - 15.00      |
| Liking confederate³   | 13.50±1.40          | 13.60±1.80          | 13.50±1.50        |
|                       | 8.90 - 15.00        | 8.00 - 15.00        | 8.00 - 15.00      |
| Familiarity confederate³ | 9.00±3.60          | 9.40±3.20          | 9.10±3.50        |
|                       | 1.00 - 15.00        | 5.00 - 15.00        | 1.00 - 15.00      |
| Grade confederate⁴ (n/n/n) | 17/17/14           | 12/7/7             | 29/24/21         |
|                       | 8:45 - 15:00        | 8:30 - 14:55        | 8:30 - 15:00     |

¹ All values are in means ± SDs. VAS, visual analogue scale
² Reflects the differences in total means between intake conditions by one-factor ANOVA or Pearson’s chi square test
³ cm on VAS
⁴ coded as younger/similar/older
Randomization checks

Randomization checks were performed to test for differences between the conditions in age, sex, BMI (z-scores), hunger, liking of test food, liking of the task, liking of and familiarity with the confederate, grade difference between the participant and confederate, and time of day in the first session. Table 4.1 summarizes the means and standard deviations (SDs) for all variables for the first session across each condition. No differences (P > .10) were found between the conditions, which indicated that randomization was successful. Additionally, differences were tested between the conditions for the variables of liking of the task, hunger and time of day for the second session. No differences were found between conditions (P > .10).

<table>
<thead>
<tr>
<th></th>
<th>Low – intake confederate (n = 77)</th>
<th>High – intake confederate (n = 72)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal</td>
<td>Over</td>
</tr>
<tr>
<td></td>
<td>(n = 51)</td>
<td>(n = 26)</td>
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<tr>
<td>Body weight</td>
<td>8.60 ± 1.00</td>
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<td></td>
<td>7 - 10</td>
<td>7 - 10</td>
</tr>
<tr>
<td></td>
<td>27/24</td>
<td>12/14</td>
</tr>
<tr>
<td>BMI</td>
<td>0.50 ± 0.80</td>
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</tr>
<tr>
<td></td>
<td>-1.13 - 1.53</td>
<td>1.62 - 3.20</td>
</tr>
<tr>
<td></td>
<td>3.10 ± 3.30</td>
<td>3.30 ± 3.50</td>
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<td>0.00 - 15.00</td>
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<tr>
<td></td>
<td>15/18/18</td>
<td>8/11/7</td>
</tr>
<tr>
<td></td>
<td>10/56 ± 1.49</td>
<td>10/52 ± 1.39</td>
</tr>
</tbody>
</table>

89
CHAPTER 4

Food intake

Spearman’s rank and Pearson’s correlations were performed for the model variables and food intake. For the first session, age ($r = -.24, P = .72$), sex ($r = -.08, P = .25$), BMI (z-scores) ($r = -.03, P = .67$), liking of the task ($r = .12, P = .08$), liking of the confederate ($r = -.06, P = .34$), familiarity with the confederate ($r = -.01, P = .91$) and grade difference with the confederate ($r = .01, P = .86$) did not correlate significantly with food intake. Hunger ($r = .39, P < .001$), liking of the test food ($r = .30, P < .001$), and time of day ($r = .13, P = .05$) were related to food intake and entered into the model as covariates. Similar to the first session, these covariates were also used in the analysis for the second session.

Main analyses

The main goal of this study was to test whether the participants’ food intake when eating with a peer (first session) or alone (second session) is influenced by the food intake of the confederates and whether this influence depends upon the child’s weight status and is persistent over time.

First Session. The covariates hunger ($F_{1,214} = 33.43, P < .001$, Cohen’s $f^2 = .54$), liking of the test food ($F_{1,214} = 11.28, P = .001$, Cohen’s $f^2 = .30$), and time of day ($F_{1,214} = 5.11, P = .025$, Cohen’s $f^2 = .19$) had a significant effect on the food intake of children. A significant main effect was found for the experimental condition on the consumed kcal intake ($F_{2,214} = 7.77, P < .001$, Cohen’s $f^2 = .25$) with a significant difference between the no- and high-intake condition ($P < .001$) but not between the no- and low- intake condition ($P = .25$) or the low- and high-intake condition ($P = .08$). There was not a main effect of BMI (z-score) ($P > .05$), however, a significant interaction was found between the experimental condition and BMI (z-score) on food intake ($F_{2,214} = 3.70, P = .026$, Cohen’s $f^2 = .16$). In this analysis, the model explained 30% of the variance in food intake.\footnote{It was tested whether there was an effect of gender or grade difference on food intake, but this was not the case ($P = .18$ and $P = .18$, respectively).}

Table 4.2 shows the amount of kcal consumed during session one, adjusted for hunger, liking of the test food and time of day. The experimental condition differently impacted children based on their weight status. Simple contrast comparisons within the three experimental conditions
showed a significant difference between food intake of the normal weight and overweight children in the no-intake condition only ($P = .03, g = .53$). Across the experimental conditions, the simple contrast comparisons showed significant differences among normal weight children between the no- and low-intake condition ($P < .001, g = .73$) and no- and high-intake condition ($P < .001, g = .76$) whereas it only showed a significant difference between the low- and high-intake condition ($P < .05, g = .76$) among the overweight participants.

Figure 4.2 depicts the food intake of normal weight and overweight children by experimental condition. The figure illustrates that the normal weight children consumed less kcal in the no intake condition and an equal amount in the low and high intake condition whereas overweight children consumed an almost equal amount in the no and low intake condition but consumed more in the high intake condition.

Second Session. The covariate hunger had a significant effect on food intake ($F_{1,213} = 22.61, P < .001$, Cohen’s $f^2 = .31$). Moreover, there was evidence that the effect of the experimental condition persisted over time. The results showed a significant main effect of the experimental condition (of the first session) on the total consumed kcal intake during the second session ($F_{2,213} = 3.50, P = .03$, Cohen’s $f^2 = .15$). Figure 4.2 illustrates a similar intake pattern for the first and second session. In this session, however, there was not a statistically significant interaction between BMI (z-score) and experimental condition ($P = .59$) nor a main effect on BMI (z-score) ($P > .05$). The pairwise comparisons with Bonferroni correction showed significant differences between participants in the no-intake and the high-intake condition ($P = .03, g = .21$). Table 4.2 shows the amount of kcal consumed during session two, adjusted for hunger and time of day. In this analysis, the model explained 17% of the variance in food intake.

The participants in the second session did not eat one kind of test food but ate from several bowls. In additional analysis, a MANCOVA, with hunger status, liking of sweet and liking of salty test foods, and time of day as covariates, was performed to test whether the effect of the confederate remained and spilled over to other test foods. The covariates hunger status had a significant effect on the participant’s sweet food

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4 We also tested whether the number of days between the first and second session affected the main findings but this was not the case.
Figure 4.2. Food intake of normal-weight and overweight children by experimental condition for session 1 and 2
intake ($F_{1,213} = 14.01$, $P < .001$, Cohen’s $f^2 = .25$) as well as on salty food intake ($F_{1,213} = 13.61$, $P = .001$, Cohen’s $f^2 = .24$), liking of sweet test foods had a significant effects on sweet food intake ($F_{1,213} = 11.04$, $P = .001$, Cohen’s $f^2 = .21$) as well as salty food intake ($F_{1,213} = 10.99$, $P = .001$, Cohen’s $f^2 = .21$), and liking of salty test foods had a significant effect on salty food intake ($F_{1,213} = 10.37$, $P = .001$, Cohen’s $f^2 = .21$) only. Moreover, there was a significant main effect of experimental condition on sweet foods only ($F_{2,213} = 3.26$, $P = .04$, Cohen’s $f^2 = .14$) with a significant difference between the no-intake ($M = 94.15$; SEM 11.80 kcal) and high-intake ($M = 134.63$; SEM 11.95 kcal) condition ($P = .05$, $g = .19$). There was no main effect for BMI (z-score) on sweet or salty food intake ($P > .05$). This indicates that the guideline that was set during the first session was carried over to the intake of sweet foods in the second session.\(^5\)

### Discussion

The present study was the first to investigate a social modeling effect on food intake among 6- to 11-year-olds by combining a social modeling experiment with a later free-eating session. This enabled to test both the

\(^5\) It was also tested whether this was caused by the test food of the first session (chocolate-coated peanuts), but this was not the case ($P > .05$).
immediate effect and the prolonged effect of a peer on the food intake of normal-weight and overweight participants. Findings indicated that a guideline in food intake that was set by a peer might persist over time. Furthermore, normal weight and overweight children differed in their overall food intake pattern with regard to eating with a peer who ate nothing, little or much.

Consistent with results of earlier studies, the findings of the first session confirmed our hypothesis that the food intake of the confederate peer strongly affects the child’s own food intake (Herman, et al., 2003). The occurrence of similar findings in the second session, without the peer being present, provides new evidence for a possible prolonged effect of a social norm on eating behavior (Herman & Polivy, 2005). Thus, the intake guideline that was initially set by a peer might have remained active in a later phase.

Herman and Polivy (2005) proposed a normative approach that distinguishes personal from situational norms. A person endorses personal norms to make a decision on eating the appropriate amount of food in a given situation based on their prior experience. On the other hand, situational norms, such as eating behavior of others, are derived from the eating situation itself. The few studies that addressed the effect of social norms and normative information on the amount of food intake (Leone, Pliner, & Herman, 2007; Pliner & Mann, 2004) examined immediate but not prolonged effects. In the present study, situational norms can explain the child’s food intake in the first session i.e., eating behavior of the peer determined the food intake of the other children. In the second, free-eating session, this situational norm might have turned into a personal norm. One could argue that this can still be seen as a situational norm because the children returned to the same situational context. Nevertheless, there were different kinds of food and, what is even more relevant, there was no peer present. Therefore, we argue that our findings support the assumption that children base their food intake on a personal norm they learn from prior experiences with peers (Laible & Thompson, 2007).

Furthermore, the findings revealed that food intake of normal weight children differed from that of overweight children. Compared to normal weight children, overweight children ate more than normal weight children when the peer was not eating only. Opposite to the findings
of studies in ‘tweens’ (girls aged between childhood and adolescence) (Salvy, Romero, et al., 2007) and adolescent females (Hermans, et al., 2008), the presence of a slimmer peer did not inhibit the food intake of the overweight participants compared to normal weight participants. A possible explanation might be found in the misperception of their own weight status among young children (Maximova et al., 2008). Young children showed greater underestimation of higher weights (Saxton, Hill, & Wardle, 2009) than children at older age (Zeller, Ingerski, Wilson, & Modi, 2001). It might be that the overweight participants did not encounter prejudicial comments about their weight status by their peers (yet) and they therefore did not feel the need to inhibit their food intake. The fact that their food intake was relatively high compared to normal weight children when the confederate ate nothing might be explained by the fact that overweight children in general eat more than normal weight children (Jansen et al., 2003; Salvy, Coelho, et al., 2007). Nevertheless, this reasoning remains speculative as it is possible that children might have encountered some level of teasing about their weight status. Therefore, further research is needed to investigate inhibition by conducting social modeling studies, for example, with overweight or obese confederates or with an older children sample.

An additional difference between normal and overweight children can be seen when focusing on the overall food intake pattern (across the three experimental conditions) of the two weight groups. Unlike overweight children, normal weight children behaved in line with previous findings obtained from modeling experiments in that they ate a little amount of food when a similar weight peer ate nothing at all and did not exceed the peer’s intake when exposed to a high food intake (Herman & Polivy, 2005; Herman, et al., 2003) whereas overweight children slightly exceeded the peer’s intake. More importantly, normal weight children ate a small amount of food when the peer ate nothing whereas when the peer ate something (either a little or large amount) their intake increased substantially. Overweight children consumed almost equal amounts of food when the peer ate nothing and when the peer ate little whereas their intake increased significantly when the peer ate a substantial amount of food. This might suggest that the intake of normal weight children was principally determined by whether the confederate ate at least something (regardless of the amount of food) whereas the intake of overweight
children seemed to be determined by whether the confederate ate a considerable amount of food. The additional cue of an eating peer on top of the sight of palatable food might have triggered normal weight children to eat whereas the amount eaten was less important (they ate a comparable amount of food in the low and high intake condition). Overweight children might have been triggered already by just the presence and sight of the snack food (they ate similar amounts in the no and low intake) whereas the generous intake of the peer functioned as an extra cue that triggered them to (over)eat. Further research is needed and should replicate the present study to unravel these mechanisms, e.g. with confederates as well as participants with a different weight status.

There was a prolonged modeling effect in the second session, but the difference in food intake between normal and overweight children disappeared. The amount of kcal in food intake of normal weight as well as overweight children increased dependent on which food(s) they consumed. The variety of foods offered or eating alone might have caused a different intake pattern for some children, explaining the absence of a significant interaction effect between weight status and confederate food intake in the second session. Nevertheless, in general the findings suggest that the situational norm that was set during the first session was used as an intake norm in the second session. Presumably, they kept their food intake by what was considered appropriate in accordance to the ‘guideline’ that was set previously. More importantly, the guideline that was set for one kind of food was spilled over to other sweet palatable snack foods. Studies indicated that in the school-food environment, peers exert major influence to conform to group norms and that children’s snack foods were primarily associated with snack foods of their peers (see for review Story, Neumark-Sztainer & French (2002)). This might imply that children take over eating behavior of their peers at school and adhere to this norm in other, similar situations, regardless of whether the same peers are around or not. Previous studies that have used peer influence to encourage young children to change food preferences in favor of novel and/or healthy foods also found a longer-term effect, however, in conjunction with repeated exposure (Birch, 1980) and reward (Lowe, et al., 2004). Nevertheless, this might be different for palatable snack foods because there is less reluctance to eat these foods (Bevelander, Anschütz, & Engels, 2012a). It would be interesting to further test the longer-term
effects of snacking in a school environment on children’s energy intake in general, as obesity research on social factors has focus so far mainly on the effect of the home environment (Strauss & Knight, 1999).

Although we used an experimental design to assess modeling in a large sample of young children that included girls and boys, some limitations should be mentioned. First, the time period between the two experimental sessions was approximately two days. Further research is needed to test the effect of repeated exposure to peer influence on children’s food intake over a longer time period. Second, the sessions were videotaped, which might have affected the children’s behavioral patterns. Nevertheless, qualitative impressions of the children’s behavior during the session and after checking the video recordings indicated that they acted quite naturally after they adapted to the new setting. Third, we made use of different instructed peers in each session whereas it is more common to use a couple of trained confederates in adolescent research (Hermans, Engels, et al., 2009; Hermans, et al., 2008). In practice, it was not possible to use only a few instructed peers because the children would miss out on their school lessons. In addition, as far as we know, this was the first social modeling experiment in children that made use of real instructed peers. Other modeling studies in children have used dyadic results of two naïve peers to investigate peer modeling behavior (Salvy, et al., 2009; Salvy, Romero, et al., 2007) or remote (video) confederates (Romero, et al., 2009). Moreover, by use of different confederates it was possible to rule out a confederate effect. Fourth, the homogeneity of the study population can be seen as a limitation. It would be interesting to conduct further research on prolonged social norms in adolescents and adults or different nationalities such as the United States. In addition, this study includes only few obese participants. Future research should focus on this weight category as well. It might be that overweight children do not suffer from stigmatization as much as obese children who might have encountered more difficulties (Latner & Stunkard, 2003). Therefore, obese children might withhold their food intake more compared to overweight and normal weight children in presence of a lean peer or they might not hold back when eating alone. Fifth, this study focused on palatable food intake. Future studies need to assess whether normative guidelines in modeling behavior also apply to different kinds of food (e.g., healthy or unfamiliar food). Sixth, different and more test foods were used in
the second session than in the first session. This might have interfered with the prolonged effect of social modeling, in that all children ate more during the second session (see also Hetherington (2007)) which might explain the less profound differences between normal weight and overweight children. However, we considered the use of different foods more similar to a real life situation in which children are confronted with all kinds of snack foods. Finally, all confederates were normal-weight children. It is important to replicate this study with overweight confederates to examine any possible stigmatization effect in modeling behavior among young boys and girls.

In conclusion, this study provided more insight into the effect of eating norms of peers on palatable food intake in normal-weight and overweight children. These findings might be of value in developing school health policies since children spend a lot of time at school. In the Netherlands, children bring their lunch and snacks from home to school, a tradition which ensures that parents are able to exert a certain amount of control over their children’s food intake. However, in the United States and the United Kingdom, for example, children choose and eat their meals and snacks in school cafeterias. Given that this study shows an effect of a peer setting a norm during only one occasion, the effect of seeing peers eat on a daily basis might be even stronger. As peers can set an example to have a certain food intake or trigger overweight children to increase their food intake it would be interesting to investigate social influence in other settings such as in school cafeterias, day care or after school facilities. The implications for government and school policies could be, for example, to prohibit children or parents to bring palatable snack food to school and to offer healthy snacks at schools. Moreover, peers could be included into teaching and prevention programs to educate children about social triggers to eat and social influence in eating in and outside of school.

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The role of explicit and implicit self-esteem in peer modeling of palatable food intake: a study on social media interaction among youngsters

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Peer modeling via social media interaction and the role of self-esteem
Abstract

This experimental study investigated the impact of peers on palatable food intake of youngsters within a social media setting. To determine whether this effect was moderated by self-esteem, the present study examined the roles of global explicit self-esteem (ESE), body esteem (BE) and implicit self-esteem (ISE). Participants (N=118; 38.1% boys; M age 11.14±.79) were asked to play a computer game while they believed to interact online with a same-sex normal-weight remote confederate (i.e., instructed peer) who ate either nothing, a small or large amount of candy. Participants modeled the candy intake of peers via a social media interaction, but this was qualified by their self-esteem. Participants with higher ISE adjusted their candy intake to that of a peer more closely than those with lower ISE when the confederate ate nothing compared to when eating a modest (β=.26, P = .05) or considerable amount of candy (kcal) (β=.32, P = .001). In contrast, participants with lower BE modeled peer intake more than those with higher BE when eating nothing compared to a considerable amount of candy (kcal) (β = .21, P = .02); ESE did not moderate social modeling behavior. In addition, participants with higher discrepant or “damaged” self-esteem (i.e., high ISE and low ESE) modeled peer intake more when the peer ate nothing (β = -.24, P = .004) or a modest amount (β = -.26, P < .0001) compared to a substantial amount of candy (kcal). Youngsters conform to the amount of palatable food eaten by peers through social media interaction. Those with lower body esteem or damaged self-esteem may be more at risk to peer influences on food intake.
Introduction

Computer use has been associated with increased sedentary behavior as well as (soft) drink and snack consumption among youngsters, which can contribute to being overweight (Epstein et al., 2008; Utter, Neumark-Sztainer, Jeffery, & Story, 2003). The majority of Dutch youth are on the Internet (96%) and converse by social media (e.g. MSN, Skype, Face book) for approximately 1.5 hours a day (Dorsselaar, Zeijl, van den Eeckhout, ter Bogt, & Vollebergh, 2007; Livingstone & Haddon, 2009). As friends and peers become more important with age, the amount of time spent on social media increases significantly during high school (Dorsselaar, et al., 2007). Numerous experimental studies have shown by means of “confederates,” who were secretly instructed to choose or eat certain types or amounts of food, that individuals adapt the food intake of peers (Bevelander, et al., 2011; Hendy, 2002; Hermans, Larsen, et al., 2009). This so-called social modeling effect was found regardless of whether the confederates were physically present (i.e., “remote” or “video” confederates) and illustrates the strong influence of others on food consumption (Feeney, et al., 2011; Leone, et al., 2007; Pliner & Mann, 2004; Roth, Herman, Polivy, & Pliner, 2001). For example, boys and girls were found to follow a remote confederate’s unfamiliar food choices during a computer game while they were shown food choices between familiar and unfamiliar foods on screen (Bevelander, et al., 2012a). In addition, a study among girls showed that they consumed more after seeing a remote (video) confederate eat a large rather than a small amount of palatable food (Romero, et al., 2009). It is unknown whether a remote confederate also influences consumption when youngsters engage in an online social interaction.

Social modeling behavior is based on a normative framework; that is, people use others’ food intake as a norm or guideline for how much is appropriate to eat (Herman & Polivy, 2005; Herman, et al., 2003). From infancy on, people model their behaviors to learn and to affiliate with others as well as to be liked and socially embedded due to our need to belong (Baumeister & Leary, 1995; Lakin, et al., 2003). However, individual characteristics (Bevelander, et al., 2012b) and social context affect to what extent people adjust their food intake (Herman, et al., 2003). For example, a study of young adults showed that females only followed the food intake of a real confederate when she was acting less sociable (Hermans, Engels,
et al., 2009). The authors argued that the participants felt a stronger need to affiliate when the confederate was acting “socially cold” than when she was acting “socially warm,” because the affiliation goal had been already achieved for the latter.

Social belonging is determined in part by self-esteem (Baumeister & Leary, 2000; Heatherton & Wyland, 2003) and self-esteem plays an important role in social interactions (Leary, et al., 1995). According to the sociometer theory, self-esteem can be seen as a monitor of social acceptance and exclusion (Leary, et al., 1995). People with high self-esteem are more likely to believe that others like them than people with low self-esteem (Bohrnstedt & Felson, 1983; Kenny & DePaulo, 1993); they worry less about how they are perceived by others and perceive a lower probability of rejection (Heatherton & Wyland, 2003). Subsequently, people with high self-esteem feel less need to affiliate with others and to affirm social bonds (e.g., by social modeling) compared to people with low self-esteem (Baumeister & Leary, 1995; Heatherton & Vohs, 2000; Heatherton & Wyland, 2003). Because individuals model behavior to affiliate or fit in (Baumeister & Leary, 1995; Lakin, et al., 2003), self-esteem may also play a role in social modeling of food intake. To our knowledge, there is only one study that examined the role of self-esteem on the matching degree of food intake in female students. Robinson et al. (Robinson, et al., 2011) found strong matching in dyads where one co-eater had low self-esteem but no matching effect in dyads where both co-eaters had high self-esteem. However, it was not possible to infer whether the participant with low self-esteem matched the food intake of the co-eater with high self-esteem, or vice versa. The present study aimed to address the question of causality.

Furthermore, it is important to note that the construct of self-esteem can be assessed in various ways. Most literature deals with global explicit self-esteem (ESE), which assesses people’s positive or negative attitude toward the self as a totality. While ESE provides insight into general psychological well-being, eating behavior might be better explained by domain-specific self-esteem (e.g. academic performance, athletic competence or (body)appearance) (Furnham, Badmin, & Sneade, 2002; Mendelson, 1982; Phillips & Hill, 1998; Rosenberg, et al., 1995). In line with this notion, having low body esteem was previously found to predict low global ESE, but not vice versa (Rosenberg, et al., 1995; Tiggeman,
2005). As research showed that young people’s body esteem is related to their eating behaviors (Ricciardelli & McCabe, 2001), the current study also included body esteem (BE) as a explicit domain-specific measure of self-esteem.

The construct of self-esteem can be further distinguished by taking into account implicit self-esteem (ISE). ISE is based on intuitive automatic self-evaluations, whereas ESE is based upon a conscious effortful retrieval of information to evaluate the self. It has been proposed that ISE develops early in life, which would produce a pre-conscious affective response to self-relevant stimuli by drawing on associative links in memory (Bosson, Brown, & Zeigler-Hill, 2003). In contrast, ESE is likely to be constructed as a function of specific contexts and goals by drawing on cognitive capacity. A new line of research investigates the discrepancy between ESE and ISE. For example, a high ISE but low ESE (i.e. “damaged” self-esteem) is related to people’s (disturbed) eating behavior (Cockerham, Stopa, Bell, & Gregg, 2009). It has been proposed that ISE might reflect a presentation of the ideal self, whereas ESE represents the real self, and that the discrepancy could lead to a disturbed feeling (Franck, De Raedt, & De Houwer, 2007). Therefore, a discrepancy between ESE and ISE might be seen as an indicator of psychological distress that can create uncertainty and lead to difficulties in maintaining a consistent self-view, which subsequently results in lower levels of mental and physical health (Franck, et al., 2007; Schroder-Abe, Rudolph, & Schutz, 2007). To our knowledge, the influence of ISE or a possible discrepancy between ESE and ISE on social modeling behavior of food intake has not yet been examined.

The aim of the present study is to investigate whether the palatable food intake of a peer (i.e., remote confederate) had an effect on the food intake of youngsters via social media interaction and whether this influence depended upon ESE, BE, ISE or a discrepancy between ESE and ISE. It was hypothesized that youngsters adjust their food intake to that of a peer but that those with lower ESE would follow the food intake of a peer more closely than those with higher ESE. Similar effects were hypothesized for BE, but it was expected that BE would have a stronger impact on modeling of food intake than ESE. As this is the first study to include the role of ISE on social modeling behavior, it explored whether ISE or a possible discrepancy between ESE and ISE had an effect on peer modeling of eating.
Methods

Participants

Figure 5.1 depicts a flow diagram of the recruitment procedure for the study. School teachers of grades 5 and 6 distributed detailed consent forms to parents of the students. For all schools that participated in this study, more than 70% of the students had a West-European or Dutch background. The study sample consisted of 118 participants (38.1% boys) with a mean age (SD) of 10.53 years (0.54) in grade 5 (n = 49) and 11.58 years (0.63) (n = 69) in grade 6. Most participants (85.6%) were normal weight; 8.5% were overweight and 5.9% were underweight. The present study was conducted according to the guidelines of the Declaration of Helsinki, and procedures were approved by the Ethics Committee of the Faculty of Social Sciences, Radboud University Nijmegen. Active written informed consent was obtained from the student’s caregivers.

Power calculations were conducted using the program G*Power 3.1.2 (Faul, Erdfelder, Buchner, & Lang, 2009). To detect a medium to large effect using linear regression ($R^2 = .20$) with 7 predictors, $^6$ 80 participants are needed (power .80, $P < .05$). Taking into account the dependence of measurement within school classes, we followed the procedure proposed by Twisk (Twisk, 2006) with an estimated Intra Class Correlation (ICC) equaling 0.04. The number of students was estimated on 15 students per class who would receive written consent by their parents and this resulted in a multiplier of 1.5. Therefore, 120 pupils in total had to be approached. However, more than 120 students were recruited because it was expected that some parents would not give informed consent or participants had to be excluded due to the study design.

Setting and procedure

Data collection took place from February through June 2012 between 8:30 AM and 3:30 PM. The social media interaction lasted 10 minutes and was videotaped. The video camera was placed on a tripod in front of the participants, which they thought was used as a web cam. Participants

$^6$ It was estimated that besides the inclusion of the main variables (self-esteem and the intake conditions), the control variables food liking, hunger and BMI had to be included.
Recruitment (January - March 2012)
7 out of 118 primary schools participated
283 households were sent informed consent forms
153 households returned consent forms

Experimental sessions (February – July 2012)
130 children received written consent to participate
12 children did not participate (by food allergies (1), awareness of fictitious video confederate or the study aim (8) or because they refused to participate (3))

Figure 5.1. Flow diagram of the recruitment procedure

were seated at a table with a laptop to play the computer game⁷, a glass of water and a bowl of candy (i.e., chocolate-coated rice crisps). A large computer screen and sound speakers (connected to a second laptop) were placed next to the participant’s laptop, through which they were able to see and hear the remote confederate. Figure 5.2 presents a still of the computer game and the setting of the study.

Experimental intake conditions and remote confederates. The remote confederates were young teenagers who were trained at a drama academy. There were three male and three female normal-weight confederates who were videotaped for each experimental intake condition. Acting according to the same script, they made remarks about the computer game, asked questions, and gave helpful instructions. Similar to previous research, they were instructed to eat nothing (no-intake condition), four pieces of candy (low-intake condition), or 15 pieces of candy (high-intake condition) at set time points which were signaled by use of a buzzer device.

⁷ The computer game ("shooting blocks") consisted of different levels with constructions (e.g., a tower or pyramid) composed of ice cubicles, some of which were pink. The participants could earn points by breaking the pink ice cubes with the computer mouse. They had to start the level over again if the construction collapsed and too many non-pink ice cubes were lost.
Figure 5.2. Computer game “Shooting Blocks” (above) and a participant waving good-bye to the remote confederate at the end of the online interaction (below)
(Bevelander, et al., 2012b). The remote confederates ate the same type of candy as the participants. The participants were randomly assigned to one of the experimental (no-, low- and high-) intake conditions.

**Cover story and modeling experiment.** The participants were delivered a cover story to conceal the actual aim of the study. Before starting the experiments in school, each class was told that the experimenters were interested in computer gaming with another peer and that an average score would be calculated by their game score and the score of another peer who was playing at the same time but at another school. Prior to the social modeling experiment, the participants were told that they had to wait for the remote confederate to come and play the computer game. They were asked to complete some computer tasks (i.e. the self-esteem measures) while they were waiting. After they finished the self-esteem measures, one experimenter made the video connection (i.e., started the video clip with the remote confederate), while the other experimenter instructed the participant about the computer game. At the same time, the participant could see and hear that the remote confederate received the same instruction by another experimenter (i.e., an actor). The experimenter made sure to wave with the participant to their remote counterparts at the exact moment that the latter waved on the video. To conceal that the participants could not really interact with the remote confederate, the participants were told that there were problems with the sound connection at the other school. Nevertheless, the participants were encouraged to try to interact whether or not the sound was working. The experimenter left the room at the same moment as the experimenter did on the video. After exactly 10 minutes, the experimenter came back again (similar to the video), waved to the remote counterparts and switched off the electronic devices. The participants’ height and weight were measured, and a short questionnaire was administered.

**Measures**

*Food intake participant.* The experimenter weighed the bowls of candy before and after each session using a digital scale (Kern 440, Kern & Sohn, Balingen, Germany). The consumed grams were converted into kilocalories (100gr/471 kcal) and used as the dependent variable in the analyses.

*Explicit self-esteem.* Explicit self-esteem (ESE) was assessed by the Rosenberg self-esteem scale which is a widely used 10-item self-report
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measure of self-esteem. Participants rated the items (e.g., “On the whole, I am satisfied with myself”) on a scale from 1 (strongly agree) to 4 (strongly disagree). Cronbach’s alpha was \( \alpha = .80 \).

Body esteem. The participant’s body esteem (BE) was measured by the Children Figure Rating Scale, which consists of nine children’s appearance drawings ranging from very thin (1) to obese (9) (Tiggeman & Wilson-Barrett, 1998). The participants were asked to choose the drawing which they perceived their current figure to be and which they perceived as their ideal figure to be. The discrepancy between their perceived current figure and their ideal figure represented their BE (J. K. Thompson & Altabe, 1991). The higher the score, the greater their body dissatisfaction and the lower their BE (Ricciardelli & McCabe, 2001). As it has been suggested that people who want to gain weight might have a different BE than people who want to lose weight (Anschütz, Kanter, Van Strien, Vermulst, & Engels, 2008; Ricciardelli & McCabe, 2001), BE was additionally tested by recoding the participant’s score of who wanted to gain weight as missing score.

Implicit self-esteem. Implicit self-esteem (ISE) was assessed with the Implicit Association Task (IAT) (Greenwald & Farnham, 2000). The IAT measures the positive and negative associations that an individual has with the self and with others. It is a computer-based response time task in which participants categorize stimuli by rapidly pressing a left-side or right-side key on the laptop keyboard without making errors. The reaction time measure assesses the relative difference of association between two target categories (i.e., me vs. not-me) with two attribution categories (i.e., positive vs. negative words or attitudes). The measure is computed by the speed at which participants press the keys in which association strengths influence performance. Participants respond faster to highly associated categories (e.g., me + positive attributions) than to less associated categories (e.g., she + positive attributions or me + negative attributions). Thus, the scores reflect the ease with which participants associate positive versus negative words with the self. The overall IAT score is computed by taking the difference between the average response times for the two test blocks (blocks 4 and 7, which were counterbalanced across participants to control for order effects). The degree to which “me-positive” and “not-me-negative” are stronger associations than “me-negative” and “not-me-positive” indicates more implicit self-esteem (see Table 5.1 for an overview of the IAT task). The improved scoring
algorithm was used (D-measure) to compute individual scores as the difference in mean latencies between the two test blocks, divided by the inclusive standard deviation of trials within the respective blocks (for further specific details on the D-measure such as practice trials and exclusion criteria, see Greenwald, Nosek and Banaji (2003). The IAT was programmed in Inquisit 3.0 (Millisecond software).

**Body weight.** Body weight is controlled for in the analyses as it is associated with BE and social modeling behavior (Bevelander, et al., 2012b). The experimenter measured height and body weight individually according to standard procedures (without shoes but fully clothed). Height was measured to the nearest 0.1 cm using a stadiometer (Seca 217 Slider, Seca GmbH & Co., Hamburg, Germany) and weight was measured to the nearest 0.1 kg using a digital scale (Seca Bella 840, Seca GmbH & Co.). The body mass index (BMI) was calculated using the formula: weight [kg]/height2 [m]. BMI (z-score) cutoff points which are representative of current z-BMI standards for Dutch youngsters were used (StichtingVoedingscentrumNederland, 2011b).

**Measurements questionnaire**

**Hunger.** To conceal the real aim of the study, participants’ subjective hunger state was measured after the experiment. The participants indicated their hunger on a Visual Analogue Scale (VAS) (0 cm, *not hungry at all*; 15 cm, *very hungry*) (Bevelander, et al., 2012b).

| Table 5.1. Procedure of the IAT response task |  |
|---|---|---|---|
| **Block** | **No. of trials** | **Left response key ’E’** | **Right response key ’I’** |
| 1 | Practice | 20 | Me | Not-me |
| 2 | Practice | 20 | Positive attributions | Negative attributions |
| 3 | Practice | 40 | Me + positive attributions | Not-me + negative attributions |
| 4 | Test | 40 | Me + positive attributions | Not-me + negative attributions |
| 5 | Practice | 20 | Not-me | Me |
| 6 | Practice | 20 | Not-me + positive attributions | Me + negative attributions |
| 7 | Test | 40 | Not-me + positive attributions | Me + negative attributions |

1 The 2 target categories were: I, Me, My, Myself; Self; Mine versus His, Her, They, Them, Their, Others. Positive versus negative attribution categories were: Fun, Nice, Positive, Good, Worthy, Clever versus Pathetic, Stupid, Negative, Bad, Worthless, Unintelligent (In Dutch these words were translated as: Leuk, Aardig, Positief, Goed, Waardevol, Slim versus Onaardig, Stom, Negatief, Slecht, Waardeloos, Dom).
Time of day. Participants’ food intake might be related to time of day. Afternoons are more commonly snack times than mornings (Cross, et al., 1994). Therefore, the actual time of day on which the participant played the computer game during the online social interaction was taken into account.

Liking of the candy. Liking of the candy was previously found to affect the participants’ food intake (Bevelander, et al., 2012b). The participants were asked to indicate how much they liked the candy on a VAS (0 cm, not at all; 15 cm, very much) with a sad looking and smiley face at the start and end of the scale, respectively.

Liking of the task. To measure the extent to which the participants liked the computer game, a VAS was used (0 cm, do not like at all; 15 cm, like it a lot) with a sad looking and smiley face at the start and end of the scale, respectively.

Liking of the remote confederate. Liking of the remote confederate might influence food intake. To measure the extent to which the participants liked the remote confederate, a VAS was used (0 cm, do not like at all; 15 cm, like him/her a lot) with a sad looking and smiley face at the start and end of the scale, respectively.

Estimation of the remote confederate’s candy intake. To test whether the participants were conscious of the remote confederate’s candy intake, they were asked if they could estimate his/her candy intake (expressed in the number of candies).

Analytical strategy

Data were analyzed using SPSS for Windows (version 20.0, 2012, SPSS Inc., Chicago, IL, US). Alpha was set at $P < .05$. First, randomization checks were performed by using one-factor analysis of variance to test for differences among the three experimental intake conditions. Second, Spearman’s rank and Pearson’s correlations were performed for the model variables of age, sex, hunger, liking of the candy, time of day the experiment took place, liking of the task, liking of the remote confederate and candy intake (kcal) to determine which variable had to be controlled for in the main analyses.

The intraclass correlation coefficient (ICC) for the outcome variable candy intake (kcal) was .05 meaning that 5% could be explained by nestedness within schools. According to Muthén (Muthen, 1994), the size of the effect should preferably be under 5%. To control for the possible
impact of clustering within schools, analyses were conducted in MPLUS with a sampling design adjusted model with schools as clusters, using the Type is Complex option in Mplus 6.0 (Kuntsche & Jordan, 2006). Of the 118 participants, 3 participants did not complete the ESE task and 5 participants did not complete the ISE task. For BE, 9 participants reported an ideal body shape that was larger than their current body shape. In a second analysis for BE, they were coded as ‘missing.’ Therefore, the analyses for ESE, ISE and BE were performed for N = 115, N = 113, N = 118 and N = 109 participants, respectively. Maximum percentage missing values was 7.6%. Missing values were handled in Mplus using full information maximum likelihood (FIML) estimation.

First, to examine whether social modeling occurred during social media interaction, the main effects of self-esteem and the experimental intake condition on candy intake (kcal) were tested in 2 different models by means of dummy coding the experimental intake conditions. Second, the interaction effects between the different self-esteem scores and experimental intake condition were tested. Model 1 tested no-intake as a reference group (dummy coded as 0) against the low-intake and high-intake condition (dummy coded as 1), and model 2 tested the low-intake as a reference group against the no-intake and high-intake condition. The interaction terms were calculated between the dummy variables (i.e., the experimental intake conditions) and the different types of self-esteem and entered into the models while controlling for hunger and liking of the candy. To interpret possible interaction effects plots were constructed using the unstandardized regression coefficients. Similar models were used to examine discrepancies between the implicit and explicit measures.

Results

Randomization and manipulation checks

Randomization checks were performed to test for differences between the experimental intake conditions in age, sex, hunger, liking of candy, liking of the task, liking of the remote confederate, ESE, ISE, BE. Table 5.2 summarizes the means and standard deviations (SDs) for all variables in each experimental intake condition. There were no significant differences
(\(P > .10\)) between the experimental intake conditions, which indicated that randomization was successful.

The manipulation check showed that there were significant differences (\(N = 117; F_{2,115}^{\cdot} = 42.18, P < .001\))\(^\text{8}\) in the participant’s estimations of the number of candies the remote confederate ate between the experimental intake conditions (no-intake: \(M = 1.17 (\pm 2.31)\); low-intake: \(6.94 (\pm 4.67)\); high-intake: \(13.88 (\pm 9.42)\). Post hoc analysis with Bonferroni correction showed that the participants’ estimations were significantly different (\(P < .001\)) for the experimental intake conditions.

**Main analyses**

Spearman’s rank and Pearson’s correlations showed that age (\(r = .02, P = .79\)), sex (\(r_s = .07, P = .48\)), time of day they played the computer game (\(r = .04, P = .67\)), liking of the task (\(r = .12, P = .19\)) and liking of the remote confederate (\(r = .10, P = .27\)) did not correlate significantly with candy intake (kcal). Hunger (\(r = .24, p = .009\)) and liking of the candy (\(r = .27, P = .003\)) were related to candy intake (kcal). Therefore, hunger

---

\(^8\) One participant did not provide an estimation

### Table 5.2. Randomization checks of the variables measured by experimental conditions

<table>
<thead>
<tr>
<th>Variables</th>
<th>No – intake confederate ((n = 41))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>11.17 (.83)</td>
</tr>
<tr>
<td>Boys/girls (n/n)</td>
<td>18/23</td>
</tr>
<tr>
<td>BMI (z-score)</td>
<td>.32 (.92)</td>
</tr>
<tr>
<td>Hunger</td>
<td>36.10 (29.16)</td>
</tr>
<tr>
<td>Liking of candy</td>
<td>109.73 (35.64)</td>
</tr>
<tr>
<td>Liking of task</td>
<td>114.80 (27.62)</td>
</tr>
<tr>
<td>Liking remote confederate</td>
<td>115.70 (20.87)</td>
</tr>
<tr>
<td>Time of day</td>
<td>11:58 (1:58)</td>
</tr>
<tr>
<td>Global explicit SE</td>
<td>3.11 (.43)</td>
</tr>
<tr>
<td>Body esteem</td>
<td>.48 (1.03)</td>
</tr>
<tr>
<td>Implicit SE</td>
<td>.44 (.41)</td>
</tr>
</tbody>
</table>

1 Values are presented in means (SD), min. – max.
<table>
<thead>
<tr>
<th>intake condition</th>
<th>Low – intake confederate</th>
<th>High – intake confederate</th>
<th>P value²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n = 36)</td>
<td>(n = 41)</td>
<td></td>
</tr>
<tr>
<td>11.08 (.81)</td>
<td>10 – 13</td>
<td>11.17 (.74)</td>
<td>10 – 12</td>
</tr>
<tr>
<td>11/25</td>
<td></td>
<td>16/25</td>
<td></td>
</tr>
<tr>
<td>.38 (1.33)</td>
<td>-4.13 – 2.98</td>
<td>.05 (.74)</td>
<td>-1.44 – 1.40</td>
</tr>
<tr>
<td>39.44 (34.76)</td>
<td>1 – 127</td>
<td>33.46 (27.47)</td>
<td>1 – 138</td>
</tr>
<tr>
<td>115.46 (33.06)</td>
<td>13 – 150</td>
<td>114.78 (36.98)</td>
<td>15 – 150</td>
</tr>
<tr>
<td>122.88 (22.36)</td>
<td>51 – 149</td>
<td>110.22 (29.84)</td>
<td>42 – 150</td>
</tr>
<tr>
<td>119.11 (21.60)</td>
<td>60 – 150</td>
<td>117.71 (14.92)</td>
<td>93 – 150</td>
</tr>
<tr>
<td>11:57 (1.56)</td>
<td>8:55 – 14:50</td>
<td>11:59 (1:57)</td>
<td>9:05 – 14:40</td>
</tr>
<tr>
<td>3.11 (.40)</td>
<td>2.20 – 3.80</td>
<td>2.96 (.44)</td>
<td>1.80 – 3.80</td>
</tr>
<tr>
<td>.42 (.69)</td>
<td>-2 – 2</td>
<td>.29 (1.03)</td>
<td>-2 – 3</td>
</tr>
<tr>
<td>.59 (.33)</td>
<td>-.64 – 1.30</td>
<td>.49 (.30)</td>
<td>-.20 - .89</td>
</tr>
</tbody>
</table>

and liking of the candy were entered into the models as covariates (in addition to BMI).

All Mplus models were saturated. In saturated models, all possible correlations between the independent variables and all possible direct paths from the predictors to the dependent variables are specified, so no fit measures are presented (Kline, 2011). The covariates hunger and liking of the candy had a significant effect on candy intake (kcal) in all three self-esteem measures in both models with model 1 testing no-intake versus low- and high-intake, and model 2 testing low- versus high-intake.

Explicit self esteem

The covariates hunger (β = .19, SE = .07, P = .006) and liking of the candy (β = .20, SE = .09, P = .036) had a significant effect on candy intake (kcal), and there were significant main effects of the experimental intake conditions on candy intake (kcal). Model 1 showed a significant difference between the no- and low-intake condition (β = .24, SE = .08, P = .002) and the no- and high-intake condition (β = .30, SE = .12, P = .013) on participant’s candy intake (kcal). Model 2 showed no significant differences between the low- and high-intake condition (P = .59). There were no effects of z-BMI (P = .41) or ESE (P = .76) on candy intake (kcal). There were also
no significant interaction effects between ESE and experimental intake condition on candy intake (kcal) \( (P > .05) \).

**Body esteem**

The covariates hunger \( (\beta = .11, \ SE = .04, \ P = .001) \) and liking of the candy \( (\beta = .10, \ SE = .05, \ P = .028) \) had a significant effect on candy intake (kcal), and there were significant main effects of the experimental intake conditions on candy intake (kcal). Model 1 showed a significant difference between the no- and low-intake condition \( (\beta = 9.46, \ SE = 2.89, \ P = .001) \) and the no- and high-intake condition \( (\beta = 10.88, \ SE = 4.03, \ P = .007) \). Model 2 showed no significant differences between the low- and high-intake condition \( (P = .60) \). There were no effects of z-BMI \( (P = .71) \) or BE \( (P = .98) \) on candy intake (kcal).

The main effect of the experimental intake condition on the participant’s candy intake (kcal) was qualified by an interaction effect between BE and experimental intake condition on participant’s candy intake (kcal). The standardized regression weights of the interaction models are presented in Table 5.3. There was only a significant difference between the no- versus high-intake condition \( (\beta = .21, \ P = .02) \). Figure 5.3 presents the interpretation of the interaction effects for BE. It shows that participants with lower BE followed the candy intake of the remote confederate more closely when they ate a substantial amount of candy compared to nothing. The models were also tested without the participants \( (n = 9) \) who wanted to gain weight. The models showed a significant difference between the no- versus high-intake condition \( (\beta = .26, \ P = .02) \) and between the low-versus high-intake condition \( (\beta = .43, \ P = .04) \) implying that participants with lower BE followed the candy intake of the remote confederate more closely when they ate nothing or a modest amount compared to a substantial amount of candy.

**Implicit self esteem**

The covariates hunger \( (\beta = .19, \ SE = .07, \ P = .009) \) and liking of the candy \( (\beta = .20, \ SE = .09, \ P = .02) \) had a significant effect on candy intake (kcal), and there were significant main effects of the experimental intake condition on participant’s candy intake (kcal). Model 1 showed a significant difference between the no- and low-intake condition \( (\beta = .24, \ SE = .08, \ P = .003) \) and the no- and high-intake condition \( (\beta = .29, \ SE = .12, \)
Table 5.3. Standardized parameter coefficients for the path models to test the interaction effects on candy intake (kcal). Model 1 presents ‘no versus low and high intake condition’ and model 2 ‘low versus no and high intake condition’ for self-esteem

<table>
<thead>
<tr>
<th>Variables</th>
<th>ESE (N=115)</th>
<th>ISE (N=113)</th>
<th>BE (N=118)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hunger status</td>
<td>.17*</td>
<td>.07</td>
<td>.21**</td>
</tr>
<tr>
<td>Liking candy</td>
<td>.19*</td>
<td>.10</td>
<td>.22*</td>
</tr>
<tr>
<td>BMI (z-score)</td>
<td>.04</td>
<td>.06</td>
<td>.06</td>
</tr>
<tr>
<td>Self-esteem</td>
<td>.13</td>
<td>.18</td>
<td>-.10</td>
</tr>
<tr>
<td>Condition low intake1</td>
<td>.09</td>
<td>.64</td>
<td>.24</td>
</tr>
<tr>
<td>Condition high intake1</td>
<td>1.23</td>
<td>.80</td>
<td>.08</td>
</tr>
<tr>
<td>Interaction no vs low*self-esteem</td>
<td>.17</td>
<td>.66</td>
<td>.07</td>
</tr>
<tr>
<td>Interaction no vs high*self-esteem</td>
<td>-.92</td>
<td>.86</td>
<td>.32**</td>
</tr>
<tr>
<td>Model 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hunger status</td>
<td>.17*</td>
<td>.07</td>
<td>.21**</td>
</tr>
<tr>
<td>Liking candy</td>
<td>.19*</td>
<td>.10</td>
<td>.22*</td>
</tr>
<tr>
<td>BMI (z-score)</td>
<td>.04</td>
<td>.06</td>
<td>.06</td>
</tr>
<tr>
<td>Self-esteem</td>
<td>.18</td>
<td>.14</td>
<td>-.03</td>
</tr>
<tr>
<td>Condition no intake2</td>
<td>-.09</td>
<td>.65</td>
<td>-.24</td>
</tr>
<tr>
<td>Condition high intake2</td>
<td>1.14</td>
<td>.50*</td>
<td>-.16</td>
</tr>
<tr>
<td>Interaction low vs no*self-esteem</td>
<td>-.18</td>
<td>.68</td>
<td>-.06</td>
</tr>
<tr>
<td>Interaction low vs high*self-esteem</td>
<td>-1.09†</td>
<td>.57</td>
<td>.26*</td>
</tr>
</tbody>
</table>

Note: † marginal significant \( P = .059 \), * \( P < .05 \), ** \( P < .01 \)
1 Model 1: Reference is no intake versus low and high experimental intake condition
2 Model 2: Reference is low intake versus no and high experimental intake condition

\( P = .012 \). Model 2 showed no significant differences between the low- and high-intake condition \( (P = .57) \). There were no main effects of z-BMI \( (P = .48) \) or ISE \( (P = .84) \) on candy intake (kcal).

Moreover, there was a significant interaction between ISE and the experimental intake condition on candy intake (kcal). The models showed a significant difference between the no- versus high-intake condition \( (\beta = .32, P = .001) \) and the low- versus high-intake condition \( (\beta = .26, P = .05) \). Figure 5.3 presents the interpretation of the interaction effects found between ISE and the experimental intake conditions. It shows that the participants with higher ISE followed the remote confederate’s candy
Figure 5.3. Interaction effect between experimental intake condition, body esteem and implicit self-esteem on social modeling of candy intake (kcal)

Note: The figure presents an interpretation of the interaction effect plotted with the unstandardized regression coefficients. In BE, there is a significant difference between the no- and high-intake condition for youngsters with lower BE. In ISE, there is a significant difference between the no- and high-, and low- and high-intake condition for those with higher ISE.
intake more closely when they ate nothing or a modest amount compared to a substantial amount of candy.

Additional analyses on implicit-explicit discrepancies

Analyses (N=113) were performed to further investigate a possible discrepancy between explicit and implicit self-esteem. Consistent with previous research (Bosson, Swann, & Pennebaker, 2000), ESE and ISE were not correlated (r = .06 P = .51). Also, BE and ISE were not correlated (r = .08 P = .42). To create a single index of discrepant self-esteem, the standardized ISE scores were subtracted from the standardized ESE scores so that higher scores indicate higher ESE and lower ISE. Model 1 revealed a significant difference between the no- versus high-intake condition (β = -.24, SE = .08, P = .004) but not between the no- versus low-intake condition (P = .86). Model 2 revealed that there was a significant difference between the low- and high-intake condition (β = -.26, SE = .07, P < .0001). [Figure 5.4] illustrates the interpretation of the interaction effect between ESE and ISE. Participants with higher ISE than ESE adjusted more to the remote confederate’s candy intake than participants with higher ESE than ISE.

An additional discrepancy score was computed between BE and ISE (N=115). Model 1 revealed no significant differences between the no- versus low-intake condition (P = .42) or the no- versus high-intake condition (P = .11). Model 2 revealed that there was a significant difference between the low- versus high-intake condition (β = -.33, SE = .14, P = .014). Again, participants with higher ISE than BE adjusted more to the remote confederate’s candy intake than participants with higher BE than ISE.

Discussion

The present study was the first to investigate whether young teenager’s palatable food intake is affected by peer intake in a social media setting and whether this association was moderated by different types of self-esteem. Findings indicated that youngsters adjusted their food intake to the amount eaten by a peer in an online interaction and that this relation was qualified by body esteem (BE) and implicit self-esteem (ISE). Youngsters with lower BE and higher ISE modeled peer intake. Global explicit self-esteem did not moderate the social modeling effect. In addition, this study was the first to indicate that discrepant self-esteem
Figure 5.4. Interaction effect between experimental intake condition and discrepant self-esteem on social modeling of candy intake (kcal)

Note: The figure presents an interpretation of the interaction effect plotted with the unstandardized regression coefficients. There is a significant difference between the no- and high-, and low- and high-intake condition for youngsters with higher ISE than ESE.

Moderated social modeling behavior. That is, youngsters with so-called “damaged” self-esteem (i.e. higher ISE than ESE) were found to follow peer intake more closely than those with lower ISE than ESE.

Going beyond previous studies on normative influences on food intake by means of remote (Bevelander, et al., 2012a; Leone, et al., 2007; Pliner & Mann, 2004; Romero, et al., 2009; Roth, et al., 2001) or real confederates (Bevelander, et al., 2011, 2012b; Hermans, et al., 2008; Hermans, Larsen, et al., 2009), the current findings showed that social modeling behavior can also occur through online interaction. Youngsters modeled their
peers when eating nothing compared to something, regardless of the amount of candy (i.e., a modest or substantial). Notably, this modeling pattern is in line with previous findings in normal-weight children who had a confederate physically present in the same room (Bevelander, et al., 2012b). It seems that the influence of a peer via social media might be similar to a real-life eating situation. Given that people increasingly engage in social interactions via the Internet, it is relevant to examine the impact of peers on food intake via social media. It should be noted that a previous study in which female students were exposed to an eating remote (video) confederate did not find a modeling effect (Hermans, Salvy, Larsen, & Engels, 2012). The authors suggested that the indication of how much the remote confederate consumed had no effect, because the consumption environment (i.e., task and physical surrounding) differed between the confederate and participants. The current study provided additional insight. Although the tasks were the same, the remote confederate was not in a similar surrounding as the participant. This might indicate that social modeling could be affected by dissimilarity in people’s activities rather than the physical environment. It would be interesting to further investigate this by means of modeling studies in which people perform different tasks versus the same tasks in the same context, for example.

The moderating effects of self-esteem on social modeling behavior were also examined in the present study. In line with the hypothesis, youngsters with lower BE modeled a peer’s candy intake more than those with higher BE; that is, when the peer ate nothing compared to a substantial amount of food. Notably, this moderation effect was not found for ESE. The findings support previous research on the notion that BE as a domain-specific self-esteem might provide more insight into explaining specific behavioral patterns compared to ESE (Rosenberg, et al., 1995). Thus, body confidence might be more relevant than the general sense of well-being with regard to adjusting to a peer’s food intake. The majority of youngsters appear preoccupied with a slim body image and

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9 The study of Bevelander et al. (2012b) showed that normal-weight children ate similar amounts when a peer ate either a modest or substantial amount of food, whereas overweight children ate similar amounts when a peer ate nothing or a modest amount and increased their intake when a peer ate a substantial amount of food.
are often conscious of their weight (Nowak, 1998). It is proposed that youngsters with lower BE are more insecure or experience distress about their body shape in an eating situation with an unknown peer than those with higher BE (Wardle & Beales, 1986). As young people often engage in social comparisons, those with lower BE might have followed the intake of a peer to avoid eating inappropriately compared to those with higher BE; especially, when the peer was eating nothing compared to a large amount of food.10

In contrast to BE and ESE, the findings on the role of ISE on social modeling may seem surprising. Youngsters with higher ISE modeled peer food intake more than those with lower ISE. As this was the first study examining the role of ISE on social modeling behavior, explanations are speculative. Implicit beliefs about the self are proposed to develop at an early age and become fairly stable over time, whereas ESE can fluctuate and, moreover, can differ from ISE (DeHart, Pelham, & Tennen, 2006). Research on the role of ISE and the connectedness in people’s relationships propose that ISE is associated with the regulation of affiliation responses (DeHart, et al., 2011). Furthermore, ISE is found to manifest in nonverbal behavior (e.g. nodding head affirmatively when someone speaks, smile at someone) and may contribute to the regulation of people’s bonding and affiliation efforts, which might be similar to modeling each other’s behavior (Lakin, et al., 2003; Leary, 2005; Longua Peterson & DeHart, 2012). DeHart et al. (2011) proposed that implicit self-esteem might function as an indicator of social acceptance. For example, when there is a need to affiliate, ISE is already activated before ESE (Rudman, Dohn, & Fairchild, 2007). In the current study, the youngsters had to engage in a social interaction with an unfamiliar peer, which might have activated their affiliation response. It is speculated that youngsters who possessed higher levels of ISE were more likely to automatically engage in nonverbal behaviors (e.g. modeling) than those with lower ISE. Following this tentative reasoning, ISE might regulate one’s capacity to perform nonverbal social behavior, so those with higher ISE match the food intake of their peers more often than youngsters with lower ISE.

10 In youngsters who were satisfied or wanted to lose weight, this was true for when the peer was eating nothing compared to a modest or a substantial amount of food.
An additional explanation for the findings on explicit and implicit self-esteem might be found in dual process models, which provide a framework for integrating both forms of self-esteem. Previous research found that people suffering from personality or clinical disorders (e.g., narcissism (Zeigler-Hill, 2006), depression and loneliness (Creemers, Scholte, Engels, Prinstein, & Wiers, 2012), bulimia nervosa (Cockerham, et al., 2009)) possessed low ESE while at the same time displaying high ISE. It is suggested that people process information through two separate but possibly interacting systems: a slow conscious reflective mode of processing drawing on cognitive capacity and effortful retrieval of information and a fast automatic mode drawing on associative links in memory. In line with this, ESE is assumed to be a product of the reflective mode, whereas ISE is assumed to be rooted in the associative mode. The incongruity between the explicit reflective and implicit associative self-esteem-systems presents a way to distinguish between two types of self-esteem discrepancies: a combination of high ISE and low ESE (i.e. “damaged” self-esteem or “discrepant low”) versus low ISE combined with high ESE (i.e., “fragile” self-esteem or “discrepant high”) (Bosson, et al., 2003; Zeigler-Hill, 2006). ISE is suggested to represent the ideal self, whereas ESE represents the real self. A discrepancy between ISE and ESE could consequently lead to a disturbed feeling (Franck, et al., 2007). Damaged self-esteem may thus be seen as an indicator of psychological distress that can create uncertainty and lead to lower levels of mental health (Schroder-Abe, et al., 2007). In this study, youngsters with damaged self-esteem (higher ISE than ESE) were found to follow the food intake of a peer more closely, while those with fragile self-esteem did not. As research on discrepant self-esteem, depression and loneliness suggested that ISE might be indicative of desired social relationships (whereas ESE represents actual social relationships) (Creemers, et al., 2012), it is possible that the youngsters engaged in social modeling behavior to fulfill their affiliation goals. As this is the first study to examine the role of implicit and explicit self-esteem on social modeling behavior of eating, more research is warranted to investigate the impact of self-esteem on people’s eating behavior in social contexts. Based on the current findings, it might be relevant to include implicit measures of self-esteem in conceptual models that aim to examine social modeling.
Several limitations associated with the current study are worth mentioning. First, the participant’s affiliation purposes were not measured during their social interaction. Although previous research supports the notion that people want to fulfill their affiliation goals through social modeling, the present study does not provide insight into whether the participants wanted to be liked by their peers. Future studies could code nonverbal behaviors such as eye contact or smiling in order to establish affiliation goals. Second, the homogeneity of the study population can be seen as a limitation. In contrast to implicit self-esteem which stays fairly stable over time, research has shown that age has an effect on explicit self-esteem across the life span (R. Robins, Trzesniewski, Tracy, Gosling, & Potter, 2002). In general, self-esteem is highest during childhood but significantly declines from childhood (ages 9–12) to adolescence (ages 13–17) and continues to decline into the college period (ages 18–22). After this period, self-esteem rises throughout adulthood (R. Robins, et al., 2002). It would be interesting to conduct further research on the role of self-esteem in peer modeling among older study populations. In addition, this study consisted out of few overweight or obese youngsters. Future research should concentrate on this weight category as well. Furthermore, this study only involved normal-weight confederates. It would be interesting to investigate whether social modeling would be different within overweight/normal-weight or overweight dyads due to possible different affiliation goals or social norms. Third, the children’s subjective hunger status was measured only after the social interaction to conceal the aim of the study. Another strategy might be to measure the children’s subjective hunger before the study or assess when (or how much) they ate (during) their last meal. Fourth, the remote peer was videotaped, so a real ongoing social interaction was not possible. Qualitative impressions after watching the video recordings of the participants showed that they did not try to verbally contact the peer after a few minutes. Although this seemed to have no effect on modeling behavior, it would be interesting to test social modeling during a real ongoing chat session. Also, the confederates were strangers. As people are more likely to chat with family and friends than with strangers and the influence of strangers on food intake has been shown to be less strong than the influence of familiar peers (Salvy, Vartanian, et al., 2008), future studies should investigate the impact of family and friends on food intake
via social media interaction. Finally, there is an ongoing debate about the validity of implicit measures to assess implicit self-attitudes. Implicit self-esteem is a complex construct, and different implicit measures may capture distinct aspects of ISE (Buhrmeister, Blanton, & Swann, 2011). Therefore, future research is warranted to use multiple indirect measures when implicit self-attitudes are examined, for example, by assessing implicit body esteem.

In conclusion, this study broadens the existing scope of normative influences on young people’s palatable food consumption. To date, we often engage in social contact by social media interactions. As this study found that youngsters even conform to their peer’s food intake via social media, online interactions should also be accounted for in research on the influence of the social environment on food intake or the development of intervention strategies. Given that body image is increasingly important in society, young people with lower body esteem may be more susceptible to peer influences on food intake. In addition, this study provided new insights into the role of self-esteem and people’s adjustment to their peers. Future modeling studies with real confederates should include self-esteem measures.

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CHAPTER 6

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Imitation of snack food intake among normal-weight and overweight children

Submitted
Imitation of snack food intake among normal-weight and overweight children
Abstract

This study investigated whether social modeling of palatable food intake might partially be explained by the direct imitation of a peer reaching for snack food and, further, assessed the role of the children’s own weight status on their likelihood of imitation during the social interaction. Real-time observations during a 10-minute play situation in which 68 participants (27.9% overweight) interacted with normal-weight confederates (instructed peers) were conducted. Children’s imitated and non-imitated responses to the confederate’s food picking movements were compared using a paired sample t-test. In addition, the pattern of likelihood of imitation was tested using multilevel proportional hazard models in a survival analysis framework. The findings suggest that the imitation of food picking movements may contribute to social modeling behavior of palatable food intake among young people. Children were more likely to eat after observing a peer reaching for snack food than without such a cue ($t_{67} = 5.69, P < .0001$). Moreover, findings suggest that children may display different imitation responses during a social interaction based on their weight status (HR = 2.6, $P = .03$, 95% CI =1.09 – 6.20). Overweight participants are almost twice more likely to imitate whereas normal-weight participants have a smaller chance to imitate in the second 5-minutes than in the first 5-minutes. Further, the mean difference in the likelihood of imitation between the normal-weight and overweight participants was only significant during the first 5-minutes in which overweight participants had a smaller likelihood to imitate than normal-weight children. Food picking by peers is likely to trigger children to eat snack food, however, the influence of others on our food intake is a complex process in which different theoretical perspectives might overlap. Potential explanations are discussed.
Introduction

Within the past 30 years, the prevalence of obesity has more than doubled in children and tripled in adolescents in the United States (CDC, 2012). As people often eat in the presence of others, the social environment is an important research area. Social modeling literature has provided ample evidence that the presence of others affects people’s food intake (Bevelander, et al., 2012b; Herman & Polivy, 2005; Herman et al., 2003; Romero, et al., 2009; Salvy, et al., 2012). Numerous studies have shown that an individual’s food intake is affected by their eating companion’s intake by means of an experimental design in which naïve participants are exposed to experimental confederates who are instructed to eat different amounts of food (Bevelander, et al., 2012b; Herman & Polivy, 2005; Herman, et al., 2003; Hermans, et al., 2008; Hermans, Larsen, et al., 2009). Social modeling studies have shown that people are likely to eat more or less food when their eating companion eats more or less. Notably, modeling of food intake has been consistently found among adults, adolescents and children regardless of one’s hunger or satiety levels and in different eating contexts (Feeney, et al., 2011; Goldman, et al., 1991; Herman & Polivy, 2005; Hermans, Larsen, et al., 2009; McFerran, et al., 2010).

A potential explanation for social modeling effects in food intake is that people are believed to monitor other’s food intake in order to resolve their own uncertainty about the appropriate amount to consume (Herman, et al., 2003). Therefore, they use the food intake of others as a guideline or norm for their own amount of intake. Besides people’s general need for an informational guideline, it is suggested that people have social motives to conform to others eating because conformity can lead to social acceptance or approval (Bevelander, et al., 2012b; Herman, et al., 2003; Hermans, et al., 2008; Hermans, Larsen, et al., 2009; Vartanian, et al., 2007). For example, a study on young female adolescents showed that the ones who were primed with feelings of social acceptance followed the food intake of their peers less often than those who were not primed with social acceptance (Robinson, et al., 2011). This line of reasoning overlaps with literature on behavioral imitation proposing that people imitate the behavior (e.g., imitation of gestures, facial expression, etc.) of others as a way to affiliate (Lakin & Chartrand, 2003). This imitation
process is assumed to occur unconsciously by a tight neural link between perception and action (Chartrand & Bargh, 1999; Chartrand, Maddux, & Lakin, 2005). That is, perceiving another person’s movements may trigger and activate one’s own motor system for the same movement (Iacoboni, 2009; Lakin & Chartrand, 2003). A new line of research investigates whether a person’s consumption behavior is directly imitated or copied by another person. For example, studies on alcohol consumption have shown that young adults might imitate the drinking behavior of peers and movie actors by taking a sip directly after the observed person had taken a sip (Koordeman, Kuntsche, Anschutz, van Baaren, & Engels, 2011; Larsen, Engels, Souren, Overbeek, & Granic, 2010). In the domain of eating, seeing another person taking a bite or snack might trigger a similar response. One study has demonstrated that female young adults imitated the bites of their eating companion (Hermans, Lichtwarck-Aschoff, et al., 2012). That is, young women were more likely to take a bite of their meal directly after their eating companion had taken a bite. Based on the findings of these studies in young adults, the aim of the current study was to investigate whether the movement of a peer reaching for food (‘food picking movements’) would trigger a similar response in young boys and girls as well.

Although people generally tend to use other’s food intake as a guideline for their own intake, it is suggested that the extent to which they model other’s food intake depends on a variety of personal and situational characteristics. The scarce studies on imitation have shown that individuals are more likely to imitate a peer at the beginning than at the end of a social interaction (Hermans, Lichtwarck-Aschoff, et al., 2012; Koordeman, et al., 2011). A tentative explanation for this finding is that affiliation goals affect behavioral imitation processes. Social psychology research suggests that people imitate each other’s behavior in order to affiliate with others and to create social bonding (Baumeister & Leary, 1995; Lakin, Jefferis, Cheng, & Chartrand, 2003). One could argue that affiliation or ingratiation strategies are stronger at the beginning than at the end of a social interaction because people get to know each other during that time. Therefore, the occurrence of imitation might decrease over the duration of a social interaction when people feel more at ease (Hermans, Lichtwarck-Aschoff, et al., 2012).
In social modeling literature, there is evidence to suggest that children's weight status might have a differential impact on the degree to which children model their peer's food intake (Bevelander et al., 2012; Salvy, Romero, et al., 2007). Therefore, the pattern of imitation during a social interaction might be relevant to examine in this context. Given that there is a strong association between overweight status and stigmatization (Herman & Polivy, 2003; Puhl & Latner, 2007), overweight children might be more inclined to affiliate with peers by imitating their food intake compared to normal-weight children during a social interaction. In contrast, normal-weight children might imitate less because they feel more socially accepted in general and have a higher social confidence level than overweight children (Pierce & Wardle, 1997; Strauss & Pollack, 2003). To the authors knowledge, no previous studies have investigated how these imitation processes unfold in real-time among normal-weight and overweight children.

Given that this is the first study on imitation of palatable food intake among children, the current study is exploratory in nature and aims to broaden the existing scope of knowledge by investigating whether children imitate the food picking movements of a peer. It was hypothesized that children would directly imitate the food picking movements of a same-sex peer. In addition, in line with previous research among young adults, it was explored whether the likelihood of imitation changed during the social interaction and whether this differed between normal-weight and overweight children.

**Experimental methods**

*Participants and procedure*

This sample was taken from a larger study investigating social modeling behavior of food intake among normal-weight and overweight children at Dutch primary schools. Each participant was placed opposite a same-sex normal-weight confederate (instructed peer) at a table with a 100-piece puzzle, two bowls of test food (chocolate-coated peanuts), and two glasses of water. The confederates were instructed to pick one chocolate-coated peanut when covertly signaled by the experimenter (i.e., 10 signals, every minute). A detailed description of the design and
methodology of the original study can be found elsewhere (Bevelander, 2012b). As this study investigated the imitation of food picking movements (i.e., eating cues), the present study included participants \( n = 72 \) who were in the ‘high intake’ condition only. Four dyads were excluded from analysis because the video records were not suitable for coding \( n = 3 \) or questionnaire information was incomplete \( n = 1 \). The final sample consisted of 68 children (50% boys; 27.9% overweight) with a mean age of 8.56 (±1.46) years.

**Measures**

*Food picking.* An apparent cue in the onset for food intake was the moment after the children had moved their arm and hand towards the food bowl and picked a chocolate-covered peanut (i.e., the test food). So, the exact time in seconds at which the confederates’ and the participants’ fingers touched and picked a chocolate peanut from the bowl was coded. Similar to a previous study on food intake, a 5-second time window was used to test whether imitation could occur (Hermans et al., 2012). The 5-second time frame started on the moment that the confederate’s fingers picked a chocolate peanut.

To investigate the participant’s imitation of the confederate’s food picking, a distinction was made between ‘imitated picking’ and ‘non-imitated picking.’ The participant picking a chocolate peanut within 5 seconds after the confederate had picked a chocolate-coated peanut, was defined as imitated picking and coded as ‘1’ (i.e., those instances were considered events in the second analyses by means of a multi-level Cox regression model). A participant taking a chocolate peanut after the 5-second interval was defined as non-imitated picking and coded as ‘0.’ When participants picked more than one chocolate peanut at the same time, this was still regarded as a single food pick because they had reached for the food bowl and picked food once. As some of the confederates missed one of the 10 covertly given signals \( n = 5 \) to pick test food, a total of \( n = 675 \) food picking occasions were used from the final sample of 68 children. Data were coded by two trained coders who coded the data independently and were blind to the time frames of imitation.

**Total number of times participant picked test food.** The occurrence of imitation is proportionate to the total number of times participants picked a chocolate peanut. That is, if a participant picks a lot of chocolate
peanuts, the occurrence of imitation might be higher due to chance alone (picking a peanut might fall into the 5-second interval due to the high rate of participants’ picking and not because of imitation). Therefore, the total number of times that participants picked chocolate-covered peanuts was controlled for.

Body weight. Participants’ height and weight were measured objectively by the experimenter based on standard procedures (i.e., without shoes but fully clothed). Height was measured to the nearest 0.1 cm using a stadiometer (Seca 206, Seca GmbH & Co., Hamburg, Germany) and weight was measured to the nearest 0.1 kg using a digital scale (Seca Bella 840, Seca GmbH & Co.). The body mass index (BMI) for each child was calculated using the formula: weight [kg]/height$^2$ [m]. BMI percentiles and BMI z-scores were calculated because BMI during childhood is age- and sex-specific. They are representative of current BMI (z-score) standards for Dutch children (Cole, et al., 2000; Cole & Roede, 1999; StichtingVoedingscentrumNederland, 2011).

Analytical strategy

General tendency to imitate. In the first analysis, it was investigated whether imitation of food picking was likely to occur among children. Estimates were calculated to indicate whether the participants were more likely to imitate the confederate’s food picking. The estimates were calculated by dividing the total duration of the social interaction (i.e., 10 minutes) into ‘sensitive’ and ‘non-sensitive’ periods. Within the 5 second-time window, the sensitive period was the 5-second interval which started when the confederate’s finger had touched the test food (sensitive in terms of the likelihood of imitation). Since the confederate was signaled by the experimenter to pick a peanut each minute, there were 10 sensitive periods of 5 seconds each.\footnote{The number of food picking cues given by the confederate was accounted for in the analyses. For example, when the confederate picked 9 times, there were 9 sensitive periods of 5 seconds each, which equals a sensitive period of 45 and a non-sensitive period of 555 seconds.} The non-sensitive periods were all the remaining time periods (e.g., total time in seconds (= 600) minus the sensitive periods (=50) equals 550). Next, the number of chocolate peanuts that were picked within those sensitive periods was divided by 50 seconds (i.e., the sensitive period). The estimate
for the non-imitated food picks represents how often participants picked a chocolate peanut in the non-sensitive periods divided by 550 (i.e., the non-sensitive period; outside the 5-second interval after the confederate picked a peanut). These two estimates were computed separately for each participant. To express whether participants had a general tendency to imitate, the sensitive and the non-sensitive estimates were tested with a paired sample t-test. A significantly higher sensitive than non-sensitive estimate indicates that participants are more likely to pick a peanut when cued by the confederates’ food picking.

Likelihood of imitation of food picking over the duration of the social interaction. The second type of analysis aimed to test whether normal-weight and overweight children showed a different pattern in the likelihood of imitation during the social interaction in general. Therefore, the 10-minute session was split into halves (referred to as the first 5-minutes and the second 5-minutes). The second 5-minutes was dummy coded as ‘1’ versus the first 5-minutes that was used as a reference category and coded as ‘0.’ Further, overweight children were dummy coded ‘1’ versus normal-weight children which were used as a reference category and coded as ‘0.’ A multilevel proportional hazard model (Cox regression) in a survival analysis framework was used to test whether the likelihood of imitation of the confederate’s food picking depended on the duration of the social interaction (i.e., in the first 5-minutes or the second 5-minutes, which is used as a time varying predictor in the survival analysis) and the participants’ weight status (which is used as a between-subjects predictor in the survival analysis). The total number of times the participant had picked chocolate peanuts was controlled for.

Hazard ratios (HRs) and confidence intervals (CIs) were presented as effect sizes. A hazard ratio is an expression of the hazard of events (imitation) occurring in one group (coded as ‘1’) as a ratio of the hazard of the events occurring in the reference group (coded as ‘0’). A hazard ratio above 1 indicates a higher hazard of events whereas a hazard ratio below 1 a reduced hazard of events. The significance level for all statistical tests was set at 5% (\( P < .05 \)). Data were analyzed using SPSS 19.0 and MPLUS 5.1 (Muthén & Muthén, 2007). To correct for the skewed distribution in weight status, the Maximum Likelihood Robust estimator (MLR) was used in the Cox regression. MLR is robust to non-normality and non-independence of observations.
Additional analysis

Additional analyses were performed to explore the likelihood of imitation of the confederate’s food picking into more detail. Therefore, separate analyses (multilevel proportional hazard model (Cox regression) in a survival analysis framework) were conducted for the weight groups (normal-weight versus overweight participants) and the duration of the social interaction (first 5-minutes versus second 5-minutes of the experiment), controlling for the total number of times that participants picked chocolate peanuts.

Results

Descriptives

The means and standard deviations (SDs) for the variables age, sex, hunger, dietary restraint and total number of times participants picked chocolate peanuts are summarized in Table 6.1. No differences ($P > .05$) were found between the two weight groups. Table 6.2 presents participants’ food picking for the first and second 5-minutes of the experimental session. The confederate followed instructions and picked food each minute throughout the session ($M = 9.9$, SD$=.7$). A 2 x 2 repeated measure ANOVA with weight status as the between-subjects factor and

| Table 6.1 | Means (SD) for variables age, sex, hunger, dietary restraint and total number of picked chocolate-coated peanuts measured by weight status$^\dagger$ |
|------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| Variables  | Total ($n = 68$) | Normal-weight ($n = 49$) | Overweight ($n = 19$) | $P$ value$^2$ |
| Age (y)    | 8.56 ± 1.46 | 8.55 ± 1.61 | 8.58 ±1.02 | .94 |
| Boys/girls (n/n) | 34/34 | 25/24 | 9/10 | .79 |
| Dietary restraint | .59 ± .45 | .53 ± 0.46 | .74 ± .39 | .09 |
| Number of picked chocolate-peanuts | 7.63 ± 6.39 | 6.75 ± 5.46 | 9.89 ± 8.07 | .07 |

$^\dagger$ All values are in means (± SDs)

$^2$ $P$ values reflect the differences in total means between weight groups by one-factor ANOVA or Pearson’s chi square test.
CHAPTER 6

Table 6.2 Food picking movements measured by the first and second 5-minutes of the social interaction

<table>
<thead>
<tr>
<th></th>
<th>Total (n = 68)</th>
<th>First 5-minutes</th>
<th>Second 5-minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food picking normal-weight</td>
<td>6.76 ± 5.46</td>
<td>3.39 ± (3.09)</td>
<td>3.33 ± (2.98)</td>
</tr>
<tr>
<td>participants (n = 49)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food picking overweight</td>
<td>9.89 ± 8.07</td>
<td>4.68 ± (4.27)</td>
<td>5.21 ± (3.97)</td>
</tr>
<tr>
<td>participants (n = 19)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food picking movements all</td>
<td>7.63 ± 6.39</td>
<td>3.75 ± (3.47)</td>
<td>3.85 ± (3.36)</td>
</tr>
<tr>
<td>participants</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 Data are presented as means (± SDs)

time (first 5-minutes and second 5-minutes) as the within-subjects factor showed that overweight and normal-weight children did not significantly differ in the total number of times they picked test food during the 10-minute social interaction ($F_{1,66} = 3.51, P = .07$). In addition, they did not significantly differ in the number of times they picked test food within the first or second 5-minutes ($F < 1$).

**Main analysis**

**General tendency to imitate.** The first analysis showed by means of a paired sample $t$-test that the participants were more likely to pick a chocolate peanut directly after the confederate had picked one than when the confederate had not reached for a peanut ($t_{67} = 5.69, P < .0001$). This shows that children are likely to imitate and pick food when triggered by the confederates’ food picking.

**Likelihood of imitation of food picking.** There was an interaction effect ($HR = 2.6, P = .03, 95\% \text{ CI} = 1.09 – 6.20$) between the duration of the social interaction and participants’ weight status on the likelihood of imitation, controlled for the total number of times participants picked chocolate peanuts ($HR = 1.09, P < .001, 95\% \text{ CI} = 1.05 – 1.12$). The interaction effect indicates that there is a difference in the likelihood of imitation of the confederate’s food picking between normal-weight and overweight participants over the time course of the social interaction. It was also tested whether sex, hunger, restrained eating or liking of the task had an effect on the main findings, but this was not the case (all $P$-values >.05).
Additional analysis

To explore the interaction effect into more detail, separate analyses had to be conducted for the normal-weight versus overweight participants and the first versus second 5-minutes of the experiment, controlled for the total number of times participants picked chocolate peanuts. Table 6.3 shows the likelihood of imitation for the interaction effect and the separate analyses. The hazard ratios of the slope across time shows that overweight participants are almost twice more likely (HR = 1.88, \( P = .004, 95\% \ CI = 1.23 \text{ – 2.86} \)) to imitate in the second 5-minutes compared to the first 5-minutes whereas normal-weight participants have a smaller chance (HR = .51, \( P = .01, 95\% \ CI = .30 \text{ – .86} \)) to imitate in the second 5-minutes than in the first 5-minutes. Further, the mean difference in

| Table 6.3. Likelihood of imitation of normal-weight versus overweight children controlled for total number of times participants picked food |
|-----------------------------------------------|------------------|-----|
| Time frame of 5 seconds                       | HR               | CI  |
| Weight status                                | .46*             | .24-.87 |
| Duration social interaction                  | .57*             | .35-.94 |
| Weight * duration social interaction          | 2.60*            | 1.09-.6.20 |
| Total number of food picks participant        | 1.09***          | 1.05-1.12 |
| **Slope across duration social interaction**  |                  |     |
| Normal-weight children                        | .51**            | .30-.86 |
| Total number of food picks participant        | 1.07**           | 1.02-1.11 |
| Overweight children                           | 1.88**           | 1.23-2.86 |
| Total number of food picks participant        | 1.12***          | 1.07-1.17 |
| **Difference normal- versus overweight**      |                  |     |
| First 5-minutes                               | .47*             | .25-.88 |
| Total number of food picks participant        | 1.07***          | 1.03-1.12 |
| Second 5-minutes                              | 1.19             | .59-.241 |
| Total number of food picks participant        | 1.09***          | 1.05-1.13 |

\*\( P < .05 \), **\( P < .01 \), ***\( P < .001 \)

\( ^1 \) Overweight participants were almost twice (HR = 1.88) as likely to imitate in the second compared to the first 5-minutes, whereas normal-weight participants were 49% (HR = .51) less likely to imitate. Within the first 5-minutes, overweight participants were 53% less likely (HR = .47) to imitate compared to normal-weight participants.
the likelihood of imitation between the normal-weight and overweight participants was only significant during the first 5-minutes in which overweight participants had a smaller chance (HR = .47, $P = .02$, 95% CI = .25 – .88) to imitate than normal-weight children.

**Discussion**

The present study investigated imitation in palatable food intake among normal-weight and overweight children. The findings suggest that the imitation of food picking movements may contribute to social modeling behavior of high-energy-dense food intake among young people. Children are more likely to eat after witnessing a peer reaching for snack food than without such a cue. In addition, children may display different imitation responses based on their weight status. By the examination of the pattern of imitation, the findings showed that overweight children are more likely to imitate a peer’s food intake in the second half of the social interaction than in the first half, whereas the opposite is true for normal-weight children. In addition, the likelihood of imitation in normal-weight children was significantly higher than in overweight children in the first half of the social interaction.

The findings support the hypothesis that children are more likely to pick food in direct response to a peer’s food picking than when the peer does not pick food. This is in line with findings on adolescents’ imitation in eating (Hermans et al., 2012) and drinking (Koordeman, et al., 2011; Larsen, et al., 2010), although assessed in longer time frames in the studies related to drinking (i.e., 10 and 15 seconds, respectively) than in the current study. A previous study on imitation during an evening meal proposed the possibility that people might automatically imitate the behavior of another person by which they synchronize their eating behavior (Hermans et al., 2012). Research supports the idea that a peer’s food picking might trigger an automatic response and guide one’s own action to corresponding behavior (Chartrand et al., 2005; Knoblich & Sebanz, 2008; Lakin et al., 2003; Rizzolatti & Craighero, 2004). One potential mechanism that might underlie imitation behavior was suggested to be the mirror-neuron system: ingestive mirror-neurons have been found to respond to observations of movements related to ingestive purposes, such as picking food, biting, or sucking (Chartrand & van Baaren, 2009;
Rizzolatti & Craighero, 2004). Physical movements preceding the action (e.g., picking food) as well as the actual action itself (e.g., eating food) activate the mirror-neuron system (Knoblich & Sebanz, 2008; Rizzolatti & Craighero, 2004). Nevertheless, the authors acknowledge that the findings provide no information with regard to any underlying processes or mechanism(s). Therefore, it can only be speculated whether imitation responses are automatic. Although imitation of food picking was likely to occur within 5 seconds, the children did not imitate all the time. Moreover, this study also showed that there were differences in the likelihood of imitation between normal-weight and overweight children. This suggests that other processes play a role in imitation responses as well.

Research has provided evidence to postulate that the differences in the likelihood of imitation between weight groups might be explained by affiliation purposes. Imitation of others is likely to be activated by a higher order goal to affiliate (Chartrand, et al., 2005; Lakin & Chartrand, 2003), which might lead to an increased liking between persons (Chartrand & Bargh, 1999). Individuals failing in their affiliation goal, however, might be more likely to increase their efforts to ingratiate (Chartrand, et al., 2005). In line with previous findings on imitation in normal-weight participants (Hermans, Lichtwarck-Aschoff, et al., 2012; H. Larsen, et al., 2010), a possible explanation for the decrease in likelihood of imitation in normal-weight children is that they perceived themselves to have achieved their affiliation goal. Following this tentative line of reasoning, overweight children might not have perceived social confidence from their peer by which they increased imitation (Pierce & Wardle, 1997). If so, one could assume that overweight children would have imitated the peer from the start of the social interaction. In contrast, overweight children followed a normal-weight peer’s food picking even less than normal-weight children, which brings into question whether they were preoccupied with ingratiation processes. As this study did not include such measurements, future research is needed to investigate this. For example, the use of overweight peers as confederates or coding gestures, smiles, and social responses might provide more insight into affiliative efforts.

Other explanations might be found in the sensitivity or responsiveness to food cues (meaning not only the confederate’s food picking but also the presence of the food bowl). As the findings show that normal-weight and overweight children started off with a significantly different imitation
pattern (while picking a similar number of times), overweight children might be more sensitive to the presence and sight of snack food than to the peer’s food picking. The picking cues might have functioned as an additional cue on top of the sight of the food that triggered overweight children to pick food and imitate later. Normal-weight children might have been triggered by the specific cue of a peer picking food at the start of the social interaction. Studies in attentional bias have demonstrated that overweight individuals automatically direct their attention to food-related stimuli and to a greater extent than normal-weight individuals (Castellanos et al., 2009; Nijs, Muris, Eusar, & Franken, 2010; Yokum, Ng, & Stice, 2011); however, findings have not been consistent with regard to whether this attention is maintained over time (Castellanos et al., 2009; Nijs et al., 2010). With regard to the present study, it might be that the attention to food picking as additional stimuli decreased in normal-weight children but increased in overweight children. In addition, the findings might imply that normal-weight children became less responsive to the food picking cues of a peer during the social interaction, whereas overweight children became more responsive to such cues. Research has shown that normal-weight children are less sensitive to triggers of (over)eating than overweight children (Jansen et al., 2003) and have more response inhibition (Braet, Claus, Verbeken, & Van Vlierberghe, 2007; Nederkoorn, Braet, Van Eijs, Tanghe, & Jansen, 2006). Given that there is no research into increasing or diminishing response inhibition over time, the interpretation of the current findings warrants caution and further research is needed.

As the study was only the first in young people and exploratory in nature, a limitation of this study was that the findings provide no information with regard to which underlying processes or mechanism(s) were at play. In addition, the study does not include measures on affiliation. One could question the reliability of self-reported measures on how much participants want to affiliate with their co-eater assessed before, during, or after a social interaction. Future studies should take appropriate measures of affiliative bonding into account. Also, there were fewer overweight than normal-weight participants in the study sample. It was not possible at the time of data collection to realize similar sample sizes. As research revealed associations between adiposity level and social relationships with peers (see for review Puhl and Latner (2007)), it would be insightful to
imitate whether imitation patterns look different, for example, within overweight (or obese) dyads versus overweight/normal-weight dyads.

In conclusion, the influence of others on our food intake is a complex process in which different theoretical perspectives might overlap. As this study was only exploratory in nature, it is inconclusive why people imitate food intake and whether imitation responses are in fact direct or automatic. Nevertheless, this study provides preliminary evidence that young people follow the actions of peers when snacking together and this response occurs within a few seconds. Food picking by peers is likely to trigger children to eat snack food. Future research is warranted to test the value of those perspectives in the context of imitation of food intake. The findings might provide potential areas for the prevention of (over)consumption or support the intake of low energy-dense foods e.g., parents and schools could provide an environment which encourages children to snack healthy foods or limit unhealthy eating.
CHAPTER 7

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Television watching and the emotional impact on social modeling of food intake among children

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Peer modeling and the role of emotions while watching TV
Abstract

The main goal of this study was to test whether exposure to happy, neutral, or sad media content influences social modeling effects of (snack) food intake in young children. The study was conducted at 14 Dutch urban and suburban primary schools. The participants (N = 112) were asked to watch a movie with a same-sex normal-weight confederate who was instructed to eat either nothing or a standardized amount of snack food (10 chocolate-coated peanuts). The study involved a 3 (movie clips: happy, neutral, and sad) x 2 (peer’s food intake: no intake versus a standardized intake) between-participants design. A significant interaction between the movie clip condition and intake condition was found ($F_{2,102} = 3.30, P = .04$, Cohen’s $f^2 = .20$). Positive as well as negative emotions were found to lead to adjustment to the intake of a peer, as compared to that of children in the neutral movie condition. The findings suggest that children eat more mindlessly when watching an emotional movie and, therefore, respond more automatically to a peer’s food intake, whereas children may be less susceptible to a peer’s intake while watching a neutral movie. As young children are not in the position to choose their food consumption environment yet, parents and schools should provide consumption settings that limit eating in front of the television.
Introduction

Watching television (TV) or video/Digital Versatile Disc (DVD) is the most common leisure activity (approximately 3 hours a day) among children in the Netherlands and the United States (CBS, 2011; Crespo et al., 2001). In young children, watching TV is associated with an increased high-fat food intake (Taveras et al., 2006), and meals or snacks are often consumed in front of the TV with family and peers (Feldman, Eisenberg, Neumark-Sztainer, & Story, 2007).

Ample studies have shown the impact of friends, family, and strangers on children’s food intake (Bevelander, et al., 2012b; Salvy, et al., 2009; Salvy, Vartanian, et al., 2008). As children mature and spend a lot of time among peers at school, peers become more important role models than parents (Fuligni & Eccles, 1993). Early studies on ‘social facilitation’ proposed that the presence of others (e.g., co-actors or spectators) may increase the level of arousal that drives our actions (Zajonc, 1965; Zajonc & Sales, 1966). In relation to food intake, this means that one’s food intake increases when eating in the presence of others compared to when eating alone (de Castro, et al., 1990; Herman, et al., 2003). However, the presence of others is also found to inhibit food intake. It seems that people adjust their intake or ‘model’ that of their eating companion(s) when they eat a little or a lot. This so-called ‘social modeling’ occurs in children, adolescents, and adults despite hunger or satiety, during snack situations, and at breakfast, lunch, and dinner meals (Bevelander, et al., 2012b; de Castro, et al., 1990; Goldman, et al., 1991; Hermans, Herman, Larsen, & Engels, 2010b; Romero, et al., 2009; Salvy, et al., 2009). An inhibited food intake is likely to occur when people want to make a good impression or avoid prejudicial effects regarding their weight status (Bevelander, et al., 2012b; Herman & Polivy, 2005; Herman, et al., 2003). Thus, it is suggested that children use others’ food intake as a normative guideline for how much they can eat.

In addition to social guidelines, people’s food intake is influenced by their emotions (Canetti, Bachar, & Berry, 2002; Macht & Simons, 2000). Despite that people often consume their meals with others and that their food intake can be influenced by the presence of other people, as well as by emotions, there is limited published research that focuses on the interaction between emotions and social context in relation to food.
intake. To our knowledge, only one study has examined obese women’s food intake and emotions while eating alone versus in the presence of others by means of a food diary (Patel & Schlundt, 2001). Generally, the findings revealed that emotions and social context separately affected food intake. Food intake was higher in positive (e.g., excited, happy), high-arousal negative (e.g., fear, anger, stress, upset, irritability), and low-arousal negative (e.g., bored, depressed, sad, tired, weak) emotional states compared to neutral emotional states.

The majority of studies on emotions have focused on eating in relation to negative emotions among particular groups, such as dieters, emotional eaters, disordered eaters, and overweight/obese individuals (see for review Macht (2008)) with a limited number of studies among children (Goossens, Braet, & Decaluwe, 2007; Marcus & Kalarchian, 2003; Vannucci et al., 2012). As in adults, negative emotions (e.g. sadness, boredom, restlessness) were related to an increased food intake in children and young adolescents (Marcus & Kalarchian, 2003). Some have argued that environmental contexts that activate negative and positive emotions distract people in their cognitive capacity to maintain a restricted diet, which could increase their food intake (Boon, Stroebe, Schut, & Ijntema, 2002; Boon, Stroebe, Schut, & Jansen, 1998). The impact of positive emotions on eating has been less extensively studied (Macht, Roth, & Ellgring, 2002), although there is increasing attention in current commercial research (cf. Garg, Wansink, & Inman, 2007; King & Meiselman, 2010).

The scarce literature on ‘normal’ eaters (i.e., normal-weight and non-emotional eaters/non-dieters) has yielded divergent findings. It is not as well established as in restrained eaters that negative emotions increase food intake and there is very little research on the influence of positive emotions in eating behavior (Canetti, et al., 2002; Garg, et al., 2007; Macht, 2008). All together, the influence of emotions on food intake is stronger in restrained eaters than in normal eaters, and it is stronger in overweight or obese than in non-obese people. To date, the majority of studies on emotions and food intake have been conducted among late adolescents and adults. Therefore, the current study particularly focuses on emotions in children.

To our knowledge, the impact of a co-eater’s food intake on emotions while watching TV has not been examined (Westerman, Spies, Stahl,
& Hesse, 1996). In social situations, emotions are found to affect people’s thoughtful actions (i.e., mindful actions) and compliance (Dolinski, 2001). For example, when a negative (e.g., fear) or positive (e.g., happiness) feeling was changed into another feeling (in this case respectively relief or disappointment), people were found to mindlessly engage in unreasonable requests more than people who were not induced with an emotional change (Dolinski, 2001). It is proposed that while people’s cognitive capacity deals with changes in the emotional state, it can cause other responses to occur automatically or mindlessly (Baumeister, et al., 2007; Dolinski, 2001). Mindfulness can be defined as a state of conscious awareness of a context or the content of information whereas mindlessness refers to the opposite (Langer, 1992). Changes in emotional states are induced when people watch TV by means of the story and/or music (Westerman, et al., 1996). Additionally, it is assumed that people act with more mindlessness in a routine situation that has repeatedly occurred in the past (Langer, 1992). As a result of the lack of motivation to function mindfully during a routine (such as watching TV) (Hetherington, Anderson, Norton, & Newson, 2006), people can become distracted or mindless, for example, by not paying attention to the amount of food eaten (Hetherington, et al., 2006; Wansink, 2006). With regard to the current study, children who experience changes in their positive or negative emotional state (due to the movie content) may become more compliant (i.e., follow a peer in food intake) because their cognitive functioning may become less efficient (Baumeister, et al., 2007; Dolinski, 2001; Wansink, 2006).

Children engage in social eating contexts in front of the TV daily. It is essential to examine the impact of emotions on social modeling of food intake because emotions influence people’s automatic impulses and emotion regulation is less developed in children compared to adolescents and adults (P. M. Cole, Martin, & Dennis, 2004; Gross, 2002). Therefore, the present study investigated the impact of emotions during an animated movie clip (i.e., happy, neutral, sad) on social modeling effects on food intake among children. It was hypothesized that social modeling behavior would be significantly stronger during the sad and happy movie than during the neutral movie.
Experimental methods

Design and participants

A between-participants experimental design included three different movie clips (happy, neutral, and sad) with varied peer food intake (no intake versus standardized intake). The participants and confederates (i.e., instructed peers) were randomly assigned to form a dyad on an ad hoc basis with the criteria that they be the same sex but not classmates. The dyads were randomly assigned to one of the six experimental conditions. The children participated in the study either as a participant or a confederate. To avoid a confederate effect, each confederate was paired with a participant only once. The confederates were normal-weight only. They were instructed to eat nothing (no-intake condition) or 10 chocolate-coated peanuts (standardized intake condition).

A total of 281 children from 14 urban and suburban schools in the Netherlands secured written consent from their caregivers to participate. All schools that participated in this study were schools of which more than 70% of the children had a West-European or Dutch background. Thirty-nine children did not participate because they took sick leave, had other educational obligations, or were excluded due to food allergies. Nine dyads (i.e., 18 children) were excluded from analysis because the confederate (6) or participant (3) did not follow instructions during the experiment. The final sample consisted of 112 dyads in which the children were either the participant or the confederate. This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects/patients were approved by the ethics committee of the Faculty of Social Sciences, Radboud University Nijmegen, the Netherlands. Written informed consent was obtained from all subjects.

The final sample consisted of 112 participants (51.8% boys) of which 11.6% were underweight, 77.7% were normal weight, and 10.7% were overweight or obese (see body mass index (BMI) classifications below). The mean age (±SD) in grade 2 (n = 55) was 7.31 (±.51) years and in grade 3 (n = 57) 8.23 (±.57) years. Dietary restraint and emotional eating were measured using the Dutch Eating Behaviour Questionnaire for children (DEBQ-C) (van Strien & Oosterveld, 2008) with response categories on a 3-point Likert-scale. Restrained eating (α = .68) and emotional eating
(α = .59) were low with a mean score of .64 (SD = .45, min. 0 – max. 2) and .40 (SD = .35, min. 0 – max. 1.57), respectively. Participants were therefore characterized as normal eaters.\textsuperscript{12}

\textit{Setting and procedure}

The experiments were conducted in the children’s primary schools from April through November 2011 with the exception of summer holidays in July and August. All experiments were conducted within two schooldays between 8:30 AM and 3:30 PM. The experiment took place in a room that was furnished with two chairs next to each other in front of the laptop on a table. The two bowls of chocolate-coated peanuts and glasses of water stood on either side of the laptop. Each of the three movies lasted 11 minutes and 12 seconds. A video camera was placed on a tripod at the side of the table to videotape the children. The few children who inquired about the video camera were told that the session was videotaped to capture their reactions during the movie.

Before the participants entered the room, they were told that there would be food and water available and that they could eat as little or as much of the food as they desired. A cover story was delivered to avoid effects that might be triggered by suspicion about the research topic. That is, moviemakers (i.e., the experimenters) had created a new version of Walt Disney's \textit{Bambi} and they were interested in the children's evaluations of the movie. In addition, the confederates were involved in an extra task: a secret mission which was related to children’s skills to carry out a task while keeping it a secret. Each confederate was instructed before the participant entered the room; they were asked to eat a chocolate-coated peanut only when they were signalled by “the buzzer,” which was a hidden small vibrating device that could be set off by the experimenter to control the timing and interval of the confederate’s food intake (cf. Bevelander, et al. (2012b)). The confederates were buzzed immediately after the experiment started and every minute thereafter until a total of 10 chocolate-coated peanuts had been eaten. The confederates in the no-intake condition were asked not to eat the food during the movie. After the movie ended, the confederate was

\textsuperscript{12} Two children had a maximum score of 2 on restrained eating. Whether restraint eating affected the main findings was tested, but this was not the case.
CHAPTER 7

enquired about their accomplishment related to the secret mission while the participant was administered a questionnaire in another room by an experimenter. The participants were assured that their answers would be kept confidential. All children were debriefed in class after the completion of data collection at the school.

Materials and measures

Movie clips. The movie clips were played on a laptop (Hewlett Packet, Compaq 6710b, 15.4-inch screen, 1280 x 800 pixels) with an integrated amplifier and speaker system (Target, TRG-S50, 50 watts power output) on each side of the laptop. A sad, happy, and ‘neutral’ movie clip of Walt Disney’s Bambi was created by mixing a renovated version of the old-fashioned movie from 1942 (Bambi I) and the modern sequel from 2006 (Bambi II) (a detailed description of the movie clips is available from the corresponding author on request). The overall valence of the movie clips was evaluated by 5 same-aged school children who watched at least two clips to be able to compare the movie content. Evaluations confirmed that the movies could be categorized as sad, happy and ‘neutral’. The purpose of the neutral movie was to show a movie clip that contained neither sad nor happy events. In this way, the movie was regarded as ‘neutral.’ Each movie clip started in a sad, neutral, or cheerful way (e.g., dramatic violin music in combination with scenes of a dark forest, lighter music behind scenes in a light part of the forest, or a very cheerful song with singing birds in a sunny forest, respectively). These scenes were followed by the birth of Bambi which was similar for all three movies, and continued with a different sad, neutral or happy story again. During the movie clips, Disney’s original music from Bambi I and II were used.

Arousal. To test whether the movie conditions differed in emotional arousal, a modernized version of the black and white drawings (i.e., the smiley faces were full color) of the nonverbal scale of emotion (ANSE) (Lay, Waters, & Park, 1989) was assessed by means of a computer task prior to the movie and immediately after the movie. The ANSE includes nine smiley faces that represent high, middle or low degrees of pleasure and arousal. Each child was shown all possible pairs of faces (N = 36) and they were asked to choose the face of the pair which resembled their feeling most. If the participants chose the face that showed higher
arousal, this would add 1 point to the overall arousal score. The choices between the nine similar face pairs did not contribute to the overall score. Thus, a higher score indicated a higher level of arousal, and the minimum score was 0 and the maximum 27.

Food intake. The experimenter weighed the bowls of snack food before and after each session using a digital scale (Kern 440, Kern & Sohn, Balingen, Germany). The consumed grams (gr.) of test food were used as the dependent variable in the analyses.

Body weight. The experimenter measured height and body weight according to standard procedures (without shoes but fully clothed). Height was measured to the nearest of 0.1 cm using a stadiometer (Seca 206, Seca GmbH & Co., Hamburg, Germany) and weight was measured to the nearest of 0.1 kg using a digital scale (Seca Bella 840, Seca GmbH & Co.). The body mass index (BMI) for each child was calculated using the formula: weight [kg]/height² [m]. BMI (z-score) for boys and girls was determined by means of current z-BMI standards and cut off points for Dutch children (StichtingVoedingscentrumNederland, 2011a). This study refers to overweight as well as obese children due to the small number of obese children (n = 4) in the study sample.

Measurements questionnaire

Sadness and happiness. To indicate how the participants felt after watching the movie clip, they were asked to rate their feelings directly after the movie ended. As people can feel happy and sad at the same time (J. T. Larsen, McGraw, & Cacioppo, 2001), the participants had to indicate their feelings on two separate visual analogue scales (VASs) to measure their happiness (0 mm, neutral; 145 mm, happy) and sadness (0 mm, neutral; 145 mm, sadness). There was a sad looking face or a smiley face at the ends of the VAS scales to indicate the range of the scale to the children.

Liking of the movie clip. To measure the extent to which the participants liked the movie, a VAS was used (0 mm, do not like at all; 150 mm, like it a lot) with a sad looking and smiley face at the start and end of the scale, respectively.

Liking of the test food. The participants were asked to indicate how much they liked the test food on a VAS (0 mm, not at all; 150 mm, very much) (Bevelander, et al., 2012b) with a sad looking and smiley face at the start and end of the scale, respectively.
Familiarity with the confederate. To measure the extent to which the participants knew the confederates, a VAS was used (0 mm, do not know him/her at all; 150 mm, know him/her very well) (Bevelander, et al., 2012b).

Hunger. To conceal the real aim of the study, participants’ subjective hunger state was measured after the experiment. The participants indicated their hunger on a VAS (0 mm, not hungry at all; 150 mm, very hungry) (Bevelander, et al., 2012b).

Time of day. Afternoons are more common snack times than mornings (Cross, et al., 1994). In practice, it was impossible to test the children at the same time of day. In addition to hunger status, the actual time of day on which the participant started the session was controlled for in the analysis (Bevelander, et al., 2012b).

Estimation of the peer’s food intake. To test whether the participants were conscious of the peer’s food intake, the children were asked if they could estimate the peer’s food intake after watching the movie clip. Children who could not make an estimation (n=10) were excluded from the analysis.

Analytical strategy

Data were analyzed using SPSS for Windows (version 17.0, 2008, SPSS Inc., Chicago, IL, US). Alpha was set at $P<.05$. First, randomization checks were performed to test whether there were differences between experimental conditions on age, sex, BMI (z-score), hunger, time of day, liking of the test food, liking of the movie clip, and familiarity with the confederate. Also, manipulation checks were performed to determine whether the movie clips had an impact on participants’ emotional state by means of independent t-tests with participants’ feelings of sadness and happiness compared to the happy, neutral, and sad movie conditions. In addition, it was tested whether arousal was the same for all three movie clip conditions by means of a 3 x 2 two-way mixed analysis of variance with the between-subjects factor movie clips (happy, neutral, and sad) and the within-subjects factor arousal measurement before and after the movie clip.

Second, Spearman’s rank and Pearson’s correlations were performed for the model variables on food intake to determine which variables had to be controlled for in the main analyses. An analysis of covariance (ANCOVA) was performed to examine the main effects for the movie conditions (sad, neutral, or happy) and intake conditions (no-intake or intake condition).
on the total food intake (gram) and the interaction effect between the movie conditions and the experimental conditions on the total food intake (gram). Additional analyses were performed to test whether participants in the neutral movie clip condition were less distracted by the movie content and had a more accurate estimation of the peer’s food intake than participants in the sad or happy movie clip condition.

Pairwise comparisons with Bonferroni correction were carried out to determine significant differences between the intake conditions. In a between-subjects design, approximately 20 participants per group are required to detect a moderate to large effect size (Cohen, 1992). Cohen’s $f^2$ effects size was calculated to assess the effect size over the conditions and effect sizes .02, .15, and .35 were termed small, medium, and large, respectively (Cohen, 1988). Following a significant interaction, simple contrast comparisons were carried out to determine whether the food intake differed significantly across and between the food intake conditions for the three movies. A simple contrast analysis was used to break down the interaction term and look at the effect of one independent variable at individual levels of another independent variable. The test used the error term and degrees of freedom from the entire design (Field, 2005). In addition, the effect sizes between the intake conditions and movie conditions were calculated with Hedges’ $g$, which took into account sample size and accordingly adjusted to the overall effect size (Hedges & Olkin, 1985). Effect sizes .20, .50, and .80 were termed small, medium, and large, respectively.

**Results**

*Randomization checks*

Randomization checks were performed by using one-factor analysis of variance and Pearson’s $\chi^2$ tests to test for differences among the experimental groups for the variables age, sex, BMI (z-score), hunger, time of day, liking of the test food, liking of the movie clip, familiarity with the confederate, and restrained and emotional eating. Table 7.1 summarizes the means and SDs for all variables across each condition. The variable time of day was significantly different between groups ($P = .03$). Therefore, time of day was controlled for in the main analyses.
Table 7.1. Randomization checks for variables of age, sex, BMI (z-score), hunger, confederate measured by confederate intake and movie condition¹²

<table>
<thead>
<tr>
<th>Variables</th>
<th>Confederate no-intake condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sad (n=19)</td>
</tr>
<tr>
<td>Age</td>
<td>7.89 (.86)</td>
</tr>
<tr>
<td>7 - 9</td>
<td>7 - 9</td>
</tr>
<tr>
<td>Sex (boy/girl) (n/n)</td>
<td>10/9</td>
</tr>
<tr>
<td>BMI (z-score)</td>
<td>.19 (1.12)</td>
</tr>
<tr>
<td>-2.01 - 1.92</td>
<td>-2.00 - 2.97</td>
</tr>
<tr>
<td>Hunger¹</td>
<td>48.68 (39.70)</td>
</tr>
<tr>
<td>0 - 121</td>
<td>0 - 145</td>
</tr>
<tr>
<td>Time of day</td>
<td>12:06 (1:59)</td>
</tr>
<tr>
<td></td>
<td>8:45 - 14:45</td>
</tr>
<tr>
<td>Liking test food</td>
<td>98.58 (44.39)</td>
</tr>
<tr>
<td>11 - 145</td>
<td>37 - 145</td>
</tr>
<tr>
<td>Liking of the movie clip</td>
<td>109.84 (33.35)</td>
</tr>
<tr>
<td>7 - 145</td>
<td>55 - 145</td>
</tr>
<tr>
<td>Familiarity confederate</td>
<td>94.00 (42.03)</td>
</tr>
<tr>
<td>6 - 145</td>
<td>55 - 145</td>
</tr>
</tbody>
</table>

¹ All values are in means (SD), minimum - maximum.
² Reflects the differences in total means between intake conditions by single factor ANOVA or Pearson’s χ² test.

Manipulation checks

Independent t-tests were performed between feelings of happiness and sadness to test whether the movies had the effect of inducing happiness after the happy movie clip and sadness after the sad movie clip. For feelings of happiness, there was a significant difference between the happy (M = 104.24 ± SD 46.34) and the sad (M = 82.5 ± SD 42.76) movie (t(77) = -2.16, P = .03). There were no significant differences between the happy and neutral (M = 95.24 ± SD 42.44) or the sad and neutral movie conditions (P > .05), which indicated that the participants were not feeling more or less happy after seeing the neutral movie clip compared to the happy and sad movie clip.

For feelings of sadness, there was a significant difference between the sad (M=46.53 ± SD 39.28) and happy (M=23.51 ± SD 29.56) movie condition (t(77) = 2.96, P = .004) as well as the sad and neutral (M=25.33 ± SD 31.08) movie condition (t(69) = 2.49, P = .015). There was no significant difference between the happy and neutral movie condition (P > .05). Although
time of day, liking of the test food and movie clip, and familiarity with the

<table>
<thead>
<tr>
<th>Confederate standardized intake condition</th>
<th>P value 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sad (n=19)</td>
<td>Neutral (n=18)</td>
</tr>
<tr>
<td>7.79 (.85)</td>
<td>7.78 (.55)</td>
</tr>
<tr>
<td>7 - 10</td>
<td>7 - 9</td>
</tr>
<tr>
<td>8/11</td>
<td>10/8</td>
</tr>
<tr>
<td>.47 (1.15)</td>
<td>.20 (1.00)</td>
</tr>
<tr>
<td>-1.38 - 3.00</td>
<td>-1.37 - 2.02</td>
</tr>
<tr>
<td>30.89 (37.45)</td>
<td>62.94 (43.12)</td>
</tr>
<tr>
<td>0 - 131</td>
<td>0 - 144</td>
</tr>
<tr>
<td>10:35 (1:54)</td>
<td>10:22 (1:22)</td>
</tr>
<tr>
<td>8:50 - 14:45</td>
<td>8:45 - 13:10</td>
</tr>
<tr>
<td>90.89 (38.50)</td>
<td>104.89 (44.04)</td>
</tr>
<tr>
<td>2 - 145</td>
<td>1 - 145</td>
</tr>
<tr>
<td>108.21 (32.64)</td>
<td>121.89 (20.30)</td>
</tr>
<tr>
<td>33 - 145</td>
<td>78 - 145</td>
</tr>
<tr>
<td>80.84 (53.36)</td>
<td>98.11 (35.29)</td>
</tr>
<tr>
<td>0 - 145</td>
<td>18 - 145</td>
</tr>
</tbody>
</table>

the dominant reported feeling was happiness, the participants felt the happiest after watching the happy and neutral movies and the saddest after watching the sad movie.

Repeated ANOVA measures revealed that participants had an average but decreased arousal state after seeing the movie clips (before \( M = 14.65 \pm .29 \); after \( M = 13.86 \pm .33 \) \( F_{1,108} = 7.65, P = .007, Cohen's f^2 = .27 \)), and there were no differences between the movie clips in arousal \( (P >.05) \). Although the children were more aroused before entering the experiment than afterward, the change was the same for all experimental conditions. This means that any differences in food intake between the movie clip conditions were not caused by differently affected arousal states (e.g., anxiety, stress, excitement).

**Main analysis**

To determine which variables had to be controlled for in the main analysis, Spearman’s rank and Pearson’s correlations were performed for
the model variables of age, sex, BMI (z-scores), hunger, liking of the test food, liking of the movie clip, familiarity with the confederate, restrained and emotional eating, and food intake. Hunger ($r = .30, P = .001$), liking of the test food ($r = .35, P < .001$), and familiarity with the confederate ($r = .23, P = .02$) were statistically controlled for since these variables correlated significantly with participants’ food intake. Time of day was controlled for since manipulation checks showed that there were differences between experimental groups.

The main goal of this study was to test whether exposure to happy, neutral, or sad media content influences social modeling effects of (snack) food intake in young children. ANCOVA revealed that the covariates hunger ($F_{1,102} = 13.37, P < .001$, Cohen’s $f^2 = .33$), liking of the test food ($F_{1,102} = 9.12, P = .003$, Cohen’s $f^2 = .27$), and familiarity with the confederate ($F_{1,102} = 8.55, P = .004$, Cohen’s $f^2 = .26$) had a significant effect on food intake, but not time of day ($P = .17$). A significant main effect was found for the intake condition on the food intake ($F_{1,102} = 3.94, P = .05$, Cohen’s $f^2 = .16$) with a significant difference between the no-intake ($M = 28.28 \pm \text{SEM 3.23 gr.}$) and standardized intake condition ($M = 37.44 \pm \text{SEM 3.11 gr.}$) ($P = .05$, $g = .38$). There was no main effect of movie condition ($P = .64$) on food intake. Moreover, a significant interaction was found between the intake condition and the movie condition on food intake ($F_{2,102} = 3.30, P = .04$, Cohen’s $f^2 = .20$). In this analysis, the model explained 31.1% of the variance in food intake. The model was also tested with BMI z-score as an additional covariate, but this had no effect on food intake ($P = .59$) or on the main findings (interaction between intake condition and movie clip $F_{2,101} = 3.21, P = .045$).

Figure 7.1 shows the number of grams consumed for the different movies, adjusted for hunger, liking of the test food, time of day, and familiarity with the confederate. The intake condition affected children differently based on the movie they watched. Simple contrast comparisons across the intake conditions showed a significant difference between the confederate’s no-intake ($M = 22.35 \pm \text{SEM 5.42 gr.}$) and the standardized intake condition ($M = 38.47 \pm \text{SEM 5.50 gr.}$) in the sad movie condition ($P = .04$, $g = .66$) and between the no-intake ($M = 25.99 \pm \text{SEM 5.24 gr.}$) and the standardized intake condition ($M = 44.81 \pm \text{SEM 5.02 gr.}$) of the happy movie condition ($P = .01$, $g = .80$). The participants’ food intake in the neutral movie condition did not differ significantly between the no-intake
Figure 7.1. Consumed palatable food intake (gram) for each movie clip

(M = 36.53 ± SEM 6.01 gr.) and standardized intake condition (M = 29.05 ± SEM 5.51 gr.) (P = .36, g = .31). Within the standardized condition, there was a significant difference between the intake in the happy movie condition (M = 44.81 ± SEM 5.02 gr.) and the neutral movie condition (M = 29.05 ± SEM 5.51 gr.) (P = .04, g = .67). This means that participants’ food intake was affected by the food intake of a peer in the happy and sad movie clips, but not in the neutral movie clip.

Additional analyses

Additional analyses were performed to test whether participants in the neutral movie clip condition may have been less distracted by the movie content and had a more accurate estimation of the peer’s food intake than participants in the sad or happy movie clip condition. Analysis of variance with intake condition and movie clip condition on the estimated peer’s food intake showed a significant interaction between the movie clip and intake condition on the estimated amount of food consumed by the peer ($F_{2,94} = 3.23$, $P = .04$, Cohen’s $f^2 = .22$). Post hoc analysis with Bonferroni correction revealed that children who watched the neutral movie clip indeed estimated the peer’s food intake more accurately than children in the sad ($P = .02$) or happy (although not significant ($P = .10$)) movie clip condition.
Discussion

The present study is the first to report the role of emotions on social modeling of food intake among 7- to 10-year-olds by combining a social modeling experiment with emotions induced by means of happy, neutral, or sad movie clips. The presence of an eating peer in combination with exposure to movie clips affected the children’s food intake differently. Watching positive and negative movie clips led to adjustment to the intake of a peer, as compared to that of children who watched a neutral movie clip.

As expected, social modeling of food intake occurred in the sad as well as the happy movie clip condition; however, it did not occur in the neutral condition. An explanation can be found in the literature which has shown that people become less thoughtful (or ‘mindful’) and respond more automatically as their cognitive functioning decreases due to coping with changes in their emotional state and routine (Baumeister, et al., 2007; Dolinski, 2001; Langer, 1992; Wansink, 2006). It is possible that the children mindlessly followed the peer's food intake because they were more emotionally engaged in the sad or happy movie clips compared to the neutral movie clip. The sad movie clip told a story of cheerless, pitiful, and disappointing events and the happy movie clip was a story with a series of humorous, entertaining, and joyful happenings. As the movies cannot maintain the same sad or happy affective tone for 10 minutes, the children had to deal with emotional changes throughout the stories which might have made other processes (such as eating or not) more automatic. In contrast, the neutral movie content might have been entertaining to watch but less profound to deal with as there were no strong affective events in the story. Speculatively, the children who were watching the neutral movie clip may have been in a less mindless state than children who were watching the happy or sad movie clip which could have affected their susceptibility to the intake of the peer. Findings on the accuracy of the estimation of how much their peer ate support this line of reasoning; that is, children who were watching the neutral movie had a better estimation of their peer's food intake than children who watched the sad or happy movie clip.

Additionally, ‘emotional contagion’ might have added to the social modeling effect in the sad and happy movie clips (Neumann & Strack,
2000). People are found to respond compassionately and unconsciously to other people’s emotional states (Neumann & Strack, 2000; Van Baaren, Fockenberg, Holland, Janssen, & Van Knippenberg, 2006). As the children watched the movie together, it is possible that they have shared the same emotions, which made the experience of watching the sad or happy movie more intense, whereas this was not the case during the neutral movie condition (Iacoboni, 2009). Similar to findings in adults, consuming large amounts of foods or ‘loss of control’ has been related to both emotional and external eating (e.g., eating in response to food-related stimuli) in children (Braet & van Strien, 1997; Tanofsky-Kraff et al., 2007). Loss of control is viewed as a problem with affect regulation; children who eat large amounts of food try to regulate and reduce their negative feelings through the consumption of food (Goossens et al., 2007). A study of Tanofsky-Kraff et al. (2007) found that children also ate in response to positive feelings when palatable food was available. Given that the children in the current sample were primarily categorized as ‘normal eaters,’ the experience of watching the movie together with a peer might have increased their emotional engagement.

Furthermore, the current findings provide more insight into eating behavior while watching TV. Ample studies have shown the effect of watching TV on children’s (increase in) weight due to reduced physical activity and increase in food intake (see for review Coon & Tucker, 2002). It has been argued that watching TV exposes people to food-related stimuli (e.g., food advertisements or eating actors) which increase food intake. In the current study, however, the children were not exposed to any food-related stimuli on TV. Therefore, the findings support an additional explanation that individuals may overeat when watching TV in general because they are distracted and not aware of their consumption (Bellisle, et al., 2004; Hetherington, et al., 2006; Wansink, 2006). The current findings broaden this scope by providing evidence that food intake is influenced by experiencing negative or positive emotions while watching TV with someone else. Future studies in mindless eating and (cognitive) distraction factors (such as watching TV) that include the social context are warranted.

Some limitations should be noted. First, inducing emotions in children might be more complicated than in adolescents and adults. Exposing children to an emotion induction of the same intensity or severity as
in older individuals would be unethical (Brenner, 2000). Although the children reported to feel most happy after seeing the happy movie compared to the sad movie and most sad after the sad movie compared to the happy and neutral movies, it might seem ambiguous that they felt mainly happy after watching the movie clips. Nonetheless, this is in line with several diary studies in early adolescents and adults which show that people experience positive affect in general (R. Larson & Lampman-Petratis, 1989; Schneiders et al., 2006). Negative events were found to lower positive affect but do not rule out positive feelings because people are capable of feeling sad and happy at the same time (e.g., joyful memories and sadness at a funeral) (J. T. Larsen, et al., 2001). In addition, the young children might have reported in ‘naïve superlatives’ even though they have considerable understanding of negative and positive emotions (Brenner, 2000; R. Larson & Lampman-Petratis, 1989). Second, our assessment indicated that children were more aroused before than after the movie clip. Qualitative impressions indicated that the children were thrilled to participate in the study. Children might have experienced their participation as more exciting than adolescents or adults who participate in a study. During the movie, they might have calmed down and became more relaxed. It is also possible that watching TV dampened cognitive activity which decreased the children’s arousal state. Nevertheless, they did not differ in baseline or post-measurement due to the different movie clips, which means that the movies caused similar low arousal. As children watch movies at home that might indeed induce high arousal states (e.g., fear, tension), future research should investigate the impact on food intake in combination with high-arousal emotions. Third, the study did not include measurement of the confederate’s feelings after watching the movie clip. As people’s emotional state can be contagious, it is suggested to measure the peer’s feelings in future research. Fourth, the children’s subjective hunger status was measured only after the movie to conceal the aim of the study. Another strategy might be to measure the children’s subjective hunger before the study or assess when (or how much) they ate (during) their last meal. Fifth, we concentrated on palatable food intake. It would be interesting to test whether emotions in social modeling also apply to different kinds of food, such as low energy-dense foods or meals. Finally, the study sample included young normal eaters and did not account for normal, restrained, or emotional
adolescent or adult eaters. To enhance the generalizability of the current findings, it would be interesting to replicate this study to examine the effects on these groups as well.

In conclusion, this study has extended previous research as it shows the combined influence of emotions and peers on food intake. The research area related to emotions and food intake should broaden its scope and pay more attention to the impact of peers in eating situations. The findings demonstrate further evidence of the need for recommendations to reduce eating in front of the TV and might be of value to the development of intervention programs aimed at mindful eating contexts. Given that people often watch eventful TV programs together during meal time or have movie nights with snack foods, it is important to educate people about the joint impact of peers and watching TV on food intake. Moreover, as young children are not in the position to choose their food consumption environment yet, parents and schools should provide consumption settings that limit eating in front of the television.

**Acknowledgements**

The authors would like to acknowledge the teachers and school children of the primary schools and the students of the Hogeschool Arnhem and Nijmegen (HAN) for their help during the study. The present study was supported by a grant of the Behavioural Science Institute of the Radboud University Nijmegen, the Netherlands. The authors declare no personal or financial conflict of interest.
PART III
INTERVENTION
CHAPTER 8

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The effect of an intervention on schoolchildren’s susceptibility to a peer’s candy intake

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An intervention:
Monkey see, monkey don’t
Abstract

The aim of the study was to pilot test two interventions designed to reduce children’s susceptibility to peers’ candy intake and to determine if interventions had different effects on boys and girls. In the standard intervention, peer modeling was explained while communicating the importance of not following other’s food intake by means of photos, video clips and interactive tasks. A second animated intervention was similar but added a monkey puppet as a (cue) reminder. A social modeling component was conducted one day after the intervention to test whether the interventions affected the extent to which children model their peers’ eating. During the modeling session, the participants’ (N = 141; 78% boys, M age = 7.84 ± .72 y) solved a puzzle with a same-sex ‘confederate’ who was instructed to eat chocolate candy when he/she was covertly signaled. The monkey puppet was put in sight to test whether the monkey served as a cue reminder in the animated intervention. Candy intake was compared across control and intervention conditions. The standard intervention reduced candy intake in boys but not girls. Nevertheless, children still remained susceptible to a peer’s eating. There was no significant effect of the animated intervention on consumption. There are gender differences when children are exposed to an (over)eating peer. While interventions are effective, social norms can be powerful. Social networks should be leveraged when possible. The study is registered at the Dutch Trial Register: NTR3459.
Introduction

A major public health concern throughout the world is the rising rate of obesity. As eating most often takes place in the company of other people, the social environment is increasingly acknowledged as an appropriate target for interventions (N. Larson & Story, 2009; Shaikh, Yaroch, Nebeling, Yeh, & Resnicow, 2008). Numerous social modeling studies have shown that people tend to use their peers’ intake as a guideline or social norm for their own food intake (Bevelander, et al., 2012b; Herman & Polivy, 2005; Herman, et al., 2003; Salvy, de la Haye, Bowker, & Hermans, 2012). Adults, adolescents and children are found to adapt to a peer’s food choice and intake by choosing similar food products or eating the same amounts (Bevelander, et al., 2012b; Goldman, et al., 1991; Hermans, Larsen, et al., 2009; Vartanian, et al., 2008; Wansink & Ittersum, 2007). As children spend a large part of their time at school, schoolmates are critical in shaping eating behaviors (Fletcher, Bonell, & Sorhaindo, 2011). Intervention programs aimed at healthy eating by use of peer influence processes have proven the impact of school peers. For example, studies have shown that children were more willing to try and eat unfamiliar healthy foods, and that fruit and vegetable intake increased by means of peer or teacher modeling (Hendy, 2002; Hendy & Raudenbush, 2000; Horne, et al., 2004; Lowe, et al., 2004). The interventions are primarily directed at increasing healthy eating; however, to prevent obesity, children must also decrease unhealthy eating. To our knowledge, there exists no intervention that aims to reduce palatable food intake by raising children's awareness of peer modeling.

In general, social modeling studies test peer influence on food intake by means of same-sex dyads in which a naïve participant is paired with a peer who received instructions to eat a predetermined amount of food. In children, no sex differences have been found in social modeling of food intake. Young girls and boys chose or ate equally lower or higher amounts of foods as their peers (Bevelander, et al., 2012b; Hendy & Raudenbush, 2000; Salvy, Coelho, et al., 2007; Salvy, Vartanian, et al., 2008). Although girls and boys seem to exhibit similar modeling tendencies, an intervention to discourage peer modeling might impact them differently. For example, females have been found to be more influenced than males by health experts and health messages related to sweet snacks (Grogan, et al., 1997).
Increasing awareness of peer influence could enable children to become less susceptible to social modeling processes on snack food intake, with a potentially stronger effect on girls than boys.

In this study, an intervention was developed to educate children about the risk of automatically following a peer’s snack food intake and the resulting risk of eating unhealthy amounts of snack foods. As individuals are often unaware of the influence of their social environment (Croker, et al., 2009), it was assumed that a symbol or ‘cue reminder’ to trigger an individual’s resistance to external pressures might facilitate recall of the prevention message. Although little research has been done on these ‘cue reminders,’ a few studies have shown promising effects related to health behavior among youth (Dal Cin, et al., 2006; Kleinjan, et al., 2012). Therefore, a second animated version of the intervention was created in which a monkey puppet was used. The monkey ‘assisted’ the experimenter to communicate the intervention message and was also used as cue reminder during the social modeling component of the study in which the interventions’ effect was tested.

The aim of the present study was to evaluate whether the short intervention ‘Monkey see, monkey don’t’ increased young children’s awareness of peer influence on their candy intake. The effect of the intervention was tested by a social modeling session. For both the intervention types, it was hypothesized that children would be less susceptible to the peer’s intake and would eat less as compared to the children in the control group. In addition, it was expected that the interventions would have a stronger effect on girls than on boys.

**Experimental methods**

*Participants*

The participants were recruited through their primary school and with the written consent of their caregivers. **Figure 8.1** provides a flow diagram of the recruitment procedure. In total, 306 children participated either as a participant (i.e., 152 participants) or as a confederate. Eleven dyads were excluded from the analyses because the confederate did not follow instructions or the children misbehaved. Therefore, the final sample consisted of 141 participants (78% boys) with a mean (SD) age
Figure 8.1. Flow diagram recruitment procedure

of 7.84 (.72) years. The majority of the participants (77.3%) had a normal weight, 9.2% were underweight, 11.3% overweight and 2.1% obese. The present study was approved by the ethical committee of the Faculty Social Sciences, Radboud University Nijmegen.

Design

The study involved a 3 condition (control group; intervention group without a cue reminder (‘standard intervention’); intervention group with a cue reminder (‘animated intervention’)) x 2 (sex) between-participants experimental design. Children were randomized to each of the three conditions. This procedure did not result in significant demographic differences between the control and intervention groups (see Table 8.2 below for randomization checks).

Standard Intervention. In a short interactive lesson featuring photos, video clips and real life situations, the children were taught the meaning of peer modeling and why it is healthier to pay attention to how much they eat in the company of their peers. Figure 8.2 provides an overview of the final intervention after adjustments were made according to the outcomes of the pilot study.
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<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
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<tbody>
<tr>
<td>1 min</td>
<td>What do you see? Children describe photos of monkeys and people who are sitting in similar poses, and a series of photos in which a girl modeled another girl during lunch. She ends up eating more slices of bread with the same topping as her peer.</td>
</tr>
<tr>
<td>1-2 min</td>
<td>What is social influence? Children explain social influence in food choice and intake. Message communicated is that it is healthier to decide yourself what and how much to eat. Children are asked to share their examples of social influence situations.</td>
</tr>
<tr>
<td>1-2 min</td>
<td>What is happening here? Children discuss 2 videos which display the same eating situation as the study’s social modeling component: a same-sex dyad is seated opposite each other while drawing at a table. One of the children picks candy from their bowl and is followed by the other.</td>
</tr>
<tr>
<td>1 min</td>
<td>What have we learned? Message repetition (do not follow others in food intake) by asking children to fill in the blanks in sentences which represent the intervention message on the computer screen.</td>
</tr>
<tr>
<td>1 min</td>
<td>Little experiment: Monkey see, monkey don’t. Bowls of vegetables (cucumber, snack tomatoes) and fruit (grapes and apple slices) are on the table. First, the experimenter assigns the children to model, and she takes one slice of apple. Second, she assigns the children to not follow and she takes three tomatoes. The children’s actions are discussed (e.g., when children did not pick the same food but did pick the same quantity, this was identified as social influence).</td>
</tr>
<tr>
<td>9 min</td>
<td>What have we learned? Questions Repetition of message: to not follow others in food intake. Explain risk of overeating. Any questions?</td>
</tr>
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</table>

**Figure 8.2. Overview of the intervention**

The intervention was developed and evaluated in a pilot study that lasted from September until December 2011. A sample of 72 children (47.2% boys; M (±SD) age = 7.69 ± 1.26) at 8 primary schools in the Netherlands was used to verify the clarity of the content and to determine the appropriate duration of the intervention and the maximum number of children per intervention group. Adjustments were made based on the experimenters’ qualitative impressions and the children’s evaluations.
**Animated intervention.** Another intervention was evaluated in which a cue reminder in the form of a monkey puppet was added to the standard intervention. The monkey puppet was introduced by the experimenter at the start of the intervention and was used by the experimenter to explain peer modeling and to communicate the prevention message.

The participants received the interventions in small groups of 5 to 7 children in a classroom during 8 minutes of their morning break.\(^1\) The children received the intervention one day before the social modeling session was employed. To prevent the experimenter from serving as a cue reminder, the experimenter who conducted the interventions was not involved in the social modeling component of the study the next day. The control group was not exposed to an intervention.

**Setting and procedure social modeling part**

The study was conducted in the children’s primary schools on weekdays between 8:30 AM and 3:30 PM from February through July 2012. Children were randomized to the control or intervention conditions. The confederates (i.e., instructed peers) and participants were paired randomly on an ad hoc basis with the criteria that they were the same sex but not classmates. Each confederate was paired with a participant only once.

Each participant was placed opposite the confederate at a table with a 100-piece puzzle, two bowls of test food (colored chocolate candy with crispy rice center), and glasses of water. In the animated intervention condition, the monkey was put on the table next to the puzzle and between the two bowls of test food. The experimenters made sure that both the food bowls were filled above the brim before each session. The sessions (with a duration of 10 minutes) were videotaped.

Before the social modeling sessions, the participants were told a cover story to avoid effects that might be triggered by suspicion about the research topic. In addition, the confederates were told a cover story of a “secret mission” in order to convince them to keep their instructions secret. The confederates were instructed to eat one piece of candy when covertly signaled by the experimenter with a small vibrating device

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\(^1\) The school system at Dutch primary schools allows children to have a morning break of 20 minutes which is usually spend outside at the school playground
CHAPTER 8

(‘the buzzer’) concealed in either their pocket or sock (Bevelander, et al., 2012b). To control the timing of the confederates’ food intake, the buzzer was set to vibrate once per minute for the 10 minutes of the experiment (i.e., 10 times).

Before the participants entered the room, they were told that there would be food and water available and that they could eat as little or as much of the food as they desired. After 10 minutes, the participants were led to another room where a questionnaire was administered. Participants were informed that their answers would be kept confidential and their anonymity was ensured. The confederates were asked if they had been able to follow their instructions. Participants and confederates were revealed the true meaning of the study after the completion of data collection.

Measures

Body weight of participants and confederates. The experimenter measured individual height and body weight of the participants and the confederates according to standard procedures (without shoes but fully clothed). Height was measured to the nearest 0.1 cm using a stadiometer (Seca 217 Slider, Seca GmbH & Co., Hamburg, Germany) and weight was measured to the nearest 0.1 kg using a digital scale (Seca Bella 840, Seca GmbH & Co.). The body mass index (BMI) for each child was calculated using the formula: weight [kg]/height² [m]. BMI (z-score) for boys and girls was determined by means of current z-BMI standards and cut off points for Dutch children (StichtingVoedingscentrumNederland, 2011a).

Food intake. The experimenter weighed the bowls of candy before and after each modeling session using a digital scale (Kern 440, Kern & Sohn, Balingen, Germany). The consumed grams of candy were converted into kilocalories (kcal) and used as the dependent variable in the analyses.

Measurements questionnaire

Hunger. The participants had to indicate their hunger on a Visual Analogue Scale (VAS) (0 cm, not hungry at all; 15 cm, very hungry).

Liking of the test food. The participants were asked to indicate how much they liked the candy on a VAS (0 cm, not at all; 15 cm, very much) with a sad looking and smiley face at the start and end of the scale, respectively.

Liking of the task. The participants were asked to indicate how much they liked the task on a VAS (0 cm, not at all; 15 cm, very much) with a sad looking and smiley face at the start and end of the scale, respectively.
Liking of the confederate. To measure the extent to which the participants liked the confederate, a VAS was used (0 cm, do not like at all; 15 cm, like him/her a lot) with a sad looking and smiley face at the start and end of the scale, respectively.

Evaluation of the intervention. After the social modeling session, the participants who received an intervention were asked whether they liked the intervention and understood the intervention message, whether they could recall examples of social modeling and whether they suspected the puzzle task to be related to the intervention message. Specific and accurate examples from the intervention were coded as social modeling examples of food intake. Other examples were coded as unrelated to food intake or erroneous examples. Also, the participants who were in the animated intervention group were asked whether they noticed anything special during the puzzle task (in order to give them the opportunity to mention the monkey without triggering their memory). If participants did not mention the monkey, they were asked whether they noticed the monkey on the table during the puzzle.

Analytical strategy

To give an indication of how participants perceived the interventions and the modeling session, qualitative impressions were tested with chi-square tests and presented in percentages. Randomization checks were performed using one-way ANOVA to test for differences among the control and intervention conditions. Pearson’s correlations were performed for the model variables and candy intake (kcal) to determine which variables had to be controlled for in the main analyses. To examine the effect of the interventions and sex on candy intake (kcal), two analyses of covariance (ANCOVA) were conducted by testing the control condition versus the intervention conditions separately. In addition, the three conditions were tested in one model. Following the ANCOVA’s, simple effects analyses were performed to examine the interaction effect between sex, and the control and intervention conditions, or the main effects on the total candy intake (kcal). Cohen’s $f^2$ effects size was calculated to assess the effect size over the conditions (Cohen, 1988). In a between-subjects design, approximately 20 participants per group are required to detect a moderate to large effect size (Cohen, 1992). In addition, the effect sizes between the control and intervention conditions and sex were calculated with Hedges $g$, which takes into account sample size and accordingly adjusts to the overall effect size (Hedges & Olkin, 1985).
Results

Descriptives

Overall, the majority of boys (81%; N = 42) and girls (86.4%; N = 44) reported that they enjoyed the interventions and that the intervention message was clear (95.2% boys; 90.0% girls). Table 8.1 shows the evaluation of the intervention and social modeling session. Chi-square tests revealed that there were no significant differences between boys and girls within or between the intervention conditions (all P-values >.05).

<table>
<thead>
<tr>
<th>Table 8.1. Evaluation of the standard and animated intervention†</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td>Recall examples from intervention related to social modeling</td>
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<tr>
<td>of food intake</td>
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<tr>
<td>Accurate recall</td>
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<tr>
<td></td>
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<tr>
<td>Erroneous/unrelated examples</td>
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<tr>
<td>No examples</td>
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<tr>
<td>Linking the intervention message to the social modeling</td>
</tr>
<tr>
<td>session</td>
</tr>
<tr>
<td>Yes</td>
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<tr>
<td>Some suspicions</td>
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<tr>
<td>No</td>
</tr>
<tr>
<td>Recall of the cue reminder (monkey puppet)</td>
</tr>
<tr>
<td>Recall</td>
</tr>
<tr>
<td>Recall after the experimenter elicited a response</td>
</tr>
<tr>
<td>No recall of the monkey puppet during the modeling session</td>
</tr>
</tbody>
</table>

†Chi-square tests revealed that there were no significant differences in sex or intervention conditions (all P-values >.05).

Randomization checks

Randomization checks were performed to test for differences between the control and intervention conditions in age, sex, BMI (z-score) of the participant and the confederate, hunger, liking of the candy and liking of
the confederate. Table 8.2 summarizes the means and standard deviations (SDs) for all variables across the conditions. No differences \( (P > .05) \) were found between the control and intervention conditions, which indicated that randomization was successful.

**Main analyses**

To determine which variables had to be controlled for in the main analysis, Pearson’s correlations \( (N = 141) \) were calculated for the model variables. Age, participant’s and confederate’s BMI (z-scores), liking of the task and liking of the confederate did not correlate significantly with candy intake \( (P > .05) \). Hunger \( (r = .30, P < .001) \) and liking of the candy \( (r = .31, P < .001) \) were related to candy intake and entered into the model as covariates.

**Standard intervention.** The covariate hunger \( (F_{1,92} = 6.07, P = .02, \text{Cohen’s } f^2 = .23) \) had a significant effect on the candy intake of the participants, but liking of the candy \( (P = .10) \) did not. There was a marginal significant effect of the standard intervention condition on candy intake \( (P = .07; \text{as compared to control condition}) \) and no effect of sex \( (P = .19) \) on candy intake. Moreover, there was a significant sex-by-condition interaction on candy intake \( (F_{1,92} = 4.17, P = .04, \text{Cohen’s } f^2 = .18) \). Simple effects analysis showed that boys \( (M = 135.39 \pm SE 13.66) \) ate significantly more than girls \( (M = 76.03 \pm SE 18.72) \) in the control condition \( (P = .01, g = .73) \). Boys ate twice as less \( (P = .004, \ g = .81) \) in the intervention condition \( (M = 68.32 \pm SE 18.24) \) than in the control condition. In girls, there was no effect of the intervention condition on their candy intake \( (P = .98) \). The model explained 23.4% of the variance in candy intake. Figures 8.3a and 8.3b depict the amount of kcal consumed by the boys and girls, and the confederate during the modeling sessions for the control and intervention conditions, adjusted for hunger and liking of the candy. Boys limited their candy intake in the intervention group, and they ate amounts similar to girls. Notably, the children did not consume less than the confederate in the control or the standard intervention condition.

**Animated intervention.** The covariates hunger \( (F_{1,92} = 5.02, P = .03, \text{Cohen’s } f^2 = .20) \) and liking of the candy \( (F_{1,92} = 7.03, P = .01, \text{Cohen’s } f^2 = .25) \) had an effect on candy intake. There was a main effect of sex \( (F_{1,92} = 5.42, P = .02, \text{Cohen’s } f^2 = .21) \) on candy intake, however, there was no effect of the intervention on candy intake \( (P = .34) \). Overall, boys ate significantly \( (P = .02, g = .74) \) more than girls \( (boys \ M = 133.26 \pm SE 14.35 \)
Table 8.2. Randomization checks of variables measured by control and intervention

<table>
<thead>
<tr>
<th>Variables</th>
<th>Sex</th>
<th>Boys (n = 36)</th>
<th>Girls (n = 19)</th>
<th>Total (n = 55)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td></td>
<td>7.86 ± .64</td>
<td>7.79 ± .79</td>
<td>7.84 ± .69</td>
</tr>
<tr>
<td></td>
<td>7–9</td>
<td>7–10</td>
<td>7–10</td>
<td></td>
</tr>
<tr>
<td>BMI participant</td>
<td></td>
<td>16.19 ± 1.59</td>
<td>16.25 ± 1.93</td>
<td>16.21 ± 1.69</td>
</tr>
<tr>
<td>BMI confederate</td>
<td></td>
<td>17.28 ± 2.32</td>
<td>16.57 ± 1.71</td>
<td>17.03 ± 2.14</td>
</tr>
<tr>
<td></td>
<td>14.73–23.59</td>
<td>13.70–20.54</td>
<td>13.70–23.59</td>
<td></td>
</tr>
<tr>
<td>Hunger</td>
<td></td>
<td>5.85 ± 4.58</td>
<td>4.97 ± 3.73</td>
<td>5.55 ± 4.30</td>
</tr>
<tr>
<td></td>
<td>0.00–15.00</td>
<td>0.00–10.90</td>
<td>0.00–14.50</td>
<td></td>
</tr>
<tr>
<td>Liking test food</td>
<td></td>
<td>12.26 ± 36.19</td>
<td>11.81 ± 3.45</td>
<td>12.11 ± 3.54</td>
</tr>
<tr>
<td></td>
<td>1.50–15.00</td>
<td>2.80–15.00</td>
<td>1.50–15.00</td>
<td></td>
</tr>
<tr>
<td>Liking of task</td>
<td></td>
<td>12.30 ± 2.76</td>
<td>13.19 ± 1.93</td>
<td>12.61 ± 2.52</td>
</tr>
<tr>
<td></td>
<td>6.70–15.00</td>
<td>7.40–15.00</td>
<td>6.70–15.00</td>
<td></td>
</tr>
<tr>
<td>Liking confederate</td>
<td></td>
<td>13.17 ± 2.19</td>
<td>11.92 ± 2.48</td>
<td>12.74 ± 2.33</td>
</tr>
<tr>
<td></td>
<td>5.70–15.00</td>
<td>7.00–15.00</td>
<td>5.70–15.00</td>
<td></td>
</tr>
</tbody>
</table>

1 Values are in means ± SDs, minimum – maximum
2 Reflects the differences in total means between intake conditions by one-factor ANOVA

Figure 8.3a. Candy intake (kcal), adjusted for hunger and liking of the candy, in the control and standard intervention condition for boys and girls
### Table

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Standard Intervention</th>
<th>Animated Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>Girls</td>
<td>Total</td>
</tr>
<tr>
<td>(n = 21)</td>
<td>(n = 22)</td>
<td>(n = 43)</td>
</tr>
<tr>
<td>7–9</td>
<td>7–9</td>
<td>7–9</td>
</tr>
<tr>
<td>8.00 ± .70</td>
<td>7.82 ± .80</td>
<td>7.91 ± .75</td>
</tr>
<tr>
<td>16.47 ± 2.39</td>
<td>16.79 ± 2.35</td>
<td>16.61 ± 2.32</td>
</tr>
<tr>
<td>16.01 ± 0.91</td>
<td>16.47 ± 1.49</td>
<td>16.30 ± 1.29</td>
</tr>
<tr>
<td>5.36 ± 3.68</td>
<td>4.72 ± 3.29</td>
<td>05.04 ± 3.41</td>
</tr>
<tr>
<td>0.00–11.70</td>
<td>0.50–13.80</td>
<td>0.00–13.80</td>
</tr>
<tr>
<td>13.32 ± 17.10</td>
<td>09.00 ± 3.01</td>
<td>11.62 ± 2.95</td>
</tr>
<tr>
<td>7.50–15.00</td>
<td>5.40–15.00</td>
<td>5.40–15.00</td>
</tr>
<tr>
<td>12.25 ± 29.37</td>
<td>12.47 ± 2.71</td>
<td>12.37 ± 2.79</td>
</tr>
<tr>
<td>6.60–15.00</td>
<td>4.30–15.00</td>
<td>4.30–15.00</td>
</tr>
<tr>
<td>13.23 ± 1.66</td>
<td>12.00 ± 2.02</td>
<td>12.60 ± 1.93</td>
</tr>
<tr>
<td>9.20–15.00</td>
<td>7.40–15.00</td>
<td>7.40–15.00</td>
</tr>
</tbody>
</table>

**Figure 8.3b.** Candy intake (kcal), adjusted for hunger and liking of the candy, in the control and animated intervention condition for boys and girls.
versus girls \( M = 74.37 \pm SE 19.63 \). There was no interaction effect between the intervention condition and sex \( (P = .34) \) on candy intake.

**Additional analysis**

As there were two interventions, we also tested the potential differential effects of the interventions in a final step. The covariates hunger \( (F_{1,133} = 6.29, P = .01, \text{Cohen’s } f^2 = .19) \) and liking for the candy \( (F_{1,133} = 7.92, P = .006, \text{Cohen’s } f^2 = .22) \) had a significant effect on candy intake. There were no main effects of sex \( (F_{1,133} = 2.99, P = .09, \text{Cohen’s } f^2 = .12) \) or intervention condition \( (F_{1,133} = 1.99, P = .14, \text{Cohen’s } f^2 = .12) \) on candy intake. There was a marginal sex-by-condition effect on candy intake \( (F_{2,133} = 2.71, P = .07, \text{Cohen’s } f^2 = .16) \). **Figure 8.4** gives an interpretation of the amount of kcal consumed by the boys and girls, and the confederate during the modeling sessions for the control and intervention conditions, adjusted for hunger and liking of the candy. Simple effects analysis showed no significant differences of candy intake between the two intervention conditions for boys or girls or within the intervention conditions between boys and girls (all \( P \)-values > .10).

![Figure 8.4. Reduced candy intake (kcal) for boys in the standard intervention](image-url)
Discussion

The present study was the first to examine whether a short intervention enables children to become less susceptible to the influence of a peer’s intake of palatable food. Boys limited their candy intake after being exposed to the standard intervention (without a cue reminder) compared to the control group, but there was no effect of the animated intervention (with a cue reminder) on their candy intake. For girls, neither intervention impacted their food intake compared to the control group. Furthermore, the findings showed that boys’ food intake was higher than girls in the presence of an eating peer. Although neither intervention showed an effect on the children’s social modeling behavior in particular, this study provides new insights into possible gender differences in social eating situations.

As there is little evidence of gender differences in children’s social modeling of eating, the finding that boys ate more than girls when in presence of an eating peer (i.e., in the control group) was rather surprising. Previous social modeling studies used a design where they compared situations in which the confederate peer ate nothing, a little or a large amount of food (e.g., Bevelander, et al., 2012b). The current study was designed differently by using a high intake situation only. Herman and Polivy (Herman, et al., 2003) suggest in their normative framework that people are inclined to eat as much of palatable foods as possible but that the presence and/or consumption of others inhibits their intake. In other words, social norms serve as a guideline for how much one is allowed to eat without eating socially inappropriate amounts. It is suggested that boys and girls differed in what they perceived to be socially inappropriate in a situation in which a peer continues eating. As boys are believed to have a higher energy requirement than girls, their social environment might grant them freedom to eat more in general (L. J. Cooke & Wardle, 2005; Fisher & Birch, 1999a; Torun, 2005). Also, ideal female body types are associated with ‘lightness’ in eating whereas the opposite is true for masculine eating styles (Rolls, Fedoroff, & Guthrie, 1991). So, the amount and type of food eaten by females has to be less substantial than by males (Chaiken & Pliner, 1987). Additionally, boys are found to engage less in social comparisons, have a lower sensitivity to their social environment and perceive less social pressure to convey a good impression of healthy
CHAPTER 8

eating (Grogan, et al., 1997; Hargreaves & Tiggeman, 2004; Jones, 2001; Salvy, et al., 2011). Thus, boys might have felt comfortable continuing eating the candy without perceiving a socially imposed ‘stop signal.’ Girls might not have perceived their peer’s intake as a “free-pass” and followed the guideline set by their peer to avoid eating inappropriately. As these explanations are speculative, research is warranted to investigate the role of gender in social eating contexts in children.

Furthermore, the findings showed that boys exposed to the standard intervention had lower candy intake compared to the control group, and that they ate amounts similar to girls. Girls were not affected by the intervention. In line with the reasoning in the above, it is possible that boys did not monitor their eating and were affected by the intervention compared to girls (Wardle et al., 2004). Interestingly, the children’s candy intake was not less than the peer’s intake but approximated the peer’s intake. Given that the intervention message was not to adapt to another’s snack food intake, it was expected that boys and girls would eat less than their peer. A possible explanation is that the children were too young to actually apply the intervention message. Research has shown that children have difficulties using nutrition messages (Lytle et al., 1997) and their understanding of the terms might have been too abstract for some of them. For example, the experimenters avoided the use of terms that could cause stigmatization or bullying (e.g., ‘overweight’ or ‘fat’), and used terms such as ‘healthy’ or ‘listening to their hunger feeling’ instead. As there were no clear guidelines for what exactly ‘healthy eating’ is, the children might have used their peer’s behavior as a benchmark for appropriate behavior. Furthermore, research has shown that people are often unaware of the influence of their social environment (Croker, et al., 2009). In this study, the majority of the children did not associate the intervention message with the social modeling session. In addition, it is possible that the confederate did not eat an amount that the participants regarded as a substantial (or ‘unhealthy’) amount of candy. Thus, the children might not have thought they were overeating when they followed the peer. All in all, it is speculated that the intervention raised awareness of ‘healthy eating’ in boys insofar as they limited their candy intake to the guideline set by their peer. It might be a regular tendency for girls to monitor their snack food intake while engaging in social comparisons.
The animated intervention did not impact the children’s candy intake compared to the control condition. It is possible that the children were distracted due to the use of the monkey puppet during the intervention lesson or the social modeling session, which might have affected them in processing or applying the intervention message. Alternatively, the monkey puppet might have worked against the intervention message. A tentative explanation can be found in theories explaining a ‘boomerang effect’ by referring to an increased motivation to engage in proscribed behavior (e.g., reactance theory (Brehm, 1966)). Similar findings have emerged from studies in which children’s palatable food intake is restricted. The restriction resulted in a heightened desire to eat the restricted foods. Boys especially exhibited stronger reactance as compared to girls (Fisher & Birch, 1999b). As the use of cue reminders in health behavior is relatively new, future research is warranted to account for the age of the target group.

Some limitations must be considered. First, the sample had mostly normal-weight and very few overweight and obese participants. Future research should test the impact of peer influence interventions in overweight and obese children as well. Second, the social modeling sessions were videotaped which might have affected the children’s candy intake. Qualitative impressions of the video recordings indicated that a majority of the participants did not notice the camera after they adapted to the new setting and concentrated on the puzzle task. Third, as mentioned above, the peer might not have set an eating norm which was considered as unhealthy by the children. It would be interesting to use an experimental design with at least one “unhealthy” condition in which a peer consumes a substantially high amount of snack. Finally, the children were exposed to the intervention only once. Future interventions could repeat exposure to the prevention message or incorporate this message into a larger intervention which not only warns against unhealthy but also promotes healthy eating.

Altogether, this was the first effort to develop a school-based intervention. Neither intervention resulted in reduced susceptibility to peer modeling of candy intake. For both boys and girls, peer influence seemed to be more powerful than the intervention message. Future interventions should tailor developmentally appropriate messages in order to inform children about the influences of their social network.
CHAPTER 8

As the findings suggest the strong impact of the social environment on children’s eating behavior, it is concluded that children profit most from being in the presence of family and peers with healthy eating habits. In addition, this study contributed new insights into possible gender differences in social eating situations. Future social modeling studies are warranted that include an additional condition in which the peer sets a high intake norm.

Acknowledgements

The authors thank the teachers and schoolchildren of the primary schools and the students of the Hogeschool Arnhem and Nijmegen (HAN) for their help during the study. The present study was supported by a grant of the Behavioural Science Institute of the Radboud University Nijmegen, the Netherlands. Julia Hastings-Black provided editorial assistance.
CHAPTER 9
General discussion
This dissertation aims to advance the understanding of peer modeling in young people’s food choice and intake. The current chapter discusses the main findings of this dissertation in light of a theoretical (normative) framework and other studies. The chapter concludes by considering the study as well as theoretical limitations and posits suggestions and implications for future research and theory.

**Social benchmarks in food choice and intake**

Overall, *Chapters 2 – 8* of this dissertation consistently demonstrate the impact of a peer on young people’s food choice and intake. Specifically in *Chapters 4 – 7*, it was demonstrated that young people are likely to adjust the amount of their food intake to that of their eating companion. The findings of *Chapter 2* and *3* provide evidence that social modeling processes occur in food choices between low- and high-energy-dense products as well. As mentioned in *Chapter 1* of this thesis, people are believed to learn how to behave and adjust their consumption behavior to a social benchmark in situations when there are no (pre-) existing guidelines and/or when they have social motives to conform to others. Although social modeling behavior seems ubiquitous, the findings of *Chapters 4, 5* and *7* reveal that the social modeling effect is weaker for some people than others or that the process takes place differently based on body weight, self-esteem or emotions. Furthermore, *Chapters 6, 7* and *8* provide preliminary evidence to believe that young people might not be aware of social modeling processes. Before reflecting on the individual and situational differences in the extent of modeling, the plausible social motivations that underlie social modeling behavior are discussed in view of a normative framework.

**Social survival**

There is an ongoing discussion about the motives for people’s adherence to social benchmarks in food intake. Herman, Roth and Polivy (2003) propose in their normative framework that people might have social motives to conform to others’ eating behavior due to affiliation/ingratiation purposes. That is, we attempt to become more attractive or likeable to another person through modeling behavior (as the saying goes, *imitation is the sincerest form of flattery*). Notably, a few years later in 2005, Herman and Polivy temper this reasoning and raise an interesting
point. The authors refer to studies that make use of remote confederate designs in which participants were exposed to information on paper about the quantity that previous participants had eaten. The studies show that participants adhere to the guidelines that were set by these non-existing others. Herman and Polivy argue that it is not likely that participants have the goal to affiliate with people who are not physically present and they will never meet. In addition, they mention that there are social modeling studies in which female young adults did not exceed the food intake of the confederate. The authors argue that because women tend to dislike other women who eat less than they do, eating less than the confederate would only infer disliking instead of liking (Herman & Polivy, 2005). Ergo, it is suggested that it is implausible that people model to elicit social approval or achieve liking. Therefore, according to the authors, it is more likely that people model because they have no point of reference and just need an informative guideline or norm (e.g., in an unfamiliar situation and/or in the absence of personal pre-existing guidelines) (Herman & Polivy, 2005). In spite of their rationale, the question underpinning this view in the (i)n(f)ormative framework is then why we would need and follow informative norms instead of making our own food intake rules in (un)certain situations. In discussing the findings of this dissertation and future implications for normative theory, it is important to explore this issue further.

Normative approaches to understand human behavior – inspired by the perspectives in the theories of reasoned action (Fishbein & Ajzen, 1975) and planned behavior (Ajzen, 1991) – have been widely used in psychology and in relation to health behavior (Cialdini, Reno, & Kallgren, 1990; Reid, Cialdini, & Aiken, 2010). The re-examination of the role of social influences and normative factors has led to various approaches which conceptualize norms in different manners (e.g., subjective, descriptive, injunctive, moral, personal norms, etc.) (White, Smith, Terry, Greenslade, & McKimmie, 2009). Importantly, all normative approaches share one common understanding: norms are seen relative to other people’s behaviors, opinions, and in light of group norms or group identification. As was mentioned in Chapter 1, people develop behavioral skills and social competences by observing and modeling the actions of others to survive physically and socially. We achieve and maintain good relationships by adjusting to our environment. When we use the behavior of others as a benchmark for our own behavior,
it enables us to feel socially embedded and we limit the chance of being ostracized from a group (Chartrand & Bargh, 1999; Cialdini & Goldstein, 2004; Lakin, et al., 2003). This is reflected in our perception of what others themselves do as well as what others approve of (Cialdini & Goldstein, 2004; White, et al., 2009).

The normative approach of Herman and Polivy seems to include what others do (alias descriptive norms: whether other people perform the behavior in question and what is typical or normal); however, it questions the impact of social approval motives (alias injunctive norms: the potential social rewards and punishments for (non-)engagement in the behavior) (Cialdini, et al., 1990). The authors’ strongest argument to reject the idea that people model due to affiliation goals is that it is implausible that participants want to ingratiate themselves to people who they do not know and are not going to meet. Interestingly, the same point is raised and discussed in literature investigating the use of (written) descriptive and injunctive norms to activate people changing their behavior. Descriptive and injunctive norms have been widely proven to function when others are not physically present (Cialdini, et al., 1990; Kallgren, Reno, & Cialdini, 2000; Larimer, Turner, Mallett, & Geisner, 2004; Stok, de Ridder, de Vet, & de Wit, 2013). The suggested explanation of our adherence to norms set by remote confederates is that we seek to satisfy the expectations of imagined audiences, which represent the viewpoint of our group or society (Reno, Cialdini, & Kallgren, 1993). We have the feeling that we have to be prepared to explain our decisions and can be held accountable for them (Cialdini & Goldstein, 2004). Thus, given this need to belong and the fear or avoidance of social exclusion, we are likely to conform to norms even when we are alone and provided with informative guidelines. Based on the previous literature, the viewpoint in this dissertation is that both motives for social modeling behavior can play a role regardless whether others are physically present or not: people follow (i)n(formative) guidelines because they want to feel socially embedded by doing what others do and/or elicit social liking, acceptance and approval.¹⁴

¹⁴ It can only be speculated in this dissertation whether young people adjusted food choice or intake due to a descriptive or injunctive type of norm because there is no information about the ingratiation goals of the participants (this will be discussed later on).
CHAPTER 9

PART I PEER INFLUENCE ON FOOD CHOICE

Low- and high-energy-dense foods

The findings presented in Chapter 2 show that despite a generally strong preference for familiar foods, young people who were exposed to a remote peer choosing unfamiliar foods chose fewer familiar foods than those exposed to a remote peer who chose familiar foods or choosing alone. Nevertheless, although the influence of a peer caused a reduction in familiar food choices, the robustness of the social modeling effect should be taken with caution. The fact that young people did not predominantly follow each choice of the peer in (un)familiar low- and high-energy-dense foods suggests that food choice might be based on certain prerequisites. The findings show that young people were willing to choose unfamiliar foods when the food was high-energy-dense and when the alternative food was low-energy-dense or when both foods were high in energy-density. It is possible that social modeling behavior is affected by young people’s strong internal principles against unfamiliar foods as well as their general preference for high-energy-dense foods. As was explained in Chapter 2, the reluctance to try unfamiliar foods and the preference for high-energy-dense foods among young people is due to evolutionary as well as environmental predispositions (e.g., negative responses of others) and can be seen as an individual trait (Birch, 1999). In view of normative theories, it is argued that people’s personal norms can influence the extent to which people adhere to social norms (Kallgren, et al., 2000). A personal norm is described as an “internal standard and principle for behavior” (Kallgren, et al., 2000) and it is suggested that personal norms can affect social modeling behavior (and thereby, even one’s need to belong or affiliation goal). Thus, it is possible that when young people are in an environment in which options are not limited to one type of food, they might still choose predominantly familiar high-energy-dense products and only adhere to what their peers do to a small extent. Another situation in which personal norms regarding food choice may play a role is presented in Chapter 3.

A common setting in which people’s food choice is not limited to one type of food is in the supermarket. The findings of Chapter 3 show that girl’s food choice is affected by the choices of their shopping companion and it was concluded that peers might facilitate girls’ high-energy-
dense food purchases. Notably, when scrutinizing the participant’s and confederate’s purchases,\textsuperscript{15} it shows that girls did not match the food choice of their shopping companion. Girls intended to consume higher caloric values than their purchase companion when she picked predominantly low-energy-dense products but they intended to consume lower caloric values than their purchase companion when she picked predominantly high-energy-dense products. These findings are now elaborated on in light of personal norms concerning people’s usual lunch meal.

The task in the study presented in Chapter 3 was to purchase products to consume at lunch, and 2 snacks and a drink for the rest of the day. It is suggested here that personal norms regarding meals such as breakfast and lunch can make young people more or less susceptible to normative information. Studies in young females’ as well as in children’s food intake have shown evidence that these meals are strong habitual eating behaviors (Salvy, et al., 2011; Wong & Mullan, 2010). For example, young female adults do not follow their eating companion in food choice and intake in a small breakfast compared to a large breakfast meal (Hermans, et al., 2010b). Other studies have demonstrated in young females as well as in children that their lunch meal intake is less influenced by others compared to the intake of palatable snack food (Clendenen, Herman, & Polivy, 1994; Salvy, et al., 2011). In line with this, the information presented in Chapter 3 about the similarities of purchased food products between the peers and girls shows that the dyads matched the least on the type of sandwich filling and bread but matched most on the 2 types of snacks. Also, 76.4% of the girls bought more products than their peer did. It is possible that these are extra products intended to have for lunch (which the peer did not buy) or additional snacks. It is speculated that the products of the peer who purchased predominantly low- or high-energy-dense products especially, were overly different from the girls’ usual lunch meal. Following this line of reasoning, the girls might have kept to their personal norms with regard to lunch meals by which they exceeded the caloric values when shopping with a peer buying low-energy-dense products whereas they stayed below the caloric values when shopping

\textsuperscript{15} Low purchase condition: participant $M=945$ kcal; confederate $M=298$ kcal. Middle purchase condition: participant $M=1046$ kcal; confederate $M=819$ kcal. High purchase condition: participant $M=1314$ kcal; confederate $M=2065$ kcal.
with a peer buying high-energy-dense products. Despite the personal norms, the shopping companion did have an effect on the energy-density of the purchases which explains the social modeling effect.

**Reflections on food choice**

The studies presented in Chapter 2 and 3 show that peers have an influence on food choice of young people, which may provide opportunities for intervention programs. To date, the majority of interventions have focused primarily on peer modeling to encourage (novel) low-energy-dense food consumption among young people (Hendy, 2002; Hendy & Raudenbush, 2000; Reverdy, et al., 2008). This seems a one-sided approach because we are usually confronted with an environment in which we are not limited to one type of food. Instead of focusing on food acceptance of low energy-dense foods alone, it may be useful to expand the research area and investigate whether the impact of a peer could be used vice versa (i.e., to reject high-energy-dense foods). Although the studies in the present dissertation did not find robust evidence that peers can reduce the preference for high-energy-dense foods, studies that investigated peer rejection of foods show that it is possible for young people (Greenhalgh, et al., 2009; Horne, et al., 2004) as well as young female adults (Robinson & Higgs, 2012) to take over a peer’s food aversion. In these studies, the aversion against certain foods was outspoken by the peer, which might have set a stronger type of norm. For example, children were not willing to eat novel foods after negative comments by their peers (Greenhalgh, et al., 2009). The idea of food rejection is implemented in a peer modeling and reward-based intervention in which heroic cartoon figures (i.e., remote confederates) encourage children to eat healthy and reject unhealthy foods. Their findings show promising changes in children’s food consumption patterns in a study sample in the United Kingdom (Horne, et al., 2004).

Furthermore, the findings of Chapter 2 and 3 provide reason to believe that personal norms may affect young people’s social modeling behavior of food choice when they are faced with an environment that provides both low- and high-energy-dense food products. Therefore, the role of personal eating habits on social modeling behavior should be investigated into more detail. For example, it would be interesting to identify which personal norms (i.e., eating habits) protect young people from overconsumption
in social situations. In addition, it would be interesting to investigate whether personal norms can be created in snacking behavior by which people are less vulnerable to external guidelines and possess an internal norm or “stop” signal to avoid overconsumption.

**PART II PEER INFLUENCE ON HIGH-ENERGY-DENSE FOOD INTAKE**

**Susceptibility**

As was mentioned previously, it can only be speculated whether young people are susceptible to adjust their eating behavior to that of a peer because they want to behave in line with what is considered normal or they want to be liked and elicit social approval (as well). *Chapter 5* in particular, shed light on the possible role of affiliation goals in social modeling behavior by exploring young people’s self-esteem. Self-esteem can be regarded as a monitor of social acceptance and exclusion (Baumeister & Leary, 2000) and people with higher self-esteem worry less about whether they are being liked and perceive a lower probability of rejection (Bohnmstedt & Felson, 1983; Kenny & DePaulo, 1993). The findings presented in *Chapter 5* support the idea that young people with higher self-esteem feel less need to affirm social bonds through social modeling behavior than those with lower self-esteem. Although it is plausible that young people with low self-esteem modeled more because they wanted to affiliate with their peers, affiliation goals were not explicitly measured (this will be further discussed below in relation to the study limitations and suggestions). Nonetheless, the findings provide evidence that those with lower self-esteem at least wanted to conform their behavior to what is considered normal more than those with higher self-esteem. Notably, the construct self-esteem was related to young people’s body esteem but not their general self-esteem. This suggests that a domain-specific type of self-esteem such as body esteem would explain our eating behavior in certain situations better than general self-esteem. Future research should consider the use of domain-specific self-esteem when examining eating behavior.

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16 The findings on implicit and discrepant self-esteem will be discussed later with regard to awareness.
Interestingly, literature has shown associations between young people’s self-esteem, body esteem and body weight (Mendelson, White, & Mendelson, 1996; Ricciardelli & McCabe, 2001). Although they are closely related, their role in social modeling behavior may not be interdependent or congruent. For example, non-overweight young people may suffer from low body esteem as well (Ricciardelli & McCabe, 2001). The findings in Chapter 4 demonstrate that overweight as well as normal-weight young people modeled a peer’s food intake but through a different pattern. Normal-weight young people increased their intake when a peer ate something, regardless of the amount, compared to nothing. As was discussed in Chapter 4, the food intake of overweight children seemed to be determined by whether the peer ate a substantial amount of food because they significantly increased their intake when a peer ate a large amount of food. An additional speculative explanation to what was presented in Chapter 4 is that this pattern could represent differences in affiliation goals and impression management. Normal-weight children seemed to restrain their food intake only when the peer ate nothing at all. When the peer ate something (either a little or a large amount), this inhibition disappeared and shifted to a moderate food intake. One can argue that overweight children inhibited their food intake when their peer did not eat much. Speculatively, the overweight children tried to avoid stigmatization and wanted to make a good impression. Previous research with overweight dyads and overweight-lean dyads has shown that children in overweight dyads consume more than children in overweight-lean dyads, presumably due to prejudicial attitudes toward overweight status (Salvy, Romero, et al., 2007). Other studies have shown that there are negative stereotypes associated with (over)eating and body weight (Vartanian, et al., 2007). For example, young people rate obese children as being less attractive than their average sized peers and being accepted by peers is associated with the thin beauty ideal and attractiveness (Ricciardelli & McCabe, 2001; Strauss & Pollack, 2003). The findings suggest that while the intake of normal-weight children was principally determined by whether the confederate ate something or nothing at all, overweight children may have felt more secure or comfortable to eat in a situation in which a slimmer peer ate a substantial amount of food than in a situation in which a slimmer peer ate a modest amount of food or nothing.
Furthermore, Chapter 4 shows by means of the second modeling session, which took place a few days later, that children followed a guideline that had been set by a peer before. It is possible that the children learned from the example that was set by their peer. Studies have shown that past behavior strongly guides future responses (Ouellette & Wood, 1998). The children might have incorporated previous learned behavior as a personal norm. Previous studies showed that peers can exert power on young children’s long-term food preferences by means of social modeling; however primarily in combination with repeated exposure and/or reward (Lowe, et al., 2004). The effect is less likely to last when exposure is not repeated (Reverdy, et al., 2008). Notably, these studies aimed to increase the willingness to try novel or low-energy-dense foods (i.e., fruits and vegetables). Perhaps influencing intake of low-energy-dense foods requires more effort than instigating the intake of high-energy-dense foods in young people. To establish this, it would be interesting to contrast the long-term impact of peer exposure to low-versus high-energy-dense food intake in one study.

**Reflections on susceptibility**

In conclusion, people’s body weight and self-esteem have been identified as factors that play a role in the extent to which young people model behavior and are susceptible to a peer’s palatable food intake. Especially overweight young people are at risk of overeating when a peer eats a substantial amount of food and young people with low body esteem adjust their intake more than those with high body esteem. It is also suggested that behavior learned from exposure to peers eating palatable foods might become a habitual or personal norm which could influence one’s eating behavior on the long term. It would be interesting to examine whether increasing someone’s self-esteem and/or body esteem would make them less susceptible to other’s eating behavior. In addition, it might be informative to examine whether there is a parallel to the extent to which young people hold on to their personal norms and their level of (body) self-esteem. For example, young people may learn healthy eating habits at home but can still be susceptible to unhealthy eating habits at school or other social eating environments due to their level of self-esteem.

Although potential individual risk factors can be identified for the extent to which some of us model more than others, it is likely that we
are all influenced by our social environment. That is, usually we are not even aware of the process in which we monitor the behavior of others and adjust our food intake to them. Research showed that people are not conscious of the impact of the social environment and their susceptibility to eating companions (Croker, et al., 2009; Nolan, et al., 2008; Vartanian, et al., 2008). Therefore, a different viewpoint is to examine awareness processes, which will be discussed in the following paragraphs.

Awareness

Infants start with imitational learning by copying the behavior of their parents, siblings and peers (Eccles, 1999; Keenan & Evans, 2009; Rizzolatti & Craighero, 2004). In social psychology, it is proposed that there are two ways that lead to human imitation (Dijkstra, 2005). One way leads to imitation in a direct manner (e.g., mimicry of gestures, postures, facial expressions, and speech) whereas the other way leads to more complex and subtle forms of imitation (e.g., by primed cues that lead to activation of imitation behavior later on). The latter is described as adjusting behavior to become more in line with the social environment, which may reflect social modeling behavior (Dijkstra, 2005; Iacoboni, 2009). Either way is believed to occur unconsciously, and moreover, to function as a way to affiliate with others (Iacoboni, 2009). Different mechanisms may underlie the automatic processes. As these different mechanisms are all believed to contribute to social behavior, there is an interest in the interconnectedness between research in social psychology on mimicry, neuroscience and cognitive models (Iacoboni, 2009).

The findings in Chapter 6 suggest that the imitation of food picking movements may contribute to social modeling behavior of high-energy-dense food intake among young people. There is preliminary evidence that children may be more likely to eat after witnessing a peer reaching for candy than without such a cue. This imitation effect was more evident at the start than at the end of the social interaction in normal-weight children whereas the opposite effect was found for overweight children. The study contributes to the scarce literature on imitation of food bites and alcohol sips, which has been conducted in young adults only (Hermans, Lichtwarck-Aschoff, et al., 2012; Koordeman, et al., 2011; H. Larsen, et al., 2010). One potential mechanism that might underlie imitation behavior was suggested to be the mirror-neuron system, and several explanations
for the difference between normal-weight and overweight children were speculated on in Chapter 6 such as affiliation goals (Lakin & Chartrand, 2003), attentional bias (Castellanos, et al., 2009; Nijs, et al., 2010) and response inhibition (Nederkoorn, et al., 2006) (to avoid repetition here, please see Chapter 6 for more details). As the study was only the first in young people and exploratory in nature, a limitation of this study was that the findings provide no information with regard to which underlying processes or mechanism(s) were at play. Therefore, it is inconclusive whether imitation responses are in fact direct and automatic. However, this study provides preliminary evidence that young people follow the actions of peers when snacking together and this response occurs within a few seconds. More research and replication of the study is needed to investigate the difference in imitation patterns between normal-weight and overweight people. For example, fMRI studies might shed light on a possible neurophysiological mechanism in social modeling behavior, for instance, by means of remote confederate designs.

Chapters 5 and 7 give insights from a cognitive perspective on social modeling behavior. In Chapter 5, the role of implicit self-esteem on social modeling behavior was assessed. Implicit self-esteem is based on intuitive automatic self-evaluations, which are not drawn on people’s cognitive capacity and conscious reflections, and is suggested to be indicative of desired social relationships (Bosson, et al., 2003; Creemers, et al., 2012). Findings indicate that youngsters with higher implicit self-esteem were more likely to adjust to the intake of a peer than those with lower implicit self-esteem. Implicit self-esteem is associated with the regulation of affiliation responses and is suggested to manifest in people’s non-verbal behavior (DeHart, et al., 2011; Longua Peterson & DeHart, 2012). Possibly, the youngsters who possessed higher implicit self-esteem modeled the intake of a peer more automatically than youngsters with lower implicit self-esteem. An additional self-esteem construct was explored by means of discrepant self-esteem, which is believed to create uncertainty and can lead to disturbed feelings (Schroder-Abe, et al., 2007). Young people with higher implicit than explicit self-esteem levels (i.e., damaged self-esteem) were found to conform to the candy intake of a peer more closely than those with lower implicit than explicit self-esteem (i.e., fragile self-esteem). As this was the first social modeling study in young people which attempted to get more insight into young people’s sense of belonging and social modeling
behavior, more research is needed. For example, if we want to investigate whether affiliation goals drive social modeling behavior, appropriate measures should be used. This will be further discussed in the limitation section of this chapter.

Apart from potentially non-conscious processes, people can be unaware of their social modeling behavior due to cognitive distractions. The findings of Chapter 7 demonstrate that when young people are emotionally engaged while watching a positive or negative movie clip, it led to the adjustment of high-energy-dense food intake compared to those watching an uneventful movie clip. It is speculated that they became less thoughtful and adjusted their behavior more automatically to that of their peer. A relevant question here is why the young people in the neutral condition did not model the high-energy-dense food intake. One would expect that young people would adjust in all movie clip conditions; however more in the emotional than in the neutral movie clip. Interestingly, the children who watched the neutral movie clip condition could give a more accurate estimation of the amount that was eaten by their peers than those who watched the happy or sad movie clip. This suggests that the children who watched the neutral movie clip were more aware of the situation they were in. Given that watching a movie is a familiar situation, perhaps the children who watched the neutral movie adhered to more personal pre-existing norms in snacking during TV watching. The children who were engaged in the happy and sad movie might have been distracted by the movie and more triggered by their peers food intake (Langer, 1992; Wansink, 2006). This explanation remains speculative because there is (to the authors knowledge) no research on the role of personal norms or habits in social modeling behavior. Future research should address the issue to which extent personal norms or habits can make us less susceptible to peer influences.

Reflections on awareness

The findings on implicit self-esteem and imitation responses provide new insights and illustrate the idea that unconscious processes may play a role in the extent to which young people are susceptible to a peer’s palatable food intake. It supports the idea that social modeling of palatable food intake can occur without young people being aware of it (Nolan, et al., 2008). The notion that distracting factors can make people less
aware of their food intake is not new (Hetherington, et al., 2006; Wansink, 2006). Mindfulness-based interventions in eating are aimed at uncovering situations in which people are distracted (Wansink, 2006); encouraging them to actively enjoy or think about their food intake and actual feelings of hunger or satiety. Although the field of research is still emerging, few studies in adults have shown promising results. For example, mindfulness approaches were associated with people’s decreased food craving (Alberts, Mulkens, Smeets, & Thewissen, 2010) and reduced body weight (Singh et al., 2008). Literature on mindfulness based interventions in young people is limited and there is scarce empirical evidence of the efficacy of these approaches (Burke, 2010; M. Thompson & Gauntlett-Gilbert, 2008). It is important to make appropriately tailored approaches to the developmental stage of the child (M. Thompson & Gauntlett-Gilbert, 2008). This issue is also addressed in the next paragraph.

Given that awareness plays a generally important role in the susceptibility to peer influences, a logical step would be to intervene by trying to make people more aware of social modeling processes. Thus, instead of concentrating on food intake and people’s internal awareness processes (which mindfulness approaches target), an intervention study was developed to raise awareness on social modeling situations.

**PART III Intervention**

**Raising awareness**

The intervention pilot study in *Chapter 8* aimed to decrease the susceptibility to a peer eating a substantial amount of high-energy-dense food by testing two types of interventions (i.e., a standard or animated version with a cue reminder, in which young people were explained social modeling behavior with illustrative photos, video clips and interactive tasks). Despite the intervention message, young people’s intake approximated the intake of the peer confederate which indicates that they remained susceptible to a peer’s food intake. In line with the previous paragraphs on awareness, a plausible explanation is that young people are not aware of the influence of their social environment (even after explaining social modeling behavior) (Nolan, et al., 2008). Notably, a monkey puppet which was used as cue reminder, did not directly remind young people of the
CHAPTER 9

intervention message. An additional explanation can be found in young people’s prospective memory, which refers to their ability to remember to carry out intended behavior or future activities. A cue presented to remind children of their intended behavior may not work because cues can remind them of the target but not of what they need to do when the target appeared (i.e., not imitate candy intake) (Guajardo & Best, 2000). It is suggested that a cue must emphasize a link between the target and the activity to be performed (Guajardo & Best, 2000; Guynn, McDaniel, & Einstein, 1998). It is possible that this link was not made obvious enough for the participants during the intervention which limited them during the social modeling situation to associate the monkey with the avoidance of imitation behavior. As this is only the first study to examine whether a short intervention enables young people to become less susceptible to the influence of a peer’s intake of palatable food, the intervention needs to be modified and further developed to get more insight into whether it is possible to raise awareness among young people. For example, developmentally appropriate messages are needed to inform young people about the influence of their social environment. In addition, when being exposed to a cue reminder, the cue should represent a clear and explicit meaning during the intervention which can be directly linked to their future behavior.

Gender difference

An additional and unforeseen finding in Chapter 8 was that boys ate significantly more than girls when being exposed to a peer who ate a substantial amount of food. None of the other studies on high-energy-dense food intake of this dissertation (Chapters 4, 5 and 7) found gender differences. It is possible that no differences were found in these types of social modeling designs because situations were examined in which a confederate ate nothing, a small or large amount of high-energy-dense food. However, other studies in social facilitation processes in which boys and girls had access to unlimited amounts of foods did not report gender differences as well (Klesges, et al., 1991; Laessle, et al., 2001; Salvy, Coelho, et al., 2007; Salvy, Kieffer, et al., 2008; Salvy, Vartanian, et al., 2008). In the scarce studies that reported about gender differences, this seemed attributed to young people’s social company. For example, boys and girls ate similar amounts when in the presence of a stranger; however, when in the company of friends, boys were found to eat more than girls (Salvy, et
al., 2009). A similar effect was found in an older age group (13 – 15 years) when males and females were in company of friends versus their mother. In addition, females ate more low-energy-dense foods when in the presence of their friends but not their mother (Salvy, et al., 2011). In line with the reasoning presented in Chapter 8, the social environment (e.g., the home environment) may be more permissive to boys than girls in relation to food intake and the thin body ideal. This suggests that boys may learn a different personal norm than girls as to what amount is appropriate to eat. This could explain the gender difference when young people are in a generous food environment. Future social modeling studies are warranted to collect information about parenting practices (this will be discussed into more detail later in this chapter) or social modeling design could include an additional condition in which the peer sets an indefinite high intake norm.

Reflections on the intervention and raising awareness

The findings presented in Chapter 8 show that while an intervention can be effective (i.e., boys ate less candy after the intervention compared to the control group), social norms are powerful. The findings presented in Chapters 2 – 8 of this dissertation showed that young people use their peers’ behavior as a guideline for their own food choice and intake. Unfortunately, the norms derived from others do not always stimulate us to behave in a desired healthy way. If imitation and modeling processes happen unconsciously, it might be difficult to target processes we are not aware of with intervening strategies. The most promising alternative seems to lie in the use of social norms in such a way that people are steered into a healthy eating pattern. Interventions are primarily directed at increasing healthy eating; however, to prevent obesity, children must also decrease unhealthy eating.

Specifically, we should keep in mind that the findings in Chapters 4, 5, and 7 of this dissertation support that the presence and behavior of others can have an inhibitory function on our high-energy-dense food intake. In general, people are found to avoid eating inappropriate high amounts to evade potential prejudice against excessive eating (Strauss & Pollack, 2003; Vartanian, et al., 2007). In addition, a study on young adults showed that friends can exert restricting norms on their peers in palatable foods (Howland, Hunger, & Mann, 2012). If people in our social environment give good examples and set healthy social norms, it is likely
that we automatically follow their behaviors and are less tempted to (over) eat high-energy-dense foods. Young people profit most from being in the presence of peers who set the (personal) norm for healthy eating habits. As our eating habits are embedded in our family and school lives, there is a big responsibility for those environments. This stresses the importance of family- as well as school-based approaches. Nevertheless, it is also important that national government regulations foster such initiatives (e.g., by promoting healthy school canteens).

**Study limitations and future directions**

In the following paragraphs, general limitations of most of the studies are discussed. Other specific limitations to the single studies can be found in the relevant chapters. Along with the discussed limitations, this section provides recommendations for future research.

**Generalizability**

The majority of the study samples (except in Chapters 4 and 6) consisted of mostly non-overweight and few overweight or obese participants. In addition, a vast majority of the confederates were non-overweight. It was not possible at the time of data collection to realize similar sample sizes because the majority of Dutch children is normal-weight or parents would not give consent to involve overweight children. Chapters 4 and 6 as well as other studies in children suggest that the adiposity level has impact on the matching degree in food intake and the quality of social relationships with peers (Puhl & Latner, 2007; Salvy, Kiefer, et al., 2008; Salvy, Romero, et al., 2007). Social modeling studies in young female adults also showed that the food intake of a similar weight eating companion was modeled but not that of an obese or leaner person (Hermans, et al., 2008; Johnston, 2002; McFerran, et al., 2010). Nevertheless, it might be that some young people do not suffer from stigmatization as much as others (Latner & Stunkard, 2003). It would be interesting to examine various combinations of lean, overweight or obese weight categories in children because they might have different affiliation goals or impression management strategies.

A general point for consideration is that some study’s sample sizes might be regarded as relatively small. In a between-subjects design,
However, approximately 20 participants per group are required to detect a moderate to large effect size (Cohen, 1992). All studies presented in this dissertation fulfilled this requirement and similar social modeling effects were found across the studies. Also, the effect sizes showed mostly moderate to large effects. Yet, a larger sample size would increase power to test moderating and mediating effects. In addition, there is a considerable amount of literature published on social modeling behavior which support the social modeling effects found in the studies (Herman, et al., 2003; Hermans, Larsen, et al., 2009; McFerran, et al., 2010; Romero, et al., 2009). Nevertheless, it would be useful to replicate some of the studies with larger sample sizes to approximate a representative sample of the population. For example, it would be interesting to test gender differences in a bigger sample size with regard to the study presented in Chapter 8.

In addition, the studies in this dissertation were conducted among young people. Potential differences between social modeling behavior in young people and older populations can be attributed to the maturing development phases in terms of attentional, cognitive and interpersonal functioning (Schaffer, 1996). Even within this dissertation, caution is warranted because the studies involved children (Chapters 2, 4, 6 – 8) and young teenagers (Chapters 2 and 5). For example, Chapter 5 showed that self-esteem affects social modeling behavior in 11-year-olds. As is mentioned in Chapter 5, research has shown that age has an effect on self-esteem across the life span. In general, self-esteem is highest during childhood but it significantly declines from childhood (ages 9–12) to adolescence (ages 13–17) to the college period (ages 18–22). After this period, self-esteem rises throughout adulthood (R. Robins, et al., 2002). It is likely that there are other differences between children, teenagers and older populations as well. To enhance the generalizability of the current findings, it would be informative to examine the effects of different age groups within one study.

Finally, a peer’s real-life choices and intake might not be as uniform as the confederate’s behavior in the experimental settings presented in this dissertation. For example, the confederate in the study of Chapter 2 chose either familiar or unfamiliar foods. It would be interesting to examine how young people would react on mixed signals. A study on young adults in which several confederates ate different amounts of palatable food suggested that when people cannot perceive a clear norm, they are more likely to eat in accordance with their own desires (Leone, et al., 2009).
2007). In addition, it would be interesting to examine how young people react when paired with the opposite sex. There is only one study in low-energy-dense food choice which found that young girls were an effective role model compared to boys (Hendy, 2002). It might be that impression management interferes with social modeling behavior during specific stages of development. For example, in a study on young adults and mixed gender couples, the conformity in food intake was highest when a female was present but not when males were paired (Salvy, Jarrin, et al., 2007). It is suggested that different processes play a role related to feminine and masculine social motives (cf. Pliner & Chaiken, 1990; Vartanian et al., 2007).

**Need to belong and affiliation goals**

An important point for consideration is that this dissertation does not answer the question of whether young people used the food choice or intake of their peer merely as an informative guideline or whether they wanted to be liked (as well). Although previous research supports the notion that people want to fulfill their affiliation goals through imitation and social modeling behavior (Dijksterhuis, 2005; Iacoboni, 2009; Lakin, et al., 2003), the studies presented in this dissertation did not provide insight into whether the participants wanted to be liked by their peers. That is, the participant’s affiliation purposes were not measured during their social interaction. One could question the reliability of self-reported measures on how much participants want to affiliate with their co-eater assessed before, during, or after a social interaction. Future studies should take appropriate measures of affiliative bonding into account, for example, by coding nonverbal behaviors such as eye contact or smiling in order to establish affiliation goals. An alternative point of view is by identifying people who have a higher need to affiliate. Besides self-esteem (Chapter 5), an alternative measure that has been used is by means of the construct of sociotropy. By measuring sociotropy, insight is gained on people’s concern with pleasing others, winning approval, and maintaining smooth and harmonious relationships (C. J. Robins et al., 1994). A study that examined young adult’s sociotropy, found that those who matched the food intake of an eating companion were the ones that had higher needs to please other people in contrast to the others who felt less need to win social approval (Exline, Zell, Bratslavsky, Hamilton, & Swenson, 2012). Other studies that tried to measure empathy have found different results. The study that
used a real model found that empathy predicted social modeling behavior (Robinson, et al., 2011) whereas the study that used a remote confederate did not (Robinson, Benwell, & Higgs, 2013). This does not rule out the need to belong that people might feel when exposed to information but it might indicate the difference between people’s need to belong and affiliation goals. It would be interesting to test different measures which test affiliation or need to belong in conjunction with remote and live confederates.

**Hunger status**

In the studies of this dissertation, subjective hunger rating after the study was controlled for in the analyses. A concern is that young people’s subjective hunger rating was measured after the experiment and that neither pre-study hunger nor pre-study food intake was assessed. Although these study measures might have been more accurate assessments of hunger status, it was critical to conceal the actual aim of the study and not get children suspicious about the research aim nor direct attention to feelings of hunger or food. It is generally accepted in social modeling studies in young adults to not assess hunger at baseline (Hermans, Herman, Larsen, & Engels, 2010a; Hermans, Larsen, et al., 2009). In addition, a study by Goldman, Herman and Polivy (1991) showed that people model another’s food intake even when being food deprived for 24 hours whereas other studies found that people model food intake while feeling satiated (Herman, et al., 2003). It is therefore assumed that hunger or satiety have a small effect on food intake in a social eating context. Further, the randomization checks in each study revealed no differences in subjective hunger states between the experimental conditions. Perhaps future studies could include measures such as the last time since participants had their last meal.

**Familiarity**

The majority of social modeling studies in adolescents and adults involve designs in which participants are paired with strangers in unfamiliar laboratory settings. Reasons for avoiding the use of familiar confederates is that eating patterns could already have been established

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17 Some studies also included ‘the time of day the social modeling study took place’ because afternoons are more commonly snack times than mornings (Cross, et al., 1994).
between persons and that people feel less need to affiliate with others who they have a relation with. Although people’s need to belong and the adjustment to social norms remains, both reasons could weaken people’s social modeling behavior because they feel less need to affiliate. Nevertheless, it seems strange to focus research on situations in which people eat with strangers because we eat among family and friends in familiar places most of the time. The studies presented in Chapters 4, 6, 7 and 8 of the current dissertation provide a more natural situation in which young people from the same school environment were paired at their school (on the condition that they were not best friends). Studies on social facilitation processes in children that investigated whether there are differences between eating with friends, siblings and strangers found that familiar people (i.e., sibling or friend) facilitate palatable food intake compared to when children eat with an unfamiliar peer. It is possible that children wanted to convey a good impression and limited their food intake in the presence of an unfamiliar peer. The matching degree of high-energy-dense food intake between strangers was significant whereas this was not among siblings because they ate a lot more when they were with their siblings. However, a study in young adults on social norms within friendships showed that friends can also influence individuals to eat less, not just more (Howland, et al., 2012). Research on social networks suggests that social factors play an important role in the spread of obesity. People’s likelihood to be overweight was even more associated with the weight of their friends than family (Christakis & Fowler, 2007). Given that young people eat with familiar people most of the time, future research is warranted to conduct research with familiar peers if we want to find ways to encourage young people to eat healthy and discourage unhealthy eating.

**Theoretical limitations and future directions**

The studies throughout this manuscript have been introduced and discussed in light of the normative framework of Herman and Polivy. The authors aimed to reconcile literature on social facilitation, impression management and social modeling processes, however, based on studies in (mostly female) adolescents and adults before 2005 (Herman & Polivy, 2005; Herman, et al., 2003). To date, the framework has been widely used
in research on social norms in eating (Hermans, et al., 2008; Howland, et al., 2012; Robinson & Higgs, 2012; Salvy, Romero, et al., 2007). The studies that have been conducted in children, adolescents and adults in the past 8 years may provide new insights which advance the understanding of social modeling processes. In the following paragraphs, some suggestions are made to further enhance the theoretical framework and potential future directions for research will be addressed.

In the discussion section of Chapter 4, personal norms are referred to as “pre-existing guidelines learned from prior experience,” which stems from the normative framework. Instead, in line with the discussion section of Chapters 2 and 3, it might be wise to modify this definition into “internal standards and principles for behavior,” which still may be learned from previous exposure to guidelines but includes individual traits such as reluctance to certain foods as well (Kallgren, et al., 2000). In addition, the difference between remote and live confederates seems quite rigid. Although it is still possible to use the distinction between live and remote models in the sense that confederates are physically present or not, it is proposed to not limit the description of a remote confederate to exposure to information about the quantity eaten by prior participants on paper. Apart from remote video models (Hermans, Salvy, et al., 2012; Romero, et al., 2009), the emerging trend of contact via social media interaction (e.g., Chapters 2 and 5) asks for a modernized description of live and remote confederates (which includes food choice as well). In addition, we should think about whether a social interaction with a peer via social media would involve a live or remote confederate design.

Intertwined with the remark about the type of confederate, it is proposed to make a distinction between descriptive (i.e., what is typical or normal) or injunctive norms (i.e., the potential social rewards and punishments for (non-)engagement in the behavior). As was mentioned previously, it is suggested that exposure to norms without someone being physically present can still involve a certain need for social approval. For example, in situations displaying norms about what people ought to do according to (similar) other people (i.e., injunctive) versus informative guidelines about what others did (i.e., descriptive) (Robinson & Higgs, 2012; Stok, et al., 2013). Recent studies on the influence of descriptive and injunctive norms and food choice and intake by means of remote confederates, show a stronger impact of descriptive norms than injunctive norms
(Lally, Bartle, & Wardle, 2011; Stok, et al., 2013). A possible explanation is that people felt they were being pushed into a certain direction and that their freedom was limited. In contrast, a descriptive norm may evoke less resistance to the proposed behavior (Brehm, 1966). This issue was also raised in Chapter 8 in which the possibility of an increased desire to engage in proscribed behavior was discussed. Therefore, it would be useful to examine how messages should be tailored. Notably, we might learn from consumer science as descriptive as well as injunctive norms are already used to stimulate people to choose certain products (Melnyk, van Herpen, Fischer, & van Trijp, 2011). As far as the author knows, there are no studies in descriptive versus injunctive norms in young people. Future research is advised to investigate the impact descriptive and injunctive norms in young people within remote as well as live confederate designs including computer-based interactions.

Finally, research has shown that the self-regulatory capacity of people is related to the effectiveness of descriptive and injunctive norms (Jacobson, Mortensen, & Cialdini, 2011; Lally, et al., 2011). Self-regulation refers to the extent a person can control an impulse or behavior (Baumeister & Heatherton, 1996). A lower self-regulation was found to lead to decreased conformity to injunctive norms but not descriptive norms (Jacobson, et al., 2011). Young people are still developing self-regulatory strategies (Magor, Phillips, & Hosie, 2010) and parenting practices have influence on their children’s self-regulation strategies (Branen & Fletcher, 1999; Laessele, et al., 2001). It is argued that the style at which parents exert power over their children have an influence on the children’s self-control (e.g., parents can restrict or encourage food intake or use food as reward or punishment (Branen & Fletcher, 1999; Puhl & Schwartz, 2003; Spence,

18 In line with the idea to tailor messages appropriately, we should also keep in mind how norms are perceived. Descriptive and injunctive norms may not always influence behavior to the same extent or even in similar direction (Cialdini, et al., 1990; Croy, Gerrans, & Speelman, 2010; Lally, et al., 2011; Larimer, et al., 2004). For example, a study on social norms and diet showed that adolescents overestimated their peers’ intake of snack foods and underestimated their intake of fruits and vegetables. In addition, they perceived their peers’ attitudes to eating healthy less positive and to eat unhealthy foods more positive than the actual attitudes of their peers were toward those foods. A misperception of social norms may lead young people to eat unhealthier than they would do when making an accurate estimation of other’s behavior (Borsari & Carey, 2003; Lally, et al., 2011; Unger & Rohrbach, 2002).
Campbell, & Hesketh, 2010). None of the studies on social facilitation or social modeling in young people have examined whether parenting practices or eating habits learned at home have an impact on children’s susceptibility to peer influences. Therefore, it seems as a logical step to investigate whether parent feeding styles or pre-existing norms learned at home could protect young people from peer modeling of unhealthy food choice and intake at school.

Conclusions

The aim of this dissertation was to advance the existing literature on social modeling behavior among young people. The investigated factors were related to the food choice between low- and high-energy-dense foods, and susceptibility and awareness processes in high-energy-dense food intake. In addition, a normative framework was discussed and propositions for further advancement were made.

Social norms have an important influence on our eating behavior because the performance of these behaviors endorses our sense of belonging. Every social situation holds its own array of norms for appropriate behavior which is derived from the behavior of others. The person(s) surrounding us while we are eating can be a powerful marker as well as tool for our food choice and intake. The findings in this dissertation suggest a (strong) impact of the immediate social environment on young people’s eating behavior. Although some young people are more susceptible to be influenced by other’s food choice and intake than others (e.g., due to our body weight and self-esteem) and personal norms might strengthen or protect against this influence, social modeling behavior is likely to impact all of us because we are often not really aware of social influences. As people’s eating habits are embedded in our home and school environment, there is an inherent responsibility for these social networks. Besides focusing on the encouragement of young people to eat (novel) low-energy-dense foods, the use of a peer model to discourage high-energy-dense food choice and intake should receive more attention. The findings and suggestions presented in this dissertation could be used as a starting point for developing and testing adequate interventions aimed at encouraging healthy eating behaviors among young people.
A


B


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C


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Summary in Dutch
(Samenvatting)
Het onderzoek beschreven in dit proefschrift heeft als doel om bij te dragen aan de ontwikkeling van kennis en theorie over sociale imitatieprocessen omtrent de voedselkeuze en –inname van jongeren. Het proefschrift is onderverdeeld in drie delen. Het eerste deel (hoofdstuk 2 & 3) richt zich op de sociale invloed van een leeftijdgenoot op voedselkeuzes van bekende en onbekende ‘(on)gezonde’ producten. Jongeren kiezen immers tussen verschillende producten in het bijzijn van anderen tijdens pauzes op school of in de supermarkt. Echter, de obesitas epidemie is sterk gelinkt aan de inname van ongezonde producten. Het tweede deel (hoofdstuk 4 – 7) richt zich daarom specifiek op factoren die een rol spelen in de sociale invloed van een leeftijdgenoot op de voedselinname van ongezonde producten. In het laatste deel (hoofdstuk 8) is een interventie gepresenteerd die gericht is op het bewustmaken van sociale beïnvloeding op ongezonde snackinname om jongeren te beschermen tegen overconsumptie.

Achtergrond

De prevalentie van overgewicht en obesitas is behoorlijk toegenomen in de afgelopen 30 jaar. In Nederland heeft 15% van de jongeren onder de 25 jaar overgewicht en ongeveer 3% tot 4% van de jongens en meisjes is obes. Dit betekent dat in een gemiddelde schoolklas 4 á 5 kinderen overgewicht hebben. Zwaarlijvigheid kan zowel op de korte als lange termijn gezondheidsproblemen veroorzaken, zoals (pre-) diabetes, hart- en vaatziekten, bot- en gewrichtsklachten, slaap problemen, verscheidene soorten kanker en sociale problemen door stereotypering, stigmatisatie en lager zelfvertrouwen. Hoewel men door genetische en metabolische factoren aanleg kan hebben om zwaarlijvig te worden, kunnen sociale omgevingsfactoren een belangrijke beschermende of verergerende rol spelen. Eten is een sociale aangelegenheid waarin men beïnvloedbaar kan zijn door het gedrag van anderen. Het is daarom belangrijk om de sociale invloed op voedselkeuze en –inname te bestuderen.

In de introductie (hoofdstuk 1) is toegelicht dat mensen zich aanpassen aan sociale richtlijnen of normen door naar het gedrag van

1 Met gezonde en ongezonde producten wordt in dit proefschrift gerefereerd naar producten met een hoge (voedsel met een hoog suiker, zout en/of vetgehalte) of lage (voedsel zoals fruit en groenten) energiewaarde.
anderen te kijken en het te kopiëren. Dit gebeurt niet alleen in situaties waarin men niet over een bepaalde (voor)kennis beschikt, maar ook wanneer er sociale motieven zijn om gepast gedrag te vertonen. Mensen kunnen zich bijvoorbeeld conformeren aan normen om een sociale band te ontwikkelen en aardig gevonden te worden of om te voorkomen dat ze buiten de groep vallen. Onderzoek laat zien dat men daarom ook geneigd is om elkaars eetgedrag als referentiepunt of sociale norm te gebruiken. Echter, niet iedereen is hier even vatbaar voor en mensen zijn zich vaak niet bewust van de sociale invloed op hun eetgedrag. Tot nu toe hebben studies naar sociale imitatieprocessen zich voornamelijk gericht op eetsituaties bij vrouwelijke (jong)volwassenen. Echter, eetgewoontes manifesteren zich al op jonge leeftijd. Daarnaast hebben jongeren een andere dagbesteding dan volwassenen en een minder ontwikkelde mate van zelfcontrole. Ook spiegelen zij zich meer aan anderen op deze leeftijd. In dit proefschrift staan daarom basisscholieren centraal in het onderzoek naar factoren die een rol spelen in imitatieprocessen en aanpassingsgedrag in sociale eetsituaties.

De inzichten zijn verkregen door experimentele studies uit te voeren op de basisschool van de jongeren of in de supermarkt. Elk hoofdstuk in dit proefschrift bestaat uit een experimentele studie waarin omwetende basisscholieren (de proefpersonen) zijn gekoppeld aan leeftijdgenoten. De leeftijdgenoten waren fysiek aanwezig of de scholieren stonden met elkaar in contact via de sociale media. In de studies zijn de ‘echte’ leeftijdgenoten betrokken in het onderzoek door een instructie te geven om bepaalde producten te kopen (hoofdstuk 3), óf niets of een bepaalde hoeveelheid snackvoedsel te eten (hoofdstuk 4, 6, 7 en 8). In de laatstgenoemde studies werd de leeftijdgenoot geholpen door een ‘buzzer.’ Dit is een apparaatje dat in de broekzak of zok van de leeftijdgenoot zat en trillsignalen gaf wanneer hij/zij wat mocht eten. Op deze manier was de beïnvloeding van snackingredients voor iedereen gelijk en vergelijkbaar. Alle basisscholieren werden op speelse wijze betrokken in het onderzoek zodat zowel de proefpersonen als de geïnstrueerde leeftijdgenoten het werkelijke doel van de studie niet wisten. In de studies gepresenteerd in hoofdstuk 2 en 5 dachten de proefpersonen met een leeftijdgenoot in direct contact te staan via de computer. In werkelijkheid waren de reacties van de leeftijdgenoten en de voedselkeuzes en -inname van tevoren al opgenomen en bepaald. Op deze manier kon in elke studie een zo natuurlijk mogelijke reactie
van de proefpersoon gemeten worden, al dan niet beïnvloed door zijn/haar leeftijdgenoot.

*Studies en bevindingen*

**DEEL I**

In *hoofdstuk 2* is een studie beschreven waarin de invloed van een leeftijdgenoot op de keuze tussen bekende en onbekende (on)gezonde producten is onderzocht. In het experiment werden basisscholieren (N=316; 50.3% jongens; gemid. leeftijd 7.13) gevraagd om in een computerspel tussen twee foto's van voedselproducten te kiezen, waarbij de foto's in de volgende (gerandomiseerde) paren op het beeldscherm verschenen:

1. bekende versus onbekende gezonde producten,
2. bekende versus onbekende ongezonde producten,
3. bekende gezonde versus onbekende ongezonde producten, en
4. onbekende gezonde versus bekende ongezonde producten.

De basisscholieren dachten dat de leeftijdgenoot hetzelfde keuzespel op een andere school aan het spelen was, maar dit was in scène gezet. De scholieren zagen voordat zij een keuze konden maken, eerst de keuze van de leeftijdgenoot. De leeftijdgenoot koos altijd voor de bekende of onbekende producten. De controlegroep werd niet aan de keuze van de leeftijdgenoot blootgesteld. Op deze manier konden 2 experimentele groepen met een controlegroep worden vergeleken. De bevindingen van dit onderzoek toonden aan dat een leeftijdgenoot de bereidheid om te kiezen voor onbekende producten kan vergroten. Desalniettemin was de voorkeur voor met name ongezonde (on)bekende producten sterk.

Een alledaagse situatie waarin mensen uit veel voedselproducten kunnen kiezen, is wanneer men winkelt in de supermarkt. De bevindingen van de studie gepresenteerd in *hoofdstuk 3* laten zien dat jonge tienermeisjes zich laten beïnvloeden door het koopgedrag van hun leeftijdgenoot. In dit onderzoek kregen meisjes (N=89; gemid. leeftijd 10.86) de opdracht om producten te kopen voor een schoolreisje. Er werd verteld dat ze rekening moesten houden met de lunch, iets om te drinken en om tussendoor te consumeren. De leeftijdgenoot was van tevoren met behulp van een memory-spel geïnstrueerd om 5 producten te kopen die bij elkaar een lage, of gemiddelde of hoge calorische waarde hadden. De meisjes die samen met iemand winkelden die calorierijke producten kocht, waren geneigd om calorierijkere producten te kopen.
Dan wanneer ze met iemand winkelden die calorie-arme producten kocht. Daarnaast kochten meisjes die honger hadden producten met een hogere calorische waarde.

**DEEL II**

Het tweede deel van dit proefschrift richt zich op factoren die mee kunnen spelen in de vatbaarheid voor sociale invloeden op snackinname. Eerder onderzoek heeft laten zien dat het gewicht van jongeren kan meespelen in de mate van aanpassingsgedrag. De studie gepresenteerd in *hoofdstuk 4* gaat over de rol van het lichaamsgewicht van de proefpersoon en de neiging om zich aan te passen aan de snackinname van een leeftijdgenoot. Daarnaast is onderzocht of een leeftijdgenoot een sociale norm of richtlijn (betreft de hoeveelheid inname) kan neerzetten, die de proefpersoon ook weer volgt wanneer hij/zij een aantal dagen later alleen is. De bevindingen zijn verkregen door basisscholieren (N=223; gemid. leeftijd 8.66) samen een puzzel te laten maken terwijl zij vrij waren om iets te eten en te drinken. Echter, de leeftijdgenoot was van tevoren geïnstrueerd om niets of (met behulp van de buzzer) een bepaalde hoeveelheid te eten. Een aantal dagen later werd de proefpersoon opnieuw uit de klas gehaald om nogmaals de puzzel te maken, maar deze keer zonder de leeftijdgenoot. Van tevoren waren alle basisscholieren gemeten en gewogen, zodat de geïnstrueerde leeftijdgenoot altijd een gemiddeld gewicht had. De proefpersonen varieerden in het hebben van een gemiddeld gewicht (N=145; 53% jongens) of overgewicht (N=78; 51% jongens). Op deze manier konden de gewichtsgroepen worden vergeleken in combinatie met het effect van de leeftijdgenoot op snackinname over een tijdsperiode. Uit de resultaten bleek dat de basisscholieren verschillen in de mate van kopieergedrag op grond van hun lichaamsgewicht. Basisscholieren met een gemiddeld gewicht waren geneigd om meer te eten wanneer een leeftijdgenoot iets at dan wanneer de leeftijdgenoot niets at. Opvallend is dat het niet uitmaakte of de leeftijdgenoot weinig of veel at. Basisscholieren met overgewicht bleken alleen meer te eten wanneer de leeftijdgenoot veel at in vergelijking met wanneer hij/zij niets of weinig at. Het kan zijn dat jongeren met overgewicht zich meer op hun gemak voelden om te eten als de ander veel eet. Daarnaast bleek dat kinderen na een aantal dagen hetzelfde eetpatroon aanhielden zonder het bijzijn van de leeftijdgenoot. De bevindingen suggereren dat de inname
van een leeftijdgenoot als voorbeeld kan dienen op de langere termijn, zelfs wanneer de leeftijdgenoot er niet meer bij is.

Studies hebben aangetoond dat het lichaamsgewicht van mensen van invloed is op hun zelfvertrouwen. Een mogelijk sociaal motief voor het aanpassen aan een norm is om te voorkomen dat men buiten de groep valt of niet aardig gevonden wordt. Het gevoel ergens bij te (willen) horen wordt mede bepaald door ons zelfvertrouwen. In hoofdstuk 5 is daarom onderzocht of het zelfvertrouwen van jonge tieners op de basisschool een rol speelt in het kopiëren van snackinname. Daarbij werd onderzocht of dit net zo aanstekelijk werkt via internet. Velen communiceren immers dagelijks met elkaar via sociale media zoals op de computer, tablet of smartphone. Het onderzoek werd uitgevoerd door basisscholieren (N=118; 38.1% jongens; gemid. leeftijd 11.14) te laten geloven dat zij in videoverbinding stonden met een andere scholier die niets at of een bepaalde hoeveelheid (weinig of veel). Er werden 3 verschillende constructen van zelfvertrouwen gemeten: expliciet algemeen zelfvertrouwen, lichaamsbeeld en impliciet zelfvertrouwen. Expliciet zelfvertrouwen wordt gemeten op basis van bewuste zelfreflectie (vragenlijst) terwijl impliciet zelfvertrouwen wordt gemeten door een taak die door middel van reactietijden een persoon vraagt om intuitief en automatisch te reageren op positieve en negatieve associaties met zichzelf. De bevindingen tonen aan dat jongeren niet alleen beïnvloedbaar zijn wanneer een leeftijdgenoot fysiek aanwezig is, maar ook via internet. Tijdens de online interactie waren de jonge tieners geneigd om hun inname aan de snack hoeveelheid van de ander aan te passen. In lijn met de verwachting, pasten de tieners met een negatiever zelfbeeld hun eetgedrag meer aan dan degenen met een positiever zelfbeeld. Daarnaast bleek ook het impliciete zelfvertrouwen een rol te spelen: hoe meer impliciet zelfvertrouwen, hoe meer de scholier zijn/haar inname aanpast aan de ander. Onderzoek bij jongvolwassenen en volwassenen laat zien dat impliciet zelfvertrouwen een rol speelt in de regulatie van sociale gedragingen en non-verbaal gedrag. Een mogelijke verklaring is dat impliciet zelfvertrouwen bijdraagt aan het creëren van een sociale band door sociale imitatieprocessen. Hierdoor zouden jongeren met een hoger impliciet zelfvertrouwen automatisch meer het eetgedrag van de ander imiteren dan jongeren met een lager impliciet zelfvertrouwen. Opvallend bij het expliciete zelfvertrouwen is dat het algemene zelfvertrouwen een minder belangrijke rol leek te spelen in het
aanpassingsgedrag vergeleken met het specifieke lichaamsbeeld van de
tieners (oftewel: de tevredenheid over hun lichaam). Mogelijk heeft dit
tevredenheid met de onzekere leeftijdsgroep. Tieners spiegelen
zich meer aan anderen dan volwassenen en zijn onzekerder over hun
eigen lichaam. Het zou daarom interessant zijn om verschillen tussen
bepaalde leeftijdsgroepen te onderzoeken en aandacht te schenken aan
verschillende soorten zelfvertrouwen.

Hoewel het lichaamsgewicht en zelfbeeld mensen meer vatbaar zouden
cunen maken voor sociale invloed, zijn de meeste mensen zich niet eens
bewust van de invloed vanuit de sociale omgeving. Om een idee te krijgen
van onderliggende en mogelijk automatische processen is in hoofdstuk 6
gekeken naar de directe imitatie van voedselinnname. Het reiken naar
voedsel zou een onbewuste reactie kunnen opwekken om ook iets te
pakken en te eten. Zo heeft onderzoek bij jongvolwassenen laten zien
dat men een grotere kans heeft om een slok drinken of hap avondeten te
nemen nadat een ander dit heeft gedaan. In de studies nam de kans op
imitatie af naarmate de tijd verstreek. Een mogelijke verklaring van de
onderzoekers was dat mensen in het begin imiteren om een sociale band te
creëren en dat dit na verloop van tijd afneemt wanneer men hierin slaagt.
In het onderzoek van dit proefschrift is getoetst of dit ook plaatsvindt
bij jongeren. Dit werd gedaan door videobeeldmateriaal op de seconde
nauwkeurig te coderen waarbij de directe respons van een proefpersoon
(N=68; 50% jongens; gemid. leeftijd 8.56) op het pakken van snackvoedsel
door een leeftijdgenoot werd gemeten. Wanneer de proefpersoon binnen 5
seconden snackvoedsel pakte nadat de leeftijdgenoot had gepakt, werd dit
gezien als imitatie. Vanwege eerdere aanwijzingen dat lichaamsgewicht
een effect kan hebben op sociale imitatieprocessen, is ook onderzocht
of gewicht een rol speelt in de directe imitatie van pakbewegingen. De
bevindingen laten zien dat er een grote kans is op directe imitatie van het
pakken van snackvoedsel door jongeren. Verder blijkt het imitatiepatroon
tussen kinderen met een gemiddeld gewicht en overgewicht te verschillen
gedurende hun sociale interactie. Bij kinderen met overgewicht nam de
waarschijnlijkheid van imitatie toe gedurende het samenzijn terwijl dit bij
kinderen van gemiddeld gewicht afnam. Met dit onderzoek is vastgesteld
dat ook jongeren direct reageren op eetbewegingen en dat gewicht een
rol kan spelen in de mate van imitatie. Mogelijke verklaringen kunnen
gevonden worden in processen omtrent impulsiviteit en zelfregulatie,
spiegelneuronen die geactiveerd worden en zorgen dat men dezelfde actie wil uitvoeren, of kopieergedrag om een sociale band te creëren. Echter, vervolgonderzoek is nodig om uit te sluiten welke processen een rol spelen.

Een andere situatie waarin we ons dikwijls niet bewust zijn van ons eetgedrag en sociale invloeden is wanneer we samen met anderen opgaan in een televisie (TV) serie of programma. In hoofdstuk 7 is onderzocht of jongeren elkaars snackgedrag kopiëren tijdens het kijken van een emotionele film. Dit werd getest door basisscholieren (N=112; 51.8% jongens; gemid. leeftijd 7.78) in koppels van jongens of meisjes een verdrietige, vrolijke of ‘neutrale’ film te laten zien. Eén van de scholieren werd in een complot betrokken en gevraagd om niets te snakken of een van tevoren vastgestelde hoeveelheid. Het blijkt dat jongeren geneigd zijn om zich aan het eetgedrag van hun leeftijdgenoot aan te passen als ze naar een verdrietige of vrolijke film kijken, maar niet naar een neutrale film (d.w.z. zonder gebeurtenissen die gevoelens van verdriet of vreugde zouden kunnen opwekken). Hoewel sommige mensen meer eten om hun negatieve en soms ook positieve emoties te reguleren, verklaarde dit niet waarom de scholieren de snackiname van de leeftijdgenoot alleen volgden bij de emotionele films. Het kan te maken hebben met het cognitieve vermogen om te kunnen functioneren bij emoties. Als men emotionele veranderingen of gebeurtenissen verwerkt, verlopen andere handelingen zoals eten soms minder aandachtig. Mensen kunnen zich daardoor onbewust aanpassen aan een richtlijn of norm die de omgeving hen ingeef. Als iemand in die omgeving weinig of veel eet, dan kan men beïnvloed worden. Uit het onderzoek blijkt dan ook dat scholieren die naar de neutrale film hadden gekeken achteraf beter konden inschatten hoeveel hun leeftijdgenoot had gegeten dan scholieren die een verdrietige of vrolijke film hadden gezien.

DEEL III

Het bewustzijn van sociale imitatieprocessen zou jongeren minder vatbaar kunnen maken voor sociale invloeden. Dit is onderzocht in een interventiestudie gepresenteerd in hoofdstuk 8 van dit proefschrift. De interventie was gericht op het uitleggen van sociale imitatieprocessen door middel van foto’s, video’s en een taakje waarin de basisscholieren wel en niet mochten imiteren. Eén dag na de interventie werden de proefpersonen (N=141; 78% jongens; gemid. leeftijd 7.84) gevraagd
om samen met een leeftijdgenoot een puzzel te maken terwijl zij vrij waren om iets te eten en te drinken. De leeftijdgenoot was van te voren geïnstrueerd om een bepaalde hoeveelheid te eten (met behulp van de ‘buzzert’). Op deze manier kon onderzocht worden of de scholieren de interventieboodschap in de praktijk konden brengen en niet het eetgedrag van de leeftijdgenoot zouden kopiëren. Er werden 2 verschillende interventies gegeven waarvan de inhoud hetzelfde was, maar één van de interventies werd gegeven met een pluche knuffelaap. De groep scholieren die de interventie met de knuffelaap hadden gekregen, werden een dag later tijdens het maken van de puzzel weer blootgesteld aan de aap om te toetsen of hij ze aan de interventieboodschap kon herinneren (‘cue reminder’). Een derde onderzoeksgroep (de controlegroep) werd niet aan de interventie blootgesteld. Naast het effect van de interventie werd ook een mogelijk verschil tussen jongens en meisjes onderzocht, omdat onderzoek heeft laten zien dat meisjes gezondheidsboodschappen beter zouden kunnen toepassen dan jongens. Uit de bevindingen blijkt dat beide interventies (met en zonder aap) geen effect hadden op het sociale imitatiedrag; zowel jongens als meisjes aten na de interventie nagenoeg dezelfde hoeveelheid als de geïnstrueerde leeftijdgenoot. Meisjes aten in beide interventiegroepen evenveel als in de controlegroep én de geïnstrueerde leeftijdgenoot. Jongens hadden een hoge inname in de controlegroep en verminderden hun inname na de interventie zonder aap tot dezelfde inname als de leeftijdgenoot. Een mogelijke verklaring is dat de basisscholieren zich niet bewust waren van hun aanpassingsgedrag. Jongens hebben waarschijnlijk hun inname verminderd omdat de interventie enige bewustzijn over gezond eten gecreëerd had. Meisjes zijn over het algemeen meer gevoelig dan jongens voor hun sociale omgeving waardoor ze de inname van hun leeftijdgenoot monitoren om ongepast (eet)gedrag te voorkomen. Uit deze studie blijkt het overheersende effect van sociale invloed op snackinname.

Discussie en conclusie

Uit de studies gepresenteerd in hoofdstuk 4 – 7 blijkt dat basisscholieren geneigd zijn om hun snackinname aan te passen aan die van hun leeftijdgenoot. De bevindingen van hoofdstuk 2 en 3 laten zien dat deze sociale invloed ook van kracht is wanneer jongeren kunnen kiezen tussen gezonde en ongezonde producten. Hoewel het sociale aanpassingsgedrag
(oftewel sociale imitatie) alom aanwezig lijkt te zijn, tonen de bevindingen van de studies in hoofdstuk 4, 5 en 7 aan dat de gevoeligheid voor sociale invloed en de mate van aanpassing kan variëren op basis van persoonskenmerken. De mate van aanpassing blijkt namelijk afhankelijk te zijn van iemands lichaamsgewicht, zelfvertrouwen of het ervaren van emoties. Met name jongeren met overgewicht zijn vatbaar voor een te hoge snackname wanneer zij in de buurt zijn van mensen die grote porties eten. Daarnaast zijn er aanwijzingen gepresenteerd in hoofdstuk 6, 7 en 8, dat jongeren zich niet bewust kunnen zijn van deze sociale imitatiesprocessen.

Naar aanleiding van de bevindingen uit het eerste deel van dit proefschrift is in de discussie (hoofdstuk 9) besproken dat de mate waarin jongeren hun keuzes aanpassen aan anderen kan afhangen van persoonlijke voorkeuren of gewoontes. Een sterke afkeer voor bepaalde producten of een gewoonte-idee over waaruit een lunch zou moeten bestaan, kan het aanpassingsgedrag beïnvloeden. Deze kennis kan ingezet worden om jongeren gezondere keuzes te laten maken: sociale imitatiesprocessen kunnen gebruikt worden om de bereidheid van jongeren te vergroten om gezondere keuzes te maken en antipathie te creëren tegen ongezonde producten of hoeveelheden daarvan. Er kan dus gekozen worden voor een gecombineerde aanpak om bepaalde producten te promoten en te ontmoedigen door een leeftijdsgenoot/rolmodel. De bespreking van de bevindingen uit het tweede deel van dit proefschrift geven aan dat vervolgonderzoek zich zou kunnen richten op de rol van gewoontes in combinatie met persoonskenmerken zoals zelfvertrouwen. Als jongeren van huis uit gezonde eetgewoontes hebben maar een laag zelfvertrouwen, zouden ze toch vatbaar kunnen zijn voor ongezonde eetgewoontes van leeftijdgenoten. Afgezien van de vatbaarheid door persoonlijke kenmerken, kunnen jongeren zich niet bewust zijn van sociale invloed op snackname. Impliciete of automatische processen kunnen hierin een rol spelen. Daarnaast kunnen jongeren afgeleid zijn door het kijken naar televisie en/of het ervaren van emoties. Bij volwassenen zijn er indicaties dat ‘mindfullness’ (het bewustzijn van wat je doet/eet) kan helpen om mensen meer aandacht te laten hebben voor hun voedselinname. Echter, er is (nog) geen onderzoek onder jongeren uitgevoerd. De bevindingen van het derde deel van dit proefschrift tonen aan dat sociale normen overheersend zijn. Interventies
gericht op het bewust maken van sociale beïnvloedingsprocessen onder jongeren zijn wellicht niet effectief. Er valt meer winst te halen uit het feit dat jongeren zich ook aanpassen aan anderen als zij minder eten of gezonde keuzes maken. Dit onderstreept het belang van een gezonde sociale omgeving. Er is een belangrijke rol weggelegd voor scholen en ouders om de juiste gezonde omgeving voor jongeren te creëren. Verder wordt gespeculeerd over de rol van sociale motieven in imitatieprocessen en worden tekortkomingen besproken. De studies geven bijvoorbeeld niet genoeg bewijs om te achterhalen of men door sociale imitatieprocessen daadwerkelijk wil bereiken dat zij aardig gevonden (willen) worden. Hiervoor is meer onderzoek nodig. Een andere limitatie is dat de leeftijdsvase fase van de jongeren een rol kan spelen in de mate waarin ze beïnvloedbaar zijn door hun omgeving. De bevindingen van dit proefschrift kunnen dus niet gegeneraliseerd worden over alle leeftijdsgroepen. Daarnaast eet men vaak met bekenden samen. Meer onderzoek met jongeren zou uitgevoerd moeten worden in de familiaire omgevingen. Tot slot zijn mogelijke implicaties voor de ontwikkeling van theorie besproken. Zo wordt voorgesteld om de rol van persoonlijke normen en gewoontes in de theorie op te nemen en onderscheid te maken tussen 2 verschillende soorten normen, namelijk descriptieve normen (afgeleid van wat anderen doen en wat normaal is om te doen) en injunctieve normen (sociaal wenselijk gedrag: sociale beloning of afstraffing door wel/ niet ‘gepast’ gedrag te vertonen).

Het proefschrift breidt de huidige literatuur uit door de sociale invloed van leeftijdgenoten op zowel voedselkeuze als -inname aan te tonen bij jongeren. Leeftijdgenoten hebben een directe en sterke impact op het consumptiegred van jongeren. Hoewel persoonskaracteristieken (zoals lichaamsgewicht of zelfbeeld), gewoontes en voorkeuren jongeren vatbaar kunnen maken voor het consumptiegred van een ander (of juist daartegen kunnen beschermen), is iedereen beïnvloedbaar omdat men zich dikwijls niet bewust is van sociale imitatieprocessen. De personen om ons heen kunnen ongemerkt leidend zijn in onze voedselkeuze en -inname. Aangezien de directe omgeving een grote rol speelt, is het aan te raden om sociale netwerken in te zetten om jongeren gezonder te laten eten. Hierbij zou niet alleen de nadruk moeten liggen op het aanmoedigen van het consumeren van gezondere producten, maar ook het ontmoedigen van (grote hoeveelheden) ongezonde producten.
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Curriculum vitae
Kirsten Bevelander was born on the 18th of December 1980 in Amstelveen, the Netherlands. After finishing secondary education (Gymnasium) at the Fioretti College in Lisse, she moved to Wageningen to study ‘International Development studies’ in 2000. During her student life, she was actively involved in numerous student committees and boards of the Wageningen University and a student association (SSR-W). In 2003/2004, she interrupted her study to work as a full-time board member at SSR-W with a scholarship from the Wageningen University. In 2004, she continued her study and specialized in ‘Communication, Technology and Policy.’ During the two-year master program, she became increasingly interested in communication strategies and behavioural science. She successfully completed her internship at a community project of the National Institute for Agricultural Technology ‘Instituto Nacional de Tecnologia Agropecuaria (INTA)’ in Balcarce (Argentina) in 2006. She travelled across Australia for several months to collect data for her master thesis on (sexual) risk behavior among backpackers, which she completed at the ‘Communication and Innovation’ department of the Wageningen University in 2007/2008. After receiving her master’s degree in 2008, Kirsten started working as a PhD researcher at the department of Developmental Psychopathology of the Radboud University Nijmegen.

In her PhD project, different research areas (e.g., consumer science, nutrition, social psychology) are combined to advance the understanding of social modeling behavior on young people’s food choice and intake. She managed and organized numerous (large) experimental studies which took place at primary schools and supermarkets. These studies could not have been conducted without the support of several bachelor and master students from the Hogeschool of Arnhem and Nijmegen (HAN) and the Radboud University Nijmegen whom she supervised during their fieldwork and thesis writing. Most of her studies have been presented at conferences and published in international peer reviewed journals. During her project, she enjoyed collaborating with (inter) national scientists and experts to exchange research ideas, organize workshops and working visits, and publish papers. In 2012, she worked for 3 months at the Food and Brand Lab of the Cornell University in Ithaca (NY), USA. Kirsten had the opportunity to review for several journals such as the Academy of Nutrition and Dietetics, Appetite, European Journal of Clinical Nutrition, International Journal of Behavioral Nutrition and
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*Physical Activity* and *Frontiers in Eating Behavior*. Throughout her PhD trajectory, she was also involved in educational activities, which resulted in a University teaching qualification (BKO). From 2009 – 2012, she was an active board member of the Behavioural Science Institute PhD student platform. Next to her work, she coaches pupils of a regional education center (ROC Nijmegen) in a community program to prevent early school drop-out and she is an alumni SOLS-W board member of her former student association. In her spare time, she enjoys to travel, read, run, play golf and spend time with her friends and family.
Publications in peer-reviewed international journals


Publications in peer-reviewed national journals


Conference presentations


**Certificates of international courses and Summer Schools**

- Summer School (2012). Hosted by the European Association for Research on Adolescence (EARA) and the Society for Research on Adolescence (SRA), Spetses, Greece.
- Summer School (2011). *Methodological workshop - Structural Equation Modeling (SEM)* Hosted by the University of Turin & European Association for Research on Adolescence (EARA), Turin, Italy.