GIVE ME A BRAKE!

THE IMPACT OF THE PRESENCE OF OTHERS ON FOOD INTAKE

ROEL C.J. HERMANS

In modern society, the consumption of food has implications beyond merely providing nutrients and energy needed to sustain life. Food and eating also play a major role in our social lives; we eat with or in the presence of other people. This dissertation covers nine experimental studies that expand our knowledge on how human food intake is affected by the presence of others. In the first part of this thesis, we address the situational factors that can affect modeling effects on eating. The second part addresses some individual factors that might make people more eager to adapt their food intake to that of others.

The findings are linked to previous and recently published modeling research in order to present the reader with a clear overview of the conclusions that may be drawn from the existing literature in general, and these situational and individual factors in particular. Finally, two steps are proposed that might inform strategies that are encouraged to improve people's eating habits in social contexts.

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“Imagination is more important than knowledge”

- Albert Einstein -

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Chapter 1

GENERAL INTRODUCTION

Ask people to explain why they are having a meal or a snack, and the most likely answer would be "because I am hungry". Ask them why they have stopped eating and the common response will be "because I had enough" or 'because I felt full'. Until the 1960s, it was assumed that these physiological signals were indeed the primary regulators of food intake (Vartanian, Herman, & Wansink, 2008). Although human food intake is obviously driven by necessity, observations of eating behavior in restaurants, bistros, cinemas or at parties demonstrates that people largely eat because food is available (Wansink, 2006). Family and friends, labels and advertisements, smell and colors, they all might influence food choice and intake (Hetherington, 2007; Hetherington, Anderson, Norton, & Newson, 2006; Salvy, Jarrin, Paluch, Irfan, & Pliner, 2007; Stroebele & De Castro, 2004; Wansink, 2006). The past 40 years have seen increasingly rapid advances in the research on the nonphysiological factors that might influence when and how much people eat. Noteworthy among these factors is the immediate social environment (Bellisle, 1979; Conger, Conger, Costanzo, Wright, & Matter, 1980; De Castro & De Castro, 1989).

Food and eating play an important social role. Most eating takes place in the presence of others and it is often perceived as an enjoyable part of a cultural experience (Rozin, 2005). Religious celebrations such as Christmas or Eid-ul-fitr, birthdays, or business meetings, they all tend to revolve around social eating. Research in sociology and anthropology has indicated that the amount and type of food that is consumed within these contexts can play a role in communication, identity expression, and gender roles (e.g., Caplan, 1996; Fischler, 1988; Germov & Lauren, 2004; Mintz & Du Bois, 2002; Murcott, 1982). Thus, eating may also serve a self-presentational statement: "You are what you eat!" Elaborating on the cultural significance of food and eating, Murcott (1982, p. 204) indicated that "eating habits are products of codes of conduct and the structure of social relationships of the society in which they occur". That is, people eat in a socially organized fashion; there are definite ideas about good and bad table manners, strict rules of how the dining table needs to be set and clear understandings of the types of food that are appropriate to different occasions. Likewise, eating with others often involves

social norms. These norms might be communicated by explicit remarks from one's eating companions on the type and amount of food that is consumed ("eating large portions of fries makes you fat!"), as well as implicitly by the other's eating behavior (ordering a salad instead of fries).

In the past decades, a growing body of literature has investigated the effects of the presence of others on eating. Three research areas can be discerned: social facilitation, modeling, and impression management (Herman, Roth, & Polivy, 2003). The pattern that can be discerned from these literatures is that people eat more – often 40% to 50% - when they eat in groups (social facilitation), that they tend to eat more or less when their eating companion eats more or less (modeling), and that when people eat in the presence of others who they believe are observing or evaluating them, they tend to eat less than they do when alone (impression management). The primary conclusion from this literature is that people's food intake is affected by that of their eating companion(s). Less is known, however, about the circumstances under which one's intake is influenced by that of one's eating companions. To gain more insight into this question, we will use a modeling paradigm in which two unacquainted individuals are eating together.

The aim of the present thesis is to explore the individual and situational factors that can influence modeling effects on eating. This insight might help to determine under which circumstances modeling operates and which individuals are more or less disposed to adapt their food intake to that of others. This introduction presents the role of social norms in explaining human behavior, after which we extend this social norm theory to the field of social eating by discussing the normative framework put forth by Herman and his colleagues (Herman et al., 2003; Herman & Polivy, 2005). This normative account on social influences on eating will be the theoretical basis of this dissertation. Then, we will discuss the most important studies in this field. These studies describe how food intake is influenced by the presence and behavior of others. At the end of this introduction, the research presented in this thesis will be summarized, along with the research approaches that were taken to examine modeling effects on eating.

The Role of Social Norms in Explaining Human Behavior

General theories of normative behavior might help to understand why people conform their behavior to that of others. Descriptive norm theories, for example, indicate that information regarding the acceptable or typical way to behave within a certain group is derived from the behavior of other group members (Aronson, Wilson, & Akert, 2005). By invoking the heuristic of "what most people are doing is probably the correct thing to do" people rely on these norms to identify adaptive behavior (Cialdini, Kallgren, & Reno, 1991). In other words, these norms can communicate appropriate behavior and might be adopted as behavioral standards of what people should do. Cialdini (1988) has argued that these norms accelerate information processing and offer a decisional shortcut about how to behave in a given situation. Thus, by simply observing how other people behave, and by adapting one's behavior accordingly, one can quickly adapt to new situations.

In contrast to these descriptive norms, which specify what others do, injunctive norms describe what one should do (Cialdini et al., 1991). In other words, these norms constitute the moral rules of the group and they motivate action because they are followed by social rewards or punishment (informal sanctions). Thus, exhibiting inappropriate behavior could result in embarrassment or rejection by desirable others, whereas socially appropriate behaviors could result in acceptance and status (Festinger, 1954). Although normative (i.e., injunctive norms) and informational (i.e., descriptive norms) influences are theoretically distinct processes, they most often operate together to create conformity (David & Turner, 2001; Turner, 1985). Indeed, the concern of being liked might be the primary motivational force that underlies the concern of being accurate. That is, conforming to the behavioral norms set by others (or at least not being too distinct) may be a means to achieve acceptance and approval.

How Social Norms Might Explain Food Intake in Social Contexts

Using a normative approach to understand social influence effects on eating, Herman and colleagues (2003) have proposed that the effects of the presence of others can be interpreted in terms of adherence

to socially derived norms. In short, these authors argue that the principal regulatory influence on eating in social contexts is exerted by people's beliefs of what or how much is appropriate to eat. This belief is often influenced by the stricture against "excessive eating". In social eating situations, this norm refers to eating appreciably more than others do. According to these authors, the intake of others most likely serves an inhibitory function, signaling when people must stop eating before their eating becomes excessive.

Given the existence of the thin beauty ideal and the negative stereotypes that are associated with eating too much (cf., Vartanian, Herman, & Polivy, 2007), it is not surprising that people are very sensitive to how much they eat in the presence of others. What constitutes "appropriate eating", however, is quite ambiguous and situationally dependent. To overcome the uncertainty about how much to consume, people often engage in social comparison (Herman & Polivy, 2005). That is, they roughly monitor what their eating companions are eating and adjust their own intake accordingly. In this way, people rely on the example of others for guidance. If the others seem to be eating a lot, one can safely eat more – and perhaps more than would do when eating alone – without being perceived as overeating. It has been proposed that these socially-derived norms of appropriateness can explain both increased or decreased intake in social eating situations (Pliner & Mann, 2004), depending on whether others are eating, how much they are eating, and the extent to which one wishes to impress these people (we will explain this below).

In the literature on social influences on food intake, three different eating norms can be distinguished: the matching norm, the norm for minimal eating, and personal norms (Herman & Polivy, 2005; Roth, Herman, Polivy, & Pliner, 2001). *The matching norm* dictates that people adjust their intake to that of their eating companion, by modeling their companion's intake. This norm can account for the majority of studies on modeling effects and is generalizable to many situations and many kinds of people (Roth et al., 2001). In line with the general theory on normative behavior, it can be assumed that people match their intake to that of others because their intake serves as a source of information of how

much one could eat within the given context. In this view, seeing another person eating can indicate a signal that is acceptable to eat more. Thus, when the other is eating (or eating a large amount), a norm can be set that justifies similar behavior. It has been widely assumed that conforming to the behavior of another person may serve a self-presentational strategy (Roth et al., 2001) or can increase social acceptance and liking.

In contrast to the matching norm, which is widely generalizable, the *norm for minimal eating* seems to apply specifically to women. This norm dictates that under conditions in which making a good impression is important (e.g., a first date), women often try to accomplish these impression management goals by eating minimally. Just as eating too much might attract criticism, eating minimally may attract admiration (cf., Vartanian et al., 2007). For example, research has shown that women who eat minimally are viewed more positively (Basow & Kobrynowicz, 1993; Bock & Kanarek, 1995; Chaiken & Pliner, 1987; Martins, Pliner, & Lee, 2004; Pliner & Chaiken, 1990). It has long been assumed that this norm might particularly exert its influence in opposite-sex eating partners (Mori, Chaiken, & Pliner, 1987), but it has become clear that women might also present themselves as minimal eaters to other women (e.g., Roth et al., 2001; Leone, Herman, & Pliner, 2008). This may not be too surprising, given that eating and weight are socially acceptable competition motives among women (Rodin, Silberstein, & Striegel-Moore, 1985). In these eating situations, women may eat minimally in order to convince their eating companion (whether male or female) of their femininity or self-control (Roth et al., 2001). It should be acknowledged, however, that this behavior-impression association might be situationally dependent. Leone and colleagues (2008) demonstrated that women who eat minimally do not necessarily make a positive impression. These authors demonstrated that when women were undercut by the intake of another woman, they preferred a female eating companion who ate more than they did. In other words, these kinds of impression management strategies can backfire under certain circumstances.

Personal norms, after all, are internalized rules that people have developed on basis of their own experiences. It is often unknown where these personal norms come from, but usually they are

both person- and situation-specific (Herman & Polivy, 2005). They can derive from one's experiences at home, where each family member is accustomed to eating two sandwiches for lunch, but it is also possible that one has learned throughout the years that two sandwiches for lunch is what people in their country usually eat. These norms might differ for men and women and younger and older people, but they can also apply to specific situations, such as at home or in restaurants. Thus, whereas the matching norm and the norm for minimal eating are directly derived from the behavior of others in the same context, personal norms are cognitive norms that are based on one's prior experience (which might or might not have a social origin).

To summarize, the eating behavior of others can thus induce a social norm about how much is appropriate to consume, and people are likely to adhere to these norms in order to behave correctly, to gain social approval, or to avoid the negative judgments that are associated with eating too much. Some people may also inhibit their intake in the presence of others, again as a means of impression management. But even when one is motivated to eat minimally, the intake of the eating companion can guide how much (or how little) one may eat while still eating less than everyone else.

We now turn to the research on modeling effects on eating. We will demonstrate how the matching norm and the norm for minimal eating can both explain the stimulating and suppressive effects of the presence of others on food intake. For the sake of brevity, we focus on the studies that were published in the years before the current research project started (which was in 2007). The modeling studies that were published after 2007 will be discussed in the different chapters and in the general discussion at the end of this thesis.

Modeling Effects on Eating: A Brief Review

Nisbett and Storms (1974) published the first experimental study on modeling effects of food intake. In their study, male undergraduates were either eating alone or with a same-sex confederate eating a small (1) or large number (20) of crackers. Regardless of the weight status of the undergraduates (i.e.

underweight, normal or overweight), it was found that they consistently ate more when accompanied by a confederate who ate a large number of crackers than when eating alone. Demonstrating the suppressive effect of the minimal eating companion, however, it was found that normal and overweight male undergraduates ate more alone than they did when the confederate was eating only one cracker.

In the subsequent years, several other attempts were made to find potential moderators of modeling effects on eating. Polivy and colleagues (1979), for example, hypothesized that similarities between eating companions would enhance modeling. They expected that a female restrained confederate would enhance modeling effects among female restrained undergraduates, whereas unrestrained females would be equally vulnerable to modeling regardless of the confederate's dieting status. Although strong modeling effects were observed, the results could not confirm the authors' initial hypotheses; no differences were found between female restrained and unrestrained undergraduates in the extent of modeling. These findings were supported by Rosenthal and Marx (1979) who also did not find any differences between female restrained and unrestrained eaters in the extent of modeling. Another interesting finding by Polivy and colleagues (1979), however, was that females who were paired with a "dieting confederate" significantly suppressed their intake compared to the other conditions, regardless of how much this confederate had consumed. This unexpected finding was explained by the possibility that the presence of a dieter (or the mention of dieting) could have alerted females to adhere to the implicit norm of minimal consumption. Although the authors did not elaborate on this normative explanation, this study is among the first that linked women's likelihood of modeling to socially derived norms.

Rosenthal and McSweeney (1979) and Conger and colleagues (1980) extended the literature by examining the differences between normal weight and overweight undergraduates (both males and females) in their likelihood of modeling of eating. These authors explored whether obese undergraduates would be more influenced by the co-eater's behavior, which would be in line with the externality hypothesis of Schachter (1971), or whether their results would contradict Schachter's notion that these

individuals differentially rely on the physiological and external cues. In accordance with the work of Nisbett and Storms (1974), however, no differences were found between normal- and overweight males and females in the extent of modeling, leading the authors to conclude that social context factors might have a strong and pervasive influence on the eating behaviors of both normal weight and overweight individuals.

Ten years later, Goldman and colleagues (1991) proposed another potential moderator of modeling effects on eating. On the basis of the boundary model of Herman and Polivy (1984), they expected to find that hungry individuals would be less inclined to model the other's intake, because their hunger should motivate them to eat without considering the amount consumed by their eating companion. Their results, however, underscored the power of social influence over eating; female undergraduates ate very little when their eating companion ate very little. These suppressive effects were even found when these women had been food-deprived for one day, clearly demonstrating that modeling can override strong physiological influences like hunger.

Another study that is important to discuss is that of Herman and his colleagues (Herman, Koenig-Nobert, Peterson, & Polivy, 2005) which sought possible moderators from the domain of personality (i.e. self-monitoring and extraversion). This study extended the literature by demonstrating that all female participants matched their intake to that of their eating companion. Given that the matching effect of eating was obtained regardless of personality, this study underscored the generality of the effect.

Using a slightly different paradigm, Roth and colleagues (Roth et al., 2001) showed that female undergraduates also adjusted their eating to the pattern described on a list of prior eaters, suggesting that modeling effects can be triggered without a real-life interaction. In their manipulation, female participants were provided with a fictitious list of how much prior participants had consumed in the same context. This manipulation was found to have a substantial effect on the amounts eaten by participants; those exposed to a high eating norm ate more than those exposed to a low eating norm. Moreover, it was found that the low-intake norm had a more powerful effect on participants' eating than

the high-intake norm. Since then, this “remote-confederate design” has been used to induce modeling effects on eating (Leone, Pliner, & Herman, 2007; Pliner & Mann, 2004). The early work of Roth and colleagues (2001), however, was the first that invoked a “matching norm” to account for the modeling effects of eating, and therefore came closest to the normative account on modeling that was developed a few years later (cf. Herman et al., 2003).

Given the previously demonstrated robustness of modeling of food intake, Johnston (2002) questioned the situations under which the seemingly inevitably modeling effect could be eliminated. On basis of the idea that stigmatization may inhibit modeling as a result of normative or informational influences, it was hypothesized that the nature of the eating companion would moderate the powerful modeling effects seen in eating behavior. In two experiments, it was clearly shown that non-obese (BMI < 30) women modeled the ice cream intake of their eating companion, but only when that companion was not obese. The author assumed that the non-obese women associated an obese eating companion with unhealthy eating and, because of the potential cost of becoming obese, they did not model her behavior. Thus, it is possible that any deviation from the co-eater’s weight status might affect individuals’ modeling behavior.

Taken together, we have seen that eating behavior is profoundly affected by social influences. Demonstrating how powerful these influences operate in explaining eating behavior in social contexts, we have shown that people conform their eating to that of others regardless of their internal signals, age, sex, weight status or personality. Most studies have used a normative account to explain their findings; people tend to adjust their eating to that of others in order to be correct, to gain social approval or to impress others.

The Present Research

Addressing Problems with Previous Studies

Although previous studies have made some headway in answering the question under which

circumstances modeling operates, a serious limitation of the literature is that the eating situations used in these studies are not comparable with actual eating situations. Most studies have used taste-paradigms in which, mostly female, participants were required to taste and rate different kinds of foods (e.g., Conger et al., 1980; Leone et al., 2007; Polivy et al., 1979; Rosenthal & Marx, 1979). Although taste rating is not a difficult task, it might interfere with normal eating behavior. Moreover, in these clinical laboratory contexts, participants were often paired with an experimental confederate with whom they were not allowed to interact. This might have induced uncertainty about how much one should consume, making people more vulnerable to the social influence effects induced by the behavior of the other person. It is possible that social modeling effects are less strong in daily life eating situations, where norms for appropriate eating may be better developed. The studies presented in this thesis are among the first in which the social modeling of eating (with the intake of the eating companion controlled by the experimenter) is tested in more naturalistic eating environments (e.g. in a living room or a replication of a real bar). Moreover, by using different eating situations (e.g., meals and snacks) in which participants were allowed to interact with same-sex peers, we increased the generalizability of our findings. Although the evaluative consequence of a live interaction between participants and confederates may introduce uncontrolled variables to our design (e.g., confederate's appearance, gestures, social skills, mannerisms or atmosphere in general), this also creates a research situation in which justice is done to the complex social situations in which eating often takes place. We realize that inviting people to eat with an unknown other in a laboratory context may still not be identical to real-life social eating contexts (e.g. at home or in a restaurant), but within the boundaries of experimental research, we think that this is the best way to overcome the limitations of earlier studies on modeling.

Potential Moderators of Modeling Effects on Intake

Although several individual factors (e.g., weight status, personality, hunger or restraint levels) have not been found to influence participants' likelihood to conform their intake to that of others (e.g., Goldman et

al., 1991; Herman et al., 2005; Polivy et al., 1979; Rosenthal & McSweeney, 1979), this does not mean that individuals might not differ in the extent of their modeling. If the food intake of others is construed as a stimulating rather than an inhibiting cue, it is possible that other individual factors may become important as well. For instance, people might differ in the extent to which they find food rewarding or not. It has been found that some individuals, such as obese or restrained eaters, may find food particularly rewarding and therefore automatically pay more attention to external food-related cues (e.g., pictures of tasty foods) (Davis, Patte, Levitan, Reid, Tweed, & Curtis, 2007; Stice, Spoor, Ng, & Zald, 2009). Conversely, this tendency to detect and attend to such external food cues may contribute to craving and subsequent eating (Werthmann, Roefs, Nederkoorn, Mogg, Bradley, & Jansen, 2011). Although previous studies have focused on the influence of increased attention for food pictures on eating behavior, it can also be reasoned that people who pay more attention to the sight of eating others, may also be more likely to eat in response to the eating behaviors of those around them. Because of the prevalence of these eating cues, it is important to consider whether individuals' attention to these cues may affect modeling of food intake.

It is also possible that individual differences in inhibitory control or impulsivity might affect the extent to which people are likely to conform their eating to that of others. That is, individuals who are unable to inhibit responses when they see others eating might be more likely to eat more just because others are. To date, numerous studies have been conducted on the influence of impulsivity (or the inability to inhibit motor responses) on food intake. One area that has not been examined, however, is whether impulsivity affects the extent to which people are likely to increase their intake in response to the sight of someone eating. Therefore, one of the studies presented in this thesis explored whether individual differences in impulsivity and attention to food and eating cues make people more (or less) likely to conform their food intake to that of others.

A Dynamic Approach to the Modeling of Food Intake

To date, most studies on modeling of food intake have tested how the eating behavior of one individual is affected by the intake of another individual (usually an instructed confederate). This is a one-sided approach that is agnostic with respect to the dynamic processes that might operate when two people are eating together. For example, there is some likelihood that both eating companions will get caught up in a process whereby the behavior of one person triggers the eating of the other, which in turn might trigger the behavior of the first person (cf., Herman et al., 2003). If one wants to know whether both eating companions are influencing each other in terms of bites, eating speed or intake, a researcher should use a free-eating paradigm in which he or she cannot control any of the intakes. This paradigm also makes it possible to examine whether people's food intake becomes synchronized through behavioral mimicry. Mimicry is assumed to occur because of the tight neural link between perception and action (Dijksterhuis & Bargh, 2001; Iacoboni, Woods, Brass, Bekkering, Mazziotta, & Rizzolatti, 1999) in which the mere perception of another's (eating) behavior automatically increases the likelihood of engaging in the same behavior. The assumption in this thesis is that behavioral mimicry can at least partially account for modeling effects on eating. To date, no studies in the field of social influences on food intake have explored the possible imitation processes that might operate when people are eating. Therefore, one study presented in this thesis examined whether people directly mimic their companions' food intake.

Overview of the Present Thesis

The research presented in this thesis capitalizes on the observation that people model the food intake of their eating companions. There is need for studies that give insight into the factors that affect the degree of modeling and for studies that examine these effects in situations that are similar (or close) to real-world eating contexts. Therefore, the aim of this dissertation is to examine the circumstances under which modeling operates by exploring the individual and situational factors that can affect this modeling

effect. It is assumed that the normative framework of Herman and colleagues (2003) is correct, and we will continue by exploring the details and limits of this model. In addition, we will examine whether the food intake of others might be construed as an external cue that stimulates food intake.

The first seven chapters present experimental studies that investigate whether and how particular situational factors moderate the modeling effect of eating in female young adults. In Chapters 2 and 3, two studies are presented that will investigate whether the physical appearance of the eating influences the degree of modeling. Given the close link between social impressions and the type of food that is consumed, this thesis examines whether the effects of the co-eater's psychical appearance differs when participants are offered low- or high-energy dense foods. In Chapter 4, a study is presented that examines whether and how the personal characteristics of the co-eater will affect the extent of modeling. In Chapters 5 and 6, two studies are presented that investigate the impact of the eating context on the extent of modeling. These studies examine whether modeling will also occur when participants are served a complete breakfast (Chapter 5) or evening meal (Chapter 6). Finally, Chapter 7 explores whether participants model the food intake of a video model who is shown eating in a different context. After that, we will examine some individual difference moderators. Chapter 8 presents a study that will investigate whether men will adapt their intake to that of their eating companions. Given that the vast majority of studies have focused on modeling among women, it is important to examine whether the same effects also occur among men. In Chapter 9, in which we focus on female eaters again, we look at two potential individual difference moderators - impulsivity and attentional bias- which might make some women more eager to increase intake in response to the eating behavior of their eating companion. To conclude, the study presented in Chapter 10 examines the possible dynamic interplay between female eating companions.

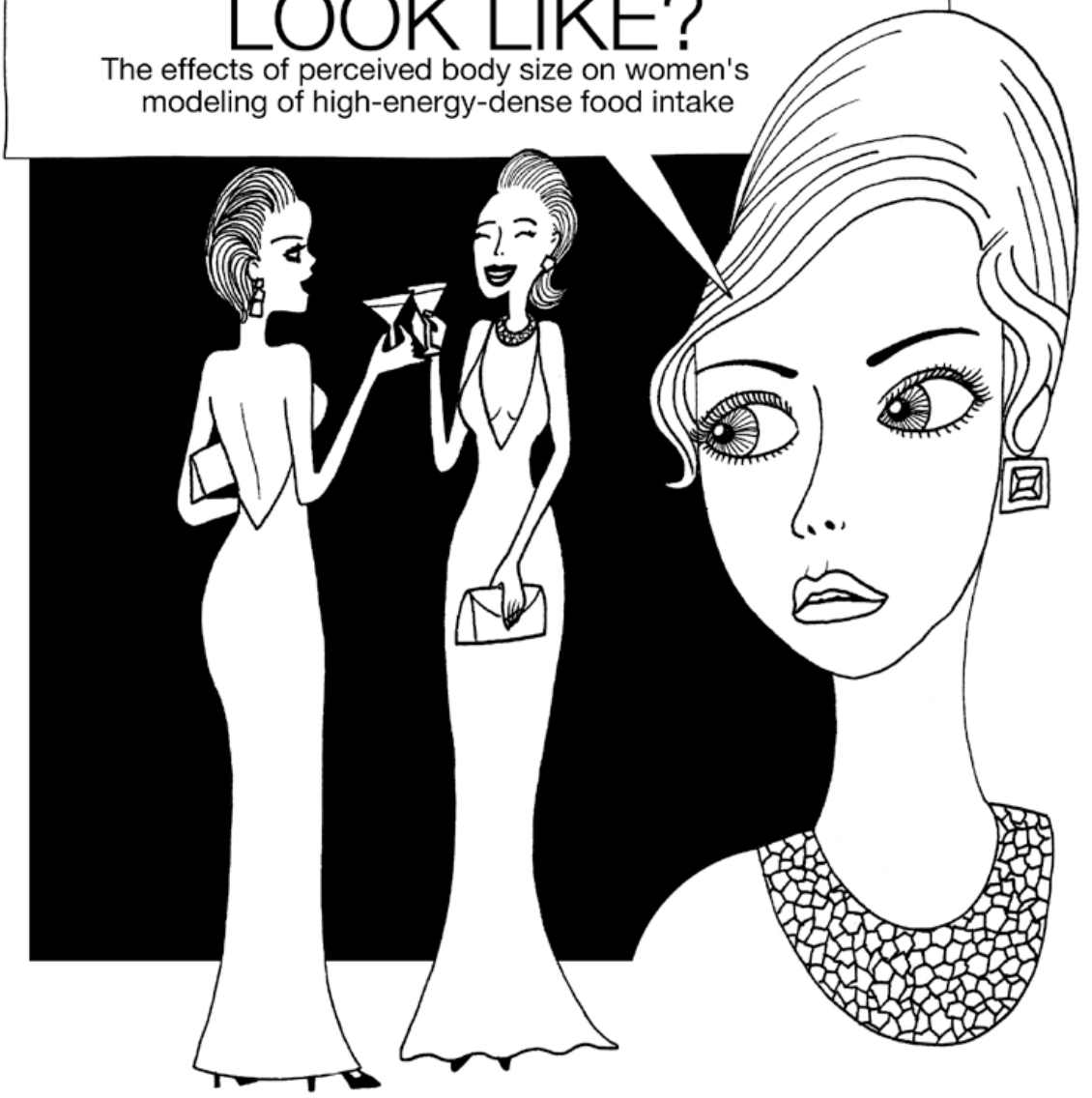
Prologue

Because adherence to socially derived norms with regard to eating may be more important to women than to men, due to women's heightened body image and eating concerns (Chaiken & Pliner, 1987), it is not surprising that most modeling studies have focused on young women. In the following five studies, we therefore opted to focus strictly on women. Next, if adherence to socially derived norms indeed plays an important role in explaining young women's food intake in social eating situations, then it seems plausible to assume that this effect can be moderated by certain characteristics of the eating companion. Given that eating and weight are socially acceptable competition motives among women (Rodin, Silberstein, & Striegel-Moore, 1985), it is expected that women might be especially prone to inhibit their intake in the presence of a rather slim eating companion, whereas they might be more inclined to follow the lead of a similar-weight eating companion. We will examine this proposition in the following two chapters.

Chapter 2

WHAT DOES SHE LOOK LIKE?

The effects of perceived body size on women's modeling of high-energy-dense food intake



Abstract

Laboratory taste-test studies have shown that social modeling effects on food intake are powerful. The aim of the present study was to examine the degree to which people model food intake in a more naturalistic eating setting. After completing a cover task, female participants (n = 102) spent a 15-min break with a female confederate who ate a large amount or a small amount of M&Ms or no M&Ms at all. Further, the confederate had a slim or (subtly manipulated) normal weight appearance. Females who were exposed to a confederate who ate much consumed more than those who were confronted with a confederate who ate only a little or nothing at all. Although the manipulation of the confederate's appearance had no significant main effect on the amount of food that participants consumed, a significant interaction effect was found, such that the modeling effect of eating was present only in the normal weight appearance condition. Our findings suggest that normal weight young women are more inclined to imitate the food intake of a female confederate if they are more similar to the confederate.

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Introduction

Food and eating play an important role in social life: the majority of our meals or snacks are consumed in the presence of other people. In general, people eat more when eating with others than when eating alone (De Castro & De Castro, 1989; Redd & De Castro, 1992). In addition to this social facilitation effect, people model each other's eating behaviors. In a typical modeling experiment, the participant eats in the presence of a confederate who has been instructed to eat either a lot or a little. Previous experiments on the modeling of food intake made use of taste-test or incidental-eating designs with a confederate present or with information provided to participants about what alleged former participants ate (remote-confederate paradigms). Such studies, regardless of the participants' hunger status, dieting status, or weight, have all found the same pattern: people tend to eat more when confederates eat more and less when confederates eat less (Conger, Conger, Costanzo, Wright, & Matter, 1980; Goldman, Herman, & Polivy, 1991; Herman, Roth, & Polivy, 2003; Rosenthal & Marx, 1979; Roth, Herman, Polivy, & Pliner, 2001). This modeling effect appears to be so powerful that it may even overwhelm feelings of hunger, satiety or dieting intentions.

Although these effects are quite strong, they have been observed primarily in laboratory taste-test studies in which participants are required to taste different kinds of foods and are allowed to eat as much as they like. This paradigm suffers from some limitations. Although 'rating the taste of food' is not a particularly difficult or exhausting performance task compared to many other performance tasks (e.g., solving mathematical problems), taste rating may nevertheless interfere with normal eating. Second, the taste-rating design forces people to eat at least something, which could be very difficult or disruptive for certain types of people (e.g., restrained eaters). Third, and probably most important, the taste-test design is not comparable with a real-world social eating situation. Experiments conducted in more naturalistic settings are more suitable to test the generalization of modeling effects (Bot, Engels, Knibbe, & Meeus, 2007; Engels & Granic, 2005). The extent to which people model other's eating behavior is likely to depend not only on the context in which the eating takes place, but also on the

characteristics of the model. Some researchers (e.g., Salvy, Romero, Paluch, & Epstein, 2007) have suggested that the model's physical appearance is important in explaining the magnitude of modeling effects. Although the availability of palatable food generally motivates eating in humans, the presence of social company might have an independent (or interactive) effect on eating. To avoid making the wrong impression, people are guided not only by the normative standards that others establish by their own eating patterns but also by what they think that others would think of them when they eat too much. This latter consideration can be explained by the fact that overeating in social contexts has negative connotations; for instance, overeaters are seen as being deficient in self-control (low delay of gratification) (Puhl, Schwartz, & Brownell, 2005). Whether people inhibit their tendencies to eat, especially in novel social contexts with strangers, may also depend on the weight of the other persons (e.g., slim, normal weight, or overweight) as this provides clues about whether the others will accept the intake of palatable food.

A few studies have examined the role of the physical appearance of the model. De Luca and Spigelman (1979) found that obese females ate more in the presence of a large-eating obese confederate than in the presence of a large-eating non-obese confederate. Similarly, Salvy et al. (2007) found that overweight girls who were with overweight peers ate more than did overweight girls who were accompanied by normal weight peers. These studies compared modeling of food intake when the confederate is normal weight versus overweight or obese, creating large contrasts in physical appearance of the model. We were interested in seeing whether normal weight young women are affected by the example of a slim versus a normal weight model. The assumption is that normal weight females will more strongly model the food intake of a normal weight confederate than of a slim confederate, because eating too much, particularly in the company of a slim model, might lead to negative judgments and social disapproval (Vartanian, Herman, & Polivy, 2007).

The main aim of the current study was to examine modeling effects on food intake in normal weight young women. An experimental–observational paradigm was used in which we varied the

confederate's physical appearance and food intake during a 15-min break in an experimental session. Two hypotheses were tested. First, we predicted that participant's food intake would be strongly affected by confederate's food intake (with three conditions: no intake, small intake, and large intake). Second, we predicted that these modeling effects would be stronger if the confederate was of normal weight than if the confederate was slim. We manipulated the confederates' physical appearance by having the same slim confederates wear a soft silicon belt underneath their clothes in the normal weight condition.

Methods

Design

An experimental design with a three (confederate intake: high, low, none) by two (confederate-weight status: slim, normal weight) factorial design was used. Participants were randomly assigned to one of the six conditions. Confederates were instructed to eat nothing (no-intake condition), 4 M&Ms (low-intake condition), or 25 M&Ms (high-intake condition). The weight condition consisted of confederates wearing either a tummy belt (normal weight condition) or not (slim condition). In the normal weight condition, the confederate wore a custom-made (SKM Rapid Modelling BV, Helmond, The Netherlands) tummy belt of soft silicon which made her look visibly thicker around her belly (**Figures 1 and 2**).

Participants

A total of 127 young women (university students) volunteered for the study. All participants were recruited via an Internet sign-up program of the Behavioural Science Institute of the Radboud University Nijmegen. Registration for our study was restricted to female students. We excluded 7 participants from further analyses because they became aware of the actual aim of the study. Additionally, as our aim was to examine whether normal weight young women were affected by the example of slim versus normal weight models, we excluded 25 overweight participants (BMI > 25) from our study. The final sample, then, consisted of 102 participants with a mean age of 20.50 (SD = 2.09) and a mean BMI of 21.50 (SD = 1.76). All participants were of normal weight.

Figure 1.

Digital photo of a confederate whose physical appearance was not manipulated.

Figure 2.

Digital photo of a confederate whose physical appearance was manipulated with a custom-made soft silicon belt.

Confederates

Seven female students at the Radboud University Nijmegen acted as confederates. They had a mean age of 22.86 (*SD* = 2.61) and a mean BMI of 20.90 (*SD* = 1.10). These girls all had relatively slim figures, which was necessary for the success of the weight manipulation. Although it is difficult to control for individual characteristics (e.g., attractiveness or friendliness), we tried to select confederates of whom the physical appearances were almost the same. Furthermore, they were all socially skilful and therefore capable to start and maintain a conversation with an unknown other. The confederates were carefully instructed and trained in the procedures. Each session included two people: one was the actual participant and the other was the confederate who acted as if she was an ordinary participant (cf. Harakeh, Engels, Van Baaren, & Scholte, 2007). The confederates were randomly assigned to one of the six conditions in a given session. They were not informed about the exact hypotheses. The seven confederates were dressed almost identically during all experimental sessions, wearing blue jeans and a form-fitting top to reduce the possibility that differences in clothing might bias the results (see Krones, Stice, Batres, & Orjada, 2005). Before the start of each session, the confederate was told to eat either nothing, a small amount, or a large amount of M&Ms during the break and to wear the tummy belt or not beneath her clothes. The confederates were assigned equally to the various conditions.

Procedure

Participants were invited to engage in a study on evaluation of TV commercials. This was a cover story to prevent the participant's attention from being drawn into the actual aim of the study, i.e., examining social modeling of food intake. No further details were given with respect to the content of the study. This type of procedure has been used in several experiments conducted in our lab on modeling of alcohol consumption or cigarette smoking (e.g., Bot, Engels, & Knibbe, 2005; Harakeh et al., 2007). To simulate a naturalistic setting, we made use of a small room that was furnished as a living room, in which a relaxing atmosphere was created. The experimental living room was furnished with a table on which

was placed a pitcher of water, six glasses, and a bowl of M&Ms. Food and drinks were easily reachable by both persons from two chairs which were situated facing each other so that the confederate and the participant could easily see each other. In the corner of the room stood a small table with a TV and DVD player and two comfortable viewing chairs.

Participants were invited to our laboratory during the period April–June 2007. All sessions took place on weekdays from 11 a.m. to 5 p.m. The participant, confederate and experimenter met each other at the front office of the research department. Then the experimenter accompanied the confederate and participant to the observation room, where the procedure of the study was explained. First, the participant and confederate were told to sit in front of the TV screen. The first task involved evaluating five commercials shown on the TV screen (neutral commercials without women or references to weight or food); they had 30 s to individually complete questions assessing whether the advertisement was irritating or appealing. This task took approximately 5 min. After completion of the task, there was a break. The participants were obliged to stay in the room, but were free to sit down at the table. They were told that they were free to help themselves to M&Ms and water. This instruction was used during all sessions. Participants were told they could talk with their partner (i.e., the alleged other participant) and recorded music was played to create a relaxing atmosphere. Type of music (Ready to go: Women of the 90s, Sony BMG Music Entertainment Netherlands BV, 1998) and volume was kept constant. The experimenter did not specify how long the break would last, unless it was specifically asked. Then the experimenter left the room. The confederate was instructed to directly take an M&M at the beginning of the break if she had been instructed to eat 4 or 25 M&Ms[1]. Further, we standardized the timing of the confederate's food intake. We gave confederates instructions with a small light in the corner of the room (invisible to the participant). When she saw the light flash, the confederate was to take a predetermined number of M&Ms. The timing was kept stable over sessions for the low- (4 M&Ms) and high-

[1] Before starting our study, a pilot study was performed among female undergraduate students and graduate students to determine a reasonable amount of M&Ms in the low- and high-intake conditions. It appeared that approximately 4 and 25 M&Ms corresponded with what people perceived as a small or large amount of M&Ms.

(25 M&Ms) intake conditions. During the 15-min break, video and audio recordings were made. One flexible camera (with zoom) was hidden in the same corner of the room as was the flashing light used for the confederates' instructions. In another room, the experimenter operated the camera and observed the behavior of the participant. After the break, the experimenter entered the room and gave instructions about the second 5-min task, in which the participant and the confederate were instructed to evaluate the commercials together and to complete the questionnaire together.

Finally, both women were asked to complete some questions about their impression of the break, judgment of the confederate's figure, hunger ratings, liking of M&Ms and the actual aim of the study. They were told that they were guided to different rooms because of the personal nature of the questions. However, the actual reason for this separation was that the confederate had a shortened version of the questionnaire, including only the questions on the atmosphere of the break and her impression of the participant. After the participant had completed the questionnaire, she was taken to another room where her weight and height were measured. Each participant received 8 euro or 1 course credit (for educational requirements) for participating in this study. After all data were collected, participants were debriefed about the actual purpose of the study by sending an e-mail to their university e-mail address.

Measures

Food intake. In the observation room, the experimenter counted the number of M&Ms eaten by the participant. At the end of the session, the total number of M&Ms eaten was counted and converted into kcal in line with Anschütz, Van Strien and Engels (2008), we used total caloric intake as the dependent variable instead of total grams of food consumed. We measured the mean weight of a single M&M by weighing ten M&Ms and dividing this by ten (M = 2.1 g). According to the food label of a bag of M&Ms, 100 g of M&Ms contains 516 kcal. So, a single M&M contains 10.84 kcal (5.16 multiplied by 2.1).

Hunger. We measured the participants' subjective hunger on a 10-point rating scale (from 1 =

not at all hungry, to 10 = very hungry).

Confederate's physical appearance. The physical appearance of the confederate was assessed by asking participants to evaluate the figure of the female confederate. We made use of a scale that was based on that of Stunkard, Sorensen and Schulsinger (1983). Participants saw nine drawings with female figures and they had to choose the figure that corresponded most closely to that of the confederate. We further split these figures into upper- and lower-body drawings. The participants had to choose the upper- and lower-body pictures that most closely corresponded to the confederate's upper and lower body, respectively.

BMI. Height and weight were measured, with participants wearing light clothing without shoes. Height was measured to the nearest 0.5 cm with an adjustable tape line attached to the wall, and weight to the nearest 0.1 kg using a digital balance (Mettler PM3000). Body mass index was calculated by the weight in kilograms divided by the square of height in meters.

Dietary restraint. To measure dietary restraint we made use of The Dutch Eating Behavior Questionnaire (DEBQ; Van Strien, Frijters, Bergers, & Defares, 1986). Examples of items were 'Do you deliberately eat less in order not to become heavier?' and 'Do you take your weight into account when eating?' Restrained eating was measured with 10 items on a 5-point scale with responses ranging from 1 ('never') to 5 ('very often'). This scale has good internal reliability and good concurrent, construct, and predictive validity (Van Strien, Engels, Van Staveren, & Engels, 2006). Cronbach's α coefficient was 0.93. Participants' mean scores on the restraint subscale of the DEBQ was 2.57 (SD = 0.84). This score is similar to the norm group score (M = 2.60; SD = 0.80) for Dutch female college students (n = 405) (Van Strien, 2005).

Strategy for analyses

Before performing our main analyses, we first checked whether the manipulation of the confederate's physical appearance was successful. Independent-sample t-tests were used to compare participants'

rating of the confederate's figure to check whether they had different perceptions of the confederate's figure in the slim and normal weight conditions. We also examined whether participants in the various conditions differed with respect to how they perceived the experimental break and how they judged the personal characteristics of the confederate, using analyses of variance. For our main question, an analysis of variance was used to examine the main effects of the intake and confederate-weight conditions and the interaction between them on participants' total kcaloric intake. BMI and dietary restraint were not significantly correlated with food intake ($p > 0.10$) and were not included in the model. However, hunger, $r(102) = 0.27$, $p < 0.01$, and liking of the M&Ms, $r(102) = 0.22$, $p < 0.01$, were significantly correlated with food intake and were entered into our model as covariates.

Results

Manipulation checks

Participants' ratings varied significantly as a function of the confederates' physical appearance, $t(100) = 2.71$, $p < 0.01$. Participants rated the figure of the model as slimmer ($M = 3.13$, $SD = 0.71$) in the slim condition than in the normal weight condition ($M = 3.58$, $SD = 0.93$). Participants significantly differed in their rating of the upper part of the confederate's body $t(100) = 3.26$, $p < 0.01$, but not in the lower part rating, $t(100) = 1.39$, n.s. In sum, our appearance manipulation was successful in the sense that participants noticed the difference between the slim and normal weight confederate. Randomization over the six conditions was also successful: participants in the various weight manipulation and eating conditions did not differ on BMI, hunger, liking of M&Ms and dietary restraint ($p > 0.10$), nor were there any significant interactions between the eating and weight condition on the above-mentioned variables.

Furthermore, the majority of the participants perceived the break as relaxing (86.3%), nice (87.3%), entertaining (86.3%) and interesting (66.7%). There were no differences between participants in the different conditions as to how they rated the atmosphere during the break. It appeared that there were no differences between participants in the different conditions as how they rated the personal

characteristics of the confederates. Our confederates were evaluated as generally friendly, attractive, sociable and healthy. Moreover, there were no differences ($p > 0.05$) between confederates as how their personal characteristics were perceived by the participants.

Food intake

Our primary question was whether participants' intake varies when in the presence of a slim or normal weight model who eats either nothing, a small amount, or large amount of M&Ms. Table 1 shows the total amount consumed in the different conditions. We controlled (through covariation) for individual variations in hunger and liking of M&M's, as these were associated with food intake. There was a significant main effect for eating condition on the amount of kcalories consumed, $F(2, 100) = 9.18$, $p < 0.001$.

Table 1
Total amount consumed in each condition.

	n	*M* kcal intake	*SD*	Adj. *M*	*SE*	Total amount of M&Ms consumed in pieces		*n*	M kcal intake	*SD*	Adj. *M*	*SE*	Total amount of M&Ms consumed in pieces
Slim confederate							Normal-weight confederate						
No intake	17	18.49	46.26	23.60	16.28	2.18	No intake	16	5.97	21.64	6.42	16.72	0.59
Low intake	20	21.13	28.01	23.61	14.97	2.18	Low intake	17	28.86	41.38	27.00	16.23	2.49
High intake	15	52.67	56.26	47.29	17.40	4.36	High intake	17	117.16	147.79	115.33	16.27	10.64

Despite the fact that the weight manipulation had no significant main effect on the amount of kcalories that the participants consumed, $F(1, 101) = 1.84$, n.s., there was a significant interaction effect between eating condition and weight condition on total amount of kcalories consumed, $F(2, 100) = 3.54$, $p < 0.05$. The total model (participants' food intake; confederates' weight status; participants' hunger level; participants' liking of M&Ms; and the interaction between these variables) explained 27% of the variance in total kcaloric intake. Closer inspection revealed a significant modeling effect in the normal weight condition, $F(2, 50) = 7.26$, $p < 0.05$, but not in the slim model condition, $F(2, 52) = 1.96$, $p = 0.15$. Scheffé post hoc tests showed that within the normal weight condition, the high-intake condition differed from the control ($p < 0.01$) and low-intake ($p < 0.05$) conditions. In terms of effect sizes these effects were large and moderate–large, respectively; participants consumed more kcalories when with a high-intake, normal weight confederate than when with a normal weight confederate who ate nothing ($d = 0.86$) or a small amount ($d = 0.72$).

Although participants consumed more kcalories when in the presence of a large-eating confederate, their actual intakes were less than half of the models'. An increase of 21 M&Ms in the intake of the model only induced an increase of approximately 8 M&Ms in the participants'. As a result, the intake of the participant was substantially lower than the confederate's. Additional analyses revealed no differences in findings for the different confederates. Furthermore, equivalent results were found when using the participants' total number of M&M's eaten as the dependent variable.

Whereas all our participants were in the normal BMI range, differences in weight were still substantial. We also performed an additional regression analysis to test whether variation in participants' BMI influenced the modeling effects found. Results showed no significant two- and three-way interactions between participants' BMI (continuous variable), eating condition and weight condition.[2]

[2] We also tested whether restrained eating influenced the modeling effects, but no significant two- or three-way interactions between restraint ($M = 2.57$, $SD = 0.84$) eating and weight condition were found.

Discussion

The present study examined social modeling effects on intake of snack food in young women. We aimed to test whether women would imitate the eating behavior of a previously unknown same-sex peer and whether imitation is moderated by the physical appearance of this model. To our knowledge, this is the first experimental study in which social modeling of eating is tested in young women in a more naturalistic environment (i.e., a living-room setting and not within the context of a taste-test study). In our opinion, using such a paradigm strengthens the generalizability of our results to real-world eating contexts. The extent to which people model others' eating behavior might depend on characteristics of the model. Therefore, we subtly manipulated the physical appearance of slim models by having them wear a soft silicon belt which made them look visibly thicker. By doing so we avoided problems that might have biased the results of earlier studies on social modeling of food intake and weight status; prior studies used different models varying in weight (i.e., De Luca & Spigelman, 1979; Salvy et al., 2007). It is clear that the presence of a female eating confederate had a significant effect on food intake of our young female participants. This result corresponds to the results of other social modeling studies on food intake; people eat more when their eating companion eats more (Conger et al., 1980; Goldman et al., 1991; Herman et al., 2003; Rosenthal & Marx, 1979; Roth et al., 2001). However, we found that normal weight female participants displayed imitation (i.e., eating substantially more when the confederate ate substantially more) only when their eating companion was also of normal weight and not when their eating partner was rather slim. This suggests that young women's modeling behavior is affected by the physical appearance of the eating partner.

A few possible explanations for this pattern of results may be offered. First, because overeating has some negative connotations (Puhl et al., 2005) and women who eat less are generally judged more positively (Chaiken & Pliner, 1987), women may inhibit their eating under conditions in which it appears that making a good impression is important. Roth et al. (2001) showed that women inhibit their eating when observed by an experimenter. In our study, the relatively slim models may have

induced minimal-eating impression-management strategies among the normal weight participants. Being thin is generally viewed as a sign of status, discipline and healthfulness (Leary, Tchividijian, & Kraxberger, 1994). Therefore, the young women in our study may have been more concerned with impressing the slim confederate than with impressing the normal weight confederate and may have presented themselves as disciplined eaters by restricting their snack intake (irrespective of how much the confederate ate). Second, a slim confederate may be seen as more likely to be judgmental than a normal weight confederate, so women interacting with a slim confederate may have felt more self-conscious about their weight, resulting in a restricted snack intake (and thus less modeling of the high-intake confederate). In contrast, in situations in which a normal weight model consumes large amounts of snack food, it may be more acceptable for participants to consume more. In this particular situation, their desire to be perceived as more feminine, or their fear of being negatively evaluated, could be reduced because the physical appearance of the eating partner was less than "perfect". We found that the participants more closely resembled (or thought that they more closely resembled) the normal weight confederates than the slim confederates on the figure rating scale of Stunkard, Sorensen, and Schulsinger (1983), suggesting that social modeling effects could be strengthened by feelings of similarity. Third, eating and weight are acknowledged as socially acceptable competition motives among women (Rodin, Silberstein, & Striegel-Moore, 1985). Perhaps women are more motivated to compete (by restricting their food intake) when with a visibly slimmer woman. Further research is required to explore the mechanisms underlying the stronger modeling effects in the normal weight models. Such exploration is rendered difficult (see also Herman et al., 2003; Salvy et al., 2007), since psychological states that occur *during* social interactions are not easily measurable if one wants to keep the situation as natural as possible. Furthermore, impression management and competition motives are often unconscious processes and therefore difficult to identify, because people may be not fully or even partially aware of their own intentions in this regard (Herman et al., 2003).

We would like to stress that our findings were independent of participants' BMI – which was of

course of restricted range as no very thin or overweight persons were included – and dietary restraint, which underscores the robustness of these findings. A study by Anschütz et al. (2008) showed that exposure to slim media models 'reminded' restrained eaters of their diets, and therefore they ate less than did unrestrained eaters. We assume that the features and consequences of social interactions between women are so important that they might overrule participants' dietary intentions. Therefore, in future studies it would be interesting to focus not only on physical appearances of partners but also on dynamic social aspects of the interaction. In the area of substance use, research has examined the nature of the social interaction by using so-called warm and cold models (i.e., sociable and unsociable models) (Quigly & Collins, 1999). The findings of some of these studies support the notion that the magnitude and duration of smoking or drinking depends on the quality of the social interaction (Collins, Parks, & Marlatt, 1985; Harakeh et al., 2007). Transposed to the domain of eating, not only the presence of an eating partner but also the quality of interaction with this partner might affect food intake. When the individual interacts with a warm and friendly model who shows some interest in her – instead of acting in an unresponsive way – we assume that the individual will be more likely to imitate the food intake of the model. The finding that an increase of 21 M&Ms in the confederate's intake (i.e., large-eating normal weight confederate) only induced an increase of 8 M&Ms in the participant could be explained by the notion that individuals use other people's intakes as ways of determining how much they themselves may eat without eating excessively (Herman et al., 2003). So, they do not exactly match or model the other's intake, but they use it as a guideline for how much food is appropriate to eat in the given situation. The confederate in our study established a maximum amount that may have operated as an indication of the maximum that the participants can safely eat. We suppose that young women consider an intake of approximately 10 M&Ms in the presence of a large-eating normal weight woman as a safe and appropriate amount (i.e., an amount that not raises negative judgments). Furthermore, it appeared that there were no differences between the participants' intake in the none- and small-eating conditions. This finding suggests that if the amount of food consumed is very small, no modeling behavior will

occur among female young adults. During the break the participants were free to pick some M&Ms from a large bowl present on the table. Our confederates were instructed to pick only 4 M&Ms from this large bowl. We assume that this amount was too small to cause effects among female young women. Probably, the young women in our sample did not notice the difference between a young woman who eats nothing and one who only eats 4 pieces from a large bowl of M&Ms present during an experimental break.

Some limitations of the present study should be mentioned. The first is that we cannot determine whether the presence of a female eating partner has restricted or enlarged the amount of food consumed. Future studies should preferably include a control condition in which participants spend the break alone in order to determine whether the presence of an eating partner per se has stimulative or suppressive effect on eating. Second, we chose to offer participants only highly palatable food. Instead of offering chocolate-coated peanuts, it would be interesting to try to replicate the findings with less palatable food (e.g., stale popcorn or chips) or healthy food snacks (e.g., cucumber, carrots or cherry tomatoes). Do individuals model other people's eating patterns even if the food is less palatable or so healthy that it makes no difference for their weight (or for the impression that they convey) how much they eat? Third, we concentrated on female university students, which restrict the generalizability of our findings. Future studies should also include males and people with a more diverse social and educational background. Fourth, we tested our hypotheses using only normal weight women (BMI between 18 and 25). Replication of our findings with lean, overweight and obese individuals (including children, adolescents, or adults) in a naturalistic eating environment would be a useful addition to research in the field of social modeling. Finally, it appeared that restrained eating did not moderate our findings on imitation of eating, which is in line with previous findings (Polivy, Herman, Younger, & Erskine, 1979; Rosenthal & Marx, 1979) and indicated that dieters and non-dieters are equally vulnerable to modeling effects (Herman et al., 2003). However, it should be noted that our study population consisted of normal weight female college students with normal dietary restraint scores. These normal and generally low restraint scores could

have limited the ability to detect effects of restraint.

All in all, our study shows that the physical appearance of a female eating partner, as well as her intake per se, affects the modeling behavior of young normal weight women. It was found that young women ate more when eating alongside a normal weight, high-intake confederate than when eating with a slimmer confederate. However, further research is needed to gain insight into the mechanisms underlying social modeling.

Prologue

In Chapter 2, it was found that the physical characteristics of the co-eater indeed determined the occurrence of modeling. Young women refrained from modeling when accompanied by a slim eating companion, whereas they showed a modeling effect when the physical appearance of the originally slim women was manipulated to a normal weight size. We have suggested that the presence and behavior of slim eating companions might induce minimal eating impression management strategies among normal weight women, and therefore these women did not match their energy-dense intake to that of their slim co-eater but rather inhibited their intake.

An interesting question, however, is whether the same effects could be obtained when normal weight women are provided with healthy nutrient-dense foods. It might be suggested that in this particular eating context, women may be less concerned with the impression that their intake conveys to others because the food is so low-energy dense that one's weight is not affected by how much one consumes from these healthy foods. The study presented in the next chapter will address this assumption by replicating the previous study, while using healthy snacks instead of unhealthy snacks.

Chapter 3

WHAT DOES SHE LOOK LIKE?

The effects of perceived body size on women's modeling of low-energy-dense food intake

Abstract

We examined whether a same-sex peer's vegetable consumption would predict the number of vegetable pieces eaten by the participant. A total of 116 Dutch women (*M* age = 20.28; *M* BMI = 21.68) participated. Their nutrient-dense food intake was measured during a 15-min break between two tasks, consisting of rating television advertisements. Participants consumed more vegetables when exposed to a peer eating a large number of vegetables than when exposed to a peer eating a small number or nothing. These findings suggest that social modeling processes may be relevant to interventions aimed at encouraging young women's nutrient-dense food intake.

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Introduction

An individual's food intake is affected by a wide array of external factors such as temperature, smell, color, and time (see for a review Stroebele & De Castro 2004). Among the most powerful factors affecting intake is others' eating behavior. Numerous studies have shown that participants eat very little when their eating companion (i.e., a confederate or actor who pretends to be a participant but actually works for the researcher) eats minimally. When the confederate eats a large amount of food, however, the participant also eats a large amount (Conger et al., 1980; Herman et al., 2003; Nisbett & Storms, 1974). These modeling effects have proven to be very powerful; people will track the intake of the confederate even after being food deprived for 24 h (Goldman et al., 1991) or when they are already sated (Herman et al., 2003). In sum, the amount of food that people consume does not always correspond to their own hunger or satiety level, but often to the amount consumed by those with whom they eat.

So far, studies on modeling of food intake have focused on high-energy-dense[3] palatable foods, with strong modeling effects irrespective of the type of palatable food offered. Young women ate more cookies (Pliner & Mann, 2004; Roth et al., 2001), mini-pizzas (Herman et al., 2005), crackers (Conger et al., 1980; Rosenthal & Marx, 1979) or chocolate-coated peanuts (Hermans, Larsen, Herman, & Engels, 2008) when their eating companions ate more of these foods. One area that has not been examined among adults is whether these modeling effects would obtain if the available foods were nutrient-dense foods[4]. Studies conducted among children have demonstrated that the eating behaviors of peers can affect children's food choices and preferences; repeated exposure to a peer eating vegetables may increase the child's preference for this food item (Hendy, 2002). A study by Salvy, Kieffer, and Epstein (2008) found that children's nutrient-dense snack consumption was predicted by their eating companion's consumption of nutrient-dense snack food. Although these studies were designed to examine the effects of social context on food intake in general rather than social modeling of nutrient-dense food intake,

[3] Energy density is defined as the amount of available dietary energy per unit of weight (expressed in kcal/g or kJ/g). High-fat foods tend to be high-energy dense, whereas foods high in water/ and or fiber are low-energy dense.
[4] Nutrient-dense foods are foods that provide substantial amounts of vitamins and minerals and relatively few calories (Dietary Guidelines for Americans, 2005).

their results suggest that modeling effects might influence children's nutrient-dense food intake. Insight into factors that may explain why people eat more (or less) when others eat more (or less) and whether this effect is affected by the energy value (or the perceived healthiness) of the food may be relevant to interventions aimed at promoting healthy eating.

We report here an attempted replication of our previous study, but this time with nutrient-dense foods. We made use of an observational-experimental design using confederates varying in weight status and intake (cf. Hermans et al., 2008). Young women's nutrient-dense food intake was compared under three conditions: with a same-sex model eating nothing (no-intake), with a same-sex model eating a small amount (low-intake), or with a same-sex model eating a large amount (high-intake). It was predicted that women would eat more in the presence of a high-intake peer than in the presence of a low-intake peer. Moreover, since the weight status of the eating companion might be an important factor in the magnitude of modeling effects, we also examined the moderating effects of the confederate's weight status on young women's social modeling of food intake.

Methods

Design

We employed a between-participants design with three experimental conditions in which the confederates differed in their food intake: a no-eating condition, a low-intake condition, and a high-intake condition. Female participants were exposed to same-sex confederates who were instructed to eat nothing (no-intake), 3 pieces of vegetables (low-intake) or 10 pieces of vegetables (high-intake). We included a control condition in our design, in which participants ate alone, to test whether the presence of an eating companion increased or suppressed participants' food intake (cf. Levine & Zentall, 1974; Zentall & Levine, 1972). To partly control for the potentially confounding effects of confederates' weight status, we manipulated the appearance of the rather slim confederates to a more normal weight appearance by letting them wear a soft silicon belt beneath their clothes, making them visibly thicker around their

waist (cf. Hermans et al., 2008). Table 1 shows the distribution of the participants over the study's experimental conditions.

Table 1
Distribution of participants over the study's experimental conditions.

	n		*n*	Total
Slim confederate		Normal-weight confederate		
No intake	17	No intake	16	33
Low intake	14	Low intake	17	31
High intake	17	High intake	18	35
Total	48	Total	51	99

Note: In the control condition 17 women participated; in the whole study 116 women participated.

Participants

Participants were 141 female undergraduate students (mainly psychology or educational science) aged 16–31 (M = 20.50; SD = 2.64). Participants were tested either alone (n = 20) or together with a previously unknown same-sex peer (n = 121). Twenty-five participants were excluded afterwards: four underweight (BMI = kg/m2, < 18) and 18 overweight (BMI > 25) participants, one participant who expressed suspicion about the actual aim of the study, and three participants who recognized the confederate as a fellow student (one of these participants was also overweight).The final sample, then, consisted of 116 female students of whom 17 were in the control condition. They had a mean age of 20.28 (SD = 2.49) and a mean BMI of 21.68 (SD = 1.65).

Confederates

Confederate models were recruited by e-mail advertisements calling for female research assistants for a new research project. After a short interview, we selected nine female students as confederates, all of whom were rather slim and sociable. They had a mean age of 22.22 (*SD* = 1.99) and their BMIs ranged from 18.69 to 22.38 (*M* = 20.30; *SD* = 1.45). Before the start of each session, the confederate was told to eat nothing, or a small amount, or a large amount of vegetables during the break and to wear the tummy belt or not. Confederates were randomly assigned to the experimental conditions.

Procedure

All participants were recruited via the internet sign-up program of the Behavioural Science Institute of the Radboud University Nijmegen. Participants registered for a study on evaluation of TV commercials, which was a cover story to prevent the participants from becoming aware of the true aim of the study. Registration for our study was restricted to those female students who had not participated in our previous study on modeling of food intake (Hermans et al., 2008).

The experiment took place in a laboratory furnished as an ordinary living room. We created a relaxing atmosphere by using dimmers and furnishing the room with two comfortable couches that were positioned at a 90° angle, a coffee table, and a side-table on which we placed a pitcher of water, four glasses, and a bowl of vegetables. The food and drinks were easily reachable by both persons. A wall unit with a projector, a DVD player and a sound system was located behind one of the couches.

The experimental sessions took place on weekdays from 10 a.m. until 5 p.m. in the period from November 2007 to February 2008. All sessions took about 60 min in total. The sessions started with a 5-min task, in which the participant and the confederate individually evaluated five neutral commercials (none of which included women or references to weight or food). After this task was completed, there was a 15-min break. Participants could spend their time as they wished but were obliged to stay in the room. The experimenter pointed out that they were free to help themselves to water and vegetables.

Before leaving the room, the experimenter put on some light background music (Novastar, 2000). The confederate was instructed to take a piece of vegetable immediately at the beginning of the break if she had been instructed to eat 3 or 10 pieces of carrot or cucumber. The confederates were free to choose between the two vegetables. Standardized time instructions were given by a small light in the corner of the room. When the confederate saw the light flashing, she had to pick a piece of carrot or cucumber (cf. Hermans et al., 2008). Behavior during the break was recorded by unobtrusive video cameras hidden in the corners of the room.

After the break, the participant and the confederate had to evaluate the same commercials again, but now they were free to engage in a discussion. This task took approximately 5 min. Next, the confederate went into a different room and the participant stayed in the experimental room to complete extensive questionnaires about the atmosphere of the break, the person with whom the break was spent, her own and the other person's body figures, hunger, liking of vegetables, and dieting intentions. Filling in these questionnaires took approximately 25 min. After the participant had completed the questionnaire, the experimenter measured her height and weight. Finally, the participant was thanked and received payment (€8) or course credits (for educational requirements). Debriefing took place after the data collection for the entire experiment was completed.

Measures

Food intake. Food intake was measured by counting the total number of pieces of vegetables consumed by each participant. Since the two kinds of snacks offered differed both in weight and caloric value, we measured the single pieces of vegetables consumed. Before starting our study, we asked 15 female undergraduate and graduate students what kind of vegetables they liked to consume as nutrient-dense 'snack food'. They could choose between cherry tomatoes, cucumber, small carrots, cauliflower, blanched celery, radish, and gherkin. Cucumber and small carrots were the most preferred snacks among these women. The snacks were bite-sized so that they were easy to eat. Both vegetable pieces

(i.e., the cucumber slices or the pieces of carrots) were of approximately the same size and weight.

Hunger. Participants rated their subjective hunger on a 10-point scale from 'not at all hungry' to 'extremely hungry' (Hermans et al., 2008). Although the best option to control for individual variations in hunger is to ask participants to refrain from eating for a certain period of time before the experiment (Polivy, Heatherton, & Herman, 1988), we assumed that this requirement would have disclosed the actual aim of the study and thereby distorted participants' natural eating behavior (see Anschütz, Engels, Becker, & Van Strien, 2008). To avoid this bias, we controlled for individual differences in hunger afterwards.

Liking of cucumber and carrot. Participants reported their liking of the available nutrient-dense food snacks on a 10-point scale from 'did not like it at all' to 'like it very much'.

Confederate's body figure. Participants' perceptions of the confederate's body figure were measured using nine drawings with female figures (based on Stunkard et al., 1983). We split the figures into upper- and lower-body drawings, so that the participant could also choose the figure that corresponded most closely with that part of the confederate.

Perception of the break. Participants' perception of the atmosphere of the break was assessed by asking about how they experienced the break. The following components were included: 'relaxing', 'boring', 'nice', 'annoying', and 'uncomfortable'. The responses ranged from not at all to very much.
Perception of the confederate. Participants' perceptions of the personal characteristics of the confederate were measured on a Likert scale with responses ranging from 1 to 7. An example of an item is 'The impression the other is conveying is 1 – boring to 7 – enjoyable'.

Height and weight. The research assistant measured each participant's height and weight following standard procedures (Lohman, Roche, & Martorell, 1998). Height was measured to the nearest 0.5 cm using a stadiometer (Seca 206, Seca GmbH & co. kg., Hamburg, Germany) and weight was measured to the nearest 0.1 kg using a digital scale (Seca Bella 840, Seca GmbH & co. kg., Hamburg, Germany).

Restrained eating. Restrained eating was measured by the dietary restraint subscale of The Dutch Eating Behavior Questionnaire (DEBQ; Van Strien et al., 1986).

Strategy for analyses

Before performing our main analyses, we first examined whether participants differed with respect to potential confounding variables. BMI, dietary restraint, and participants' liking of the vegetables did not significantly correlate with the total intake ($p > 0.10$) and therefore were not included in the model as potential confounds. Using analysis of variance, we also examined whether participants in the different conditions differed with respect to how they judged the break or the personal characteristics of the confederates. To answer our main question, an ANOVA was used to examine the main effect of the modeling conditions. Additionately, we checked, by using t-tests, whether the participants perceived the confederate's figure as different in the slim and the normal weight conditions. Subsequently, we investigated with an ANOVA whether there was an interaction between the confederates' intake and appearance on the participants' total intake. All analyses were performed with SPSS 15.0 (SPSS for Windows, Rel. 15.0.1.2006. Chicago: SPSS Inc.).

Results

Manipulation checks

Participants in the different conditions did not differ in BMI, dietary restraint, and hunger ratings or liking of the vegetables available (p's > 0.10); implying that randomization over conditions was successful. Further, no differences were found between participants in their perceptions of the atmosphere of the break in the different conditions. More than 80% very much liked being engaged in the experiment and perceived the break as relaxing and comfortable. Participants did not differ in their ratings of the confederates' characteristics (e.g., friendliness or kindness). No differences were found among confederates in how they were perceived by the participants ($p > 0.05$).

Food intake

Table 2 shows the amounts consumed in the various conditions. Differences in the overall intakes of vegetables among the three modeling conditions were found $F(2, 96) = 3.24$, $p < .05$.[5] When exposed to a high-intake confederate, participants consumed significantly more vegetables than when exposed to a low-intake confederate $t(64) = -2.43$, $p < 0.05$ or a no-intake confederate, $t(66) = -2.09$, $p < 0.05$. The size of the modeling effect of nutrient-dense food, however, was rather small (Cohen's $f^2 = 0.08$).

Table 2
Total number of nutrient-dense food snacks consumed by the participants.

Modeling condition	*n*	Mean	Standard error
No intake	33	1.39	0.42
Low intake	31	1.48	0.43
High intake	35	2.71	0.40
Alone (control)	17	2.35	0.59

Additional analyses

Participants' ratings of the confederate's appearance did not vary significantly as a function of the appearance manipulation, $t(96) = -1.60$, $p = 0.18$. The slim confederates' figures were rated 3.09 (SD = 0.75), whereas the figures of the (manipulated) normal weight confederates were rated 3.31 (SD = 0.91)

[5] When comparing the three separate modeling (i.e., no-, low-, and high-intake) conditions with the control condition, no significant differences were found between participants eating with a confederate and participants eating alone.

(Stunkard et al., 1983). No differences were found for the participants' upper- or lower-body ratings of the confederate's figure in the two appearance conditions. Thus, participants did not notice the difference between the slim and (manipulated) normal weight confederate. Additionately, we found no main effect of confederates' weight status on participants' total intake, $F(1, 97) = 0.12$, $p = 0.73$. Further, we found no interaction between modeling condition and confederates' weight status on participants' total intake, $F(2, 93) = 0.43$, $p = 0.65$.

We also tested whether the use of different confederates affected our findings. To test whether participants consumed significantly more or less vegetables when in the presence of a particular confederate, we used the confederates as factor in our ANOVA. However, no differences were found among confederates; no confederate individually induced higher or lower intake. We also checked whether variations in participants' BMIs or dieting intentions influenced the effects found. However, there were no significant two- or three-way interactions between participants' BMI (continuous variable) or dietary restraint and eating and weight conditions.

Discussion

The current study examined social modeling effects of nutrient-dense foods in young women. It confirmed previous findings that normal weight young women model other people's food intake (Conger et al., 1980; Herman et al., 2005; Roth et al., 2001); young women adapted their intake of vegetables to that of their eating companion. To our knowledge, this is the first study in which social modeling is linked to young women's nutrient-dense food intake. A comparison between the size of the modeling effects of this study and a study with energy-dense foods using a similar paradigm and population (cf. Hermans et al., 2008), however, reveals larger effects in the study with high-calorie snacks (Cohen's $f^2 = 0.08$, and Cohen's $f^2 = 0.47$, respectively). That is, young women are more likely to model a same-sex peer when the food is energy-dense than when the food is nutrient-dense. We propose that when the food is perceived as being typically healthy and low in energy, young women may be less concerned

about the appropriateness of the quantity they consume than when the food is energy-dense, limiting the use of food-related impression-management strategies. They may think that they can eat as much as they would like without gaining weight or conveying negative impressions, so matching the other's intake becomes less important. On the other hand, when the food is energy-dense it may be more important for young women not to endanger their feminine identity. Therefore, matching their intake to that of the other person might be a good solution to avoid negative judgments regarding their intake. More specifically, they can afford to eat a lot only when the other person eats a lot.

A few limitations warrant discussion. First, although we tried to create a setting that was as naturalistic as possible (i.e., a living-room setting), this context may be still not be representative for young women's daily nutrient-dense food consumption. Even though this study found that young women modeled the intake of a same-sex stranger, future studies are needed to examine whether young women would model the nutrient-dense food intake of strangers, acquaintances or relatives in more natural (i.e., less controlled) eating settings, such as restaurants or cafeterias. Second, because the current study used a snack situation to examine social modeling of food intake, the modeling effects may have been accentuated. That is, for snack situations there are few guidelines (other than other people's intake) that can be used as an indicator of how much you should eat (Herman & Polivy, 2005). Therefore, the young women may have been more vulnerable to the intake of a same-sex peer insofar as they used her intake for guidance as to the appropriate amount to consume (Herman et al., 2003). Future studies might include serving young women with complete meals at a mealtime, which might provide us with useful information on social modeling in situations for which a pre-existing intake norm already exists. Third, as participants did not notice the difference between the slim and (manipulated) normal weight confederates, we conclude that our weight manipulation was too weak to produce any effects in this context. Therefore, this study cannot address whether models' weight status affects modeling of nutrient-dense food intake. Although it is difficult to manipulate the confederates' physical appearance substantially within an experimental design, future research might use more realistic presentations of

varying weight status for the confederates who serve as models to increase the possibility that the participants will notice any weight differences between the models.

In conclusion, our results suggest that modeling also occurs for nutrient-dense foods. However, the magnitude of the modeling effect in the present study (using nutrient-dense food) was considerably smaller than was the effect found in a previous study (using energy-dense foods). Hence, with regard to practical implications, the current findings might inform strategies to improve young women's eating behaviors. We propose that interventions should focus more on the prevention of modeling of energy-dense foods instead of encouraging the modeling of nutrient-dense foods. Future intervention studies should examine which strategies work best to improve young women's eating behaviors.

Prologue

The study presented in Chapter 3 found that young women modeled the vegetable intake of a same-sex peer; eating more vegetables when their co-eater ate more of these snacks and less when their co-eater ate less. In line with the idea that impression management is less important when it concerns nutrient-rich food, however, it was found that the co-eater's physical appearance did not seem to play a role in the extent of modeling.

Importantly, it appeared that the participants did not seem to notice the difference in physical appearance between the slim and (manipulated) normal weight eating companion. Although a direct comparison between the two studies reported in Chapters 2 and 3 is rendered difficult because we did not manipulate the types of food and physical appearance simultaneously in one study, we tend to argue that the type of food available might have been responsible for the young women's failure to notice the difference. Previous research has shown that people's weight status is perceived as varying as a function of the type of food they consume (cf. Vartanian, Herman, & Polivy, 2007). Studies focusing on social impression as a function of low- or high-fat diets, for instance, have shown that people who consume low-fat meals are rated as having a smaller body size than those who consume high-fat meals (e.g., Fries & Croyle, 1993; Mooney, DeTore, & Malloy, 1994). When comparing participants' ratings of their eating companion across both studies, we found that the normal weight companion was perceived as slimmer when she was eating "healthy food" then when she was eating "unhealthy food". These differences in ratings were not found between the slim confederates. This might have led to the significant effects of the effective appearance manipulation in Chapter 2 but not in the current study.

The co-eater's physical appearance, however, might not be the only factor that can affect the extent of modeling. Previous studies on imitation have suggested that copying the behavior of others increases as social interactions become more personal (Jefferis, Van Baaren, & Chartrand, 2003). It has even been argued that imitation constitutes the social glue that makes people social animals (Dijksterhuis, 2005). Given the relationship between norm adherence and social approval (Festinger,

1954), it seems plausible to assume that women might adapt their food intake to that of others to ingratiate themselves with their interaction partner. The study presented in Chapter 4 will therefore examine how the nature of the eating companion will affect the degree of modeling.


Chapter 4
THE GOOD
AND THE BAD
The influence of quality of social interaction on women's modeling of palatable food intake.

Abstract

This study investigates the effects of the quality of social interaction on modeling of food intake among young women. A two (confederate's food intake: high versus low) by two (confederate's sociability: sociable versus unsociable) between-participant factorial design was employed. A total of 100 young women (18–27 years) participated. Findings indicated that young women generally ate more when exposed to a high-intake peer than women exposed to a low-intake peer. However, this modeling effect was only found in the unsociable context. This study underscores the influence of social atmosphere on modeling effects of palatable food intake and suggests that contextual uncertainty or ingratiation strategies may be important in explaining the magnitude of modeling effects.

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Introduction

In modern society, the consumption of food has implications beyond merely providing nutrients and energy needed to sustain life. Food and eating also play a major role in our social lives; we eat with or in the presence of other people. Therefore, we should not be surprised if there were a strong connection between social context and the amount of food consumed. Research on modeling of food intake reveals that people tend to eat more when others eat more and less when others eat less (cf. Herman, Roth, & Polivy, 2003). Despite the numerous studies showing the robustness of modeling of food intake, little is known about why individuals model other people's food intake.

Rather than pursuing individual-difference moderators, we will focus on the conditions under which an individual's food intake becomes more like of that of their eating companion. Modeling is beneficial for various reasons, but of particular importance might be its social function. It might constitute the social glue that makes people social animals (Dijksterhuis, 2005). It is suggested that the primary force behind modeling among humans is a desire to be like others and belong to others (De Waal, 2001). Additionately, modeling can be used as a tool to communicate liking for and rapport with another (Lafrance & Ickes, 1981). It was found that when people have a goal to affiliate, they model more (Lakin & Chartrand, 2003). There is also experimental evidence that modeling leads to rapport. Chartrand and Bargh (1999) showed that individuals who were modeled liked the other person more and indicated that the interaction had been more smooth and harmonious. Further, modeling increases as social interactions become more personal (Jefferis, Van Baaren, & Chartrand, 2003). Sharing personal information may lead to greater rapport, which is expressed through increased modeling. Given the importance of the social function of modeling, we propose that the extent to which the eating behavior of the model will be reproduced by the observer might be influenced by the nature of the relationship between both.

To our knowledge, no experimental studies in the field of social modeling of food intake have investigated whether the quality of social interaction between young women (i.e., a confederate and a

participant) affects the magnitude of the modeling effect. However, studies in other research fields have explicitly paid attention to the nature of the social interaction. Already in the 1960s, it was demonstrated that maternal nurturance was related to the child's tendency to imitate the mother's behavior (Bandura & Huston, 1961). In the warm and rewarding interactions, the children were more likely to imitate the mother's behavior as opposed to the children from which the mother avoided any interaction. Studies that have focused on the influence of social interaction on modeling of cigarette smoking or drinking, and therefore more comparable with our research aim, have all revealed the same: participants were more inclined to model a warm and interactive person than an unsociable person (Collins, Parks, & Marlatt, 1985).

The main aim of the current study was to investigate whether the quality of the social interaction affects the magnitude of the modeling effects of palatable food intake. An experimental-observational paradigm was used in which we varied the confederate's food intake (i.e., low versus high-intake) and sociability (sociable versus unsociable) during a 15-min break. We also made use of a control condition in which the participant was alone to test whether the presence of an eating companion increased or suppressed participants' food intake (cf. Zentall & Levine, 1972). Previously, it has been found that when participants are left alone, thus in a no-model condition, they eat intermediate amounts (Conger, Conger, Costanzo, Wright, & Matter, 1980). First, we expected the participants' intake to be strongly affected by the confederate's intake. Second, in line with studies on modeling of alcohol and smoking, we expected the modeling effects of food intake to be stronger when the confederate was sociable than when the confederate was unsociable. Third, we expected that participants who were alone in the room consumed an intermediate number of M&Ms, closer to the number consumed in the high-intake condition than to the number consumed in the low-intake condition.

Methods

Design

The experiment involved a 2 (eating condition: low- versus high-intake confederate) by 2 (nature of social interaction: sociable versus unsociable confederate) factorial design. The eating condition consisted of confederates eating 6 M&Ms (low-intake condition) or 24 M&Ms (high-intake condition). We restricted our study to female participants, since conforming to social norms with regard to eating may be more important for women than for men, due to impression management strategies (Pliner & Chaiken, 1990). We received approval for conducting the present study of the ethical committee of the Faculty of Social Sciences, Radboud University Nijmegen.

Participants

One hundred female undergraduate students (mainly in psychology or educational sciences) participated in this study. All participants were between 18 and 27 years of age (M = 20.20; SD = 1.99). Eighty-three percent of our sample had a Body Mass Index (BMI = weight in kilograms divided by the square of height in meters) within the normal range (18 < BMI < 25) (M = 22.50; SD = 3.34). Participants were tested either alone (n = 22) or together with a same-sex confederate (n = 78). The participants received course credits or payment (€ 8) for their participation.

Confederates

Seven female undergraduate students volunteered as confederates in our study. Their ages ranged from 19 to 24 (M = 20.83; SD = 1.63). They had a mean BMI of 20.69 (SD = 0.94). Before each session, the confederate was told whether she had to eat 24 or 6 M&Ms during the break and whether she had to act sociable or unsociable. In the sociable condition, the confederate was warm and friendly, and reacted naturally to remarks of the participant (cf. Harakeh, Engels, Van Baaren, & Scholte, 2007). In the unsociable condition, the confederate read some magazines and did not initiate or maintain a

conversation with the participant. All confederates were trained in the procedure by participating in a workshop run by a professional drama coach. The confederates were instructed to remain sociable or unsociable during the whole session.

Setting and procedure

The experiment took place in a laboratory furnished as an ordinary living-room. The room was decorated with paintings, plants, and small decorations. It was furnished with two comfortable couches positioned at a 90° angle, a coffee table and a side table on which a pitcher of water, four glasses, and a bowl of M&Ms were placed. The bowl of M&Ms and pitcher of water were within easy reach of both participants. A wall unit with a projector, a DVD player and a sound system was placed behind one of the couches. During the experimental break, popular music was played. The participants were invited to our laboratory on weekdays between 10 a.m. and 7 p.m., in the period February–April 2008. All sessions took about 60 min in total.

Participants registered for a study on evaluation of movie trailers, which was a cover story to prevent the participants from becoming aware of the true aim of the study (i.e., modeling of food intake). The experimenter met both the participant and the confederate at the front office of the lab facilities. They were accompanied to the laboratory where the procedure of the study was explained to them. They were required to individually evaluate three different movie trailers. This task was very straightforward and took approximately 10 min.

There was a break after completion of this first task. Participants could spend their time as they wished but had to stay in the room. They could read some magazines, background music was put on, and they were told they were free to help themselves to M&Ms and water. These instructions were used during all sessions. The experimenter did not specify how long the break would last. In the sociable condition, the confederate was instructed to directly initiate a conversation with the participant on topics in which the participant seemed to be interested (e.g., education or sports). In the unsociable

condition, the confederate avoided eye-contact and started reading a magazine after 2 min. When the participant talked to the confederate, the confederate responded with a single word or short phrase. The confederate was instructed to directly pick one (low-intake) or four (high-intake) M&Ms at the beginning of the break. Because we were interested in modeling behavior, the confederate always had to pick the first M&Ms. During all sessions, the confederates did not make any remarks on the taste, color or the perceived palatability of the M&Ms. Standardized time instructions were provided by a small light in the corner of the room (i.e., the confederate saw the light six times). When the confederate saw the light flashing, she had to pick the predetermined number of M&Ms (for a more detailed overview of the instructions, see (Hermans et al., 2008). The experimental break was video-recorded by an unobtrusive camera hidden in the corner of the room. After 15 min, the experimenter re-entered the room and gave instructions about the second evaluation task. Participants had to evaluate the three movie trailers again, but were now free to engage in discussion. This task took approximately 10 min.

Finally, both participants were told that they had to fill in some personal questionnaires. The confederate was asked to fill in the questionnaire in another room due to privacy matters. However, the actual reason was that only the participant had to fill in a questionnaire about the atmosphere of the break, the impression of the other person, dietary restraint, subjective rating of hunger and liking of the M&Ms. After the participant completed this questionnaire, the experimenter measured her height and weight. Debriefing took place after the data collection for the entire experiment was completed.

Measures

M&M consumption during the break. In the observation room, a research assistant counted the total number of M&Ms consumed. The total quantity of food consumed (i.e. single pieces of M&Ms) was used as our dependent variable. M&Ms are a preferred snack food for young women, at least in The Netherlands, (Anschütz et al., 2008) and it is known that sweet and high-fat snacks are highly rewarding (e.g., Olszewski & Levine, 2007).

Hunger. Participants' subjective hunger was recorded on a 10-point rating scale, with possible responses ranging from 1 = not at all hungry, to 10 = very hungry (Hermans et al., 2008).

BMI. The research assistant measured the participants' height to the nearest 0.5 cm. and weight was measured to the nearest 0.1 kg using a digital balance. BMI was calculated as weight in kilograms divided by the square of height in meters.

Dietary restraint. Restrained eating was measured with 10 items in the Dutch Eating Behavior Questionnaire (DEBQ; Van Strien et al., 1986) with response categories ranging from 1 ('never') to 5 ('very often'). Cronbach's alpha was 0.93. Participants' mean score on this subscale of the DEBQ was 2.53 (SD = 0.80). This score is close to the norm group score (M = 2.60; SD = 0.80) for Dutch female college students (n = 405) (Van Strien, 2005).

Results

Manipulation checks

Participants rated the confederates in the sociable condition as more friendly, pleasant, kind and less annoying and arrogant than the confederates in the unsociable condition ($p < 0.001$). Furthermore, participants perceived the break as more pleasant, more relaxing and less uncomfortable when they were in the presence of a sociable confederate than when in the presence of an unsociable confederate ($p < 0.01$). Second, ninety-six percent of the participants ($n = 75$) noticed that the other person consumed some M&Ms. Participants exposed to a high-intake confederate reported the confederates' total number of M&Ms consumed as higher (M = 17.63; SD = 7.03) than did participants exposed to a low-intake confederate (M = 6.42; SD = 2.97), $t(74) = -9.05$, $p < 0.001$.

BMI, dietary restraint, participants' subjective hunger and liking of M&Ms were not significantly correlated with participants' M&M consumption ($p > 0.10$) and therefore not included in the model as potential confounds. Additionately, participants in the four conditions did not differ on the above mentioned variables ($p > 0.10$).

Impact of eating condition and nature of social interaction on intake

The main question is whether the confederates' warmth (or coldness) and intake (high or low) affected the participants' total intake during the break. Table 1 shows the total number of M&Ms consumed in the different conditions.

Table 1
Total number of M&Ms consumed in the different conditions.

	Low intake confederate		High intake confederate	
	Mean	Standard error	Mean	Standard error
Sociable confederate	6.58	1.97	5.68	1.97
Unsociable confederate	2.14	1.87	10.63	1.97

Note: In the control condition participants consumed a mean number of 8.45 M&Ms (*SE* = 2.17).

Participants exposed to a confederate who ate a large number of M&Ms consumed marginally more than did those exposed to a confederate who ate only a small number of M&Ms, $F(1, 74) = 3.81$, $p = 0.06$. This main effect was qualified by a significant interaction between eating condition and the nature of the social interaction condition $F(1, 74) = 5.81$, $p < 0.05$. The pattern of this interaction indicates that the customary modeling effect was found only in the unsociable condition. Post hoc tests revealed a strong difference in intake between the participants exposed to an unsociable confederate consuming either a few or a many M&Ms, $t(38) = -2.67$, $p = 0.01$. No significant differences in consumption were found when participants were exposed to a low- or high-intake sociable confederate. When excluding the non-M&Ms eaters from our sample, we found a stronger interaction effect between eating condition

and nature of social interaction, $F(1, 36) = 10.77$, $p < 0.01$. The pattern of the interaction was similar as in the overall analysis.

Finally, when comparing the four separate conditions with the control condition, we found that participants exposed to an unsociable low-intake confederate consumed significantly fewer M&Ms than participants who were eating alone $t(41) = -2.72$, $p < 0.01$). Participants who were alone in the room consumed approximately 8 M&Ms, which is in the middle in terms of total number of M&Ms consumed in the other conditions.

Additional analyses

Since it might take some time before the participant finds out that the confederate is not responsive and warm and that the interaction will not be so cordial, we conducted the analyses again but now omitting intake within the first 2 min of the session. The interaction between eating condition and nature of social interaction remained significant, $F(1, 74) = 5.99$, $p < 0.05$. Finally, we also used a difference score between what the confederate ate and what the participant ate as an alternative dependent variable. Again, the interaction between eating condition and nature of social interaction remained significant, $F(1, 74) = 4.31$, $p < 0.05$.

Discussion

This study examined how and under what circumstances young female adults adjust their level of eating to a same-sex peer. We investigated whether the quality of the social interaction between the two people would influence the modeling effect.

The present study showed, first, that young women who were exposed to a same-sex peer eating a large amount of high calorie palatable food ate more than those exposed to a peer who ate a small amount of high calorie palatable food. This finding is in accordance with other research on modeling of palatable food intake. Young women tend to adjust their food intake to those with whom

they eat (e.g., Herman, Koenig-Nobert, Peterson, & Polivy, 2005). Additionately, this study showed that young women eating alone consumed an intermediate amount compared to individuals eating together with another woman. If we assume that young women use another women's intake as a guide for their own eating behavior to ensure that they eat an appropriate amount, then the absence of such a model will lead to an eating pattern that is not affected by social norms (apart from personal norms). The modeling effect on eating, however, was qualified by an interaction between confederate's intake and the nature of the social interaction. In line with observational studies in the field of alcohol consumption (e.g., Collins et al., 1985), we expected to find stronger modeling effects in the sociable context. Our results seem to indicate the opposite. In the sociable context, there was no indication of modeling, whereas there was a strong modeling effect in the unsociable condition. Young women exposed to a low-intake unsociable peer consumed less than those exposed to a high-intake unsociable peer.

We offer two possible explanations for this unexpected finding. First, it may be that the unsociable atmosphere generates feelings of contextual uncertainty among the female participants. An important factor contributing to increased modeling is the uncertainty of how one should behave in a given situation (Deutsch & Gerard, 1955). By accommodating one's own behavior to that of others one might resolve feelings of uncertainty about how much food is appropriate to consume in a given situation (Herman et al., 2003). This uncertainty-reduction explanation for modeling seems to be apparent in the unsociable conditions. Participants in the unsociable conditions perceived the break as more uncomfortable and less relaxing, which may have made the participant more uncertain about the appropriate amount of food to consume and therefore more likely to use the behavior of the confederate as a guide to behavior, leading to more modeling. Furthermore, the finding that participants in the two high-intake conditions differed in their level of accuracy of their eating partner's consumption might indicate that an unsociable eating context makes young women more aware of the other's eating behavior.

Another possibility, not incompatible with the first, is that the enhanced modeling in the unsociable condition may reflect an attempt at ingratiation. Modeling the behaviors of others is a

common response in situations in which there is a desire to affiliate (Lakin & Chartrand, 2003). Imitation may be also used to build liking and rapport between people (Chartrand & Bargh, 1999). Perhaps the participants were trying to ingratiate themselves with the unsociable confederate by modeling her intake. There might be less need to establish a strong bond with the sociable confederate who was already friendly and showing interest. The unsociable confederate, however, was unresponsive and did not show any interest in the participant. Perhaps the participants tried to win the aloof confederate over by emulating her ("imitation is the sincerest form of flattery") (Colton, 1837).

By using observational data from young adults in a (semi-) naturalistic setting, we enhanced the ecological validity of the study. Despite this strength, some limitations should be considered. Although the results of the present study are justifying the generalization that young women eat more palatable snack food when exposed to a high-intake model than when exposed to a low-intake model, it was found that the overall degree of intake during the 15-min break was relatively low. At best, participants consumed a mean number of 11 M&M's, which is still half of the confederate's intake. The finding that participants eat less than the confederate is not uncommon in the literature on social modeling of food intake (e.g., Conger et al., 1980). The question, however, is whether we have to expect exact matching of the confederate's intake. A possible reason why we might not expect exact modeling effects is that when the confederate eats a large amount of snack food in short period of time, nonsocial factors such as sensory-specific satiety (Rolls, Rolls, & Rowe, 1982) may place a upper limit of how much one should eat. This might also be the case in our study. Second, future studies might manipulate portion size or should give participants a choice between different types of snacks (e.g. pizza slices or chicken wings), as we expect more variation in the amount of food consumed when they have to choose among a variety of foods. Third, we concentrated on young women, which restrict the generalizability of our findings. It is important to replicate findings with men. Previously, it has been found that female participants eat less in the presence of an opposite-sex eating companion (versus a same-sex eating companion) (e.g., Mori, Chaiken, & Pliner, 1987). Therefore, it would be interesting to replicate findings with opposite-sex

partners in order to determine whether the modeling effect is restricted to the sex of the eating partner.

We have articulated that the quality of the social interaction affects young women's modeling behavior. However, empirical studies are needed to gain more insight into the underlying mechanisms why and under what circumstances people model each other's eating behaviors. The impact of ambience on social modeling of food intake should be tested, for example in studies that manipulate the relationship between the people present. These studies might examine the moderating effects of type (i.e., familiar or unfamiliar eating companions) and duration of the relationship on social modeling of food intake. In general, people will be more relaxed and comfortable with familiar people than with strangers (Stroebele & De Castro, 2004). Although this relaxation might increase overall food intake, our present findings suggest less modeling among familiar people than among strangers. Moreover, to further understand social modeling of food intake in this context it is important to focus on personal factors relevant to the participant and the confederate that might have influenced the results. For instance, future studies could examine whether or how participants' own sociability is influencing social modeling in a sociable or unsociable context.

All in all, the present study demonstrates that the quality of social interaction affects young women's modeling of palatable food intake. Young women are more likely to model the high-calorie intake of an unsociable eating companion than the intake of a sociable companion. In order to provide a better understanding of the mechanisms underlying this modeling effect of food intake, future research should further examine the impact of social atmosphere on people's modeling behavior.

Prologue

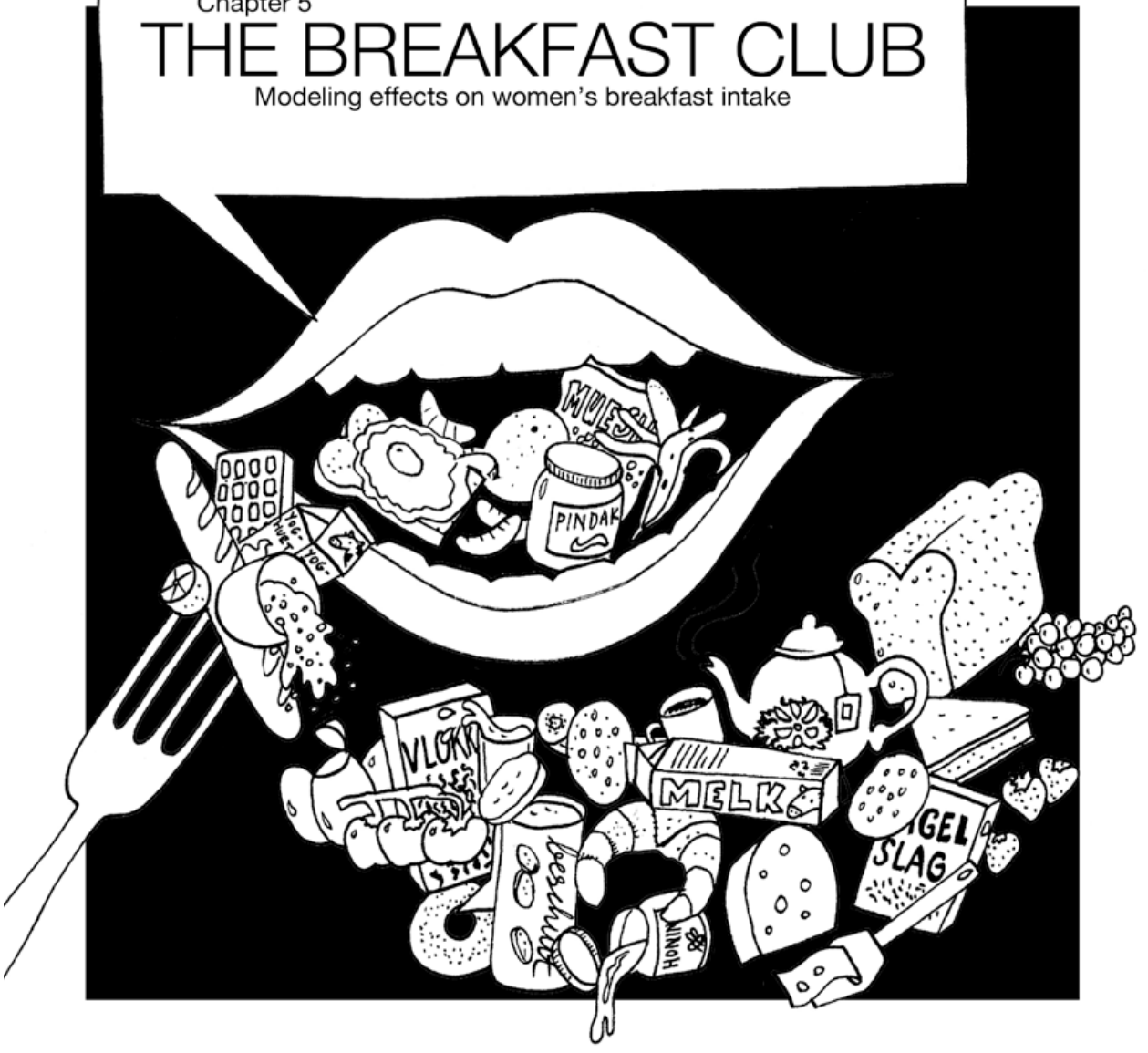
The previous study supported the idea that the social atmosphere in which the food is consumed might influence the degree of modeling. In contrast to our hypothesis, however, it was found that women only modeled the intake of an unsociable co-eater. A possible explanation for this unexpected finding is that participants' need for social approval or their desire to be liked by others might have increased their motivation to conform their behavior to that of their interaction partner. The current pattern of findings suggest that contextual uncertainty or ingratiation strategies may enlarge women's' motivation to adhere to socially derived norms of appropriateness (and thus increase the extent of modeling).

If modeling indeed reflects an aim to eat appropriately, then we might expect less modeling in situations in which clear norms about appropriateness exist or in which people have already formed clear eating routines or scripts. To date, most studies have only used snack food to examine modeling effects. These specific eating contexts might have increased women's likelihood of modeling because the quantity that one can consume from these snacks may be especially ambiguous. In the next two chapters, we will further examine how the eating context (e.g. breakfast or dinner) affects young women's tendency to model the intake of others.

Chapter 5

THE BREAKFAST CLUB

Modeling effects on women's breakfast intake



Abstract

Numerous studies have shown that the presence of others influences young women's food intake. They eat more when the other eats more, and eat less when the other eats less. However, most of these studies have focused on snack situations. The present study assesses the degree to which young women model the breakfast intake of a same-sex peer in a semi-naturalistic setting. The study took place in a laboratory setting at the Radboud University Nijmegen, the Netherlands, during the period January to April 2009. After completing three cover tasks, normal weight participants (n = 57) spent a 20-minute break with a peer who ate a large amount or a small amount of breakfast or no breakfast at all. The participants' total amount of energy consumed (in kilocalories) during the break was measured. An analysis of variance was used to examine whether young women modeled the breakfast intake of same-sex peers. Results indicate a main effect of breakfast condition, $F(2, 54)= 8.44$; $p < 0.01$. Participants exposed to a peer eating nothing ate less than did participants exposed to a peer eating a small amount (d = 0.85) or large amount of breakfast (d=1.23). Intake in the small-breakfast condition did not differ substantially from intake in the large-breakfast condition. The findings from the present study provide evidence that modeling effects of food intake are weaker in eating contexts in which scripts or routines guide an individual's eating behavior.

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Introduction

There is little question that human food intake is influenced by social factors. Numerous studies have shown that an individual's food intake may be modified by the presence of another person (Herman et al., 2003). In general, people tend to eat more when their eating companion eats more and less when their eating companion eats less. It has been suggested that in the absence of clear guidelines, people often use the intake of their eating companion(s) as a source of normative information about how much they may eat in a given context (Leone et al., 2007). Because eating excessively elicits negative stereotypes such as being deficient in self-control (Puhl et al., 2005), people may use the amount eaten by their eating companion(s) as an indication of the maximum amount that they themselves may safely eat without being negatively evaluated by others or themselves. If one's companion eats a large amount, it is permissible to eat a large amount too, whereas it is safer to suppress one's intake when one's companion is eating nothing or only a small amount.

Although the effects of social modeling on intake have proven to be very powerful, they have been observed primarily in situations in which participants ate snacks, such as chocolate-coated peanuts (Hermans, Larsen, Herman, & Engels, 2009b) or cookies (Pliner & Mann, 2004). A limitation of using snack situations to examine social modeling is that this type of eating context might affect the magnitude of the modeling effect (Hermans et al., 2009b). That is, the quantity of food that is acceptable to consume may be especially ambiguous in such situations, rendering the companion's intake all the more important as an indicator of how much one should appropriately consume. This situational ambiguity may increase the tendency to model the other's food intake.

Perhaps social modeling has less influence on food intake in situations in which people already have clear eating routines or scripts. Routines or scripts related to eating reflect what people have learned is an appropriate, expected, or desirable amount to consume in a particular cultural or social context. Breakfast consumption has been shown to be a stable and habitual eating behavior within individuals (Wong & Mullan, 2009). Accordingly, preexisting breakfast-related scripts or routines

may largely determine an individual's breakfast consumption. If social modeling reflects a search for guidelines regarding routines or scripts for appropriate intake, then modeling effects should be weaker in a breakfast context for which these preexisting scripts—what (Herman & Polivy, 2005) have called *personal norms*—already exist.

The main aim of the present study was to examine whether social modeling affects young women's breakfast intake in a semi-naturalistic setting. An experimental-observational paradigm was used in which young women were exposed to a same-sex peer instructed to eat nothing, a small amount, or a large amount of breakfast during a 20-minute break between two cover tasks. Because breakfast consumption is stable and habitual, making people less likely to search the social environment for guidelines for appropriate intake, it is predicted that modeling effects on breakfast intake would be attenuated.

Methods

Design

This study used a between-participants design, with participants randomly assigned to one of three conditions. All three conditions involved the participant being exposed to a same-sex confederate who was instructed to eat nothing (no-breakfast condition), a small amount (small-breakfast condition), or a large amount (large-breakfast condition). Each session included two people: one was the actual participant and the other was the confederate who acted as if she was an ordinary participant.

Participants

A total of 57 young women volunteered for the study. All participants were recruited through an Internet sign-up program of the Behavioural Science Institute of the Radboud University Nijmegen and were included only if they had a body mass index (BMI; calculated as kg/m^2) within the normal weight range ($18 < BMI < 25$). The Ethics Committee of the Faculty of Social Sciences of the Radboud University

Nijmegen approved the study protocol and all participants provided written informed consent. Participants were awarded course credit (for educational requirements) or a €10 gift cheque for completing the study.

Confederates

Five female students acted as confederates. They had a mean age of 22.60 years (*SD* = 0.89 years) and a mean BMI of 20.73 (*SD* = 1.12). Confederates were assigned randomly to one of the three experimental conditions each session. The Small-breakfast confederates were instructed to eat one slice of bread (brown or white) with sandwich filling (sweet or savory) and one cup of tea or coffee (approximately 171 kcal). In the Large-breakfast condition, the confederates were instructed to eat four slices of bread with sandwich filling and two cups of tea or coffee (approximately 547 kcal). The No-breakfast confederates did not eat or drink from the available breakfast products. The confederates were instructed not to make any remarks on the smell or taste of the available food during the break (Hermans et al., 2009b).

Setting and Procedure

The experiment took place in the bar laboratory at the campus of the Radboud University Nijmegen during the period January to April 2009. All sessions took place on weekdays from 8:30 am to 9:30 am or from 9:45 am to 10:45 am. Under the pretext of a study on the influence of consuming breakfast on cognitive performance, participants were asked to individually perform three tasks involving concentration and spatial insight both before and after breakfast consumption. They were told that they were participating with another person in order to speed up data collection. The three cover tasks took approximately 15 minutes. Data from these cover tasks were not used in this study. To avoid large variations in satiation, participants were asked to refrain from eating 3 hours before the experiment (Polivy et al., 1988). After performing the three tasks, the confederate and the participant had a 20-minute break, which they could spend together. They were told that they could help themselves to the breakfast that was provided for them. After the break, the participant filled in a questionnaire about her breakfast patterns. Next, the

experimenter measured the participant's height and weight. Postexperimental interviews indicated that participants were naïve about the real aim of the study and that they were unaware that their breakfast consumption was being measured.

Breakfast

The breakfast used in this study consisted of a variety of foods. Before starting the study, 10 female undergraduate students were asked what kind of foods they would normally drink or eat for breakfast. On the basis of these women's choices, the following breakfast ingredients were selected: plain brown bread (95 kcal per slice) and white bread (85 kcal per slice), coffee (no calories), tea (no calories), milk (110 kcal per 225-mL glass), yogurt (75 kcal per 150-mL bowl), orange juice (94 kcal per 200-mL bottle), cheese (59 kcal per slice), and ham (32 kcal per slice). Participants could choose between a number of individually packaged sandwich fillings consisting of butter (34 kcal; 10.7 g), chocolate sprinkles (65 kcal; 20 g), peanut butter (99 kcal; 15 g), chocolate pasta (85 kcal; 15 g), syrup (40 kcal; 15 g), honey (48 kcal; 20 g), and jam (59 kcal; 25 g). In addition, participants could add sugar (16 kcal; 4 g) or coffee milk (10 kcal per cup) to their coffee or tea.

Measures

Participants were asked how many times a week (weekdays only) they had breakfast, with response categories ranging from 0=0 times per week to 5=5 times per week. In addition, they were asked to indicate at what time they had breakfast and with whom they ate breakfast most of the time. In order to calculate the participants' BMI, the experimenter assessed weight and height following standard procedures (Lohman et al., 1998). 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 0.10 kg using a digital scale (Seca Bella 840, Seca GmbH & Co). The participants' total quantity of breakfast consumed (i.e., amount of energy consumed in kilocalories) was used as the dependent variable.

A digital scale (Kern 440, Kern & Sohn, Balingen, Germany) for measuring amounts consumed (in grams) was used. For each type of food that the participant ate, the experimenter determined the total number of grams consumed and converted grams to total amount of energy consumed (in kilocalories). If the participant did not eat all of a particular individually packaged sandwich filling, the experimenter subtracted the leftovers from the net weight of the small package. The total amount of breakfast consumed by the participant and the confederate was measured by adding up the kilocalories for all the products consumed.

Strategy for analyses

Preliminary analyses were performed on baseline variables (breakfast frequency, age, and BMI) to determine whether there were differences between conditions. To answer the main question, an analysis of variance (followed by post hoc analyses) was used to examine the main effect of the modeling conditions. The Bonferroni correction was used to adjust for the inflation of type I error. Statistical significance was set at $p < 0.05$. Data were analyzed using SPSS for Windows (version 15.0, 2006, SPSS Inc, Chicago, IL).

Results

There were no significant differences between groups in age, BMI, or breakfast frequency (see **Table 1**, all p values were > 0.10). All participants consumed breakfast at least once a week, and 70% of the participants ($n = 40$) indicated that they had breakfast every weekday. The vast majority of participants (80%) consumed breakfast between 7 am and 9 am. As a manipulation check, participants were asked to estimate the other's food intake (in slices of bread) during the break. Participants estimated the intake of the confederate as larger in the large-breakfast condition ($M = 3.11$, $SD = 0.88$) than in the small-breakfast condition ($M = 1.12$, $SD = 0.33$), $t(34) = -8.80$; $p < 0.001$, confirming that the intake manipulation was successful. None of the participants in the no-breakfast condition reported that the

Table 1
Age, body mass index and breakfast frequency of normal-weight female participants exposed to a same-sex peer eating a large or small amount of breakfast or no breakfast at all.

Variables	No breakfast condition	Small breakfast condition	Large breakfast condition
n	21	17	19
Age	21.85 ± 5.83	20.81 ± 2.56	20.79 ± 1.62
BMI [a]	22.08 ± 1.97	21.41 ± 1.48	21.65 ± 1.25
Breakfast frequency (weekdays)	4.67 ± 0.80	4.29± 1.21	4.21± 1.27

Note: mean ± standard deviation. There were no significant differences in means between conditions.
[a] BMI= body mass index (calculated as kg/m^2).

confederate ate anything.

An analysis of variance showed a significant difference among participants in the three intake conditions, $F(2, 54)=8.44$; $p < 0.01$. Bonferroni post hoc tests showed that intake in the no-breakfast condition was lower than in the small-breakfast condition ($p < 0.05$, d = 0.85) or than in the large-breakfast condition ($p < 0.01$, $d = 1.23$) (see Table 2). Intake in the small-breakfast condition did not differ significantly from intake in the large-breakfast condition. Results of this study suggest that young women do not eat more breakfast when their eating companion eats a lot rather than a little, but that they do eat less when the other eats nothing.

Table 2
Normal-weight participants' total amount of breakfast consumed (in kilocalories) in the during a 20-min break for each modeling condition.

	No breakfast condition	Small breakfast condition	Large breakfast condition
n	21	17	19
Participants' mean intake in kilocalories	185	294	355
Standard error (*SE*) in kilocalories	29	32	30
95% confidence limits	(127, 243)	(229, 358)	(294, 416)

Discussion

The absence of the standard small-large modeling effect found in the current study is inconsistent with previous research on modeling of food intake. Earlier studies examining modeling of food intake have focused on the intake of snack foods, such as cookies, baked cheese crackers, cocktail nuts, sandwich quarters, or chocolate-coated peanuts (Conger et al., 1980; Goldman et al., 1991; Hermans et al., 2009b; Hermans, Herman, Larsen, & Engels, 2010a; Nisbett & Storms, 1974; Polivy et al., 1979; Rosenthal & Marx, 1979; Rosenthal & McSweeney, 1979). These studies have all found the same pattern: people eat more when their eating companion eats more and less when their eating companion eats less. All attempts to demonstrate individual differences in the extent of modeling have failed. The modeling effect was found both for men (Conger et al., 1980; Hermans et al., 2010a; Nisbett & Storms, 1974) and women (Conger et al., 1980; Hermans et al., 2009a; Polivy et al., 1979; Rosenthal & Marx, 1979; Rosenthal &

McSweeney, 1979), restrained and unrestrained eaters (Polivy et al., 1979) obese and normal weight (Conger et al., 1980; Nisbett & Storms, 1974), hungry or satiated individuals (Goldman et al., 1991), and extraverts or introverts (Herman et al., 2005), indicating that modeling effects of snack intake are rather robust. This study is the first to demonstrate that young women do not necessarily eat more when their eating companion eats more. A possible explanation for the absence of the standard small-large modeling effect is that the present study focused on a specific meal context (breakfast) instead of snack foods. With snacks, the quantity (or range) that is acceptable to consume may be especially unclear and, therefore, modeling behavior might be elicited. Breakfast intake, however, is known to be a stable and habitual eating behavior (Wong & Mullan, 2009), consisting of routines or scripts that guide an individual's eating behavior. Once these scripts have been determined to work well, they provide a level of comfort and predictability and are likely to be repeated (Connors, Bisogni, Sobal, & Devine, 2001). The young women participating in the current study might have brought with them their idiosyncratic breakfast routines ("personal norms"), which made them less susceptible to the normative information conveyed by the breakfast intake of the other peer.

Participants were clearly affected by the behavior of others in the no-breakfast condition, and ate much less in this condition. It might be the case that, in this situation, the salience of norms induced by the peer did influence participants' intake. But in snack situations, the most salient norm might be a peer eating a large amount of food, in a more standardized eating situation, the most salient norm might have been the peer eating nothing from the available breakfast. Four participants conformed to the no-eating norm, and the other participants in this condition consumed considerably less than did those exposed to a peer eating a small or large amount of breakfast. It is probably worth noting that in the No-breakfast condition, the peer was not only modeling zero intake but was also serving as a non-eating observer, and non-eating observers are notorious for suppressing the intake of those they are observing (Roth et al., 20010). The no-eating peer might have set a powerful norm, leading to suppressed intake, whereas any eating by the peer might have authorized the participants to eat the

same amount as they usually would for breakfast (or somewhat more or less).

This study is not without limitations. First, there is substantial between-person variation in normal breakfast intake, and the current design makes it impossible to determine whether the presence of a same-sex peer eating smaller or larger breakfasts has reduced or increased women's normal breakfast intake. Second, although ecological validity was increased by using a breakfast setting that was as naturalistic as possible, participants were provided with a large variety of palatable breakfast ingredients from which they could select their "normal breakfast." In addition, they did not have breakfast in their normal context. This "experimental" breakfast might have been different from their normal eating routine and it is known that the more food people are provided with, the more they will eat (Rolls, Roe, Meengs, & Walls, 2004).

The findings from the present study provide evidence for the proposal that modeling effects of food intake are weaker in eating contexts in which scripts or routines are available to guide an individual's eating behavior. However, the influence of these scripts or routines on social modeling of food intake was not directly tested in the present study. Most studies on breakfast consumption among children and adolescents have focused on family correlates, such as parental breakfast eating or parental control on food choice to promote healthy breakfast consumption (Pearson, Biddle, & Gorely, 2009). The current study underscores the potential importance of peers or siblings on breakfast consumption. Implications are that interventions designed to promote healthy breakfast consumption must ensure that young people do not consume their breakfast in the presence of non-eating peers or siblings. As long as their eating companions eat at least something, then they are likely to consume their customary breakfast.

Prologue

In Chapter 5, it was found that women do not necessarily eat more when accompanied by a high-intake companion. That is, they did not consume more breakfast when their eating companion ate more. In contrast, it was only found that women eat less when in the presence of someone who does not eat. This is the first study on modeling effects among women that did not detect any evidence of the standard modeling effect. Nevertheless, this study demonstrates the power of social influence over food intake, in the way that even stable and habitual eating behaviors might be affected by the eating behavior of others. Furthermore, this study speculated that in standardized eating situations (e.g., breakfast) the most salient norm might be eating companions who eat nothing.

Although this study provided more insight into how the eating context might affect modeling effects on intake, it should be noted that breakfast intake is such a standardized eating behavior that these results may not be generalizable to other eating contexts such as an evening meal. That is, determining how much to eat for breakfast might be a low-involvement decision in which personal norms may be well developed. These personal norms might have less influence in less standardized eating contexts such as evening meals. There might also be more day-to-day variation in the quantity and type of food that is consumed during dinner, and these meals are often consumed in different social contexts (e.g., at home, with friends, in a restaurant).

The eating situation itself may also give information on which one can base one's beliefs about appropriate amounts to consume. One particularly important factor in this context seems to be portion size. Although portion size and the presence of others might be somewhat different in their effects on intake, they have much in common - both portion size and the eating behavior of others suggest a consumption norm that can influences how much people believe is appropriate to eat (Wansink, & Van Ittersum, 2007). In the next study, we will investigate the combined effects of both portion size and the eating behavior of others on young women's food intake during a single eating occasion. This particular eating context also does justice to the myriad of environmental cues that simultaneously affect people's

intake in daily-life eating situations. Therefore, in order to enhance the value of our research findings, we specifically examined this research question in a replication of a restaurant setting.

Chapter 6

HOW MUCH SHOULD I EAT?

The combined effects of portion size and the intake of others on women's meal intake

Abstract

Portion size and the intake of others have been found to influence people's food intake. No study, however, has tested the potential influences of both types of situational norms on intake during the same eating occasion. We experimentally tested the effects of manipulating portion size and the intake of others on young women's meal intake during a 20 min eating opportunity. An experimental design with a three (confederate's intake: small, standard, large) by two (portion size: small, standard) between-participants design was used. A total of eighty-five young women participated. Portion size and the confederate's intake both influenced young women's intake. Participants consumed more when offered a larger portion than when offered a smaller portion, and they also ate more when their eating companion ate more. The present results indicate that the effects of portion size and the intake of others were independent but additive. Thus, both types of situational norms might independently guide an individual's intake during a single eating occasion.

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Introduction

Over the past few years, the environment has received increasing attention as a major driver behind the worldwide increase in obesity (Hill & Peters, 1998; Papas, Alberg, Ewing, Helzlsouer, Gary, & Klassen, 2007). In fact, it has been suggested that over 86% of the variance in intake among humans is due to factors in their immediate environment (De Castro, 1993). For example, a robust influence on people's eating behavior is the presence and behavior of others (Herman et al., 2003). Numerous studies have shown that people eat larger amount of foods when they eat in the presence of other people than when they eat alone (Clendenen, Herman, & Polivy, 1994; De Castro, 1990). Moreover, people also adjust their intake directly to that of their eating companion; people tend to eat more in the presence of an eating companion who eats a lot of food than when in the presence of an eating companion who eats just a little (Conger et al., 1980; Hermans et al., 2008; Goldman et al., 1991). Herman and Polivy (2005) proposed that, in the absence of clear intake guidelines, people often use the intake of their eating companion(s) as a source of normative information about how much they may eat in a given context. The eating behavior of others might thus suggest a quantity (or range) that is acceptable or appropriate to consume within a given context. If one's companion eats a large amount, then it is permissible to eat a large amount too, whereas it is safest to suppress one's intake when one's companion is eating nothing or only a small amount.

The intake of others, however, is not the only situational factor that may influence food intake. The environment also promotes food intake by providing more frequent occasions for the consumption of large quantities of highly palatable, energy-dense foods (Hill & Peters, 1998). The portion sizes of many foods have increased in recent years (Young & Nestle, 2002), and this trend has been observed in restaurants, supermarkets and in the home (Nielsen & Popkin, 2003; Young & Nestle, 2002). There is ample evidence that portion size directly influences the amount consumed. This so-called portion-size effect is well documented: people tend to consume more when they are served larger portions (Rolls, Morris, & Roe, 2002; Rolls, Roe, & Meengs, 2006). In addition, people also eat more from large

packages or containers (Wansink & Kim, 2005; Weijzen, Liem, Zandstra, & De Graaf, 2008). Herman and Polivy (2005) proposed that, as with the modeling effect, the portion-size effect is also a reflection of normative controls on eating. That is, people tend to assume that the portion that they have been served represents an authoritative judgment as to what one should eat. Consequently, eating beyond the initial portion may be considered inappropriate insofar as people have the expectation that the amount of food served to them by others is appropriate (Rolls et al., 2002)

Although both portion size and the intake of others might provide clues as to how much people may eat without eating excessively, to date the social modeling and portion size literatures have been independent of each other. This is surprising, because both of these environmental factors could operate simultaneously. For instance, eating with another person could have a direct impact on one's food intake through social modeling processes, but intake could also be affected by the size of the portion that is served. The present study was intended to examine the potential influences of both types of situational norms during a single eating occasion. To examine the question whether both portion size and the intake of others affect food intake, an experimental–observational paradigm was used in which portion size (i.e. small or standard) and the eating companion's food intake (i.e. small, standard or large) were manipulated. First, portion size was manipulated by providing both participants with either a small or standard-size portion, after which the eating companion was instructed to eat a small, a standard or large amount of this portion, respectively. It was hypothesized that both portion size and the intake of the eating companion would operate as separate normative cues, and therefore would independently affect young women's food intake.

Methods

Design

An experimental design with a three (confederate's intake: large, standard and small) by two (portion size: small, standard)between-participants design was used. Depending on condition, participants were

thus offered a small- or standard-size meal, and were exposed to a same-sex confederate who had been instructed to eat a relatively small, medium or large amount from the meal offered. Participants and confederates were randomly assigned to one of the six conditions.

Participants

The sample consisted of eighty-five women (mainly first-year university students). The mean age of the women was 20.85 (*SD* = 3.51) years. In our sample, 3.6% of the women were underweight, 82% had a normal weight and 13.2% were overweight. BMI information for one participant was missing, because she refused permission to measure her height and weight. The percentage of overweight young women in the present study is slightly lower than the current percentage of overweight women (18–25 years) in The Netherlands (19.3 %) (Statistics Netherlands, 2010). All participants were asked to refrain from eating for 3 h before their scheduled session to control for individual variations in hunger (Polivy, Heatherton, & Herman, 1988).

Confederates

In the present study, five female students at the Radboud University Nijmegen, between 19 and 24 years of age (*M* = 22.40; *SD* = 2.07) and with a mean BMI of 21.88 (*SD* = 2.32) acted as confederates. Each confederate served in each condition several times. We specifically recruited second- or third-year students in order to reduce the possibility that participants and confederates were taking classes together, and therefore were already acquainted with each other, since it is known that eating with friends or acquaintances differs from eating with strangers (Hetherington et al., 2006). Afterwards, it appeared that only one participant was acquainted with her eating companion (i.e. the confederate). Removing this session from our final analysis, however, did not affect the present results.

Procedure

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 of the Radboud University Nijmegen. Written informed consent was obtained from all subjects. Data collection took place on weekdays between 16.45 and 20.15 hours during the period January–June 2010. Each experimental session lasted approximately 1 h. Participants were awarded course credit (for educational requirements) or a €10 gift cheque for completing the study. To simulate a naturalistic setting, we made use of the bar laboratory situated on the campus of the Radboud University Nijmegen. This laboratory is furnished as an ordinary small pub (Bot et al., 2005), with a relaxing atmosphere. The bar was furnished with a table for two on which was placed a pitcher of water, two glasses, cutlery, two plates, a hot plate and some napkins. The chairs were situated facing each other so that the confederate and the participant could easily see each other. Upon arriving at the front office of the research facility, both participants were informed that the purpose of the study was to examine the effects of nutrition on cognitive test performance. Participants were asked to read and provide written consent and were then asked to stand in front of the television screen and the Nintendo Wii. They were asked to individually play a Wii game in which their cognitive performance both before and after meal consumption was tested. In the meanwhile, the confederate completed three paper-and-pencil tasks involving concentration and spatial insight (Hermans et al., 2010b). These tasks took approximately 15 min. Because the true purpose of the study was to examine the effects of portion size and the intake of others on actual intake (and not cognitive performance), the cognitive tasks were bogus tests and the second set of cognitive tests never occurred (Koh & Pliner, 2009). After performing the cover tasks, the confederate and the participant were asked to sit down at the table that was especially set for them. They would have 20 min to eat a complete meal. During this time, participants were free to talk and interact as they would during a normal meal. The experimenter put on some recorded music (Tourist, ST. Germain, Blue Note Records, 2000, NY, USA) and left the room to get the meals. While the experimenter prepared

the meals, both participants had some time to get acquainted with each other. After approximately 5 min, the experimenter came back and served the meal (described below) while informing the participants that they could eat as much or as little as they liked and that more food was available on the hot plate if they wanted to eat more. At this point, the experimenter told the participants to 'enjoy their meal' and left the room. These instructions were used during all sessions. Participants were observed by the experimenter from an adjacent room via a flexible camera (with zoom) hidden in the corner of the room where time allocated to eating was recorded. After exactly 20 min, the experimenter returned to the laboratory to collect uneaten food and to ask participants to complete some post-meal questions about their impression of the break, their general meal patterns and eating behavior, and how much they liked the test food. Participants were told that they were being taken to different rooms because of the personal nature of the questionnaire. However, the actual reason for this separation was that only the participant had to fill in this questionnaire. After the participant had completed the questionnaire, her height and weight were measured, and she received a short debriefing about the purpose of the study. After all data were collected, participants were fully debriefed about the study by email.

The meals

Before registering for the study, participants were asked to choose among four different meals in order to ensure that they liked the test food offered during the break. They could choose between lasagna, macaroni Bolognese, spaghetti with cheese sauce (vegetarian) and a typical Dutch meal (mash pot). Before starting the study, sixteen female undergraduate students were asked to serve themselves a standard-size meal from a large kettle of macaroni or mash pot. Their plates were then weighed to determine the amount of food considered to comprise a standard meal. In this pilot sample, 415 g (SD = 127.67) of macaroni and 477 g (SD = 98.50) of mash pot were considered to be standard size portions. Therefore, in the present study, we chose to initially offer participants 500 g of food in the standard-size portion condition, with additional food available from a bowl on a nearby hot plate. For the confederate's

small or large intake conditions, this amount was either halved (250 g) or increased by 50% (750 g). The small portion-size condition consisted of an initial 250 g portion, and the confederate was instructed to eat half the portion (125 g), to finish the portion (250 g) or to eat 50% more (375 g). In the small-intake conditions, the experimenter weighed the exact amount the confederate had to eat and indicated this with a small line on the confederate's plate (invisible to the participant). In the large-intake conditions, the exact amount to be eaten in addition to the initial portion was indicated with a small line in the bowl on the hot plate. Because the confederate was always the first person who took some extra food from the bowl, we could accurately measure the remainder that was available for the participant if she wanted to serve herself an extra portion too. How often the meal was chosen and the energy content of each meal is depicted in **Table 1**. It appeared that the distribution of meals over conditions was roughly even. That is, no differences were found in meal choice between conditions.

Table 1
Experimental foods used in the experiment.

	Choice frequency	Energy per 100 g	Fat per 100 g	Carbohydrate per 100 g	Protein per 100 g
	(*n*)	(kJ)	g	g	g
Macaroni Bolognese	28	439.61	3	14	3.5
Spaghetti with cheese sauce	19	523.35	5	15	5.5
Mash pot	32	502.42	6	11	5
Lasagna	6	607.09	7.5	11	4.5

Measures

Food intake. A digital scale (Kern 440; Kern & Sohn, Balingen, Germany) was used for measuring amounts served and consumed. At the end of each session, the amount of food consumed in grams was measured. If the participant did not finish her portion or took some extra food, the experimenter subtracted the leftovers from the served portion (250 g or
500 g) or added the extra amount to the amount initially served. The dependent measure was the amount of food consumed in grams.

BMI. BMI, measured as weight (kg)/height^2 (m^2), was calculated based on measured height and weight. Participants' weight and height were measured following standard procedures (Lohman et al., 1988). Height was measured to the nearest 0.5 cm using a stadiometer (Seca 206; Seca GmbH & Company, Hamburg, Germany) and weight was measured to the nearest 0·1 kg using a digital scale (Seca Bella 840; Seca GmbH & Company). We determined whether participants were underweight, normal weight, overweight or obese using the International Classification of adult underweight, overweight and obesity according to BMI (WHO, 2010).

Meal palatability. Participants were asked to rate the palatability of the meal that they consumed (pleasantness of appearance, odor and taste) on a ten-point rating scale,
with possible ranges from 1 (not at all true) to 10 (completely true). An example of an item was 'I liked the taste of the meal'.

Portion size. Participants' perception of the size of the portion offered was measured on a ten-point scale with responses ranging from 1 (small) to 10 (large). This question was designed primarily as a manipulation check.

Meal patterns. To measure participants' general meal patterns, they were asked to indicate at what time and with whom they had dinner most of the time.

Restrained eating. Restrained eating was measured by the dietary restraint subscale of the Dutch Eating Behavior Questionnaire (Van Strien et al., 1986). Cronbach's alpha was 0.92.

External eating. External eating was measured by the external eating subscale of the Dutch Eating Behavior Questionnaire (Van Strien et al., 1986). Cronbach's alpha was 0.77.

Strategy for analyses

Data were analyzed using SPSS for Windows (version 17.0,2008; SPSS, Inc., Chicago, IL, USA). Alpha was set at $p < 0.05$. First, using one-way ANOVA, we checked whether there were any differences in age, BMI, hunger level, meal palatability, external eating and dietary restraint between conditions. Second, we checked whether the manipulations of portion size were successful, using an independent sample *t* test, whereas the confederates' intake manipulations were checked using ANOVA. If they were significantly correlated with food intake, time of consumption, hunger level, meal choice, BMI, external eating and dietary restraint were entered into the model as covariates. To answer the main question, an ANCOVA was used to examine the main and interaction effects of the portion-size and modeling manipulations on the participants' total food intake (in g). We used Cohen's f^2 instead of Cohen's *d* to indicate the effect size of the main effect of modeling manipulations, since we had more than two conditions in our design (Cohen, 1988). Effect sizes of 0.02, 0.15 and 0.35 are termed small, medium and large, respectively (Cohen, 1988). Additionally, to check whether participants ate significantly more or less when in the presence of a particular confederate, we also added the confederates as a factor in the present main analysis.

Results

Individual characteristics

The results of ANOVA indicated no significant differences in age, BMI, hunger level, dietary restraint and external eating across conditions (all *p*'s > 0.20). Table 2 displays the participants 'characteristics across conditions.

Table 2
Characteristics of the study population by condition (Mean values and standard deviations).

	Condition*											
	1		2		3		4		5		6	
	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*
n	15		15		14		13		14		14	
Age (years)	21.07	3.69	20.50	2.21	20.14	0.86	21.15	3.21	21.79	6.91	20.29	2.02
BMI (kg/m^2)	22.73	2.50	21.95	3.03	22.72	1.68	21.58	2.78	23.10	2.04	22.08	1.63
Dietary restraint	2.70	0.68	2.81	0.67	2.57	0.69	2.35	1.18	2.47	0.66	2.54	0.70
External eating	3.37	0.24	3.12	0.69	3.26	0.53	2.96	0.70	2.94	0.46	3.11	0.47

Note: *Condition 1 = small portion, small intake; 2 = small portion, standard intake; 3 = small portion, large intake; 4 = standard portion, small intake; 5 = standard portion, standard intake; 6 = standard portion, large intake.

The vast majority of the participants (80 %) usually had dinner between 18.00 and 19.00 hours in the evening. Furthermore, 59% of the participants usually consumed their dinner in the presence of their roommates, family members or romantic partner. Since the experimental dinner time varied over 3.5 h, and thus could have been different from the participant's usual dinner time, it was checked whether this had an effect on participant's total amount consumed. It appeared that there were no differences between the different experimental dinner times and the participants' total amount consumed. All participants (n = 85) were able to easily finish their meal within the 20 min break.

Manipulation checks

Participants' ratings of portion size varied significantly as a function of the portion-size manipulation, $t(83) = 6.87$, $p < 0.001$. Participants perceived the portion as smaller in the small portion conditions ($M = 4.61$; $SD = 2.04$) than in the standard- size portion conditions ($M = 7.10$; $SD = 1.14$), confirming that the portion-size manipulation was successful. Furthermore, participants significantly differed in their estimations of the confederate's intake in the different intake conditions, $F(2,84) = 27.69$, $p < 0.001$. Participants exposed to a confederate who ate 50% more estimated the intake of their co-eater as higher than did participants exposed to a confederate who ate half a portion less or finished her portion ($p < 0.001$ for both). Furthermore, it was found that participants exposed to a confederate who ate a half portion less estimated the other's intake as smaller than did participants exposed to confederates who finished their portion ($p > 0.05$). Because participants were free to choose between four different meals, we also checked whether there were differences between meals in perceived palatability. There were no differences between meals in how their taste, smell or sight of the meal was rated by the participants (all p's > 0.10). Moreover, no significant differences were found between meal choice and participants' total amount consumed ($p = 0.59$).

Food intake

Restrained eating was significantly correlated with food intake, $r(85) = -0.23$, $p < 0.05$, and was therefore entered into our model as a covariate. BMI, time of consumption, meal choice and external eating were not significantly related to food intake, so these variables were not included in the model. Our primary question was whether participants' intake would depend on initial portion size and/or the food intake of their eating companion. **Table 3** shows the total amount consumed (in g and kJ) in the various conditions. Both portion size, $F(1,78 = 54.07$, $p < 0.001$, $d = 1.59$) and the intake of the confederate, $F(2,78) = 7.41$, $p < 0{\cdot}01$, $f^2 = 0.38$, had a main effect on participants' food intake. No interaction was found between portion size and the confederate's intake, $F(2,78) = 0.07$, $p = 0.94$. Thus, the larger the

portion and the more the eating companion ate, the more of the test food participants ate. In terms of effect sizes, these effects were large.

Table 3
Total amount consumed (g and kJ) in the different conditions by participants, controlled for individual variations in restraint (Mean values with their standard errors).

	Amount consumed (g)		Amount consumed (kJ)	
	Mean	Standard error	Mean	Standard error
Small portion				
Small intake (*n* 15)	342.55	21.87	1749.54	128.38
Standard intake (*n* 15)	398.98	22.01	1987.54	129.18
Large intake (*n* 14)	423.04	22.59	2001.01	132.58
Total (*n* 44)	388.19	12.83	1912.69	75.29
Standard portion				
Small intake (*n* 13)	477.04	23.62	2412.54	138.60
Standard intake (*n* 14)	528.99	22.63	2572.07	132.82
Large intake (*n* 14)	568.92	22.60	2790.92	132.62
Total (*n* 41)	524.98	13.31	2591.84	78.08

These effects were obtained when we controlled for individual variations in restraint. The total model (portion size manipulations, confederates' intake manipulations, participants' restraint levels) explained 47% of the variance in the total amount of food consumed. Bonferroni post hoc tests showed that participants exposed to a small-intake companion consumed significantly less than did participants exposed to a companion eating a large amount ($p < 0.001$). The difference between participants exposed

to a small-intake or standard intake companion was only marginally significant ($p = 0.06$). No differences in intake were found between participants exposed to a standard- or large-eating companion ($p = 0.47$). We also tested whether the use of different confederates affected our findings. However, no differences were found among confederates; no confederate individually induced higher or lower intake $F(5,73 = 1.08, p = 0.38)$.

Consumption monitoring

Whereas fifty-nine (70%) of the participants reported that they had consumed as much as was typical for them, twenty-one participants indicated that they had consumed an amount less than they normally would have for dinner. Of these twenty-one participants, seventeen participants were offered a small portion. When participants were asked whether they adjusted their intake to that of their eating companion, 78% ($n = 66$) claimed that they had not and 21% ($n = 18$) said that they had consumed less because the other had consumed less. However, no differences were found between participants in the three modeling manipulations on whether or not participants believed that they had adjusted their intake to that of their eating companion, $F(2,84) = 2.19$, $p = 0.12$. Furthermore, participants significantly differed in their ratings of appropriateness concerning their eating companion's intake, $F(2,84) = 18.01$, $p < 0.001$. Participants exposed to a companion who ate half a portion less rated the companion's intake as less appropriate than did participants exposed to a companion who finished her portion or ate 50% more ($p < 0.001$ for both). This effect was found in both portion size manipulations. Finally, it was found that participants significantly differed in their rating of the eating companion as a function of the companion's eating behavior, $F(2,84) = 4.05$, $p < 0.05$. That is, participants rated the small-intake companions as more annoying than they rated the standard- or large-intake companions ($p < 0.05$ for both).

Discussion

The present study examined the influences of portion size and the intake of others on young women's food intake during a single eating occasion. In accordance with our hypotheses, it was found that the effects of portion size and the intake of others were independent of one another but acted additively to promote increased intake.

The results of the present study are consistent with previous findings: serving larger portions of food causes people to eat more food (Rolls et al., 2002; 2006). Moreover, the present results also confirmed previous findings that women model other people's food intake (Conger et al., 1980; Hermans et al., 2008; Goldman et al., 1991). These findings may be explained by the notion that people are often uncertain when it comes to how much they should eat. They are eager to avoid eating excessively, because they are aware that their eating might lead them to be judged negatively. Because eating too much may be associated with various negative stereotypes, such as being deficient in self-control (Puhl & Brownell, 2001) or being less feminine (Chaiken & Pliner, 1987) and attractive (Bock & Kanarek, 1995), they search their environment for clues, allowing them to infer how much they may eat without eating an inappropriately large amount (Herman & Polivy, 2005). In the present study, participants had to eat along with a previously unknown eating companion in an eating context that was probably different from the context in which they normally would eat their dinner. Within this specific eating context, reliance on the example set by others or on portion size might have been particularly evident, because participants had no other obvious basis for determining appropriate meal size. It was found that the effects of portion size and the companion's intake were both significant as main effects; that is, both manipulations exerted an influence on young women's intake. These findings indicate that the uncertainty that people display about how much to eat is not necessarily completely removed by providing them with a single normative cue. Portion-size manipulations guide behavior, but social norm manipulations further affect behavior, suggesting that portion-size information does not completely satisfy the eater's search for guidance. In the domain of disinhibition of eating, Herman, Polivy, Lank, and Heatherton (1987) demonstrated that

the application of one disinhibitor effectively pre-empted further disinhibition by a second disinhibitor. In the present study, however, the application of one normative cue by no means pre-empted a second normative cue from further influencing behavior. Abiding by two norms – the served portion and the example set by the other person – might have provided participants with some extra assurance that they were not eating excessively. An alternative explanation for why our participants ate more when they were served a larger portion may be that they have learned throughout the years that cleaning their plate is what is expected (Birch, McPhee, Shoba, Pirok, & Steinberg, 1987). Routines related to eating reflect what people have learned is an appropriate, expected or desirable amount to consume in a particular context. Once these scripts have been found to work well, they provide a level of comfort and predictability and are likely to be repeated (Connors et al., 2001). Thus, when people have a tendency to clean their plate, this may often be repeated in a variety of contexts. Moreover, it has also been found that participants eating different amounts of foods reported similar ratings of hunger and fullness after the meal, despite large differences in food intake (Rolls et al., 2001). In other words, it may be that as portion size is varied, individuals adjust their perception of satiety cues while consuming more food. It is possible, then, that the larger portions in the present study may have led the participants to think that they also could eat more, whereas the smaller portions led to opposite expectations.

Although the results clearly indicated that participants' intakes were affected by the portion-size manipulation, they generally ate more than the initial small portion that was served to them. Participants were offered only 250 g of food in the small-portion conditions, an amount that was considerably lower than participants perceived as a standard-size meal (as our pilot study revealed). The initial amount served in these conditions might therefore have seemed an inappropriately small dinner, and so participants felt free to serve themselves more food without worrying about being judged to be an excessively large eater. In effect, when the initial served portion is unduly small, the portion-size effect may break down (Herman & Polivy, 2005). However, when people are simultaneously exposed to eating companions who eat beyond the initial portion, they will also eat more (resulting in the largest intakes

in the small portion condition when the confederate ate the most). Therefore, strategies for addressing the influence of portion size on intake should focus not only on the consumer, but also on the immediate environment; that is, reducing the portion sizes of food may be an overly simple approach to prevent people from overeating, especially when their eating companions are eating large amount of foods.

The effectiveness of the norm manipulations may be best seen in the fact that a vast majority of the participants claimed that they had consumed an amount that was typical for them, whereas it is evident that they altered their intake in response to both portion-size and confederate-intake manipulations. This finding is consistent with research showing that people cannot accurately identify specific influences on food intake (e.g. the presence of others) (Roth et al., 2001; Vartanian et al., 2008) and supports the notion that normative controls on eating may be relatively automatic and often occur outside conscious awareness (Wilson & Brekke, 1994). The intake of participants exposed to a companion who ate 50% more was roughly 7% more than when the companion ate a standard amount, whereas the intake of participants exposed to a companion who ate 50% less was on average about 12% less than when the companion ate a standard amount. It is possible that the example of a minimal-eating companion is simply more powerful than is that of a large eating companion, perhaps because inhibitory signals are stronger than are permissive signals. This finding, however, may also be explained by the fact that there is some built-in asymmetry in the current design. That is, the standard intake of the eating companion was two-thirds the size of the large intake, whereas the small intake was only half of the standard intake.

A final point for consideration involves the finding that participants exposed to a companion who ate 50% less perceived the companion's intake as less appropriate than did those who were exposed to an eating companion who finished her portion or ate 50% more. Additionally, these minimal eaters were also rated as more annoying than were those who finished their portion or ate more than the initial portion. Leone, Herman and Polivy (2008) found that people generally dislike others who eat considerably less than they do, presumably because their companions' sparse intake means that they

themselves may eat only a small amount if they want to avoid the stigma of being an 'excessive eater'. Thus, it might be that the participants exposed to the minimal eaters were unable to eat as much as they would have wanted to and therefore perceived her as more annoying and rated her intake as less appropriate. Another possibility is that because people typically clean their plates and not finishing one's portion may be considered correspondingly impolite, such concerns might have led to the less positive judgments of the minimal-eating companions.

The results of the present study show that portion size and the eating behavior of others directly affect young women's food intake. From the present results, however, we cannot identify whether there are any particular characteristics that make some women more or less susceptible to the effect of portion size and social modeling on intake. If both portion size and the eating behavior of others are considered as external cues that might stimulate intake, there might be large individual variation in the intensity of responsiveness to these food-related cues. Because eating behavior is a complex interplay between biological, environmental and psychological factors, it seems important to focus on possible interactions between these factors when investigating the underlying mechanism of responsiveness to food-related cues. Identifying such individual differences (e.g. reward-sensitivity or inhibitory control) would be valuable for developing interventions aimed at counteracting the effects of environmental stimuli that induce overeating (Herman & Polivy, 2008). Next, since both situational norms were manipulated simultaneously, it remains unknown how much of the variance of the participants' total energy intake was independently accounted for by portion size and the intake of others. Third, even though both the portion size and the eating behavior of the other seemed to have affected participants' food intake, there was no control condition in which participants ate alone from either a small- or standard-size meal, and thus no definitive statements can be made about whether portion size and/or the intake of the other increased or decreased participants' intake compared with a 'non-manipulated' baseline. Finally, although our sample was large enough to detect main effects of both portion size and the confederate's intake, the present study might have been insufficiently powered to detect an

interaction effect. To definitely exclude the possibility of an interaction effect, it is recommended that the present study be replicated with more participants per condition.

As obesity rates continue to rise, it is important to gain insight into the question why and under what conditions people are affected by environmental stimuli. The present study demonstrates that both portion size and the intake of others can significantly affect young women's intake (apparently without their awareness). As long as people are unaware of these influences, or fail to acknowledge them, it will remain difficult to avoid overeating in a 'toxic' environment in which one is constantly exposed to super-sized portions and the super-sized intake of others.

Prologue

The study presented in Chapter 6 clearly demonstrated that women's meal intake is strongly affected by portion size and the behavior of others. This study also underscores people's unawareness of how their intake is affected by these cues. In accordance with the extensive literature on mindless eating (a term introduced by Brian Wansink in 2004), it was found that the vast majority of women could not accurately identify the specific influences of their intake, leading us to conclude that normative controls on eating may be largely automatic and often occur outside conscious awareness.

Until now, we have examined modeling effects on food intake in contexts in which the eating companion was physically present. Previous studies, however, have demonstrated that modeling of food intake can occur without real-life interaction. In these studies, participants were made aware of how much others had consumed in the same context by using a norm-sheet that was "incidentally" left in the room. Using an alternate remote-confederate manipulation, we will examine whether women will also model the food intake of a same-sex video model. This might give us more insight into the question whether modeling effects will exist when women do not interact with their eating companion, but only observe the eating behavior of another person on screen.

Chapter 7

SEEING IS EATING?

Examining the effects of a remote-video confederate on women's palatable food intake

Abstract

One's decisions about eating are at times, largely based on the observations of other people's eating behavior. Previous studies have shown that modeling of eating is a robust effect. The current research examined the impact of a remote video confederate on young women's food intake. Experiment 1 examined the effect of an eating or non-eating video confederate. Participants (*n* = 77 female undergraduate students, *M* age = 20.29) were exposed to a same-sex video confederate (i.e., a 25 year old woman) who was modeling eating (i.e., 4 winegums; pastille-type sweets) or not eating (i.e. no food visible). Results indicated that participants exposed to the eating confederate did not eat more than participants exposed to the non-eating confederate. Experiment 2 was conducted to address some of the limitations of Experiment 1. In this experiment, participants (*n* = 51, *M* age = 20.43) were exposed to one of three intake conditions: no-eating(i.e. food visible but not consumed), small portion-size condition (i.e., 8 M&Ms) or large portion-size condition (i.e., 20 M&Ms). The same video confederate as in Experiment 1 modeled these three conditions. Results indicated that participants did not adjust their intake to that of a video model. The current findings provide preliminary evidence for the assumption that modeling only exists if people have clear indications about how much others have consumed in the same context (as was the case in previous modeling studies). Future research is needed to further examine this proposition.

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Introduction

There is little doubt that an individuals' eating behavior is influenced by others (Herman & Polivy, 2008). One way in which social influences operate on food intake is in determining what is socially appropriate to eat. An anecdotal observation of this effect, for instance, is that one is less likely to order dessert if no one at the table orders dessert. Socially-derived norms often prevail over one's desire to consume palatable food. This is reflected in the main tenet of the normative framework put forth by Herman and colleagues, which posits that in the presence of palatable food, and in the absence of inhibitory forces (such as satiety), people continue to eat indefinitely unless clear norms of appropriate eating are in place (cf. Herman et al., 2003). What constitutes "appropriate eating" (and not excessive eating), however, is quite ambiguous and situationally dependent, so people often engage in social comparison (Herman & Polivy, 2005). That is, they look at the intake of others as a guideline to adjust their own level of intake. This concern with eating appropriately is not misguided, and in particular not for women (Bock & Kanarek, 1995), because eating excessively often elicits negative stereotypes such as being deficient in self-control or being seen as unattractive and heavy (see Vartanian et al., 2007 for a review). People are also motivated to conform to others' eating because of the expectations that conformity leads to social acceptance or approval (Deutsch & Gerard, 1955; Roth et al., 2001).

Several studies have examined the effects of eating norms on food intake by using an experimental design, in which naïve participants are exposed to experimental confederates instructed to eat different amounts of food. People are likely to eat more or less when these confederates eat more or less (see Herman et al., 2003 for a review). The ubiquitous effect of social influences is substantiated by the research indicating that modeling of food intake occurs in men and women (e.g., Conger et al., 1980; Rosenthal & Marx, 1979), children and adults (Bevelander, Anschütz, & Engels, 2011; Hermans et al., 2009a), obese and normal weight individuals (Conger et al., 1980; Nisbett & Storms, 1974), and hungry or satiated individuals (Goldman et al., 1991).

One might argue that the influence of others is especially powerful when other eating

companions are physically present. This contention, however, is undermined by research indicating that modeling of eating also occurs in situations in which the model is not actually present (i.e., remote-confederate design). Roth and colleagues (2001) exposed participants to a fictional list of how much prior participants had consumed in the same context and found that people modeled the eating pattern as described on the list. Pliner and Mann (2004) and Leone, Pliner, and Herman (2007) also found clear modeling effects using this fictional list. Recent evidence even demonstrates that remote models might produce a similar effect to live models (Feeney, Polivy, Pliner, & Sullivan, 2011), underscoring the power of social norms over individuals' food intake. Another paradigm to examine the effect of remote-confederates on food intake was used by Romero, Epstein, and Salvy (2009). They "incidentally" exposed pre-adolescent female participants (8–12 years old) to a video in which a same-sex female (alleged participant) consumed either a small or large serving of cookies. It was found that girls exposed to the large portion-size condition consumed more cookies than girls exposed to the small portion-size condition, suggesting that a video model is also effective in producing eating conformity/modeling.

The current research examined the impact of a remote-confederate on young women's food intake using the video modeling manipulation used by Romero and colleagues (2009). Because adhering to socially-derived norms with regard to eating may be more important for women than for men, due to women's heightened body image and eating concerns (Chaiken & Pliner, 1987; Vartanian et al., 2007), we restricted our study to female university students. Two experiments were conducted to examine whether young women would model the eating behavior of a same-sex video model. In Experiment 1, participants were randomly exposed to one of two conditions involving a 25-year old female confederate presented on video. In the first condition, the confederate ate snack food (eating condition; confederate eating 4 candies); in the second condition, the confederate engaged in alternative activities (no-eating condition; no food visible). Based on the study of Romero et al. (2009), we hypothesized that participants exposed to the eating condition would eat more than participants exposed to the no-eating condition. To further investigate our hypotheses, we set up Experiment 2. This time, however, the video confederate

modeled one of three eating conditions: (1) no-eating(i.e., food visible but not consumed), (2) small portion-size (8 candies, 7.2 g) or (3) large portion-size condition (20 candies, 18 g). Because this design was more similar to other modeling studies using remote confederates (e.g., Leone et al., 2007; Roth et al., 2001), we hypothesized that participants would adjust their level of eating to the confederate's intake (i.e., eating more in the large portion-size condition than in the small portion size and the no-eating conditions).

Experiment 1

Methods

Design

A single factor (eating condition versus no-eating condition) between-subjects design was used to examine whether young women's intake was influenced by the eating behavior of the video confederate (see description below). Participants were randomly assigned to one of two conditions. We received approval from the ethics committee of the Faculty of Social Sciences, Radboud University Nijmegen.

Participants

Ninety-five women volunteered for this study. All participants were recruited through an Internet sign-up program of the Behavioural Science Institute (BSI) of the Radboud University Nijmegen. This system is used by all researchers of the BSI and participants could self-register for studies that might be of interest to them. Participants received course credit or five euro for their participation. Thirty-two participants were excluded afterwards: 10 overweight (BMI = kg/m2, > 25) participants, 4 participants with missing BMI scores, 4 participants who reported an allergy to peanuts and therefore could not eat the available test food, and 14 participants who became aware of the actual aim of the study. The final sample, then, consisted of 63 female undergraduate students with a mean age of 20.32 (*SD* = 2.03) and a mean BMI of 22.05 (*SD* = 1.86).

Video confederate

A 25-year old average-weight woman (BMI = 22.04) modeled the eating and no-eating conditions (see description of her actions below). In the eating condition, the model ate four winegums (i.e., pastille-type sweets); whereas in the no-eating condition, the model did not eat. The model was instructed to eat one candy immediately at the beginning of the video and the other three at equal time intervals throughout the 15-min video exposure (i.e., one candy every 4 min).

Procedure

Under the pretext of a study on observational strategies, participants were asked to watch a 15-min video of a female student performing various work-related tasks in a university office (i.e., working on a computer, reading, highlighting a textbook and stapling papers together). This was a cover story to prevent the participants from becoming aware of the true aim of the study. Participants were tested individually on weekdays between 11.00 and 17:00. All sessions took about 30 min in total.

Upon arrival at the laboratory, the participants were accompanied to the experimental room where the procedure of the study was explained to them (see Hermans et al., 2009a for a detailed description of this room). Participants were asked to watch a 15-min video of a female student performing various study-related tasks (i.e., working on a computer, reading, highlighting a textbook and stapling papers together). Under the rationale of making the task more pleasant, participants could help themselves to chocolate-coated peanuts (M&Ms ©, Mars Netherlands BV, Veghel) and they were provided with a glass of water (200 ml). Participants were told that they could eat as much or as little as they wanted. These instructions were identical across conditions. The experimenter then started the video clip and left the room. Participants' food intake while watching the clip was recorded using an unobtrusive camera hidden in the corner of the room. After the 15-min task, participants were asked to complete a series of questions to assess their level of hunger prior to the study session, liking of the test food, dietary restraint, their perception of the video confederate's food intake, and their awareness

of study aims. After the participant completed this questionnaire, the experimenter measured her weight and height. Debriefing took place after the data collection for the entire experiment was completed.

Measures

Food intake. The content of the bowl of M&Ms was weighed with a digital scale (Kern440, Kern & Sohn GmbH, Balingen, Germany) immediately before and after the video in order to determine the amount of test food (in grams). The dependent variable, then, was the total amount of M&Ms consumed in grams. We also measured the mean weight of a single M&M by weighing 10 M&Ms and dividing this by ten (M = 2.1 g). This measure was used to compare the number of candies eaten by the video confederate and participants.

Height and weight. The experimenter measured each participant's height and weight following standard procedures (Lohman et al., 1998). Height was measured to the nearest 0.5 cm using a stadiometer (Seca 206, GmbH & co., Hamburg, Germany) and weight was measured to nearest 0.1 kg using a digital scale (Seca Bella 840, Seca GmbH & co, Hamburg, Germany).

State hunger. Hunger was measured on a 140 mm visual analogue scale, ranging from 0 (not hungry at all) to 140 (very hungry). Although the best option to control for individual variations in hunger is to ask participants to refrain from eating for a certain period of time before the experiment (Polivy et al., 1988), we assumed that this requirement would have disclosed the actual aim of the study and thereby distorted participants' natural eating behavior. To avoid this bias, we measured participants' pre-experimental hunger retrospectively at the end of the experimental session (see also Anschütz et al., 2008; Hermans et al., 2010a).

Liking of test food. Participants reported their liking of the available chocolate-coated peanuts on a 10-point scale from 0 'did not like it at all' to 10 'like it very much.'

Dietary restraint. Restrained eating was measured by the dietary restraint subscale of The Dutch Eating Behavior Questionnaire (DEBQ; van Strien et al., 1986). Cronbach's α was 0.93.

Awareness of the video model's intake. To measure participants' awareness of the video model's intake, we asked them to indicate how many candies the model had eaten.

Strategy for analyses

Before analyzing the effects of confederates' intake on participants' food intake, we examined whether participants differed with respect to potential confounding variables. BMI, dietary restraint, and participants' liking of the test food did not correlate with food intake (all $p > 0.01$) and therefore were not included in the model as potential confounds. However, hunger $r(63) = 0.37$, $p < 0.01$, was significantly correlated with food intake and was entered into our model as covariate. Analyses of variance (ANOVAs) were performed on these variables to determine whether there were baseline differences between the two conditions. Also, *t*-tests were used to assess whether participants in the two conditions differed in their estimations of the model's intake. An ANCOVA was used to examine the main effect of the video confederate's intake on participants' intake. Further, to examine whether there were differences in the amount consumed between participants who chose to initiate eating, a final ANCOVA was performed only on the participants who ate some of the food.

Results

Participants' characteristics and manipulation checks

Participants in the two conditions did not differ in their subjective hunger level, BMI, liking of the test food and dietary restraint (all $p > 0.10$, see **Table 1**). Participants estimated the video confederate's intake as higher ($M = 3.74$, $SD = 1.05$; 95% CL = 3.37– 4.10) in the eating condition than in the no-eating condition ($M = 0.00$, $SD = 0.00$; $t(63) = 19.07$, $p < 0.001$).

Table 1
Participants' characteristics providing mean ± *SD* (data derived from Experiment 1).

	No eating condition	Eating condition
n	29	34
Age (in years)	20.38 ± 1.93	20.26 ± 2.14
BMI	22.45 ± 1.74	21.71 ± 1.91
Hunger level	58.86 ± 35.48	66.91 ± 38.74
Dietary restraint	2.53 ± 0.83	2.55 ± 0.75
Liking of M&Ms	6.83 ± 2.85	7.74 ± 1.31

Food intake data

No significant difference in the total amount consumed (in grams) was found between conditions. Participants in the eating condition (M = 10.55, SE = 2.56; approximately 5M&Ms) did not eat significantly more than participants in the no-eating condition (M = 9.16, SE = 2.86; approximately 4.5 M&Ms), $F(1, 60) = 0.14$, $p = 0.71$. No between-condition difference was found in the total amount consumed (in grams) among those who initiated eating, $F(1, 30) = 0.61$, $p = 0.44$.

Discussion

Contrary to our hypothesis, participants exposed to the eating video confederate did not eat more than participants exposed to the no-eating video confederate. In both conditions, participants ate around five M&Ms. Although participants clearly perceived that the confederate was eating four candies or was not eating, they did not adjust their level of eating to conform to the confederate's intake. There is evidence

that modeling does not always occur when participants are exposed to ambiguous eating patterns or norms (Leone et al., 2007). In other words, when the eating norms as to what is appropriate to eat are not salient, participants rely on other cues or on their own experiences to determine how much they should eat. In our study, the video confederate in the "eating condition" was consuming four candies in 15 min while engaging in a series of alternative activities, whereas in the no-eating condition no food was visible. Consequently, the "eating or no-eating" in the video was possibly not salient enough to influence participants' intake. Although the number of candies in the eating condition was based on studies in which real-life confederates were used (e.g., Brunner, 2010; Hermans et al., 2008) this amount might have been too small to induce an effect among young women in a remote-video confederate design. Next, the fact that the participants in our study had access to a different type of snack food than the video confederate, may also explain why participants' intake was not affected by the eating condition. The present findings suggest that participants were eating according to their own desire and might have relied on other cues to determine how much they should eat. Whether the lack of a modeling effect is due to the factors mentioned above, or whether video-modeling is not apparent among young women is not clear from Experiment 1. Therefore, we set up Experiment 2 in which participants were offered the same food as shown in the video and made the eating norms more salient by using the same conditions as in the classical modeling studies (i.e., no-eating with food visible, small portion-size, and large portion-size manipulations).

Experiment 2

Methods

Design

A between-participants design was employed with three experimental conditions in which female participants were exposed to a video confederate who was instructed to eat nothing (no-eating condition;

with food visible), 8 M&Ms (i.e., 7.2 g; small portion-size condition) or 20 M&Ms (i.e., 18 g; large portion-size condition).

Participants

A total of 58 young women participated in this study. Seven participants were excluded from further analyses because they were overweight/obese (n = 6) or were lactose intolerant and therefore could not eat the test food (n = 1). The final sample, then, consisted of 51 female undergraduate students with a mean age of 20.43 (SD = 2.44) and a mean BMI of 21.99 (SD = 1.90).

Video confederate

The same video confederate was used as in Experiment 1. To increase the ecological validity of the video, the confederate was shown in a real-life living room setting, where she was seen watching television, reading and writing in her agenda and having a telephone call with her alleged boyfriend. In the no-intake condition, she was seen not eating. In the eating conditions, the confederate was instructed to reach for M&Ms, two at a time, on different occasions. In the small portion condition, the model consumed 8 M&Ms (i.e., reached four times), whereas in the large portion condition she consumed 20 M&Ms (i.e., reached ten times).

Procedure

The procedure was identical to that of Experiment 1 with two exceptions: (1) we ensured that none of the participants from Experiment 1 could register for Experiment 2, (2) participants and video confederate were offered the same snack food (i.e., milk-chocolate M&Ms). Unfortunately, we could not use the same type of snack food as in Experiment 2 (i.e., M&Ms with peanuts or winegums), because the video confederate was allergic to peanuts. We chose not to offer winegums, because the number of candies consumed may be easy to monitor and therefore increases the possibility of consumption-monitoring

(which in turn might suppress participants' intake).

Results

Participants' characteristics and manipulation checks

There was no difference in terms of hunger level, BMI, dietary restraint (Cronbach's α was 0.94) and liking for the test food across conditions (all $p > 0.20$, see Table 2). However, there was an effect of hunger $r(51) = 0.63$, $p < 0.001$, and liking for the test food, $r(51) = 0.29$, $p < 0.05$, on food intake. Consequently, hunger and liking were entered as covariates in the analyses.

Table 2
Participants' characteristics providing mean ± *SD* (data derived from Experiment 2).

	No eating condition	Small portion-size condition	Large portion-size condition
n	16	19	16
Age (in years)	20.31 ± 1.58	21.00 ± 3.59	19.88 ± 1.09
BMI	22.20 ± 1.51	21.92 ± 1.74	21.87 ± 2.08
Hunger level	72.38 ± 44.70	61.16 ± 40.69	62.69 ± 43.84
Dietary restraint	2.83 ± 0.82	2.68 ± 0.91	2.71 ± 0.86
Liking of M&Ms	7.69 ± 1.49	7.32 ± 1.30	7.31 ± 1.74

Participants exposed to the large portion-size condition reported that the confederate reached more often to pick food ($M = 5.00$, $SD = 1.86$; confederate reached ten times) than the confederate in the

small-portion condition (M = 3.16, SD = 1.34, $p < 0.01$; confederate reached four times) or no-eating condition (M = 0.50, SD = 0.89, $p < 0.001$), $F(50) = 40.77$.

Food intake data

This study assessed whether participants adjusted their eating behavior to the level of eating of a video confederate. Results indicated no main effect of eating condition on participants' food intake, $F(2,46) = 0.44$, $p = 0.65$. Participants in the large portion-size condition did not eat more (M (in grams) = 15.45, SE = 4.29; approximately 17 M&Ms) than participants in the small portion-size condition (M = 20.57, SE = 3.94; approximately 23 M&Ms) or no-eating condition (M = 19.91, SE = 4.32; approximately 22 M&Ms). No differences were found between conditions for amount eaten by those participants who initiated eating, $F(2,28) = 0.05$, $p = 0.95$.

Discussion

Experiment 2 was set up to further investigate whether young women's food intake is affected by the eating behavior of video confederates. Some of the limitations of Experiment 1 were remediated in the current experiment. First, we provided the participants with the same food as the one consumed by the confederate and second, we used three levels of eating: no eating, small portion-size, and large portion-size. It was found that participants' food intake was not influenced by the video manipulation, as participants' intake did not significantly differ across conditions. Participants ate an average of 20 M&Ms regardless of the experimental condition in which they were randomized. These results suggest that female university students' intake is not affected by the eating norms induced by a same-sex video confederate.

One weakness of Experiment 2, however, is that participants in the large portion-size condition did not perceive that the video confederate reached for M&Ms on ten different occasions. That is, participants' estimations of the number of times the confederate reached for M&Ms (mean was 5) was

half of the confederate's actual number of reaches (i.e., 10 times). Therefore, we cannot be entirely sure that the large-eating video confederate was also perceived as a same-sex peer eating a large amount of snack food. The fact that the video confederate was performing a series of other activities while eating from the bowl of snack food (i.e., watching television, reading and writing in her agenda, and having a phone call with her alleged boyfriend) might have drawn the participants' attention away from the confederate's eating, and therefore the confederate's eating behavior might have been not salient enough to influence the participants' behavior. It should be noted, however, that participants' perceptions of the confederate's amount eaten in this large portion-size condition still significantly differed from the other eating conditions. To ensure that the results of the current experiment are not due to the issues mentioned above, it would be necessary to replicate this study using a video in which the intake of the video-confederate is more salient. To make the confederate's eating more salient, future studies could zoom in close on the confederate's hand and mouth when reaching for and eating the food. Making the eating too salient, however, may also increase participants' awareness of the study aims which consequently interferes with their natural eating behavior.

General discussion

These studies examined the impact of a remote confederate (a video model) on young women's food intake. The results of both studies indicated that participants did not eat according to the prediction put forward by previous modeling studies. More specifically, participants did not eat more or less when the confederate ate more or less.

These results were unexpected considering the extensive literature on modeling of food intake (see Herman et al., 2003 for a review of these studies) and a recent study that suggests that remote models might produce similar effects to live models (Feeney et al., 2011). However, the present findings may not be so surprising when considering the peculiarities of the designs used compared to traditional modeling studies and other modeling studies using remote-confederates. In traditional modeling studies,

the participants were tested in the presence of an alleged participant (an experimental confederate whose level of eating was pre-determined by the experimenter). In studies using remote-confederates, it was implied that the confederates were also participants involved in the same study as the participant (Romero et al., 2009; Roth et al., 2001). For example, in the "fictional list" manipulation, participants were lead to believe that they were seeing the intake of previous subjects completing the same experiment. In the same video-manipulation used by Romero and colleagues (2009), participants were "incidentally" exposed to a participant performing the same task, with the same food, and in the same room as the participants. Therefore, the confederate's behavior in these studies was clearly indicative of what "others" were doing in the same context (i.e., a clear descriptive norm, Christensen, Rothgerber, Wood, & Matz, 2004). In our studies, however, the context in which participants were eating was clearly different from the situation and environment depicted in the video. As a result, the participants may have seen the model's intake as irrelevant to gauge their own food intake, and therefore modeling was less likely to occur. Unfortunately, based on our data, we cannot unequivocally conclude that contextual differences moderated modeling of food intake. In order to test this contention, one would need to directly manipulate the context in which the confederate and participant are eating (e.g., similar vs. different contexts). Based on the current findings, however, it seems reasonable to assume that modeling effects only exist if people have clear indications about how much others have consumed in the same context (as was the case in previous modeling studies).

Another noticeable difference between our study and the Romero et al. (2009) study is the age of the participants. Our study involved undergraduate female students, whereas Romero's participants were pre-adolescent girls. It has been described that the environment of a food-choice event includes not only one's expectations, but also one's prior experiences and habits (Bell & Meiselman, 1995). Regardless of the social norm manipulations, participants ate approximately five chocolate-coated peanuts in Experiment 1, whereas they ate approximately 20 milk-chocolate candies in Experiment 2. It is possible that participants' personal norms (i.e., 5 or 20 M&Ms) or snack habits might have made them

less susceptible to the normative information conveyed by a video-confederate. Hermans et al., (2010a) suggested that the effect of modeling on food intake in female university students would be weaker in eating contexts in which scripts or routines are available to guide their eating behavior. Although the influence of personal norms on modeling was not directly tested in the present experiments, the findings are consistent with this proposition.

Finally, both studies also differed with respect to the amounts of food consumed by the video confederate. Our video confederate was consuming 8 milk-chocolate M&Ms in the small portion-size condition and 20 M&Ms in the large portion-size condition (i.e., reached for M&Ms 4 or 10 times, respectively). In the Romero et al. study (2009) the model consumed 10 Mini Oreo Bite-Size cookies (i.e., the recommended serving size) in the small portion-size condition and 77 bite-size cookies in the large portion-size condition (i.e., 20 regular-size Oreo cookies). Conceivably, the larger portions in both conditions may have removed the possibility of a ceiling effect and push upward the amount of food that was "appropriate to eat". A few limitations should be mentioned. A first limitation pertains to the absence of an eating alone condition. In absence of such condition, it is not possible to determine whether participants were eating more or less than they do in their natural environment. Second, this study involved young highly-educated (Caucasian) women. The homogeneity of our sample obviously limits the generalizability of our findings to other populations (e.g., male and other demographics). Third, our samples were limited to normal weight women. If we consider the exposure to the eating behavior of others and the availability of palatable food as external cues that might stimulate intake, there might be large individual variation in the intensity of responsiveness to these food-related cues. For example, Salvy, Coelho, Kieffer, & Epstein (2007) have found that social context differently impacts the eating behavior of overweight and normal weight youths. They found that overweight children ate more when they were alone than when they were with peers, whereas non-overweight children ate more with other children than when alone. It has also been suggested that overweight females are more responsive to external food-cues than are non-overweight females (Tetley, Brunstrom, & Griffiths, 2009).

Despite these limitations, our results highlight the importance of contextual cues when considering the effects of social influences on eating. Although previous studies have indicated that modeling effects on snack intake are rather robust (Herman et al., 2003), this study did not find these modeling effects when young women were exposed to a same-sex eating individual on screen. These findings provide preliminary evidence for the proposal that remote and live models may not be equally effective in determining young women's food intake when model and observer eat in different contexts. It should be acknowledged that most studies focusing on social influences have isolated the effects of others from environmental factors. Although social influences have been shown to be very powerful, it is important to note that these factors are most likely part of an intricate web of complex relations involving individual characteristics and other physical and environmental factors, such as the frequent exposure to energy-dense, heavily advertised, inexpensive, highly accessible foods (Hill & Peters, 1998). The current studies suggest interesting lines of research examining the interactions between social and physical/environmental factors and how these forces co-operate to determine food intake.

Prologue

In Chapter 7 it was shown that young women did not model the eating behavior of a same-sex video model. In two experiments, it was demonstrated that participants did not eat more or less when the video model was shown eating more or less. Although these experiments suggest that there is no general response among young women to adapt their food intake to that of a same-sex video model, the designs makes it difficult to ascertain which mechanisms can account for these null effects. It is possible that the participants may have seen the model's intake as irrelevant to gauge their own food intake, because of the different context in which the behavior was observed. But it is also possible that these null effects can be explained by the lack of a behavioral mimicry effect. That is, perceiving the video model grabbing for a snack might have not stimulated women to perform the same movement, which in turn might have led to a decreased likelihood of a modeling effect. It is acknowledged, however, that further experimental investigations are needed to disentangle the behavioral processes that can best explain these results. We will elaborate on this issue in the General Discussion.

To summarize, we have found that both the eating context and the personal characteristics of the eating companion can determine the occurrence of modeling effects. In addition, it has been demonstrated that both portion size and the intake of others can simultaneously affect women's food intake during one eating occasion, and that these effects often occur outside conscious awareness. Finally, we have shown modeling effects are less likely to occur when the model is not physically present or when the model's behavior is not inducing a clear descriptive norm.

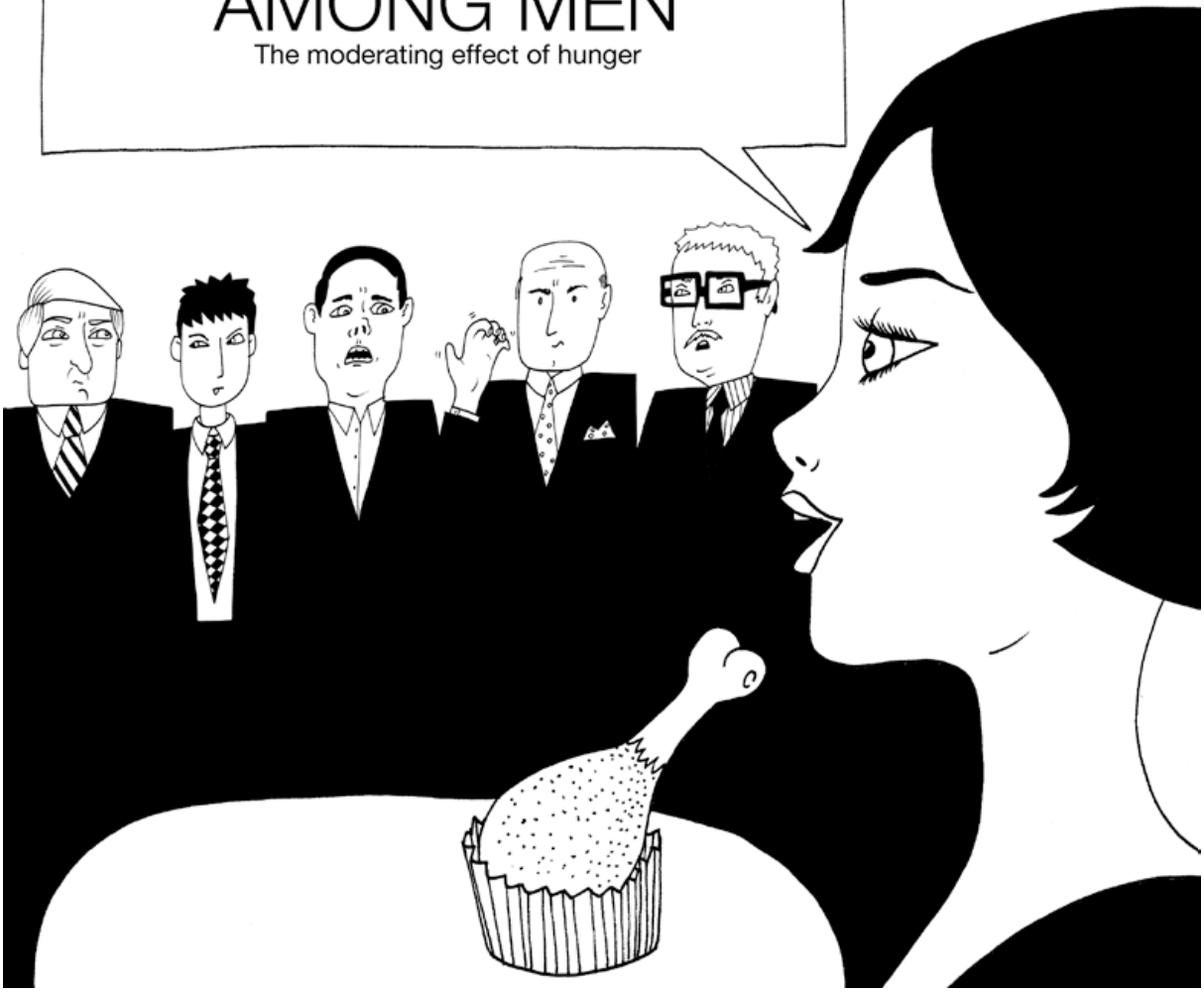
Up to now, however, we have only investigated some situational factors that might determine the occurrence of modeling. It should be clear that individual characteristics might also be important in the extent of modeling. Therefore, in the next two Chapters we will explore some of these individual difference moderators. First, although modeling effects on eating have been well documented among women, less is known whether men will also model the food intake of their eating companions. If we want to generalize our findings to a broader population, it seems important to replicate these effects

among men. Therefore, the following study will examine whether men are also model the other's food intake.

Chapter 8

MODELING EFFECTS AMONG MEN

The moderating effect of hunger



Abstract

This study examined whether young men adjusted their snack-food intake to that of a same-sex eating companion. Additionally, hunger was assessed as a possible moderating variable. A total of 59 young men (*M* age = 21.73) participated. An interaction between participants' hunger and confederate's intake on the total amount of snack food (in grams) consumed was found. Only those males who were hungry at the start of the experiment modeled the intake of their eating companion. This finding suggests that hunger may play an important role in explaining the magnitude of social modeling among young men.

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Introduction

The association between environmental factors and human eating behavior has been studied extensively (Brug, 2008; Stroebele & De Castro, 2004; van der Horst, Oenema, Ferreira, Wendel-Vos, Giskes, van Lenthe et al., 2007). These studies have consistently shown that food intake and food choice are affected by where, when and with whom one eats. Moreover, eating with or in the presence of other people might result in a different consumption pattern than solitary eating. Social facilitation studies have demonstrated that people eat more in the presence of others than when alone. It has been found repeatedly that as the number of people present increases, the amount of food consumed increases (e.g., De Castro, & de Brewer, 1992; Patel & Schlundt, 2001). Evidence for a direct effect of one's eating companion's intake on one's own intake can be found in the social modeling literature. These studies all find the same pattern: people tend to eat more when their eating companion eats more and less when their eating companion eats less (see Herman et al., 2003 for a review). One mechanism proposed to explain this effect is that in the absence of clear intake guidelines, people often engage in social comparison (Leone et al., 2007). More specifically, the amount eaten by the other might serve as a guide for appropriate intake. Most people are worried about being seen as eating excessively, because excessive eating is associated with negative connotations such as being deficient in self-control or the ability to delay gratification (Puhl et al., 2005); so the eating behavior of others might serve as an indication of how much is the appropriate (non-excessive) amount to eat. If the eating companion eats a large amount, one can safely eat a large amount too. However, if the eating companion eats only a small amount, then one must eat a small amount as well if one is to avoid eating excessively by comparison.

Until now, the vast majority of studies on social modeling among same-sex eating partners has focused almost exclusively on females (e.g., De Luca & Spigelman, 1979; Goldman et al., 1991; Hermans et al., 2008; Polivy et al., 1979; Roth et al., 2001). A few studies have been conducted on social modeling and food intake in men, and their results are mixed. One study that explicitly targeted males was the first study on modeling effects on eating behavior. Nisbett and Storms (1974) found

that male participants consumed more food (i.e., crackers) in the presence of a male confederate who ate several (20) crackers and consumed less when in the presence of a confederate who ate only one cracker. These results were replicated in a study that compared modeling of food intake between male and female participants (Conger et al., 1980), where it was found that participants' cracker intake increased with increases in the eating companion's intake for both males and females. In a more recent study, however, no similarities in food intake were found in dyads consisting of two male friends or two male strangers, indicating that men did not match each other's intake (Salvy et al., 2007).

We propose that sex differences in modeling of food intake might be explained by the notion that women and men possess divergent motivations when it comes to eating in social situations. If people adjust their intake to that of others to remove uncertainty about appropriate intake or to avoid negative judgments, then women are perhaps more likely to display social modeling of food intake. Eating, body image, weight and physical appearance are acknowledged as particularly salient concerns among women (Rodin et al., 1985) and therefore women may be more inclined to adjust their intake to that of their eating companion in order to avoid creating a negative impression. If these assumptions are correct, then the question arises to what extent men's intake is affected by their eating companion's intake. In this study, we focus exclusively on males in order to determine whether the modeling effect is restricted to females (cf. Hermans et al., 2009a). Because social modeling effects of food intake among men have been examined mostly in laboratory taste-test designs (e.g., Conger et al., 1980; Nisbett & Storms, 1974), and therefore are not comparable with real-world eating situations, we unobtrusively observed male participants in a semi-naturalistic setting (i.e., a simulated living room) in order to maximize ecological validity.

Since eating behavior is multiply determined, it is important to take other important factors into account that may affect eating (and subsequently social modeling). An important and obvious factor might be an individual's level of hunger. Hunger is defined as a strong desire or need for food (Smith & Ferguson, 2008). Hunger is obviously associated with food intake and promotes food-seeking and

ingestive behaviors (e.g., Castonguay, Applegate, Upton, & Stern, 1983; Nicolaidis & Even, 1985). There is not much research on the possible moderating role of hunger on social modeling of food intake. Goldman and colleagues (1991) were the first to manipulate hunger in a social-modeling experiment, pairing 12 or 24 h food-deprived individuals with a confederate instructed to eat either a lot or a little. The modeling effect was pronounced irrespective of (female) participants' feelings of hunger. So, regardless of what their body was telling them, the women's default response was to model their eating partner's food intake. This finding might be explained by the notion that women, more than men, are aware of their eating partner's intake and use this amount in order to determine their own intake (by matching their intake to that of the other person). For men, however, it might be that social modeling will play a role only if they are intrinsically motivated to eat. Their hunger level will make them more aware of the other's intake, which might lead consequently to a more prominent role of modeling of food intake. To our knowledge, this is the first study that examines whether hunger would promote social modeling among males.

In the present study, an experimental–observational design was used in which male participants spent a 15 min break, between two cover tasks, with a male confederate instructed to eat nothing, or a small amount, or a large amount of snack food. The main aim of this study was to examine whether young men adjusted their snack intake to that of another young man (previously unknown to them). Moreover, since not much is known about the role of males' hunger levels in the magnitude of modeling effects, we also examined the moderating effect of (measured, not manipulated) hunger levels on young men's social modeling of snack intake.

Methods

Design

We employed a between-participants design with 3 experimental conditions in which male participants were exposed to male confederates who were instructed to eat nothing (no-intake confederate condition),

2 handfuls of cocktail nuts (low-intake confederate condition) or 10 handfuls of cocktail nuts (high-intake confederate condition).

Participants

A total of 61 young men (mainly undergraduate students) volunteered for the study. Participants were recruited via the sign-up system of the Behavioural Science Institute of the Radboud University Nijmegen or through direct approach by the experimenters in public places around the campus. Participants were awarded course credit (for educational requirements) or a €10 gift cheque for completing the study. Two participants were excluded from further analyses because they reported an allergy to peanuts and therefore could not eat the available test food. The final sample, then, consisted of 59 participants with a mean age of 21.73 (*SD* = 3.73) and a mean BMI of 23.13 (*SD* = 2.68). **Table 1** displays the participants' characteristics across conditions.

Table 1
Participants' characteristics providing mean ± *SE* and range in parentheses.

	Total	No intake condition	Low intake condition	High intake condition
n	59	18	20	21
Age (years)	21.73 ± 0.49 (15-35)	22.56 ± 0.86 (19-35)	21.00 ± 0.70 (18-32)	21.71 ± 0.94 (15-31)
BMI	23.13 ± 0.35 (18.41-31.25)	23.32 ± 0.73 (20.23-31.25)	23.58 ± 0.71 (19.04-30.86)	22.54 ± 0.35 (18.41-25.96)
% overweight	15.3	16.8	25.0	4.8
% obese	3.4	5.6	5.0	0
Hunger level	4.12 ± 0.31 (1-8)	4.06 ± 0.58 (1-7)	4.15 ± 0.54 (1-8)	4.14 ± 0.53 (1-8)

Confederates

Four male students at the Radboud University Nijmegen acted as confederates. They had a mean age of 23.90 (*SD* = 2.91) and a mean BMI of 22.51 (*SD* = 1.58). Before the start of each session, we instructed the confederates regarding the amount of snack food that they had to consume (i.e., nothing, 2 handfuls, or 10 handfuls of cocktail nuts) during the break. The confederates were carefully instructed and trained in the procedure of picking the handfuls of nuts. They were randomly assigned to one of the three confederate-intake conditions. Further, the confederates were instructed not to take the initiative in the social interaction but to react naturally to remarks and questions from the participant (cf. Van Straaten, Engels, Finkenauer, & Holland, 2009).

Procedure

Under the pretext of a study on the evaluation of movie trailers, participants were asked to watch and evaluate three movie trailers. This was a cover story to prevent participants from becoming aware of the actual aim of the study (i.e., social modeling of food intake). The true nature of the study was discussed after the data collection of the whole study had been completed.

With the rationale of making the situation as naturalistic as possible, we furnished a small room as an ordinary living room (cf. Hermans et al., 2009a). Participants were invited between 10 a.m. and 6 p.m., during the months of September–December 2008. Each session took approximately 60 min in total.

The experimenter met both the participant and the confederate at the front office of the lab facilities. After providing consent, both men were accompanied to the laboratory where the procedure of the study was explained to them. First, they were told that they would individually evaluate the movie trailers of three popular Dutch movies (none of which contained references to weight or food). They were instructed not to engage in any discussion of their evaluations with the other person, or to talk about the movie in general. The experimenter then started the DVD and left the room. The task took approximately 10 min.

After this task, the experimenter entered the room again. On the pretext that there had to be an interval of time before the evaluation of the next set of movie trailers, participants were told that they would have a break. They were instructed to stay in the room, but they could spend their time as they wished. The experimenter did not indicate how long the break would last, unless specifically asked, in which case he told the participant. Finally, the experimenter put on some light background music (Ibiza Lounge, EMI Music Holland B.V., The Netherlands) and casually told the participants that they were free to help themselves to the water and the cocktail nuts. These instructions were identical across sessions. Participants were positioned at a 90° to each other, so that they could easily face each other. The bowl of nuts (described below) and the jug of water were within easy reach of both participants. Because our

aim was to examine modeling of snack intake, the confederate always had to take the first handful of nuts at the beginning of the break. During all sessions, the confederate followed instructions to avoid making any remarks on the taste, color, smell or palatability of the available food snacks. Standardized time instructions were given by a small light in the corner of the room (visible only to the confederate). When the confederate saw the light flashing, he had to take a handful of nuts (cf. Hermans et al., 2008). In the low- and high-intake confederate conditions, the light flashed on two and ten occasions, respectively. Behavior during the experimental break was recorded with an unobtrusive camera hidden in the corner of the room. After exactly 15 min, the experimenter reentered the room and turned off the background music. Instructions were then given for the second evaluation task. Participants had to watch the same set of movie trailers, but were now free to discuss their evaluations. This task lasted approximately 10 min.

Finally, both participants had to complete some questionnaires. They were told that owing to privacy concerns, they would be separated from each other. The actual participant completed a questionnaire about his subjective rating of pre-experimental hunger, food-related allergies, and his awareness and perception of the other's snack intake. After he completed the questionnaire, the participant's height and weight were measured. Post-experimental interviews indicated that participants were naïve regarding the real aim of the study and that they were unaware that their snack consumption was being measured.

Measures

Food intake. Because we intended to use popular, high-caloric snack food, we asked 15 young men (including the confederates) in a preliminary enquiry what kind of snack food they liked best when watching a movie. They reported cocktail nuts as one of their most preferred choices. The nuts were 'Knabbelnoten Oriëntal', produced by Duyvis (The Netherlands) and had a mean weight of 0.8 g per nut and contained a mean of 4.52 kcal/g. In order to create a setting as naturalistic as possible, we

offered only one bowl of nuts, which the participants had to share. The content of the bowl was weighed to the nearest 0.10 g (Kern440, Kern & Sohn GmbH, Balingen, Germany) immediately before and after the sessions in order to determine the amount of snack food eaten. Because both participants were free to eat from the same bowl, we estimated the mean intake of the confederate in the low- and high-intake confederate conditions. In the low-intake condition (i.e., 2 handfuls of nuts), the confederate ate approximately 8 g of nuts. In the high-intake condition (i.e., 10 handfuls of nuts), the confederate ate approximately 40 g. Thus, each handful consisted of approximately 5 cocktail nuts (4 g). We used the following formula to determine the amount of nuts (in grams) eaten by the participant: weight of the bowl before the experiment minus the weight of the bowl after the experiment minus 8 or 40 g in the low- or high-intake confederate condition, respectively. In the no-intake condition, in which the confederate ate nothing, the amount of food eaten was calculated as the weight of the bowl before the experiment minus the weight of the bowl after the experiment. Our dependent variable, then, was the total amount of nuts eaten (in grams) by each participant. Of course, the results would have been the same if we had used total number of kcal consumed, since using kcal involves a mere recoding of grams.

Hunger. Hunger was assessed using a 10-point rating scale, with possible responses ranging from 1 ('not at all hungry') to 10 ('very hungry') (cf. Hermans et al., 2008). We assumed that asking participants to refrain from eating for a certain period of time before the experiment, which is the best option for controlling individual variations in hunger (Polivy et al., 1988), might have suggested the actual aim of the study and thereby distorted participants' natural eating behavior. To avoid this bias, we measured participants' pre-experimental hunger at the end of the experimental session (cf. Anschütz, Engels, Becker, & Van Strien, 2009; Hermans et al., 2008).

Height and weight. The research assistant measured each participant's height and weight following standard procedures (Lohman et al., 1998). 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 0.10 kg using a digital scale (Seca Bella 840, Seca GmbH & co., Hamburg, Germany). BMI was

calculated as weight in kg divided by the square of height in meters.

Participants' awareness of confederate's intake. To measure participants' awareness of the confederate's intake, we asked them to indicate how many handfuls of cocktail nuts the other person had eaten.

Results

Manipulation checks

Participants estimated the intake of the confederate as higher (M = 3.45, SD = 2.39, 95% CI = 2.33 – 4.57) in the high-intake condition than in the low-intake condition (M = 1.47, SD = 0.98, 95% CI = 1.00 – 1.95), $t(37) = -3.35$, $p < 0.01$. All participants in the no-intake confederate condition (n = 18) reported that the confederate did not eat any nuts during the 15 min break.

Impact of confederate's intake condition and participants' hunger on intake

Before performing our main analysis, we first examined whether participants differed with respect to potential confounding variables. BMI and liking of the snack food available were not significantly correlated with participants' intake ($p > 0.10$) and therefore not included in the model as potential confounds. In order to examine the moderating role of hunger on social modeling of snack intake, we added hunger as a linear variable to our statistical model. Prior to the ANCOVA analysis, participants' hunger was standardized. All analyses were performed with SPSS 15.0 (SPSS for Windows, Rel. 15.01.2006, Chicago: SPSS Inc.).

No main effect was found for the confederate's intake condition on the total amount of nuts eaten (in grams) eaten by the participant, $F(2, 53) = 2.54$, $p = 0.09$. In contrast, a main effect for hunger was found, $F(1, 53) = 10.87$, $p < 0.01$, indicating that participants who reported having been hungrier before the experiment ate more snack food during the break. Moreover, a significant interaction effect was found between confederate's intake condition and participants' hunger on the total amount of snack

food consumed, $F(2, 53) = 3.55$, $p < 0.05$. To clarify the interaction, we conducted analyses of simple effects. We ran two regressions involving hunger levels one standard deviation above and one standard deviation below the standardized pre-experimental hunger score (Aiken & West, 1991). These analyses revealed no effect of confederate's intake condition for participants with a below-average hunger score, $F(2, 53) = 0.57$, p = n.s., but there was an effect of confederate's intake condition for participants with an above-average hunger score, $F(2, 53) = 5.55$, $p < 0.01$. In other words, only those participants with an above-average hunger score adjusted their intake to that of the confederate. They consumed more snack food when with a high-intake confederate than when with a low-intake confederate ($p < 0.05$) or a no-intake confederate ($p < 0.01$) (see **Table 2**).

Table 2
Total amount of energy dense food (in grams) consumed in the different conditions by participants with different levels of hunger.

	Below average hunger	Average hunger	Above average hunger
	Mean (*SE*)	Mean (*SE*)	Mean (*SE*)
No intake condition	0.27 (3.95)	3.32 (2.83)	6.37 (4.06) *
Low intake condition	5.62 (3.84)	7.21 (2.68)	8.80 (3.79)
High intake condition	0.99 (3.74)	11.97 (2.62)	22.94 (3.70)**

Note: $*p < 0.05$, $** p < 0.01$.

Additional analyses

Although BMI was unrelated to intake, we examined whether omission of overweight participants would alter the results. Examining only the normal weight (18 < BMI < 25) participants in our sample (n =

48), we found the same interaction between participants' pre-experimental hunger and confederate's intake condition on the total amount of nuts eaten, $F(2, 24) = 3.92$, $p < 0.05$. Furthermore, we checked whether the participants' hunger levels were related to the participants' estimations of the confederates' handfuls of nuts picked. A marginally significant interaction was found between confederate's intake condition and participants' level of hunger on the participants' estimations of confederate's number of handfuls picked, $F(1, 35) = 3.07$, $p = 0.09$, indicating that the participants with above-average hunger scores also reported that the high-intake confederate took more handfuls (see Table 3).

Table 3
Participants' estimations of confederates' handfuls picked by participants with different levels of hunger.

Confederate's intake condition	Participants' level of hunger	Mean	*SE*
Low intake confederate (2)	Low	1.54	0.51
Low intake confederate (10)	High	1.36	0.67
High intake confederate (2)	Low	2.71	0.51
High intake confederate (10)	High	4.56	0.62

Note: between parentheses is the actual number of handfuls picked by the confederates.

Discussion

Heretofore, the majority of studies on social modeling of food intake have focused almost exclusively on females (see Herman et al., 2003, for a review). This may be due to the fact that one of the mechanisms proposed to explain this effect (i.e., social norms regarding appropriate intake) is assumed to be more important for females than for males. In this study, we examined social modeling of snack-food intake among young men. Further, we investigated the possible moderating role of hunger on social modeling

of snack-food intake.

This study showed, first, that men who were hungry prior to the experiment ate more snack food during the break. The effect of hunger on food intake is consistent with findings indicating that hunger is associated with food-seeking behaviors and actual intake (e.g., Castonguay et al., 1983; Nicolaidis & Even, 1985). Second, and more importantly, it was found that the modeling effect was qualified by the level of hunger. That is, only the men who reported high pre-experimental hunger adjusted their intake to that of their eating companion. They ate more snack food when the other ate more snack food, but they also refrained from eating when the other refrained from eating. This suggests that males' hunger levels were more readily expressed when the males were exposed to an eating companion eating a large amount of cocktail nuts.

We offer two possible explanations for the moderating effect of hunger found in the present study. First, it may be that men have to be in a state of hunger (and thus intrinsically motivated to satisfy one's hunger) before social modeling processes come to fore. It may be that hungry males eat as much as possible, but within the constraints imposed by their eating companion. Hunger is an excitatory process that arises from energy needs (Smith & Ferguson, 2008) and is defined as a strong desire or need for food. Therefore, the hungry males were simply more motivated to eat the available snack food in order to fulfill their bodily needs. Nonetheless, they still take into account their eating companion's intake in order not to eat appreciably more than the companion does. The males with moderate and low levels of hunger were not motivated to eat maximally. So, even though their eating companion ate a large amount, they were less likely to eat more (and thus did not model the other's intake). In sum, this first normative explanation suggests that hungry males exposed to an eating companion eating a little have inhibited their intake.

A second explanation may be that the males who were accompanied by a high-intake companion were more exposed to food-related sensory stimuli (e.g., sight and sounds), which may have led, in combination with their high levels of hunger, to a substantial increase in intake. Hunger makes people

more responsive to these external food-related cues (Jacobs & Sharma, 1969; Kauffman, Herman, & Polivy, 1995) and individuals with high levels of hunger exhibit an attentional bias for food-related stimuli (Mogg, Bradley, Hyare, & Lee, 1998). In the high-intake condition, the males were exposed to another male who took a handful of cocktails nuts on 10 occasions (which amounts to a handful of nuts every 90 s). This means that they were regularly exposed to an eating person whose consumption was accompanied by the sound of crunching nuts. All in all, the sight and sound of the eating companion might have provided very powerful cues, which might have resulted in a substantial increase in intake among these hungry males. In the present study, it was found that hungry males were more accurate in their estimations of the amount eaten by the other person. This finding supports the assumption that hungry individuals are more responsive to external food-related cues. It would be interesting to investigate the specific role of hunger on responsiveness to food-related cues and modeling behavior in future studies.

One possible concern arises from the fact that the hunger ratings were made at the end of the experiment. It is conceivable that the males who ate a lot in the presence of a high-intake confederate rated themselves as hungry only retrospectively, in light of how much they ate. This potential artifact, however, cannot explain why males rated themselves hungry in the low- and no-intake conditions, in which they did not eat a lot even when the companion did.

Our results are not in line with the study of Goldman and colleagues (1991) who found that women modeled the intake of a same-sex eating companion regardless of their hunger levels. We propose that women's more intense social motives are responsible for this finding. It is widely assumed that self-presentational statements regarding food and eating are more important for women than for men (e.g., Berry, Beatty, Klesges, 1985; Roth et al., 2001). Moreover, behaving appropriately with respect to one's eating behavior may be a particularly female concern. It might be that women, whether or not hungry, adjust their intake to that of another woman because they feel obliged (for social reasons) to do so. So, whereas for women adjusting one's intake to that of another person seems to be the default

response to avoid negative judgments (Roth et al., 2001), this study demonstrates that males may not be as concerned with social propriety.

A few limitations warrant discussion. Since the majority of our sample consisted of relatively young and normal weight men, the question arises as to whether we should expect the same results for overweight or obese hungry men in older age groups. It might be the case that obese men will be more concerned with making a good impression (or avoiding negative judgments), and therefore be more likely to model the intake of their eating companion. Moreover, it may be that when examining same-sex and same-weight men, low-hunger obese men will model the high-intake model out of a sense of social obligation. Second, the men in our study were paired with a same-sex confederate who was previously unknown to them. The strange eating companion or the experimental setting might have led to a general inhibition of eating as reflected in the fact that the overall level of intake during the break was generally low. Although this finding is not uncommon in the modeling literature (cf. Hermans et al., 2009a), the question remains as to whether the role of hunger on modeling of food intake would have been the same if the males were friends, family members or acquaintances. Third, we chose to offer only one specific snack food (nuts) which might have limited the generalizability of our study results. Findings should be replicated with other types of snack food or complete meals.

Taking these limitations into account, our findings provide evidence for the fact that hungry males may be more aware of the amount eaten by their eating companion and therefore more likely to display social modeling behavior. We suggest that these results might be helpful in the development of prevention strategies focusing on overeating (or under eating) in social contexts. Insight into the question of why hungry males eat more or less just because an eating companion does may be help to explain the increase of human food intake in recent years. Moreover, prevention strategies might inform men of the social factors affecting their intake and make them more aware of these influences. In conclusion, the present study showed that young men modeled the intake of their same-sex eating companion only when they were in a state of hunger. This study provided the first experimental evidence

that hunger may moderate men's modeling of snack-food intake. However, future studies are needed to further disentangle the effects of hunger and social motives on modeling of food intake.

Prologue

The study presented in Chapter 8 suggests that men lack a general to adapt their intake to that of their eating companion; only hungry males were found to model the intake of their eating companion. This finding has not previously been described in the literature and fits the inconsistent pattern of findings on modeling effects among men. One explanation for the lack of a general modeling effect is that males may be less concerned about avoiding the negative stereotypes associated with eating excessively, and therefore are less likely to match their intake to that of a previously unknown eating companion.

In the next study, we will investigate two individual difference moderators that might influence the extent to which women are likely to increase eating in response to the intake of others. If the eating behavior of others is considered as an external cue that might stimulate food intake, it is possible that women vary in the extent to which they respond to these cues. Two factors might be especially important in this context - impulsivity and attentional bias. In the next chapter, we will examine whether young women's impulsivity and attentional bias levels might influence their extent of modeling.

Chapter 9 Modeling effects on food intake

THE EFFECTS OF IMPULSIVITY AND ATTENTIONAL BIAS

Abstract

Numerous studies have shown that people adjust their intake directly to that of their eating companions. A potential explanation for this modeling effect is that the eating behavior of others operates as an external eating cue that stimulates food intake. The current study explored whether this cue-reactive mechanism can account for modeling effects on intake. It was investigated whether attentional bias towards dynamic eating cues and impulsivity would influence the degree of modeling. Participants completed one individual session and one session in which an experimental confederate accompanied them. In the first session, eye movements were recorded as an index of attentional bias to dynamic eating cues. In addition, self-reported impulsivity and response inhibition were assessed. The second session employed a between-participants design with three experimental conditions in which participants were exposed to a same-sex confederate instructed to eat nothing, a low, or large amount of M&Ms. A total of 85 young women participated. Participants' self-reported impulsivity determined the occurrence of modeling; only low-impulsive women adjusted their intake to that of their eating companion. Attention toward eating cues and response inhibition, however, did not moderate modeling of food intake. The present study suggests that cue-reactive mechanisms may not underlie modeling of food intake. Instead the results emphasize the importance of social norms in explaining modeling effects whereas it is suggested that the degree of impulsivity may play a role in whether or not women adhere to the intake norms set by their eating companion.

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Introduction

Food and eating are intertwined with our social lives; mostly we eat with or in the presence of other people. Therefore, it should not be too surprising that one's eating behavior is profoundly affected by social factors. Studies have consistently shown that people tend to eat as much or as little as do those with whom they eat (Conger et al., 1980; Johnston, 2002; Hermans, Larsen, Lochbuehler, Nederkoorn, Herman, & Engels, 2012). The process of adjusting one's intake to that of others is often referred to as modeling of food intake. Although these modeling or matching effects have proven to be very powerful, little is known about the mechanisms underlying these effects.

People's tendency to adapt their intake to that of others is often attributed to one's concern with what their eating behavior is communicating to others (Leone et al., 2008). Herman and colleagues (2003) have suggested a normative model which posits that people use other's intake as a way of determining how much they may eat without appearing to eat excessively. Thus, people use the intake of others as an example of "appropriate eating" and adjust their own level of intake accordingly. A limitation of this normative framework, however, is that it gives little insight in whether there any particular characteristics that makes some people more or less susceptible to the effect of modeling on intake. Because an individual's intake is multiply determined, it is important to consider other mechanisms that may affect eating (and subsequent modeling behavior).

If the eating behaviors of others is construed as an external eating cue that may stimulate food intake (Koh & Pliner, 2009), there might be large individual variation in the intensity of responsiveness to this dynamic eating cue. Thus, in addition to the normative framework, it is also possible that a cue-reactivity model (Jansen, 1998) may help to explain modeling effects. It must be acknowledged that there is a distinction between food cues per se (i.e., sight, smell, or taste of food) and dynamic eating cues (e.g., the sight of someone eating). That is, dynamic eating cues probably can never be entirely separated from food cues per se, because the sight of someone eating almost necessarily involves the sight of the food that is being eaten. The principal aim of the current study is to explore whether a cue-

reactive mechanism can (at least partially) explain modeling of food intake. Therefore, two individual-difference moderators (i.e., attentional bias to dynamic eating cues and impulsivity) that might influence the extent to which people are likely to increase eating in response to a real-life dynamic eating cue (i.e., the sight of someone eating) were examined.

In an environment which is characterized by an abundance of highly palatable food items and the presence of eating others, people are frequently exposed to attractive food or eating cues. Although this may generally lead to an increased temptation to indulge (Hill & Peters, 1998), not everyone is equally susceptible to these temptations (Polivy, Herman, & Coelho, 2008). Some individuals may find food particularly rewarding (Davis et al., 2007; Stice et al., 2009) and therefore automatically attend to external food-related cues. Conversely, this tendency to automatically detect and attend to such external food cues may contribute to craving and subsequent (over)eating (Werthmann et al., 2011). It has been theorized that these attentional biases for food cues follow from the cues' incentive salience (e.g., Berridge, 2009; Robinson & Berridge, 2003). According to this incentive-salience theory, as a consequence of classical conditioning, the cue itself is able to produce a conditioned rewarding experience. As a result, these cues gain "attention grabbing powers", which enable them to capture attention and elicit approach behavior (Field & Cox, 2008; Robinson & Berridge, 2003). These cues might not only refer to the food itself (i.e. sight, smell, or taste of food), but also directly to stimuli associated with the food (e.g., packaging, plates, or cutlery) or intake routines (i.e., grabbing or biting the food) (Jansen, 1998). The most direct way to assess individual differences in attention toward these cues is to record eye movements during a visual attention paradigm, because this provides a direct, observable, dynamic, and ecologically valid measure of visual attention processes (Mogg, Bradley, Field, & De Houwer, 2003). The existence of attentional biases to passive food cues (i.e., words and pictures) has repeatedly been established among normal- and overweight individuals (Castellanos, Charboneau, Dietrich, Park, Bradley, Mogg, & Cowan, 2009; Werthmann et al., 2011). The present study, however, is the first to examine whether attentional biases toward dynamic eating cues moderate

modeling effects on food intake. Because of the prevalence of dynamic eating cues in our current "toxic environment" (Schwartz & Puhl, 2003), it is important to examine whether individuals' attention to these cues may affect modeling of food intake.

Another factor that might moderate people's food intake in response to the sight of eating others is impulsivity. Impulsivity is generally defined as the tendency to think, control, and plan insufficiently, which often results in maladaptive or inaccurate responses (Solanto, Abikoff, Sonuga-Barke, Schachar, Logan, Wigal et al., 2001). Although impulsive behaviors can be very diverse, scholars have distinguished three important main aspect of impulsivity. The first is impulsiveness, which was defined by Eysenck and colleagues (1984) as "acting in the spur of the moment without being aware of any risk involved" (p. 315) and is often measured by self-report. The second aspect is response inhibition, an executive function which is assumed to be at the heart of impulsive behavior (Barkley, 1997). Response inhibition is needed to overrule impulsive reactions in order to regulate long-term goals and standards (Logan & Cowan, 1984) and is measured by behavioral tasks. A third aspect is reward related impulsivity, which can be measured by behavioral tasks and self-reports. Reward-sensitive people detect more rewarding stimuli and are more likely to approach these stimuli (Avila, 2001). In the context of the current study, we chose to focus on (self-reported) impulsiveness and response inhibition, but not on reward-sensitivity. To date, numerous studies have been conducted on the influence of both aspects of impulsivity on food intake. For example, Guerrieri, Nederkoorn, and Jansen (2007a) found that high-impulsive women consumed more than did less impulsive women when confronted with palatable food (during a taste task), but these effects were only found when participants were categorized based on the self-report measure of impulsivity as opposed to the behavioral measure. In another study, however, the same authors demonstrated that both measures of impulsivity predicted food intake in normal weight healthy women (Guerrieri, Nederkoorn, Stankiewicz, Alberts, Geswchwind, Martijn, & Jansen, 2007b). Likewise, Jansen and colleagues found that restrained eaters ate more in response to smelling palatable food but only if they were deficient in their response inhibition (Jansen, Nederkoorn, van Baak, Keirse,

Guerrieri, & Havermans, 2009). Finally, it has been found that experimentally inducing a lack of control by manipulating response inhibition increased food intake among normal weight women (Guerrieri, Nederkoorn, Schrooten, Martijn, & Jansen, 2009; Rotenberg, Lancaster, Marsden, Pryce, Williams, & Lattimore, 2005). In sum, both impulsiveness and response inhibition seem to be linked to reactions to palatable food. Thus, it might be harder for high-impulsive people to control food intake in response to food cues (e.g., the smell and availability of food) than it is for low-impulsive people. However, one area that has not been studied is whether impulsiveness and response inhibition also affect the extent to which people are likely to increase eating in response to the sight of someone eating.

The present study aimed to explore whether a cue-reactive mechanism can account for modeling of food intake. It was investigated whether attentional bias toward dynamic eating cues and impulsivity would influence people's modeling of food intake. As in most previous studies that examined modeling of food intake (cf. Herman et al., 2003), the focus was exclusively on females. Because food intake is triggered by the exposure to external cues (Herman & Polivy, 2008) and a positive relationship is proposed between food-related attention and food intake (Berridge, 2009; Robinson & Berridge, 2003; Mogg et al., 2003), it was hypothesized that women with an attentional bias toward eating cues would be more likely to model the eating behavior of a same-sex confederate. Most researchers have monitored participants' attention as they complete a visual probe task in which food-related and matched control pictures compete for participants' attention (e.g., Castellanos et al., 2009; Nijs, Muris, Euser, & Franken, 2010; Werthmann et al., 2011). To increase ecological validity, however, women's attention while watching a movie with dynamic eating cues was investigated. Second, it was hypothesized that impulsive women would be more likely to model the intake of their eating companion than low- impulsive women, as they may be less able to control their impulses in response to real-life dynamic eating cues.

Methods

Design

Participants had to complete two testing sessions: one individual session and one session in which they were accompanied by an experimental confederate (eating partner). In the first individual session, participants filled out a series of questionnaires and afterwards watched a movie while their eye movements were recorded with an eye-tracker. At the end of this session, participants' response inhibition was assessed. The second session employed a between-participants design with three experimental conditions in which participants were exposed to a female confederate who was instructed to eat nothing (no-intake confederate condition), or 4 M&Ms (181.55 kJ; low-intake confederate condition) or 24 M&Ms (1089.29 kJ; high-intake confederate condition). On average, there were five days between the first and second session (*SD* = 4).

Participants and confederates

The sample consisted of 85 participants with a mean age of 20.20 (*SD* = 1.85) years and a mean BMI of 22.38 (*SD* = 2.26). In our sample, 88% of the women had a normal weight, and 12% were overweight. Five female students acted as confederates in the second session. They had a mean age of 21.40 years (*SD* = 1.52) and a mean BMI of 20.74 (*SD* = 1.33). Confederates were instructed not to make any remarks on the taste, colour or palatability of the M&Ms, or to offer participants any M&Ms. Each confederate served in each condition several times.

Materials and measures

In the first individual session, an eye-tracker paradigm was used in which participants' eye movements were recorded as a direct measure of their attention toward dynamic food cues (i.e., the sight of others eating). The stimulus material consisted of 17 minutes of the movie "Eat Pray Love" (2010). In this movie, the main female character (Julia Roberts) starts a journey around the world that becomes a quest for

self-discovery. The first part of the movie, in which she discovers the true pleasure of nourishment by eating in Italy, was used. Fifty-one scenes in which ample food-related cues are depicted (range in ms is 600-24760) were selected. Food-related cues were mainly portrayed in the form of the protagonist eating highly palatable foods (alone or with others). Participants' eye movements while watching the movie clip were recorded with a corneal reflection eye-tracker (Tobii T120 Eye Tracker, Tobbii Technology, Danderyd, Sweden). The gaze of each participant was calibrated prior to testing. For more detailed information on the calibration and specific eye-tracking procedure, see Lochbuehler, Voogd, Scholte, & Engels, 2011. For each scene, the area of interest was defined. This area was restricted to the display of an eating cue, which means that a fixation took place only if at least one of the participant's eyes overlapped with the display of an eating cue (i.e. food or a person eating). Each scene was coded as to whether there was a fixation or non-fixation on the cue or whether data were missing. Two coders, who were blind to our research questions, independently coded participants' data.

Attentional bias for food cues. To measure participants' attention to food-related cues, three dependent variables were used: 1) the number of fixations on the food-related cues, 2) the duration of fixations (i.e., gaze duration) and 3) the latency of initial fixations on the food-related cues (cf. Field, Eastwood, Bradley, & Mogg, 2006; Lochbuehler et al., 2011; Mogg et al., 2003). A participant's number of fixations was determined by counting the total number of times the participant fixated on the food cues. A participant's gaze duration was defined as the overall amount of time that the participant's gaze was directed to the food cues. A participant's initial fixation was defined by the time of the first fixation of the cue after its appearance. These three variables for each participant for each of the 51 scenes were assessed. In the main analyses, then, the overall scores of all scenes (for each variable separately) were used.

Self-reported impulsivity. The Barratt Impulsiveness Scale (Patton, Stanford, & Barrat, 1995) was used to measure trait impulsiveness. Examples of items were 'I don't pay attention' and 'I like to

think about complex problems'. The scale consists of 30 items rated on a 4-point scale, with possible scores ranging from 30 to 120. Higher scores indicate more impulsiveness. Cronbach's alpha was 0.72.

Response inhibition. The stop signal task (Logan, Schachar, & Tannock, 1997) was used to measure response inhibition. Response inhibition, as measured with this task, has been shown to be related to impulsivity. The stop signal task is a choice reaction time task in which participants should respond as fast as possible to a visual go-signal (an X or an O), unless an auditory stop signal is presented (through headphones), in which case the response should be inhibited (25% of the trials) (For more detailed information on this task see Nederkoorn, Houben, Hofmann, Roefs, & Jansen, 2010). Participants completed two practice blocks without stop signals and one with stop signals. Next, they completed four test blocks of 128 trials successively. The two variables measured in this task are reaction time and mean stop delay. The SSRT (in ms) was calculated by subtracting the stop delay from reaction time. Higher SSRTs indicate less inhibitory control.

Hunger. A Visual Analogue Scale (VAS; 140 mm) was used to measure the extent to which the participants felt 'satisfied' or 'hungry' before the second session. To avoid demand characteristics, participants' hunger level after the experimental manipulation was assessed (see also Anschütz et al., 2009; Hermans et al., 2010a).

Liking of the test food. Participants reported their liking of the available chocolate-coated peanuts on a 10-point scale from 'did not like it at all' to 'liked it very much'.

Participants' awareness of confederate's intake. To measure participants' awareness of the confederate's intake, participants were asked to indicate how many M&Ms the other person had eaten (Hermans et al., 2010a).

Actual food intake. Participants' actual food intake in the break of the second session was measured by counting the total number of M&Ms consumed by each participant. The total quantity of snack food consumed (i.e., single pieces of M&Ms) was used as the dependent variable.

Procedure

The first individual session lasted approximately 45 minutes. After entering the lab, participants were asked to fill out a series of questionnaires, after which they were told that they would watch a segment of the contemporary movie "Eat Pray Love". Participants were seated in a chair, 60 cm in front of the eye-tracker so that their eye movements could be recorded while they watched the movie. They were instructed to find a comfortable position in which they could watch the movie in a relaxed way without moving. After participants were successfully calibrated, the experimenter left the room. After they watched the movie, participants completed the Stop Signal Task, which lasted approximately 20 minutes. Next, participants were requested to complete a questionnaire in which, amongst other measures, self-reported impulsivity was assessed with the BIS. Finally, their height and weight were measured in order to calculate their body mass index (BMI; calculated as kg/m2). In order to simulate a naturalistic eating context, the second session took place in a laboratory furnished as an ordinary living room. During this session, participants were paired with a female confederate with whom they had to spend an experimental break during the interval between two bogus tasks. This session lasted approximately 30 minutes. Participants received course credits or payment (€15) after they volunteered for both sessions. Debriefing took place after the data collection for the entire experiment. 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 of the Radboud University Nijmegen. Written informed consent was obtained from all subjects.

Strategy for analyses

Data were analysed using SPSS for Windows (version 17.0, 2008; SPSS, Inc., Chicago, IL, USA). Alpha was set at $p < 0.05$. Originally, the sample consisted of 100 female undergraduate students. However, 15 participants were excluded from the analyses. The eye-tracking data of 11 participants could not be analyzed because more than 50% of their data was missing (due to calibration problems); and

4 participants had to be excluded because they reported an allergy to peanuts and therefore could not eat from the available test food in the second session. First, using one-way ANOVA, we checked whether there were any differences in BMI, hunger level, self-reported impulsivity, response inhibition and attention to food-related cues (all three measures) between conditions. If they were significantly correlated with food intake, BMI, hunger level and liking of the test food were entered into the model as covariates. To answer the main questions, separate ANCOVAS were used to examine the main and interaction effects of the modeling manipulations, the impulsivity, and the attentional attention bias measures on the participants' total food intake (in single pieces of M&Ms). Cohen's f was used to indicate the effect size of the main effect of the modeling manipulations, because we had more than two conditions in our design (Cohen, 1988). Effect sizes of 0.02, 0.15 and 0.35 are termed small, medium, and large, respectively (Cohen, 1988).

Results

Individual characteristics

Participants' BMI, hunger level, self-reported impulsivity, response inhibition and attention to food-related cues did not differ across the three confederate's intake conditions (all *p*'s > 0.05). **Table 1** displays the participants' characteristics across conditions. All measures used in the current study were included in a correlation matrix (see **Table 2**). BMI ($r85 = -0.28$, $p < .05$) and participants' liking of the test food ($r85 = 0.32$, $p < 0.01$) were significantly correlated with actual food intake during the second session and therefore entered into our model as covariates. It should be noted that the results remained the same when these variables were not included in the main analyses.

Table 1
Characteristics of the study population by condition (Mean values and standard deviations).

	Condition							
	Total		No intake		Low intake		High intake	
	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*
n	85		31		26		28	
Age (years)	20.20	1.85	20.19	1.97	19.88	1.53	20.50	1.99
BMI (kg/m^2)	22.38	2.26	23.04	2.53	22.29	2.31	21.72	1.70
Liking of test food	6.98	2.35	6.26	2.58	7.23	2.41	7.53	1.84
BIS	63.22	7.47	61.42	7.02	63.77	6.95	64.71	8.24
SSRT	224.32	26.82	225.98	35.48	236.20	44.98	211.53	25.58
AB-measure 1*	50.69	15.45	51.84	12.98	46.65	15.08	53.18	17.93
AB-measure 2ǂ	6.35	1.57	6.41	1.58	6.30	1.54	6.34	1.62
AB-measure 3 ŦŦ	19.78	5.61	19.05	4.39	21.22	5.91	19.25	6.43

BIS, Barratt Impulsiveness Scale; SSRT, stop-signal reaction time; AB, attention bias.
*Number of fixations.
ǂ Gaze duration (in ms)
ŦŦ Latency of initial fixations (in frames)

Table 2
Pearson's product-moment correlations between actual food intake, BMI, self-report impulsiveness, behavioral impulsivity, and the three attention bias (AB) measures.

	Food intake	Self-reported impulsiveness	Behavioral impulsivity	BMI	AB-measure 1	AB-measure 2	AB-measure 3
Food intake	-						
Self-reported impulsiveness	-0.07	-					
Behavioral impulsivity	-0.16	0.06	-				
BMI	-0.28*	-0.07	0.12	-			
AB-measure 1	-0.01	-0.24	-0.10	0.14	-		
AB-measure 2	0.02	-0.04	-0.01	0.01	0.66**	-	
AB-measure 3	0.15	0.00	0.02	-0.09	-0.30**	-0.38**	-

Note: Correlation is significant: * $p < 0.05$, ** $p < 0.01$ (two-tailed).

Main effect of confederate's intake on participants' intake

A significant difference in intake was found among participants in the three intake conditions, $F(2,80) = 8.49$, $p < 0.001$, $f^2 = 0.46$), while controlling for participants' BMI and liking of the test food. When exposed to a high-intake confederate, participants consumed significantly more M&Ms than they did when exposed to a low-intake confederate ($p < 0.05$) or no-intake confederate ($p < 0.001$). Participants consumed a mean of 1.82 M&Ms (45.39 kJ; *SE* = 1.07) when exposed to a confederate eating nothing (no-intake), 3.94 M&Ms (178.83 kJ; *SE* = 1.13) when exposed to a confederate eating 4 M&Ms (181.55 kJ; low-intake) and 8.22 M&Ms (373.08 kJ; *SE* = 1.11) when exposed to a confederate eating 24 M&Ms (1089.29 kJ; high-intake). Forty-one participants (48%) did not eat any M&Ms, 25 of them in the no-intake condition.

Moderating effects of attentional bias to dynamic food cues on modeling of intake

To examine the moderating effects of attention (i.e., number of fixations, gaze duration, and initial fixation), we performed three separate ANCOVAS with each of the attention measures added as an

extra factor to our model (while also controlling for BMI and liking of the test food). First, there was no main effect of participants' number of fixations on food cues in session one on participants' intake in session two, $F(1,77) = 0.06$, $p = 0.81$, nor was there an interaction between the number of fixations and confederate's intake condition on participants' intake, $F(2,77) = 0.72$, $p = 0.49$. Also, there was no main, $F(1,77) = 0.02$, $p = 0.89$, or interaction effect, $F(2,77) = 0.51$, $p = 0.60$, for participants' gaze duration. Finally, we did not find a main, $F(1,77) = 1.50$ $p = 0.23$, or interaction effect, $F(2,77) = 1.25$, $p = 0.29$, of participants' initial fixation on participants' actual food intake or participants' modeling behavior.

Moderating effects of response inhibition and self-reported impulsivity on modeling of food intake

To examine the moderating effect of response inhibition on participants' modeling of food intake, we added the SSRT-score as a factor to our model. Neither influence of response inhibition on actual food intake, $F(1,72) = 1.83$, $p = 0.18$, nor an interaction, $F(2,72) = 2.09$, $p = 0.13$, between response inhibition and confederate's intake on participants' actual food intake was found. To examine the moderating effect of self-reported impulsiveness on participants' modeling of food intake, we added the BIS-total score as a covariate to our model. No main effect of self-reported impulsiveness on intake was found, $F(1,77) = 1.66$, $p > 0.20$. However, a significant interaction between confederate's intake condition and participants' self-reported impulsiveness was found, $F(2,77) = 4.32$, $p < 0.05$. To clarify the interaction, we used a median-split (median=61) of the BIS-score to differentiate low-impulsive participants from high-impulsive participants. The pattern of the interaction indicates that the customary modeling effect was found among the low-impulsive participants, $F(2, 38) = 10.97$, $p < 0.001$, but not among the high-impulsive participants, $F(2,37) = 1.01$, $p > 0.20$, indicating that only the low impulsives modeled the food intake of their eating companion (i.e., eating more or less when the other ate more or less). The difference in intake between the low- and high-impulsives was particularly evident in the high-intake condition. In this condition, low-impulsives ate an average of 11.52 M&Ms (522.26 kJ; $SE = 1.52$), whereas high-impulsives only ate 4.60 M&Ms (208.78 kJ; $SE = 1.51$) (see **Table 3**).

Table 3
Total number of M&Ms consumed in the different conditions by participants with different levels of self-reported impulsivity.

	Low-impulsivity Mean (*SE*)	High-impulsivity Mean (*SE*)
No-intake confederate condition	1.58 (1.42)	1.85 (1.44)
Low-intake confederate condition	3.58 (1.59)	4.30 (1.47)
High-intake confederate condition	11.42 (1.46)	4.73 (1.52)

Additionately, it was checked whether the low- and high impulsives differed in their estimations of the confederate's number of M&Ms consumed in the high-intake condition. When exposed to a confederate eating 24 M&Ms, low-impulsives indicated that the confederate consumed approximately 17 M&Ms, whereas the high-impulsives indicated that the confederate consumed approximately 10 M&Ms, p = 0.05.

Discussion

As yet, little is known about the mechanisms underlying modeling of food intake. This study aimed to explore whether a cue-reactive mechanism can (at least partially) explain modeling of food intake. It was investigated whether attentional bias toward eating cues and the degree of impulsivity influenced young women's modeling of food intake. The results confirmed previous findings that young women

adjust their intake to that of others (Conger et al., 1980; Hermans et al., 2012; Johnston, 2002). The current study adds to this basic finding the discovery that self-reported impulsivity can moderate this modeling effect. In contrast to our hypothesis, however, only low-impulsive women modelled the intake of their eating companion. Participants' attention toward eating cues and response inhibition did not moderate modeling effects on food intake.

In line with the extensive literature on the effects of food-cue exposure on food intake (e.g., Jansen, 1998), it was hypothesized that the eating behavior of another person could serve as a powerful stimulating eating cue, in particular for women with an enhanced attention bias. However, no relation was found between women's attention toward dynamic eating cues and the likelihood of modeling: women with enhanced attention for eating cues did not display greater modeling than did those who paid less attention to these eating cues. Furthermore, no differences in overall intake were found between women with different attention levels. These findings suggest that individual differences in attention toward eating cues are overruled by a general tendency to adhere to socially derived norms of appropriateness. Thus, in spite of variations in attention toward food-related cues, women are likely to adapt their intake to that of others. Another possibility is that individual differences in attention were restricted in range and therefore did not exert a discernible effect. The current study focused on (mainly) normal weight women. Previous research has shown that overweight or obese people exhibit an enhanced attentional bias to food-related stimuli compared to normal weight individuals (Castellanos et al., 2009; Nijs et al., 2010). It is possible that a causal link between attention toward eating cues and modeling may be observed only among overweight or obese individuals, as they are generally more vulnerable to food cues. Finally, the dynamic sight of someone eating might have lower "attention grabbing powers" than attention for passive food cues (i.e., words or pictures) as measured in traditional food-related Stroop or dot-probe tasks and could therefore be easily overwhelmed by other external influences (e.g., social norms).

Although the present results are justifying the generalization that young women eat more when their eating companions eat more, it was found that the overall degree of intake was relatively low. At

best, participants consumed a mean number of 8 M&Ms, which is still considerably lower than the intake of the large-eating companion (who ate 24 M&Ms). Albeit this finding is not uncommon in the literature on social modeling on food intake (Conger et al., 1980; Hermans et al., 2009a) and non-social factors such as sensory-specific satiety might have been responsible for these patterns of findings (Rolls et al., 1982), it might also be that the intake of the eating companion rather inhibits than stimulates people to eat. This accords with previous modeling research that shows that minimal eating companions produce the most significant change in eating quantity (e.g., Feeney et al., 2011; Polivy et al., 1979). Determining whether specific individuals regard the intake of others as an inhibiting or stimulating cue would require future research, in which people are asked to report their eating motivations in a social context. It should be noted, however, that such explorations are rendered difficult, because psychological states that occur during social interactions are difficult to identify as people are often unaware of their own intentions in this regard (Vartanian et al., 2008). Next, this line of research would benefit from including a control condition in which participants eat alone in order to make definitive statements about whether the intake of others increases or decreases one's intake.

If the eating behavior of others acts as an inhibiting rather than a stimulating cue, this might also explain our unexpected impulsivity finding. It has been proposed that an individual's inhibitory control system may override the motivation to consume food and makes it possible for more deliberate long-term goals to predominate. In the context of consummatory behavior, such goals often reflect health concerns or social norms (Nederkoorn et al., 2010). Thus, for low-impulsive women who are generally well controlled it may be easier to control their intake in the presence of palatable food and conform to the behavior of others in order to fulfil more deliberate goals, such as avoiding negative stereotypes or gaining social approval or acceptance (Deutsch & Gerard, 1955; Roth et al., 2001; Vartanian et al., 2007). Highly-impulsive women, however, were found to eat the same amount regardless of whether their eating companion was eating a lot or a little, which suggests that they were less inclined to follow the other's intake. In this context, however, we might have expected to find the highly impulsive women

to eat uniformly more than their eating companion, but this was not supported by our data. Why did they eat so little? It is possible that the high-impulsives focused more on the bowl of M&Ms than on the other's intake, which may have facilitated the subsequent use of counteractive control strategies to resist overconsumption. Overweight people show a characteristic pattern of initial automatic orientation toward food cues and a subsequent voluntary attentional shift away from food (Werthmann et al., 2011). Considering the link between obesity and impulsivity (Braet, Claus, Verbeken, & Vlierberghe, 2007; Nederkoorn, Braet, Van Eijs, Tanghe, & Jansen, 2006), it is possible that the same approach-avoidance pattern might also have accounted for the relatively low intake among the high-impulsives, in particular when exposed to a peer eating a large amount of snack food. The fact that the high-impulsives were less accurate in their estimations of the amount eaten by the high-intake companion than were low-impulsives and, thus, seemingly paid less attention to the intake of the other person might support this assumption. Another explanation is that the bowl of M&Ms did not have enough sensory impact to stimulate food intake or to reduce counteractive control strategies in response to a large eating unknown other. It is possible that we might have found a different result if we had used food with stronger sensory properties, such as pizza-slices, fries or freshly baked cookies.

Although self-reported impulsivity was found to be related to modeling, we were not able to demonstrate the same effects for response inhibition. A few possible explanations are offered here. First, this behavioral measure might not have been sensitive enough to detect differences in a non-clinical populations (i.e., normal weight women) (Guerrieri et al., 2007a; Lijffijt, Bekker, Quick, Bakker, Kenemans, & Verbaten, 2004).Yet, because the effects were in the same direction and showed a trend towards significance, we are likely to assume that women with effective response inhibition may also be more likely to model their intake on that of others. It is possible, however, that the effects of response inhibition are noticeable only in long-term food intake patterns (Guerrieri, Nederkoorn, & Jansen, 2008) and not in a short time period such as was measured in the current study. Furthermore, because there were some days between the two experimental sessions, participants' response inhibition was actually

conceptualized as a trait whereas it may be also be a state (Guerrieri et al., 2007b). Therefore, it is possible that some participants lacked inhibitory control in the first session, but were able to control their impulses in the second ad-lib eating context, explaining the missing link between response inhibition and modeling of food intake.

Some limitations of the present study should be noted. First, just like the behavioral measure of impulsivity, participants' attention towards eating cues was also conceptualized as a trait instead of a state. It is known that attention biases and craving are reciprocally related (Field et al., 2008; Smeets, Roefs, & Jansen, 2009), and therefore it is possible that an elevated attention to eating cues may not explain people's response to the eating behavior of others a few days later. However, cognitive biases toward food stimuli are ubiquitous and there is evidence that such biases arise in particular for people with certain trait characteristics, such as being an external eater (Franken & Muris, 2005) or restrained eater (Tapper, Pothos, Fadardi, & Ziori, 2008). Second, although we enhanced the ecological validity of our study by measuring participants' attention toward dynamic food cues embedded in a larger context, it remains unclear whether participants are more likely to attend to the eater or to the food and how this difference might influence subsequent modeling behavior. The problem, however, is that food-related cues (i.e., properties that refer to food itself) and eating cues (i.e. the eating behavior of another person) usually go together and therefore it is difficult to examine their independent contributions. Nevertheless, it appears worth investigating participants' specific attention toward the eating behavior of others and its influence on subsequent modeling behavior. Another point for consideration involves the fact that only impulsiveness and response inhibition were measured in the present study. To further understand the link between impulsivity and modeling of food intake, it might also be important to focus on the possible moderating role of reward-sensitivity. Future research might examine how reward-sensitive people react to the sight of eating others. If they detect more rewarding stimuli and are more likely to approach these stimuli, it is possible that a different pattern of results might have appeared when measuring this aspect of impulsivity. Finally, contemporary dual-process models propose that an individual's eating

behavior is guided by two distinct cognitive systems that interact with each other: one system operating through fast, automatic impulses, and another system determining whether these automatic impulses are controlled (Strack, Werth, & Deutsch, 2006). Although our sample was large enough to examine main and interaction effects of both impulsivity and attentional bias, the present study was insufficiently powered to investigate the combination of attentional bias and response inhibition in the interaction with modeling of food intake. Future research may benefit from using a dualistic model approach focusing on this interaction to explain modeling of food intake.

To conclude, the results of the current study may provide further insight into the possible mechanisms underlying modeling of food intake. On the basis of our findings, we are likely to suggest that cue-reactive mechanisms may not be helpful in explaining modeling of food intake. Instead we propose that a normative explanation may best explain people's tendency to adjust their intake to that of others. It was found that only low-impulsive women who are generally well-controlled are able to follow the intake of their eating companion and adhere to the norms set by this person. As this is the first study investigating the influence of impulsivity on modeling of food intake, additional research is needed to replicate the current findings and to investigate why low- but not high-impulsive people are more likely to conform to the eating behavior of others.

Prologue

Testing a cue reactivity model to gain insight into possible individual differences in the modeling of food intake, we examined the moderating effects of impulsivity and attentional bias on social modeling. Our findings seem to suggest that this cue-reactive mechanism might not be of particular importance in explaining modeling effects among young women. Yet, this needs to be addressed further by tighter research in which the combined effects of the motivational drive to consume food and a higher-order inhibitory control system are examined. Nevertheless, it seems a safe generalization at this point to say that the operalization of a social norm perspective might better help to understand modeling effects on intake.

To date, most studies on modeling of food intake have tested how the eating behavior of one person (usually a young women) is affected by the intake of another person (an instructed same-sex confederate). This is rather a one-sided approach that is agnostic with respect to the dynamic processes that might operate when two women are eating together. To gain more insight into this dynamic process, we investigated whether eating companions also adjusted the timing of their bites in line with each other, thereby mimicking each other. In addition, it was also examined whether this process depended on the person who took the first bite and whether the likelihood of mimicry changed over the course of the interaction.

Chapter 10

IT TAKES TWO TO TANGO

The dynamic interplay between eating companions

Abstract

Numerous studies have shown that people adjust their intake directly to that of their eating companions; they eat more when others eat more, and less when others inhibit intake. A potential explanation for this modeling effect is that both eating companions' food intake becomes synchronized through processes of behavioral mimicry. No study, however, has tested whether behavioral mimicry can partially account for this modeling effect. To capture behavioral mimicry, real-time observations of dyads of young females having an evening meal were conducted. It was assessed whether mimicry depended on the time of the interaction and on the person who took the bite. A total of 70 young female dyads took part in the study, from which the total number of bites (n = 3,888) was used as unit of analyses. For each dyad, the total number of bites and the exact time at which each person took a bite were coded. Behavioral mimicry was operationalized as a bite taken within a fixed 5-second interval after the other person had taken a bite, whereas non-mimicked bites were defined as bites taken outside the 5-second interval. It was found that both women mimicked each other's eating behavior. They were more likely to take a bite of their meal in congruence with their eating companion rather than eating at their own pace. This behavioral mimicry was found to be more prominent at the beginning than at the end of the interaction. This study suggests that behavioral mimicry may partially account for social modeling of food intake.

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Introduction

A plethora of research has demonstrated that eating behavior is profoundly affected by social influences. Social facilitation research shows that the presence of others influences the amount of food eaten in a meal. Several studies have found that people eat more in the presence of others than when alone (de Castro & de Brewer, 1992; Patel & Schlundt, 2001). Likewise, an individual's consumption can be modified by an eating companion; people tend to eat as much or as little as do those with whom they eat (Conger et al., 1980; Herman et al., 2003; Hermans et al., 2009a). The process of adjusting one's intake to that of others is often referred to as modeling of food intake. These effects have been found to be robust and to override strong physiological influences (Goldman et al., 1991). Although the effects have been well documented, the underlying mechanisms are less clear.

Herman and Polivy (2005) proposed a social-normative framework that assumes that people use other people's intake as a way of determining how much they may eat without appearing to eat excessively. What constitutes "appropriate eating" (and not excessive eating), however, is quite ambiguous and situationally dependent, so people often engage in social comparison. That is, they use the intake of others to determine what constitutes "appropriate eating" and adjust their own level of intake accordingly. This concern with eating appropriately is not misguided, and in particular not for women (Bock & Kanarek, 1995), because excessive eating often elicits negative stereotypes (Vartanian et al., 2007). Although this normative framework provides a fairly simple, straightforward mechanism and explanation for modeling effects on eating, it is agnostic with respect to the dynamic processes that operate when two people are eating together. One possibility is that the intake of both eating companions becomes synchronized in real-time through behavioral mimicry. The principal aim of the current study is to test whether behavioral mimicry can (at least partially) account for modeling of food intake.

Behavioral mimicry refers to a process in which a person unwittingly imitates the behavior of another person. Research has shown that individuals automatically mimic many aspects of the people

with whom they interact, including their postures, gestures, mannerisms, and speech accents (Lakin, Jefferis, Cheng, & Chartrand, 2003). This mimicry is assumed to occur because of the tight neural link between perception and action (Dijksterhuis & Bargh, 2001; Iacoboni et al., 1999). That is, perceiving another person's movements activates one's own motor system for that same movement (Knoblich & Sebanz, 2006), which in turn increases the likelihood and ease of initiating a matched action (Brass, Bekkering, & Prinz, 2001). In the domain of eating, seeing another person taking a bite might trigger a similar response in the perceiver, i.e. taking a bite as well. To the best of our knowledge, no studies in the field of social influences on food intake have tested whether people mimic the eating behavior of others in real-time (i.e., taking a bite when the other does). However, studies on alcohol consumption have investigated whether people mimic the drinking behavior of others. For example, Larsen, Engels, Souren, Overbeek, & Granic (2010) examined whether young adults mimicked the sipping behavior of a same-sex peer during a 30-minute interaction. Their results showed that young adults were likely to take a sip directly after the other did. Koordeman, Kuntsche, Anschütz, van Baaren and Engels (2011) demonstrated that young adults even mimicked the drinking behavior of movie actors while watching a one-hour movie, suggesting that mimicking the behavior of others can be triggered without a real-life interaction. These same perception-behavior linkages may operate in social eating contexts.

Although people often unwittingly imitate the behaviors of others, they do not mimic all the time (van Baaren, Janssen, Chartrand, & Dijksterhuis, 2009). Mimicry is increased in a situation in which there is a desire to affiliate with the interaction partner (Lakin & Chartrand, 2003; Lakin et al., 2003). Thus, when people have the motive to get along with their interaction partner, they are more likely to mimic that person. Next, it has also been found that individuals who were mimicked reported greater liking for those who mimicked them, and perceived their interaction with this person as having gone more smoothly (Chartrand & Bargh, 1999). These findings suggest that people may "use" mimicry to build liking and rapport with their interaction partner (Lakin & Chartrand, 2003).

In order to capture behavioral mimicry processes in eating situations, real-time observations of

dyadic meal interactions were conducted. There is ample evidence indicating that young adult females adjust their intake to that of their eating companions. This is the first study, however, that examines whether mimicry can (at least partially) account for these modeling effects. Based on the studies of imitation of alcohol consumption among young males and females (Larsen et al., 2010; Koordeman et al., 2011), we hypothesized that females would mimic the eating pattern of their eating companions by taking a bite after their eating companion had taken a bite. Moreover, to gain more insight into how situational factors might influence mimicry, we examined whether mimicry depended on the time of the interaction and on the person who took the bite. Because it is likely that winning the esteem of a previous-unknown interaction partner might be particularly evident at the beginning of an interaction, and it has been found that affiliation goals can augment behavioral mimicry (Lakin & Chartrand, 2003), we hypothesized that young females would be more likely to mimic the bites of their eating companion at the beginning than at the end of the eating occasion.

Methods

Participants and design

The total sample consisted of 85 female dyads who were eating together during a 20-minute eating occasion. This sample was part of an earlier study on the effects of portion size and the intake of others young women's food intake (Hermans et al., 2012). In this earlier study, naïve participants were paired with an instructed co-eater whose level of eating (i.e., small, medium or large amount) was determined by the experimenter. Further, the size of the initial portion was manipulated (i.e. small or medium-size portion). This eventually resulted in six different eating conditions. Because the co-eater did not receive instructions on when and how much bites she had to take from the meal, both women in the dyad can be seen as participants. Data from 15 dyads could not be used for subsequent analyses for the following reasons: (a) the videotaping equipment malfunctioned during the study (n = 10), (b) the DVD records were incomplete (n = 3), or (c) BMI values were missing (n = 2). The final sample, then, consisted of 70

same-sex dyads from which the total number of bites (n = 3888) was used. The mean age of each dyad was 21.62 (SD = 2.99).

Setting and procedure

All sessions took place in the bar laboratory (which is a replication of a real bar) at the campus of the Radboud University Nijmegen (Bot et al., 2005). The bar was furnished with a table for two on which was placed a pitcher of water, two glasses, cutlery, two plates, a hot plate and some napkins. The chairs were situated facing each other so that both eating companions could easily see each other. Both women were served a complete meal; participants were free to eat as much or as little as they liked, whereas the overall intake of the instructed co-eater was determined by the experimenter. During each 20-min session, both women were observed by the experimenter from an adjacent room via a camera hidden in a lamp that was located next to the table. For each dyad, the experimenter coded the total number of bites and the exact time at which each woman took a bite.

Measures

Timing and number of bites. First, we coded the exact time at which both women took a bite. A single bite was defined as a concrete touch of the fork to the mouth, while the food was cut with the teeth. Second, we counted the total number of bites taken by both women. To investigate behavioral mimicry, we distinguished between 'mimicked bites' and 'non-mimicked bites'. Mimicry was operationalized as a bite taken within a fixed 5-second interval after the other person had taken a bite (also defined as the eating cue), whereas non-mimicked bites were defined as bites taken outside the 5-second interval. Previous studies on mimicry of sipping behavior have used 10- or 15-second time frames to answer comparable research questions (Larsen et al., 2010; Koordeman et al., 2011). In the current study, however, a shorter time frame was used because bites during a normal eating situation appear to have a much higher pace than do alcohol sips. Therefore, to prevent overrepresentation of

mimicry, a more stringent 5-second time frame was used.

Height and weight. In order to calculate both women's BMIs, the experimenter assessed height and weight following standard procedures (Lohman et al., 1998). 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 0.10 kg using a digital scale (Seca Bella 840, Seca GmbH & Co, Hamburg, Germany). BMI was calculated as the weight in kilograms divided by the square of height in meters.

Strategy for analyses

Because both women's bites were nested within the dyads, a multilevel framework was used for analysis. The dependent variable was dichotomous (i.e., mimicry versus no mimicry). The first aim was to test whether both women mimicked each other's intake. First, the total interaction time (i.e. 20 minutes) was divided into sensitive and non-sensitive periods. A sensitive period is a 5-second interval after one person within the dyad has taken a bite (sensitive in terms of the likelihood of mimicry), the non-sensitive periods are all of the remaining time periods after a bite. Thus, for each woman in the dyad we added all of the 5-second intervals (i.e. sensitive periods), this sum corresponds to the total number of bites the eating companion has taken multiplied by the 5-second interval. The non-sensitive periods are the remaining periods (i.e. total time in seconds (= 1200) minus the sensitive periods). We then computed the ratio for the mimicked bites, which calculates how many bites a person has taken within those sensitive periods. A higher ratio means more mimicry. The ratio for the non-mimicked bites represents how many bites a person has taken in the non-sensitive periods (i.e. outside the 5-second interval after the eating companion has taken a bite). These two ratios were computed for both women separately. To examine whether both persons in the dyad were more likely to eat in the sensitive period than in the non-sensitive period, paired sample t-tests were computed comparing the ratios of the mimicked with the ratios of the non-mimicked bites. To examine whether both women in the dyad differed in the relative degree to which they mimicked the other person's bites, paired sample t-tests were computed

comparing both women's overall bite ratios (i.e. mimicked bite ratio divided by non-mimicked bite ratio).

The second aim was to test whether the likelihood of behavioral mimicry depended on the time of the interaction and on the person who took the bite. To examine this question, the 20-min eating occasion was split into halves (i.e., the first ten minutes versus the second ten minutes). Further, each bite was assigned a 0 or 1 indicating whether the bite was mimicked or not by one of the two eating companions. A Multilevel Proportional Hazard Model (Cox regression) in a Survival Analysis framework was used to examine whether mimicry depended on the timing of the interaction (beginning or end of the interaction) and on the person who took the bite In contrast to the overall bite ratios, this analysis takes only the mimicked bites into account and therefore these results differ from the conducted t-tests. Data were analyzed using MPLUS 5.1 (Muthén & Muthén, 2007). Because the physical appearance of the eating companion might have affected the extent to which individuals modeled the eating behavior of this person (Hermans et al., 2007; Salvy et al., 2007), we controlled for both women's BMI scores in further analysis. Hazard ratios and Confidence Intervals were presented as effect sizes.

Results

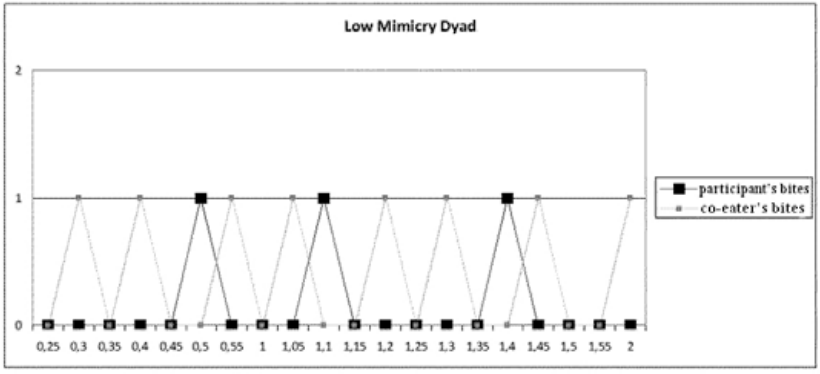
Descriptives

On average, participants took 41.11 bites (SD = 13.34), whereas instructed co-eaters took an average of 30.13 bites (SD = 12.98) during the 20-minute eating occasion. This difference was significant, $t(69) = 6.53$, $p < 0.001$. In terms of the total amount of food consumed, participants ate an average of 452.13 grams (SD = 116.57) and instructed co-eaters 370.79 grams of food (SD = 211.27), $t(69) = 4.09$, $p < 0.001$. The intra-class correlation showed that the amount eaten (in grams) by dyad members was significantly correlated, $r(70) = 0.52$, $p < 0.001$. It should be noted, however, that the instructed co-eaters' total amount consumed was determined by the experimenter. They were instructed to eat 125, 250, or 375 gram of food in the small-size portion conditions, whereas they were instructed to eat 250. 500, or 750 grams in the medium-size portion conditions. Across the eating occasion, significantly more bites

were present in the beginning of the meal occasion compared to the end (3068 versus 820 respectively, $p < 0.001$). The difference over time in the number of bites does not affect the results of the survival analysis, because the likelihood of mimicry at a certain point in time is defined as the conditional probability of a mimicked bite given the number of bites during a particular time of the eating occasion.

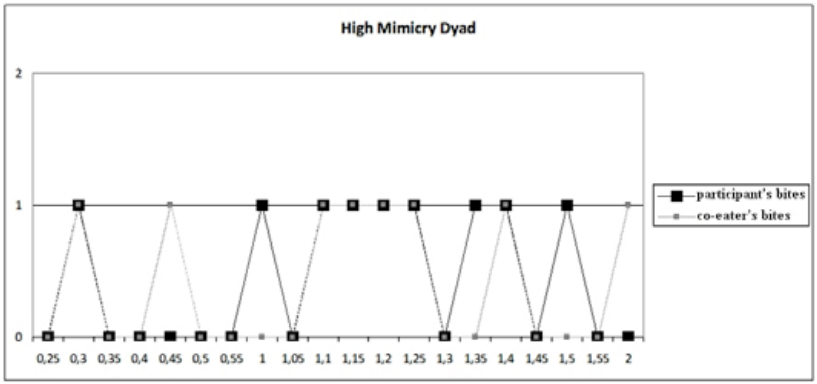
Do young women mimic the intake of their eating companion?

The first aim was to test whether young women mimicked the intake of their eating companion. It was found that both women were significantly more likely to take a bite congruent with their eating companion's bite (i.e. within 5 s), participant: $t(69) = 6.54$, $p < 0.001$; co-eater: $t(69) = 8.67$, $p < 0.001$. That is, they were more likely to take a bite when their eating companion was taking a bite rather than when the eating companion was not taking a bite. No differences were found between both women in the overall degree to which they mimicked their eating companion's bites, $t(69) = 1.81$, $p > 0.05$. **Figures 1 and 2** display examples of the behavioral data of high- and low-mimicry dyads.



Note: these are the first 2 minutes of the eating occasion. The overall ratio for the participant and the instructed co-eater in this dyad are respectively 1.72 and 1.33.

Figure 1. Example of behavioral data of a low-mimicry dyad.



Note: these are the first 2 minutes of the eating occasion. The overall ratio for the participant and the instructed co-eater in this dyad are respectively 3.28 and 6.97.

Figure 2. Example of behavioral data of a high-mimicry dyad.

Does the timing of the interaction affect young females' likelihood of mimicry?

Second, we investigated whether the likelihood of behavioral mimicry depended on the time of the interaction and on the person who took the bite. It appeared that women were almost more than three times as likely to mimic the intake of their eating companion at the beginning of the interaction compared to the end of the interaction (Hazard Ratio = 3.57, $p < 0.05$, 95% CI = 2.23 – 5.72). The likelihood of mimicry was significantly higher when the instructed co-eater took a bite (Hazard Ratio = 1.93, $p < 0.001$, 95% CI = 1.20 – 3.09). Further, a marginally significant interaction was found between the timing of the eating occasion and the person who took the bite (Hazard Ratio = 4.39, $p = 0.054$, 95% CI = 2.77 – 6.94). To further examine the interaction effect, we conducted separate analyses for the participants versus instructed co-eaters and first half versus second half of the interaction respectively. Throughout the interaction participants were significantly more likely to mimic the instructed co-eater than vice versa. Further, participants' as well as instructed co-eaters' likelihood of mimicry decreased significantly over time, whereas the decrease in mimicry was slightly more pronounced in the instructed co-eaters.

In additional analyses we also controlled for both women's BMIs. While controlling for BMIs, the effect of time remained significant (Hazard Ratio = 3.52, $p < 0.05$, 95% CI = 2.20– 5.63). Furthermore, it was still found that mimicry was significantly higher when the instructed co-eater took a bite of her meal (Hazard Ratio = 1.93, $p < 0.001$, 95% CI = 1.20 – 3.09). Differences in BMIs also did not affect the interaction between the timing of the eating occasion and the person who took the bite (Hazard Ratio = 0.64, $p > 0.05$, 95% CI = 0.41 – 1.02). Thus, while controlling for differences in women's BMI, the results remained the same; mimicry was stronger in the beginning of the interaction and more likely to occur when the instructed co-eaters took the bite. Finally, because in the original study six different eating conditions were used, we also investigated whether the effects would be the same across conditions. The same model was run in all different eating conditions separately. The same pattern of results was found across conditions. The analyses for the separate conditions may be obtained from the corresponding author upon request.

Discussion

Studies on modeling of food intake have consistently shown that young adult females eat more when their eating companions eat more and less when their eating companions eat less. The aim of the present study was to examine whether behavioral mimicry can (at least partially) account for these modeling effects of eating. Additionally, to gain more insight into how situational factors might influence mimicry, we examined whether mimicry of meal bites depended on the time of the interaction and on the person who took the bite.

First, the results showed that young females generally mimicked each other's eating behavior. That is, they were more likely to eat congruent (i.e. within 5 s) rather than incongruent with their eating companion. The matched actions of both eating companions fall within the typical definition of behavioral mimicry, i.e. the process in which a person unwittingly imitates the behavior of another person. Studies on human mimicry have explained this behavioral matching by proposing a mirroring

network in which the perception of an action influences corresponding activation in the perceiver's motor system (Chartrand & van Baaren, 2009; Dijksterhuis & Bargh, 2001), a process which is also known as the "perception-behavior expressway" (Dijksterhuis & Bargh, 2001). The findings of the current study suggest that the same automatic perception-behavior linkages might be activated when two women are eating together. Thus, perceiving the eating companion taking a bite might have activated young women's motor system for the same movement, which in turn might have led to an increased likelihood of taking a bite as well. Another possibility is that that young women monitored each other's eating behavior in order to maintain a similar eating pattern. If the eating behavior of others communicates 'appropriate' eating, one's perceptions of another's behaviors might then be used to guide one's own eating behavior. This type of monitoring might fit into the normative framework of Herman and Polivy (2005) that features individuals' desire to eat appropriately as an important determinant of their eating. Adjusting one's bites to that of others might be another solution (next to adjusting one's overall intake) to guard against overindulgence and to avoid the negative stereotypes that are associated with eating inappropriately (Vartanian et al., 2007). It should be noted, however, that the current study did not test (or rule-out) whether young females' deliberately adjusted their behavior at such a micro-level or whether they unwittingly mimicked their eating companion's behavior.

Next, both women did not mimic the bites of their eating companion all the time. It appeared that both women were almost more than three times as likely to mimic the intake of their eating companion at the beginning of the interaction (i.e. first ten minutes) compared to the end of the interaction (i.e. last ten minutes). Previous studies have demonstrated that affiliation goals can augment behavioral mimicry (Lakin & Chartrand, 2003; Stel, van Baaren, & Vonk, 2008). It is possible that young women's tendency to ingratiate themselves with their eating companion was especially marked at the beginning of the interaction, resulting in an increased likelihood of behavioral mimicry. By the same token, there might be less need to ingratiate at the end of the interaction, which might explain why the likelihood of mimicry diminished over the course of the interaction. The finding that this decrease was slightly

more pronounced among the instructed co-eaters might be explained by the fact that the instructed co-eater was already acquainted with the study's procedure (i.e. eating with an unknown other), which in turn might have resulted in less prominent affiliation goals among the co-eaters. Although it is true that affiliation goals and rapport between two interaction partners are important moderators of mimicry effects, we would like to stress that this does not mean that mimicry requires rapport or affiliation goals to occur. We have articulated that the likelihood of mimicry diminished over the course of the interaction which might be due to the explanations given above. However, empirical studies are needed to gain more insight into why and under what circumstances people mimic each other's eating behavior. The potentially important role of conversation during the meal should be tested, for example in studies that investigate whether eating companions talk and eat in turns or might talk and eat in unison. These studies might examine the moderating effects of type of relationship (i.e. familiar or unfamiliar eating companions) and time spent on eating and talking on participants' synchronization of behavior.

Again, although the current study shows that behavioral mimicry may partially account for modeling of eating, we do not want to make the claim that all modeling effects on food intake can be explained by mimicry processes. Studies that simply made participants aware of how prior participants had behaved ('remote-confederate design') also found powerful modeling effects (Leone et al., 2007; Pliner & Mann, 2004; Roth et al., 2001). Insight into whether or not people are mimicking each other's intake, however, may help to resolve the question of whether large-eating companions allow their co-eaters to eat more or whether they force their co-eaters to eat more. Herman and colleagues (2003) argued that, in the presence of palatable food, and in the absence of other constraints, people are motivated to eat as much as they want but that social norms serve an inhibitory function, indicating at what point one must stop eating in order to avoid excess. Thus, the large amount eaten by the eating companion allows people to eat more as well (without eating excessively). However, it is also possible that the large amount eaten by the eating companion does not simply allow to eat a lot, but virtually force one to eat a lot. Leone and colleagues (2008) found that people who eat minimally are not particularly

liked by their eating companions. Thus, if the other eats a lot, one might eat a lot as well (or at least not less than the other) in order to maintain a positive social relationship.

A few limitations warrant discussion. Although our findings suggest that affiliation goals might moderate mimicry of food intake, this was not specifically tested. To further understand the role of ingratiation attempts in explaining behavioral mimicry, future studies could specifically measure both eating companions' feelings toward each other and the quality of social interaction. This may give more insight into the possible bi-directional relationship between mimicry of food intake on the one hand, and affiliation goals or liking on the other. It would be interesting to compare those who mimicked with those who did not mimic in order to investigate the possible social bonding effects of mimicry in real-life eating situations. Second, the current study found no effect of weight status on people's tendency to mimic the eating behavior of their eating companion. It should be noted, however, that the research sample consisted of mostly normal weight participants. Future studies are needed to examine whether normal weight and overweight individuals differ in their likelihood of mimicry. In fact, it would be interesting to investigate whether similarities between both eating companions' physical appearance would influence behavioral mimicry effects. Third, the current study concentrated on young women. It is important to examine whether the same mimicry effects may be observed among other groups, such as children and adolescents. Because an important part of their socialization is acquired through the observation of their caregivers' and peers' behaviors (Keenan & Evans, 2009; Laible & Thompson, 2007), and children and adolescents generally eat their meals and snacks in the presence of family members or peers at home or at school (Birch & Fisher, 1998; Eccles, 1999), it is worth examining whether the same effects can be observed among these age groups. The current study used data from an experimental study in which young women were exposed to previously unknown eating companions. Although a highly natural, and thus generalizable, eating context was used, the question remains as to the extent to which family members, friends, or acquaintances would also mimic each other's eating behavior. In general, people should be more motivated to convey a good impression during their initial interactions with a

stranger than with someone who they know well (Leary, Nezlek, Downs, & Radford-Davenport, Martin, & McMullen, 1994). If behavioral mimicry reflects an attempt to ingratiate with others, we would expect less behavioral mimicry among familiar people than among strangers. Future studies, however, could examine whether this assumption is valid. Finally, one might argue that the specific eating context used in this study (i.e., dinner) facilitates behavioral mimicry. It would be interesting to replicate this study by using a different eating context in which, for example, individuals sometimes reach for palatable foods such as chips or sweets. If perceiving a nearby individual reaching for a snack results in a matched action, this might provide potential areas for interventions to prevent overconsumption of snack food.

All in all, our results suggest that behavioral mimicry may partially account for social modeling of food intake. Social modeling of food intake is a complex process, however, and may be explained from different theoretical perspectives. It seems to us that modeling can be both explained by norms regarding appropriate intake and social motives (affiliation / ingratiation) and that behavioral mimicry may underlie these processes, but that it depends on the context (i.e. whether or not the eating companion is actually present) which process (norms or social motives) is the most relevant. Nevertheless, insight into questions such as why people eat more or less just because someone else does or how mimicry develops over the course of an eating occasion has significant implications for one's health and well-being. The current study showed that people adjust their eating pattern to that of others. As long as such important influences on intake are not wholeheartedly acknowledged, it will be difficult to make healthy food choices and maintain a healthy diet, especially in eating contexts in which people are often exposed to the eating behavior of others.

Prologue

The study presented in Chapter 10 underscored the importance of social dynamics in the research on modeling effects on eating. It was found that both women tended to synchronize their bites with their eating companion rather than eating at their own pace. This form of mimicry was almost three times more prominent at the beginning of the meal than at the end. We proposed two possible explanations for this mimicry effect. It could be due to a basic desire to mimic others – when women see others taking a bite, it activates their own motor system to take a bite as well. But it is also possible that women keep an eye on the other's eating behavior and respond correspondingly in order to maintain a similar eating pattern. The current study did not test (or rule out) which explanation is the most likely.

Chapter 11

GENERAL DISCUSSION

Abstract

The primary aim of the present thesis was to examine the circumstances under which modeling of food intake operates by investigating the situational and individual factors that can influence this modeling effect. In this concluding chapter, we will elaborate on the different factors that might make people more or less likely to adapt their intake to that of their eating companion, after which we discuss a dynamic approach to understand modeling effects on eating. In addition, we propose an integrative model to explain the observed effects of the presence of others on people's food intake. After that, we will discuss some limitations of the present research, following by our suggestions for future research directions. Finally, we will discuss the possible implications of our research for prevention and intervention studies that are encouraged to stimulate healthy or mindful eating. Since the research described in this thesis mainly focused on female undergraduate students, it is important to acknowledge that the conclusions presented in this general discussion may specifically apply to female young adults.

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Summary of the Main Findings

Situational factors that can affect modeling	**Chapters**
• Young women modeled both the high- and low-energy-dense food intake of their companions.The modeling effect, however, was weaker for low-energy-dense foods.	**2-3**
• The physical appearance of the eating companion influenced the occurrence of modeling. Young women only modeled the intake of a (manipulated) normal weight eating partner, but not that of a slim eating partner. This effect, however, was found only when the food was high-energy-dense.	**2-3**
• The social nature of the eating companion moderated the modeling effect; young women were more likely to model the intake of an unresponsive eating companion than a responsive eating companion.	**4**
• The modeling effect was found to have less influence in a breakfast context. Young women ate less when their eating companion ate less, but not more when their eating companion ate more.	**5**
• For an evening meal, however, the standard modeling effect was found; young women ate more or less from an evening meal when their eating companion ate more or less.	**6**
• The modeling effect is additive to the portion size effect; young women were found to eat the most when they were served a large portion and were accompanied by an eating companion who ate a large amount of food.	**6**
• Young women did not adapt their food intake to that of a video model shown eating different amounts of food.	**7**

	Chapters
Individual factors that can affect modeling	
• No general tendency was found among young men to model their eating companions' food intake. Only hungry men modeled the other's food intake, eating more or less when the other ate more or less. For women, modeling of food intake was found in all studies.	**8**
• Self-reported impulsivity was found to influence the occurrence of modeling. Only low-impulsive women modeled their eating companion's food intake.	**9**
• Attentional bias and response inhibition were not found to moderate modeling effects (although the effects of response inhibition showed a trend towards significance).	**9**
A dynamic approach to examine modeling effects	
• Young women were found to eat congruently rather than incongruently with their eating companion. This effect was more evident at the beginning of the meal.	**10**

Reflection on the Main Findings

Most of the chapters presented in this focused on the circumstances under which modeling operates. It has been proposed there are some situational and individual factors that can influence the degree to which one is likely to adapt one's food intake to that of another person. In the following section, we will elaborate on these factors. We link our findings to previous and recently published modeling research in order to present the reader with a clear overview of the conclusions that may be drawn from the existing literature in general, and these situational and individual factors in particular.

Situational Characteristics and Their Impact on Modeling of Food Intake

Physical appearance of the eating companion

Several prior studies have demonstrated that the physical characteristics of the eating companion can influence the occurrence of modeling. De Luca and Spigelman (1979), for instance, demonstrated that being accompanied by an obese- or non-obese eating companion could differentially affect women's food intake. They found that obese and non-obese women modeled the food intake of their eating companion only if they shared a comparable weight status. This finding was replicated by Johnston (2002) who found that non-obese young women modeled the intake of a similar-weight eating companion, but not that of an obese eating companion. These studies, however, compared modeling of food intake using different confederates who were either normal weight or overweight/obese, leading to large contrasts in the body sizes of the different models. In the present thesis, the appearance of a rather slim eating woman was subtly manipulated by having her wear a soft silicon belt that made her look visibly thicker around her waist. The results presented in Chapter 2 confirmed the hypothesis that young women will more strongly model the palatable food intake of a similar-weight eating companion than the intake of someone of a different weight, in this case someone who is rather slim. A few years later, McFerran, Dahl, Fitzsimmons and Morales (2010) made use of a comparable manipulation to investigate the effects of perceived body size on social influences on eating. Instead of manipulating only the waist of the

model, the researchers provided the confederate with a professionally constructed obesity prosthesis making her whole appearance overweight. Their results were in accordance with our findings. It was found that normal weight young women adapted their intake to that of another woman, but only if they shared a comparable weight status (i.e., when both women were of normal weight).

We offer two possible explanations for these corroborative findings on the influence of body size on modeling effects. With regard to eating, it is possible that normal weight and obese women feel more self-conscious in the presence of a slim person, and therefore inhibit their intake when eating with someone who is slimmer than they are themselves. In addition, a rather slim eating companion might also be seen as more likely to be judgmental, leading to restricted food intake (and corresponding decreased modeling effects). In the presence of a similar weight person, however, such feelings might be reduced and therefore these women are able to relax their inhibitions (leading to increased intake or modeling). This explanation builds on the assumption that the body type of others may activate thoughts about whether their intake will be accepted or not by the co-eater (cf. Vartanian et al., 2007). Given that eating and weight are acknowledged as socially acceptable competition motives among women (Rodin et al., 1985), it is possible that women who eat with a slim eating companion are more motivated to portray the image of being a disciplined eater who can inhibit intake in the presence of palatable food, whereas this may be less important when eating with someone of a similar weight status.

A more general explanation for these findings is based on identification (or perceived similarity) with the eating companion. Research on behavioral imitation has suggested that imitation may (unconsciously) create a bond between individuals and that humans automatically and unconsciously try to prevent imitation when they do not want a bond with this other person (van Baaren, Janssen, Chartrand, & Dijksterhuis, 2009). These effects have been found for different behaviors and characteristics of the interaction partner, from social stigmas like obesity (Johnston, 2002) to implicit attitudes towards Christians (Yabar, Johnson, Miles, & Peace, 2006), all showing that people do not wish to emulate the behaviors of those with whom they do not have much in common. Thus, for normal weight women their

overweight or obese eating companions may represent a dissociative reference group that they do not wish to emulate (Berger & Rand, 2008), whereas being accompanied by a similar eating companion might increase their tendency to model this person's food intake.

It should be noted that the moderating effect of perceived body size on modeling of food intake might only apply to high-energy dense foods. In Chapter 3, we found no interaction between the confederate's intake and the confederate's weight status on young women's intake, indicating that young women were not more (or less) likely to model the healthy food intake of a slim or (manipulated) normal weight female eating companion. However, as participants did not notice the difference in physical appearance between the slim and (manipulated) normal weight eating companion, it is possible that our weight manipulation might have been too weak to produce any effects in this context. McFerran and colleagues (2010), for example, did find an interaction between the confederate's amount consumed and the confederate's body type. Young women inhibited their intake when exposed to a large-eating confederate who was heavy, whereas the opposite pattern was observed when this woman was taking a small amount. In this context, the women were found to chose and eat more when the confederate was heavy rather than when she was thin. In contrast to our study, however, McFerran et al. provided the confederate with a professionally constructed obesity prosthesis making her whole appearance overweight/obese. Given the differences in weight manipulations between our and McFerran's study, it is recommended that further research will explore the likelihood to which women will adapt their intake to normal weight, overweight, or obese eating companions and whether this differs for both healthy and unhealthy foods. Moreover, as the research on the impact of the eating companion's body size on young women's modeling of food intake is scarce, future research is needed to examine whether and how food-related stereotypes are driving the moderating effect of perceived body size and whether the type of food (healthy vs. unhealthy) is important in this context as well.

Type of food

In addition to its influence on the moderating effect of body size on modeling effects, the type of food might also be important in explaining the magnitude of the overall modeling effect. Earlier studies examining modeling of food intake have largely focused on the intake of snack foods. These studies have used high-energy-dense foods such as cookies, cheese crackers, cocktail nuts or popcorn, whereas in the current thesis mostly chocolate-coated peanuts were used to examine modeling effects. These studies, however, have all found the same pattern; people eat more or less when their eating companions eat more or less of these snacks. Given that a substantial number of studies have demonstrated these effects, it seems safe to conclude that regardless of the type of snack food that is offered, people are likely to model the snack food intake of others. For healthy foods, such as vegetable snacks, less robust modeling effects were found in Chapter 3. We explained these findings by proposing that when the food is perceived as being typically healthy, women may be less concerned about the appropriateness of the quantity they consume and therefore modeling the other's intake might become less important. Given the lack of research on this topic, this conclusion is still tentative. McFerran and colleagues (2010), for instance, found almost identical effects for both healthy and unhealthy foods; showing that women took significantly more healthy or unhealthy foods when they first observed another woman doing so, whereas Robinson and Higgs (2012) found that women who were exposed to an unhealthy eating partner were significantly less likely to choose and consume healthy foods than when alone or in the presence of a healthy eater. Further work, therefore, should establish whether people would be equally likely to model their companion's healthy and unhealthy food and whether norms of appropriateness might explain the possible differences between these types of food.

Eating context

In addition to the focus on the influence of healthy and unhealthy snack foods on modeling effects, we have also examined whether modeling occurs in contexts such as breakfast (Chapter 5) or evening

meals (Chapter 6). First, it was found that the standard small-large modeling effect was eliminated when participants were offered a complete breakfast; young women did not increase intake when their eating companion ate a large quantity of breakfast products. When both women were offered an evening meal, however, the standard modeling effect was found again. These findings suggest that modeling effects may be stronger in contexts in which women are uncertain about the "correct" amount to consume, whereas these effects might be weaker in contexts in which well-established routines guide eating behavior. Breakfast intake is known to be a stable and habitual eating behavior (Wong & Mullen, 2009), and therefore individuals might feel (more) sure about how much to consume, making them less susceptible to the normative information conveyed by the intake of the eating companion. Throughout the years, they might have learned that two slices of bread for breakfast is a good start of the day for them and this knowledge might have overruled the normative information conveyed by the intake of the other person, leading to weaker modeling effects. With regard to snacks and dinners, however, the quantity of food that is acceptable to consume may be especially ambiguous, and therefore the companion's intake is all the more important as an indicator of how much one should appropriately consume.

In Chapter 7, it was demonstrated that when the other's behavior is not clearly indicative of how much "others" are eating in the same context, and thus clear descriptive norms are absent, young women may rely on other cues or experiences to determine how much snack food they should eat. Thus, when the situation and environment in which the eating takes place are different for both companions, modeling may be less likely to occur because the other's behavior is perceived as irrelevant to gauge one's own food intake. One source of weakness of this study, however, was that we did not directly manipulate the context in which both eating companions were eating (i.e., same versus different eating contexts). Therefore, further experimental investigations are needed to specifically test whether modeling exists only when people have clear indications about how much others have consumed in the same context.

Given that the motivation to convey a favorable impression is a necessary precondition for impression-management efforts (Leary, 1995), it has long been assumed that whether or not one is familiar with the eating companion has an important influence on the magnitude of the modeling effect. The few studies that have been conducted in this area, however, do not support this proposition. Salvy, Jarrin, Paluch, Irfan, & Pliner (2007c), for instance, found that modeling effects on intake in dyads of strangers did not differ from the modeling of familiar eating companions, whereas Howland, Hunger, and Mann (2012) found that young adults who ate with restricting friends ate fewer pieces of food than those who ate with friends who did not restrict their intake, suggesting that people also conform their intake to close friends. A possible explanation for why friends and strangers may not differ in the extent of modeling is that different mechanisms might lead to the same effects. For instance, it is possible that being frequently exposed to friends or family members who eat a large amount of food might cause eating large amounts of food to become a normative state. Social psychology research has shown that social norms (or what is considered typical) are likely to influence the initiation and maintenance of variety of behaviors, such as alcohol consumption and sexual behavior and attitudes (Fisher, 2009; Franca, Dautzenberg, & Reynaud, 2010). Recent evidence suggests that the same is true for obesogenic behaviors (e.g., Baker, Little, & Brownell, 2003; Brug, 2008; Christakis & Fowler, 2007). Thus, after becoming aware that friends or family members are eating a lot (or a little), an individual might start eating more (or less) because the standards and social norms for food intake have been altered. When it comes to strangers, however, it is possible that impression-management-related concerns or norms of appropriateness are driving the modeling effects (Herman et al., 2003). Before we can accept this proposition, however, it is recommended that further research is undertaken in the area of modeling effects among friends and strangers. We will come back to this important issue in the section in which we propose some future research directions.

Conclusions: Situational characteristics

In sum, it has been proposed that women's tendency to model the intake of others may be moderated by the body size of their eating companion (Chapter 2 and 3). We have argued that normal weight women are prone to model similar-weight eating companions, whereas overweight or obese women might be more likely to model the food intake of another overweight or obese eater. Yet, given the associations between weight status and stereotype-consisted food choices, it is possible that the type of food (healthy versus unhealthy) might be of particular importance in this context. Furthermore, the findings presented in this thesis underscore the notion that the effects of social influences on food intake are related to the individual's uncertainty about the appropriate amount to consume within a given context (Herman et al., 2003; Pliner & Mann, 2004). It has been found that modeling effects are particularly evident in eating contexts for which the norms for appropriate intake are unclear (e.g., snacks and meals; Chapter 4 and 6). To resolve this uncertainty, people search in their environment for guidelines regarding appropriate intake, which often appears to be the behavior of other people. In eating contexts in which preexisting intake routines or guidelines prevail, such as breakfast, people might be less likely to use the eating behavior of others as a guide for their own intake, and therefore modeling effects on intake seem less likely to occur (Chapter 5). It should be clear, however, that even if people have developed clear personal norms regarding appropriate intake, they might deviate from these guidelines if the behavior of others is clearly distinctive of their own behavior. On the other hand, modeling effects may not at all occur if the eating companion is eating in a context that is clearly different from the situation and environment in which one's own eating takes place (Chapter 7). As a result, clear descriptive norms are lacking and therefore the other's behavior may be considered irrelevant to gauge one's own intake. To conclude, although it has been proposed that modeling of food intake might be less evident in situations in which one's eats with familiar others (as opposed to unfamiliar others), experimental research suggests that this is assumption is not valid. Given that only two studies have specifically examined the impact of familiar and unfamiliar others on modeling effects, however, future experimental research on this topic is clearly warranted.

Individual Characteristics and Their Impact on Modeling of Food Intake

One of the aims of this thesis was to investigate the possible individual factors that could make one more or less disposed to adapt one's food intake to that of others. Over the years, several attempts have been made to reveal individual differences that could moderate the modeling effect (Rosenthal & McSweeney, 1979; Rosental & Marx, 1979; Herman et al., 2005). Because all of these attempts have failed, Herman and colleagues (2005) concluded that modeling exists regardless of personal characteristics. The findings presented in Chapter 4, 8 and 9 and those of recent studies conducted in this area suggest that individual differences do make a difference in the extent of modeling. We now turn to discuss this research field and its findings.

Sex and gender differences

To date, a considerable amount of literature has been published on modeling effects among women. The present thesis confirms previous findings and contributes additional evidence that suggests that women generally adapt their food intake to that of (unfamiliar) others. In this thesis, however, it was also found that these modeling effects might be less evident among men (Chapter 8). This finding corresponds to Salvy et al.'s (2007c) strong sex-related difference in the general modeling effect. In this study, it was found that modeling occurred only in dyads that included at least one woman.

A few possible explanations may be offered for the difference between men and women in their likelihood of modeling. With regard to eating, it has been suggested that women's motivations related to eating are often reinforced by the social pressure to attain and maintain a socially acceptable slim body (Birch, Fedoroff, & Guthrie, 1991; Grogan, Bell, & Connor, 1997). Thinness is considered to be attractive in our culture and numerous scholars have indicated that this "thinness is attractive" equation is more true for women than for men (e.g., Chaiken & Pliner, 1987; Garfinkel & Garner, 1982; Polivy & Herman, 1983; Rodin et al., 1984). Compatible with the idea that women - more than men - are under pressure to conform to this thinness ideal and that body image and weight are acknowledged as particularly salient

concerns among women (Rodin et al., 1984), it has been argued that self-presentational statements regarding food and eating may be more important for women than for men (Herman & Polivy, 2010; Roth et al., 2001; Vartanian et al., 2007). These heightened impression management concerns often lead to increased uncertainty about the appropriate amounts to consume, which eventually may lead to increased conformity. In line with this, adjusting one's intake to that of another person may be women's default response to avoid negative judgments, whereas males may not be as concerned with this form of social propriety.

Another explanation for why men and women might differ in the extent to which they are prone to model the food intake of others is that they differ in their social motives and that those motives play out when interacting with others. It has been argued that women are more likely than men to consider their interaction partner's needs and reactions and are better at adjusting situational factors to foster affiliation (Pollak, Levine, & Feldman, 1997). Given that modeling can be used as a tool to communicate liking for and rapport with another (laFrance & Ickes, 1981) and might constitute the social glue that makes people social animals (Dijksterhuis, 2005), it is possible that women's affiliative and supportive nature in interpersonal interactions (Eagly, 1978; Wood, Christensen, Hebl, & Rothgerber, 1997) might increase their likelihood of modeling. Men, on the other hand, are more oriented toward independence and are assume to have a greater drive for distinctiveness (Baumeister & Sommer, 1997; Cross & Madson, 1997), which, in turn, might decrease their likelihood of conformity.

Taken together, although the existing literature suggests that men are less likely to consider their eating companion's intake as a guide for their own behavior, these findings do not provide a clear picture of possible gender-related differences in the vulnerability to modeling effects on intake. Therefore, it is not surprising that numerous scholars have suggested a more systematic look at sex and gender-related differences in eating behavior as an important area for future research (Exline, Zell, Bratslavsky, Hamilton, & Swenson, 2012; Herman & Polivy, 2010; Leone et al., 2008). Further research, for example, might investigate whether the possible differences between men and women in their social

motives can account for the differences in the extent of modeling. A further study could also assess the differences between men and women in their concerns of behaving appropriately with respect to one's eating and its impact on modeling effects. There is plentiful evidence that eating minimally allows women to convey an impression of feminity (see Vartanian et al., 2007 for a review), whereas less is known about males' intentions in this context. Given that social facilitation of eating may be substantially stronger in men than in women (Rolls et al., 1991), it would be interesting to examine whether and how men use their eating in order to convey a particular impression to their same-sex eating companions. If women restrict their intake to appear more feminine or to impress their same-sex eating companion, do men increase their intake to appear more masculine or compete with the other males in the same eating context (cf. Herman & Polivy, 2010)? To examine this proposition, a future study could experimentally manipulate the eating norms in a group of men. The experimenter might secretly instruct some of the males to eat either a lot or a little from typical "masculine" foods (e.g., steak or spareribs) and not to eat from "feminine" foods (e.g., salad or quiche), whereas in another context the males are instructed to eat either a lot or a little from the "feminine" foods instead of the "masculine" foods. Then, the eating behavior of one of the males is observed and coded, after which this male is asked for his food-related motives. It would be interesting to see whether this male would assert his masculinity in terms of quantity and food choice (choosing and eating more "masculine" food when the others are eating "feminine" food) or whether he would directly conform his choice and intake to that of the others. In addition, this study could examine whether these effects would differ between acquainted and unacquainted male eating companions. The questionnaire data then might inform us about men's social motives with regard to their eating and how they are rating the other men's masculinity or feminity depending on their food choice and intake.

The need to affiliate

The study presented in Chapter 4 was the first to examine whether the quality of the social interaction between two female eating companions affected the magnitude of the modeling effect. It was found that young women were more inclined to model the intake of an unresponsive woman than a woman who acted friendly and warm. Although this study examined a contextual factor that could affect the occurrence of modeling, the findings suggest that differences in participants' need to ingratiate across conditions might have been responsible for the effects occurred. That is, the exposure to a socially 'cold' eating companion might have caused young women to try and ingratiate themselves with their eating companion through modeling, whereas there might have been less need to do this when the other was already friendly and interested. A recent study by Robinson, Tobias, Shaw, Freeman, and Higgs (2011) further investigated the potential relationship between modeling and the need for social acceptance by conducting two experiments in which they focused on two individual traits (i.e., empathy and self-esteem) that could influence food matching and/or modeling. Self-esteem and empathy were indeed found to be associated with the degree of matching, with lower self-esteem scores associated with a greater degree of matching and higher empathy scores also associated with greater matching. In addition, they found that the removal of the need for affiliation by priming feelings of social acceptance led to an elimination of the modeling effect. The results of a study by Exline and colleagues (2012) further corroborate the assumption that women might adjust their food intake to that of others in order to ease the social interaction or to win social approval. These researchers demonstrated that those women who were preoccupied with pleasing others and maintaining social harmony ate more when they believed that their eating companion wanted them to eat more and reported greater effort to match their food intake to that of their eating companion. Altogether these findings provide some support that modeling of food intake might reflect an attempt to ingratiate with the eating companion, and that the need for social acceptance could affect the magnitude of the effect. It should be acknowledged, however, that the importance of these personality factors as critical factors in explaining modeling

effects remains unclear. For example, Robinson et al. (2011) found that participants' self-esteem and empathy levels accounted for only a small amount of variance in individuals' food matching, whereas the study presented in Chapter 4 could not answer the question which personal characteristics have led to the observed differences in participants' likelihood of modeling across conditions.

Impulsivity

In Chapter 9, we argued that the degree to which one can control one's impulses might be an important factor influencing modeling effects. It was hypothesized that individuals who are less able to control their impulses would be more vulnerable to modeling effects. In contrast to this expectation, however, it was found that only low-impulsive women modeled the food intake of their same-sex eating companion. An explanation for this unexpected finding might be that for those who are generally well controlled, the inhibitory control system overrides the motivation to consume palatable food and allows the individual to fulfill more deliberate goals, such as adhering to social norms. Thus, women who are generally well controlled may find it easier to control their intake in the presence of palatable food and conform to the behavior of others in order to fulfill more deliberate goals, such as avoiding negative stereotypes or gaining social approval or acceptance. For high-impulsive women, on the other hand, some unexpected results were found. Although they were generally less able to control themselves, they did not eat uniformly more than their eating companion. In contrast, they ate the same amount of food regardless of how much the other was eating. Moreover, they were less accurate in their estimations of the amount eaten by the other person, suggesting that they paid less attention to the other's intake. Although we did not found a moderating effect of response inhibition, the effects were in the same direction and showed a trend towards significance, which may imply that women with effective response inhibition may also be more likely to model the intake of others. Because this is the first study to show a relationship between impulsivity and modeling behavior, the results must be interpreted with caution. More research on this topic needs to be undertaken to further validate this particular finding. Notwithstanding the foregoing,

the findings presented in Chapter 9 underscore the possibility that individual differences in the ability to control one's impulses could affect the extent of modeling.

Heightened attention to eating cues

In Chapter 9, we also argued that individual differences in attention toward dynamic eating cues may make some individuals more or less disposed to increase intake in response to the eating behavior of their eating companion. The study's findings, however, did not support this hypothesis. In spite of their variations in attention toward food-related cues, women were generally found to adapt their intake to that of their same-sex companion. Although this is the first study that specifically examined the moderating effect of attentional bias on modeling of food intake, our findings seem to imply that cue-reactive mechanisms may not be important in explaining modeling effects. Further experimental work, however, needs to be done to establish whether this proposition also holds for children, older women, males or overweight/obese individuals.

Conclusions: Individual characteristics

Taken together, these recent findings provide preliminary evidence that personal characteristics can influence the occurrence of modeling; some women use matching in order to affiliate with their eating companion or to make their eating companion more comfortable about her food intake. These findings emphasize that the need for social acceptance or the desire to get along with one's interaction partners can be stronger than one's own basic dispositions regarding food intake. Next, it has also been demonstrated that the ability to control one's impulses can influence the occurrence of modeling. We have shown that generally controlled women are more inclined than are less controlled women to follow the lead of their eating companion. An interesting idea for a future study would be to examine whether these two individual moderators (i.e. impulsivity and need to affiliate) jointly or independently affect modeling. This study, for instance, could directly manipulate participants' need to affiliate and/or

self-control in order to investigate the main and interaction effects of both factors on food matching or modeling. Finally, we demonstrated that those women who showed an elevated attention for dynamic eating cues were not more (or less) likely to adapt their food intake to that of their eating companion. This suggests that cue-reactive mechanisms might be less or not at all important in explaining modeling effects. Given that the study presented in this thesis was conducted among (mostly) normal weight young women, further research among more diverse groups is needed to validate this conclusion.

Modeling of Food Intake: A Dynamic Process

In Chapter 10, we demonstrated that young women closely monitor the other's eating behavior; young women were found to eat congruently rather than incongruently with their eating companion, an effect that was more evident at the beginning of the meal. To our knowledge, this is the first study in which the synchronization of both eating companions is linked to real-time behavioral mimicry processes. We offered two explanations for this dynamic process. These effects may be explained by pure mimicry, in which eaters mimic the behavior of others around them without deliberate thought (Chartrand & Bargh, 1999). In this view, the perception of another person taking a bite might have automatically activated young women's motor system for the same movement, which in turn might have led to an increased likelihood of taking a bite as well. This explanation would be in line with the 'direct matching hypothesis' in which the action that is performed directly matches the action that is observed (Iacobini et al., 1999; Rizzolati, Fogassi, & Gallese, 2001). The finding that both women were not mimicking each other's bites all the time, however, undermines the automaticity of this process. Young women were more likely to adapt their bites at the beginning of the meal, which may imply that the women were mimicking each other's bites because of affiliation goals. Previous studies have demonstrated that affiliation goals can augment behavioral mimicry (Lakin & Chartrand, 2003; Stel et al., 2008) and it is possible young women's tendency to ingratiate themselves with their eating companion at the beginning of the interaction has resulted in an increased likelihood of behavioral mimicry. In line with the normative framework of

Herman and Polivy (2005), however, it is also possible that women synchronized their bites in order to maintain a similar eating pattern. If the eating behavior of others communicates 'appropriate' eating, one's perceptions of the other's eating pattern might then be used to guide one's own eating behavior. If both women, for instance, believed that it was impolite to eat while the other was talking, they might have waited till their eating companion was ready to take a bite, leading to a synchronized bite pattern over the course of the eating session. It should be noted, however, that the current study did not test (or rule-out) whether both women automatically mimicked the other's bites (without motivation to do so) or whether they adjusted their eating because of affiliation goals or to conform to the social norms in place. Likewise, it is also possible that these processes are underlying each other and that mimicry of food intake involves an intention or attempt to affiliate or to adhere to some social norm. Although these findings enhance our understanding of the complex process of modeling of food intake, further research is needed to understand the reasons behind imitated eating patterns. We will come back to this issue in the section in which we propose some future research directions.

An Integrative Model to Explain Modeling of Food Intake

On basis of the findings from the present thesis, along with the knowledge obtained from previous research on modeling effects on food intake, we propose an integrative model to explain modeling effects on food intake. This model is a simplified representation of the intricate web of complex relations between the individual and situational factors that together determine whether and how the other's food intake is perceived and the degree to which one is likely to adapt one's food intake to one's eating companion. **Figure 1** shows a graphical representation of this model.

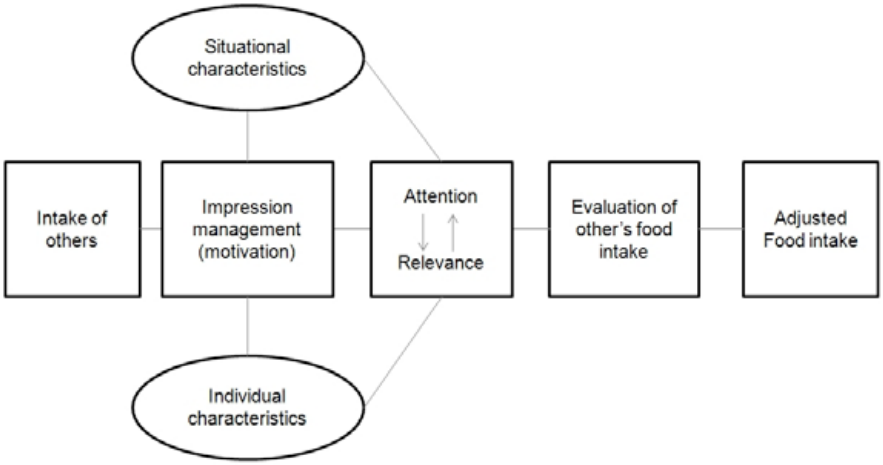

Figure 1. Proposed integrative model to explain modeling effects on food intake.

Once one is exposed to the food intake of others, the motivations to impress one's eating companion influences the degree to which impression-management efforts occur. Generally, these efforts increase when the motivation to convey this impression is heightened, such as when the impression is related to a highly valued reward or outcome (cf. Vartanian et al., 2007). For example, people should be more motivated to convey a favorable image of oneself if one wants to gain social approval or if one wants to avoid negative judgments. Factors that could influence this motivation include one's sex or body size, but also the personal characteristics of the eating companion might affect the degree to which one is eager to impress this person. The motivation to impress or affiliate with the eating companion also affects the amount of attention that is paid to the intake of this person. It has been argued in this thesis that individuals should be especially prone to pay attention to the other's behavior if the norms for appropriate intake are unclear and people do not know how to behave "appropriately". To

resolve this uncertainty, they often engage in social comparison. The more uncertain individuals are about "appropriate behavior", the more relevant the other's food intake should become. Theoretically, this also should lead to increased attention to the other's food intake. Situational factors that influence the attention to and relevance of the other's intake could involve the familiarity with the eating companion, what the companion looks like in terms of body size and the type of food (e.g., healthy versus unhealthy) that is available. Given the negative stereotypes that are associated with eating too much high-energy-dense foods, it is expected that individuals are especially careful to display appropriate behavior when eating with unfamiliar others, which again might explain their increased attention to and the increased relevance of the other's behavior. It should be noted, however, that increased attention to the other's behavior does not always makes this behavior more relevant for gauging one's own behavior. For example, although the large intake of an obese individual may specifically draw one's attention, this does not necessarily imply that the obese person's intake will be used as a guide for determining one's own intake. Given that individuals do not wish to emulate the behaviors with whom they regard negatively, it is expected that a large deviation from the co-eater's body size would decrease the relevance of the other's behavior. Thus, when attention is paid to the other's behavior and this behavior is considered to be relevant, then the evaluation of this behavior might determine whether the behavior is emulated. Individual characteristics that might influence the amount of attention to and relevance of the other's food intake might range from one's sex or body size to one's hunger or impulsivity levels. All in all, the impact of the presence and behavior of others on food intake is part of a complex web of relations between situational and individual characteristics that altogether influence the extent to which one is likely to adapt one's intake to that of others. Finally, the degree to which one is motivated to impress these people and whether and how the other's intake is perceived are of particular importance in determining one's response to the eating behavior of others.

Limitations and Future Directions

Despite the numerous studies that have been conducted on modeling effects on food intake, numerous questions remain unanswered. Alongside the limitations of our research, we address some of these questions by proposing some ideas for future studies that might help to provide more insight into the possible underlying mechanisms of modeling of food intake.

Examining modeling effects in familiar eating patterns and in different subgroups

Firstly, although we were able to isolate specific social influences on eating behavior by using a laboratory approach, this context still deviates from the context in which people usually consume their food. Next to that, the co-eaters in our studies have been strangers, rather than family members or friends, which limits the generalizability of claims than we can make from these studies. Although the findings of Salvy and colleagues (2007c) and Howland and colleagues (2012) suggest that friends and strangers may not differ in their extent of modeling, it is not certain that the findings presented in this thesis could be replicated using real-world eating contexts in which participants eat with familiar eating companions. Therefore, further experimental research is needed to examine whether and how social influence effects on eating might depend on the eating context and the relation between the eating companions. In addition to observational experimental research, these studies could make use of social network analysis that examines why and how the direct social environment affects eating behavior. One of the most highly cited studies in this research field is that of Christakis and Fowler (2007), who demonstrated that were more likely to become overweight if their friends or family members were overweight or obese (an effect that has also been reported in children; Grafova & Thakur, 2008; Trogdon, Nonnemaker, & Pais, 2008). It remains unclear from this study, however, whether this social contagion could be explained by behavioral imitation processes, whereby individuals modeled the food intake of their overweight or obese network members, or whether the effects were due to changes in individual's perceptions of the social norms. Most recently, preliminary evidence has been found that suggests that

it may be modeling processes, as opposed to social norms regarding the acceptability of obesity, that may best explain the similarity of health behaviors among social contexts (de la Haye, Robins, Mohr, & Wilson, 2010; Hruschka, Brewis, Wutich, & Morin, 2011; Leahy, LaRose, Fava, & Wing, 2011). However, whether and how social modeling and/or social norms predict changes in eating behavior among peers, friends and family members is a question that requires additional research over longer periods of time, as well as research that focuses on the whole social network surrounding the individual. Given that social influences on food intake consist of a myriad of factors that simultaneously affect the individuals within the network, future experimental research also needs to consider the potential role of these various mechanisms driving social influences on food intake, after which longitudinal studies should specify and test the pathways of social influence in social networks.

Another point for consideration involves the fact that the studies presented in this thesis all focused on young adults, which again restricts the generalizability of our findings. Although modeling effects on food intake have also been found in children and young adolescents (e.g., Bevelander, Anschütz, & Engels, 2012; Salvy et al., 2007a; 2008ab; Romero et al., 2009), these studies also demonstrate that children and young adolescents tend to eat large amounts of food when palatable food is offered to them. The amounts eaten by these children often exceed the already large intake of their (instructed) peer, a pattern that is rarely seen in adult samples. This particular finding may imply that among children the exposure to a large-eating peer may serve as stimulating cue to eat more, whereas among adults the intake of the eating companion most likely serves an inhibitory function signaling when they most stop eating. If this speculation holds, then when does this process start to change? To gain more insight into the possible differences between children, adolescents and adults in their vulnerability to social influences on food intake, future research will need to determine the developmental trajectory of concerns with eating appropriately and whether children and youth also associate their eating behaviors with impression-management strategies.

Thirdly, our research mainly focused on modeling effects among normal weight individuals

(BMI between 18 and 25). Although numerous scholars have demonstrated that modeling effects have a strong and pervasive influence on the eating behaviors of both normal- and overweight people (Conger et al., 1980; Nisbett & Storms, 1974; Rosenthal & McSweeney, 1979), research has also shown that the extent to which children are influenced by their eating companion does depend upon their weight status. Bevelander et al. (2012), for instance, found that overweight children were more sensitive to observing a large amount of snack food (and as a result, more likely to overeat) than were normal weight children, suggesting that peers (and the degree to which they eat) may have a particularly strong impact on the eating behavior and patterns of overweight children. Replication of our findings with lean, overweight and obese individuals (children as well as adults) would be a useful addition to research in the field of social modeling.

Examining the frameworks underlying modeling effects on food intake

Although the normative framework that has been discussed in this thesis appears to be useful heuristic in explaining why people eat as they do in social contexts, there is a clear need for research specifically testing the possible mechanisms that may underlie these modeling effects. It has been suggested that young women might conform their intake to that of others in order to gain social approval, to affiliate with others or to accomplish their impression-management goals. As is evident in this thesis, however, it is not always clear which motive prevails and under what circumstances. Moreover, it remains unclear whether young women "only" adhere to the social norms that are in place, or whether they also directly respond to the eating behavior of others by means of behavioral imitation. One difficulty inherent in these questions is that all three motives and both behavioral processes seem to be interrelated, which makes it difficult to examine their independent impact on modeling effects on food intake. As we have seen in this thesis, this may also largely depend on the strength of the manipulation. For example, we have found that the mere exposure to a video confederate shown eating different amounts of food does not lead to modeling effects among young women, whereas the findings presented in Chapter 10

suggest at least some behavioral imitation effects in social eating contexts. Therefore, we recommend focusing future research on examining the reasons behind imitated eating patterns and studies that "pit" one explanation against the other. This study, for instance, should distinguish between pure mimicry (in which the behavior of the eating companion is directly copied) and eating as a means of norm adherence (and thus the behavior of the eating companion serves only as a rough guide for one's own intake). This study could make use of a 2x2 design in which participants are either exposed to a real-life or remote-video confederate eating a small or large amount food, respectively. Then, one might examine whether participants adjust their intake to that of both confederates, or whether one of the confederates is stronger than the other in inducing an effect. Furthermore, one might examine in which context participants mimic the confederate's behavior to greater extent. Although the study presented in Chapter 7 suggests that women do not directly copy the other's food intake when there is no real-life interaction between both eating companions, and therefore a direct matching mechanism might be less important in explaining mimicry of food intake, further research should specifically compare modeling of food intake in both eating contexts.

Another interesting question in this context is the extent to which the effects of socially derived norms remain over time. In the present thesis, participants' response to either a no, small- or large-eating norm was measured during one single eating occasion. Although we were able to demonstrate that socially derived norms have a powerful effect on food intake, the question remains whether the behavior derived from these norms becomes habitual in the absence of those norms. In other words, does one's prior experience with a socially derived norm predict one's response in a similar context at a later point in time, even when this source of normative information is absent? Furthermore, it would be interesting to examine whether those who decreased or increased their intake in response to a small- or large-eating companion would compensate for this behavior by eating more or less at a later point in time. If such compensation were found, this might also give more insight into the question whether people automatically or deliberately adapt their food intake to others.

Modeling effects on food choice

Although there is a considerable amount of literature published on modeling effects on intake, much less is known about modeling of food choices. In this thesis, the modeling effect of high-energy-dense foods appeared to be stronger than modeling of low-energy-dense foods. Yet, because we did not examine the moderating role of the type of food within one study in the present thesis, it is not certain that the same effects could be replicated if we had offered both types of food (i.e., healthy versus unhealthy) simultaneously. Pliner and Mann (2004) have suggested that food choices may be more resistant to social influence than amounts consumed because people may feel sure about their food likes and dislikes and therefore do not need the guidance of others in determining their choice. This proposition is underscored by the findings of Robinson and Higgs (2012), who demonstrated that social influences have only a weak influence on food choices. They found that women who were in the presence of an unhealthy eating partner (i.e., someone who eats unhealthy food) were less likely to consume low-energy dense foods, and that they did not increase their healthy food intake in the presence of an healthy eater (i.e., someone who consumed healthy foods). Among children it has been extensively examined whether social modeling might be an effective mechanism through which food choices can be influenced. Because children generally prefer high-energy (unhealthy) foods over low-energy-dense foods (healthy foods) (Birch & Fisher, 1998), as well as they prefer the higher-energy-dense foods, such as banana, potato or apple, within the 'healthy fruits and vegetables' category (Gibson & Wardle, 2003), it has been investigated whether peer or adult models can get children to eat enough healthy foods. Salvy et al. (2008a), for instance, demonstrated that peers' healthy snack consumption could influence youths (9-11 years) to consume more healthy foods; even when unhealthy food options are available as well. Likewise, it has been found that children are more willing to try unfamiliar (healthy) food products if they see their parents or friends consuming these foods (Hendy, 2002; Hendy & Raudenbush, 2000). Because only a few studies have examined social influences on food choices among adults, further research examining whether modeling could promote the choice of healthy (versus unhealthy) foods is

suggested. With regard to practical implications, it would be interesting to know whether people would follow the healthy or unhealthy food intake of their eating companions if they could freely eat both types of food. All in all, further research on modeling effects on food choice among children, adolescents and adults would be of great help for interventions that are aimed at encouraging healthy eating.

Implications for Prevention and Intervention

Lately, people's eating habits have frequently been cause for concern, particularly with respect to health outcomes. Although the findings of the present thesis should be replicated and expanded across different populations (e.g., normal- and overweight children, adolescents, and adults), they might nevertheless inform strategies that are encouraged to improve people's eating habits. We propose two steps that could be effective in changing people's (unhealthy) eating behaviors in the long term.

Modifying the social network

One approach to modify the social environment with regard to food and eating might be the community reinforcement approach. This approach is based on the conceptualization of the powerful role that socio-environmental contingencies play in encouraging (or disencouraging) healthy behaviors. According to this approach, social, recreational, and familial reinforcers are used to assist individuals in the adoption and maintenance of a healthier lifestyle, within the context of a supportive social network (Meyers, Villanueva, & Smith, 2005). Family-based approaches are an obvious source of social support and can engage families in a supportive-health-oriented social network. With regard to eating, the social network has the potential to positively influence one's energy balance and diet composition at a young age in a numerous ways. Parents, for instance, may influence the family environment by exposing the family members to certain foods, to encourage them to eat these foods or to passively allow them to eat other foods (Clark, Goyder, Bissel, Blank, & Peters, 2007; Golan & Crowe, 2004). By doing so, the parents set the social norms regarding food and eating, and these social norms regarding "appropriate" behavior

are likely to influence the initiation and maintenance of children's regular eating habits. Conceivably, modifying family social network norms can help redefine appropriate (and healthy) eating. Next, given that parents also serve as direct role models for children's and adolescents' eating behavior (cf., Bauer, Berge, & Neumark-Sztainer, 2011; Brown & Ogden, 2004; Eisenberg, Ayala, Crespo, Lopez, Zive, Corder, et al., 2012; Patrick & Nicklas, 2005), parents should become aware that their food choices are often modeled by the other members in the network and therefore they have to adhere to a healthier lifestyle as well. Thus, modifying the family social network might help to decrease the support for unhealthy eating and to enhance the support for healthy eating. Consequently, this may facilitate generalization of healthy behaviors across environments, as well contribute to the maintenance of healthy behaviors in the community (e.g., within the peer group or at school). Although this community reinforcement approach has shown promising results in the treatment of substance use (Meyers, Smith, & Lash, 2003; Pantalon, Chawarski, Falcioni, & Pakes, Schottenfeld, 2004; Smith, Meyers, & Miller, 2001), future research will be determinant in assessing whether this approach is also efficacious and effective in improving people's (healthy) eating habits. Given the substantial body of evidence that indicates that people are disposed to adapt their food intake to that of familiar and unfamiliar others, however, we are hopeful that one's social network can be used to change unhealthy eating habits.

Encouraging mindful eating

Throughout this thesis, we have clearly shown that one's food intake is profoundly affected by external influences. The fact that young women do no acknowledge their susceptibility to social influences on food intake is consistent with research showing that, although people generally acknowledge that external elements influence others, they deny the influence of those elements on their own behavior (the third-person effect; Davison, 1983). In light of the increasing concerns with overeating and obesity, it thus seems valuable to increase people's awareness or acknowledgement of what actually influences their food intake. Given the findings of this thesis, it appears to be important to focus on the relationship

between social influences and eating behavior. In line with Vartanian and colleagues (2008), we propose that one way to reduce the power of social influences on food intake might be to increase mindfulness. Mindfulness is deliberately paying attention, being fully aware of what is happening both inside and outside the self – in the body and mind – and outside oneself, in the environment. Mindfulness is awareness without criticism and judgment (Bays, 2009). With regard to eating, it involves paying full attention to the experience of eating and drinking, with respect to the sight, smell, texture, flavor, temperature and even sounds of the food, but also to the body and mind by paying attention to the experiences of the body (e.g., fullness in the stomach) and the emotions and impulses that are influencing one's eating. Lately, only a few studies have addressed the effectiveness of mindfulness in the domain of eating, but so far the findings seem to be promising and suggest that mindfulness can reduce BMI in overweight individuals (Tapper et al., 2009), can decrease food cravings (Alberts, Mulkens, Smeets, & Thewissen, 2010) and reduce binge eating (Kristeller & Hallett, 1999). In addition, Alberts, Thewissen and Raes (2012) demonstrated that a mindfulness intervention can decrease food cravings, body-image concerns, and emotional and external eating among women with disordered eating behaviors. Finally, it has been found that teaching people how to recognize and respond appropriately to hunger results in healthier body weights (Ciampolini & Bianchi, 2006; Ciampolini, Lovell-Smith, & Sifone, 2010). All in all, these findings suggest that mindfulness-based interventions may be a fruitful way to reduce one's vulnerability to external food-related factors such as the sight or smell of palatable foods in general, and the behavior of other people in particular, by learning to pay attention to the decision's involved in one's food selection. Further experimental research should examine whether mindfulness training indeed has the potential to overcome (or limit) social modeling effects on eating.

Concluding Statement

On basis of the existing literature and the studies presented in this thesis examining the situational and individual factors that the occurrence of modeling, we may conclude that

modeling effects on intake can best be explained by one's tendency to adhere to social norms. In this thesis, it has been repeatedly demonstrated that young women are likely to increase intake when in the presence of others who do likewise. The findings of the studies in which we included an eating alone condition (Chapter 3 and 4), however, suggest that being in the presence of a large eater does not necessarily lead to "overeating" among young women (i.e., eating much more than when alone) but rather to eating "normally"(i.e., eating somewhat more or the same amounts as when alone). When the eating companion is eating lightly or nothing at all, however, young women are generally found to inhibit intake (and thus eat much less than when alone). These findings are consist with the normative framework of Herman and colleagues (2003; 2005) who have argued that the intake of others mostly serves an inhibitory function, indicating at what point people must stop eating if they are to maintain appropriate intake and to avoid the stigma of being an excessive eater. Although the absence of an eating alone condition in most of our studies makes it difficult to ascertain whether these women were eating more or less than they normally would do in their natural environment, it is conceivable that modeling effects are not explained by the stimulating effect of others eating more, but rather by the inhibiting effect of those who eat nothing or only a small amount. The challenge of future work in this field is to further develop a thorough understanding of how, why, and in which contexts social influences affect people's food intake. To achieve this goal, we will need to address mechanisms accounting for the effects of the social environment on children's, adolescents' and adult's food intake, yet be sufficiently broad in scope to inform public policy, prevention efforts, and interventions.

Dutch Summary

(Nederlandse samenvatting)

Eten speelt een belangrijke rol in ons sociale leven. Verjaardagen, promotiefeesten of religieuze feesten, zoals Kermis en het Suikerfeest, ze worden graag gevierd met veel en lekker eten. Omdat eten een sociale functie heeft, is het aannemelijk dat de sociale omgeving een belangrijke rol kan spelen in het bepalen van wat en hoeveel er gegeten wordt. Tal van studies hebben reeds aangetoond dat de aanwezigheid van anderen het eetgedrag behoorlijk kan veranderen. Zo blijkt dat mensen meer eten in groepen dan alleen (vaak 40-50% meer) en dat er minder gegeten wordt wanneer men het idee heeft dat de inname bekeken of geëvalueerd wordt. Daarnaast heeft onderzoek aangetoond dat mensen geneigd zijn om meer of minder te eten als hun tafelgenoot dit doet. Dit wordt ook wel imitatie van eetgedrag genoemd. Hoewel het onderzoek naar sociale invloeden op eetgedrag duidelijk aantoont dat de directe omgeving ons eetgedrag beïnvloedt, is er tot op heden nog weinig bekend over de situationele en individuele factoren die ervoor kunnen zorgen dat iemand meer of minder geneigd is om het eetgedrag van de personen in zijn of haar directe omgeving over te nemen. Dit proefschrift beschrijft negen experimentele studies waarin imitatie van eetgedrag bij jonge mannen en vrouwen wordt onderzocht. De belangrijkste resultaten en conclusies van deze onderzoeken worden hieronder weergegeven.

Situationele invloeden die imitatie van eetgedrag kunnen beïnvloeden

In de eerste zes hoofdstukken van dit proefschrift hebben we onderzocht onder welke omstandigheden imitatie van eetgedrag meer of minder zou kunnen voorkomen bij jonge vrouwen. Deze onderzoeken zullen worden beschreven aan de hand van de specifieke onderzoeksvragen die we vooraf hadden opgesteld.

Hoofdstuk 2: Welke invloed heeft het gewicht van de eetpartner op de imitatie van calorierijke (ongezonde) snacks?

In het eerste hoofdstuk van dit proefschrift wordt een experimentele studie beschreven waarbij we het

eetgedrag van 102 vrouwen met een normaal gewicht in de leeftijd van 18 tot 30 jaar geobserveerd hebben. Deze vrouwen werden gekoppeld aan een slanke actrice die instructies had gekregen om niets, weinig of veel te eten van een schaaltje M&Ms. Naast deze specifieke instructies, hadden we het gewicht van de actrice gemanipuleerd door haar een siliconenband onder haar kleding te laten dragen die haar visueel dikker maakte. Zo creëerden we een situatie waarin de actrice de ene keer slank was en de andere keer een (gemanipuleerd) normaal postuur had. De resultaten van deze studie toonden aan dat jonge vrouwen met een normaal gewicht het eetgedrag van de actrice imiteerden wanneer zij de siliconenband droeg, maar niet wanneer zij deze band niet droeg. Op basis van deze bevinding stelden we dat vrouwen met een normaal gewicht eerder geneigd zijn om het eetgedrag over te nemen van een tafelgenoot met een soortgelijk figuur dan dat zij een slanke vrouw imiteren. Daarnaast opperden we dat de relatieve slanke actrice de proefpersoon onzeker zou hebben kunnen gemaakt over haar eigen gewicht en zij daardoor geneigd was om haar eigen inname te beperken (en imitatie dus minder voorkwam), terwijl de actrice die de siliconenband droeg het wellicht toeliet om zelf ook wat (meer) te eten van de calorierijke snacks.

Hoofdstuk 3: Welke invloed heeft het gewicht van de eetpartner op de imitatie van caloriearme (ongezonde) snacks?

Omdat we in de vorige studie enkel calorierijke snacks gebruikten om imitatie van eetgedrag te onderzoeken, besloten we om in hoofdstuk 3 te onderzoeken of het gewicht van de actrice net zo'n belangrijke rol zou spelen op de imitatie van gezonde snacks. Wederom nodigden we studentes uit in onze nagebootste huiskamer om samen te eten met een actrice die zij niet kenden. Het onderzoek dat we uitvoerden in dit hoofdstuk was grotendeels gelijk aan de studie die beschreven werd in het voorgaande hoofdstuk, maar één ding was anders; de M&M's werden vervangen door gezonde komkommerschijfjes en Parijse worteltjes. De resultaten toonden aan dat vrouwen hun eetgedrag aanpasten aan dat van de actrice, door meer of minder te gaan eten van de groentesnacks als de actrice dit deed, maar dat

de gewichtsmanipulatie geen effect bleek te hebben. Bovendien leek het imitatie-effect minder sterk te zijn dan in de voorgaande studie. Ondanks dat we de effecten van de gewichtsmanipulatie en het type snacks op imitatie van eetgedrag niet in één studie hebben onderzocht, en dit eigenlijk wel nodig was geweest om causale uitspraken te doen, suggereren de bevindingen van de studies beschreven in hoofdstuk 2 en 3 dat imitatie van eetgedrag zowel voor gezond als ongezond eetgedrag plaatsvindt. Het gewicht van de eetpartner lijkt echter minder van belang te zijn voor de sterkte van het imitatie-effect als er gezond gegeten wordt.

Hoofdstuk 4: Welke invloed heeft de kwaliteit van de sociale interactie op imitatie van eetgedrag?

Uit de literatuur weten we dat het overnemen van andermans gedrag een belangrijke sociale functie heeft. Er wordt zelfs gesuggereerd dat imitatie een middel zou kunnen zijn om aardig gevonden te worden en bij de 'groep' te horen. In hoofdstuk 4 stelden we dan ook dat de mate waarin vrouwen het eetgedrag van anderen overnemen beïnvloed zou kunnen worden door de affectieve band die ze voelen met hun eetpartner. Om deze stelling te toetsen, werden 100 jonge vrouwen gekoppeld aan een actrice die instructies had gekregen om erg aardig of juist afstandelijk te zijn. Daarnaast kreeg de actrice de standaardinstructie om niets, weinig of veel te eten tijdens de pauze. In tegenstelling tot onze verwachting, bleek dat de proefpersonen niet het eetgedrag van de vriendelijke actrice, maar juist van de afstandelijke actrice overnamen. We verklaarden deze bevinding door te stellen dat contextuele onzekerheid of de neiging om aardig gevonden te willen worden imitatie van eetgedrag zou kunnen versterken.

Hoofdstuk 5: Imiteren vrouwen ook de ontbijtinname van hun eetpartner?

Tot op heden richtte eerder onderzoek naar imitatie van eetgedrag zich enkel op eetsituaties waarin kleine snacks zoals pinda's en koekjes werden aangeboden. In deze specifieke eetsituatie is de

hoeveelheid die “gepast” is om te eten erg onduidelijk, waardoor men wellicht meer geneigd is om te kijken hoeveel de ander de eet om daar vervolgens de eigen inname op aan te passen. In hoofdstuk 5 onderzochten we of jonge vrouwen zich net zo sterk laten beïnvloeden door de actrice wanneer ze al bestaande normen hebben over de hoeveelheid die ze kunnen eten van een bepaald soort voedsel. We nodigden daarom 57 vrouwen met een normaal gewicht uit om tussen half negen en half elf ’s ochtends een ontbijt te komen nuttigen in ons barlab (een onderzoeksruimte waarin een kroeg is nagebootst). Net als in de voorgaande onderzoeken werden zij gekoppeld aan een actrice die instructies kreeg over de hoeveelheid die zij moest eten van dit ontbijt. De resultaten toonden aan dat jonge vrouwen hun ontbijtinname aanpasten aan dat van de actrice. In tegenstelling tot de vorige studies vonden we echter dat vrouwen alleen minder, maar niet meer, aten als de actrice dit deed. Aangezien het ontbijt doorgaans bestaat uit vaststaande patronen die elke dag herhaald worden, suggereren onze bevindingen dat imitatie van eetgedrag minder voorkomt in eetsituaties waarin men al weet hoeveel men wil eten en er dus minder behoefte is om te weten hoeveel de ander eet (om daar vervolgens het eigen gedrag op aan te passen).

Hoofdstuk 6: Welk gezamenlijk effect hebben portiegrootte en het eetgedrag van de eetpartner op de maaltijdinname van jonge vrouwen?

Naast het eetgedrag van anderen, wordt ook de grootte van een portie beschouwd als een normatief signaal dat gebruikt wordt om te bepalen wat gepast is om te eten. In het verleden is er nog geen onderzoek gedaan naar het gezamenlijke effect van beide signalen. Dit is opmerkelijk, aangezien beide signalen vaak tegelijkertijd voorkomen in één eetsituatie. In hoofdstuk 6 onderzochten we daarom hoe het eetgedrag van vrouwen beïnvloed zou worden door verschillende portiegroottes en het eetgedrag van een tafelgenoot. Aan dit onderzoek namen 85 studentes deel. Beide personen kregen dezelfde warme maaltijd aangeboden. Zowel de grootte van de aangeboden portie als de voedselinname van de tafelgenoot bleken een onafhankelijke invloed te hebben op de voedselinname van proefpersonen. De

vrouwen aten niet alleen meer wanneer hun tafelgenoot veel at, maar deden dat ook wanneer ze een grotere portie aangeboden kregen. Vrouwen die een gemiddelde portie kregen aangeboden, aten 35% meer dan vrouwen die een kleine portie kregen aangeboden. De vrouwen die een gemiddelde portie kregen aangeboden én samen aten met een tafelgenoot die veel at, aten 19% meer dan vrouwen die samen aten met een tafelgenoot die de helft van deze portie liet staan. De resultaten suggereren dat jonge vrouwen meerdere omgevingsfactoren gebruiken als richtlijn om te bepalen hoeveel ze kunnen eten.

Hoofdstuk 7: Imiteren vrouwen ook de snackinname van een andere vrouw die alleen op TV te zien is?

In de voorgaande studies hebben we gezien dat de hoeveelheid snacks die vrouwen eten vaak gebaseerd is op de hoeveelheid die hun eetpartner eet. In hoofdstuk 7 onderzochten we of proefpersonen hun eetgedrag ook zouden aanpassen aan dat van een etende vrouw op televisie. In twee verschillende experimenten lieten we daarom 119 vrouwen een zelfgemaakt filmpje zien waarin een ‘studente’ te zien was die wel of niet snoepte van een schaaltje M&M’s of winegums. In dit onderzoek hadden de proefpersonen dus geen contact met de andere vrouw, maar zagen zij haar enkel op televisie. Beide studies toonden aan dat jonge vrouwen hun eetgedrag niet aanpasten aan dat van de ander; ze aten niet meer of minder als de vrouw op televisie dit deed. Deze bevindingen suggereren dat imitatie van eetgedrag met name plaatsvindt in sociale situaties waarbij de etende ander ook echt lijfelijk aanwezig is. Eerder onderzoek heeft echter laten zien dat vrouwen hun inname ook conformeren aan de hoeveelheid die anderen hebben gegeten in dezelfde situatie, waarbij een papieren lijst die ‘achtergelaten’ wordt in de onderzoeksruimte voldoende is om dit effect te creëren. Als we deze bevinding vergelijken met de resultaten van onze studie, dan lijkt het erop alsof imitatie van eetgedrag met name plaatsvindt wanneer vrouwen specifieke informatie hebben gekregen over hoe anderen zich gedragen in dezelfde context, waarbij het niets uit lijkt te maken of de etende ander nu lijfelijk aanwezig is of niet. Gezien

de tekortkomingen van de studies die beschreven worden in hoofdstuk 7 is deze uitspraak echter speculatief en zou het onderzoek herhaald moeten worden om deze hypothese te toetsen. In deze vervolgstudie zou vervolgens meer gelet moeten worden op de context waarin de proefpersonen en de actrice eten en de mate waarin het gedrag van de actrice waargenomen en gebruikt wordt om het eigen gedrag op aan te passen

Naast de omstandigheden waarin imitatie van eetgedrag meer of minder zou kunnen voorkomen, waren we in dit proefschrift ook geïnteresseerd in de vraag of sommige mensen meer of minder geneigd zouden zijn om hun eetgedrag aan dat van een ander aan te passen. De belangrijkste bevindingen en conclusies van deze twee onderzoeken zullen hieronder beschreven worden.

Hoofdstuk 8: Nemen mannen ook het eetgedrag van anderen in hun omgeving over?

Aangezien het merendeel van het onderzoek naar imitatie van eetgedrag zich heeft gericht op jonge vrouwen, besloten we in hoofdstuk 8 te onderzoeken of jonge mannen hun eetgedrag ook zouden laten beïnvloeden door dat van een etende ander. We nodigden daarom 59 studenten uit om naar ons lab te komen, waar zij gekoppeld werden aan een acteur die de standaardinstructies had gekregen over de hoeveelheid borrelnootjes die hij moest eten. Waar alle onderzoeken naar imitatie van eetgedrag bij vrouwen sterke effecten laten zien, bleek uit ons onderzoek dat dit voor mannen wellicht anders ligt. De resultaten toonden aan dat niet alle mannen het eetgedrag van de acteur overnamen; enkel de mannen die hadden aangegeven hongerig te zijn voor hun deelname aan het onderzoek, bleken meer of minder te gaan eten als de andere man dit deed. Hoewel de proefpersonen in het algemeen niet zo bezig leken te zijn met het eetgedrag van de acteur, zou hun honger ertoe geleid kunnen hebben dat zij meer bewust werden van de hoeveelheid die de ander at. De resultaten toonden niet alleen aan dat zij meer aten wanneer de acteur veel at, wat logisch was gezien hun honger, maar ook dat zij minder aten

als de acteur slechts enkele borrelnootjes nam. Aangezien dit het eerste onderzoek is dat een dergelijke bevinding doet, raden we in dit hoofdstuk een vervolgstudie aan waar dit verder wordt uitgezocht.

Hoofdstuk 9: Wat is het effect van individuele verschillen in aandacht voor voedselcues en impulsiviteit op imitatie van eetgedrag?

In hoofdstuk 9 stelden we dat het eetgedrag van anderen gezien zou kunnen worden als een extra stimulans om te gaan eten. Er zouden dan ook individuele verschillen kunnen bestaan tussen mensen in de mate waarin zij hun reactie op dit signaal zouden kunnen controleren. Daarnaast zouden sommige mensen meer aandacht kunnen hebben dan anderen voor deze 'eetsignalen' in hun directe omgeving. Om deze mogelijke individuele verschillen te onderzoeken, nodigden we 85 vrouwen uit om twee keer naar ons lab te komen. In de eerste sessie werd hun aandacht gemeten voor eetsignalen tijdens het bekijken van een kort filmfragment uit de film 'Eat Pray Love'. Deze film bevat veel referenties naar eten en etende mensen en is daarom uitermate geschikt om individuele verschillen te meten in aandacht voor deze signalen. Terwijl de proefpersonen naar deze film keken, werden hun oogbewegingen gemeten zodat we precies konden zien waar hun aandacht naar toe ging. Na het zien van het filmpje, moesten ze een computertaak volbrengen waarin hen gevraagd werd om hun impulsen te controleren. Tenslotte vulden ze een batterij vragenlijsten in, waarin onder andere de mate van impulsiviteit werd gemeten. Tijdens de tweede sessie werden ze tenslotte gekoppeld aan een actrice die de standaardinstructies ontving met betrekking tot de hoeveelheid M&M's die zij moest eten. Uit de resultaten bleek dat enkel de vrouwen die hun impulsen goed konden controleren, het eetgedrag van de actrice overnamen. De mate waarin de proefpersonen verschilden in de aandacht voor eetsignalen in de film, bleek geen effect te hebben op de imitatie van eetgedrag. Deze resultaten suggereren dat individuele verschillen in de mate van aandacht voor eetsignalen geen rol speelt in het verklaren van imitatie van eetgedrag. De mate waarin proefpersonen hun impulsen kunnen controleren lijkt echter wel een rol te spelen; de vrouwen met een betere impulscontrole waren eerder geneigd om hun eetgedrag aan te passen aan dat van een

etende ander. Aangezien deze studie voor het eerst een effect vindt voor impulscontrole op imitatie van eetgedrag, is vervolgonderzoek aan te raden waarin beter gekeken wordt naar de richting van het effect en mogelijke onderliggende verklaringen.

Hoofdstuk 10: Zou imitatie van eetgedrag ook een dynamisch proces kunnen zijn waarbij beide eetpartners elkaar imiteren?

Het imitatie-effect van eetgedrag wordt doorgaans toegeschreven aan de aanwezigheid van (sociale) eetnormen, waarbij het eetgedrag van de ander als voorbeeld dient voor de hoeveelheid die gepast of normaal is om te eten binnen de specifieke context waarin men zich bevindt. Hoewel het conformeren aan normen voor gepast eetgedrag een belangrijke verklaring kan zijn voor imitatie van eetgedrag, geeft het nauwelijks inzicht in een mogelijk meer dynamisch beïnvloedingsproces tussen twee tafelgenoten. Deze normverklaring gaat namelijk uit van een eenzijdige beïnvloeding waarbij de totale inname van de ene persoon de andere persoon beïnvloedt, terwijl het ook mogelijk is dat beide personen tijdens het eten hun gedrag aan elkaar aanpassen. Het doel van het onderzoek dat beschreven wordt in hoofdstuk 10 is om meer in inzicht te krijgen in het mogelijke dynamische beïnvloedingsproces dat speelt wanneer twee vrouwen samen eten en om te bepalen of beide vrouwen naast de hoeveelheid die ze eten, ook hun happen op elkaar afstemmen. Het eetgedrag van twee tafelgenoten werd daarom geobserveerd en nauwkeurig vergeleken om inzicht te krijgen in het imitatieproces van eetgedrag. Gevonden werd dat beide vrouwen hun eetgedrag aan elkaar aanpasten. De vrouwen waren eerder geneigd om een hap van de maaltijd te nemen als hun tafelgenoot dit deed dan dat ze hun eigen eettempo bepaalden. Oftewel, uit dit onderzoek blijkt dat vrouwen niet alleen de totale hoeveelheid die ze eten aanpassen aan dat van hun tafelgenoot, maar ook dat ze het moment waarop ze hun happen nemen laten afhangen van de ander.

Conclusies en implicaties op basis van dit proefschrift

Op basis van de reeds bestaande literatuur en de studies die beschreven worden in dit proefschrift, concluderen we dat imitatie van eetgedrag het beste verklaard kan worden door de neiging die mensen hebben om hun gedrag te conformeren aan dat van anderen. In dit proefschrift wordt herhaaldelijk aangetoond dat met name vrouwen geneigd zijn om meer of minder te gaan eten als de persoon met wie ze eten dit doet. De aanwezigheid van een grote eter leidt er echter niet per se toe dat iemand gaat 'overeten', maar vaker dat iemand iets meer of wellicht hetzelfde eet als men doorgaans alleen zou doen. De sterkste beïnvloeding vindt plaats wanneer de tafelgenoot niets of weinig eet. Onder deze omstandigheden zijn vrouwen geneigd om hun inname te beperken en minder te eten dan zij waarschijnlijk alleen hadden gedaan. Deze conclusie is in lijn met het normatieve model van Herman en collega's (2003; 2005). Hoewel dit proefschrift ons tal van inzichten heeft gegeven over de omstandigheden waarin imitatie van eetgedrag meer of minder voorkomt, is het van belang om in vervolgonderzoek nog meer te kijken naar waarom, hoe en onder welke omstandigheden mensen hun eetgedrag aanpassen.

Het is belangrijk te vermelden dat wij ons met name hebben gericht op het eetgedrag van hoogopgeleide, jonge vrouwen. Hoewel de bevindingen gerepliceerd dienen te worden bij kinderen, adolescenten of oudere volwassenen, kunnen ze desondanks nuttig zijn bij het inrichten van preventie- of interventiestrategieën die gericht zijn op het verbeteren van ongezond eetgedrag. De laatste tijd is er steeds meer aandacht voor de invloed van de directe sociale omgeving op gewichtstoename en ongezond eetgedrag. De studies die beschreven worden in dit proefschrift tonen herhaaldelijk aan dat jonge vrouwen de neiging hebben om hun eetgedrag aan dat van een ander aan te passen. In dit proefschrift worden twee stappen voorgesteld die van pas zouden kunnen komen bij het voorkomen of verbeteren van ongezond eetgedrag. Aangezien mensen beïnvloed worden door hun directe omgeving, zou een eerste stap kunnen zijn om de eetpatronen van de directe sociale omgeving (bijv. familieleden) te verbeteren. Daarnaast zouden we mensen kunnen aanmoedigen om een eetstijl te hanteren waarbij

men meer bewust is van hoe, wat en waarom zij eten. Deze bewustwording zou vervolgens een eerste stap kunnen zijn in gedragsverandering.

References

A

Aiken, L. S., & West, S. G. (1991). Multiple regression: testing and interpreting interactions. Newbury Park, CA: Sage.

Alberts, H. J., Mulkens, S., Smeets, M., & Thewissen, R. (2010). Coping with food cravings. Investigating the potential of a mindfulness-based intervention. *Appetite, 55*, 160-163.

Alberts, H. J., Thewissen, R., & Raes, L. (2012). Dealing with problematic eating behaviour. The effects of a mindfulness-based intervention on eating behaviour, food cravings, dichotomous thinking and body image concern. *Appetite, 58*, 847-851.

Anschütz, D. J., Engels, R. C. M. E., Becker, E. S., & van Strien, T. (2008). The bold and the beautiful. Influence of body size of televised media models on body dissatisfaction and actual food intake. *Appetite, 51*, 530-537.

Anschütz, D. J., Engels, R. C. M. E., Becker, E. S., & Van Strien, T. (2009). The effects of TV commercials using less thin models on young women's mood, body image and actual food intake. *Body Image, 6*, 270-276.

Anschütz, D. J., van Strien, T., & Engels, R. C. M. E. (2008). Exposure to slim images in mass media: Television commercials as reminders of restriction in restrained eaters. *Health Psychology, 27*, 401-408.

Aranson, E., Wilson, T. D. & Akert, R. M. (2007). *Social Psychology*, 6th edition, Pearson Prentice Hall, NJ.

Avila, C. (2001). Distinguishing BIS-mediated and BAS-mediated disinhibition mechanisms: a comparison of disinhibition models of Gray (1981, 1987) and of Patterson and Newman (1993). *Journal of Personality and Social Psychology, 80*, 311-324.

B

Bandura, A., & Huston, A. C. (1961). Identification as a process of incidental-learning. *Journal of Abnormal and Social Psychology, 63*, 311-318.

Baker, C. W., Little, T. D., & Brownell, K. D. (2003). Predicting adolescent eating and activity behaviors: the role of social norms and personal agency. *Health Psychology, 22*, 189-198.

Barkley, R. A. (1997). Behavioral inhibition, sustained attention, and executive functions: constructing an unifying theory of ADHD. *Psychological Bulletin, 121*, 65-94.

Basow, S. A., & Kobrynowicz, D. (1993). What is she eating? The effects of meal size on impressions of a female eater. *Sex Roles, 28*, 335-344.

Bauer, K. W., Berge, J. M., & Neumark-Sztainer, D. (2011). The importance of families to adolescents' physical activity and dietary intake. *Adolescent Medicine: State of the Art Reviews, 22*, 601-613.

Baumeister, R. F., & Sommer, K. L. (1997). What do men want? Gender differences and two spheres of belongingness. Psychological Bulletin, 122, 38–44.

Bays, J. C. (2009). Mindful eating: *A guide to rediscovering a healthy and joyful relationship with food*. Shambhala Publications, US.

Bell, R., & Meiselman, H. L. (1995). The role of eating environments in determining food choice. In D. W. Marshall (Ed.), *Food choice and the consumer*. (pp. 292-310). London: Blackie Academic.

Bellisle, F. (1979). Human feeding behavior. *Neuroscience & Biobehavioral Reviews, 3*, 163-169.

Berger, J., & Rand, L. (2008). Shifting signals to help health: Using identity signaling to reduce risky health behaviors. *Journal of Consumer Research, 35*, 509-518.

Berridge, K. C. (2009). 'Liking' and 'wanting' food rewards: Brain substrates and roles in eating disorders. *Physiology & Behavior, 97*, 537-550.

Berry, S. L., Beatty, W. W., & Klesges, R. C. (1985). Sensory and social influences on ice-cream consumption by males in females in a laboratory setting. *Appetite, 6*, 41-45.

Bevelander, K. E., Anschütz, D. J., & Engels, R. C. M. E. (2011). Social modeling of food purchases at supermarkets in teenage girls. *Appetite, 57*, 99-104.

Bevelander, K. E., Anschütz, D. J., & Engels, R. C. (2012). Social norms in food intake among normal weight and overweight children. Appetite, 58, 864-872.

Birch, L. L., & Fisher, J. O. (1998). Development of

eating behaviors among children and adolescents. *Pediatrics, 101*, 539-549.

Birch, L. L., McPhee, L., Shoba, B. C., Pirok, E., & Steinberg, L. (1987). What kind of exposure reduces children's food neophobia - looking vs tasting. *Appetite, 9*, 171-178.

Bock, B. C., & Kanarek, R. B. (1995). Women and men are what they eat: The effects of gender and reported meal size on perceived characteristics. Sex Roles, 33, 109–119.

Bot, S. M., Engels, R. C. M. E., & Knibbe, R. A. (2005). The effects of alcohol expectancies on drinking behaviour in peer groups: observations in a naturalistic setting. *Addiction, 100*, 1270-1279.

Bot, S. M., Engels, R. C. M. E., Knibbe, R. A., & Meeus, W. H. J. (2007). Sociometric status and social drinking: Observations of modelling and persuasion in young adult peer groups. Journal of Abnormal Child *Psychology, 35*, 929-941.

Braet, C., Claus, L., Verbeken, S., & Van Vlierberghe, L. (2007). Impulsivity in overweight children. *European Child & Adolescent Psychiatry, 16*, 473-483.

Brass, M., Bekkering, H., & Prinz, W. (2001). Movement observation affects movement execution in a simple response task. *Acta Psychologica, 106*, 3-22.

Brown, R., & Ogden, J. (2004). Children's eating attitudes and behaviour: a study of the modelling and control theories of parental influence. *Health Education Research, 19*, 261-271.

Brug, J. (2008). Determinants of healthy eating: motivation, abilities and environmental opportunities. *Family Practice, 25*, I50-I55.

Brunner, T. (2010). How weight-related cues affect food intake in a modeling situation. *Appetite, 55*, 507-511.

C

Caplan, P. (1996). Why do people eat what they do? Approaches to food and diet from a social science perspective. *Clinical Child Psychology and Psychiatry, 1*, 213–227.

Castellanos, E. H., Charboneau, E., Dietrich, M. S., Park, S., Bradley, B. P., Mogg, K., & Cowan, R. L. (2009). Obese adults have visual attention bias for food cue images: evidence for altered reward system function. *International Journal of Obesity, 33*, 1063-1073.

Castonguay, T. W., Applegate, E. A., Upton, D. E., & Stern, J. S. (1983). Hunger and appetite- old concepts new distinctions. *Nutrition Reviews, 41*, 101-110.

Chaiken, S., & Pliner, P. (1987). Women, but not men, are what they eat. The effect of meal
size and gender on perceived femininity and masculinity. *Personality and Social Psychology Bulletin, 13*, 166-176.

Chartrand, T. L., & Bargh, J. A. (1999). The Chameleon effect: The perception-behavior link and social interaction. *Journal of Personality and Social Psychology, 76*, 893-910.

Chartrand, T. L., & van Baaren, R. (2009). Human mimicry. In M. P. Zanna (Ed.), *Advances in Experimental Social Psychology, 41*, (pp. 219-274).

Cialdini, R. B. (1988). *Influence: Science and practice* (2nd ed.). Glenview, IL: Scott, Foresman.

Cialdini, R. B., Kallgren, C. A., Reno, R. R. (1991). A focus theory of normative conduct: A
theoretical refinement and reevaluation of the role of norms in human behavior. *Advances in Experimental Social Psychology, 24*, 201-234.

Ciampolini, M., & Bianchi, R. (2006). Training to estimate blood glucose and to form associations with initial hunger. *Nutrition & Metabolism, 3*, 42.

Ciampolini, M., Lovell-Smith, D., & Sifone, M. (2010). Sustained self-regulation of energy
intake. Loss of weight in overweight subjects. Maintenance of weight in normal weight subjects. *Nutrition & Metabolism*, 7: 4.

Clark, H. R., Goyder, E., Bissell, P., Blank, L., & Peters, J. (2007). How do parents' child-feeding behaviours influence child weight? Implications for childhood obesity policy. *Journal of Public Health, 29*, 132-141.

Clendenen, V. I., Herman, C. P., & Polivy, J. (1994).

Social facilitation of eating among friends and strangers. *Appetite, 23*, 1-13.

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.

Collins, R. L., Parks, G. A., & Marlatt, G. A. (1985). Social determinants of alcohol consumption - The effects of social interaction and model status on the self-administration of alcohol. *Journal of Consulting and Clinical Psychology, 53*, 189-200.

Connors, M., Bisogni, C. A., Sobal, J., & Devine, C. M. (2001). Managing values in personal food systems. *Appetite, 36*, 189-200.

Colton, C. C. (1837). *Lacon or many things in few words: addressed to those who think*. London: Longman, Orme, Brown, Green, & Longmans.

Conger, J. C., Conger, A. J., Costanzo, P. R., Wright, K. L., & Matter, J. A. (1980). The effect of social cues on the eating behavior of obese and normal subjects. *Journal of Personality, 48*, 258-271.

Christakis, N. A., & Fowler, J. H. (2007). The spread of obesity in a large social network over 32 years. *New England Journal of Medicine, 357*, 370-379.

Christensen, P. N., Rothgerber, H., Wood, W., & , & Matz, D. C. (2004). Social norms and the self: A motivational model of normative impact. *Personality and Social Psychology Bulletin, 30*, 1295-1309.

Cross, S. E., & Madson, L. (1997). Models of the self: Self-construals and gender. *Psychological Bulletin, 122*, 5–37.

D

David, B., & Turner, J. (2001). Majority and minority influence: a single process self-categorization analysis. In C. K. W. De Dreu & N. K. De Vries (Eds.). *Group Consensus and Minority Influence: Implications for Innovation.* (pp. 91-121). Malden, MA: Blackwell.

Davis, C., Patte, K., Levitan, R., Reid, C., Tweed, S., & Curtis, C. (2007). From motivation to behaviour: a model of reward sensitivity, overeating, and food preferences in the risk profile for obesity. *Appetite, 48*, 12-19.

Davison, W.P. (1983). The Third-person Effect in Communication. *Public Opinion Quarterly, 47*, 1-15.

de Castro, J. M. (1990). Social facilitation of duration and size but not rate of the spontaneous meal intake of humans. *Physiology & Behavior, 47*, 1129-1135.

de Castro, J. M. (1993). Genetic influences on daily intake and meal patterns of humans. *Physiology & Behavior, 53*, 777-782.

de Castro, J. M., & Brewer, E. M. (1992). The amount eaten in meals by humans is a power function of the number of people present. *Physiology & Behavior, 51*, 121-125.

de Castro, J. M., & de Castro, E. S. (1989). Spontaneous meal patterns of humans: influence of the presence of other people. *American Journal of Clinical Nutrition, 50*, 237-247.

de la Haye, K., Robins, G., Mohr, P.,& Wilson, C. (2010). Obesity-related behaviors in adolescent friendship networks. *Social Networks, 32*, 161–167.

De Luca, R. V., & Spigelman, M. N. (1979). Effects of models on food-intake of obese and non-obese female college students. *Canadian Journal of Behavioural Science, 11*, 124-129.

Deutsch, M., & Gerard, H. B. (1955). A study of normative and informational social influences upon individual judgment. *Journal of Abnormal Psychology, 51*, 629-636.

Dijksterhuis, A. (2005). Why we are social animals: the high road to imitation as social glue. In S. Hurley & N. Charter (Eds.), *Perspectives on imitation: from cognitive neuroscience to social science* (vol. 2, pp. 207-220). Cambridge, MA: MIT Press.

Dijksterhuis, A. & Bargh, J.A. (2001). The perception-behavior expressway: Automatic effects of social perception on social behavior. In M. Zanna (Ed.), *Advances in Experimental Social Psychology, 33*, pp. 1-40.

De Waal, F. (2001). *The Ape and the Sushi Master: Cultural reflections of a primatologist.* New York: Basic Books.

E

Eagly, A. H. (1978). Sex differences in influenceability. *Psychological Bulletin, 85*, 86–116.

Eccles, J. S. (1999). The development of children ages 6 to 14. *Future of Children, 9*, 30-44.

Eisenberg, C. M., Ayala, G. X., Crespo, N. C., Lopez, N. V., Zive, M. M., Corder, K., & Elder, J. P. (2012). Examining multiple parenting behaviors on young children's dietary fat consumption. *Journal of Nutrition Education and Behavior, 44*, 302-309.

Engels, R. C. M. E., & Granic, I. (2005). Experimental observational studies on peer influence processes and alcohol consumption. *Research proposal NOW Open Competitie.*

Eysenck, S. G. G., Eating, G., & Pearson, P. R. (1984). Age norms for impulsiveness, venturesomeness and empathy in children. *Personality and Individual Differences, 5*, 315–321.

Exline, J. J., Zell, A. L., Bratslavsky, E., Hamilton, M., & Swenson, A. (2012). People-pleasing through eating: Sociotrophy predicts greater eating in response to perceived social pressure. *Journal of Social and Clinical Psychology, 31*, 169-193.

F

Feeney, J. R., Polivy, J., Pliner, P., & Sullivan, M. D. (2011). Comparing live and remote models in eating conformity research. *Eating behaviors, 12*, 75-77.

Festinger, L. (1954). A theory of social comparison processes. *Human Relations, 7*, 117-140.

Field, M., Eastwood, B., Bradley, B. P., & Mogg, K. (2006). Selective processing of cannabis cues in regular cannabis users. *Drug and Alcohol Dependence, 85*, 75-82.

Fischler, C. (1988). Food, self and identity. *Social Science Information, 27*, 275-292.

Franca, L. R., Dautzenberg, B., & Reynaud, M. (2010). Heavy episodic drinking and alcohol consumption in French colleges: the role of perceived social norms. A*lcoholism: Clinical & Experimental Research, 34*, 164–74.

Franken, I. H. A., & Muris, P. (2005). Individual differences in reward sensitivity are related to food craving and relative body weight in healthy women. *Appetite, 45*, 198-201.

Fisher, T. D. (2009). The impact of socially conveyed norms on the reporting of sexual behavior and attitudes by men and women. J*ournal of Experimental Social Psychology, 45*, 567–72.

G

Garfinkel, P. E., & Garner, D. M. (1982). *Anorexia nervosa: A multidimensional perspective*. New York: Brunner/Mazel.

Germov, J., & Lauren, W. (2004). *A Sociology of Food & Nutrition: The Social Appetite*. Victoria: Oxford University Press.

Gibson, E. L., & Wardle, J. (2003). Energy density predicts preferences for fruit and vegetables in 4-year-old children. *Appetite, 41*, 97-98.

Golan, M., & Crow, S. (2004). Parents are key players in the prevention and treatment of weight-related problems. *Nutrition Reviews, 62*, 39-50.

Goldman, S. J., Herman, C. P., & Polivy, J. (1991). Is the effect of a social model on eating attenuated by hunger. *Appetite, 17*, 129-140.

Grogan, S. C., Bell, R., & Conner, M. (1997). Eating sweet snacks: gender differences in attitudes and behaviour. *Appetite, 28*, 19-31.

Guerrieri, R., Nederkoorn, C., & Jansen, A. (2007a). How impulsiveness and variety influence food intake in a sample of healthy women. *Appetite, 48*, 119-122.

Guerrieri, R., Nederkoorn, C., & Jansen, A. (2008). The interaction between impulsivity and a varied food environment: its influence on food intake and overweight. *International Journal of Obesity, 32*, 708-714.

Guerrieri, R., Nederkoorn, C., Stankiewicz, K., Alberts, H., Geschwind, N., Martijn, C., & Jansen, A. (2007b). The influence of trait and induced state impulsivity on food intake in normal weight healthy women. *Appetite, 49*, 66-73.

Guerrieri, R., Nederkoorn, C., Schrooten, M., Martijn, C., & Jansen, A. (2009). Inducing impulsivity leads high and low restrained eaters into overeating, whereas current dieters stick to their diet. *Appetite, 53*, 93-100.

H

Harakeh, Z., Engels, R. C. M. E., Van Baaren, R. B., & Scholte, R. H. J. (2007). Imitation of cigarette smoking: An experimental study on smoking in a naturalistic setting. *Drug and Alcohol Dependence, 86*, 199-206.

Hendy, H. M. (2002). Effectiveness of trained peer models to encourage food acceptance in preschool children. *Appetite, 39*, 217-225.

Hendy, H. M., & Raudenbush, B. (2000). Effectiveness of teacher modeling to encourage food acceptance in preschool children. *Appetite, 34*, 61-76.

Herman, C. P., & Polivy, J. (1984). A boundary model for the regulation of eating. *Research publications - Association for Research in Nervous and Mental Disease, 62*, 141-156.

Herman, C. P., & Polivy, J. (2005). Normative influences on food intake. *Physiology & Behavior, 86*, 762-772.

Herman, C. P., & Polivy, J. (2008). External cues in the control of food intake in humans: The sensory-normative distinction. *Physiology & Behavior, 94*, 722-728.

Herman, C. P., & Polivy, J. (2010). Sex and gender differences in eating behavior. *Handbook of Gender Research in Psychology, 6*, 455-469.

Herman, C. P., Polivy, J., Lank, C. N., & Heatherton, T. F. (1987). Anxiety, hunger, and eating behavior. *Journal of Abnormal Psychology, 96*, 264-269.

Herman, C. P., Koenig-Nobert, S., Peterson, J. B., & Polivy, J. (2005). Matching effects on eating: Do individual differences make a difference? *Appetite, 45*, 108-109.

Herman, C. P., Roth. D. A., Polivy, J. (2003). Effects of the presence of others on food intake: A normative interpretation. *Psychological Bulletin, 129*, 873-886.

Hermans, R. C. J., Driessen, J. U. J., Anschütz, D. J.,

& Otten, R. (2013). A soon to be doctor and his three paranymphs. Just an example of how our scientific paper could have looked like. *The Eight Hour Journal, 1*, 10-12.

Hermans, R. C. J., Herman, C. P., Larsen, J. K., & Engels, R. C. M. E. (2010a). Social modeling effects on snack intake among young men. The role of hunger. *Appetite, 54*, 378-383.

Hermans, R. C. J., Engels, R. C. M. E., Larsen, J. K., & Herman, C. P. (2009a). Modeling of palatable food intake. The influence of quality of social interaction. *Appetite, 52*, 801-804.

Hermans, R. C. J., Herman, C. P., Larsen, J. K., & Engels, R. C. M. E. (2010b). Social Modeling Effects on Young Women's Breakfast Intake. *Journal of the American Dietetic Association, 110*, 1901-1905.

Hermans, R. C. J., Larsen, J. K., Herman, C. P., & Engels, R. C. M. E. (2009b). Effects of social modeling on young women's nutrient-dense food intake. *Appetite, 53*, 135-138.

Hermans, R. C. J., Larsen, J. K., Herman, C. P., & Engels, R. C. M. E. (2008). Modeling of palatable food intake in female young adults: effects of perceived body size. *Appetite, 51*, 512-518.

Hermans, R. C. J., Larsen, J. K., Herman, C. P., & Engels, R. C. M. E. (2012). How much should I eat? Situational norms affect young women's food intake during meal time. British J*ournal of Nutrition, 107*, 588-594.

Hetherington, M. M. (2007). Cues to overeat: psychological factors influencing overconsumption. *Proceedings of the Nutrition Society, 66*, 113-123.

Hetherington, M. M., Anderson, A. S., Norton, G. N. M., & Newson, L. (2006). Situational effects on meal intake: A comparison of eating alone and eating with others. *Physiology & Behavior, 88*, 498-505.

Hill, J. O., & Peters, J. C. (1998). Environmental contributions to the obesity epidemic. *Science, 280*, 1371-1374.

Howland, M., Hunger, J., & Mann, T. (2012). Friends

don't let friends eat cookies. Effects of restrictive eating norms on consumption among friends. *Appetite, 59*, 505-509.

Hruschka, D. J., Brewis, A. A., Wutich, A., & Morin, B. (2011). Shared norms and their explanation for the social clustering of obesity. *American Journal of Public Health, 101*, S295-300.

I

Iacoboni, M., Woods, R. P., Brass, M., Bekkering, H., Mazziotta, J. C., & Rizzolatti, G.
(1999). Cortical mechanisms of human imitation. *Science, 286*, 2526-2528.

J

Jacobs, H. L., & Sharma, K. N. (1969). Taste versus calories - sensory and metabolic signals in control of food intake. *Annals of the New York Academy of Sciences, 157*, 1084-1125.

Jansen, A. (1998). A learning model of binge eating: Cue reactivity and cue exposure. *Behaviour Research and Therapy, 36*, 257-272.

Jansen, A., Nederkoorn, C., van Baak, L., Keirse, C., Guerrieri, R., & Havermans, R. C. (2009). High-restrained eaters only overeat when they are also impulsive. *Behaviour Research and Therapy, 47*, 105-110.

Jefferis, V. E., van Baaren, R., & Chartrand, T. L. (2003). *The functional purpose of mimicry for creating interpersonal closeness*. The Ohio State University.

Johnston, L. (2002). Behavioral mimicry and stigmatization. *Social Cognition, 20*, 18-35.

K

Kauffman, N. A., Herman, C. P., & Polivy, J. (1995). Hunger-induced finickiness in humans.
Appetite, 24(3), 203-218.

Keenan, T., & Evans, S. (2009). An introduction to child development. London: Sage.

Knoblich, G., & Sebanz, N. (2006). The social nature of perception and action. *Current Directions in Psychological Science, 15*, 99-104.

Koh, J., & Pliner, P. (2009). The effects of degree of acquaintance, plate size, and sharing on food intake. *Appetite, 52*, 595-602.

Koordeman, R., Kuntsche, E., Anschütz, D. J., van Baaren, R. B., & Engels, R. C. M. E. (2011). Do we Act upon what we see? Direct effects of alcohol cues in movies on young adults' alcohol drinking. *Alcohol and Alcoholism, 46*, 393-398.

Kristeller, J. L., & Hallett, C. B. (1999). An exploratory study of a meditation-based intervention for binge eating disorder. *Journal of Health Psychology, 4*, 357-363

Krones, P. G., Stice, E., Batres, C., & Orjada, K. (2005). In vivo social comparison to a thin-ideal peer promotes body dissatisfaction: A randomized experiment. *International Journal of Eating Disorders, 38*, 134-142.

L

Lafrance, M., & Ickes, W. (1981). Posture mirroring and interactional involvement - sex and sex typing effects. *Journal of Nonverbal Behavior, 5*, 139-154.

Lakin, J. L., & Chartrand, T. L. (2003). Using nonconscious behavioral mimicry to create affiliation and rapport. *Psychological Science, 14*, 334-339.

Lakin, J. L., Jefferis, V. E., Cheng, C. M., & Chartrand, T. L. (2003). The chameleon effect as social glue: Evidence for the evolutionary significance of nonconscious mimicry. *Journal of Nonverbal Behavior, 27*, 145-162.

Larsen, H., Engels, R., Souren, P. M., Granic, I., & Overbeek, G. (2010). Peer influence in a micro-perspective: Imitation of alcoholic and non-alcoholic beverages. *Addictive Behaviors, 35*, 49-52.

Laible, D., Thompson, R. A. (2007). Early socialization: A relationship perspective. In Grusec, J. E., Hastings, P. D., (eds.). Handbook of Socialization: *Theory and Research*. New York: The Guilford Press.

Leahey, T. M., Gokee LaRose, J., Fava, J. L., & Wing, R. R. (2011). Social influences are associated with BMI and weight loss intentions in young adults. *Obesity, 19*, 1157-1162.

Leary, M. R. (1995). Self-presentation: Impression management and interpersonal behavior. Madison, WI: Brown and Benchmark Publishers.

Leary, M. R., Nezlek, J. B., Downs, D., Radford-Davenport, J., Martin, J., & McMullen, A. (1994). Self-presentation in everyday interaction - effects of target familiarity and gender composition. *Journal of Personality and Social Psychology, 67*, 664-673.

Leary, M. R., Tchividijian, L. R., & Kraxberger, B. E. (1994). Self-presentation can be hazardous to your health - Impression management and health risks. *Health Psychology, 13*, 461-470.

Leone, T., Herman, C. P., & Pliner, P. (2008). Perceptions of undereaters: A matter of perspective? *Personality and Social Psychology Bulletin, 34*, 1737-1746.

Leone, T., Pliner, P., & Herman, C. P. (2007). Influence of clear versus ambiguous normative information on food intake. *Appetite, 49*, 58-65.

Levine, J. M., & Zentall, T. R. (1974). Effect of conspecifics presence on deprived rats performance-social facilitation vs distraction-imitation. Animal *Learning & Behavior, 2*, 119-122.

Lijffijt, M., Bekker, E. M., Quick, E. H., Bakker, J., Kenemans, J. L., Verbaten, M. N. (2004). Differences between low and high trait impulsivity are not associated with differences in inhibitory motor control. J*ournal of Attention Disorders, 8*, 25–32.

Lochbuehler, K., Voogd, H., Scholte, R. H. J., & Engels, R. C. M. E. (2011). Attentional bias in smokers: exposure to dynamic smoking cues in contemporary movies. *Journal of Psychopharmacology, 25*, 514-519.

Logan, G. D., & Cowan, W. B. (1984). On the ability to inhibit thought and action: a theory of an act of control. *Psychological Reviews, 91*, 295-327.

Lohman, T. G., Roche, A. F., & Martorell, R. (1988). *Anthropometric standardization reference manual.* Champaign, IL: Human Kinetics.

M

Martins, Y. Pliner, P., & Lee, C. (2004). The effect of meal size and body size on individuals' impressions of males and females. *Eating Behaviors, 5*, 117–132.

McFerran, B., Dahl, D. W., Fitzsimons, G. J., & Morales, A. C. (2010). I'll have what she's having: effects of social influence and body type on the food choices of others. J*ournal of Consumer Research, 36*, 915-929.

Meyers, R. J., Smith, J. E., & Lash, D. N. (2003). The Community Reinforcement Approach. *Recent Developments in Alcoholism, 16*, 183-195.

Meyers, R. J., Villanueva, M., & Smith, J. E. (2005). The Community Reinforcement Approach: history and new directions. *Journal of Cognitive Psychotherapy, 19*, 251-264.

Mintz, S. W., & Du Bois, C. M (2002). The anthropology of food and eating. *Annual Review of Anthropology, 31*, 99-119.

Mogg, K., Bradley, B. P., Hyare, H., & Lee, S. (1998). Selective attention to food-related stimuli in hunger: are attentional biases specific to emotional and psychopathological states, or are they also found in normal drive states? *Behaviour Research and Therapy, 36*, 227-237.

Mogg, K., Bradley, B. P., Field, M., & De Houwer, J. (2003). Eye movements to smoking-related pictures in smokers: relationship between attentional biases and implicit and explicit measures of stimulus valence. *Addiction, 98*, 825-836

Mori, D., Chaiken, S., & Pliner, P. (1987). Eating lightly and the self-presentation of femininity. *Journal of Personality and Social Psychology, 53*, 693-702.

Murcott, A. (1982). The cultural significance of food and eating. *Proceedings of the Nutrition Society, 41*, 203-210.

Muthén, L. K., & Muthén, B. O. (2007). Mplus statistical analysis with latent variables user's guide. Los Angeles, CA.

N

Nederkoorn, C., Braet, C., Van Eijs, Y., Tanghe, A., &

Jansen, A. (2006). Why obese children cannot resist food: the role of impulsivity. *Eating Behaviors, 7*, 315-322.

Nederkoorn, C., Houben, K., Hofmann, W., Roefs, A., & Jansen, A. (2010). Control yourself or just eat what you like? Weight gain over a year is predicted by an interactive effect of response inhibition and implicit preference for snack foods. *Health Psychology, 29*, 389-393.

Nicolaidis, S., & Even, P. (1985). Physiological determinant of hunger, satiation, and satiety. American *Journal of Clinical Nutrition, 42*, 1083-1092.

Nijs, I. M. T., Muris, P., Euser, A. S., & Franken, I. H. A. (2010). Differences in attention to food and food intake between overweight/obese and normal weight females under conditions of hunger and satiety. *Appetite, 54*, 243-254.

Nisbett, R. E., & Storms, M. D. (1974). Cognitive and social determinants of food intake. In H. London & R. E. Nisbett (Eds.), *Thought and feeling: cognitive alteration of feeling states* (pp. 190-208). Chicago: Aldine.

Noteboom, E. (2012). The artist who illustrated his thesis. Retrieved from http://www.elmarnoteboom.com. Check him out!

O

Olszewski, P. K., & Levine, A. S. (2007). Central opioids and consumption of sweet tastants: When reward outweighs homeostasis. *Physiology & Behavior, 91*, 506-512.

P

Pantalon, M. V., Chawarski, M. C., Falcioni, J., Pakes, J., & Schottenfeld, R. S. (2004). Linking process and outcome in the community reinforcement approach for treating cocaine dependence: a preliminary report. *American Journal of Drug and Alcohol Abuse, 30*, 353-367.

Papas, M. A., Alberg, A. J., Ewing, R., Helzlsouer, K. J., Gary, T. L., & Klassen, A. C.(2007). The built environment and obesity. *Epidemiologic Reviews, 29*, 129-143.

Patel, K. A., & Schlundt, D. G. (2001). Impact of moods and social context on eating behavior. *Appetite, 36*, 111-118.

Patrick, H., & Nicklas, T. A. (2005). A review of family and social determinants of children's eating patterns and diet quality. *Journal of the American College of Nutrition, 24*, 83-92.

Patton, J. H., Stanford, M. S., & Barratt, E. S. (1995). Factor structure of the Barratt Impulsiveness Scale. *Journal of Clinical Psychology, 51*, 768-774.

Pearson, N., Biddle, S. J. H., & Gorely, T. (2009). Family correlates of breakfast consumption among children and adolescents. A systematic review. *Appetite, 52*, 1-7.

Pliner, P., & Chaiken, S. (1990). Eating, social motives, and self-presentation in women and men. *Journal of Experimental Social Psychology, 26*, 240-254.

Pliner, P., & Mann, N. (2004). Influence of social norms and palatability on amount consumed and food choice. *Appetite, 42*, 227-237.

Polivy, J., Heatherton, T. F., & Herman, C. P. (1988). Self-esteem, restraint, and eating behavior. *Journal of Abnormal Psychology, 97*, 354-356.

Polivy, J., & Herman, C. P. (1983). Breaking the diet habit. New York: Basic Books.

Polivy, J., Herman, C. P., & Coelho, J. S. (2008). Caloric restriction in the presence of attractive food cues: external cues, eating, and weight. *Physiology & Behavior, 94*, 729-733.

Polivy, J., Herman, C. P., Younger, J. C., & Erskine, B. (1979). Effects of a model on eating behavior - Induction of a restrained eating style. *Journal of Personality, 47*, 100-117.

Pollak Levine, S., & Feldman, R. S. (1997). Self-presentational goals, self monitoring, and nonverbal behavior. *Basic and Applied Social Psychology, 19*, 505–518.

Puhl, R., & Brownell, K. D. (2001). Bias, discrimination, and obesity. *Obesity Research, 9*, 788-805.

Puhl, R. M., Schwartz, M. B., & Brownell, K. D. (2005).

Impact of perceived consensus on stereotypes about obese people: A new approach for reducing bias. *Health Psychology, 24*, 517-525.

Q

Quigley, B. M., & Collins, R. L. (1999). The modeling of alcohol consumption: A meta-analytic review. *Journal of Studies on Alcohol, 60*, 90-98.

R

Redd, M., & de Castro, J. M. (1992). Social facilitation of eating - Effects of social instruction on food-intake. *Physiology & Behavior, 52*, 749-754.

Renna, F., Grafova, I. B., & Thakur, N. (2008). The effect of friends on adolescent body weight. *Economics & Human Biology, 6*, 377-387.

Rizzolatti, G., Fogassi, L., & Gallese V. (2001). Neurophysiological mechanisms underlying the understanding and imitation of action. *Nature Reviews Neuroscience, 2*, 661-670.

Robinson, T. E., & Berridge, K. C. (2003). Addiction. *Annual Review of Psychology, 54*, 25-53.

Robinson, E., & Higgs, S. (2012). Food choices in the presence of 'healthy' and 'unhealthy' eating partners. *British Journal of Nutrition*. May 30:1-7. [Epub ahead of print]

Robinson, E., Tobias, T., Shaw, L., Freeman, E., & Higgs, S. (2011). Social matching of food intake and the need for social acceptance. *Appetite, 56*, 747-752.

Rodin, J., Silberstein, L., & Striegelmoore, R. (1984). Women and weight - A normative discontent. *Nebraska Symposium on Motivation, 32*, 267-307.

Rolls, B. J., Fedoroff, I. C., & Guthrie, J. F. (1991). Gender differences in eating behavior and body weight regulation. *Health Psychology, 10*, 133-142.

Rolls, B. J., Morris, E. L., & Roe, L. S. (2002). Portion size of food affects energy intake in normal weight and overweight men and women. *American Journal of Clinical Nutrition, 76*, 1207-1213.

Rolls, B. J., Roe, L. S., Kral, T. V. E., Meengs, J. S., & Wall, D. E. (2004). Increasing the portion size of a packaged snack increases energy intake in men and

women. *Appetite, 42*, 63-69.

Rolls, B. J., Roe, L. S., & Meengs, J. S. (2006). Larger portion sizes lead to a sustained increase in energy intake over 2 days. *Journal of the American Dietetic Association, 106*, 543-549.

Rolls, B. J., Rolls, E. T., & Rowe, E. A. (1982). The influence of variety on human food intake and selection. In L. M. Barker (Ed.), *The psychobiology of human food selection* (pp. 101-122). Westport, CT: AVL.

Romero, N. D., Epstein, L. H., & Salvy, S. J. (2009). Peer Modeling Influences Girls' Snack
Intake. *Journal of the American Dietetic Association, 109*, 133-136.

Rosenthal, B., & Marx, R. D. (1979). Modeling influences on the eating behavior of successful and unsuccessful dieters and untreated normal weight individuals. *Addictive Behaviors, 4*, 215-221.

Rosenthal, B., & McSweeney, F. K. (1979). Modeling influences on eating behavior. A*ddictive Behaviors, 4*, 205-214.

Roth, D. A., Herman, C. P., Polivy, J., & Pliner, P. (2001). Self-presentational conflict in social eating situations: a normative perspective. *Appetite, 36*, 165-171.

Rotenberg, K. J., Lancaster, C., Marsden, J., Pryce, S., Williams, J., & Lattimore, P. (2005). Effects of priming thoughts about control on anxiety and food intake as moderated by dietary restraint. *Appetite, 44*, 235-241.

Rozin, P. (2005). The meaning of food in our lives: a cross-cultural perspective on eating and well-being. Journal of Nutrition *Education and Behavior, 37*, S107-S112.

S

Salvy, S. J., Coelho, J. S., Kieffer, E., & Epstein, L. H. (2007b). Effects of social contexts on overweight and normal weight children's food intake. *Physiology & Behavior, 92*, 840-846.

Salvy, S. J., Jarrin, D., Paluch, R., Irfan, N., & Pliner, P. (2007c). Effects of social influence on eating in couples, friends and strangers. *Appetite, 49*, 92-99.

Salvy, S. J., Kieffer, E., & Epstein, L. H. (2008a). Effects of social context on overweight and normal weight children's food selection. *Eating Behaviors, 9*, 190-196.

Salvy, S. J., Romero, N., Paluch, R., & Epstein, L. H. (2007a). Peer influence on pre-adolescent girls' snack intake: Effects of weight status. *Appetite, 49*, 177-182.

Salvy, S. J., Vartanian, L. R., Coelho, J. S., Jarrin, D., & Pliner, P. P. (2008). The role of familiarity on modeling of eating and food consumption in children. *Appetite, 50*, 514-518.

Schachter, S. (1971). Some extraordinary facts about obese humans and rats. *American Psychologist, 26*, 129-144.

Schwartz, M. B., & Puhl, R. (2003). Childhood obesity: a societal problem to solve. *Obesity reviews : an official journal of the International Association for the Study of Obesity, 4*, 57-71.

Smeets, E., Roefs, A., & Jansen, A. (2009). Experimentally induced chocolate craving leads to an attentional bias in increased distraction but not in speeded detection. *Appetite, 53*, 370-375.

Smith, P. M., & Ferguson, A. V. (2008). Neurophysiology of hunger and satiety. *Developmental Disabilities Research Reviews, 14*, 96-104.

Smith, J. E., Meyers, R. J., & Miller, W. R. (2001). The community reinforcement approach to the treatment of substance use disorders. *The American Journal on Addictions, 10*, 51-59.

Solanto, M. V., Abikoff, H., Sonuga-Barke, E., Schachar, R., Logan, G. D., Wigal, T., et al., (2001). The ecological validity of delay aversion and response inhibition as measures of impulsivity in AD/HD: A supplement to the NIMH multimodal treatment study of AD/HD. *Journal of Abnormal Child Psychology, 29*, 215-228.

Statistics Netherlands (2010). Health, Lifestyle, Use of Medical Facilities. Version current 16 March 2010. http://tinyurl.com3yvv83k (accessed 28 September 2010).

Stel, M., Van Baaren, R. B., & Vonk, R. (2008). Effects of mimicking: Acting prosocially by being emotionally

moved. *European Journal of Social Psychology, 38*, 965-976.

Stice, E., Spoor, S., Ng, J., & Zald, D. H. (2009). Relation of obesity to consummatory and anticipatory food reward. *Physiology & Behavior, 97*, 551-560.

Strack, F., Werth, L., & Deutsch, R. (2006). Reflective and impulsive determinants of consumer behavior. *Journal of Consumer Psychology, 16*(3), 205-216.

Stroebele, N., De Castro, J. M. (2004). Effect of ambience on food intake and food choice. *Nutrition, 20*, 821-838.

Stunkard, A. J., Sorensen, T., & Schulsinger, F. (1983). Use of the Danish Adoption Register for the study of obesity and thinness. *Association for Research in Nervous and Mental Disease, 60*, 115-120.

T

Tapper, K., Pothos, E. M., Fadardi, J. S., & Ziori, E. (2008). Restraint, disinhibition and food-related processing bias. *Appetite, 51*, 335-338.

Tetley, A., Brunstrom, J., & Griffiths, P. (2009). Individual differences in food-cue reactivity.
The role of BMI and everyday portion-size selections. *Appetite, 52*, 614-620.

Trogdon, J. G., Nonnemaker, J., & Pais, J. (2008). Peer effects in adolescent overweight.
Journal of Health Economics, 27, 1388-1399.

Turner, J. (1985). Social categorization and the self-concept: a social cognitive theory of group behavior. In E. J. Lawler (Ed.), *Advances in Group Processes* (pp. 77-122). Greenwich, CT; JAI.

V

Van Baaren, R., Janssen, L., Chartrand, T. L., & Dijksterhuis, A. (2009). Where is the love? The social aspects of mimicry. Philosophical Transactions of the Royal Society of Biological Sciences, 364, 2381-2389.

Van der Horst, K., Oenema, A., Ferreira, I., Wendel-Vos, W., Giskes, K., van Lenthe, F., & Brug, J. (2007). A systematic review of environmental correlates of obesity-related dietary behaviors in youth. *Health Education Research, 22*, 203-226.

Van Straaten, I., Engels, R. C. M. E., Finkenauer, C., & Holland, R. W. (2009). Meeting your match: How attractiveness similarity affects approach Behavior in mixed-sex dyads. *Personality and Social Psychology Bulletin, 35*, 685-697.

Van Strien, T. (2005). *Nederlandse Vragenlijst voor Eetgedrag 2005. Handleiding en verantwoording*. Amsterdam: Boom test uitgevers.

Van Strien, T., Engels, R., van Staveren, W., & Herman, C. P. (2006). The validity of dietary restraint scales: Comment on Stice et al. (2004). *Psychological Assessment, 18*, 89-94.

Van Strien, T., Frijters, J. E. R., Bergers, G. P. A., & Defares, P. B. (1986). The Dutch Eating Behaviour Questionnaire (DEBQ) for assessment of restrained, emotional, and external eating behaviour. *International Journal of Eating Disorders, 5*, 295-315.

Vartanian, L. R., Herman, C. P., & Polivy, J. (2007). Consumption stereotypes and impression management: How you are what you eat. *Appetite, 48*, 265-77.

Vartanian, L. R., Herman, C. P., & Wansink, B. (2008). Are we aware of the external factors of the external factors that influence our food intake? *Health Psychology, 27*, 533-538.

W

Wansink, B. (2006). *Mindless Eating: Why We Eat More Than We Think*. New York, NY: Bantam Dell.

Wansink, B., & Kim, J. (2005). Bad popcorn in big buckets: Portion size can influence intake as much as taste. Journal of Nutrition Education and Behavior, 37, 242-245.

Weijzen, P. L. G., Liem, D. G., Zandstra, E. H., & de Graaf, C. (2008). Sensory specific satiety and intake: The difference between nibble- and bar-size snacks. *Appetite, 50*, 435-442.

Werthmann, J., Roefs, A., Nederkoorn, C., Mogg, K., Bradley, B. P., & Jansen, A. (2011). Can(not) take my eyes off it: Attention bias for food in overweight participants. *Health Psychology, 30*, 561-569.

Wilson, T. D., & Brekke, N. (1994). Mental contamination

and mental correction - unwanted influences on judgments and evaluations. *Psychological Bulletin, 116*, 117-142.

Wong, C. L., & Mullan, B. A. (2009). Predicting breakfast consumption: An application of the theory of planned behaviour and the investigation of past behaviour and executive function. *British Journal of Health Psychology, 14*, 489-504.

Wood, W., Christensen, P. N., Hebl, M. R., & Rothgerber, H. (1997). *Conformity to sex-typed norms, affect, and the self-concept. Journal of Personality and Social Psychology, 73*, 523-535.

World Health Organization (2010). *Global Database on Obesity*. http://tinyurl.com/nvs7gp (accessed 28 September 2010).

Y

Yabar, Y., Johnson, L., Miles, L., & Peace, V. (2006). Implicit behavioral mimicry: Investigating the impact of group membership. J*ournal of Nonverbal Behavior, 30*, 97-113.

Young, L. R., & Nestle, M. (2002). The contribution of expanding portion sizes to the US obesity epidemic. *American Journal of Public Health, 92*, 246-249.

Z

Zentall, T. R., & Levine, J. M. (1972). Observational learning and social facilitation in rat. *Science, 178*, 1220-1221.

Publications in this thesis

International publications (in order of appearance)

Hermans, R. C. J., Larsen, J. K., Herman, C. P., & Engels, R. C. M. E. (2008). Modeling of palatable food intake in female young adults. Effects of perceived body size. *Appetite*, *51*, 512-518.

Hermans, R. C. J., Larsen, J. K., Herman, C. P., & Engels, R. C. M. E. (2009). Effects of social modeling on young women's nutrient-dense food intake. *Appetite*, *53*, 135-138.

Hermans, R. C. J., Engels, R. C. M. E., Larsen, J. K., & Herman, C. P. (2009). Modeling of palatable food intake. The influence of the quality of social interaction. *Appetite*, 52, 801-804.

Hermans, R. C. J., Herman, C. P., Larsen, J. K., , & Engels, R. C. M. E. (2010). Social modeling effects on young women's breakfast intake. *Journal of the American Dietetic Association*, *110*, 1901-1905.

Hermans, R. C. J., Herman, C. P., Larsen, J. K., , & Engels, R. C. M. E. (2010). Social modeling effects on snack intake among young men. The role of hunger. *Appetite*, *54*, 378-383.

Hermans, R. C. J., Larsen, J. K., Herman, C. P., & Engels, R. C. M. E. (2012). How much should I eat? Situational norms affect young women's food intake. *British Journal of Nutrition*, *107*, 588-594.

Hermans, R. C. J., Lichtwarck-Aschoff, A., Bevelander, K. E., Herman, C. P., Larsen, J. K., & Engels, R. C. M. E. (2012). Mimicry of food intake: The dynamic interplay between eating companions. PLoSONE, *7(2)*.

Hermans, R.C.J., Larsen, J.K., Lochbuehler, K., Nederkoorn, C., Herman, C. P., & Engels, R.C.M.E. (2012). The power of social influence over food intake: examining the effects of attentional bias and attentional bias. *British Journal of Nutrition*, *May 9*: 1-9 [Epub ahead of print]

Salvy, S-J., Hermans, de la Haye, K., Bowker, J., & Hermans, R. C. J. (2012). Influence of peers and friends on children's and adolescent's eating and activity behaviors. *Physiology & Behavior*, *106*, 369-378.

Hermans, R.C.J., Salvy, S-J., Larsen, J.K., & Engels, R.C.M.E. (2012). Examining the effects of remote-video confederates on young women's food intake. *Eating Behaviors*, *13*, 246-251.

National publications (in order of appearance)

Hermans, R. C. J., Larsen, J. K., & Engels, R. C. M. E. (2008). Zien eten doet eten: een experimentele studie naar imitatie van eetgedrag bij vrouwen. *Psychologie & Gezondheid*, *38*, 163-170.

Hermans, R. C. J., Larsen, J. K., & Engels, R. C. M. E. (2010). Een goed begin van de dag: een experimentele studie naar imitatie-effecten van ontbijtgedrag. *Psychologie & Gezondheid*, *36*, 191-199.

Hermans, R. C. J., Bevelander, K. E., Larsen, J. K., & Engels, R. C. M. E. (2011). Het effect van portiegrootte en het eetgedrag van anderen op het eetgedrag van anderen. *Nederlands Tijdschrift voor Voeding & Diëtetiek*, *66*, s1-s7.

Hermans, R. C. J., Lichtwarck-Aschoff, A., Bevelander, K. E., Engels, R. C. M. E., Larsen, J.K. (resubmitted to *Nederlands Tijdschrift voor Voeding & Diëtetiek*). Samen eten: een kwestie van aanpassen? Een

experimentele studie naar imitatie van eetgedrag bij jonge vrouwen.

Other Publications (in order of appearance)

Engels, R. C. M. E., Hermans, R. C. J., van Baaren, R., Hollenstein, T., & Bot, S. M. (2009). Alcohol portrayal on television affects actual drinking behaviour. *Alcohol & Alcoholism*, *44*, 244-249.

Larsen, J. K, Hermans, R. C. J., & Engels, R. C. M. E. (2012). Food intake in response to food-cue exposure: Examining the influence of duration of the cue exposure and trait impulsivity. *Appetite*, *58*, 907-913.

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-Henry Ford-

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"Many hands make light work"
-John Heywood-

Het opzetten en uitvoeren van 10 experimenten in 5 jaar tijd is geen misselijke opgave. Zonder de inzet van "mijn" studenten had ik nu nog in het lab gezeten! Maartje, Florien, Moniek, Evelien, Cynthia, Anneliek, Sanne, Esther, Steffi, Louise, Audrey, Mariole, Femke, Joyce, Jolique, Tine, Sterre, & Annemijn. Super bedankt voor al het werk dat jullie verzet hebben! Ook wil ik graag de acteurs en actrices bedanken die me hebben geholpen om onze proefpersonen om de te tuin te leiden. Iris, Fleur, Merel, Annelies, Esther, Sophie, Tessa, Elise, Monique, Aike, Ron, Roel, Stijn, Jurieël, Esther, Rian, Maartje, Michelle, Sharon, & Ilse. Jullie hebben mij én de wetenschap een goede dienst bewezen,

maar daar moesten jullie wel een offer voor brengen. Sorry, voor die enorme hoeveelheden M&M's, borrelnootjes en warme maaltijden (750g magnetron boerenkool!) die jullie misschien niet wilden, maar MOESTEN eten van mij ☺

Als experimenteel onderzoeker moet je niet alleen een goed idee hebben, maar je moet het ook (goed!) uit kunnen voeren. *Gerard, Hubert, & Pascal,* super bedankt voor jullie creatieve oplossingen op het gebied van audio, video- of licht! De ICT-afdeling: *Igor, André, Harry en Nicolette.* Bedankt voor jullie hulp bij computerstoringen, verlopen software licenties en allerlei andere ICT-gerelateerde problemen. *Rinske,* bedankt voor de hulp bij het analyseren van de data van enkele experimenten. Mijn "ik heb maar 10 minuten nodig" liepen steevast uit op afspraken van een uur…. Bedankt voor je tijd en geduld! *Ronny,* het BSI kan zich geen betere labbeheerder wensen! Dank voor je hulp en met name je praatje wanneer ik me weer eens verveelde daar in B004a. Dames van het secretariaat. *Lonneke, Katja, Diana, Claudia, & Hedwig.* Bedankt voor het opknappen van de kleine klusjes en jullie "open-deur."

"Pleasure in the job puts perfection in the work"
-Aristoteles-

De *collega's van de 6e.* Het gaat wat ver om jullie allemaal persoonlijk toe te spreken (al zou ik dat voor elkaar krijgen ☺), maar ik wil jullie graag allemaal SUPER bedanken voor de vijf mooie jaren! Gezelligheid is jullie niet vreemd. Ik kijk dan ook met veel plezier terug op de vele leuke, onverwachte en grappige gesprekken die ik met ieder van jullie wel ergens gevoerd heb in één van de vele kroegen in of rondom Nijmegen! Proost!

Een paar collega's wil ik toch nog graag in het bijzonder bedanken.
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Doeschka, mijn eerste kamergenoot: je had een weekje nodig om aan me te wennen, maar daarna waren we onafscheidelijk. Jij maakte AIO-zijn extra leuk! Jouw werklust, creativiteit en intellect werkten aanstekelijk en zorgden ervoor dat ik het uiterste van mezelf vroeg. Of het nu met de deur open was, of met de deur dicht ☺ A06.02 rockte hard! En als we niet alles op het werk besproken kregen, praatten we gewoon verder in de kroeg of restaurant. Ik ben super blij dat je nog een keer achter me staat als paranimf! *Carmen,* roomey nummer 2. Mijn kipje was nauwelijks weg of ik kreeg de unieke kans om jou te "adopteren". Een klein zwaluwtje, helemaal voor mezelf. Mijn excuses voor de momenten dat ik je uit je "proefschriftflow" haalde, maar online shoppen naar kleding, meubels en allerlei andere bizarre dingen is óók leuk, toch? Jij gaf A06.02 nieuw elan, met de introductie van zwevende minimal sets en bonkende techno. Dank voor de ontspannende en mega-coole laatste maanden! *Roy,* na 5 jaar de kamer gedeeld te hebben met vrouwen die een "clean-desk policy" hanteerden, moest ik even wennen aan jouw "opgeruimdheid". Maar… Jij maakt elke werkdag tot een feestje! Eindelijk iemand waar ik de

meest flauwe grappen, (bizarre) ideeën en hersenspinsels mee kan delen. Maar jij bent meer dan dat ☺ Super fijn dat we ook goede (en diepgaande) gesprekken over nieuw onderzoek (To deplete or not to deplete, that's the question!), het leven, het heelal én de liefde kunnen hebben. Hopelijk mag ik dit nog lang met je delen, ouwe kadaverton! Cool dat óók jij achter me staat als paranimf!

"Werken is leuk. Maar andere dingen zijn nóg veel leuker"
-ondergetekende-

Orion-boys. Bedankt voor de uitlaatklep op dinsdag, donderdag en zondag (en vrijdag en/of zaterdag). "Het kan dooien, het kan vriezen, we kunnen winnen of verliezen, maar een beet're club dan deze is er niet" [6]. Jullie zijn een hele grote in MIJN boekje. JWZ ☺

Gulden Vlies bewoners. Steffie, Fleur, Alfred, Michel en Anneli. De overgang van een 'easy-going' studentenleven naar een ambitieuze baan als promovendus is niet zo eenvoudig. Na een dag nadenken is er dan ook niets relaxter dan thuis komen in een huis met allemaal fijne huisgenoten, waar niets moet maar alles kan! Bedankt voor de vele mooie jaren en memorabele avondjes!

Hoewel sommige van de nu volgende personen hun vraagtekens zetten bij het 'arbeidsethos' op de universiteit (lees: uit eten, borrelen, werkweken in Frankrijk) en meermaals hun twijfels hebben geuit over mijn "werktijden" (10 tot 4 ☺), hebben jullie er wel voor gezorgd dat ik op de juiste momenten stoom kon afblazen.

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[6] Wrample (alias written sample): uit Dit is mijn club van Jiskefet.

Samen naar Australië, het EK in Oostenrijk en Zwitserland en Lowlands. Jij bent episch gezelschap! *Coenen.* Jij geeft het begrip koppigheid een andere dimensie. Het laatste woord is nu een keer aan mij. Dank voor je luisterend oor en de vele 100-punten avonden! “Hoe nu verder? Ja, lampies erin!” [7] *Camiel.* Oppervlakkigheid én diepgang☺ Bedankt voor de smerige film tips, de cult-klassiekers en de bonkende dubstep beats, maar ook de filosofische gesprekken op de terugweg van een avondje stappen. P’z. Daarnaast ook super bedankt dat je de inhoud van dit proefschrift z’n eigen smoelwerk hebt gegeven! *Erik.* Als er iemand zichzelf is ben jij het. Jij bent A.A.N. Bedankt voor je motiverende en uitdagende gesprekken. *Jelle.* In goede én slechte tijden. Een betere vriend kan ik me niet wensen! Ik ben blij én trots dat ik jou als paranimf achter me heb staan tijdens deze mijlpaal. Thanks man! *Noortje.* Wanneer ik ga zweven als doctor ben jij de eerste die me met beide benen op de grond zal zetten. Bedankt voor je adviezen, meningen en luisterend oor. Zonder Jelle en jou had dit proefschrift nog wel even op zich laten wachten. Bedankt voor jullie ‘open deur’ toen ik die zo nodig had. Much appreciated!

Aukje. ‘Niet meer wij, maar ik en jij’. [8] Ik ben dankbaar voor de vele mooie momenten die we samen hebben beleefd. Bij jou kon ik mezelf zijn en even ontsnappen uit het wetenschappelijk regime. Sorry nog van die winegums en de ongevraagde wetenschappelijke observaties aan de eettafel…..

Ankie & Jolanda. Ankie. Grote zus. Ik ben trots op je! Kleine broertjes worden groot. Ik kom er steeds meer achter dat we meer op elkaar lijken dan dat we vroeger dachten. Fijn dat ik altijd bij je terecht kan! Jolanda. Dank voor je “spiegel”. Relaxed dat ik me even kon terugtrekken in jullie fijne huis om te schrijven aan dit proefschrift. Bedankt voor de gastvrijheid! Super cool dat Flore nu voorgelezen kan worden uit een boek dat door haar eigen oom geschreven is☺

[7] Wrample: uit Tiny & Lau met kerst.
[8] Wrample: uit ’t Gaat te Fur met Aila van de Jeugd van Tegenwoordig.

Pap & Mam. Jullie geven me de ruimte en onvoorwaardelijke liefde die ik nodig heb. Jullie laten me doen wat ik denk dat goed is. Maar wanneer het even niet loopt zoals ik wil, weet ik dat ik altijd bij jullie terecht kan voor een advies of steuntje in de rug. Jullie zorg is me dierbaar en hoop er nog lang van te mogen genieten!

Ik heb geschreven.

Curriculum Vitae

Roel Cornelis Joseph Hermans was born in Roermond, the Netherlands on May 27th, 1984. Despite several years of peer deviancy training and his "bad" behavior actively monitored by his teachers throughout the years, he managed to complete secondary school (VWO) in 2002. Given his personal interests in peer pressure and adolescents' risky behavior, he then studied Pedagogical Science at the Radboud University Nijmegen, where he graduated in 2007. His master thesis, entitled *'Watching is Drinking. The influence of movie images on adolescents' alcohol use',* received widespread media-attention and was awarded the best master's thesis of 2006-2007 from the Faculty of Social Sciences at the Radboud University. Directly after receiving his degree in Social Sciences, Roel began his PhD project at the Developmental Psychopathology department of the same university. The overall aim of his PhD – supervised by Rutger Engels, Junilla Larsen, and Peter Herman (University of Toronto, CA) – was to gain insight into the circumstances under which individuals are more likely to model the food intake of others. The findings of his research project appeared in national and international newspapers and magazines, such as *The Daily Mail* and *Quest Psychologie* and on national television (*Noorderlicht Nieuws*) and radio (*Hoe?Zo! radio*). In addition to his research, he co-organized several colloquia to enhance (inter)national collaboration with researchers outside of the Radboud University's Behavioural Science Institute (BSI) and he was an active member of the BSI's PhD student platform (2009-2011). Gaining insight into *why* and *how* the social environment influences children's, adolescents' and adults' health behavior is one of his main research interests. Currently, he is working as a postdoctoral fellow collaborating on a project focused on reducing adolescents' substance-use in social contexts by using a cue-reminder intervention (funded by ZonMW).