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Research report

# Modeling of eating style and its effect on intake ☆

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ABSTRACT

Observational research has indicated that modeling of eating style might occur when eating in the presence of an eating companion. This experiment investigated the effect of bite frequency of a same-sex eating companion on bite frequency, meal size and meal duration. A total of 30 normal weight young adults (m/f = 8/22, age: 21.2 ± 1.9 years, BMI: 21.2 ± 1.6 kg/m$^2$) had three ad libitum meals together with a same-sex confederate (i.e. instructed eating companion). Confederates were instructed to eat at a slow (3 bites/min), medium (5 bites/min) or fast (7 bites/min) bite frequency in randomized order. Eating style was assessed through video registration and weighing left-overs. It was found that the participants' bite frequency was similar during all three conditions, i.e. slow: 3.9 ± 1.3, medium: 4.0 ± 1.1, fast: 4.0 ± 1.3 bites/min ($p = 0.75$), as was average bite size (11 ± 2.6 g). Time eaten of the participants was shorter in the medium (14.9 ± 3.6 min) and fast condition (14.4 ± 3.7 min) compared to the slow condition (16.8 ± 4.8 min) (post hoc in both cases $p < 0.01$), and intake was lower in the medium (634 ± 183 g) and fast condition (624 ± 190 g) compared to the slow condition (701 ± 220 g) (post hoc in both cases $p < 0.05$). This experimental study suggests that bite frequency is not affected by the confederate. However, the meal duration of the confederates showed a significant effect on the meal duration and meal size of the participants. It seems that intake was influenced as a result of copying meal termination.



## Introduction

Many factors affect the amount of food that people ingest. These factors can be roughly divided into three categories: (1) the food, e.g. palatability and physical structure of the food (e.g. Viskaal-van Dongen, Kok, & de Graaf, 2011); (2) the individual, i.e. psychological and physiological factors (Story, Neumark-Sztainer, & French, 2002); and (3) the environment, e.g. the surroundings or the presence of others during eating (e.g. Wansink, 2004). Modeling of intake is an example of the latter category; it can be defined as the process during which food intake is affected by the intake of an eating companion (Herman, Roth, & Polivy, 2003).

It has been shown repeatedly that people adjust their intake to that of others; i.e. people eat more when their eating companion eats more and they eat less when their eating companion eats less (e.g. Goldman, Herman, & Polivy, 1991; Herman et al., 2003; Hermans, Larsen, Herman, & Engels, 2008). A clear example is the study by Goldman et al. (1991). In this study, confederates were instructed to eat six bite-sized foods or to eat 16 bite sized foods. Participants who were eating together with the confederates were affected by the eating behavior of the confederates; they consumed on average 10 in the six foods condition and 14 in the 16 foods condition. A study conducted by Hermans et al. (2008) showed similar findings; when confederates were instructed to eat four chocolate candies the participants ate on average two chocolate candies, and when the confederates were instructed to eat 25 chocolate candies the participants ate on average 10 chocolate candies.

Although it has been repeatedly shown that modeling of food intake exists, little is known about the mechanism underlying it. An important process might be mimicry of motor movement, in other words copying the act of the hand bringing food to the mouth (Robinson, Tobias, Shaw, Freeman, & Higgs, 2011). It has been shown that people unconsciously mimic motor behaviors of the people they interact with (Chartrand, Maddux, & Lakin, 2005; Dijksterhuis & Bargh, 2001; Lakin, Jefferis, Cheng, & Chartrand, 2003). For example, Chartrand and Bargh (1999) found that participants were more likely to rub their face or shake their foot if the other person present was doing so. This illustrates the presence of a 'perception–behavior link'. Simply perceiving a behavior increases the likelihood of executing it, as perceiving a behavior activates neurons involved in the execution of that behavior (Chartrand & Bargh, 1999; Dijksterhuis & Bargh, 2001; Rizzolatti & Craighero, 2004; Rizzolatti, Fabbri-Destro, & Cattaneo, 2009). This could also explain the occurrence of modeling of intake in the above described studies (Goldman et al., 1991; Hermans et al., 2008), as in both studies it concerns intake of bite-sized foods, which involves clearly visible motor movement with each bite. As Hermans et al. (2012) already mentioned, mimicry of

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the act of taking a bite, and therefore modeling intake, might be explained by this perception–behavior link.

However, when it comes to a meal instead of bite sized foods, the interplay between eating companions can be more complex. Hermans et al. (2012) analyzed the timing and interplay of 70 female couples who had a meal together. The analyses showed that participants were most likely to take a bite when their eating companion had also taken a bite, that is within 5 seconds, suggesting that the participants copied the bites taken by their eating companion. However, as this analysis was based on observational data, it could not be ruled out that other factors may have played a role in this interplay between eating companions, such as the conversation.

The current experiment has been designed to test whether people copy the act of taking a bite and whether it affects their meal intake. Participants had three meals in the company of a same-sex confederate, who was instructed to take bites at a different frequency (i.e. slow, medium or fast) every meal. This experimental design enabled investigation of the cause–effect relation between bites taken by eating companions. Furthermore, the meals were homogeneous of structure, which allowed for variation in bite size and as result for distinguishing between effects on bites taken and intake. We expected to demonstrate mimicry of the act of taking a bite, with the participants adjusting their bite frequency to that of the confederates.

## Material and methods

### *Participants and confederates*

Participants and confederates were recruited among students of Wageningen University. In order to participate people had to be native Dutch, 18–25 years old, healthy, non-dieting, non-vegetarian, and they needed to have a normal BMI (18.5–25 kg/m$^2$), a normal appetite and no allergy or intolerance for the food under study.

Subjects were invited for an intake interview after coupling them with another subject of the same sex. During the intake interviews one person of each couple was informed on what to expect as a participant. The other person was instructed to be a confederate (i.e. instructed eating companion). Furthermore, height was measured using a stadiometer (Seca 213, Seca GmbH & Co., Hamburg, Germany) and weight with a digital scale (Seca 877, Seca GmbH & Co.).

Written informed consent was obtained from both participants and confederates. Additionally, the confederates received information on their task and signed a confidentiality statement. During the recruitment and the experimental phase a cover story was used for the participants. Participants were told that the study aimed to investigate the effects of having dinner on mood. After finalizing the experiment the participants were debriefed. Furthermore, after completing the experiment confederates and participants received a gift certificate.

In total 30 participants and 30 gender matched confederates participated in the experiment. There were no drop-outs. The descriptive characteristics of both participants and confederates are shown in Table 1. Four out of the 30 couples were already acquainted prior to the experiment; two as friends and two as acquaintances.

### *Study design*

The experiment had a randomized cross-over design with three experimental conditions. In the period of October to December 2012 the participants came to the university three times to have a warm meal with the same confederate. These sessions were scheduled either at lunchtime or at dinnertime, which was a fixed time per couple. Furthermore, they were preferably scheduled on the same week day, but with at least 1 week in between.

**Table 1**
Descriptive characteristics (mean ± SD) of the confederates (n = 30) and participants (n = 30).

| | Males | | Females | |
|---|---|---|---|---|
| | Confederates (n = 8) | Participants (n = 8) | Confederates (n = 22) | Participants (n = 22) |
| Age (year) | 22.2 ± 1.8 | 21.2 ± 1.8 | 22.0 ± 1.6 | 21.2 ± 2.0 |
| Height (m) | 1.73 ± 0.08 | 1.74 ± 0.06 | 1.74 ± 0.09 | 1.73 ± 0.08 |
| Weight (kg) | 64.7 ± 6.7 | 64.4 ± 7.0 | 65.3 ± 8.9 | 67.9 ± 9.8 |
| BMI (kg/m$^2$) | 21.6 ± 2.2 | 21.6 ± 1.6 | 22.8 ± 2.7 | 21.1 ± 1.6 |

During the sessions the confederates were instructed to eat at one of the three predefined bite frequencies; 3, 5 or 7 bites/min in the slow, medium and fast condition, respectively. These frequencies were based on pilot measurements, in which 5 bites/min was the average bite frequency. The order of the experimental conditions was randomized within subjects. Furthermore, the subjects were secretly filmed and their leftovers were covertly weighed in order to assess their eating style.

### *Setting and experimental procedure*

At the entry of the dining room two isolated places were created for the participants and the confederates to fill in questionnaires in private. Further along the room the dining table and two chairs were positioned. The chairs were positioned opposite to each other. Across the dining table a hidden camera was placed between the ceiling and wall to record both the participants' and the confederates' eating style. The room was decorated with table cloths and soft music (*21*, Adele, XL Recordings, 2011, London, England) was played throughout the sessions to create a pleasant atmosphere.

Participants and confederates came to the research site after at least 1 hour of fasting. They then filled in a short questionnaire, including questions on satiety feelings and mood (see 'Questionnaires'). After both the participant and confederate had finished the questionnaire the researcher invited them to the dining table for their meal.

Here they were served a large portion of readymade hotchpotch with kale and bacon (968 ± 21 g, per 100 g: 548 kJ, 2.9 g protein, 10.2 g carbohydrate, 8.2 g fat, 2.7 g fiber, Bonfait B.V., Denekamp, The Netherlands). This hotchpotch is a traditional Dutch food, which has a homogeneous structure. The meal was heated for 8.5–10 minutes using a microwave just before the start of the meals. Participants and confederates were then instructed to eat until they were pleasantly satisfied. The couples were free to talk while they were eating.

As stated before, the participants and confederates had fixed places at the dining table opposite to each other. The confederates were instructed to take bites at a certain frequency, according to the experimental condition. This frequency was signaled by a laptop which was placed diagonally behind the participant, so that the confederates could look at the participant and the laptop screen simultaneously. When a black screen appeared on the laptop the confederates had to take a bite as quickly as possible. Note that the confederates were free in choosing the size of their bites and were instructed to stop eating when pleasantly satisfied. The participants were only instructed to eat until pleasantly satisfied.

After both the participant and the confederate had finished their meal they filled in a second questionnaire. They also received a glass of water, as they did not get anything to drink during the meal. After the third session participants received an additional questionnaire in which we asked what they thought was the study aim. None of the participants were aware of the actual aim.