



# SHAPING INSECTS

A categorization approach towards the  
acceptability of insects as a food.

MSC. THESIS

Tessa Maas  
Wageningen University  
910204537060  
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Author: Tessa Maas  
Registration number: 910204537060  
MSc. Program: Management, Economics and Consumer studies  
University: Wageningen University  
Course: MSc Thesis Marketing and Consumer Behaviour  
Course code: MCB-80433  
First supervisor: dr.ir. ARH (Arnout) Fischer  
Second supervisor: dr.ir. PW (Ellen) van Kleef  
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**Department of Social Science  
Marketing and Consumer Behaviour  
Wageningen University, The Netherlands.**

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## ABSTRACT

**Objective:** To examine the effect of information in the categorization of insects as a food and to determine the best product combination for insects to be accepted as a food.

**Method:** 177 respondents participated in this research, divided over eight different groups. Each group gained a different informational cue. After receiving this information, participants needed to fill out a survey containing questions about the perceived fit, beliefs, attitude and willingness to consume of different insect food combinations.

**Results:** Giving information about the edibility of insects had no effect on this particular target group. However, insects are perceived to fit better in a “foreign” dish compared to a traditional Dutch dish. Next to this, a restaurant setting is also perceived to be more fitting than preparing insects at home. Furthermore results about the perceived taste attributes of insects show that participants believe insects are crunchy and add a certain bitterness to the dish. Results also show a positive relationship between the attitude towards an insect product and the participants’ willingness to consume.

**Conclusions:** The information manipulation was not successful, which could be due to the limited target group and/or the information being too weak. It can be concluded that this target group was not influenced by the information given about both the edibility of insects and the food subcategory they should belong to. This target group perceived insects to be more fitting in case of a ‘foreign’ dish in a restaurant context. Which means that when introducing insects as a food it should be positioned as a something ‘foreign’. And that introducing insects as a food would work best in a restaurant context, as consumers are more willing to try it in this context. Furthermore, crunchy is the most salient taste attribute for insects in general. This taste attribute should therefore be used to meet consumers’ expectations.

**Keywords:** Insect, consumption, categorization, accommodation, re-categorization, perceived fit, sensory attributes and consumer behaviour.

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## INTRODUCTION

The world population is growing exponentially, by 2050 the world is expected to host 9 billion people (Van Huis et al., 2013). Current food production will not be sufficient to feed all these people. Therefore there is a great need for new food alternatives to ensure enough supply of food for every person in the world. One of these alternatives is the consumption of insects, which is nothing new for 80% of the world population. In parts of Africa, South-America and Asia insects are a vital part of the daily meal. Continents normally described as the Western world (North-America, Australia and Europe) are not (yet) considering insects as something that should be part of their daily meal. Different factors have proven to be the cause of this negative Western attitude towards the consumption of insects.

One of these factors is that insects are not considered to be food and thus rejected (Costa-Neto and Magalhães, 2007). Food rejection can, according to Rozin and Fallon (1987) have three underlying motives; Sensory-affective, which is the belief that the food has negative sensory properties such as bad taste. Secondly, foods can be rejected when perceived to be harmful in either the short or the long term. Lastly, food rejection can also arise from ideational factors in which people reject food based on their origin; rejected because of what they are, where they come from or their social history (who touched them).

According to Rozin and Fallon (1987) within these three motivations different types of rejections can be identified. For the sensory properties *distaste* can be the reason for rejection. This focuses on the fact that an item has a bad smell or taste as well as its appearance or texture. Quantitative studies on predictors of food choice found that taste and pleasure are the most important predictors of food choice (Roininen, Lähteenmäki & Tuorila, 1999).

The origin of a product can also be an important factor and might be very relevant in case of insects. Firstly because they are seen as *inappropriate* foods, they are rejected based on motivations by ideational factors. The food is not classified as food within the culture, which is the case for insects in Western society. This might also relate to *disgust* which also is a type of rejection motivated by ideational factors: the nature or origin of the item or its social history. Unlike inappropriate items, disgusting items have offensive properties, with the result that there is a presumption that the item would taste bad. Thus, disgusts are negatively loaded on both sensory-affective and ideational motivations. Disgusting items have the capacity to contaminate and are usually animals or animal products (Rozin and Fallon, 1987). In other words the sensory properties, such as appearance and taste, are eliciting a response of disgust.

Lastly, within the motivation of harmfulness Rozin and Fallon (1987) describe *danger* as a type of rejection. Where foods are rejected based on their anticipated harmful consequences. Insects might be perceived as dangerous for some people due to the lack of knowledge about the consequences of consumption.

When a product is unfamiliar to a consumer, one way of adapting to the newness is through categorization, also called the information processing perspective. The categorization approach posits that consumers store information in memory around a set of category expectations (Ozzane et al., 1992). These expectations are in a lot of cases formed based on previous experience with the same product, or if the product is recognizable, for example by its brand name (Grunert, 2007). However, in most cases consumers are not yet familiar with insects as a food. The sensory properties (eg. How it looks, how it smells, or how it tastes) can therefore be more important in the first step towards the willingness to eat. Next to Rozin and Fallon (1987), Oude ophuis et al. (1995) as well as Grunert (2007) describe that sensory properties can be important in consumer evaluations and are the basis for determining food quality as well as willingness to eat. Beliefs about those sensory properties and the quality of the product are based on the attributes of a product. Those attributes in turn, facilitate the process of categorization. Taste is an experience attribute, and cannot be measured when a consumer is not willing to eat the insect based on its appearance. Therefore changing the product combination and with that appearance might be the first step in changing consumers attitude towards the consumption of insects.

## PROBLEM DEFINITION & RESEARCH QUESTION

Although sensory properties and categorization seem to have a critical importance in consumer's perception of food in general, there is no research in the field of insect consumption that explains the way in which consumers categorize insects and whether steering towards a certain category by changing the attributes can influence the quality perception as well as the willingness to eat of consumers. Therefore this research will focus on what the effect of different product combinations is on categorization and thus, the willingness of consumers to eat insects. The product combination is in this research used to improve the appropriateness and thus removing disgust. When the association with disgust is lower it is expected that the perceived sensory properties such as taste and texture are more positive.

This leads to the following research question:

*Does product combination affect how consumers categorize insects as a food and thus, their willingness to consume?*

The answer to this question gives insight on how to make the consumption of insects more attractive by determining whether product combination has an effect on willingness to consume and if yes, what the best combination would be to stimulate consumers towards are more positive attitude.

## LITERATURE REVIEW

The goal of categorization in a consumers' mind is to create a structure that maximizes the similarity of objects within each category while simultaneously minimizing the similarity of objects in different categories (Rosch 1978, cited in: Lajos et al, 2009). This suggests that knowledge in memory is organised based on a network of knowledge with relevant concepts such as attributes or brands for example.

Michaut (2004) states that there are four ways in which a consumer categorizes a product based on how well the attributes match the first category cued. The processes assimilation, accommodation, re-categorization and piece-meal categorization are described in the next paragraph as well as the resources that are necessary for this process to be successful.

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### ASSIMILATION

When a consumer is faced with a new product of which the attributes have a substantial but not a perfect overlap with an existing category in memory, the consumer will try to force the product into a category by re-organizing the knowledge structure. In this case the product is similar to the prototype of the first category cued. Only part of the product is new (eg. a new attribute, slightly different colour or shape) and it is relatively easy to categorize the product. This process is called assimilation, where a product is seen as familiar and acceptable (Michaut, 2004). In a study of Hoek et al. (2011) such assimilation effect took place in an experiment with meat substitutes. In the experiment, the meat substitute was presented in the shape of a hamburger. This made it easy for the consumer to position the meat substitute as part of the "burger" category. When applying this as a tool for insects to be accepted as food, this would imply that the insect is processed and hidden as the ingredient of a burger or a sausage for example. However, it is questionable whether it would work to categorize insects in such a way. Firstly because the taste of insects might not resemble the taste of meat which people are used to. After trying, the consumer will most likely experience an incongruent effect between what was expected of the taste and what it really tastes like. When expectations about the sensory properties are not met, the likeliness of consumers trying it again is lower. (Percacchio and Tybout, 1996) Next to this, when positioning a product as being meat, although it is not really meat, might negatively influence the trust of the consumer in the brand as well as the supermarket who sells the brand. Hence it is unlikely that insects are easily assimilated in this way.

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## ACCOMMODATION

When the product is somewhat different (eg. Several attributes are different) and there is a mismatch with the first category cued, the consumer will try to accommodate the product into another existing category. The concept of accommodation implies that the knowledge structure is changed in order to categorize the product anyway. This means that either the category is broadened or a certain *subcategory* is used in which the product can be placed. The category of food can be divided in many subcategories. On one hand they can be categorized based on the context or time in which they are eaten, which is called script-based categorization. This includes snack-foods, breakfast foods and fast-foods for example. On the other hand foods can also be categorized based on taxonomic categories. These are categories to which a product belongs naturally (Ross & Murphy, 1999). For example broccoli belongs to the vegetable category and milk belongs to the dairy category. These subcategories can be categorized even further. Take snack-foods for example, where a distinction can be made between sweet, salty or savoury snacks. Another form of categorization is context based categorization, where products present in the category “snacks I eat in combination with a cup of coffee” differ from “snack foods that are eaten on a Friday evening party while drinking a beer” (Ratneshwar and Shocker, 1991). Which subcategory a food belongs to depends a lot on this context. The importance of context in the process of categorization will be elaborated on later in this paper.

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## PIECE-MEAL CATEGORIZATION

In case of piece-meal categorization, the product is categorized based on an attribute-by-attribute basis. In this case, a set of different evaluations is combined to determine what is expected of the new product, the different attributes are evaluated thoroughly. The piece-meal process is a process which most of the time only takes place in case the product is completely new (Michaut, 2004). However, insects are not completely new to a consumer and evaluating a product on an attribute-by-attribute basis will require a lot of cognitive effort. In food there are a lot of different alternatives and most consumers are not willing to put much effort in their choice of food. For piece-meal categorization to be successful it will be necessary to define motives that go beyond the utilitarian function. For example by giving it a whole new social function.

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## RE-CATEGORIZATION AND CONTRAST

Re-categorization follows when a product cannot be accommodated. Re-categorization entails that the first category cued is highly incongruent with the product’s attributes and therefore cues a new one based on the consideration of target attributes. The first category that comes to mind when speaking about insects is not food but rather plague or pest (van

Huis et al., 2013). Food is in this case a contrasting category. This contrast needs to be eliminated in order to let consumers make new inferences about insects as a product from the food category. In order to re-categorize insects to become part of the food category, it will be necessary to use the cues and attributes in steering the consumer towards that category such as informational cues for example. When the consumer does not categorize insects as a food in the first place, it is expected that insects will not be seen as food products but rather as a 'plague'. If re-categorization is successful, it is expected that it will be easier for consumers to accommodate the product into a certain food subcategory based on the informational cues given.

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#### PERCEIVED FIT

Accommodation into a certain subcategory can have different results depending on the degree of fit between the new instance and the category. The two contrasting food subcategories for insect as a meal are in this case defined as the foreign meal or "less known" category and the traditional and "well-known" (Dutch) meal category. The degree of congruence or category fit between the new product and the pre-existing ones is called *perceived fit* (Bhat & Reddy, 2001; Czellar, 2003). Perceived fit is a well-known term when speaking about brand extensions. It is seen as one of the key factors for brand extensions to be successful. In brand extension literature it is described as the degree of proximity between the parent brand and the extension that consumers perceive (Bridges et al., 2000). How well a product fits the category depends a lot on the appropriateness. Appropriateness interferes in the relationship between preference/liking and intake and choice. The match or appropriateness of a food combination is affected by experiences and expectations of what a dish should look and taste like. Within the traditional Dutch meal category it is expected that the appropriateness of insects is very low as it does not meet the requirements of what it normally looks like. Foreign meals on the other hand often have unknown ingredients and could therefore result in a better fit.

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#### CONTEXT

As we have seen in the paragraph about accommodation, context can influence the way in which products are categorized, as well as the appropriateness of the food product in a certain situation. Different environments seem to influence the quality perception. In a study executed by Meiselman et al.(2000), acceptability of food was higher in case of a restaurant setting compared to a laboratory or dining hall. This study showed that the acceptability was indeed a result of the environment rather than the food itself, as different foods were tested in both settings. Besides this study, not much research is available to identify differences in a restaurant setting versus an at-home setting (Meiselman, 2007).

Foods that are very special need special occasions on which they can be eaten; very common foods need common eating occasions (De Graaf, 2007). This suggests that insects, which are special foods in this case, need to be eaten in special situations. Dining out in a restaurant is expected to be more special than eating at home. Next to this, consumers seek for experiences that are different from their everyday meals at home (Turgeon & Pastinelli, 2002). And new foods and new restaurants are appealing because consumers are seeking novelty (Peters, 2005).

Altogether it can be stated that insects are not yet considered as something that is part of the food category but rather the “pest” or “plague” category. Insects need to be re-categorized first into the category of food, before it can be considered as part of a specific food subcategory. Therefore, hypothesis 1 is formulated as follows:

**H1: Providing information about the edibility of insects compared to providing no information will lead to re-categorization and accommodation of the insect product into the mentioned food subcategory.**

When re-categorization into the food category is successful, it is expected that in particular situations accommodation is likelier to take place. Namely in case of the “foreign” food subcategory as well as the restaurant context subcategory. This leads to the following two hypotheses:

**H2: This effect will be largest for a “foreign” less known subcategory compared to accommodation into a very well-known subcategory.**

**H3: This effect will be largest for a restaurant context compared to accommodation into an at home context.**

In case the perceived fit is positive and the product is typical for the subcategory, beliefs about the prototype will be transferred onto the new product (Loken et al. 2008). In other words, when subcategorizing insects into a curry for which the perceived fit is high, beliefs about the traditional taste of a curry will be transferred to the new insect product. This will result in certain beliefs about the taste (eg. spicy in this case). When the perceived fit is high, it is expected that the taste congruency is also high.

**H4: The higher the fit the closer the taste expectations of the insect to that of a stereotypical subcategory member.**

In case of a high fit, the beliefs and associations about the pre-existing products will be transferred to the new product. Which can result in a positive evaluation of the new product.

However, when the perceived fit is low, and the incongruence is large, it will negatively affect the new product acceptance. (Mandler, 1982 cited in: Loken et al., 2008). Next to this, it is important to take note that the overall attitude towards the product category is also of high importance in a consumer's evaluation of the product. (Loken et al., 2008) This means that in case the consumer has a negative attitude towards foreign meals, a negative attitude will still be present when presenting him or her with a foreign meal which includes insects as an ingredient.

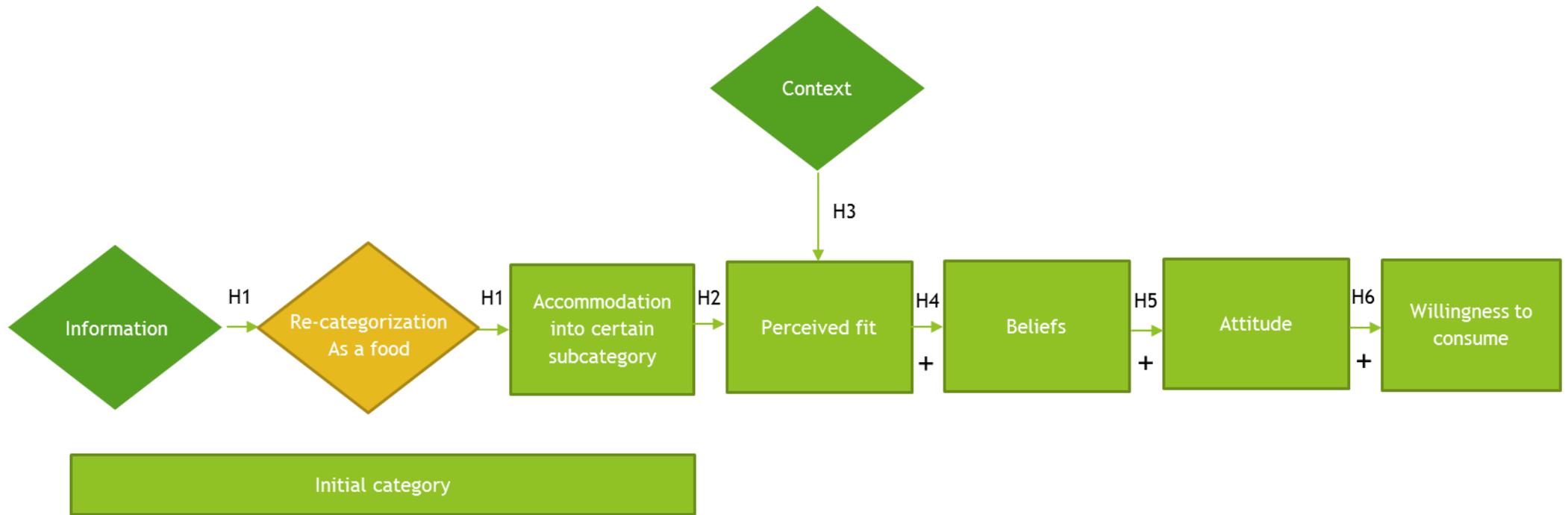
**H5: The more positive the beliefs the more positive the attitude.**

As soon as the attitude is positive this will have consequences for a consumer's intentions as well. According to the theory of planned behaviour (Ajzen, 1991) intention and perceived behavioural control (PBC) are the most proximal determinants of behaviour; intention in turn is determined by attitude towards the behaviour, subjective norm and PBC. In other words, the intention to do something strongly depends on the attitude. Therefore, it is expected that when the consumer has a positive attitude towards an insect product, the willingness to consume will also be higher.

**H6: The more positive the attitude, the higher the willingness to consume.**

These hypotheses are summarized in figure 1, which shows the theoretical model of this study.

FIGURE 1 THEORETICAL MODEL



## METHOD

### RESEARCH DESIGN

This study had a 2x2x2 design, where participants were exposed to three independent variables with two levels: *an informational cue* (insects are edible or no information about the edibility) as well as an informational cue steering to either a local or a foreign food category and a particular *eating context* (restaurant or at home) as shown in table 1. It is a between subjects design as different participants were exposed to different cues. Students from Wageningen University were asked to participate. A sample of 160 participants was set as a minimum in order to gain sufficient power. The research was conducted in a room in the Forum building of Wageningen University. The survey was created using Qualtrics software, and can be found in Appendix I.

**TABLE 1 EIGHT DIFFERENT CONDITIONS IN DATA-COLLECTION**

Group	X1	X2	X3
1	Informational cue food	Local	Restaurant
2	Informational cue food	Local	At home
3	Informational cue food	Foreign	Restaurant
4	Informational cue food	Foreign	At home
5	No information	Local	Restaurant
6	No information	Local	At home
7	No information	Foreign	Restaurant
8	No information	Foreign	At home

### MANIPULATION

#### INFORMATIONAL CUE

The participant received one of the eight different stories to read before starting the rest of the survey. The different stories were randomly allocated to the participants. The story consisted out of three parts in which the different manipulations changed. Firstly the participant gained either information about the edibility of insects or gained no information about the edibility of insects. Secondly the participants got something to read considering the use of insects in a particular dish (local or foreign). The last part of the story utilized

the context manipulation. Participants gained information about the context in which insects can be eaten, either a restaurant setting or an at-home setting by means of a recipe. When putting this together these are the different scenarios that a participant could have been exposed to during the survey.

**Overall start of the story:** *People grow up in different countries, with different cultural habits. These habits are normal in case you are born within the culture. However, for an outsider it is sometimes hard to understand the habits of other cultures. Eating habits play a very large role in every culture. One eating habit of many Asians, Africans and South-Americans is the consumption of insects.*

**Group 1:** Insects are a source of proteins and can be eaten in various ways. **In the Netherlands** they can be served in combination with potatoes and vegetables. There are several **restaurants** that already serve them.

**Group 2:** Insects are a source of proteins and can be eaten in various ways. **In the Netherlands** they can be served in combination with potatoes and vegetables. **A lot of recipes** can be found on the world wide web for preparing insects at home.

**Group 3:** Insects are a source of proteins and can be eaten in various ways. **In Asia** for example, they are eaten in a curry dish. There are several **restaurants** that already serve them.

**Group 4:** Insects are a source of proteins and can be eaten in various ways. **In Asia** for example, they are eaten in a curry dish. **A lot of recipes** can be found on the world wide web for preparing insects at home.

**Group 5:** **In the Netherlands** they can be served in combination with potatoes and vegetables. There are several **restaurants** that already serve them.

**Group 6:** **In the Netherlands** they can be served in combination with potatoes and vegetables. **A lot of recipes** can be found on the world wide web for preparing insects at home.

**Group 7:** **In Asia** for example, insects are eaten in a curry dish. There are several **restaurants** that already serve them.

**Group 8:** **In Asia** for example, they are eaten in a curry dish. **A lot of recipes** can be found on the world wide web for preparing insects at home.

## MEASUREMENTS

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### CATEGORY MEMBERSHIP

At first, the participant was asked to indicate what an insect is to him or her. This to understand which category is cued first by the participant. Only one answer was possible, which resulted in the participant giving the most prominent category in memory. By asking this question, differences between participants can be understood. It might be the case that participants who see insects as a food source, have another view on in which dish or context it fits best than those who see it as an animal or plague. This measure was used to show that the informational cue was effective. Because of that, the same question was asked a second time, to see if the participant changed his or her opinion.

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### PERCEIVED FIT

As a next step the participant was exposed to both subcategories (foreign and Dutch) and both contexts (restaurant and at-home) by means of different statements. And was asked about the perceived category fit of the different combinations. The participants could rate on a scale from 1 to 7 (1=not agree at all, 7= totally agree) whether an insect fits in the mentioned situation and whether it is a logical situation (Keller and Aaker, 1992).

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### SENSORY ATTRIBUTES (BELIEFS)

As a next step the participant was asked to indicate what he or she expected from the sensory attributes of the insect product. This was done through sensory profiling, in which different sensory attributes were listed and the participant indicated which attributes he or she expected the product to have. Ten different attributes were provided. These attributes were selected from a study by Fabrigar et al. (2006) and included general sensory dimensions that people use to evaluate foods (e.g. taste, smell) and specific sensory qualities of foods (e.g. oily, salty). Participants could rate all boxes that applied in their opinion (CATA).

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### ATTITUDE

Participants were asked to give their opinion about the insect product to determine whether he or she has a positive or negative attitude towards the insect product as well as the overall subcategory. A 3 item, 7-point scale was used, questions were based on the food attitude questionnaire (Fabrigar et al., 2006).

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## WILLINGNESS TO CONSUME

Participants were also asked to indicate on a scale from 1 to 7 how willing they are to try the insect product.

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## PERSONAL INFORMATION

At the end of the survey the participants were asked to fill out some background information. This is used to explain differences between participants and to define segments within the sample. Information that is asked for is age, gender and included questions to determine the participant's degree of food neophobia. The Food Neophobia Scale or FNS (Pliner and Hobden, 1992) is used to determine the degree of food neophobia of each participant.

## ANALYSIS

Hypothesis 1 is tested by asking what an insect is most to that person two times (before and after the informational cue). If a person answers the question differently the second time, the informational manipulation was successful. Next to this, hypothesis 1 is also checked through the perceived fit scores. When the participant sees an insect as a non-food product, but gives high scores on the different food product combinations, the informational manipulation was successful.

Hypothesis 2 is tested using a repeated-measures design (GLM). Each group needed to give a score for the perceived fit for all different combinations (foreign/Dutch x restaurant/at home).

For H2 to be true, scores for group 3 and 4 need to be higher compared to group 1 and 2. This because group 3 and 4 receive information about the use of insects in a foreign dish and group 1 and 2 in a Dutch dish. For the same reason the scores for group 7 and 8 are expected to be higher than those of group 5 and 6 .

Hypothesis 3 is tested in the same way as H2, for H3 to be proven, the score of group 1 is higher than group 2, 3 is higher than 4, 5 is higher than 6 and 7 is higher than 8. This because group 1, 3, 5 and 7 receive information linked to the fact that insects can be eaten in a restaurant.

Hypothesis 4 is tested as follows: firstly, the CATA data is analysed and the sum differences is calculated for both combinations. The lower the difference, the more positive the beliefs. A regression analysis is done to see whether the relation between perceived fit and beliefs is indeed positive. If for example Fit4 (food/foreign/restaurant) is positive, the taste

resemblance will be high for insect curry vs. traditional curry. The higher the fit, the higher the taste resemblance.

Attitude is positive when high scores on liking, happiness and low scores on disgust. The relation between attitudes and beliefs (H5) is tested using regression by comparing the attitude score to the score on taste beliefs (resemblance). The same goes for H6; attitude versus willingness to consume, where a positive attitude score should lead to a positive score on willingness to consume.

## RESULTS

### SAMPLE DESCRIPTION

The sample consisted out of 184 Dutch students, 7 responses were removed from the dataset because they were incomplete, which means that in total 177 responses were used in the analysis. Participants were between 17 and 29 years old. There were more female participants (62.7%) than male participants (37.3%). In theory, scores on the FNS could range from 10 to 70; in this study the scores ranged between 21 and 70, with a mean score of 52. A high neophobia score (>35) means that neophobia itself is low (Pliner & Hobden, 1994). Therefore, it can be concluded that it is a group of people that is open to novel foods, not afraid of trying new foods.

### RELIABILITY MEASURES

In order to ensure reliability of the scale measures, Cronbach alpha's were calculated for each measure. The different Cronbach alpha's are shown in table 2. The results show high values, which means that the measures are sufficiently reliable.

**TABLE 2 CRONBACH ALPHA'S FOR THE DIFFERENT MEASURES**

Measure	Cronbach alpha
Attitude insect curry	0.905
Attitude Dutch dish	0.889
Perceived fit Dutch/home	0.853
Perceived fit Dutch/restaurant	0.817
Perceived fit foreign/home	0.847
Perceived fit foreign/restaurant	0.831
Food Neophobia	0.870

## HYPOTHESES

H1, H2 and H3 were tested using a repeated measures ANOVA, with perceived fit as the dependent variable. Dutch/foreign was used as a within factor and a second within factor was whether it was home prepared/restaurant (context). The between group factor was whether it was communicated that an insect was a food or a non-food item.

The main effect of food versus non-food was not significant ( $F(1,169)= 0.538$ ,  $p\text{-value}=0.464$ ) which means that H1 is not confirmed. Providing information on the edibility has no effect on the re-categorization and accommodation of the insect product into the mentioned meal subcategory. Table 3 illustrates the mean scores for the groups that gained information about the edibility of insects compared to the groups that did not gain any information about the edibility of insects. The groups that gained information have a slightly higher mean for all perceived fits, but this was not significant.

**TABLE 3 MEAN SCORES FOR PERCEIVED FIT IN CASE OF INSECT EDIBILITY INFORMATION COMPARED TO NO INSECT EDIBILITY INFORMATION**

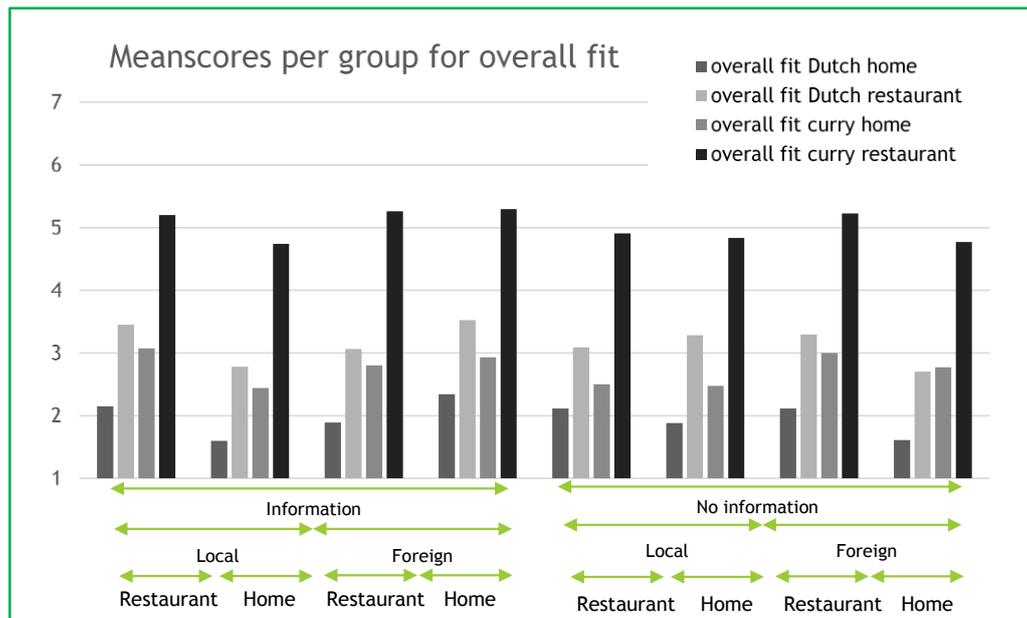
Measure	Mean	Standard deviation
Information, overall fit home	2.39	1.28
Information, overall fit restaurant	4.15	1.24
Information, overall fit Dutch	2.58	1.28
Information, overall fit foreign	3.95	1.24
No information, overall fit home	2.31	1.25
No information, overall fit restaurant	4.01	1.18
No information, overall fit Dutch	2.51	1.21
No information, overall fit foreign	3.81	1.24

The mixed effect, which is the effect of the interaction between the within factor of foreign/Dutch and the between factor food/non-food, is stronger for foreign foods, however the result is not significant ( $F(1,169)= 0.170$ ,  $p\text{-value}=0.681$ ). Therefore H2 is also not confirmed. The information effect is not significantly larger for a “foreign” less known subcategory compared to accommodation into a well-known subcategory.

The mixed effect, which is the effect of the interaction between the within factor of restaurant/at home and the between factor food/non-food, is stronger for the restaurant context, however this result is not significant either ( $F(1,169)=0.102$ ,  $p\text{-value}=0.750$ ), which means H3 is also not confirmed. The information effect is not significantly larger for a restaurant context compared to accommodation into an at home context.

Overall, the within effects show that foreign is considered more fitting for an insect product than local ( $F(1,169)=251.492$ ,  $p\text{-value}=0.000$ ). Next to this, a restaurant setting is also considered more fitting ( $F(1,69)= 418.610$ ,  $p\text{-value}=0.000$ ) compared to an at-home setting. This implies that either the beliefs about the fit were already strongly present and hard to change or the information given was too weak. This also shows in the mean scores for the different combinations, as shown in figure 2 on the next page.

**FIGURE 2 MEAN SCORES FOR PERCEIVED FIT IN ALL CONDITIONS**



Next to this, participants were also asked twice what an insect was to them. Once before the informational manipulation and a second time after the informational manipulation. Only six participants answered the question differently the second time and thus changed from the “non-food category” to the “food category”.

*H4 The higher the fit, the closer the taste expectations of the insect product to that of a stereotypical subcategory member.*

For this relation, a regression analysis was carried out with the overall fit as a predictor and taste resemblance as the dependent variable. Next to this, another regression analysis was carried out with the overall fit as a predictor and the sum of differences in CATA-score as the dependent variable. Results for the analysis with taste resemblance as the dependent variable are shown in table 4, in this analysis all groups are taken into account regardless of the information they received.

**TABLE 4 OUTCOMES REGRESSION BETWEEN OVERALL FIT AND TASTE RESEMBLANCE**

Combination	Outcome	R-square
Overall fit curry restaurant vs. taste resemblance curry	F(1,175)=35.715 p-value: 0.000	0.169
Overall fit curry home vs. Taste resemblance curry	F(1,175)=43.557 p-value: 0.000	0.199
Overall fit Dutch restaurant vs. Taste resemblance Dutch	F(1,175)=32.289 p-value: 0.000	0.156
Overall fit Dutch home vs. Taste resemblance Dutch	F(1,175)=61.507 p-value: 0.000	0.260
Overall fit curry home & restaurant vs. Taste resemblance	F(2,174)=29.786 p-value: 0.000	0.255
Overall fit Dutch home & restaurant vs. taste resemblance	F(2,174)=32.656 p-value: 0.000	0.273

For the CATA-scores the results for Dutch/home were not significant ( $F(1,1,75)=0.352$ , p-value: 0.554). Next to this, the result of the CATA-scores for Dutch/restaurant were also not significant ( $F(1,175)=0.001$ , p-value: 0.981). For the foreign/home the results were marginally better, but still not significant ( $F(1,175)=3.246$ , p-value: 0.073). The foreign/restaurant results were significant ( $F(1,175)=4.139$ , p-value: 0.0403 ).

Based on the results of the CATA-analysis combined with the results from the question about taste resemblance, H4 is partially supported.

In table 5 the means for both measures are shown. In case of the curry, the taste profile is more easily accepted than in case of the Dutch dish. This also shows in the CATA-profile, as shown in figure 3. Results of a cross tabulation analysis in which the different CATA-labels are compared for both the foreign and the Dutch combination show which taste attributes are significantly different when comparing the insect dish to the traditional dish. For interpretation, adjusted residuals are provided in figure 3c,d. Results for the Chi-square analysis show;  $\chi^2(8, N=955)=146.791$  ( $p<.001$ ) for foreign and  $\chi^2(8, N=955)=221.985$  ( $p<.001$ ) for Dutch). Cramer's V results show 0.364 for foreign and 0.482 for Dutch.

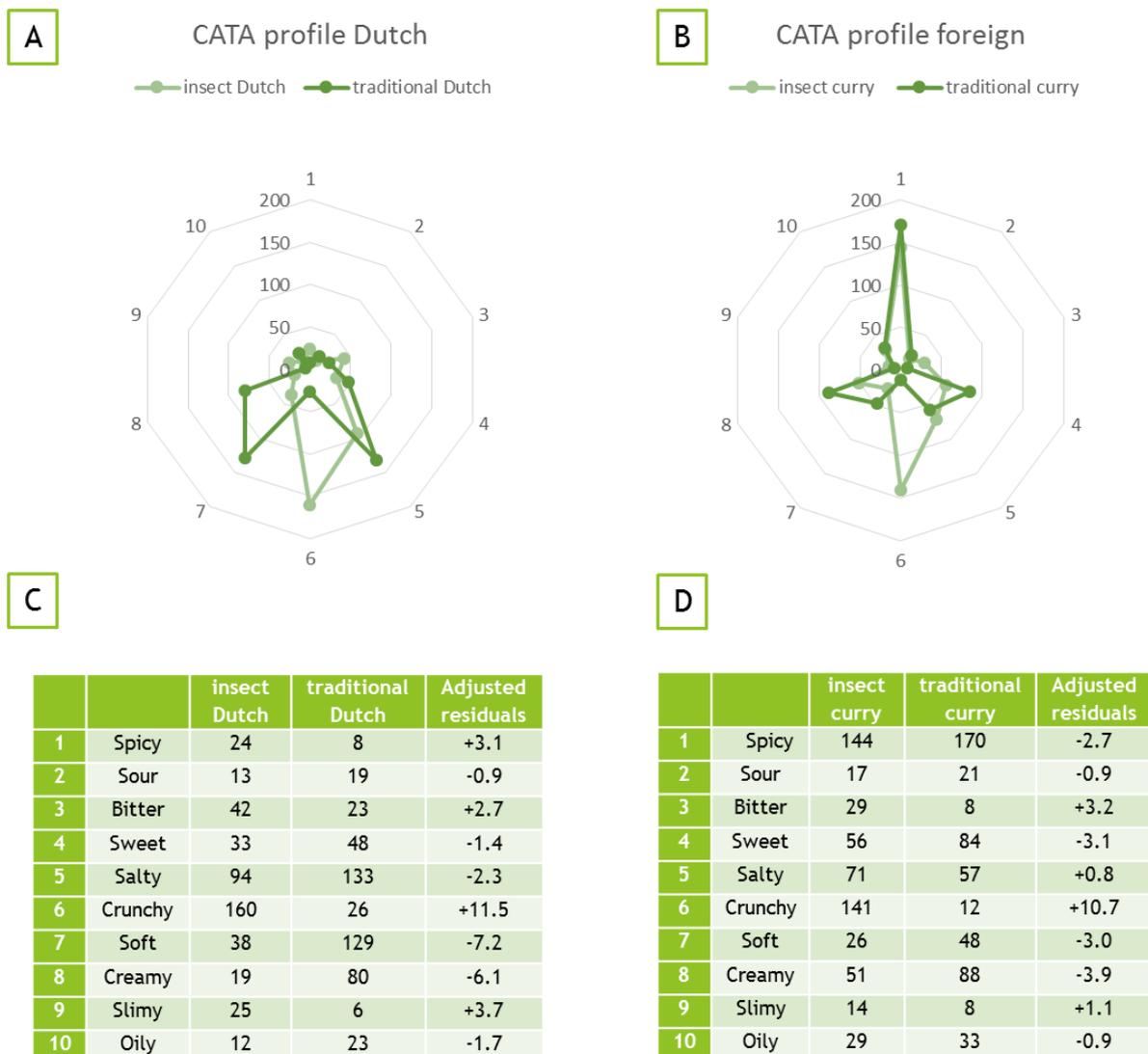
As one can see in the table, crunchiness is a very salient taste attribute in both the insect curry as well as the Dutch insect dish. Next to this, a traditional Dutch dish is perceived to be more creamy than a Dutch dish in combination with insects. In line with this, the traditional Dutch dish is perceived to be more soft. When looking at the taste attributes of the different curries, it can be concluded that a traditional curry is perceived to be more

creamy and less bitter than an insect curry. Furthermore it is perceived to be more soft, sweeter and slightly spicier.

**TABLE 5 OUTCOMES PAIRED T-TEST BETWEEN TASTE RESEMBLANCE SCORES AND SUM OF DIFFERENCES IN CATA SCORES**

Measure	Mean
Taste resemblance Dutch	2.49
Taste resemblance curry	4.24
Mean sum of differences CATA score Dutch	3.29
Mean sum of differences CATA score curry	2.31

**FIGURE 3 COLLECTED DATA FROM CATA**



*H5 The more positive the beliefs the more positive the attitude.*

The relation between beliefs and attitude is measured using simple linear regression. Where taste resemblance of the insect curry and the Dutch insect dish was the predictor and the attitude towards both, the dependent variable. The results show a significant relationship between beliefs and attitude ( $F(1,175)=50.500$ ,  $p\text{-value}=0.000$ ) for the insect curry. Next to this an R-square value of 0.224 is measured for the insect curry, meaning that almost 23% of the attitude towards an insect curry can be predicted from the beliefs on taste resemblance between a traditional curry and an insect curry.

For the relation between beliefs and attitude towards the Dutch insect dish, similar results are measured. ( $F(1,175)=51.692$ ,  $p\text{-value}=0.000$ ), R-square of 0.228. Since the results are significant ( $p_v = <0.05$ ), H5 can be accepted.

*H6 The more positive the attitude, the higher the willingness to consume.*

The relation between attitude and willingness to consume has been measured using simple linear regression as well. Where attitude towards the insect product was the predictor and willingness to consume the dependent variable. All results show a significant relationship ( $p_v=<0.05$ ), in table 6 the outcome statistics for each combination are shown. Based on these outcomes, H6 can be accepted. Next to this, mean values show that the willingness to consume any insect based product is highest for a “foreign” product in a restaurant context.

**TABLE 6 RESULTS REGRESSION ANALYSIS ATTITUDE AND WILLINGNESS TO CONSUME**

Combination	Outcome	R-square	mean
Willingness to consume an insectcurry in a restaurant.	F=270.009 p-value: 0.000	0.607	4.57
Willingness to consume an insectcurry recipe at home.	F=178.962 p-value: 0.000	0.711	3.23
Willingness to consume an insect in combination with potatoes and vegetables in a restaurant.	F=196.416 p-value: 0.000	0.727	3.54
Willingness to consume an insect in combination with potatoes and vegetables at home.	F=130.877 p-value: 0.000	0.654	2.55

## CONCLUSIONS

In this chapter the main conclusions, limitations, suggestions for further research and implications are discussed.

### CONCLUSION AND DISCUSSION

Giving information about the edibility of insects as well as giving information about the food subcategory it belongs to, had no significant effect on this target group. This could be due to the fact that the information given was too weak and/or unreliable in the eyes of the participants or it could be the case that the participants already knew that insects can belong to the category of food. In case of the latter, re-categorization and accommodation do not take place and existing ideas determine how insects fit in the food category. The fact that most participants answered that they had heard at least a little about the consumption of insects supports this.

This means that insects as a food is not completely new to this target group and existing ideas therefore determine the degree of fit. The existing ideas of this target group are likely to be based on information they have gained while being a student at Wageningen University. Within this university, a lot of research is done considering the consumption of insects and it is therefore likely that the participants have picked up information from presentations, teachers, journals and other previous research already. With this information, they have created an image and idea of what fits when speaking about insect consumption and cannot be changed with information that has been used in this study.

As mentioned before, existing ideas determine the degree of fit for the product combinations used in this study. Results clearly show that the fit is much higher for a “foreign” food subcategory compared to a traditional “Dutch” food subcategory. This is probably because the prototype “Dutch” meal does not include any ingredient that can be compared to an insect. Ingredients in a Dutch meal are quite straightforward, meaning that it has a traditional format (potatoes, meat and vegetables). Foreign dishes on the other hand might have more room for the “unknown”. Alternatively participants may know that insects are more common food in Asia.

Next to this, results also show that a restaurant context would be more fitting compared to an at-home context. Which could mean that restaurants (or cooks) are more likely to search for new ingredients to offer their guests something new. On the other hand, insects were not available in Dutch supermarkets at the time of the study and therefore cannot be bought by a consumer easily.

Next to that, the results also give information about other expectations of this target group when it comes to consuming insects such as the taste attributes. Both insect dishes (Dutch and foreign) are perceived to be crunchy. Crunchiness is therefore a salient attribute of insects in general. Next to this, participants also believe insects have a certain bitterness.

It also seems that the taste attributes of the prototype are copied more easily when speaking about a foreign dish compared to a traditional Dutch dish. The fit for a curry was high and the fit for Dutch was low, which is in line with the assumption that the taste profile will be copied in case the fit is high.

Next to this the relation between beliefs and attitude as well as attitude and willingness to consume has been tested again in this research. It seems that the consumption of insects is no exception to the rule and that when beliefs about the taste are positive, the attitude towards the insect product is positive too. The same goes for attitude and its relation to willingness to consume, which actually shows a very strong relationship.

#### LIMITATIONS AND FURTHER RESEARCH

One of the main limitations of this study is the fact that the target group is very specific. Students from Wageningen University are likely to be more knowledgeable on this subject compared to other people in the Netherlands. Using a different target group in further research could therefore lead to new insights on the subject. Especially answers of participants that have no knowledge on the consumption of insects are likely to give different results.

Next to this, the information within this research might have been too weak. Further research could focus on other ways of presenting participants with information such as an expert (or another source that is perceived to be reliable) giving different types of information or providing pictures of (Western/Asian) people eating insects.

Another limitation was that this research focused on two food subcategories only. It could for example be interesting to see whether within the foreign food subcategory differences can be defined (eg. an Indian curry versus Mexican Chili Con Carne). With that, it would be wise to use images to ensure that all participants are on one line. As in this study, no images were used, and this might have influenced the perception.

Furthermore, specifying the type of insect might also give different results when repeating this study, eg. using a grasshopper curry as a foreign dish and hodgepodge with crickets as a Dutch dish. By specifying the type of insect the results of the CATA-profiles might be

different as well. In this study, crunchiness was the most frequently mentioned attribute for the insect related dish. However this might be different when using a specific type of insect.

## IMPLICATIONS

Based on the results of this study, for the introduction of insects as a food ingredient, the chances for success are highest when positioning insects as a “foreign” product in the market. This because it is perceived to be better fitting and thus easier to accept. This means that when introducing it for example in the retail channel, products should be positioned near other foreign products or as an extension of existing Asian food brands (eg. Conimex, Go-Tan).

Next to this, restaurants seem to be a good “channel” to introduce insects as a food ingredient as well. Most importantly because consumers experience a “fit” in this case and because they are actually willing to try it in a restaurant context. Introducing it in this branch, might also help in the promotion of insects as a food ingredient rather than a plague.

Lastly, it has been shown that crunchy is the most salient taste attribute when speaking about insects. It is what consumers expect of the taste. This is something which could be taken into account in case of marketing communications, for example by using words that are associated with crunchy. But could also be important in product development, for example by using insects in combination with crackers or toasts as they are perceived to have the same taste attribute.

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### Default Question Block

Thank you for your willingness to participate in this survey. The survey contains 17 questions and will take about 10 minutes. There are no right or wrong answers. All information will be kept confidential and will be used for academic purposes.

What is an insect most to you?

- An animal
- A plague
- A food ingredient
- A delicacy

### Block 1

People grow up in different countries, with different cultural habits. These habits are normal in case you are born within the culture. However, for an outsider it is sometimes hard to understand the habits of other cultures. Eating habits play a very large role in every culture. One eating habit of many Asians, Africans and South-Americans is the consumption of insects. Insects are a source of proteins and can be eaten in various ways. In the Netherlands they can be served in combination with potatoes and vegetables. There are several restaurants that already serve them.

### Block 2

People grow up in different countries, with different cultural habits. These habits are normal in case you are born within the culture. However, for an outsider it is sometimes hard to understand the habits of other cultures. Eating habits play a very large role in every culture. One eating habit of many Asians, Africans and South-Americans is the consumption of insects. Insects are a source of proteins and can be eaten in various ways. In the Netherlands they can be served in combination with potatoes and vegetables. A lot of recipes can be found on the world wide web for preparing insects at home.

### Block 3

People grow up in different countries, with different cultural habits. These habits are normal in case you are born within the culture. However, for an outsider it is sometimes hard to understand the habits of other cultures. Eating habits play a very large role in every culture. One eating habit of many Asians, Africans and South-Americans is the consumption of insects. Insects are a source of proteins and can be eaten in various ways. In Asia for example, they are eaten in a curry dish. There are several restaurants that already serve them. .

### Block 4

People grow up in different countries, with different cultural habits. These habits are normal in case you are born within the culture. However, for an outsider it is sometimes hard to understand the habits of other cultures. Eating habits play a very large role in every culture. One eating habit of many Asians, Africans and South-Americans is the consumption of insects. Insects are a source of proteins and can be eaten in various ways. In Asia for example, they are eaten in a curry dish. A lot of recipes can be found on the world wide web for preparing insects at home.

### Block 5

People grow up in different countries, with different cultural habits. These habits are normal in case you are born within the culture. However, for an outsider it is sometimes hard to understand the habits of other cultures. Eating habits play a very large role in every culture. One eating habit of many Asians, Africans and South-Americans is the consumption of insects. In the Netherlands they can be served in combination with potatoes and vegetables. There are several restaurants that already serve them.

**Block 6**

People grow up in different countries, with different cultural habits. These habits are normal in case you are born within the culture. However, for an outsider it is sometimes hard to understand the habits of other cultures. Eating habits play a very large role in every culture. One eating habit of many Asians, Africans and South-Americans is the consumption of insects. In the Netherlands they can be served in combination with potatoes and vegetables. A lot of recipes can be found on the world wide web for preparing insects at home.

**Block 7**

People grow up in different countries, with different cultural habits. These habits are normal in case you are born within the culture. However, for an outsider it is sometimes hard to understand the habits of other cultures. Eating habits play a very large role in every culture. One eating habit of many Asians, Africans and South-Americans is the consumption of insects. In Asia for example, insects are eaten in a curry dish. There are several restaurants that already serve them.

**Block 8**

People grow up in different countries, with different cultural habits. These habits are normal in case you are born within the culture. However, for an outsider it is sometimes hard to understand the habits of other cultures. Eating habits play a very large role in every culture. One eating habit of many Asians, Africans and South-Americans is the consumption of insects. In Asia for example, they are eaten in a curry dish. A lot of recipes can be found on the world wide web for preparing insects at home.

**Block 11**

Please indicate for each statement whether you agree or not (1=not agree at all, 7=totally agree)

	1	2	3	4	5	6	7
It is logical to make a traditional Dutch dish with potatoes, vegetables and insects at home.	●	●	●	●	●	●	●
It is logical for a local restaurant to serve insects in combination with potatoes and vegetables	●	●	●	●	●	●	●
It is logical to make insect curry at home.	●	●	●	●	●	●	●
It is logical for an ethnic restaurant to serve an insect curry.	●	●	●	●	●	●	●
Insects fit in a traditional Dutch dish with potatoes and vegetables which I make at home.	●	●	●	●	●	●	●
Insects fit in combination with potatoes and vegetables on the menu of a local restaurant.	●	●	●	●	●	●	●
Insects fit in a curry dish which I make at home.	●	●	●	●	●	●	●
Insects fit in a curry dish on the menu of an ethnic restaurant.	●	●	●	●	●	●	●

**Block 12**

Please indicate for each statement whether you agree or not (1=not agree at all, 7=totally agree)

	1	2	3	4	5	6	7
Insects fit in a curry dish on the menu of an ethnic restaurant.	<input type="radio"/>						
Insects fit in a curry dish which I make at home.	<input type="radio"/>						
Insects fit in combination with potatoes and vegetables on the menu of a local restaurant.	<input type="radio"/>						
Insects fit in a traditional Dutch dish with potatoes and vegetables which I make at home.	<input type="radio"/>						
It is logical for an ethnic restaurant to serve an insect curry.	<input type="radio"/>						
It is logical to make insect curry at home.	<input type="radio"/>						
It is logical for a local restaurant to serve insects in combination with potatoes and vegetables	<input type="radio"/>						
It is logical to make a traditional Dutch dish with potatoes, vegetables and insects at home.	<input type="radio"/>						

**Block 9**

Please check all boxes that apply

*What do you believe does an insect curry taste like?*

- Spicy
- Sour
- Bitter
- Sweet
- Salty
- Crunchy
- Soft
- Creamy
- Slimy
- Oily

Please check all boxes that apply

*What do you believe does an insect in combination with potatoes and vegetables taste like?*

- Spicy
- Sour
- Bitter
- Sweet
- Salty
- Crunchy

- Soft
- Creamy
- Slimy
- Oily

Please check all boxes that apply

*What do you believe does a curry taste like?*

- Spicy
- Sour
- Bitter
- Sweet
- Salty
- Crunchy
- Soft
- Creamy
- Slimy
- Oily

Please check all boxes that apply

*What do you believe does a traditional Dutch meal taste like?*

- Spicy
- Sour
- Bitter
- Sweet
- Salty
- Crunchy
- Soft
- Creamy
- Slimy
- Oily

### **Block 13**

What is an insect most to you?

- An animal
- A plague
- A food ingredient
- A delicacy

Please indicate to what extent you agree with the following statements (1=do not agree at all, 7=totally agree)

	1	2	3	4	5	6	7
The taste of an insect curry resembles the taste of a traditional curry	<input type="radio"/>						
The taste of an insect in combination with potatoes and vegetables resembles the traditional taste of a Dutch meal	<input type="radio"/>						

Please indicate to what extent you agree with the following statements (1=not agree at all, 7=totally agree)

	1	2	3	4	5	6	7
Overall, I like curry	<input type="radio"/>						
Overall, I like traditional Dutch food	<input type="radio"/>						

Please indicate for each statement whether you agree or not (1=not agree at all, 7=totally agree)

	1	2	3	4	5	6	7
Eating an insect curry would make me feel happy.	<input type="radio"/>						
Eating an insect curry would make me feel disgusted.	<input type="radio"/>						
Eating traditional Dutch food with insects would make me feel happy.	<input type="radio"/>						
Eating traditional Dutch food with insects would make me feel disgusted.	<input type="radio"/>						

Please indicate for the following statements to what extent you agree (1= not agree at all, 7= totally agree)

	1	2	3	4	5	6	7
I would like traditional Dutch food in combination with insects.	<input type="radio"/>						
I would like an insect curry	<input type="radio"/>						

Please indicate your willingness to try the following items (1=not willing at all, 7=absolutely willing)

	1	2	3	4	5	6	7
An insect curry recipe at home.	<input type="radio"/>						
An insect curry in a restaurant.	<input type="radio"/>						
An insect in combination with potatoes and vegetables at home.	<input type="radio"/>						
An insect in combination with potatoes and vegetables in a restaurant.	<input type="radio"/>						

### Block 10

What is your gender?

- Male
- Female

What is your age in years?

Please indicate for the following statement whether you agree or not. (1=not agree at all, 7=totally agree)

	1	2	3	4	5	6	7
I am constantly sampling new and different foods.	<input type="radio"/>						
If I don't know what is in the food, I won't try it.	<input type="radio"/>						
At dinner parties I will try a new food.	<input type="radio"/>						
I don't trust new foods.	<input type="radio"/>						
I like foods from different countries.	<input type="radio"/>						
Ethnic food looks too weird to eat.	<input type="radio"/>						
I am afraid to eat things I have never had before.	<input type="radio"/>						
I am very particular about the foods I will eat.	<input type="radio"/>						
I will eat almost anything.	<input type="radio"/>						
I like to try new ethnic restaurants.	<input type="radio"/>						

Did you already know that you can eat insects before you participated in this study?

- Yes
- I have heard little about it
- No, I never heard about it before