Insects as a food source: assessing the disgust factor

MSC. THESIS

Dolezalova, Tereza

Author:	Tereza Dolezalova
Reg. n.:	86 1107 187 200
MSc. Program:	Management, Economics and Consumer studies
University:	Wageningen University
Course:	MSc Thesis Marketing and Consumer Behaviour
Course code:	MCB - 80433
Supervisor:	dr.ir. ARH (Arnout) Fischer
Second Reader:	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

Excessive meat consumption and the related activities have been recognized as one of the main culprits of environmental degradation. With increasing global population it is not feasible to sustain global demand of meat and animal products. Implementing insects in global diet is one of the proposed steps to solve this issue. Despite the nutritional and environmental benefits, insect consumption is still confined to minor amount of countries. Western consumers, - the leaders in meat consumption, perceive strong disgust to insect consumption while consuming other animals. Understanding the source of this disgust remains unclear. Therefore the objective of our experimental research is to provide insight into the possible drivers of disgust related to insect eating in Western countries. Participants (N = 172) were divided over eight different groups. Each group was manipulated by different informational cues. The main outcomes of the study shows contrary to our expectations that recognisability and inappropriateness had no effect on ideational contamination for this target group. The ideational contamination had significant negative effect on disgust towards insect products. The effect of previous consumption of insects decreases significantly ideational contamination in relation to insects. Neophobia does not influence attitude to insect product consumption directly, but is fully mediated through disgust.

Key words: Insect consumption, edible insects, entomophagy, disgust, ideational contamination, neophobia, attitudes.

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Chapter 1. Introduction

The steadily growing number of the world population becomes an apparent threat related to global food security, availability of natural resources and consequent human impact on the Earth. Apart from other environmental pressures, food consumption has been recognized as a significant behaviour accounting for 20 – 30 percent of total environmental impact of western world (Beverland, 2014). While negative impact of human behaviour on the Earth is vividly discussed topic, it has been proven that consumers are rather unaware of their own environmental impact associated to particular product criteria (Tobler, Visschers, & Siegrist, 2011), especially to meat (Lea & Worsley, 2008), which is still perceived as nutritious and inevitable part of balanced healthy diet (Biesalski, 2005; McAfee et al., 2010). Although some ecologists identify reducing meat consumption as the most crucial sustainability issue (Carlsson-Kanyama & González, 2009), Tobler and colleagues (2011) on the contrary found that reducing meat consumption was perceived by consumers as the least environmentally beneficial behaviour.

According to FAO's rather optimistic report the world's meat production is responsible for 18% of the global emissions of greenhouse gases (Steinfeld et al., 2006). The World's Watch Institute however argues that as soon as emissions from respiration and land use are brought into picture, livestock production accounts for as much as 50 per cent of all greenhouse gas emissions (Beverland, 2014). Another factor that should be considered is decreasing global water supply. Lack of water has already negative impact on biodiversity, agricultural and food production in many regions around the world (Water, 2012). The agricultural sector has the greatest relevance for excessive use of water. According to Pimentel and colleagues (2004) agriculture accounts for about 70 percent of freshwater worldwide. The meat and dairy production in comparison with crop production is significantly more water demanding. For example producing 1 kg of rice requires about 3,500 L water, 1 kg beef about 15,000 L of water (Chapagain & Hoekstra, 2008) in (Water, 2012). The exact numbers of the water necessary to raise 1 kg of insect meat are still unavailable however would be substantially lower (FAO, 2009). Furthermore the UNFAO report (FAO, 2009) predicts that by 2050, the world's population is projected to grow from 6.8 billion to 9.1 billion, with meat consumption increasing from 50kg per year per capita to 80kg per year per capita (Alexandratos & Bruinsma, 2012). Due to the environmental degradation, energy and resources loss associated to meat production, providing animal based proteins from traditional livestock is already becoming extremely unsustainable (Yen, 2009) and problematic.

Although the western and developed countries are habitually leaders in the amount of meat consumed per capita, present studies identified trend of so-called westernization of Asian and developing countries diet. This westernization is characterised by increased consumption of meat and animal products at the expense of traditional local eating habits (Delgado, 2003; Pingali, 2007). With such a prospect it is not feasible to sustain global increasing demand of meat and animal products.

The trend of excessive yet still increasing meat consumption has been under considerable critique for its negative impact on the natural environment (Odegard & van der Voet, 2014; Pimentel & Pimentel,

2003) and calls upon innovative solutions. Albeit dietary changes in meat consumption are believed to bring potential benefits (Hallstrom, Roos, & Borjesson, 2014), systematic and powerful public-policy actions reducing meat consumption are inexistent both at international level as well as within European Union legislation. The reduction in meat consumption has been recognized as the most important sustainability issue (Carlsson-Kanyama & González, 2009) and is inevitable part of our future. Since meat eating is not mere reflection of nutritional needs, but it is also determined by taste, odour, and texture, as well as by geographical area, culture, ethics and wealth (Richardson, Shepherd, & Elliman, 1993), some consumers may find transition to balanced - plant based diet, that was confirmed to fully substitute meat centred one (Appleby, Thorogood, Mann, & Key, 1999) uneasy. Thus introduction of novel, resource efficient and sustainable source of protein on the market and implementing it in some form into balanced healthy diet of consumers might be the way to tackle the issue.

As mentioned above one of the proposed steps towards food security involves adding various insect to the global diet. Entomophagy is a term used for human consumption of insects as source of food (DeFoliart, 1992). Insect eating practice has been acquired and preserved by different ethnic groups in Africa, Asia, Central and South America and Australia(Durst, Johnson, Leslie, & Shono, 2010). In these areas insects are a common part of the menu for substantial amount of human population and represent wide range of 1386 edible insect species around the world (RamosElorduy, 1997). In the current study Van Huis and colleagues (2013) estimated that edible insects account for 1900 species all over the world with increasing tendency as the research focused on entomophagy evolves. Some insects are eaten as larvae or pupae, others as adults (Verkerk, Tramper, van Trijp, & Martens, 2007). Insects can be used as alternative or additional source of protein (Yen, 2009) and have always been a part of human diet (Bodenheimer, 1951; Morris, 2008). Besides the high protein content insects are nutritious source of fat and various crucial minerals (FAO, 2009). When compared to conventional meat, insects are considerably more resource–efficient food source (Odegard & van der Voet, 2014; Van Huis et al., 2013) with low environmental footprint. Despite of nutrient and environmental benefits, entomophagy is still confined to minor amount of developing and Asian countries. Additionally, in western countries where the meat consumption per capita is the highest, deliberate entomophagy is very sporadic (Yen, 2009).

The majority of western consumers does not classify insect as food item (Verkerk et al., 2007). There is substantial attitudinal barrier to the use of insect as a food (DeFoliart, 1992; Vanhonacker, Van Loo, Gellynck, & Verbeke, 2013) varying in intensity with each and every individual. Western attitudes towards insect eating can be divided into two divergent groups; the minor group where potential consumption is driven by curiosity and the major one associating insect consumption with negative emotions. The consumers eating out of curiosity are likely to seek for gourmet or adrenalin experiences and are more likely to accept idea of insect as a future source of protein (Heather Looy & John R Wood, 2006). Such consumers might form a potential target group for changing eating habits towards edible insect on bigger scale. Whereas people experiencing barriers exhibiting themselves by negative emotions are strongly influenced by western cultural conditioning (Schösler, De Boer, & Boersema, 2012; Vanhonacker et al., 2013) in which insects are viewed generally as pests (Van Huis et al., 2013) or source of contamination, and in relation to people as dirty, disgusting and dangerous animals (Heather Looy & John R Wood, 2006). In order to preserve and spread this food habit, it is of a great importance to reinforce acceptance of insects as highly nutritious and sustainable source of

protein (Van Huis et al., 2013) and attempt to diverge the conceptualization of insects from agricultural pests towards ordinarily consumed food.

Most of the recent studies related to entomophagy focus on collecting information about countries and tribes practicing insect consumption (Chakravorty, Ghosh, & Meyer-Rochow, 2013; Obopile & Seeletso, 2013; Zhi-Yi, 1997), exploring attitudes of western society towards edible insects (Looy, Dunkel, & Wood, 2014) and recently studies assessing consumer's acceptance of insects as food (Lensvelt & Steenbekkers, 2014; Verbeke, 2015). Lack of consumer's acceptance has been recognized as central barrier (Verbeke, 2015; Verkerk et al., 2007). In meat eating cultures around the world, out of over 7.7 million animal species (Mora, Tittensor, Adl, Simpson, & Worm, 2011), people tend to classify only a handful as edible (Angyal, 1941). All the rest are perceived as inappropriate to eat or even disgusting. It is not clear why western people are disgusted by eating insects, while not disgusted by eating the selective species they have learned to think of as edible.

While disgust towards insects as food has been observed by several authors (Bednářová, Borkovcová, Mlček, Rop, & Zeman, 2013; Heather Looy & John R. Wood, 2006), there is a gap in the literature regarding to that disgust factor. It is not clear what properties/elements of insects evoke the disgust. For the potential implementation of insects to western diet it is of great importance to investigate which cues trigger the disgust factor and whether the associated negative attitudes could be altered by removing or altering such cues.

Therefore the aim of the present paper is to provide insight into the exact drivers of disgust related to insect eating in Western countries, and how can consumers overcome them. The main research question is formulated as follows:

MRQ: What are the drivers of disgust that restrain western people from insect consumption?

Chapter 2. Theoretical background

2.1 Food (In)appropriateness

Food is a central part of daily life for humans as well as for animals. It is a fundamental contributor to physical well-being, source of both pleasure and anxiety, a way in which nutrition and toxins enter body, one of the greatest category of expenditures (Rozin, Fischler, Imada, Sarubin, & Wrzesniewski, 1999) and expression of social relations, religion and values (Fieldhouse, 1995). Especially nowadays consumption serves as main indicator of who we are. By purchasing and consuming particular food and goods people express their identity (Friedman, 2005). For instance, consumption of meat is associated predominantly to male identity (Loughnan, Bastian, & Haslam, 2014). This association became so strong that male vegetarians are perceived as less masculine when compared to meat eaters (Ruby & Heine, 2011). Moreover, it is still widely believed that by eating a specific kind of food we are taking on ourselves the properties of consumed item (Rozin & Fallon, 1987). According to findings of Nemeroff and Rozin (1989), this unconscious tendency rather than belief is still salient even amongst segments of western academic audience, and influences people's perception of food.

Since mouth is the main route of incorporating the outside world in to the body, food selection and consumption do involve some of the strongest emotional reactions (Nemeroff & Rozin, 1989) like happiness, disgust etc. For instance, in western societies chocolate consumption brings in most of the people feelings of happiness and pleasure, however chocolate-coated locust that is traditionally not considered as food would be evaluated as inappropriate and disgusting. In all societies eating constrains and restrictions are closely related to social and cultural identities, yet appropriateness criteria are paramount. Food is an integral component of culture, prone to specific rules of usage (Fieldhouse, 1995). By consuming culturally inadequate food one can experience strong discomfort, easily fall in spinning circle of judgments or in the worst case be even marginalized from society.

Inappropriateness, as opposed to appropriateness, innapropriatness can serve as cue for disgust. Innapropriate food in its simplest meaning is food that is not acceptable to eat in particular culture due to different reasons. Innapropriate food is carrying some kind of negative association. Such food can have low appeal, be unpalatable, have repulsive sensory properties, contamination potency or involve ideational forces (learned beliefs about the nature and origin of the item (Rozin & Fallon, 1987)), therefore triggers disgust.

As already mentioned, in our view food appropriateness is closely related to disgust and contamination forces, therefore carries strong emotional valence. In this study appropriate food items will be assessed as edible items, accepted by western culture as food item, however not necessarily liked by everyone. The consumption of an appropriate food item does not violate moral standards of particular culture and most importantly such consumption does not cause psychological or physical harm to the consumer. An inappropriate item on the food market can thus be a highly sustainable product, with good nutritional value, made from mealworms that were processed in accordance with safety and hygienic food design procedures. Despite the fact that such a product fulfils all conditions for food appropriateness from a rational point of view, prevailing amount of western consumers would probably be experiencing strong affective response to it. Due to the strong emotional valence exhibiting as disgust possibly caused by spoilage association, this product would be judged as inappropriate for consumption.

This approach is slightly different to the one of Rozin & Fallon (1980), who assess appropriateness from another perspective. Same as in our paper they suggest that in order to be rejected on appropriateness the food item is classified as not edible within a given culture, however not primarily due to strong affective response but rather due to low appeal; for example cloth, paper, and rocks, tree bark, sand etc. (Rozin & Fallon, 1980). In our paper those items belong rather to a category of inedible items suggested by MacClancy & Macbeth (2007).

MacClancy et al. (2007) suggest that process of categorization of some item as food (edible) or non-food (inedible) is generally influenced by "economic, nutritional, medicinal, ideological and religious factors" (p. 43). Nevertheless, almost everything with nutritional value is consumed by people around the world. Thus, there are immense differences when defining what is edible and what is not, varying predominantly within every culture but on individual level as well. According to Rozin et al. (1999) food identification as omnivores is guided initially on the basis of previous experience with the consequences of ingestion, and after that by set of sensory properties. Therefore theoretically speaking, learning and cultural patterns appears to be the main means by which humans distinguish what is edible, useful and healthy (Rozin & Fallon, 1980).

In order to understand how people judge what is and what is not edible in practice, it is necessary to look at food and non-food concept. Considering the variation in learning and cultural patterns, edible food items can be generally defined as any substance recognised for its nutritive or additional dietary value that people eat or drink in order to maintain life and growth (MacClancy et al., 2007). On the other hand, inedible items might be both of organic or inorganic origin, however due to their properties members of particular cultures do not accept them as food. Reasons for refusal may vary from unattractive sensory properties, to anticipated negative psychological effect or culturally determined dislike or disgust (MacClancy et al., 2007).

2.2 Disgust

There is a substantial amount of the literature related to the topic of disgust varying both in its definitions and span. Generally speaking, disgust is an emotion of avoidance with strong survival usage. Disgust is a very powerful emotion that can be linked to a number of situations, objects and actions. Since the word disgust in its simplest context means something offensive to the taste, most research on disgust is focused mainly on mouth incorporation and ingestion as an origin of disgust (Rozin, Haidt, & McCauley, 2008). Besides the taste, disgust may be experienced through smell, touch, hearing and even sight. There is a vast amount of cues that can evoke disgust. Rozin et al. (2008) suggest that people tend to be disgusted from up to nine domains, comprising of food, body products, animals, sexual behaviours, contact with death or corpses, violation of exterior envelope, poor hygiene, interpersonal contamination and certain moral offenses (Haidt, McCauley, & Rozin, 1994; Haidt, Rozin, McCauley, & Imada, 1997). Apart from its fundamental role in food choice and food acceptance/rejection, disgust is considered to be one of the most powerful transmitters of cultural values (Rozin & Fallon, 1987).

Ever since Darwin, disgust has been recognized as one of the basic food related emotions with characteristic facial expression and experienced revulsion associated with the "actually perceived or vividly imagined taste but also smell, touch and even eyesight" (p.757) (Darwin 1872/1965 cited in (Rozin et al., 2008)). Later on Angyal (1941) redefined disgust mainly as repulsion to the thoughts of oral incorporation of disgusting item. More recent emotion theorists acknowledge disgust as a one of the six basic emotions, and expand on Darwin's approach by food related physiological response of nausea, and an action component represented by urge to distance from the object of disgust (Izard, 1991; Rozin et al., 2008). In this line of thought, it is correct to assume that disgust was shaped by evolution as a protective survival tool, inhibiting from ingestion of dangerous and unknown food. Martins and Pliner (2006) confirm this assumption by finding that nausea, a specific physiological state accompanying disgust, may occur also prior or even without ingestion of disgusting item. In fact, there are several authors linking origin of disgust to defence against contamination and disease (Izard & Ackerman, 2000), and implement the skin and consequent touch as central agent of possible contamination (Rozin et al., 2008).

It is evident that different perspectives of disgust add to the complexity of the topic. In order to define content and span of disgust relevant for this study, concept of "*core"* disgust suggested by Fallon and Rozin (1987) will be used. The "*core"* disgust is defined as:

> "… that form of food rejection which is characterized by revulsion at the prospect of oral incorporation of an offensive and contaminating object." (p. 24)

A study carried out by Haidt et al. (1997) proposes that core disgust is ingrained in evolution but it is also product of culture. According to Fallon and Rozin (1983) the appraisal that elicits core disgust requires fulfilling three conditions; idea of potential oral incorporation hence a connection with food or eating, a sense of offensiveness and contamination potency. The core disgust is highly relevant for three disgust domains consisting of food, animals and body products (except tears)(Rozin & Fallon, 1987). All these domains at the prospect of oral incorporation elicit some level of disgust. The research of Martins and Pliner (2006) provides solid findings that there is a tendency to avoid food items due to aversive textural properties and animal association. The results of this study indicate that disgust reactions towards foods are based on two latent variables: (1) their aversive textural properties and (2) the extent to which they are reminders of "animalness" (Martins & Pliner, 2006).

Disgust is both of nature and nurture (Rozin, Fallon, & Augustoni-Ziskind, 1986). Thus it can be formed by innate evolutionary survival mechanisms as well as by learned patterns. These learned patterns are also called ideational forces and give guidance to an individual on what to think about a particular item within a particular culture (Rozin, 1997). The ideational forces are those beliefs that people hold about the nature and origin of disgusting items (Rozin & Fallon, 1987). For instance, in the case of insects Bodeinhammer (1951) emphasize that disgust to insects is not innate but learned since in some locations of the world insects are part of human diet. Knowledge of the nature or origin of the item plays a central role in consequent acceptance or rejection. Disgusting items are assumed to be distasteful and dangerous, and may at the same time be considered offensive (Martins & Pliner, 2006). The nature of the item in concern could be tolerable, however due to the unsavoury origin, the item is rendered tainted and turns disgusting as a whole. This is relevant for a

wide range of insects, because inherently they might be quite acceptable, however the environment they are living in changes the perception.

Theoretically, some items like faeces are intrinsically disgusting. The disgust is inherent to an object. However there are neutral objects that once in contact with faeces stop being neutral and are considered disgusting as well. Therefore disgusting items are believed to have contaminating properties that lower the value of other objects, with which they have been in contact (Rozin & Fallon, 1987). Moreover disgust and contamination are exhibiting themselves in very similar manner. Clearly core disgust is closely related to indication of contamination. Such an indication if confirmed, activates action not to eat, and can serve as disease avoidance mechanism (Rozin & Fallon, 1987). A cookie that has been in contact with faeces would no longer be perceived as acceptable for human consumption due to contamination and disease avoidance mechanism.

2.2.1 Other food rejections

Besides disgust as the strongest experienced food rejection, there are other food related rejection reactions, namely distaste, danger and in/appropriateness (Rozin & Fallon, 1987) to which we already made extensive reference (Chapter 2.1). These are all to some extent related to disgust.

Distaste is food rejection motivated by bad sensory properties (Rozin & Fallon, 1987) accounting for the highest level of within-culture variation. It is important to note that items rejected on distaste are still accepted by members of particular culture as food (Koivisto & Sjoden, 1996). Distasteful items are undesirable mainly when in the mouth or smelled. Rarely there is an objection to them when eaten by others or when already in body. For instance cross-cultural study carried out by Tan et al.,(2015) have shown that not all Thai people are motivated to consume locally edible insects due to the distaste factor, likewise not all Dutch are enjoying eating brussels sprouts.

Danger in relation to food is a more complex type of rejection motivated by fear or anticipation of harmful consequences caused to the body and soul by consumption (Rozin & Fallon, 1987). Dangerous items are undesirable in the mouth and the body however not in the environment. The rejection on danger is rather universal e.g. poisonous plants, however there are also distinct cases related to health and individual allergies. There is substantial overlap between danger and disgust. Rozin and Fallon (1987) found out that initial reasoning for rejecting many disgusting items like faeces or cockroaches is often due to the believe that they will cause harm.

2.3 Disgust towards insect eating

Despite the fact that insects represent crucial element in ecosystems in food provision, pollination, seed dispersal, and waste decomposition (Kellert, 1993), the general public attitude in most Western public towards insect species in non-food context is characterized by ignorance, fear, dislike, and disgust (Davey, 1994) rather than appreciation. The negative attitudes are highly supported by media, where insects are presented mainly as crop destroyers, pest, dangerous disease carriers or annoyance. Regardless that most of nature documentaries about insects are focused on education and enlightenment regarding insects and aim to show their positive impact on the environment,

Kellert (1993) found out that these programmes often evoke anxiety in viewers. According to Randler, Ilg, & Kern (2005) this anxiety correlates negatively with people's attitudes towards invertebrates and thus lowering the level of interest to explore more about them.

Interestingly there are different attitudes towards different insect species. People do not tend to be disgusted by all insect species. Some of them for instance butterflies or ladybirds are even considered beautiful and are accepted rather well in comparison to cockroaches or maggots. Kellert (1993) in his survey provides evidence considering negative public attitude towards several insect species. In particular according to his research majority of general public experience a dislike of ants, bugs, beetles, ticks, cockroaches, and crabs; an aversion to insects in home; a fear of stinging insects, spiders, and scorpions; a desire to eliminate mosquitoes, cockroaches, fleas, moths, and spiders (Kellert, 1993). There seems to be a pattern closely connected to previously mentioned contamination sensitivity. Most insects regarded as disgusting are inherently or secondary in relation to faeces (dung beetle, faeces of insect, fly), rotten meat (fly larvae, maggots), and spoilage (maggots, mealworms) or represent a disease carrier (mosquitos, ticks and flees).

The closer the contact with the disgusting item, the stronger will be the degree of unpleasant reaction. There is a vast difference between having disgusting insect in one's surroundings, on bare skin or ingesting them (Angyal, 1941). This hypothesis gives us clear reasoning why the most negative attitudes of western population are concentrated around insects as a source of food (Wood & Looy, 2000). Only the idea of insect consumption arouses feelings of disgust, revulsion, and fear.

The limited interest in insect eating is mainly caused by disgust and hygiene concern; however some authors are also assigning the refusal to completely novel approach that might evolve neophobic reactions (Menzel & D'Aluisio, 1998). Interestingly, most people in western societies involuntarily consume insects because of the levels permitted in food products (Kellert, 1993). Besides the insect fragments tolerance levels, people already consume insects without realizing it; for example red scale insects are used as food colouring agent E120 in Smarties candy, yogurts, and the alcoholic beverage Campari (Verkerk et al., 2007).

The conditioned western cultural perception of insects as harmful, useless, or disgusting needs to be changed, in order to separate insects that are suitable for food purposes, from species that carry disease, are inappropriate for consumption, or actually cause harm. If this does not happen, disgust towards insect will continue to be a significant barrier (Looy et al., 2014).

2.4 Contamination and ideational forces

In general contamination refers to the process when a previously neutral item turns impure either by physical contact with inherently dirty or disgusting item (Rozin et al., 2008), in other words by physical contamination or by employment of ideational forces, therefore by belief that the item in focus must be disgusting due to its nature or origin. Disgusting entities are believed to have contaminating properties (Rozin & Fallon, 1987). These contaminating properties are instantly transmittable, degrading the status of a previously acceptable item, and have continuous effect. People and cultures differ in the levels of contamination sensitivity, as well as in selection of objects that are perceived to have contaminating properties.

Contamination sensitivity is a basic feature of disgust (Rozin et al., 2008). It can be understood as a valence/strength of the experienced contamination. The contamination sensitivity can differ with each individual in intensity and focus; however in general there seems to be some kind of pan-cultural selection of objects related to contamination. In this line Rozin (1987) suggests that contamination is powerful and has rather universal bias amongst adults. Rozin and other authors indeed come to an agreement that faeces, rotten meat, spoilage and disease carrying animals are major sources of contamination for adults (Angyal, 1941; Haidt et al., 1994). It is highly important to realize that contamination sensitivity is not innate but evolves in children around the age of seven, when a child begins to understand higher-level ideas of matter and germs/microbes (Fallon, Rozin, & Pliner, 1984). Therefore it is possible to conclude that contamination similarly to disgust is predominantly learned and influenced by culture.

Physical contact can leave physical or psychological trace. In the case of physical trace, the contaminated item has visible residues of physical contact that was made with the entity. In the case of psychological trace, the residues of contamination are no longer present or even detectable, nevertheless for the observer the item stays tainted (Nemeroff & Rozin, 1989). Moreover contamination creates enduring changes in how people respond to and evaluate contaminated item. Morales et al. (2007) found out that even if consumers are exposed to cognitive load and the contact with disgusting item is very short the contamination still leads to genuine changes that are long lasting.

When disgusting objects touch food even briefly, people no longer consider such a food edible. This might be appropriate reaction led by intention to avoid disease. For instance when food is in the contact with cockroach, there might be chance of microbial contamination. However as proven by Rozin, Millman, and Nemeroff (1986), when the potential contamination was not present and participants were informed that sterilized cockroach was used in a drink, the drink continued being undesirable. This phenomenon of generalization to contexts in which it does not apply is called ideational contamination and accounts for a prevailing number of situations, when judgments about the state of the item are being made (Rozin & Fallon, 1987). The ideational contamination seems to be salient culprit of disgust and crucial factor for changing attitude towards insect eating.

Fallon et al.,(1983) introduced a concept of associational contamination and found out that numerous people are reluctant to eat a favourite food if it has contacted an item that merely resembles a disgusting item. For instance, (Gilovich, Griffin, & Kahneman, 2002) found out that serving apple juice in sterilized urine containers decreased amount of drunken apple juice by nurses, who were supposed to serve it to children in hospitals.

Framing is the strategy to keep potential contamination out of consideration (Rozin & Fallon, 1987). This framing strategy is a part of our everyday decisions. When valuating particular object of interest or situation we do not always think the same about contaminating history unless we are explicitly reminded of it. For instance we do not ponder over hygienic habits of people who participated in preparation of our food in restaurants or imagining the suffering and horrible living conditions of farm animals that become the juicy steak on our plate.

2.5 Neophobia - Food rejection of unknown

Neophobia, the reluctance to eat and/or rejection of novel food is typical for humans and is supposed to have adaptive value (Pliner, 1994). When a new food product is introduced in society, the response of consumers tends to involve negative feelings of fear and rejection (Pliner & Salvy, 2006). Rozin and Fallon (Fallon & Rozin, 1983) have proposed that in humans there are three main bases for rejection of food: (i) dislike of its sensory characteristics; (ii) danger, a fear of negative consequences of eating it; and (iii) disgust, arising from the idea of the food's nature or origin. This classification of the bases for rejection of foods provides a useful starting point for the discussion of the rejection of novel foods by humans.

While Rozin and Fallon focused on familiar foods, there is evidence for the relevance of each of these factors as a basis for rejection of novel foods as well (Pliner & Hobden, 1992). Exposure to a specific food item is a prerequisite for learning to accept and prefer that item. It has been proven by several researchers that neophobia is significantly influenced by situational factors. Humans, particularly children, tend to prefer familiar foods to novel ones (Birch & Marlin, 1982). However when novel food was introduced by their mother, children were more likely to consume novel food (Harper & Sanders, 1975). Surprisingly similar pattern was found in adults, who were more likely willing to consume unknown food when served by their friends than by researchers (Pliner & Hobden, 1992). As suggested by Pliner (1994) neophobia is supposed to have adaptive value and can be often reduced by repeated exposure to and consumption of the specific novel food item (Pliner, Pelchat, & Grabski, 1993).

In the case of entomophagy, neophobia can be explained by the two hypotheses of Rozin and Fallon (Rozin & Fallon, 1980): the first is rejection of insects because of the knowledge of their origin and habitats, and the second is rejection due to anticipated negative post-ingestional consequences.

As mentioned previously attitudes are personal traits that relate to the extent to which consumers accept new or unusual products (Pliner & Hobden, 1992) or products produced using unfamiliar or unknown technologies (Cox, Evans, & Lease, 2007), which is clearly the case for insects in Western societies (Verbeke, 2015). McFarlane and Pliner (1997) found that, willingness to try novel ethnic foods seems to show a different relationship with age. People seem to become more willing to try novel ethnic foods as they get older. Furthermore (Rozin & Rozin (1981)in (Pliner & Salvy, 2006)) have proposed that by adding familiarity to otherwise unfamiliar substances is supposed to decrease neophobia. This proposition is in the same line of thinking with findings of Wansink (2002) who suggest that for food to be perceived as acceptable it must fulfil the following conditions; it must be available, it must taste good, it must be familiar and must look, taste and feel as expected. Therefore adding familiarity to insect products might increase its acceptance.

2.6 Recognisability

Consuming flesh of animals has a strong connection to our prehistoric roots. Association of people and animals, or as Rozin (1987) says "animalness" was sufficient condition for disgust. We presume that need to differentiate from animals goes hand in hand with creating new terms for human diet. We no longer eat flesh of animals, we eat meat. This etymological progress went in some languages

even further. For instance in English, Czech and other languages, different kinds of meat are called completely different than the animal providing it (i.e. beef, poultry, and pork). This superficially created distance, together with fact that most of the consumers don't kill or hunt their own dinner, highly simplified our food choices. Animals are seen rather as meat product rather than living creatures. The consumers buying meat in supermarket are buying nice chunk of steak, that doesn't remind the animal in any way. In this way of thought we decided to implement recognisability in our framework. We believe that for successful implementation of insect food on the western market, the products should carry different name than for instance "Insect cookies", and the insect should not be recognisable in the product.

We found support for our presumption in literature. For instance, Kubberod et al.(2002) suggest that physical characteristics of food are important for determining the hedonic response and willingness to eat. This seems to confirm findings of Schösler, de Boer, and Boersema (2012) who examined readiness of Dutch consumers for adopting meat substitutes including fried mealworms or locusts, and fictive pizza comprising of protein derived from insects. As expected , meat substitutes with visible insects were perceived way more negatively in comparison to other options (Schösler et al., 2012). The pizza with processed insect protein was rated somewhat more positively, especially by younger people (Schösler et al., 2012). Therefore protein extraction from insect, insect flower, or mildly grinded insects that are used as food garnish in Mexico, could be a good start for acceptance in western countries.

2.7 Attitudes

An attitude is a general evaluation of people, objects or issues with some degree of favour and disfavour (Solomon, Russell-Bennett, & Previte, 2012). Attitudes are rather permanent and stable evaluations of an item. There are two aspects of attitudes: the direction that can be either positive or negative and intensity referring to strength of the experience. Anything towards which one holds an attitude is called an attitude object (Solomon et al., 2012). Attitudes are important psychological constructs because they have been found to influence and predict many types of behaviour. Moreover they have been found to be the strongest predictor of behavioural intention (Solomon et al., 2012). Yet, intentions have usually been included under the concept of attitude because of strong relationship between attitude and intentions (Fishbein & Ajzen, 1975).

The Theory of Reasoned Action and the Theory of Planned Behaviour hypothesized that attitudes lead to behavioural intentions which, in turn, lead to behaviour. By applying Theory of reasoned action a person's actual behaviour is driven by the intention to perform the behaviour. The common assumption is that the more positive a person's attitude towards some object, the more they will intend to perform such a positive behaviour and vice versa (Ajzen & Fishbein, 1977).

Several models are used to capture and understand attitudes. The simplest ABC Model of Attitudes suggests that an attitude has three components: affect, behaviour, and cognition. The ABC Model of Attitudes puts the emphasis on the relationship between knowing, feeling, and doing (Solomon et al., 2012). Affect is the feeling of an individual experience in relation to an object. In the current context, affect represents the emotion or opinion about a product or service. Behaviour is the responses of a consumer resulting from affect and cognition. Behaviour only implies intention. Cognition is an individual's belief or knowledge about an attitude object.

The most influential multi-attribute model - the Fishbein model - is used to understand and measure attitudes and also consists of three elements - attributes, salient beliefs, and weights. The first, (object) attributes are the characteristics of the attitude object. Second, salient beliefs, is a reference to the beliefs a person might gain during the evaluation of a product or service or basically a measurement of a particular attribute. Finally, the third component, is an indication of priority or importance of the particular attribute (Solomon et al., 2012). Under this framework, an attitude towards a product is based on knowledge about the product itself as well as its attributes, which is referred to as the so-called 'bottom-up' formation of attitudes (Grunert et al., 2003). Attitudes do not depend only on one specific belief but on a handful of them. A multi-attribute model can be used to measure a consumer's overall attitude.

2.8 Theoretical framework

The existing literature indicates that there is lack of acceptance towards insects as a source of food and part of western diet. Insects as a source of food are heavily rejected on disgust. In order to understand what are the drivers triggering the disgusting associations, following hypotheses based on the literature review have been formulated.

H1: Inappropriateness increases ideational contamination.

H2: Ideational contamination increases disgust towards eating insects.

H3: Rational argumentation positively influence attitudes to insect consumption.

H4: Recognisability increases ideational contamination.

H5: Disgust negatively influence attitude towards insect as a food

H6: Neophobia increases disgust.

H7: Neophobia changes attitude to insect as food.

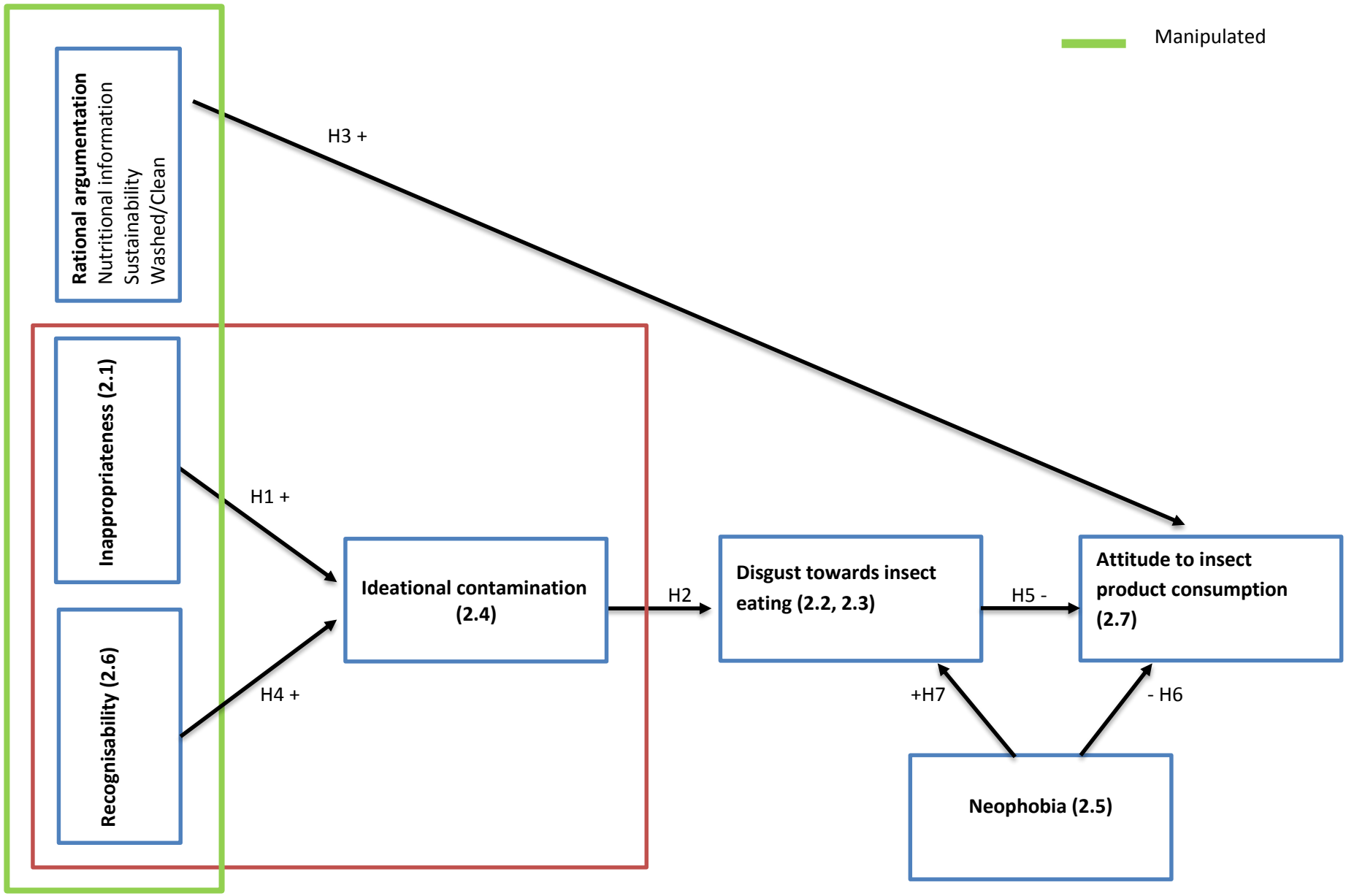


Figure 1 Theoretical framework

Chapter 3. Methodology

In order to understand what properties of insects are triggering the disgusting associations, ideational contamination, disgust towards insect eating and attitude to insect product consumption will be measured. In order to manipulate recognisability, inappropriateness and rational argumentation experimental design was developed, in which participants were asked to read a story about insect consumption.

3.1 Design and Participants

For this study we adopted a 2 (inappropriate versus appropriate) by 2 (recognisability versus non-recognisability) by 2 (rational argumentation versus no argumentation) full factorial design. In this design, three independent variables (factors) each with two levels were manipulated to test the hypotheses. Participants were randomly assigned into eight experimental groups. Participants got just one story scenario that differed in provided informational cues relevant for the experimental group setup. In total the study involved 172 participants. Participants were randomly assigned to eight conditions.

The sample was drawn from the student population of Wageningen University using convenience sampling, which involves using participants that are easiest to recruit due to best proximity to the researcher. The data were collected through web-based survey. The survey was presented through online social media channels. Out of all participants; 109 (63.4 %) were female, 59 (34.3 %) were male and there were 4 missing responses regarding the gender. Age of participants ranged between 18 and 46 years (M=24.42). Participants differed in their study programs at Wageningen University, and they were from 28 different countries.

3.2 Manipulations

In order to measure participants' disgust towards insect eating participants were divided into 8 different conditions. Each condition had different manipulation purpose set up combining three factors: appropriateness, recognisability, argumentation and its levels.

Appropriate	Recognisable	Rational argumentation
		None
	Non-recognisable	Rational argumentation
		None
Inappropriate	Recognisable	Rational argumentation
		None
	Non-recognisable	Rational argumentation
		None

Table 1 Manipulations

To assure good experimental control following story with different manipulated scenario relevant to one of 8 conditions was provided to participants.

To manipulate **appropriateness**, the statement bellow was presented. The reason for including these particular sentences was to emphasize that insect consumption is appropriate in western cultures.

> *"Nowadays insects are being re-introduced as food to the western diet. Insect products have appeared in Western eating cultures for a long time. Traditional dishes like the Italian cheese Cazu Marzu can only be made with insects. Besides that insects are also used as food colouring ingredient E120 in a variety of products like candies, yogurts, and the alcoholic beverage Campari."*

In the case of **inappropriateness**, the statement bellow was included. The reason for employing these particular sentences was to emphasize that insect consumption is inappropriate in western cultures.

> *"Nowadays insects are penetrating the western markets. New insect products are placed in the supermarkets on the same shelf as conventional food. Insects should replace the meat in traditional dishes like hamburgers. Besides that insects will be used as a novel ingredient in a variety of products like chips, protein bars, and spreads."*

To manipulate **recognisability,** the statement bellow was implemented. The aim of adding these particular sentences was to point out that parts of insects are detectable in a product by eye sight and can be experienced texture-wise as well.

> *"Insect burgers that resemble the traditional ones except the fact that **some insect parts are recognisable** by eyesight or texture-wise can be an easy way how to implement insects in our diet."*

In the case of **unrecognizability,** the statement bellow was implemented. The aim of adding this particular statement was to emphasize that absolutely no parts of insects are detectable in product neither by eye sight and neither can be experienced texture-wise.

> *"Insect burgers that resemble the traditional ones except the fact that **some unrecognisable insect flour is added** can be an easy way how to implement insects in our diet."*

To check whether rational argumentation changes attitude towards insect product, rational information was either provided or not mentioned at all depending on the assigned group. In order to manipulate **rational argumentation,** the following rational arguments were provided.

> *"Insects have high protein content and are a good source of fat and various important minerals. When compared to conventional meat, insects are more sustainable as they require less space; less food and water, less energy per amount of food compared to even the most efficient meat source. Insects are therefore a high quality food source with low environmental footprint."*

In accordance with developed manipulation scheme participants were randomly assigned to 8 different scenarios. To give an example, one of the possible scenarios is presented below.

Example scenario: Appropriate – Recognisable – Rational argumentation

"Nowadays insects are being re-introduced as a food to the western diet. Insect products have appeared in Western eating cultures for a long time. Traditional dishes like the Italian cheese Cazu Marzu can only be made with insects. Besides that insects are also used as a food colouring ingredient E120 in a variety of products like candies, yogurts, and the alcoholic beverage Campari.

Insect burgers that resemble the traditional ones except the fact that some insect parts are recognisable by eyesight or texture-wise can be an easy way how to implement insects in our diet.

Insects have high protein content and are a good source of fat and various important minerals. When compared to conventional meat, insects are more sustainable as they require less space; less food and water, less energy per amount of food compared to even the most efficient meat source. Insects are therefore a high quality food source with low environmental footprint."

3.2.1 Pilot test

In order to start successful data analysis it was important to pre-test our manipulations and find out whether our story scenarios were successful in triggering intended outcomes. A pilot-test on scenarios was carried out. The first two pilot tests disclosed that the respondents were not able to distinguish which scenario is appropriate and which inappropriate. The rational argumentation was showing expected results. Based on this finding small adjustments in pilot test were made to strengthen the manipulations. The final pilot test consisted of 2 questions. The first question presents two scenarios. Participants were asked to read both scenarios carefully and rate which of the two scenarios would be more appropriate for the introduction of insect products on the western market. They were asked to rate the scenarios on 9 point scale, where 1 (scenario 1) – 9 (scenario two) with 5 representing the scale centre. After that participants were instructed to continue to question number 2 presenting rational argumentation and choose the response that most resembles their opinion (a,b,c,d,e). It was emphasized that there are no correct or incorrect responses; and that researchers are merely interested in participants' personal point of view. The manipulations were validated. One sample t-test showed significant difference ($p<.01$) between scenarios. For the Pilot test, please see the Appendix I.

3.3 Measures

To measure **attitude to insect consumption** we adjusted set of questions from Sample TPB Questionnaire by Icek Ajzen (2013). The statements targeting attitudes were chosen and adjusted to fit our purpose. The Sample TPB Questionnaire makes a use of direct method for measuring attitudes, specifically semantic differential scale. This seven-point bipolar adjective scale is used to

anchor both ends of attitudes. The scale is focusing on a continuum from very negative to very positive attitudes. This range allows us to determine where on the continuum the attitudes of individuals fall in. For the details of the statements see the scale bellow (Figure 3). After summarizing scores, a mean attitude score was calculated, with higher numbers corresponding to positive attitude and vice versa (M=4.84, SD=1.37). In order to determine whether the scale is reliable, Cronbach's alpha was calculated. The scale was reliable with Cronbach's alpha (α) = 0.92.

1) For me to eat insect products is

extremely bad: ___1__:___2__:___3__:___4__:___5__:___6__:___7__: extremely good

2) For me to eat insect products is

extremely worthless: ___1__:___2__:___3__:___4__:___5__:___6__:___7__: extremely valuable

3) For me to eat insect products is

extremely unpleasant: ___1__:___2__:___3__:___4__:___5__:___6__:___7__: extremely pleasant

4) For me to eat insect products is

unreasonable: ___1__:___2__:___3__:___4__:___5__:___6__:___7__: reasonable

5) For me to eat insect products is

unacceptable : ___1__:___2__:___3__:___4__:___5__:___6__:___7__: acceptable

Figure 2 Attitude scale

To measure **disgust** two parallel measures were used. For the first measure we used template of facial expressions pictures of Ekman and Friesen (Ekman & Friesen, 2003). Ekman conducted extensive research on basic emotions, using pictures of 6 basic emotions to people across the world, in order to prove universality of emotions (Ekman & Keltner, 1970). The question "*Which picture best represents your first impression of the insect burger?"* was constructed in order to control for the disgust factor. Respondents were asked to choose only one picture that best represents their feeling about the insect burger. We used this picture scale to disguise the focus on disgust in our respondents. The list of 6 basic emotions consequently presents all basic ones; Anger, Disgust; Scare, Happiness, Sadness and Surprise. The Second disgust measure involved the following question about insect burgers "*How disgusting would you find the presented burger with insects in it?"* The question and two responses measure the level of disgust related to insect as a food on 7 point Likert scale. After summarizing scores, the mean score for disgust (Likert scale) was calculated (M=2.88, SD=1.70), with higher numbers corresponding to higher disgust and vice versa. The scale was reliable with Cronbach's alpha (α) = 0.80. The mean score for Ekman scale couldn't be calculated due to the characteristics of the scale, however only 17 (9.9%) respondents chose the disgust face. Surprisingly the greatest amount of respondents 66 (38.4%) selected the happy face.

1) **Which picture best represent your first impression of the insect burger?**

2) **How disgusting would you find the presented burger with insects in it?**

a) That burger sounds disgusting.

Not at all : ___1__:___2__:___3__:___4__:___5__:___6__:___7__: extremely

b) I would never put that burger in my mouth.

Strongly disagree: ___1__:___2__:___3__:___4__:___5__:___6__:___7__: strongly agree

Figure 3 Disgust scales

To measure **contamination** we adapted several questions from two different contamination **subscales; a) the Vancouver Obsessional Compulsive Inventory (VOCI) assessing contamination fears** and washing compulsions (Thordarson et al., 2004) and **b) Padua Inventory** (PI) assessing contamination obsessions and washing compulsions (Burns, Keortge, Formea, & Sternberger, 1996). Due to the fact that both VOCI and PI subscales are measures assessing character traits relevant to contamination, we could not use them to measure insect relevant contamination. However we used the subscales as a template for a new scale. We created a new scale consisting of 2 questions adapted from the VOCI contamination subscale and of 5 questions adapted from PI scale. The new Insect Contamination Scale (ICS) is comprised of 7 statements, each scored on a 7-point scale ranging from 1 (agree strongly) – 7 (disagree strongly). After summarizing scores, the mean score of contamination was calculated (M=4.49, SD=1.36). Higher scores indicated higher level of contamination. The scale was reliable with Cronbach's alpha (α) = 0.87.

	Insect Contamination Scale							
1	I feel food is dirty when it's touched by insect.	Strongly Disagree	Disagree	Disagree Somewhat	Undecided	Agree somewhat	Agree	Strongly Agree
2	I think even slightest amount of insects will contaminate food.	Strongly Disagree	Disagree	Disagree Somewhat	Undecided	Agree somewhat	Agree	Strongly Agree
3	I find it hard to eat an object when I know it has been in contact with insect.	Strongly Disagree	Disagree	Disagree Somewhat	Undecided	Agree somewhat	Agree	Strongly Agree
4	I find it difficult to touch insects like maggot or cockroach.	Strongly Disagree	Disagree	Disagree Somewhat	Undecided	Agree somewhat	Agree	Strongly Agree

5	I avoid drinking water with fly in it due to contagion and disease.	Strongly Disagree	Disagree	Disagree Somewhat	Undecided	Agree somewhat	Agree	Strongly Agree
6	If I touch an insect that I think is "contaminated" I immediately have to wash or clean myself.	Strongly Disagree	Disagree	Disagree Somewhat	Undecided	Agree somewhat	Agree	Strongly Agree
7	I feel very contaminated if I touch an insect.	Strongly Disagree	Disagree	Disagree Somewhat	Undecided	Agree somewhat	Agree	Strongly Agree

Table 2 Insect contamination scale

To measure **neophobia** we used Pliner's and Hobden's (1992) ten item Food Neophobia Scale questionnaire. These questions were developed in order to recognize neophobia traits in humans eating behaviour. Neophobia is defined in terms of the average willingness to taste the novel foods, divided by the average willingness to taste the familiar foods (Pliner & Salvy, 2006). Every question can be rated on 7-point Likert scale 1 (agree strongly) – 7 (disagree strongly). Low scores on this measure serve as an indicator of high neophobia. The FNS scale has been extensively validated and used in different set ups including willingness to eat novel foods both in and out of the laboratory conditions, familiarity and experience with relatively exotic foods and 'foreign' cuisines (Pliner & Salvy, 2006). The neophobia scale was reliable with Cronbach's alpha (α) = 0.87.

Food Neophobia Scale								
1	I am constantly sampling new and different foods. (R)	Agree strongly	Agree	Agree Somewhat	Undecided	Disagree somewhat	Disagree	Strongly disagree
2	I don't trust new foods.	Agree strongly	Agree	Agree Somewhat	Undecided	Disagree somewhat	Disagree	Strongly disagree
3	If I don't know what is in a food, I won't try it.	Agree strongly	Agree	Agree Somewhat	Undecided	Disagree somewhat	Disagree	Strongly disagree
4	I like foods from different countries. (R)	Agree strongly	Agree	Agree Somewhat	Undecided	Disagree somewhat	Disagree	Strongly disagree
5	Ethnic food looks too weird to eat.	Agree strongly	Agree	Agree Somewhat	Undecided	Disagree somewhat	Disagree	Strongly disagree
6	At dinner parties, I will try a new food. (R)	Agree strongly	Agree	Agree Somewhat	Undecided	Disagree somewhat	Disagree	Strongly disagree
7	I am afraid to eat things I have never had before.	Agree strongly	Agree	Agree Somewhat	Undecided	Disagree somewhat	Disagree	Strongly disagree
8	I am very particular about the foods I will eat.	Agree strongly	Agree	Agree Somewhat	Undecided	Disagree somewhat	Disagree	Strongly disagree
9	I will eat almost anything. (R)	Agree strongly	Agree	Agree Somewhat	Undecided	Disagree somewhat	Disagree	Strongly disagree
10	I like to try new ethnic restaurants. (R)	Agree strongly	Agree	Agree Somewhat	Undecided	Disagree somewhat	Disagree	Strongly disagree

Remark: Items for which scoring is reversed are marked (R).

Table 3 Food Neophobia scale

3.4 Background variables

The background variables relevant for this study are the typical demographic characteristics as age, gender and country of origin. For instance a study carried out by Verbeke (2015) shows that acceptance of edible insect as food was stronger among males than females, and younger consumers were more likely to adopt insect food in comparison to older ones. The participants in the present study are coming from different countries around the world. In some countries eating insects is normal or part of tradition, contrary to other countries where insect eating is highly inappropriate. Moreover we include study programme, diet and most importantly prior experience with eating insect or insect products. Diet is another variable worth considering; we propose that vegans and vegetarians might refuse the idea of eating insect from the ethical reasons. Lastly and most importantly prior insect eating experience should positively influence attitude to insect consumption.

3.5 Procedure

The survey was conducted to recognize the disgust culprits and provide insight into the factors that influence the attitude to insects' product consumption. The data collection was carried out through online questionnaire. In the first part participants started the experiment by clicking on the provided link. Through this link they were redirected to introduction story line followed by one of the eight scenarios. Subsequently they were asked to answer the set of questions from Sample TPB Questionnaire, both Disgust Scales and the contamination Insect contamination scale. In the last part participants were asked to fill in the Food neophobia scale and background questions which ended the experiment. The survey predominantly consisted of statements that could be rated on a 7 point Likert scale, only a few open questions were used.

Chapter 4. Results

In this part we present the results of our statistical analysis. We applied regression analysis for the cases where we investigated causal relationships between the dependent and our independent variables and analysis of covariance (ANCOVA) to compare means between groups of categorical variables.

4.1 Preparatory statistics

4.2.1 Reliability measures

In order to ensure reliability of the Likert scale measures, Cronbach's alpha was calculated for each measure that has been employed in this study. The different outcomes are presented in Table 4. The outcomes of Cronbach alpha's show high values, which indicate that the selected measures were sufficiently reliable.

Measure	Cronbach's alpha
Attitude to insect consumption	0.916
Disgust – Ekman scale	N/A
Disgust (mini scale)	0.798
Insect contamination scale	0.868
Food neophobia scale	0.818

Table 4 Cronbach alphas of the scale measures

4.2.2 Reported means and standard deviations of variables

For better orientation descriptive statistics of the dependent and explanatory variables are provided in Table 5.

Variable	Mean (S.D.)
Ideational Contamination	4.50 (1.36)
Disgust	2.88 (1.70)
Neophobia	5.39 (0.90)
Attitude to insect	4.84 (1.37)

Table 5 Means and standard deviations of dependent and explanatory variables

4.2.3 The disgust scales

The dependent variable disgust was measured by two different constructs. The first construct uses facial expression pictures of Ekman (Ekman & Friesen). This measure represented by question "*Which picture best represent your first impression of the insect burger?"* was used in order to control for the disgust factor. As a template we used Ekman's list of 6 basic emotions photographs that were presented to participants in order to disguise the focus on disgust. Second construct consisted of one question and two associated responses which measured level of disgust related to insect eating (7 point Likert scale). The Multinomial logistic regression between two disgust scales has been used in order to predict which of the 6 emotion categories are scored on based on disgust scale and whether the two measures are related to each other.

The reference category: Disgust

EMOTION		Coefficient, Significance
Anger	DISGUSTSCALE	-0.290 (0.240)
Scare	DISGUSTSCALE	0.210 (0.363)
Happy	DISGUSTSCALE	-2.368 (0.000)**
Sad	DISGUSTSCALE	-0.418 (0.020)**
Surprise	DISGUSTSCALE	-0.897 (0.001)**

** denote significance in the 5% level of significance

Table 6 Multinomial logistic regression

Table 6 shows that both disgust measures are usefully related to each other. It has been proven that the two scales are measuring the disgust. Changes in score of disgust in the disgust scale don't change score in anger (p-value=0.204) and scare (p-value=0.363) because of the similarity between anger, scare and disgust. On the contrary it has a significant big negative effect on happiness (coef. = -2.368, p-value=0.000), significant positive intermediate effect on surprise (coef. =3.255, p-value=0.001) and significant smaller negative effect on sadness (coef. = -0.418, p-value=0.020). Since the two disgust measures were very similar subsequent analyses will be conducted on the disgust Likert scale. Due to the categorical nature the disgust face scale is not statistically powerful.

4.2 Hypothesis testing

4.2.1 Hypotheses 1 and 4

H1: Inappropriateness increases ideational contamination.

H4: Recognisability increases ideational contamination.

Hypotheses 1 and 4 were jointly tested with an ANCOVA model. In particular, we investigated whether our measures for appropriateness, recognisability, their interaction terms as well as previous consumption of insects significantly influence ideational contamination in relation to insects. However, before proceeding with the results, it is necessary to verify the assumptions on which our test is based.

At first, the normality assumption is checked with the help of a QQ plot (APPENDIX II.) which verifies the normal distribution of our dependent variable. Secondly, equality of variances across groups is tested by Levene's test. The results of this test are presented in the APPENDIX II. As we can see on the respective table, the p-value for Levene's test is equal to 0.492, which indicates that the error variance of the dependent variable is not equal across groups. This is not an insurmountable problem for our analysis, however it subtracts from the predicted value of our model.

Dependent Variable: Contamination

Independent Variable	F-value, Significance
Recognisability	0.016 (0.900)
Appropriateness	0.016 (0.901)
Recognisability * Appropriateness	1.001 (0.318)
Previous Insect Consumption	13.678 (0.000)**

** denote significance in the 5% level of significance

Table 7 Ancova results

Table 7 provides the results of the two way ANCOVA with the effect of recognisability, appropriateness and their interaction on ideational contamination with the additional inclusion of a variable indicating whether participants had previously eaten insects (The original SPSS output is provided in the APPENDIX II.). Our model predicted that neither the effect of appropriateness F (1,167) =0.016; p=.900; nor that of recognisability F (1,167) =0.016; p=.901, or their interaction F (1,167) =1.00; p=.318 was significant. Hence neither H1 nor H4 could be confirmed. Providing information on appropriateness of insects in western diet and recognisability of the insect in the burger has no effect on the contamination. On the other hand, the effect of previous consumption of insects showed that people who had this experience, perceived significantly less ideational contamination in relation to insects F(1,167)=13.68; p<.001. The R-square value is 0.081.

4.2.1 Hypothesis 2

H2: Ideational contamination increases disgust towards eating insect products.

Assuming linear relationship between the dependent and the independent variables (APPENDIX III.– Scatterplot), the above hypothesis was investigated by simple linear regression between ideational contamination as predictor and disgust (disgust scale) as the dependent variable. In addition, we verified the homoscedasticity assumption (equality of variances across our sample) (APPENDIX III.- QQ Plot).The results (Table 8) show significant negative effect of contamination on disgust equal to -0.572 ($p<0.050$). Based on these outcomes, we can accept that ideational contamination increases disgust towards eating insects. Next to this, the validity of our model is verified by the p-value of the F-statistic (APPENDIX III.– ANOVA Table as part of the complete SPSS output) and the R-square value of 0.21 shows that almost 21 % of the disgust towards an insect can be predicted from the Ideational contamination.

Dependent Variable: Disgust

Independent Variable	Coefficient, Significance
Contamination	-0.572 (0.000)**

** denote significance in the 5% level of significance

Table 8 Regression Analysis Results

4.2.1 Hypotheses 3, 5 and 6 as determinants of attitude

H3: Rational argumentation positively influence attitudes to insect consumption.

H5: Disgust negatively influence attitude towards insect as a food

H6: Neophobia changes attitude to insect as food.

For this relation, a multiple regression analysis was carried out with attitude to insect as dependent variable and rational argumentation, Neophobia and Disgust as our set of predictors. The results of the multiple regression are indicated in Table 9. The full SPSS output together with the QQ plot verifying the assumption of equal variances across the sample is provided in APPENDIX IV.

Dependent Variable: Attitude to Insect

Independent Variables	Coefficient, Significance
Scale of Disgust	-0.652 (0.000)**
Neophobia	-0.048 (0.581)
Rational	0.277 (0.042)**

** denote significance in the 5% level of significance

Table 9 Regression Analysis Results

As is observable from the above table (Table 9), there are two significant effects on our dependent variable. At first, Disgust affects Attitude to insect negatively (coef. = -0.652, p-value=0.000). Secondly, Rationality affects Attitude to Insect in a positive way (coef. = 0.277, p-value = 0.042). Our model fail to predict a significant relationship between Neophobia and Attitude to Insect (coef. = -0.048, p-value = 0.581).

4.2.1 Hypothesis 7

H7: Neophobia increases disgust.

For this relation, simple linear regression was carried out with Neophobia as predictor and Disgust (disgust scale) as the dependent variable. Having checked the linear relationship between our dependent and independent variables (APPENDIX V.– Scatterplot), we proceed to the result presentation. At first, our independent variable accounts for almost 25% of the variation of the dependent one (R-square = 0.245 – APPENDIX V.). The results (Table 10) show significant negative effect of Neophobia on disgust (coef. = -0.931, p-value=0.000). In fact our model predicts a negative relationship between neophobia and disgust. However, taking into account the reverse scale of neophobia (low values responds to high neophobia), we actually verify our hypothesis that neophobia increases disgust.

Dependent Variable: Disgust

Independent Variable	Coefficient, Significance
Neophobia	-0.931 (0.000)**

** denote significance in the 5% level of significance

Table 10 Regression Analysis Results

Chapter 5. Discussion

In this chapter the summary of the main study results, reflection on the results, limitations and suggestion for further research are discussed.

5.1 Summary of the Main Study Results

This study explored what are the drivers of disgust that restrain western people from consumption of insect products. After the literature review of available scientific literature, the theoretical framework was built. We looked at the relation of ideational contamination leading to disgust towards eating of insect products (H2). As well as how recognisability of the insects in the product and inappropriateness of the insect product influence ideational contamination (H1+H4). Furthermore we analysed whether disgust towards insects has negative impact on the attitude to insect product consumption (H5). We investigated whether neophobia plays significant role in this relationship, particularly whether neophobia increases disgust towards insect eating (H6), and whether changes attitude to insect product consumption (H7). Lastly we investigated whether providing rational argumentation (sustainability, nutritional information, washed/clean) have positive influence on the attitude to insect product consumption (H3).

Summing up the results, we did find a significant main effect of ideational contamination on disgust towards insect products. People who perceive insects as disgusting, dirty, contaminating tend to feel higher level of disgust to insect products. This was also in line with our research hypothesis. We also tested whether recognisability and inappropriateness had an impact on the ideational contamination. The obtained results didn't show any significant effect on our target group. Neither the effect of inappropriateness, nor the effect of recognisability, nor their interaction was significant. This could mean that recognisability and inappropriateness were not strong enough to increase perceived contamination. Furthermore we found evidence that conjoint effect of rational argumentation, disgust and neophobia has significant effect on attitudes to insect products. Finally, we found a significant effect of neophobia on disgust. This means that when people are neophobic, they perceive higher levels of disgust towards insect products. Therefore our hypothesis that neophobia increases disgust was in accordance with our results.

5.2 Reflection on Results

The fact that neither appropriateness nor recognisability had the expected effect on the ideational contamination may be due to the ideational contamination scale. The measure was reliable (Cronbach alpha = 0.87), however not accurate enough. The scale was measuring rather general contamination towards insect than contamination regarding the particular product. We could not be aware of this issue at the beginning of our research. We supposed that the contamination scale is valid and reliable scale.

Furthermore the manipulations weren't strong enough. In the case of recognisability this could be caused by the fact that the visual representation was missing in the experiment. We conclude that, text may not be sufficient to raise strong affective response. In the further research we highly recommend to provide pictures or even actual insect products. In the case of manipulation of inappropriateness, the inappropriateness concept may not have been convincing. The participants could already knew about insect products and did not perceive it as inappropriate anymore. The Wageningen University is well known for edible insect research and students are much exposed to different insect related events, from educational lectures to actual tasting of insect products.

Even though ideational contamination was measuring rather general insect contamination not product specific, and as result was not affected by our manipulation, it is still highly relevant for disgust to insect eating. The relationship still holds and it is significant. When insect product is considered, consumer can experience disgust to that product, but at same time disgust to insect in general. In the same virtue, Ideational contamination regarding insect in general is likely to link to feeling of contamination when exposed to insect product.

The fact that we found a significant effect of disgust towards insect eating on attitude towards insect products is well in line with the existing theory. Based on the literature we related neophobia to both attitude and disgust. We revealed unexpected outcome of this relation, which we didn't consider before. Neophobia does not influence attitude to insect product consumption directly, but is fully mediated through disgust. This could be explained due to the fact that same as disgust neophobia has strong emotional valence. Therefore the power detours through disgust, which in turn forms attitude to insect products. The attitudes are created by affective (emotional) and cognitive part. In

regards to food, the emotional part tends to overrule the cognitive (rational) part, which is the case with neophobia in our case.

5.3 Limitations and Further Research

As mentioned above one of the main limitations of this study is the fact that the contamination scale that we constructed was not measuring the contamination regarding insect products but rather insect contamination in general. For the further research we highly recommend to use product specific contamination scale to gain more precise responses.

The face disgust scale inspired by research of basic emotions of Ekman did prove to have several drawbacks for our research. We found out that it was difficult for our participants to answer this scale, which makes the scale less reliable. Moreover the scale is not statistically powerful. Despite the drawbacks, it was worthwhile to include the scale. We found out that the face disgust scale was related to the disgust Likert scale. Therefore inclusion of the face disgust scale supported the validity of disgust Likert scale, we can now more confidently rely on our disgust Likert scale. For the future research we recommend to construct more precise and extensive disgust scale that would be appropriately validated through the time by broad range of respondents.

Furthermore the participants were taking part in the experiment without supervision, in different time slots and different places. All of these factors could have an effect on the way they responded. The survey was available online and the time was not limited. It would be practically impossible to get the required amount of participants in one time and place. We were not able to control whether the participants were filling the survey when they were alone. It has been proved that presence of other people influence the way people respond due to lowered focus. In addition we believe that motivation to respond correctly might have impact on the final results, even though we made clear in the survey, that we are interested mainly in personal opinion. In the further research we recommend to provide same experimental setting for all respondents.

Due to the financial constrains it was not realistic to set up real experiment with insect burgers. Participants were asked to imagine the insect burgers themselves. By not presenting the real dish or at least descriptive picture, the information within this study might have been too weak or also vary with imagination capacity of each participant. For the further research we recommend to use descriptive pictures of insect product or ideally the insect product itself to ensure same level of exposure.

Next to this the target group was very specific. The sample consisted entirely from students of Wageningen University. The students are rather familiar with topic of edible insects due to the lectures and events organized by university and also interaction with students from countries where edible insects are consider as food item. As a result we need to be very careful in generalizing our findings to the population with different age, education level and profession. Using a different target group in further research is highly recommended and could lead to new insights on the subject.

To conclude, in this research we focused on what are the drivers of disgust that restrain western people from insect consumption. We predicted that ideational contamination is responsible for the

perceived disgust. Our results show that for our target group the ideational contamination is significantly increasing disgust. The ideational contamination is therefore one of the drivers of disgust towards insect product consumption. The effect of previous consumption of insects showed that people who had prior insect eating experience, perceived significantly less ideational contamination in relation to insects. Hence for the successful introduction of the insect products on western market it is important to change the perception of consumers. To emphasize the difference between insects in their natural environment and breeding insects for human consumption, that are subjected to strict food safety rules, therefore have no real contamination potency. For the future research we would suggest to further investigate whether removing of ideational contamination can lower the disgust to consumption of insect products.

References

Ajzen, Icek. (2013). Constructing a TpB Questionnaire: Conceptual and Methodological Considerations

Ajzen, Icek, & Fishbein, Martin. (1977). Attitude-behavior relations: A theoretical analysis and review of empirical research. *Psychological bulletin, 84*(5), 888.

Alexandratos, Nikos, & Bruinsma, Jelle. (2012). World agriculture towards 2030/2050: the 2012 revision. *ESA Work. Pap, 3*.

Angyal, Andras. (1941). Disgust and related aversions. *The Journal of Abnormal and Social Psychology, 36*(3), 393.

Appleby, Paul N, Thorogood, Margaret, Mann, Jim I, & Key, Timothy JA. (1999). The Oxford vegetarian study: an overview. *The American journal of clinical nutrition, 70*(3), 525s-531s.

Bednářová, Martina, Borkovcová, Marie, Mlček, Jiří, Rop, Otakar, & Zeman, Ladislav. (2013). Edible insects-species suitable for entomophagy under condition of Czech Republic. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis, 61*(3), 587-593.

Beverland, M. B. (2014). Sustainable Eating: Mainstreaming Plant-Based Diets In Developed Economies. *Journal of Macromarketing, 34*(3), 369-382. doi: Doi 10.1177/0276146714526410

Biesalski, H-K. (2005). Meat as a component of a healthy diet–are there any risks or benefits if meat is avoided in the diet? *Meat science, 70*(3), 509-524.

Bodenheimer, Friedrich Simon. (1951). *Insects as human food*: Springer.

Burns, G Leonard, Keortge, Susan G, Formea, Gina M, & Sternberger, Lee G. (1996). Revision of the Padua Inventory of obsessive compulsive disorder symptoms: distinctions between worry, obsessions, and compulsions. *Behaviour research and therapy, 34*(2), 163-173.

Carlsson-Kanyama, Annika, & González, Alejandro D. (2009). Potential contributions of food consumption patterns to climate change. *The American journal of clinical nutrition, 89*(5), 1704S-1709S.

Chakravorty, Jharna, Ghosh, Sampat, & Meyer-Rochow, V Benno. (2013). Comparative survey of entomophagy and entomotherapeutic practices in six tribes of Eastern Arunachal Pradesh (India). *Journal of ethnobiology and ethnomedicine, 9*(1), 50.

Chapagain, Ashok K, & Hoekstra, Arjen Y. (2008). The global component of freshwater demand and supply: an assessment of virtual water flows between nations as a result of trade in agricultural and industrial products. *Water international, 33*(1), 19-32.

Cox, D. N., Evans, G., & Lease, H. J. (2007). The influence of information and beliefs about technology on the acceptance of novel food technologies: A conjoint study of farmed prawn concepts. *Food Quality and Preference, 18*(5), 813-823. doi: DOI 10.1016/j.foodqual.2007.01.011

Davey, Graham CL. (1994). The" disgusting" spider: The role of disease and illness in the perpetuation of fear of spiders. *Society & Animals, 2*(1), 17-25.

DeFoliart, Gene R. (1992). Insects as human food: Gene DeFoliart discusses some nutritional and economic aspects. *Crop protection, 11*(5), 395-399.

Delgado, Christopher L. (2003). Rising consumption of meat and milk in developing countries has created a new food revolution. *The Journal of Nutrition, 133*(11), 3907S-3910S.

Durst, Patrick B, Johnson, Dennis V, Leslie, Robin N, & Shono, Kenichi. (2010). Forest insects as food: humans bite back. *RAP publication*.

Ekman, Paul, & Friesen, Wallace V. (2003). *Unmasking the face: A guide to recognizing emotions from facial clues*: Ishk.

Ekman, Paul, & Keltner, Dacher. (1970). Universal facial expressions of emotion. *California Mental Health Research Digest, 8*(4), 151-158.

Fallon, April E, & Rozin, Paul. (1983). The psychological bases of food rejections by humans. *Ecology of Food and Nutrition, 13*(1), 15-26.

Fallon, April E, Rozin, Paul, & Pliner, Patricia. (1984). The child's conception of food: The development of food rejections with special reference to disgust and contamination sensitivity. *Child development*, 566-575.
FAO, UN. (Ed.) (2009) Rome: High-Level Expert Forum.
Fieldhouse, Paul. (1995). *Food and nutrition: customs and culture*: Chapman & Hall Ltd.
Fishbein, Martin, & Ajzen, Icek. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research*.
Friedman, Jonathan. (2005). *Consumption and identity*: Routledge.
Gilovich, Thomas, Griffin, Dale, & Kahneman, Daniel. (2002). *Heuristics and biases: The psychology of intuitive judgment*: Cambridge University Press.
Haidt, Jonathan, McCauley, Clark, & Rozin, Paul. (1994). Individual differences in sensitivity to disgust: A scale sampling seven domains of disgust elicitors. *Personality and Individual differences, 16*(5), 701-713.
Haidt, Jonathan, Rozin, Paul, McCauley, Clark, & Imada, Sumio. (1997). Body, psyche, and culture: The relationship between disgust and morality. *Psychology & Developing Societies, 9*(1), 107-131.
Hallstrom, E., Roos, E., & Borjesson, P. (2014). Sustainable meat consumption: A quantitative analysis of nutritional intake, greenhouse gas emissions and land use from a Swedish perspective. *Food Policy, 47*, 81-90. doi: DOI 10.1016/j.foodpol.2014.04.002
Harper, Lawrence V, & Sanders, Karen M. (1975). The effect of adults' eating on young children's acceptance of unfamiliar foods. *Journal of Experimental Child Psychology, 20*(2), 206-214.
Izard, Carroll E. (1991). *The psychology of emotions*: Springer Science & Business Media.
Izard, Carroll E, & Ackerman, Brian P. (2000). Motivational, organizational, and regulatory functions of discrete emotions. *Handbook of emotions, 2*, 253-264.
Kellert, S. R. (1993). Values and Perceptions of Invertebrates. *Conservation Biology, 7*(4), 845-855. doi: DOI 10.1046/j.1523-1739.1993.740845.x
Koivisto, Ulla-Kaisa, & Sjoden, Per-Olow. (1996). Reasons for rejection of food items in Swedish families with children aged 2–17. *Appetite, 26*(1), 89-104.
Kubberød, Elin, Ueland, Øydis, Rødbotten, Marit, Westad, Frank, & Risvik, Einar. (2002). Gender specific preferences and attitudes towards meat. *Food Quality and Preference, 13*(5), 285-294.
Lea, E., & Worsley, A. (2008). Australian consumers' food-related environmental beliefs and behaviours. *Appetite, 50*(2-3), 207-214. doi: DOI 10.1016/j.appet.2005.07.012
Lensvelt, Eveline JS, & Steenbekkers, LPA. (2014). Exploring Consumer Acceptance of Entomophagy: A Survey and Experiment in Australia and the Netherlands. *Ecology of food and nutrition, 53*(5), 543-561.
Looy, H., Dunkel, F. V., & Wood, J. R. (2014). How then shall we eat? Insect-eating attitudes and sustainable foodways. *Agriculture and Human Values, 31*(1), 131-141. doi: DOI 10.1007/s10460-013-9450-x
Looy, Heather, & Wood, John R. (2006). Attitudes Toward Invertebrates: Are Educational" Bug Banquets" Effective? *The journal of environmental education, 37*(2), 37-48.
Looy, Heather, & Wood, John R. (2006). Attitudes Toward Invertebrates: Are Educational "Bug Banquets" Effective? *The Journal of Environmental Education, 37*(2), 37-48. doi: 10.3200/joee.37.2.37-48
Loughnan, Steve, Bastian, Brock, & Haslam, Nick. (2014). The Psychology of Eating Animals. *Current Directions in Psychological Science, 23*(2), 104-108.
MacClancy, Jeremy, Henry, C. J. K., & Macbeth, Helen M. (2007). *Consuming the inedible : neglected dimensions of food choice*. New York: Berghahn Books.
Martins, Y., & Pliner, P. (2006). "Ugh! That's disgusting!": Identification of the characteristics of foods underlying rejections based on disgust. *Appetite, 46*(1), 75-85. doi: DOI 10.1016/j.appet.2005.09.001

McAfee, Alison J, McSorley, Emeir M, Cuskelly, Geraldine J, Moss, Bruce W, Wallace, Julie MW, Bonham, Maxine P, & Fearon, Anna M. (2010). Red meat consumption: An overview of the risks and benefits. *Meat science, 84*(1), 1-13.

McFarlane, Traci, & Pliner, Patricia. (1997). Increasing willingness to taste novel foods: effects of nutrition and taste information. *Appetite, 28*(3), 227-238.

Menzel, Peter, & D'Aluisio, Faith. (1998). *Man eating bugs*: Ten Speed Press.

Mora, Camilo, Tittensor, Derek P, Adl, Sina, Simpson, Alastair GB, & Worm, Boris. (2011). How many species are there on Earth and in the ocean? *PLoS biology, 9*(8), e1001127.

Morales, A. C., & Fitzsimons, G. J. (2007). Product contagion: Changing consumer evaluations through physical contact with "disgusting" products. *Journal of Marketing Research, 44*(2), 272-283. doi: DOI 10.1509/jmkr.44.2.272

Morris, Brian. (2008). Insects as food among hunter-gatherers. *Anthropology Today, 24*(1), 6-8.

Nemeroff, Carol, & Rozin, Paul. (1989). "You Are What You Eat": Applying the Demand-Free "Impressions" Technique to an Unacknowledged Belief. *Ethos, 17*(1), 50-69.

Obopile, M., & Seeletso, T. G. (2013). Eat or not eat: an analysis of the status of entomophagy in Botswana. *Food Security, 5*(6), 817-824. doi: DOI 10.1007/s12571-013-0310-8

Odegard, IYR, & van der Voet, E. (2014). The future of food—Scenarios and the effect on natural resource use in agriculture in 2050. *Ecological Economics, 97*, 51-59.

Pimentel, David, Berger, Bonnie, Filiberto, David, Newton, Michelle, Wolfe, Benjamin, Karabinakis, Elizabeth, . . . Nandagopal, Sudha. (2004). Water resources: agricultural and environmental issues. *BioScience, 54*(10), 909-918.

Pimentel, David, & Pimentel, Marcia. (2003). Sustainability of meat-based and plant-based diets and the environment. *The American Journal of Clinical Nutrition, 78*(3), 660S-663S.

Pingali, Prabhu. (2007). Westernization of Asian diets and the transformation of food systems: implications for research and policy. *Food policy, 32*(3), 281-298.

Pliner, Patricia. (1994). Development of measures of food neophobia in children. *Appetite, 23*(2), 147-163.

Pliner, Patricia, & Hobden, Karen. (1992). Development of a scale to measure the trait of food neophobia in humans. *Appetite, 19*(2), 105-120.

Pliner, Patricia, Pelchat, Marcia, & Grabski, Marius. (1993). Reduction of neophobia in humans by exposure to novel foods. *Appetite, 20*(2), 111-123.

Pliner, Patricia, & Salvy, S. (2006). Food neophobia in humans. *Frontiers in Nutritional Science, 3*, 75.

RamosElorduy, J. (1997). Insects: A sustainable source of food? *Ecology of Food and Nutrition, 36*(2-4), 247-276.

Richardson, NJ, Shepherd, R, & Elliman, NA. (1993). Current attitudes and future influence on meat consumption in the UK. *Appetite, 21*(1), 41-51.

Rozin, Paul. (1997). Why we eat what we eat, and why we worry about it. *Bulletin of the American Academy of Arts and Sciences*, 26-48.

Rozin, Paul, & Fallon, April. (1980). The psychological categorization of foods and non-foods: A preliminary taxonomy of food rejections. *Appetite, 1*(3), 193-201.

Rozin, Paul, Fallon, April, & Augustoni-Ziskind, MaryLynn. (1986). The child's conception of food: The development of categories of acceptable and rejected substances. *Journal of Nutrition Education, 18*(2), 75-81.

Rozin, Paul, & Fallon, April E. (1987). A perspective on disgust. *Psychological review, 94*(1), 23.

Rozin, Paul, Fischler, Claude, Imada, Sumio, Sarubin, Allison, & Wrzesniewski, Amy. (1999). Attitudes to food and the role of food in life in the USA, Japan, Flemish Belgium and France: Possible implications for the diet–health debate. *Appetite, 33*(2), 163-180.

Rozin, Paul, Haidt, Jonathan, & McCauley, Clark R. (2008). Disgust.

Rozin, Paul, Millman, Linda, & Nemeroff, Carol. (1986). Operation of the laws of sympathetic magic in disgust and other domains. *Journal of personality and social psychology, 50*(4), 703.

Ruby, Matthew B, & Heine, Steven J. (2011). Meat, morals, and masculinity. *Appetite, 56*(2), 447-450.

Schösler, Hanna, De Boer, Joop, & Boersema, Jan J. (2012). Can we cut out the meat of the dish? Constructing consumer-oriented pathways towards meat substitution. *Appetite, 58*(1), 39-47.
Solomon, Michael, Russell-Bennett, Rebekah, & Previte, Josephine. (2012). *Consumer behaviour*: Pearson Higher Education AU.
Steinfeld, Henning, Gerber, Pierre, Wassenaar, Tom, Castel, Vincent, Rosales, Mauricio, & Haan, C de. (2006). *Livestock's long shadow: environmental issues and options*: Food and Agriculture Organization of the United Nations (FAO).
Tan, Hui Shan Grace, Fischer, Arnout RH, Tinchan, Patcharaporn, Stieger, Markus, Steenbekkers, LPA, & van Trijp, Hans CM. (2015). Insects as food: Exploring cultural exposure and individual experience as determinants of acceptance. *Food Quality and Preference*.
Thordarson, Dana S, Radomsky, Adam S, Rachman, S, Shafran, Roz, Sawchuk, Craig N, & Hakstian, A Ralph. (2004). The Vancouver obsessional compulsive inventory (VOCI). *Behaviour research and therapy, 42*(11), 1289-1314.
Tobler, C., Visschers, V. H., & Siegrist, M. (2011). Eating green. Consumers' willingness to adopt ecological food consumption behaviors. *Appetite, 57*(3), 674-682. doi: 10.1016/j.appet.2011.08.010
Van Huis, Arnold, Van Itterbeeck, Joost, Klunder, Harmke, Mertens, Esther, Halloran, Afton, Muir, Giulia, & Vantomme, Paul. (2013). *Edible insects: future prospects for food and feed security*: Food and agriculture organization of the United nations (FAO).
Vanhonacker, Filiep, Van Loo, Ellen J, Gellynck, Xavier, & Verbeke, Wim. (2013). Flemish consumer attitudes towards more sustainable food choices. *Appetite, 62*, 7-16.
Verbeke, W. (2015). Profiling consumers who are ready to adopt insects as a meat substitute in a Western society. *Food Quality and Preference, 39*, 147-155. doi: DOI 10.1016/j.foodqual.2014.07.008
Verkerk, M. C., Tramper, J., van Trijp, J. C. M., & Martens, D. E. (2007). Insect cells for human food. *Biotechnology Advances, 25*(2), 198-202. doi: DOI 10.1016/j.biotechadv.2006.11.004
Water, UN. (2012). Managing water under uncertainty and risk, The United Nations world water development report 4, UN Water Reports, World Water Assessment Programme: UNESCO, Paris, France.
Wood, John R, & Looy, Heather. (2000). My ant is coming to dinner: Culture, disgust, and dietary challenges. *PROTEUS-SHIPPENSBURG-, 17*(1), 52-56.
Yen, Alan L. (2009). Edible insects: Traditional knowledge or western phobia? *Entomological Research, 39*(5), 289-298.
Zhi-Yi, Luo. (1997). Insects as food in China. *Ecology of food and nutrition, 36*(2-4), 201-207.

Appendix I.

Pilot test

The present questions will be part of a survey conducted by Wageningen University. There are two questions presented below. First question introduces two scenarios. Please read both scenarios carefully and rate them on 9 point scale. After that go to question number 2 and choose the response that most resembles your opinion. There are no correct or incorrect responses; we are merely interested in your personal point of view.

1) **Which scenario for the introduction of insects on the western market would result in the most appropriate insect products? Please use the 9 point scale bellow to rate the scenarios.**

   Scenario 1

   Nowadays insects are being re-introduced as a food to the western diet. Insect products have appeared in Western eating cultures for a long time. Traditional dishes like the Italian cheese Cazu Marzu can only be made with insects. Besides that insects are also used as a food colouring ingredient E120 in a variety of products like candies, yogurts, and the alcoholic beverage Campari.

   Scenario 2

   Nowadays insects are penetrating the western markets. New insect products are placed in the supermarkets on the same shelf as conventional food. Insects should replace the meat in traditional dishes like hamburgers. Besides that insects will be used as a novel ingredient in a variety of products like chips, protein bars, and spreads.

   1__:___2__:___3__:___4__:___5__:___6__:___7__:___8__:___9__:

   Definitely scenario 1 — **Definitely scenario 2**

2) **Read the following statement carefully and choose the response that most resembles your opinion.**

Insects have high protein content and are a good source of fat and various crucial minerals. When compared to conventional meat, insects are more sustainable as they require less space; less food and water, less energy per amount of food compared to even the most efficient meat source. Insects are therefore a high quality food source with low environmental footprint.

<u>In my opinion the information provided above:</u>

a) Gives no rational arguments to eat insects at all.
b) Gives few rational arguments to eat insects.
c) Gives some rational arguments to eat insects
d) Gives number of rational arguments to eat insects.
e) Gives strong rational arguments to eat insects.

Attitude measure

1) For me to eat insect products is

extremely bad: ___1__:___2__:___3__:___4__:___5__:___6__:___7__: extremely good

2) For me to eat insect products is

extremely worthless: ___1__:___2__:___3__:___4__:___5__:___6__:___7__: extremely valuable

3) For me to eat insect products is

extremely unpleasant: ___1__:___2__:___3__:___4__:___5__:___6__:___7__: extremely pleasant

4) For me to eat insect products is

unreasonable: ___1__:___2__:___3__:___4__:___5__:___6__:___7__: reasonable

5) For me to eat insect products is

unacceptable : ___1__:___2__:___3__:___4__:___5__:___6__:___7__: acceptable

Disgust Measure

1) Which picture best represent your first impression of the insect burger?

2) How disgusting would you find the presented burger with insects in it?

a) That burger sounds disgusting.

Not at all : ___1__:___2__:___3__:___4__:___5__:___6__:___7__: extremely

b) I would never put that burger in my mouth.

Strongly disagree: ___1__:___2__:___3__:___4__:___5__:___6__:___7__: strongly agree

Contamination scale

	Insect Contamination Scale							
1	I feel food is dirty when it's touched by insect.	Strongly Disagree	Disagree	Disagree Somewhat	Undecided	Agree somewhat	Agree	Strongly Agree
2	I think even slightest amount of insects will contaminate food.	Strongly Disagree	Disagree	Disagree Somewhat	Undecided	Agree somewhat	Agree	Strongly Agree
3	I find it hard to eat an object when I know it has been in contact with insect.	Strongly Disagree	Disagree	Disagree Somewhat	Undecided	Agree somewhat	Agree	Strongly Agree
4	I find it difficult to touch insects like maggot or cockroach.	Strongly Disagree	Disagree	Disagree Somewhat	Undecided	Agree somewhat	Agree	Strongly Agree
5	I avoid drinking water with fly in it due to contagion and disease.	Strongly Disagree	Disagree	Disagree Somewhat	Undecided	Agree somewhat	Agree	Strongly Agree
6	If I touch an insect that I think is "contaminated" I immediately have to wash or clean myself.	Strongly Disagree	Disagree	Disagree Somewhat	Undecided	Agree somewhat	Agree	Strongly Agree
7	I feel very contaminated if I touch an insect.	Strongly Disagree	Disagree	Disagree Somewhat	Undecided	Agree somewhat	Agree	Strongly Agree

Food neophobia scale

Food Neophobia Scale								
1	I am constantly sampling new and different foods. (R)	Agree strongly	Agree	Agree Somewhat	Undecided	Disagree somewhat	Disagree	Strongly disagree
2	I don't trust new foods.	Agree strongly	Agree	Agree Somewhat	Undecided	Disagree somewhat	Disagree	Strongly disagree
3	If I don't know what is in a food, I won't try it.	Agree strongly	Agree	Agree Somewhat	Undecided	Disagree somewhat	Disagree	Strongly disagree
4	I like foods from different countries. (R)	Agree strongly	Agree	Agree Somewhat	Undecided	Disagree somewhat	Disagree	Strongly disagree
5	Ethnic food looks too weird to eat.	Agree strongly	Agree	Agree Somewhat	Undecided	Disagree somewhat	Disagree	Strongly disagree
6	At dinner parties, I will try a new food. (R)	Agree strongly	Agree	Agree Somewhat	Undecided	Disagree somewhat	Disagree	Strongly disagree
7	I am afraid to eat things I have never had before.	Agree strongly	Agree	Agree Somewhat	Undecided	Disagree somewhat	Disagree	Strongly disagree
8	I am very particular about the foods I will eat.	Agree strongly	Agree	Agree Somewhat	Undecided	Disagree somewhat	Disagree	Strongly disagree
9	I will eat almost anything. (R)	Agree strongly	Agree	Agree Somewhat	Undecided	Disagree somewhat	Disagree	Strongly disagree
10	I like to try new ethnic restaurants. (R)	Agree strongly	Agree	Agree Somewhat	Undecided	Disagree somewhat	Disagree	Strongly disagree

Remark: Items for which scoring is reversed are marked (R).

The Survey

Dear participant,

Thank you for taking the time to complete this survey. This survey is part of a research conducted for my Master Thesis at Wageningen University. The survey should take approximately 5 minutes to complete and your participation is vital to the success of this project. There are no correct or incorrect answers. Please keep in mind that once you press "next button" you cannot return to the previous page again. All your answers will be kept completely anonymous and confidential.

Q1 Please read the text below carefully.

“Nowadays insects are being re-introduced as a food to the western diet. Insect products have appeared in Western eating cultures for a long time. Traditional dishes like the Italian cheese Cazu Marzu can only be made with insects. Besides that insects are also used as a food coloring ingredient E120 in a variety of products like candies, yogurts, and the alcoholic beverage Campari. Insect burgers that resemble the traditional ones except the fact that some insect parts are recognizable by eyesight or texture-wise can be an easy way to implement insects in our diet. Insects have high protein content and are a good source of fat and various important minerals. When compared to conventional meat, insects are more sustainable as they require less space; less food and water, less energy per amount of food compared to even the most efficient meat source. Insects are therefore a high quality food source with low environmental footprint.”

Q2 Please read the text below carefully.

“Nowadays insects are being re-introduced as a food to the western diet. Insect products have appeared in Western eating cultures for a long time. Traditional dishes like the Italian cheese Cazu Marzu can only be made with insects. Besides that insects are also used as a food colouring ingredient E120 in a variety of products like candies, yogurts, and the alcoholic beverage Campari. Insect burgers that resemble the traditional ones except the fact that some insect parts are recognizable by eyesight or texture-wise can be an easy way how to implement insects in our diet."

Q3 Please read the text below carefully.

“Nowadays insects are being re-introduced as a food to the western diet. Insect products have appeared in Western eating cultures for a long time. Traditional dishes like the Italian cheese Cazu Marzu can only be made with insects. Besides that insects are also used as a food colouring ingredient E120 in a variety of products like candies, yogurts, and the alcoholic beverage Campari. Insect burgers that resemble the traditional ones except the fact that some unrecognizable insect flour is added can be an easy way to implement insects in our diet. Insects have high protein content and are a good source of fat and various important minerals. When compared to conventional meat, insects are more sustainable as they require less space; less food and water, less energy per amount of food compared to even the most efficient meat source. Insects are therefore a high quality food source with low environmental footprint.”

Q4 Please read the text below carefully.

“Nowadays insects are being re-introduced as a food to the western diet. Insect products have appeared in Western eating cultures for a long time. Traditional dishes like the Italian cheese Cazu Marzu can only be made with insects. Besides that insects are also used as a food colouring ingredient E120 in a variety of products like candies, yogurts, and the alcoholic beverage Campari. Insect burgers that resemble the traditional ones except the fact that some unrecognizable insect flour is added can be an easy way to implement insects in our diet."

Q5 Please read the text below carefully.

“Nowadays insects are penetrating the western markets. New insect products are placed in the supermarkets on the same shelf as conventional food. Insects should replace the meat in traditional dishes like hamburgers. Besides that insects will be used as a novel ingredient in a variety of products like chips, protein bars, and spreads. Insect burgers that resemble the traditional ones except the fact that some insect parts are recognizable by eyesight or texture-wise can be an easy way to implement insects in our diet. Insects have high protein content and are a good source of fat and various important minerals. When compared to conventional meat, insects are more sustainable as they require less space; less food and water, less energy per amount of food compared to even the most efficient meat source. Insects are therefore a high quality food source with low environmental footprint.”

Q6 Please read the text below carefully.

“Nowadays insects are penetrating the western markets. New insect products are placed in the supermarkets on the same shelf as conventional food. Insects should replace the meat in traditional dishes like hamburgers. Besides that insects will be used as a novel ingredient in a variety of products like chips, protein bars, and spreads. Insect burgers that resemble the traditional ones except the fact that some insect parts are recognizable by eyesight or texture-wise can be an easy way to implement insects in our diet.”

Q7 Please read the text below carefully.

“Nowadays insects are penetrating the western markets. New insect products are placed in the supermarkets on the same shelf as conventional food. Insects should replace the meat in traditional dishes like hamburgers. Besides that insects will be used as a novel ingredient in a variety of products like chips, protein bars, and spreads. Insect burgers that resemble the traditional ones except the fact that some unrecognizable insect flour is added can be an easy way to implement insects in our diet. Insects have high protein content and are a good source of fat and various important minerals. When compared to conventional meat, insects are more sustainable as they require less space; less food and water, less energy per amount of food compared to even the most efficient meat source. Insects are therefore a high quality food source with low environmental footprint.”

Q8 Please read the text below carefully.

“Nowadays insects are penetrating the western markets. New insect products are placed in the supermarkets on the same shelf as conventional food. Insects should replace the meat in traditional dishes like hamburgers. Besides that insects will be used as a novel ingredient in a variety of products

like chips, protein bars, and spreads. Insect burgers that resemble the traditional ones except the fact that some unrecognizable insect flour is added can be an easy way to implement insects in our diet."

Q1

Now that you have read the previous story scenario, I want you to picture yourself in this person's position that has just been presented an insect burger. Choose only one picture which best represents your first impression of the mentioned insect burger by clicking on it. If you have accidentally clicked on more than one picture, you can deselect it by clicking on it again.

Q2

For me eating the insect burger mentioned in the story is:

	1	2	3	4	5	6	7	
extremely bad	○	○	○	○	○	○	○	extremely good
extremely worthless	○	○	○	○	○	○	○	extremely valuable
extremely unpleasant	○	○	○	○	○	○	○	extremely pleasant
unreasonable	○	○	○	○	○	○	○	reasonable
unacceptable	○	○	○	○	○	○	○	acceptable

Q3

How disgusting would you find the presented burger with insects in it?

That burger sounds disgusting.	Not at all disgusting	Low disgust	Slightly disgusting	Neutral	Moderately disgusting	Very disgusting	Extremely disgusting
I would never put that burger in my mouth.	Strongly Disagree	Disagree	Somewhat Disagree	Undecided	Somewhat Agree	Agree	Strongly Agree

Q4

Please use the following scale to indicate your degree of agreement or disagreement with each of the statements below. Click the circle that best represents your opinion

	Strongly Disagree	Disagree	Disagree Somewhat	Undecided	Agree somewhat	Agree	Strongly Agree
I feel food is dirty when it's touched by insect.							
I think even slightest amount of insects will contaminate food.							
I find it hard to eat an object when I know it has been in contact with insect.							
I find it difficult to touch insects like maggot or cockroach.							
I avoid drinking water with fly in it due to contagion and disease.							
If I touch an insect that I think is "contaminated" I immediately have to wash or clean myself.							
I feel very contaminated if I touch an insect.							

Q5

Select the response that best describes how much you agree or disagree with the statement for each question.

	Agree strongly	Agree	Agree Somewhat	Undecided	Disagree somewhat	Disagre e	Strongly disagree
I am constantly sampling new and different foods.	○	○	○	○	○	○	○
I don't trust new foods.	○	○	○	○	○	○	○
If I don't know what is in a food, I won't try it.	○	○	○	○	○	○	○
I like foods from different countries.	○	○	○	○	○	○	○
Ethnic food looks too weird to eat.	○	○	○	○	○	○	○
At dinner parties, I will try a new food.	○	○	○	○	○	○	○
I am afraid to eat things I have never had before.	○	○	○	○	○	○	○
I am very particular about the foods I will eat.	○	○	○	○	○	○	○
I will eat almost anything.	○	○	○	○	○	○	○
I like to try new ethnic restaurants.	○	○	○	○	○	○	○

Q9

Gender

○ Male

○ Female

Q19

What is your age (in years)?

Q20

What is your country of origin?

Q21

What is your study specialization/program?

Q22

What is your diet?

- Meat eater (meat at least 2 times a week or more often)
- Flexitarian (occasional meat but less than 1 time a week)
- Vegetarian
- Vegan

Q23

Do you have previous insect eating experience?

- Yes
- No

Q25

Please indicate the degree of satisfaction/enjoyment with your previous insect eating experience. (Applies only if the 23 was 1)

	Very Bad	Bad	Poor	Neither Good nor Bad	Fair	Good	Very Good
My insect eating experience was:							

Q26

Would you like to try the insect burger presented in our story?

- Definitely would not try
- Probably would not try
- Don't know
- Probably would try
- Definitely would try

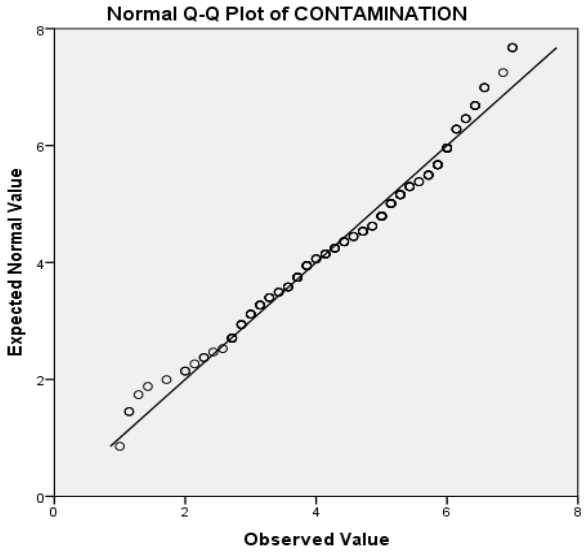
Q27

Dear participant. Thank you for taking the time to complete our survey. Your input has been extremely valuable. Please do not hesitate to contact me if you have any further comments or question regarding to the survey via email below.Tereza.Dolezalova@wur.nl

APPENDIX II.

SPSS Output Hypotheses 1 and 4

Normality and equality of variances assumptions:



Levene's Test:

Levene's Test of Equality of Error Variances[a]

Dependent Variable: CONTAMINATION

F	df1	df2	Sig.
.806	3	168	.492

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

SPSS output for Hypotheses 1 and 4.

Tests of Between-Subjects Effects

Dependent Variable: CONTAMINATION

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	25.283[a]	4	6.321	3.656	.007
Intercept	569.917	1	569.917	329.683	.000
RECOGNISABLE	.027	1	.027	.016	.900
APPROPRIATE	.027	1	.027	.016	.901
RECOGNISABLE * APPROPRIATE	1.731	1	1.731	1.001	.318
Q23	23.641	1	23.641	13.676	.000
Error	288.689	167	1.729		
Total	3786.694	172			
Corrected Total	313.972	171			

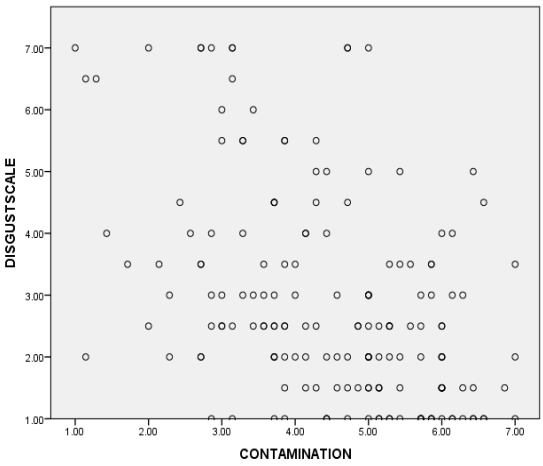
a. R Squared = .081 (Adjusted R Squared = .059)

APPENDIX III.

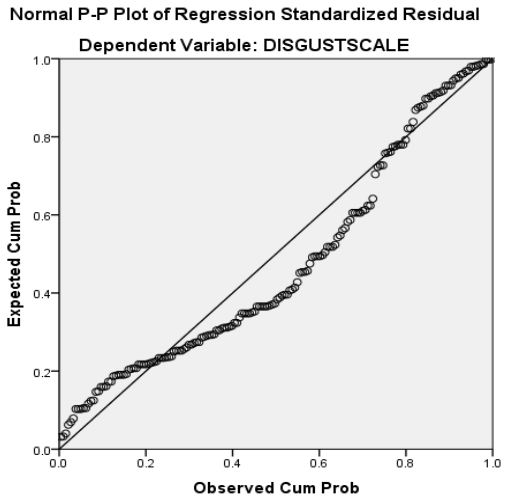
SPSS Output Hypothesis 2

Simple linear regression analysis results:

Scatterplot between Disgust Scale and Contamination to test the linearity assumption:



QQ plot of standardized residuals, to test the assumption of homoscedasticity.



Simple linear regression, original SPSS tables:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.456[a]	.208	.203	1.51751

a. Predictors: (Constant), CONTAMINATION

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	102.692	1	102.692	44.594	.000[b]
	Residual	391.483	170	2.303		
	Total	494.174	171			

a. Dependent Variable: DISGUSTSCALE

b. Predictors: (Constant), CONTAMINATION

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	5.453	.402		13.571	.000	4.660	6.247
	CONTAMINATION	-.572	.086	-.456	-6.678	.000	-.741	-.403

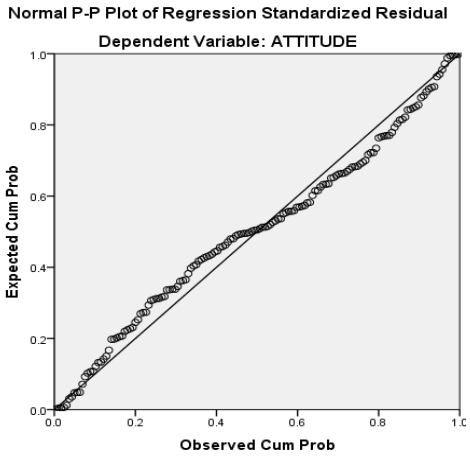
a. Dependent Variable: DISGUSTSCALE

APPENDIX IV

SPSS Output Hypotheses 3, 5 and 6

Multiple Regression Analysis Results:

QQ plot of standardized residuals, to test the assumption of homoscedasticity.



Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.803[a]	.644	.637	.83027

a. Predictors: (Constant), RATIONAL, DISGUSTSCALE, NEOPHOBIA

b. Dependent Variable: ATTITUDE

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	185.910	3	61.970	89.897	.000[b]
	Residual	102.713	149	.689		
	Total	288.623	152			

a. Dependent Variable: ATTITUDE

b. Predictors: (Constant), RATIONAL, DISGUSTSCALE, NEOPHOBIA

Coefficients[a]

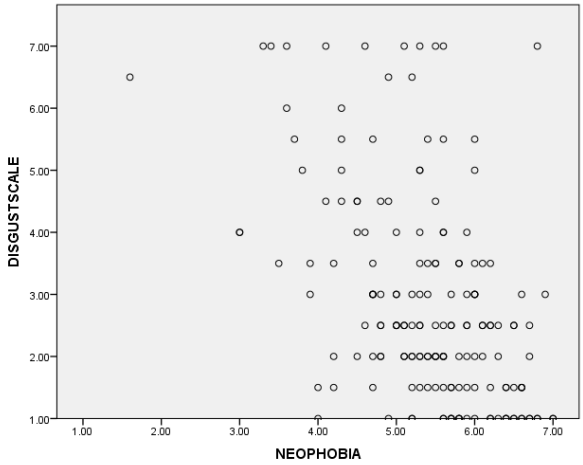
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	6.861	.555		12.355	.000
	DISGUSTSCALE	-.652	.045	-.809	-14.435	.000
	NEOPHOBIA	-.048	.088	-.031	-.553	.581
	RATIONAL	.277	.135	.100	2.049	.042

a. Dependent Variable: ATTITUDE

APPENDIX V.

SPSS Output Hypothesis 7

Scatterplot between Disgust Scale and Neophobia to test the linearity assumption



Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.495[a]	.245	.240	1.48170

a. Predictors: (Constant), NEOPHOBIA

b. Dependent Variable: DISGUSTSCALE

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	120.948	1	120.948	55.091	.000[b]
	Residual	373.226	170	2.195		
	Total	494.174	171			

a. Dependent Variable: DISGUSTSCALE

b. Predictors: (Constant), NEOPHOBIA

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.906	.686		11.525	.000
	NEOPHOBIA	-.931	.125	-.495	-7.422	.000

a. Dependent Variable: DISGUSTSCALE

QQ plot of standardized residuals, to test the assumption of homoscedasticity