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# QUALITATIVE RESEARCH

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On the Attitudes toward Consumption of Insect Based Flours and Powders

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## 2 EXECUTIVE SUMMARY

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The aim of this research is to explore the attitudes, and try to recognize their underlying factors, toward the possible consumption of insect powder and flour based products of young, educated, individuals in Ireland.

The initial observations of this qualitative research showed a promising starting base, on which to build future strategies for the introduction and the acceptance of entomophagy in a traditionally narrow culinary culture, such as the Irish one.

Some of the result outlined in this study are:

- Taste, intended in its sensory-liking aspect, is largely the main concern for the respondents, in regards of the willingness to consume insect based products,
- The sample investigated, of young-adult students and graduates, had limited knowledge regarding entomophagy and its benefit, but ate the same time little preconceptions, being both curios and cautious, but overall open to such idea.
- Cultural and social negotiated barriers toward edible insects (Disgust, Distaste, Food Neophobia), although present to a limited extent, did not influenced much the sample examined, due probably to exposure of the respondents to different and foreign culinary cultures.
- A preliminary, mostly sensorial, evaluation, in the form of samples and tasters, was required and demanded before making final decision and judgement about the product category.
- The source and the quality of the insects used as ingredients for the products evaluated, and the safety measures and regulations put in place, similarly to other animal derived food, was an expressed concern by some of the respondent.

Based on the result of this research few recommendations were outlined for strategies aimed to the introduction and the promotion of entomophagy in the western culture and in Ireland especially.

### 3 INTRODUCCION

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Insects have been defined as one of the few, really sustainable, alternatives to feed the planet in the future. And their adoption in the “West World” is growing slowly, but steadily, with a sudden surge of interest in the last few years. Trend that is believed to endure. Therefore, is fascinating to investigate and explore the existing attitude toward edible insects of the main consumers of the next half of the century and possible early adopters of novel food and novel food technologies, such as college students and recent graduates.

In the first part the rationale behind the adoption of insects in our diet has been explained. This notion of using insects as food is not completely novel and irreconcilable with our culture. The benefit that this introduction in our consumption patterns could have, are several and go from a possibly more ideological perspective, regarding sustainability and the environment, to more utilitarian reasons, such as the possibility of a new, cheap source of nutrients, especially proteins.

Then the previous studies on the matter, almost the totality of which are quite recent and published in the last three years, has been reviewed and the appropriate theories, drawn from the relevant literature, have been summarised in a *theoretical framework*.

Being this and exploratory qualitative research, the methodology adopted is the one of the *one-to-one semi-structured interview*. Therefore, a 4-part interview has been devised to try to stimulate significant discussions and results.

From the data gathered, with the 11 interviews completed, several *themes* have been elicited, then analysed at the light of the theories evaluated.

Lastly some *recommendation*, based on the result of this research, have been outlined.

#### 4 RESEARCH RATIONALE

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Entomophagy has been deemed as an effective way to address various, current and future, critical food issues such as environmental sustainability, the forthcoming food demand, due to the expanding world population, and current nutritional deficit in parts of the world population (Nadeau, Nadeau, Franklin, & Dunkel, 2015; Nowak, Persijn, Rittenschober, & Charrondiere, 2015; Phimmasane, Rajaonarivo, & Barenes, 2015; Ramos-Elorduy, 1997; Arnold van Huis, 2013).

The last couple of years have witnessed an increasing attention, both from the media and the academics, about insects used as food, and the rising of new insect based products (Fleming, 2016; Sogari, 2015; Verbeke, 2015), making this a new and interesting research field, that is still underexplored, but steadily developing. A number of recent studies have tried to assess both the viability and the limits (and their dimensions) of the adoption of entomophagy in western culture, with various different focus and approaches (DeFoliart, 1999; Hartmann, Shi, Giusto, & Siegrist, 2015; Martins & Pliner, 2005, 2006; Megido et al., 2014; Shelomi, 2015; Sogari, 2015; Verbeke, 2015; Vermeir & Verbeke, 2008). One, if not the main, rationale that supports the idea of a growing development of human consumption of insects is their remarkably superior environmental value, compared to both livestock and fish farming (Gahukar, 2012; Tomberlin et al., 2015; A. Yen, 2015). In 2013 the *Food and Agriculture Organization of the United Nation* (FAO) released a report on the use and the future prospect of insects for human consumption, highlighting the environmental and nutritional benefit of entomophagy (Huis, 2013). This thoughtful study approached the issue on different perspectives (environmental, cultural, and economic among others) and sparked a fresh interest on the matter, clearly evident from the number of studies and research published in the last three years, and the creation of an ad-hoc journal, “*Journal of Insect as Food and Feed*” (A. L. Yen, 2014), and will also provide the backbone of this research.

One of the common finding is that there are various barriers against this kind of consumption: disgust, especially in its sensory (aspect, texture and taste), or *distaste*, and “*animal reminder*” components (Hamerman, 2016) along with social acceptance concerns. The peculiarity of the product investigated, flours and powders, used both as a basic

ingredient or as a component in the formulation of familiar, ready-to-eat, products (which range could be very broad going from cookies, bars, pasta to smoothies, sauces and stuffing) could address and/or bypass those barriers, except maybe for the more social and cultural based ones.

In addition to the aforementioned motives, the constantly increasing request of alternative (with an increasing trend towards *non-meat*) source of protein (Passport, 2016), particularly in their deconstructed configuration, like whey, casein or soy protein powders, can further enhance the relevance of this research.

The interest about human entomophagy, however, is not entirely new. In 1951 Bodenheimer published a book, "Insect as Human Food" analyzing more or less the same issues of today's studies (Bodenheimer, 1951). Human entomophagy itself is an ancient and documented phenomenon (Ruddle, 1973), mainly performed through the gathering of the 2000~ species of edible insects, which were, and still are, in several non-occidental cultures, an important source of nutrition (Ramos-Elorduy et al., 1997; Ramos-Elorduy, 1997) and even considered tasty treats (Tan, Fischer, van Trijp, & Stieger, 2016).

## **5 BACKGROUND LITERATURE REVIEW AND THEORETICAL PERSPECTIVE**

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### **5.1 ATTITUDES TOWARD INSECT CONSUMPTION**

Attitudes toward insect consumption are quintessentially negative in the West. In western culture this kind of consumption was regarded as barbaric (Bodenheimer, 1951; Ruddle, 1973) and is still widely rejected and associated with lower social condition or extreme adventurous behaviour. Kellert (1993), in his research on *values and perception of invertebrates*, has found that terrestrial arthropods are categorised, in occidental cultures, into one large homogeneous category of "bugs", treated with hostility, "attitudes of fear, antipathy, and aversion" and almost all considered as potential threats.

#### **5.1.1 Top Down and Bottom Up Attitude Formation**

As said this research aims to investigate the attitudes toward insects' flour based products. Attitudes perform several functions in human behaviour, such as guiding perception and influencing behaviour. As conceptualised in the Theory of Planned Behaviour, attitudes refer

to the degree to which a person has a favourable or unfavourable evaluation or appraisal of the possibility of performing a behaviour in a particular situation (Ajzen, 1991).

Understanding them and their formation, with regard to insects' consumption could serve to predict the intended behaviour (Fandos Herrera & Flavián Blanco, 2011) concerning this novel product and also which leverage point could be used to boost the positivity toward the prospect of adopting insects in our diets.

Attitudes are formed by the concurrence of two different mechanisms, associated respectively with two theoretical approaches: Bottom-Up and Top-Down. Grunert, Bredahl, and Scholderer (2003) on their study of the European attitudes towards GM in food, give a substantial definition of these processes: The Bottom-Up process asserts that attitudes towards an object are formed based on the knowledge that the consumer has of such object. This knowledge is comprised by beliefs about characteristics, both pleasant and unpleasant, of the attitude object. The resulting attitude toward the object will then be a weighted average of the evaluation of its perceived characteristics, which strongly relates to the Theory of Perceived Risk (Nielsen et al., 2009). The top-down formation of attitudes regards an attitude as embedded into a system of general attitudes and values. These general attitudes, culturally and socially negotiated, function as guidance in deriving attitudes towards more specific objects in a way which preserves the evaluative tendency of the higher-order attitudes. (Grunert et al., 2003)

This distinction is helpful when evaluating the attitudes of consumer toward a product of which they have limited knowledge and experience. Attitudes toward human consumption of insects are culturally relative (Deroy, Reade, & Spence, 2015; Huis, 2013; Looy, Dunkel, & Wood, 2014), therefore mostly created by top-down processes and possibly strongly held even when additional knowledge is provided and benefits are communicated; also because consumer have limited cognitive capacity and tend largely not to process concrete information aimed at reducing food uncertainty (Stone & Grønhaug, 1993; Verbeke, Frewer, Scholderer, & De Brabander, 2007) the numerous educational efforts that have been made to promote insect consumption and its benefits, although beneficial and to some extent effective toward both intention and behaviour (Tan et al., 2015; Verneau et al., 2016), were not able to extensively revise attitudes, because, as mentioned, they are not merely rational mental frameworks, but also have emotional and cultural dimensions. (Deroy et al., 2015; Looy et al., 2014; Tan et al., 2015)



## 5.2 REJECTION OF INSECT BASED FOOD PRODUCTS

Food rejection in humans it is said to be based on three different rejection motivations: the anticipation of negative sensory properties; the likelihood of harmful injection, harm that can be both of physical or social nature; the rejection based on ideational factors, based on the perceived origin of the evaluated food. These motivations contribute, by interacting and combining with each other, to generate the four major categories of food rejection (Rozin & Fallon, 1987). Insects, and in this case insect flours, are considered *novel food*, thus they are still subject, for the western consumer, to an acceptance evaluation. Acceptance/rejection of (both familiar and unfamiliar) food are considered function of four bipolar motivational dimensions, named after their negative pole: *danger* refers to the benefits or harmful consequences caused by the consumption of the food; *distaste* which involves the actual or perceived sensory characteristic of the food (appearance, taste, texture or smell); *disgust* is based on ideational properties and relates to the nature or the origin of the food: *inappropriateness*, that relates to what is considered as food in a given cultural sphere. (Martins & Pliner, 2005, 2006; Rozin & Fallon, 1987)

In this research the notion of rejection toward edible insects will be considered as a results of Disgust, Distaste and Food Neophobia (Pliner & Salvy, 2006), whose theories will be used as a framework, in the light of which the results will be analysed.

### 5.2.1 Disgust

If we proposed to someone, out of the blue to eat an insect, the reaction that we would expect is their face frowning, making a step back and saying “Ew!”. This reaction is a very peculiar one and is coded inside our psychological responses. We can recognise it immediately and categorize it as Disgust. Disgust is a complex and multifaceted emotion and is known as one of the six core emotions. It originates from the mammalian bitter taste rejection system (distaste), which in turn activates a disgust output system (Rozin, Haidt, & Fincher, 2009). This food rejection system, which we have developed to harness ourselves from possible harmful substances, was later on influenced by cultural and biological evolution, translating it in a *disgust evaluation* that configures as a rejection of potential food on the base of their nature and or perceived origin (Rozin et al., 2009). Disgust signals that the object or action we are contemplating, such as eating a particular food, will have

both physically or culturally threatening consequences (Looy et al., 2014) even reaching moral judgement implication (Rozin et al., 2009).

Rozin and Fallon (1987) conceptualized the notion of *core disgust*, refined during the years and subsequently divided in different components (Olatunji et al., 2007): a *core component* based on a sense of offensiveness and contamination through the oral incorporation of food. An animal component, so-called "*Animal Reminder*", which suggests that animals, and their products, are primary elicitor of disgust (Martins & Pliner, 2006; Rozin & Fallon, 1987). Olatunji et al. (2007) proposed a third component, *contamination*, separating it from the core disgust. These three components are related but not reductant and associated to personal traits, that varies largely from individual to individual. Insect are known elicitor of disgust, even if not universally recognised as such (Martins & Pliner, 2005), and have been extensively used as a component in the studies on the matter (Druschel & Sherman, 1999; Martins & Pliner, 2005; Olatunji & Sawchuk, 2005; Olatunji et al., 2007; Rozin & Fallon, 1987; Rozin et al., 2009). Various studies have individuated that disgust as one of the main barrier against acceptance of insect consumption and it is a factor in considering the appropriateness, acceptance and the willing to try insects as food (Hamerman, 2016; Martins & Pliner, 2006; Tan et al., 2016), especially in its sensory (aspect, texture and taste), related also to *distaste*, and "*animal reminder*" components (Hamerman, 2016; Martins & Pliner, 2005; Tan et al., 2016).

### **5.2.2 Distaste**

As said disgust, danger and distaste are closely related. Items that elicit disgust are presumed to taste bad and to be harmful. The difference stands in the notion of *contamination* and the "Law of sympathetic magic", for which anything that enters in contact with a disgusting object, either literally or figuratively, becomes disgusting by association even if present even in small, undetectable quantities in a dish (Martins & Pliner, 2005, 2006; Olatunji & Sawchuk, 2005; Olatunji et al., 2007; Rozin & Fallon, 1987). In contrast, items rejected on the basis of distaste are not objectionable if they are not detectable, and contamination is not a necessary component of *danger* (Martins & Pliner, 2005, 2006). *Distaste* is a type of rejection primarily motivated by sensory factors. The focus is on bad taste and/or smell but may include texture or appearance. In a "pure" case, the

substance is not thought to be harmful or undesirable on ideational grounds (Rozin & Fallon, 1987). So distasteful items are not rejected on the basis of their origin or their possible harmfulness, but purely on the basis of a subjective, actual or predicted, sensory evaluation regarding the sensory attributes of the object itself. Therefore distaste can be present at individual level and it is not necessarily related to novel, animal or cultural inappropriate food (Martins & Pliner, 2005). Predicted sensory evaluations in the case of insects are often met with negative expectation, which can be easily defused by actual exposure and experience of edible insects and the quality of the sensory-liking experience that, even if not sufficient per se, has been proved to increase acceptance (Megido et al., 2014; Sogari, 2015; Tan et al., 2015; Tan et al., 2016).

Deroy et al. (2015) propose a sensory driven strategy to resolve the “insectivores’ dilemma”, which consists in matching the documented benefits of including insect in our diet and the unappealing option offered to us, derived by a lack of exposure to the possible enjoyable sensory characteristic of edible insects. They state that a possible solution is to increase the efforts toward sensory-liking strategies, which comprises of a mixture of culinary knowledge (see also Megido et al. (2014) and Hamerman (2016)), imagery and representation approaches and categorization of the novel insect products. Other studies have also found that sensory-liking, with taste above all, is a significant predictor of the willingness to eat (Hartmann et al., 2015; Tan et al., 2016).

### **5.2.3 Food Neophobia**

*Food Neophobia*, defined as the Human propensity of rejecting the ingestion of a novel kind of food to protect the body from a possible hazard (danger) (Baker, Shin, & Kim, 2016; Martins & Pliner, 2005), and is a common trait found in children, associated to lower consumption of meat, vegetable and fruit (Martins & Pliner, 2005). Food Neophobia is an individual trait that can change deeply between individuals. A psychometric instrument, The Food Neophobia Scale (FNS), has been developed by Pliner and Hobden (1992), and has been proved effective, in various studies, to measure food Neophobia through a 10 item, each one evaluated on a seven-point Likert scale (Ritchey, Frank, Hursti, & Tuorila, 2003). In various studies, Food Neophobia, due to the novelty of the idea of edible insects in the western culture, has been found as a critical factor of acceptance and possible adoption (Baker et al., 2016; Deroy et al., 2015; Hamerman, 2016; Verbeke, 2015). Food

Neophobia can be countered by embedding in the novel food an element of familiarity (Deroy et al., 2015; Pliner, Pelchat, & Grabski, 1993), furthermore, if considered in the same manner of other phobias, as an inappropriate response of fear to a stimulus which is not harmful, can be counteracted by actively let the subject be exposed to such stimuli (Pliner & Hobden, 1992).

### **5.3 PERCEIVED RISK**

Another important theory for this research is the one of *Perceived Risk*, the definition of which is somewhat debated, but it can be simplified as the perceived amount of benefit loss felt by the consumer, and correspondingly the amount of possible unwanted consequences, derived from consuming a product.

*Perceived risk* has found its success in marketing researches for its versatility and intuitive appeal and because it is a powerful tool in explaining consumers' behaviour (Mitchell, 1999). Risk is also a crucial factor for the future acceptance of technology and products (Verbeke et al., 2007). Of the two kinds of *perceived risk*, *Inherent*, which is related to the latent risk that a product class or category level has, and *Handled*, present at a product-specific level, the first is primarily relevant for this research, as it is the product class that will be investigated (Mitchell, 1999), and also because consumers do not differentiate greatly between various types of risk within a particular food group or category (Verbeke et al., 2007). Six dimensions of Perceived Risk have been identified: functional, social, psychological, financial, physical and temporal, each one related to a specific category of benefit (and loss of it), and they have been found to contribute significantly to explaining the overall risk (Stone & Grønhaug, 1993).

Risk perceptions and their evaluation are an integral part of the bottom-up attitude formation process (Nielsen et al., 2009), therefore they are influenced by the degree of knowledge and familiarity that the consumers have of the product evaluated. This knowledge has different sources, which can be institutional or derived from the personal experience of the consumer or their friends or family, with differing impacts for negative and positive (often deemed "incomplete") views (Lobb, Mazzocchi, & Traill, 2007)

In the case of edible insects the degree of unfamiliarity and negative feelings associated makes consumers perceive this category of products as a high-risk food source, resulting in

major barriers in the promotion of insect use in food products and such consumers' judgments on the seriousness of negative consequences are substantial (Baker et al., 2016). However there is often little relationship between the perceived risk associated with a specific food safety concern and its actual risk (Verbeke et al., 2007). Therefore, if the only barrier toward the adoption of insect food products were merely a great level of uncertainty, the intuitional educational effort and the gathering information of the individual consumers would be sufficient for them to make an informed purchase decision. As already mentioned, if provided with information aimed to reduce *food safety uncertainty*, consumers often do not process such information (Verbeke et al., 2007) and educational efforts made to persuade about the benefit of entomology are often ineffective by themselves (Hamerman, 2016). The negative feelings associated with edible insects, especially from Westernized countries, are severe enough to scare off many consumers. Risk perception theories have more explanatory power when the study context involves high prices and the theory is not as significant when the context involves cheaper products. However, the theory is still applicable in this context, regardless of the price, since the food products examined can activate the feeling of "fear", through "cues that notify consumers to identify edible insect containment can elicit the feeling of disgust, along with fear, in the consumer which can greatly discourage purchasing behaviours" (Baker et al., 2016). Also due to their limited cognitive capacity consumers tends to process only a small part of the entirety of the information provided and/or available. Baker et al. (2016), for example, found that images of actual insect on product packages, in a retail setting, dissuaded consumers by increasing perceptions of functional, social, physical, and psychological risks, while description effects did not influence significantly risk perceptions allowing consumer to make decisions based on imagery information rather than descriptive information, due probably to the inherent perceived lack of time while shopping, which in its term causes a lack of cognitive effort. While in a restaurant setting consumers give more attention to the description.

Another aspect observed regarding risk toward edible insect consumption is its Social component. In an exploratory study of on Italian consumers Sogari (2015) found out that one of the most diffuse concern about the introduction of insects in the respondents' diet was the opinion of family and friends. Social acceptance was also found as a significant

predictor for willingness to eat (Hartmann et al., 2015). The risk of being seen as inappropriate and primitive by eating insects is a concern that even a culture that traditionally used to eat insects, due to the globalization and the “Westernisation” of consumption, now consider it as an indication of a social inferior status (Rozin & Fallon, 1987; Shelomi, 2015). On the other hand entomophagy could still hold some social status benefit for the early adopters, consumers with high social positions in their community who are seen by their peers buying and consuming insects, which become "gourmet" dishes or delicacies, often served in luxurious restaurants at exorbitant prices, by their peers (Ramos-Elorduy, 1997; Shelomi, 2015).

#### **5.4 WHY FLOUR AND POWDER?**

The focus of this research is insect powder based products, which for the specificity of their nature could be a more approachable and viable solution to introduce edible insects in our diets, as it is generally conceivable to use insects and their products as food ingredients with nutritional but also with functional benefits (Rumpold & Schlüter, 2013). One of the most significant food trend of the last years is the increasing demand of new, non-animal, sources of protein and protein rich food, which, along with an arising awareness about environmental and sustainability, could sprout a market for insect flour and powder, which could be also targeted to the niche of Paleo Diets adopters (Passport, 2016). Some insect based powder have been studied for their functional properties and have been found to have interesting qualities, suitable for their use in the food industry, in regards to enhancing sensory-liking and manufacturing as texturizing food ingredients and as ingredients of protein-rich meat replacing products (Omotoso, 2006; Osasona & Olaofe, 2010; Rumpold & Schlüter, 2013)

The use of powder and flour can enhance the acceptability of insects based product in two main ways. First, it eliminates completely any visual reminder of the presence of the actual insect in the food product. Studies have found that the likelihood of acceptance generally increases with a decreasing degree of visibility of the whole insect (Verbeke, 2015) probably because it bypasses the elicitor aspects of the *animal reminder* component of disgust. This relates to both the images of insects on the product packaging (Baker et al., 2016) and the presence of unprocessed insects in the food product, to which the participant of various

studies preferred, and evaluated as better option, the processed (not visible) insects alternatives such as pizza with insect proteins or cookies based on cricket flour (Hartmann et al., 2015; Schösler, De Boer, & Boersema, 2012; Verneau et al., 2016)

The second reason is that this flour and powders can be incorporated in common and recognizable food products (especially bakery, dessert and protein fortified products), enhancing then the familiarity of the consumer with the novel category of edible insects. The notion of familiarity can counteract both rejection and end negative evaluation based on Neophobia and Risk and it also increases the level of expected sensory-liking and food appropriateness of the novel ingredient (Tan et al., 2016), reducing the impact of predicted Distaste.

One of the possible drawback of introducing entomophagy through flour and powder could be represented by the grade of disgust of the consumers: as already stated and in accordance with Rozin and Fallon (1987), even the tiniest, sensorial undetectable trace of a disgusting item may render an otherwise acceptable food unacceptable, which means that even insect powder would be problematic among consumers who consider insects as 'objects having contamination properties'. (Verbeke, 2015)

## **5.5 THEORETICAL FRAMEWORK**

Drawing from the relevant theories and the previous studies, it is clear that the, mostly negative, attitudes toward edible insects are influenced by both Top-Down (Disgust, Distaste and Neophobia) and Bottom-Up (Unfamiliarity, Uncertainty and Risk) process, but which one is the most impactful is still debated. And that, even if undoubtedly there is a growing interest and appreciation toward insect used as human food in the western countries, the effort put in motion to contrast the causes of rejection are often beneficial but not sufficient. There are two main classes of strategy used in the promotion of entomophagy. The first is connected to the creation and expansion of awareness in the consumers of the documented benefits of insects, from a cultural, environmental, nutritional and safety perspective. The second involves the intensification of exposure of consumer to the edible insects by increasing the occasion of first-hand experience, such as "*bug-banquet*" and ad-hoc gathering, and at the same time by trying to improve the sensory likeness and the familiarity of this novel product category.

Therefore, shown below is the proposed theoretical framework (Figure 1) on which this research is based.

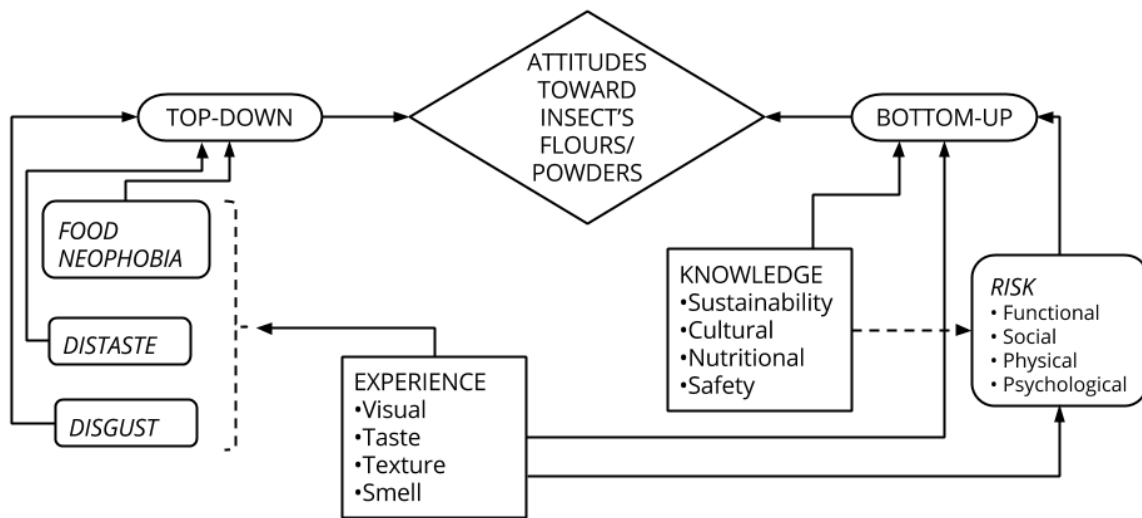


Figure 1 - Proposed Theoretical Framework

Both Top-Down and Bottom-Up approaches are considered and is shown by the graph the expected impact of both Experience and Knowledge on attitude formation. Experience is considered as first hand encounter and exposure to the novel food, and it will influence both Top-Down and Bottom-Up process. While knowledge is intended as both as the notion of the consumer about the product and as its perceived benefits and it will influence the Bottom-Up process, while at the same time counter the Perceived Risk.



## 6 METHODOLOGY

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### 6.1 SEMI-STRUCTURED INTERVIEW

Being this predominantly an exploratory research, which are effective in analyzing “what lies behind or, underpins, a decision, attitude or behavior” (Ritchie, Lewis, Nicholls, & Ormston, 2013), a qualitative approach is the one that best suits this research. Therefore, due also to the fact that Distaste, Disgust and Food Neophobia are individual traits, a one-to-one semi structured interview methodology has been used, which allows for a deeper probing in the individual interviewee’s responses.

### 6.2 INTERVIEW GUIDE

A four-part interview guide has been developed (see Appendix 1), on the basis of the theoretical framework to account for the aforementioned relevant theories and propositions.

#### 1. Introduction

At the beginning of the interview the respondents were asked to talk about their dietary requirements and pattern of food preferences, to discover, for example, if they were user of protein fortified product, prone to snacking and/or meat lovers, which correlates negatively (Tan et al., 2015) with the willingness to try insects (Verbeke, 2015). This was followed by probing question to assess their Neophobia level, using question derived the from Food Neophobia Scale (FNS) (Pliner & Salvy, 2006; Ritchey et al., 2003) and the exposure to different culinary cultures.

#### 2. Knowledge building

Attitude formation is a cognitive process that can be verbalized (Ericsson & Simon, 1980). Attitude formation is therefore ideally studied in a setting where respondents are prompted to form new attitudes because of external stimulation with new information on the attitude objects, and where they find it natural to verbalize their cognitive responses to this new information (Nielsen et al., 2009).

Therefore, the second step of the interview was meant assess and, at the same time, to expand the respondent knowledge on sustainability, nutritional and safety aspects of entomophagy.

In regards to sustainability, the data presented concerned the current situation of the agricultural sector in Ireland (Figure 2), which impacts more than industry and construction to Greenhouse emission (CSO, 2016) and the almost unbearable resource consumption of traditional livestock farming (Anankware, Fening, Osekre, & Obeng-Ofori, 2015; Gustavsson, Cederberg, Sonesson, Van Otterdijk, & Meybeck, 2011; Huis, 2013; Melo-Ruiz, Sanchez-Herrera, Garcia-Nunez, Diaz-Garcia, & Garcia, 2013; Nadeau et al., 2015; Ramos-Elorduy, 1997; A. Yen, 2015)

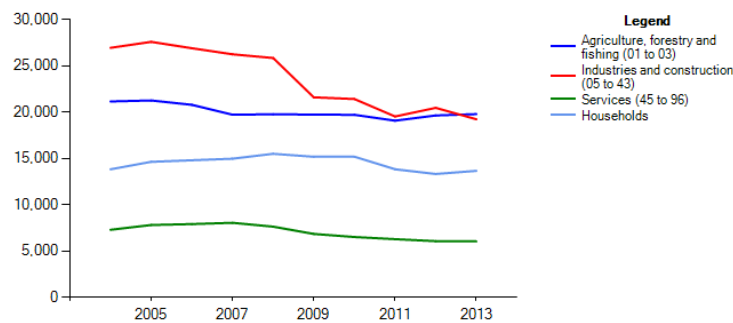


Figure 2 - Greenhouse emissions in Ireland by sector, from 2004 to 2013. Source: CSO

Furthermore, they were made aware, using also a chart as visual aid (retrieved from Sogari (2015)), of the specific environmental benefits of insect micro farming compared to traditional livestock farming, which is one of the most vital and traditional sector in Ireland, specifically in regards to the fact that (Huis, 2013):

- Insects emit relatively few GHGs and relatively little ammonia.
- Insects have high feed-conversion efficiency (an animal’s capacity to convert feed mass into increased body mass, represented as kg of feed per kg of weight gain).
- Insects require significantly less land and water than cattle rearing.

In regards to nutritional aspects of insects, respondents were informed about the overall better performances of insects compared to livestock in terms of, without too much details or technicalities, protein, amino acid and polyunsaturated fatty acid (omega 3 and 6) contents, but also about the great variety of nutritional composition among the around 2.000 species of edible insects (Chakravorty, Ghosh, Jung, & Meyer-Rochow, 2014; Dzerefos & Witkowski, 2014; Elemo, Elemo, Makinde, & Erukainure, 2011; Gordon, 1968; Huis, 2013; Nadeau et al., 2015; Nowak et al., 2015; Payne, Scarborough, Rayner, & Nonaka, 2016; Phimmasane et al., 2015; Ramos-Elorduy et al., 1997; Raubenheimer & Rothman, 2013;

Arnold van Huis, 2013; A Van Huis, Dicke, & Van Loon, 2015; Verkerk, Tramper, Van Trijp, & Martens, 2007; A. Yen, 2015).

Lastly some information about the safety were given about the minor risk of zoonotic infection, the disease that transmit from animal to human, that insects pose, because of their significant distance from our physiology, which make them virtually safer than livestock (Huis, 2013; Arnold van Huis, 2013), and about the notion of insect microfarming, which, due to their minor land requirement, could be conducted in a controlled environment (Rumpold & Schlüter, 2013; Arnold van Huis, 2013)

In this phase respondent were asked to assess their initial thought on entomophagy and its adoption.

### 3. Vignette

To further investigate the role of Social Pressure and Social Risk, the vignette methodology has been used. This method is largely used in qualitative consumer research when there is the needs of an assessment of a social situation (Grønhøj & Bech-Larsen, 2010).

Vignette are short, hypothetical, descriptions of a familiar social situation which contain precise references to what are thought to be the most important factors in the decision-making or judgment-making processes of respondents (Barter & Renold, 2000), where respondent are encouraged to react to a situation that is described with a certain degree of detail. This makes it possible to examine the importance of the actual situation including specific influential contextual conditions that may be of relevance to the choice or buying decision. (Grønhøj & Bech-Larsen, 2010). The vignette were introduced at this point in the interview using an approach, which aims to “freeze the picture” to confirm (or reject) the relevance of the depicted situations (Grønhøj & Bech-Larsen, 2010).

<b>Purpose</b>	<b>Construction</b>	<b>Presentation</b>	<b>Variation</b>	<b>Response options</b>	<b>Validation</b>
<i>Freeze the picture</i>	Based on a priori or in-study knowledge	In the middle/ towards the end of the interview	Relatively few (1-5) and detailed stories	affirmation/rejection And elaboration	The criterion of personal relevance

Table 1 - Strategies for Vignette-Based Qualitative Interviews, Source: Grønhøj et al. (2010).

The three vignettes (see: Appendix 1) used in this research were designed to immerse the respondent in a familiar situation, where he/she is presented with the choice of trying insect based product, in all three cases some kind of dessert including processed insects. The vignettes were given in an order of a possible increased respondent' social pressure. In the first scenario the choice was offered by a waiter in an ethnic restaurant setting; in the second by an acquaintance at a party; in the last by a close friend at a dinner where the respondent is a guest.

As mentioned, Perceived Risk is especially relevant and often used in marketing in regards to situation where the financial impact of a choice or purchase is substantial, but in this case, both for the nature of the product (insects) studied and for the particular component of risk (social) examined, the situation described in the vignette where stripped off of any financial aspects. The respondents were always offered for free the choice of trying the insect dessert.

This approach was also useful to elicit other factor, other than just social risk, underlying the decision process toward the willingness to try insect powder based product.

#### 4. Tasting Experience

The last part of the interview was a testing experience of an actual insect based product. This step was devised to test the respondents' willingness to try insect based product and to allow them to have a first-hand experience and sensory assessment, while monitoring their reaction toward the specificity of the product.

The product choose was a protein bar that uses cricket flour as its main source of protein. The choice for this particular product, a USA based brand that has been quite successful in its niche, was made on the basis of its compatibility to the research questions and its availability. The flavour "Cocoa Nuts" was selected by being the brand's most selling version of the product.

### **6.3 POPULATION CHOICE AND SAMPLING**

The population investigated were a young adult (18 - 35) cohort of college students. There are some notions in the relevant literature that support this choice. Among the several identified factors affecting individuals' willingness to eat insect based food, gender and age are found to be particularly relevant: male and young individuals show more positive

attitude, while female scores for disgust and Neophobia are usually higher.(Tan et al., 2016; Verbeke, 2015; Verneau et al., 2016); whereas effect of education is still debated (Schösler et al., 2012; Verbeke, 2015; Verneau et al., 2016)

In the gathering of the data a non-randomized, “reasoned”, convenience sampling was employed. The data was gathered mainly on UCC campus, trying to maintain a balance between gender and background.

#### 6.4 DATA ANALYSIS

Subsequently to the completion of the interviews, these were transcribed and then the data gathered was examined using the methodology of Thematic Analysis. An initial manual assessment of themes and an initial coding was carried out on paper. Then the recurring themes and findings were extrapolated with the aid of a qualitative data analysis software (MAXQDA<sup>1</sup>). Of all the codes sequenced, only the ones that had a relevant number of sequences (cutoff=10), were retained, for a total of 27.

### 7 FINDINGS

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#### 7.1 SAMPLE PROFILE

A total of eleven interviews were carried out. The respondents, 6 males and 5 females, were all Irish students, at different stage of their educational careers, except for two respondents which came respectively from Luxemburg and Spain and were full time employees. Their age range went from 19 to 29, with an average of 23 years old. Also, the majority of them (8/11) had a scientific background and had been studying in a STEM Field. As for their level of education, this was more evenly spread out:

Education Level	# of Respondent
Bachelor's degree	5
Higher Diploma	2
Master's degree	4

*Table 2 - Educational Level of Respondents*

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<sup>1</sup> <http://www.maxqda.com/>

### 7.1.1 FOOD NEOPHOBIA

The sample investigated scored rather low in regards to Food Neophobia, expressing fairly neophilic attitudes toward the willingness to try new and novel food, with no discernible distinction between age or gender.

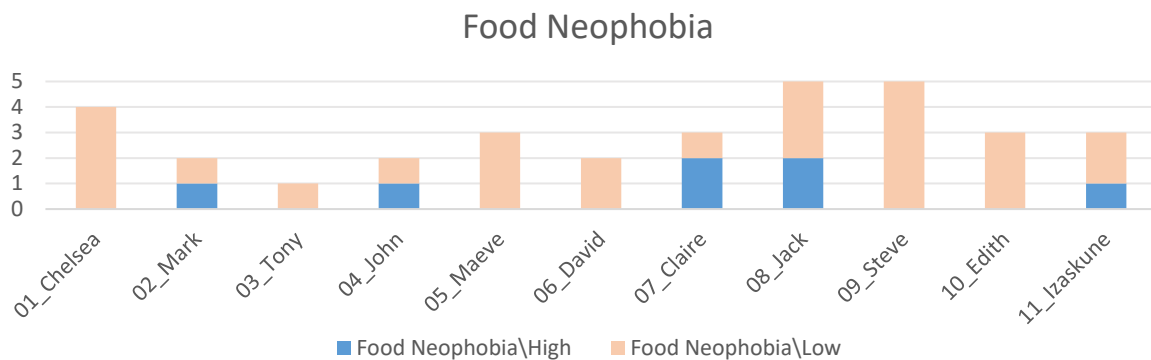


Figure 3 - Food Neophobia/Neophilia Mentions per Respondents

When asked about their willingness to sample new food and their opinion about ethnic food and restaurants, the responses were quite consistent toward the keenness to try new food and create new experiences:

*“That’s a tough one. I’ve been to China and I’ve tried a lot of street food. that was in 2008 so, 8 years ago now and it was just everything kinda piled into one a deep fried pit, kinda butter. I wasn’t even sure what was in it. I just know that, no doubt, was definitely the strangest stuff I’ve ever ate.”*

**Steve, 22, Irish**

*“...yeah, like I am going to china now, in October. I can't wait to just to eat whatever is it there. just give it a go.”*

**Jack, 22, Irish**

Consistently to this observation, all of them, except one, have travelled to other countries and had experience of different cultures and have been exposed to different cuisines beside their native one. The majority of them had undertaken these travels and foreign food experiences as part of their studies in college:

*“I was on a week of a college project in Bilbao. And pinchos, it's like a fish [cake]...pinchos I think, have you heard of them?”*

**John, 23, Irish**

*“The stranger food I ever eaten? let me think...maybe escargot form French, you know? just snails [...] I lived in France for a Year.”*

**Mark, 23, Irish**

### 7.1.2 DISGUST

The sample also scored quite low in regard to their expression of Disgust toward edible insects. And the references to possible Disgust were rarely accompanied by actual disgust outputs and signals of manifest revulsion, being instead more of a conceptual nature.

*“I have an idea, I have an image of just "going out just grabbing insects, they are now part of a meal and there is your meal!". Not gonna eat that.”*

**John, 23, Irish**

Most of the sequences coded with disgust had to do, coherently with the previous research (Martins & Pliner, 2006), with the Animal Reminder component:

*“Only see fish brought in shops that sells like the full fish just staring at you...I'm like {frowning} whoa!”*

**Maeve, 20, Irish**

Although sometimes was difficult to discern exactly it from the other components, Core and Contamination:

*“you know people think that insects are like, you know...crawlies...”*

**Claire, 19, Irish**

As predicted, gender had an influence on the disgust estimation (Verbeke, 2015), as the two respondents who showed the most amount of disgust were both female (Figure 4):

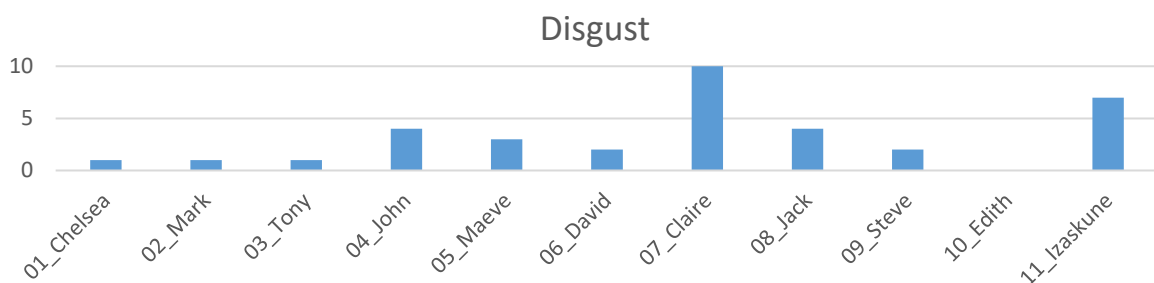


Figure 4 - Disgust Mentions per Respondents

The first, Claire, even if intrigued by the idea of eating insects and relatively responsive to the benefits of entomophagy, she was clearly uncomfortable with the association between food and insects. The other respondent that showed a high degree of disgust, Izaskune, was the only one that mentioned insects as food, while discussing ethnic foods, even before they had been revealed as the focus of this research:

*“Yeah, well in fact in Indian restaurants or something like that, they use insects, or something like that, mmm {disgust expression}, they usually fry insect. This no, but the rest why not?”*

**Izaskune, 29, Spanish**

### **7.1.3 AWARENESS**

When their awareness toward environmental and nutritional aspects were investigated, nearly the entirety of the respondents were noticeably oblivious about sustainability issues, and labelled themselves as not particularly conscious about the environment and the impact of their consumption conduct on the latter.

On the other hand, the respondents were more conscious from a nutritional point of views: Some were actively searching to introduce more protein in their daily intake, and this was also related to exercise.

*“...depending if I am going to the gym that day, would be dictate what kind of carbs that you having in it. Or if I am doing a training session, I would have more carbs. If not, I would keep it strictly to maybe chicken and veg if possible.”*

**John, 23, Irish**

Roughly half the respondent had already some knowledge, to a different degree, of the possibility of using insects as a food ingredient and as a source of nutrients, but none of them had direct experiences.

*“Grasshoppers are considered cuisine in some country, so they obviously can’t be that bad! so yeah! I’ll definitely be up for trying it.”*

**Chelsea, 20, Irish**

*“There’s enough lot of country that do eat insects. It is not something that I would be very comfortable cooking myself, but if was abroad and I was at a market and they were there, I definitely would try them.”*

**Edith, 29, Luxembourg**



## 7.2 TASTE IMPORTANCE

The most salient theme that arises from the interviews, coherently to previous research (Deroy et al., 2015; Tan et al., 2016), is that the decisive factor in the evaluation of a novel food is *taste*, above all other sensory and non-sensory aspects.

Unanimously the respondent asserted that taste is the main, and for someone the only, concern about the consumption of insect food products. However, an interesting finding is the concept of *Distaste* based rejection, defined as predicted unsatisfactory sensory experience, was not directly applicable to this research, as the respondents did not have any preconception to what an insect would taste like, probably due to a total lack of experience and minor exposure to the notion of entomophagy. The respondent were quite open to face the novel sensory evaluation:

*“...but I mean again it's all then about the taste that I actually would like, if it tastes nice and if taste good, I don't think that the idea of having insect [...], I shouldn't have any problem with it like, you know. I don't think it should have been a factor as long it tastes the same and it taste good and it taste good in your senses, I just think that I'll be fine, like...”*

**David, 22, Irish**

*“It would purely dictate by the taste. I'd actually get over the idea of eating insects because I am a meat lover, so, the idea of any kind of animal doesn't bother me, and would try new things, but is purely on the taste. “*

**John, 23, Irish**

This finding does not directly reinforce the theory proposed by Deroy et al. (2015) that revulsion felt toward insect is a form of *acquired distaste*, but support their concept of a sensory-driven strategy to encourage edible insect consumption in the western countries.

Especially when presented with the offer of tasting some insect based food product, during the vignette phase, taste was the discriminatory factor to keep eating and the product after the first bite:

*“I would take the first taste; I wouldn't bite it straight away. cause you said they offer me a taste yeah? So I'll taste it, and if it's nice I'll buy it, if not I won't.”*

**Mark, 23, Irish**

For some of the respondent other sensory aspect have been also deemed important such as texture:

*“If it's appealing to eat it and then the texture, and what it tastes, but I guess that it will be so much chocolate on it that it will taste just as chocolate.”*

**Edith, 29, Luxembourg.**

*“[talking about red meat] I don't like the taste of it. I don't like the texture of the fat and it's not so much whatever is doing to my health, that's not an issue, it's the whole taste.”*

And visual aspects:

*“We tried octopus, and it was certainly something special, it looks horrible.”*

**Chelsea, 20, Irish**

*“Again I think the main thing, if it was, appearance wise, looking nice. Cause I think that for me one of the most important things, if I think that it will look fine and nice to eat, definitely I'll give it a bite and then if I was happy with it then I'll definitely continue eating that.”*

**David, 22, Irish**

Especially aspect can be important to the introduction of flour and powder the absence of a visible insect was regarded positively, in accordance with the literature.

*“I don't know I would probably try like the insect powder does not seem like...like I don't know, Chunks of insects or anything. But...thinking about digesting this kind of things. Yeah I would probably try it.”*

**Claire, 19, Irish**

During the tasting experience of the bar, the focus of the respondent was on taste and the packaging. This is relevant as the reasoning of the respondent about the taste of the bar, in most cases, overshadowed completely the fact that the bar contained cricket flour. Due to the peculiarity of the product most of the respondent found the taste too strong and for their palate and different from what they were used to, denoting a low degree of familiarity, which we know as an important factor for acceptance, with the product

*“but yeah, it looks really nice and it taste something different like. [...] There is a strange taste of them, but you wouldn't be able to pinpoint that is insects.”*

**Chelsea, 20, Irish**

and the bar was too heavy to become an everyday snack.

*“It's not bad, it's quite strong for something every day, but...”*

**Maeve, 20, Irish**

While other liked very much the taste and deemed the bar equivalent to the more conventional alternatives.

*“Oh the taste of that it's absolutely fantastic! I mean, if you put that in normal packaging and put that up against any other normal protein bar, and that it didn't have cricket on it, I can't even tell the difference, to be honest, I think it taste exactly like.”*

**David, 22, Irish**

### **7.3 WILLINGNESS TO TRY**

All the respondents have asserted the willingness to, at least try the insect based product, giving it at least a chance denoting a surprising positive attitude toward the idea of exploring entomophagy. Respondents were asked directly if they would consider trying to add insects or insect based food product to their diets. This direct approach was employed as the implementation of a dichotomous seeker/avoider segmentation is preferable when the product category under investigation is not frequently purchased and/or when there is a strong attitude towards the product category, both conditions in this case fulfil (Verbeke, 2015). This willingness was approached with high *curiosity*, but also with a degree of *caution* at the same time

*“At first, I would be shocked, like get surprised because I would not be used to eating grasshopper, but I would be intrigued. [...] I'll be hesitant, but I'll be intrigued to find out what it tastes like, you know, like taste...”*

**Mark, 23, Irish**

*“Interesting probably... takes a lot of courage to try it but it'd be very interesting. Obviously it looks like improve a lot of production of gas and like more efficient and stuff like that. That is an interesting concept, I don't really imagine that happening, but definitely very interesting. “*

**Claire, 19, Irish**

Only few showed a higher degree of acceptance toward the inclusion of insects in their diets.

Every respondent replied positively to the tasting offer described in the vignette, with a more confident propensity for the first one, due to the restaurant setting (view also section 7.7). And all, except one, follow up to their words with actions when presented with the protein bar to taste. Most of them were unfazed by the presence of cricket inside the product.

*“Yeah but the insect thing wouldn't put me off at all in that”.*

**Jack, 22, Irish**

Except *Claire*, who had a high level of disgust and who was clearly not too comfortable with the idea of eating insects. She however did taste a small piece of the bar, probably more because of a consistency bias, after affirming her willingness to try during the Vignette phase, than for a real curiosity.

The only respondent, Izaskune, that did not take nor try the bar, claimed that it was on the basis of ideational reasons toward the fact that protein bars, as a category, are not real food and unnecessary chemical products.

*“It's chemical and to be honest, I can accept the fact that is save for the environment and something like that, you can recycle this {referring to the packaging}, but if you don't need, why do you need to eat this?”*

**Izaskune, 29, Spanish**

But she also stated that the presence of the grinded insect, as was not visible, did not bother her and she would have been willing to try other insect based product like, for example bread:

*“Yeah, a bread for example, if you need to eat bread, like a slice per day, I would eat it! but this is extra {referring to the bars} for your body during the day, in my case now. and I don't need, that's it”*

**Izaskune, 29, Spanish**

It is also important to note that this positive willingness to try doesn't automatically translate into acceptance of a main stream consumption of edible insects (see Tan et al. (2015) ) as there is more to acceptance than the mere willingness to taste and the liking of a food's sensory properties.(Tan et al., 2016)

The respondents were discretely receptive of the benefit communicated, expressing attention to this benefit during the decision process of eating insect based products. Coherently to the level of their awareness, nutritional benefits stuck in the respondent minds.

*“Yeah, not for me that I am not very conscious about what I eat nutritiously, but if you can make them taste good, and there's an added benefit of that, then probably.”*

**Chelsea, 20, Irish**

*“I wouldn't see a problem in that, really. It is like, again, if they are providing the same nutrients and the same beneficiaries, that be great and maybe in a lab or in a pharmaceutical plant wouldn't see a problem to be honest, I mean if they utilize kind of less land, less water supply and even less food intake, won't see a problem with it at all, because it provides same benefits as any other, that would be fine.”*

**David, 22, Irish**

On an interesting, colourful note, at the end of the interviews, every respondent that accepted the bar, held on to it on the account to share it, and the unusual experience that it represents, with their friends and/or family.

*“Yeah! I will take it with me and give it to people and how many actually realize, if you don't mind.”*

**Chelsea, 20, Irish**

*“I would try it and if I liked it, I'll try to get the friends to try it too! believe me! it's my kinda...It's me! what I kinda do...”*

**Maeve, 20, Irish**

This kind of behaviour is really interesting, because it showed the high interest in edible insects as a novelty experience and the inclusion of friends in such experience could be a factor in alleviating Social Risk and promoting awareness of entomophagy in the young-adult cohort.

#### 7.4 SAMPLING IMPORTANCE

During the scrutiny of the situation described in the first Vignette, every respondent accepted the sample offered by the waiter, highlighting the importance of a preliminary sensory evaluation before making a decision toward edible insects.

*“I’ll sample, and then if it tastes nice, go ahead, like.”*

**Tony, 24, Irish**

*“I would sample it. I wouldn’t order it without sampling it, but like I said if he gave me a small bite to sample. [...] I would actually try it yeah, before discarding the idea completely.”*

**John, 23, Irish**

Importance reiterated also later in the interviews:

*“yeah, but I would want the sample. Like if I was in a shopping centre and someone say “just try this are new or whatever”, I would, like give a taste first. [...] But if you gave me a sample of that, and actually if I thought “ yeah that taste better”, I’ll have that.”*

**Jack, 22, Irish**

This finding is very relevant from a marketing perspective as samples and taster are a common strategy for the introduction in the market of novel products and are also known to be effective in reducing Perceived Risk, hence their classification as “*risk relievers*” (McCarthy & O'Reilly, 1999).

#### 7.5 PUBLIC SCEPTICISM

Another noteworthy theme that arises is the overall high level of scepticism, from the Irish respondents, that a product made with insect would be widely accepted and find its way into the Irish families’ tables. This scepticism goes over the individual caution that the respondents showed and seemed to be much more linked to the strong food culture Ireland has. As Steve, quite insightfully, presented it:

*“Trying you get something like this into Ireland is probably...could be a huge challenge. just from the perspective of the Irish Culture is very prompt to sticking to the basics and sticking to what when know. [...] is kinda changing now, but...ten years ago there wouldn't be an at all, because people are just afraid to try stuff. I am definitely not like that at all. I want to definitely try more than just the ordinary potatoes and two veg.*

*[Talking about an insect based shepherd pie] I couldn't imagine anyone ever in Ireland doing it, I could imagine if you did it that would be mass panic or something."*

This observation can be worrisome by a marketing perspective for the introduction of edible insects in Ireland. Since even people who showed positive attitude and the willingness to try insect based food had found hard to consider a positive general reception of this kind of products, this could be an indication of how deep rooted the top-down negative attitudes, based on cultural and socially negotiated widespread attitudes, can be.

## **7.6 SECURITY**

Three respondents were much more concerned, compared to the other, about the source of the insects used in the products and the safety measures and regulation put in place to assure them.

*"Yeah, I guess if I would eat insects, they would have to come from a place that has regulations as well like. [...] Because any food basically you will be worried from [where] it comes from."*

**Tony, 24, Irish**

As said, edible insects, thanks to their novelty, in the western culture are perceived as an high-risk food source (Baker et al., 2016). That is why the role of regulations and clear security standards, if thoroughly communicated, could contribute to lower the consumers perceived risk, mainly in its physical component, but not only.

Another aspect, that arose during the tasting experience of the protein bar, is the role of the packaging and the information on it, to provide cues that alleviate the Perceived Risk.

*"yeah, like I said, if something is packaged well is kind of...I'd make the assumption that is safe to eat. the fact that there's cricket wouldn't turn me off. there's more harmful chemicals and things in stuff like coke and other things that I enjoy, so I don't see why it would have much of an effect. And as I said, I probably try it just to have tried it, just because is something different, something that I haven't tried before."*

**Steve, 22, Irish**

## 7.7 RESTAURANT TRUSTWORTHINESS

Noteworthy, related to the concept of safety and trustiness, it is the different reactions between the first and the second vignette (see: Appendix 1). In the first, the restaurant setting had a positive impact on the perceived security and quality, also from a sensory perspective, of the insect based food product.

*“Why not if the waiter recommends it, I would try. Another thing is like later he offers a bit, I would try so I could say thank you I don't like it. but why not?”*

**IZASKUNE, 29, Spanish**

*“yeah, I definitely try it. Definitely would try it! especially in a restaurant, especially if you had a good meal like I definitely trust what they have to say about whatever else they are offering. I don't see why...like the addition of the grasshopper wouldn't bother me. if they haven't done it just for this one cake that are gonna serve to me, it's obviously something that they do and they know what they are doing like. I suppose you have to give a bit of trust in a restaurant, when you are eating there, that they know what they are doing and how to prepare food right.”*

**Steve, 22, Irish**

Otherwise, in the second vignette, the unfamiliarity with the person offering the insect brownies and the casualness of the setting, let the respondents raise some doubts about the source and therefore the safety of the insects.

*“yeah, it's not coming from a restaurant. it's like someone decided "I am just gonna grab it all random ingredients and bake myself some brownies". like that can be just any lunatic on the street deciding that he's gonna bake some brownies. I'll be more turned off by that now to be honest.*

**John, 23, Irish**

*“yeah, but I would have been interested more than worried just because is something that I've never heard of. So I'd be interested if he just goes out to some rock and picked them up and do it themselves”*

**Steve, 22, Irish**



## 8 CONCLUSION

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The findings of this research showed a promising starting base, on which to build future strategies for the introduction and the acceptance of entomophagy. The main finding of the research is the importance of the tasting experience for the segment of consumers investigated, college student and recently graduated. This preliminary tasting evaluation was faced by the respondent with little to none pre-existent bias toward edible insects. Which it also explained the active search for samples and introductory tasting occasions. Sensory aspects and their individual assessment were revealed to be more important of the, customarily negative, culturally and socially sanctioned attitudes regarding this peculiar kind of consumption.

On the other hand, this openness and curiosity to try edible insects was accompanied by a certain dose of caution and a quite resilient scepticism in regard to mainstream adoption of insects as food in Ireland.

## 9 RECOMENDATION

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Based on the result of this research the subsequent recommendations have been outlined:

- As proposed by Deroy et al. (2015) a sensory-driven strategy seems the most viable approach to introduce and boost acceptance of edible insect in the west. And the pursue, through extensive sensory researches, studies and analysis, of the appropriated sensory profile, for the consumes, of the novel products would be key to the possibility of their commercial success.
- Embedding element of familiarity, both in a sensory sense and at a product category level, in the novel insects based products would be extremely important to counteract both Top-Down, such as Food Neophobia and Distaste, and Bottom-Up, the Perceived Risk, adverse attitudes.
- The use of sample and taster, primarily in a retail environment, can be a strategy effective in reducing Perceived Risk, letting them become “*risk relievers*”, and, at the same time increase the consumer exposure and familiarity toward the insect based products.
- Another evident conclusion is that the two main strategies used for promoting a more diffuse consumption of edible insects, exposure and benefit communication,

by themselves have been beneficial but not sufficient in supporting a radical change in consumption pattern in the west. Therefore, a conjoined approach, by trusted sources, is advised that these two typologies of effort will go “hand in hand”, sustaining and reinforcing each other.

A future possible step is the design, and the subsequent implementation of a quantitative research, based on the results and the theoretical framework of this study, that could expand the sample size and its background (one of the main limitation of this exploratory study) and also the scope of the research questions investigating more than the consumers basic attitudes and the willingness to try the edible insects, and tapping in into the actual acceptance, and therefore the willingness to adopt and buy, insect based food products.

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## APPENDIX

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### 1 INTERVIEW GUIDE

#### 1 Introduction

- 1) First of all, can you describe to me your typical meal pattern through the day?
  - i) What is your main meal of the day? Of What it usually consists?
  - ii) Do you usually eat with other people or by yourself?
  - iii) Are you used to cook? For yourself or for other?
- 2) What are your specific preferences in food? What food do you particularly like and what do you dislike?
  - i) Are you particular/selective in the food that you eat?
- 3) Are you particularly conscious about what do you eat? Are you careful about the nutrient of your food, daily intake, etc....?
  - i) Do you read the information of the packaging of the food that you buy? Which kind of information do you seek?
  - ii) Do you consume some fortified product, like protein or vitamin enriched ones, for example?
- 4) Do you like Sampling new food that you never tried before?
  - i) Do you like going to ethnic restaurant? Which kind?
- 5) What do you recall being the strangest food that you have eaten? Can you describe that experience?
  - i) Have you travelled much? And have you tried some of the local cuisine?
- 6) Do you consider yourself an environmental conscious person?
  - i) Do you take into account the environmental impact of your food purchase?

#### 2 Knowledge Assessment and benefit communication

Now to get closer to the matter at hand, I will provide you some information and data and I wish to hear your consideration about them.

- 7) Are you aware that the current production of livestock farming is very resource consuming, and that in Ireland the greenhouse emissions (CO<sub>2</sub>, methane and ammonia) are mostly produced by the agricultural sector, and it is actually more impactful than the industrial and construction sector?

Looking at the chart (source: Sogari, 2015)

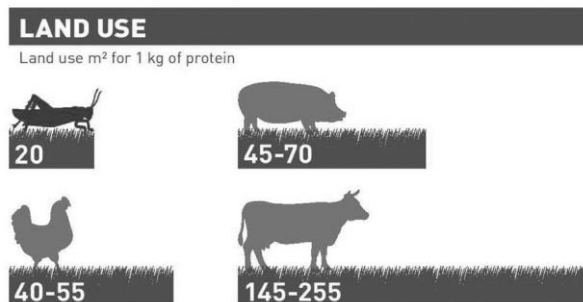
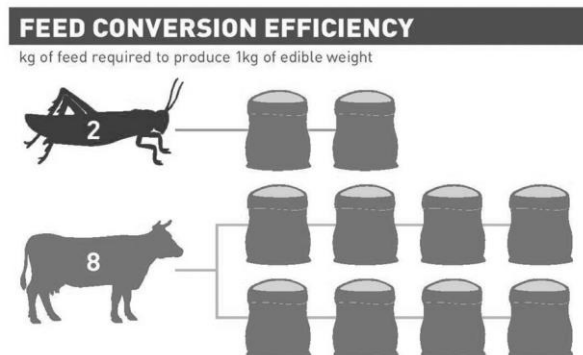
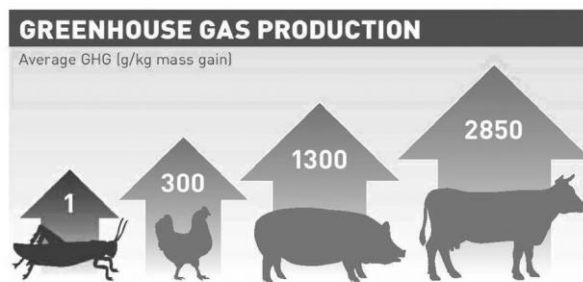
How you can see, producing a kg of mass gain for the beef generates almost 3k of grams of greenhouse emission. On the other hand, if you start to farm insects for the same amount of gain you produce only 1 gram of emission. They perform better also in respect of poultry and pigs. Also their feed conversion is better than cattle, using  $\frac{1}{4}$  less feed.

The soil used to produce 1kg of protein is significantly smaller than the other traditional livestock.

8) What do you think about a possible introduction of insects in your diet?

Ok, what if I tell that insects are considered to have very good nutritional value. They differ highly from species to species, but overall they are a good source of protein, and also they have lots of amino acid, really good polyunsaturated fatty acid, like omega-3 and omega-6.

9) Would you consider buying and/or using some products that use insects as a source of nutrients?



### 3 Vignette

Now I will give you some cards with some situation described on it. I want you to read them and then tell me how you would behave in that situation.

#### Vignette1

*You went out for dinner with some friends in a Pan-Asian restaurant, that offers a meal deal (one main dish, one side, drink and dessert). You had a lovely meal, and now it has arrived the moment of choosing the dessert. While ordering the server highly recommend to you a new cake recently added to the menu. This is a chocolate cake that is partially made with dried and grinded grasshoppers and served with whipped cream and fruits. The server also offers to give you a small bite for you to sample before ordering.*

#### Vignette 2

*You are attending at a dinner party at a friend house where every guest was asked to contribute with some food or drink to share with the others. At a certain point during the evening you approach the food table and are some brownies that catches your eyes. Another guest that you know only by sight, come up to you and tells that he has baked them himself.*



*He also feels compelled to tell you that in the recipe he used some grinded insect powder. Then he exhorts you to try at least a piece.*

### Vignette 3

*You are a guest at a friends' house. You have been invited for dinner and they cooked a full course meal for you and at the of it you are presented with a pretty cupcake. Before you eat your friend tells you that he/her has backed them partly with some cricket flour, mixed with the plain one, that he/her has recently acquired, and also tells you that it enhances both texture and taste.*

## 2 RESPONDENT PROFILE

### Demographic Data

Name	# of coded segments	Sex	Age	Nationality	Education Level	Occupation	Field of study
Chelsea	78	F	20	Irish	Bachelor's degree	Student	Law
Mark	59	M	23	Irish	Master's degree	Student	Information Systems
Tony	93	M	24	Irish	Master's degree	Student	Data Science
John	87	M	23	Irish	Master's degree	Student	Information Systems
Maeve	111	F	20	Irish	Bachelor's degree	Student	Biology
David	69	M	22	Irish	Bachelor's degree	Student	Neuroscience
Claire	58	F	19	Irish	Bachelor's degree	Student	Computer Science
Jack	95	M	22	Irish	Higher Diploma	Student	Business Information System
Steve	78	M	22	Irish	Higher Diploma	Student	Business Information System
Edith	51	F	29	Luxemburg	Bachelor's degree	Full time employed	Tourism
Izaskune	55	F	29	Spanish	Master's degree	Full time employed	Engineering

### Disgust Coded Sequences

	Disgust\Animal Reminder	Disgust\Contamination	Disgust\Core	Sum
01_Chelsea	1	0	0	1
02_Mark	0	0	1	1
03_Tony	0	0	1	1
04_John	2	1	1	4
05_Maeve	3	0	0	3
06_David	0	0	2	2
07_Claire	5	2	3	10
08_Jack	0	3	1	4
09_Steve	0	2	0	2
10_Edith	0	0	0	0
11_Izaskune	3	1	3	7
SUM	14	9	12	35

### Neophobia Coded Sequences

	Food Neophobia\High	Food Neophobia\Low
01_Chelsea	0	4
02_Mark	1	1
03_Tony	0	1
04_John	1	1
05_Maeve	0	3
06_David	0	2
07_Claire	2	1
08_Jack	2	3
09_Steve	0	5
10_Edith	0	3

<b>11_ IZASKUNE</b>	1	2
<b>SUM</b>	6	25

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## 5 CODE SYSTEM

<b>Code Name</b>	<b>#</b>
<b>Total</b>	<b>868</b>
Awareness	
High	
High Cultural	8
High Environmental	9
High Nutritional	19
High Safety	11
Low	
Low Cultural	4
Low Environmental	26
Low Nutritional	9
Low Safety	2
Caution	30
Curiosity	38
Disgust	26
Animal Reminder	14
Contamination	9
Core	12
Distaste	7
Experience	
Smell	5
Taste	29
Texture	6
Visual	10
Family Mention	4
Farm Background	2
Food Neophobia	
High	6
Low	25

Fortified Product User	6
Friend Inclusion	6
Gym Goers	7
Importance	
Familiarity	24
Sampling	20
Quality/Safety	27
Smell	2
Taste	44
Texture	7
Visual	11
Insect Acceptance	13
Insect Powder/Flour	22
Insect Presence	18
Irish Farming Protection	2
Meal Pattern	
B-L-D Pattern	10
Main Meal	
Dinner	4
Lunch	3
Snaking	6
Cooks	1
Him/Herself	9
Other	2
Meat Lovers	4
Perceived Benefit	
Environmental	12
Nutritional	18
Safety	13
Product Specific	
Chemical	1

	Different	8
	Heavy	7
	Information & Claims	9
	Natural	1
	Packaging	13
	Strong Taste	16
	Public Scepticism	24
	Restaurant Trustiness	6
	Risk Related	
	Financial	6
	Physical	11
	Psychological	3
	Social	3
	Sweet Tooth	5
	Travels	10
	Unwillingness to Buy	1
	Unwillingness to Try	4
	Willingness to Buy	10
	Willingness to Try	69

## 6 RETRIEVED CODES (CUT-OFF POINT=10)

Code System	01_Chelsea	02_Mark	03_Tony	04_John	05_Maeve	06_David	07_Claire	08_Jack	09_Steve	10_Edith	11_Izaskune
▼ Awareness											
▼ High											
High Nutritional		•	•	•	•	•	•	•			•
High Saefy		•	•	•	•			•	•	•	
▼ Low											
Low Environmental	•	•	•	•		•	•	•	•	•	•
Caution		•	•	•	•	•	•	•	•	•	•
Curiosity	•	•	•	•	•	•	•	•	•	•	•
▼ Disgust	•	•	•	•	•	•	•	•	•		•
Animal Reminder	•			•	•		•				•
Core		•	•	•		•	•	•			•
▼ Experience											
Taste	•	•	•	•	•	•	•	•	•	•	
▼ Food Neophobia											
Low	•		•	•	•	•	•	•	•	•	•
▼ Importance											
Familiarity			•	•	•		•	•	•		•
Sampling		•	•	•		•	•	•	•		•
Quality/Saefy			•	•			•	•	•		•
Taste	•	•	•	•	•	•	•	•	•	•	•
Visual	•		•	•		•				•	•
Insect Acceptance					•	•			•	•	•
Insect Powder/Flour	•		•	•	•	•	•	•	•	•	•
Insect Presence	•		•	•	•	•	•	•	•	•	•
▼ Perceived Benefit	•	•	•	•	•	•	•	•	•	•	•
Environmental	•		•	•	•	•	•			•	•
Nutritional	•	•	•	•	•	•		•	•		•
Saefy	•	•	•	•	•	•		•			•
▼ Product Specific											
Packaging	•		•		•	•		•	•	•	
Strong Taste	•	•	•	•	•			•			
Public Skepticism	•	•	•	•	•	•	•	•	•		
▼ Risk											
Physical	•		•	•	•	•		•	•	•	•
Willingness to Try	•	•	•	•	•	•	•	•	•	•	•